

## 08 - Front axle

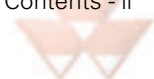
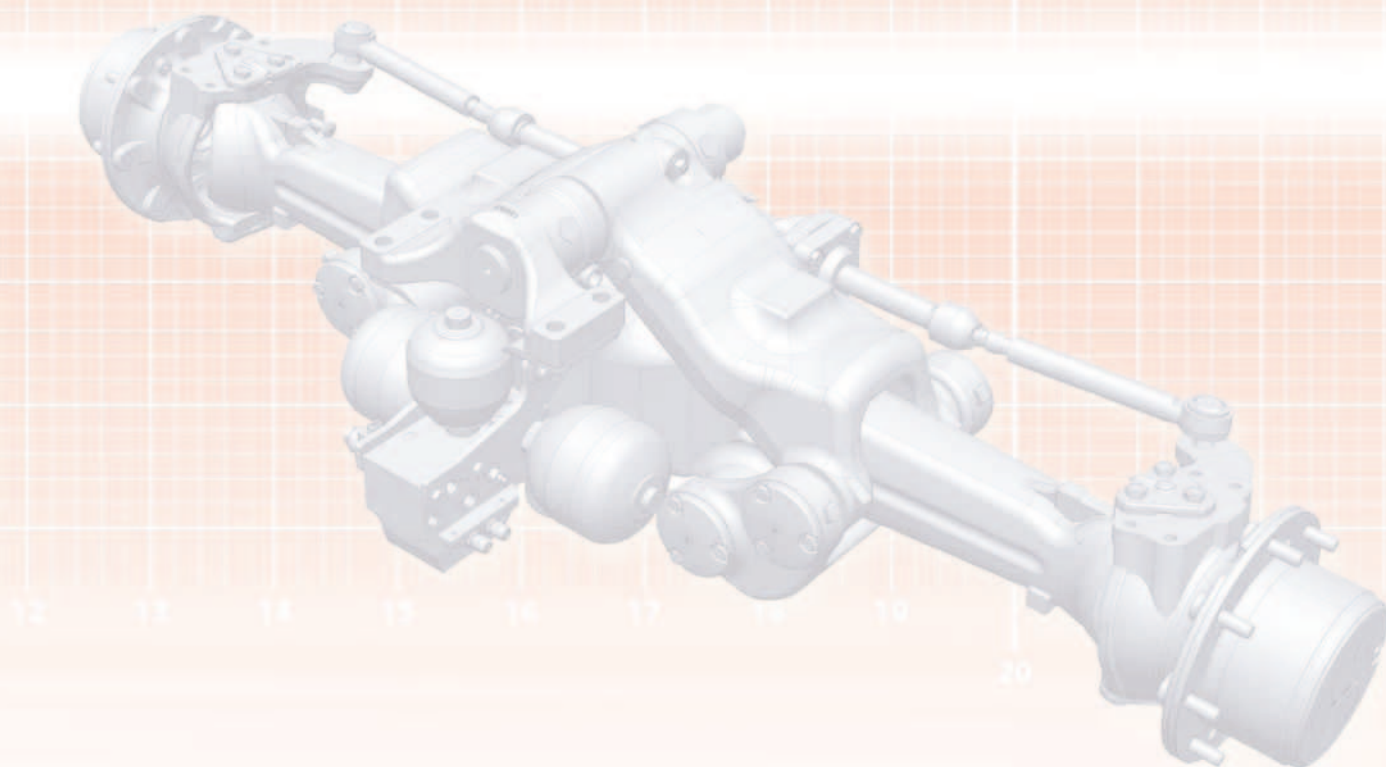
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## Front axle



# 6400



*8A10- General*

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## A . General description

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The axle described in this manual has been designed and produced according to the customer's specifications; it comprises a housing containing the differential in its central section and a wheel hub assembly at each end.

The differential is "Limited slip" type, and is held in place by two half bearings mounted on a suitable support allowing to adjust the bevel gear assembly.

The bevel ring gear is adjusted using two nuts fitted opposite.

The bevel gear is supported by two bearings, and is adjusted using shims.

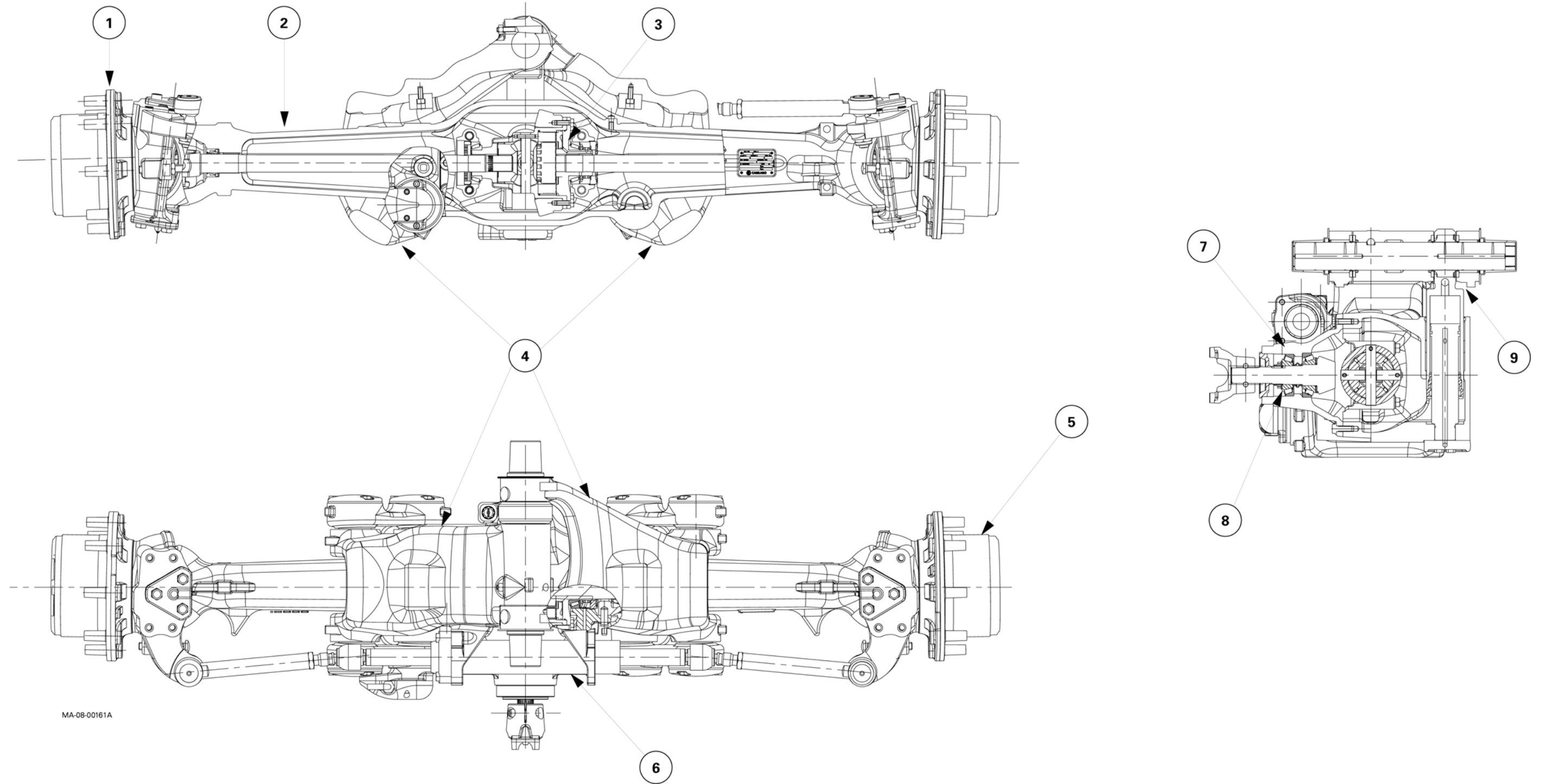
The wheel hubs containing the epicyclic drive units are held in place by two taper roller bearings and driven a hydraulically controlled steering unit.

The axle is fitted with electronically controlled hydro-pneumatic suspension (Carraro patented), which ensures the tyres' constant adherence with the ground, regardless of operating conditions.

## Parts list

- (1) Hub assembly
- (2) Axle beam assembly
- (3) Differential assembly
- (4) Arm assembly
- (5) Epicyclic drive unit assembly
- (6) Steering ram assembly
- (7) Differential housing assembly
- (8) Pinion assembly
- (9) Suspension ram assembly

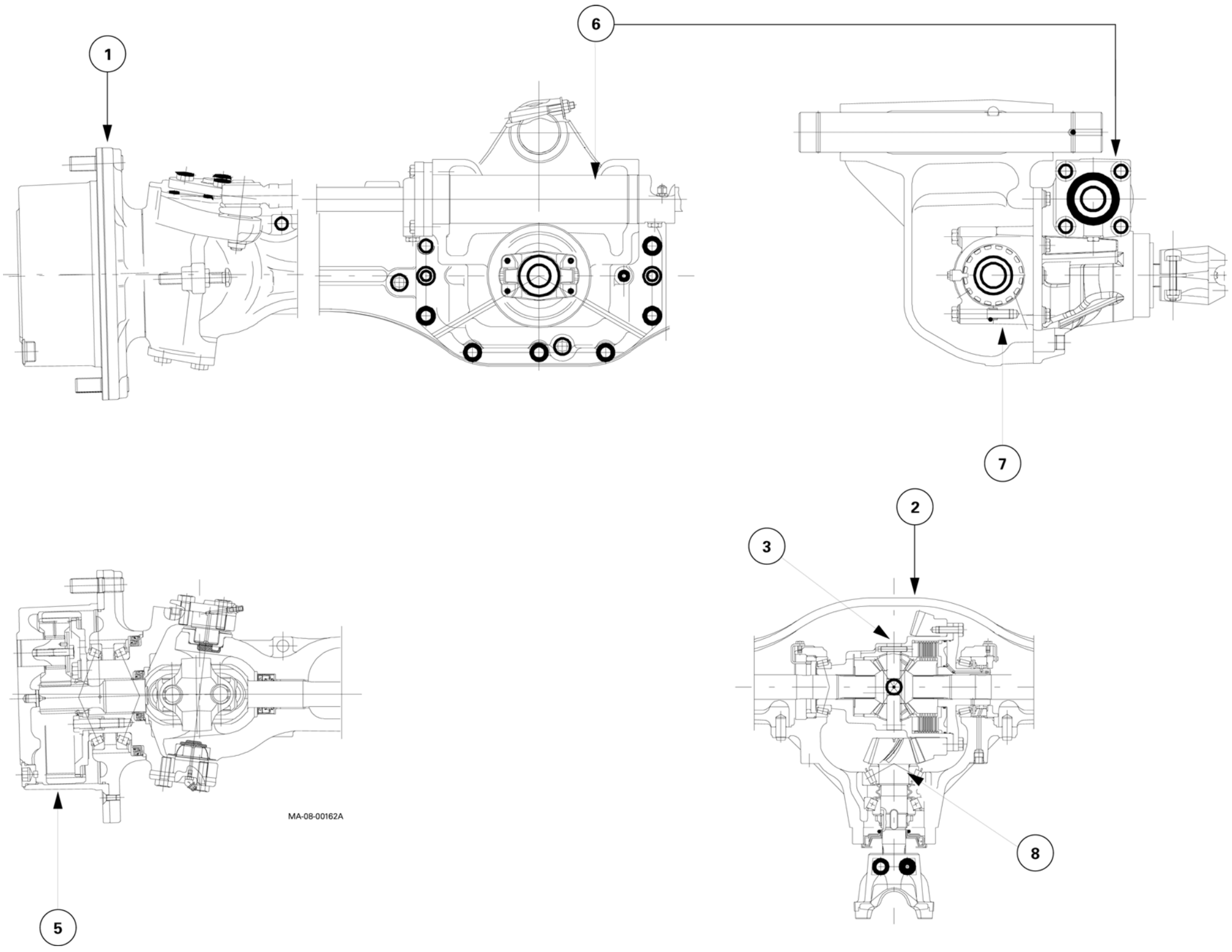




MA-08-00161A

Fig. 1

General



MA-08-00162A

Fig. 2



**Dimensions**

All values in the following tables are given in millimetres.

Dimensions for models 20.19 S and 20.22 S (Fig. 1)

A = 2045	F = Ø 275	K = 255 ± 45
B = 523	G = M18 x 1.5	L = 60
C = Ø 320	H = 457	M = 160
D = Ø 220.8	I = 161 / 164*	N = 348
E = 1800	J = 176.3	O = 508

\* measurement specific to axle 20.22 S.

Dimensions for models 20.19 S and 20.43 S (Fig. 1)

A = 2145 / 2213*	F = Ø 335	K = 260 ± 45
B = 548	G = M22 x 1.5	L = 66
C = Ø 380	H = 454	M = 160
D = Ø 280.8	I = 90	N = 348
E = 1900	J = 183	O = 508

\* measurement specific to axle 20.43 S.

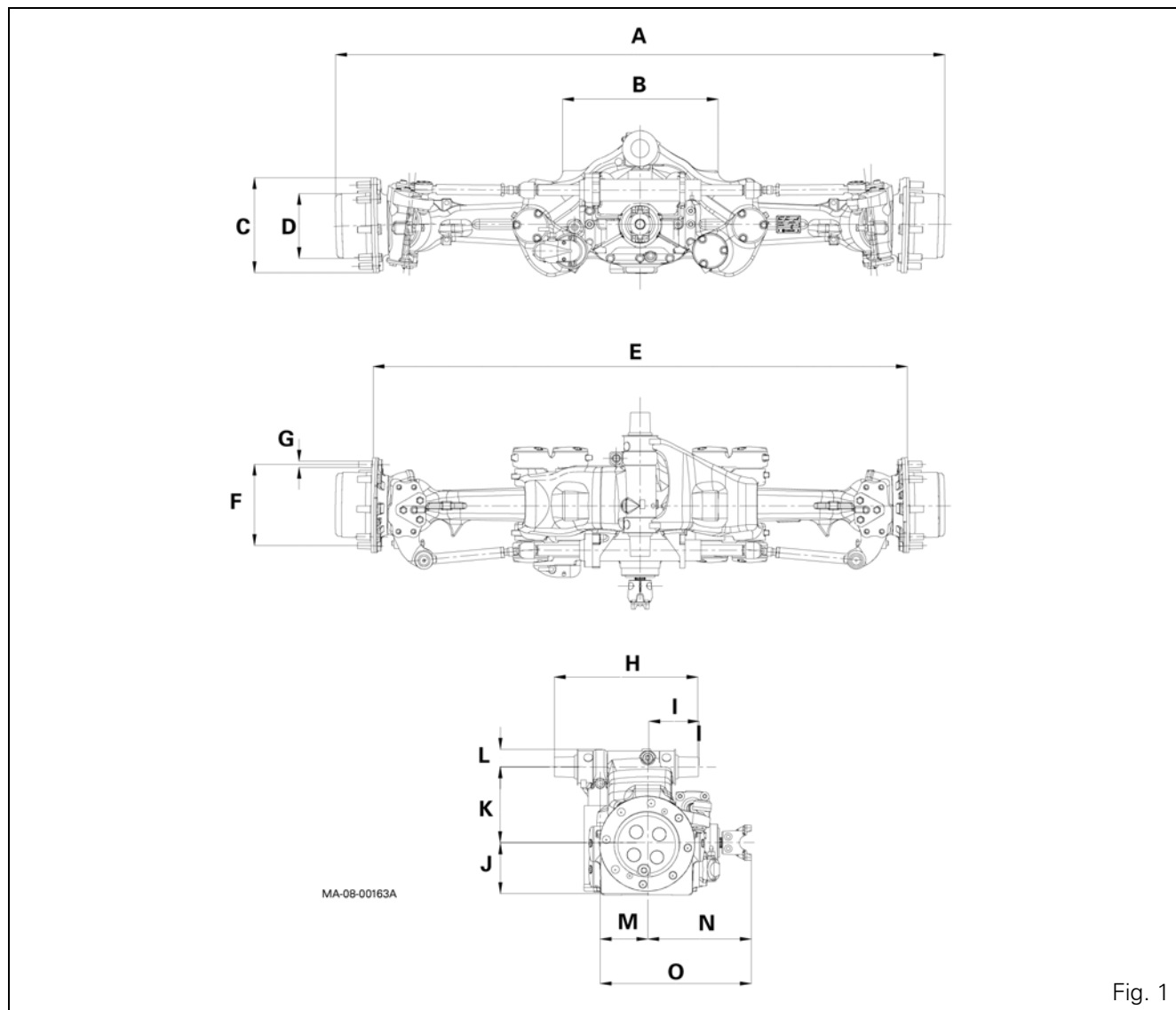


Fig. 1

# General

Dimensions for models 20.19 ACP and 20.22 ACP (Fig. 2)

A = 2045	F = Ø 275	K = 136
B = Ø 320	G = 456	L = 134
C = Ø 220.8	H = 90	M = 347
D = 1800	I = 49	N = 481
E = M18 x 1.5	J = 215	O = 115

Dimensions for models 20.29 ACP and 20.43 ACP (Fig. 2)

A = 2150 / 2213*	F = Ø 335	K = 136
B = Ø 380	G = 456	L = 134
C = Ø 280	H = 90	M = 347
D = 1900	I = 49	N = 481
E = M22 x 1.5	J = 215	O = 115

\* measurement specific to axle 20.43 ACP.

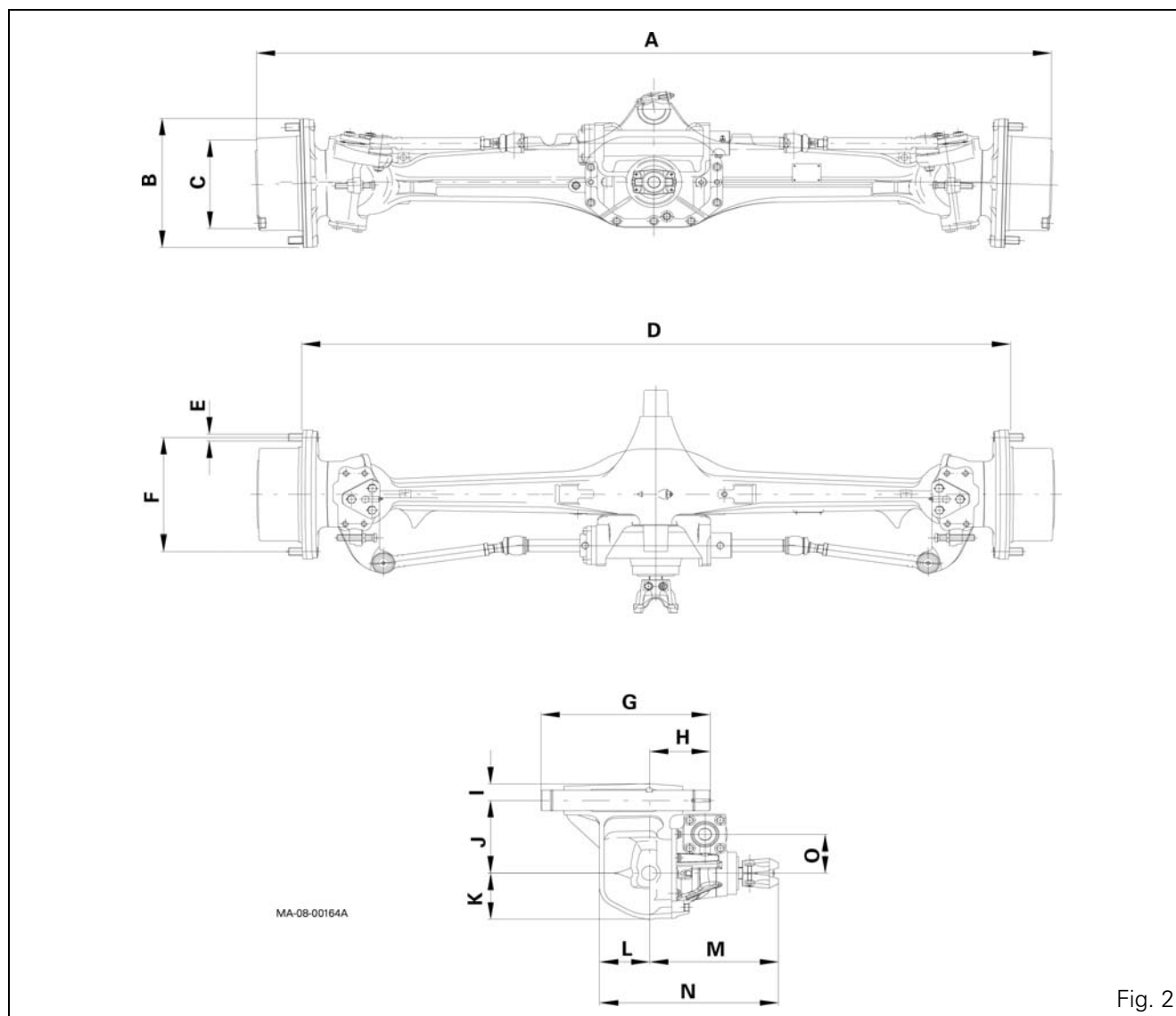


Fig. 2

**Product identification**

The Carraro front axle is identified by a plate on the axle (Fig. 3).

**Parts list**

- (1) Axle type
- (2) Serial number
- (3) Carraro number
- (4) Customer code
- (5) Total reduction ratio
- (6) Rotational direction
- (7) Differential type
- (8) Differential oil type
- (9) Differential oil quantity
- (10) Epicyclic drive unit oil type
- (11) Epicyclic drive unit oil quantity

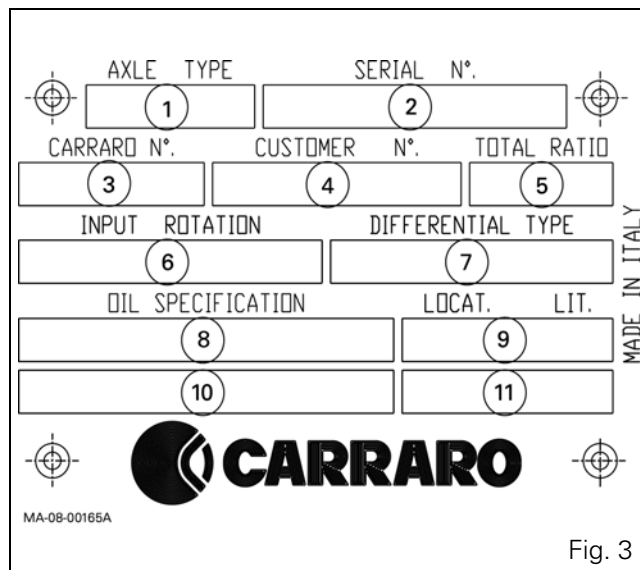


Fig. 3

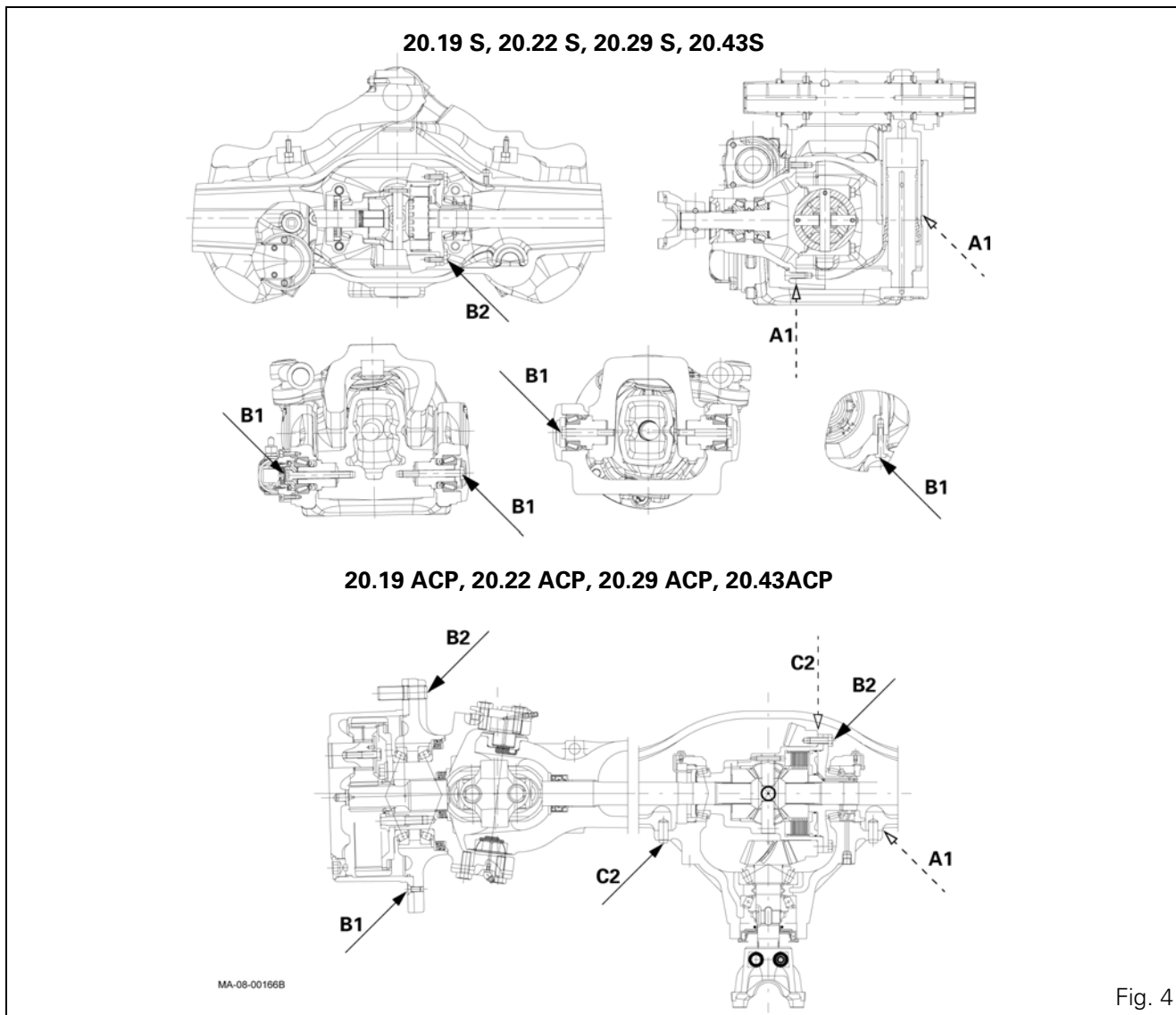
# General

## Technical characteristics

Axle model	20.19ACP	20.19S	20.22ACP	20.22S	20.29ACP	20.29S	20.43ACP	20.43S
Tractor	6465		6475		6480 / 6485 / 6490		6495	

DESCRIPTION	VALUES							
	20.19		20.22		20.29		20.43	
	ACP	S	ACP	S	ACP	S	ACP	S
Drive unit with bevel gear	3,55 / 1		3,55 / 1		3,00 / 1		3,00 / 1	
Epicyclic drive unit	6,00 / 1		6,00 / 1		6,923 / 1		6,923 / 1	
Total reduction ratio	21,33 / 1		21,33 / 1		20,769 / 1		20,769 / 1	
Unladen weight	314 kg	496 kg	324 kg	502 kg	389 kg	590 kg	405 Kg	620 Kg
Input rotation	Anti-clockwise							
Differential type	Hydraulically operated multidisc wet clutch							
Maximum steering angle	55 °	55 °	55 °	55 °	55 °	55 °	55 °	55 °
Wheel alignment	A O-2							
Oil specifications	SAE 85W- 140 EP In compliance with standards API GL4 - GL5 respectively MIL-L-2105 and MIL-L-2105D							
Differential oil capacity (litres)	6	8,5	6	8,5	6	8,5	6	8,5
Epicyclic drive unit oil capacity (litres)	0,7 + 0,7	0,6 + 0,6	0,7 + 0,7		1,5 + 1,5	1,3 + 1,3	1,5 + 1,5	1,6 + 1,6
Differential lock clutch supply pressure	20 bar							
Grease	POLYMER 400/L DIN = KHER1R ISO-I-XMR-XM2							
Bevel gear backlash	0.18 + 0.23 mm							
Rotational torque of bevel gear bearings "P"	"P = 1.82 to 2.72 Nm							
Total pulling torque of ring-gear "T"	"T = (P+1.82) + (P+2.12) Nm							

Retaining compounds and sealing products



A1 = Loctite 510		B2 = Loctite 270	
A2 = Loctite 573		C1 = Loctite 405	
A3 = Loctite 518		C2 = Loctite 496	
B1 = Loctite 542		C3 = Loctite 638	
Apply to mating surfaces			
Apply to screw threads and pins			

# General

## Tightening torques

References for all tightening torques are given in the following tables:

## Tightening torques for models 20.22 S and 20.19S (Fig. 5 and Fig. 6)

Ref.	Description	Thread	Nm
1	Wheel hub stud	M18 x 69	70
2	Ring gear carrier attachment screw	M12 x 45	120
3	Magnetic plug	M30 x 2	60
4	Planet carrier attachment screw	M8 x 20	25
5	Swivel pin attachment screw	M14 x 35	190
6	Oil filler cap	M24 x 1.5	60
7	Steering locknut	M16	150
8	Steering arm pivot ball locknut	M20 x 1.5	220
9	Oil breather	M10 x 1	10
10	Differential unit / ring gear attachment screw	M10 x 30	70
11	Pad attachment screw	M10 x 25	10
12	Cover attachment screw	M10 x 30	60
13	Pivot ball	-	300
14	Steering ram flange attachment screw	M12 x 45	120
15	Flange attachment screw	M10 x 60	57
16	Steering arm locknut	M24 x 10	250
17	Grease nipple	M6 x 1	8
18	Differential housing attachment screw	M12 x 55	110
19	Differential housing attachment screw	M12 x 33	169
20	Cover attachment screw	M10 x 35	60
21	Half-bearing attachment screw	M14 x 75	266
22	Arm upper pin attachment screw	M14 x 100	190
23	Attachment screw of arm lower pin bearing	M14 x 120	190
24	Arm upper pin attachment screw (potentiometer)	M14 x 120	190
25	Potentiometer attachment screw	M4 x 12	3
26	Potentiometer cover attachment screw	M8 x 25	13
27	Grease nipple	M6 x 1	8

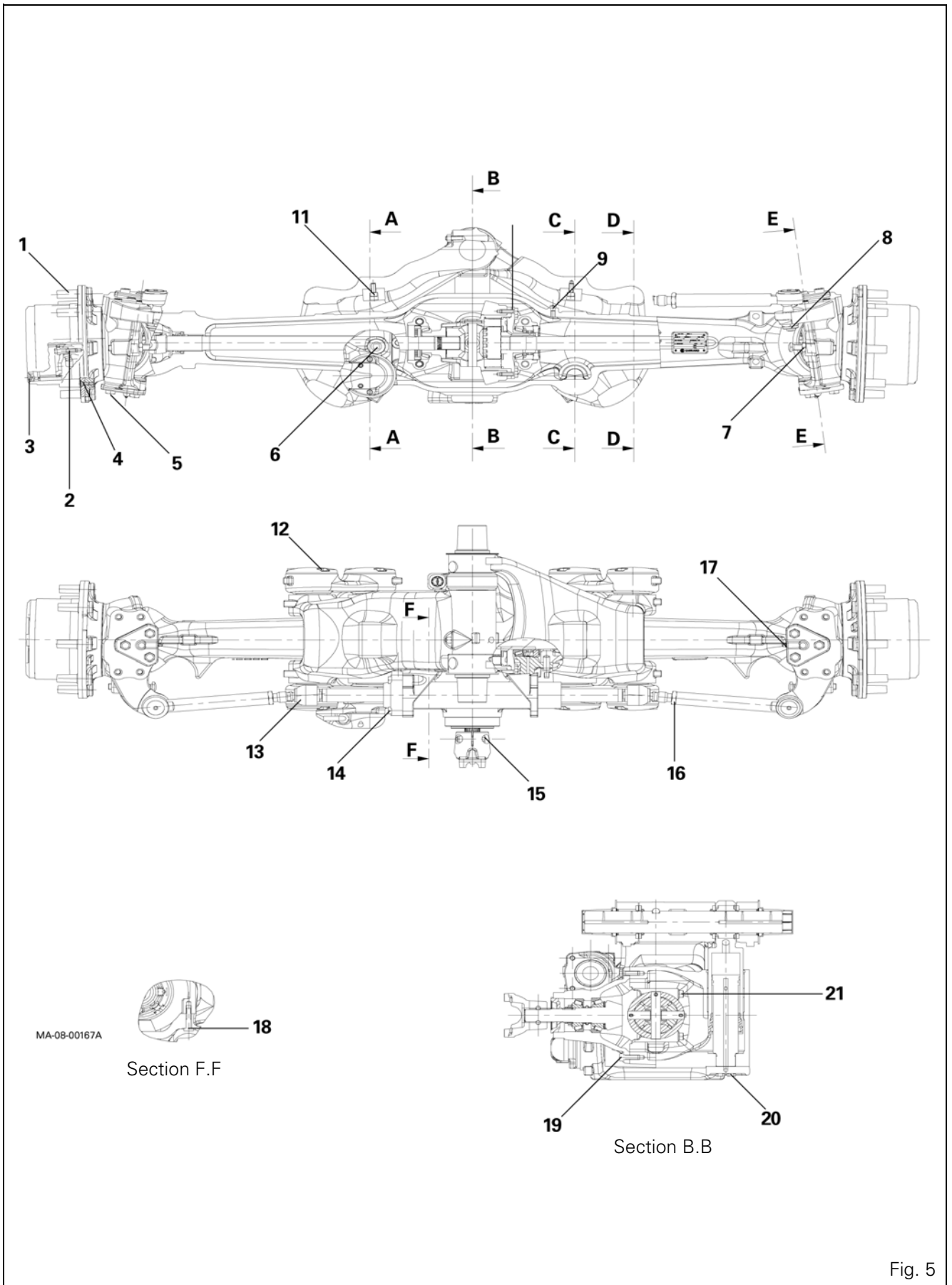
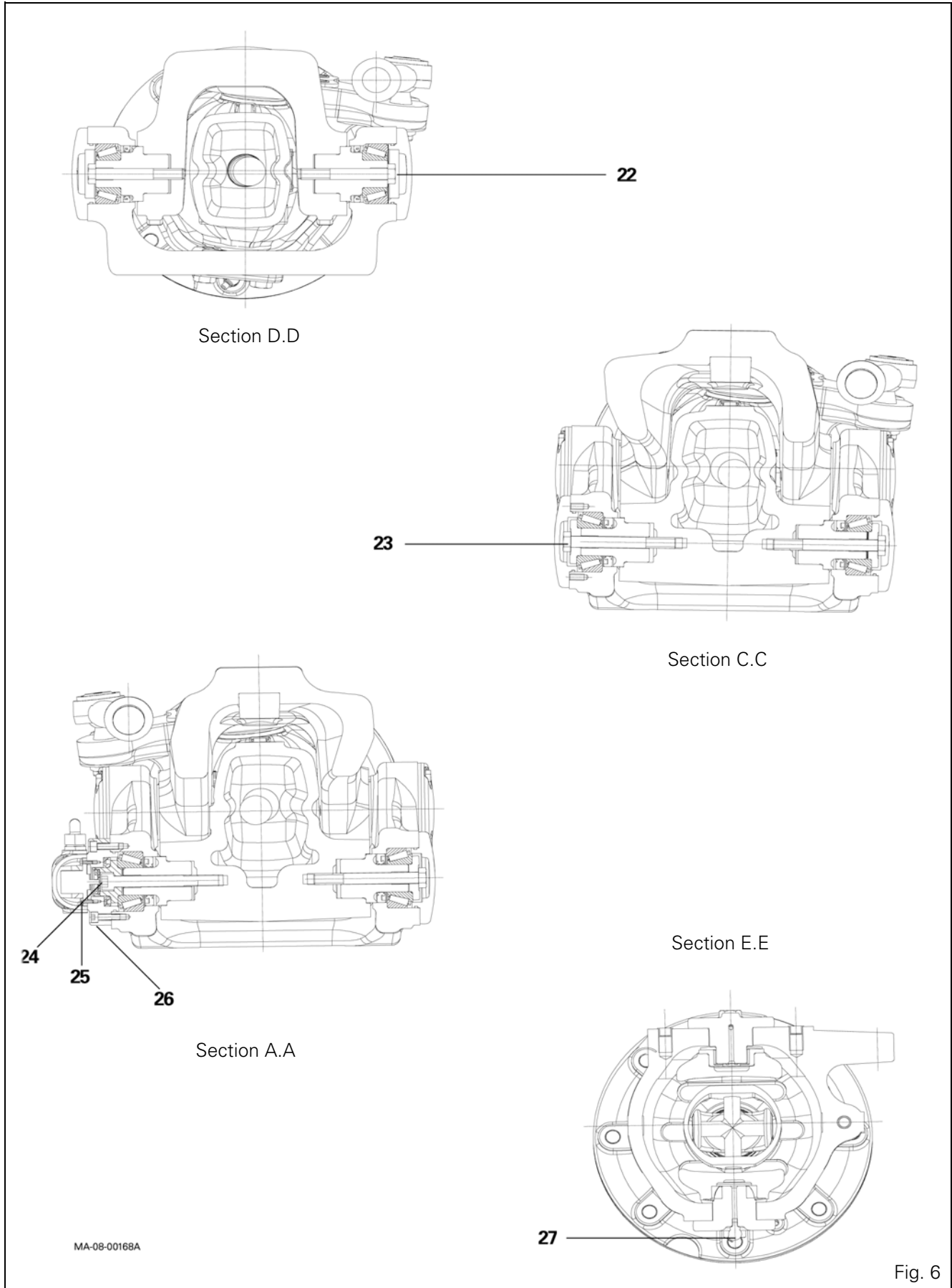


Fig. 5

# General





## Tightening torques for models 20.29 S and 20.43 S (Fig. 7 and Fig. 8)

Ref.	Description	Thread	Nm
1	Wheel hub stud	M18 x 69	70
2	Pinion gear attachment screw	M10 x 50	79
3	Ring gear carrier attachment screw	M14 x 65	230
4	Magnetic plug	M30 x 2	60
5	Planet carrier attachment screw	M8 x 20	25
6	Pad attachment screw	M10 x 25	10
7	Differential unit / ring gear attachment screw	M10 x 30	70
8	Oil breather pipe	M10 x 1	10
9	Steering arm pivot ball locknut	M20 x 1.5	220
10	Spindle gear attachment screw	M14 x 35	190
11	Oil filler cap	M24 x 1.5	60
12	Steering locknut	M16	150
13	Cover attachment screw	M10 x 30	60
14	Grease nipple	M6 x 1	8
15	Pivot ball	-	300
16	Steering ram flange attachment screw	M12 x 45	120
17	Flange attachment screw	M10 x 60	57
18	Steering arm locknut	M24 x 10	250
19	Arm upper pin attachment screw (potentiometer)	M14 x 120	190
20	Potentiometer attachment screw	M4 x 12	3
21	Potentiometer cover attachment screw	M8 x 25	13
22	Half-bearing attachment screw	M14 x 75	266
23	Differential housing attachment screw	M12 x 33	169
24	Damper cover attachment screw	M10 x 35	60
25	Attachment screw of arm lower pin bearing	M14 x 120	190
26	Arm upper pin attachment screw	M14 x 100	190
27	Grease nipple	M6 x 1	8
28	Differential housing attachment screw	M12 x 55	169

# General

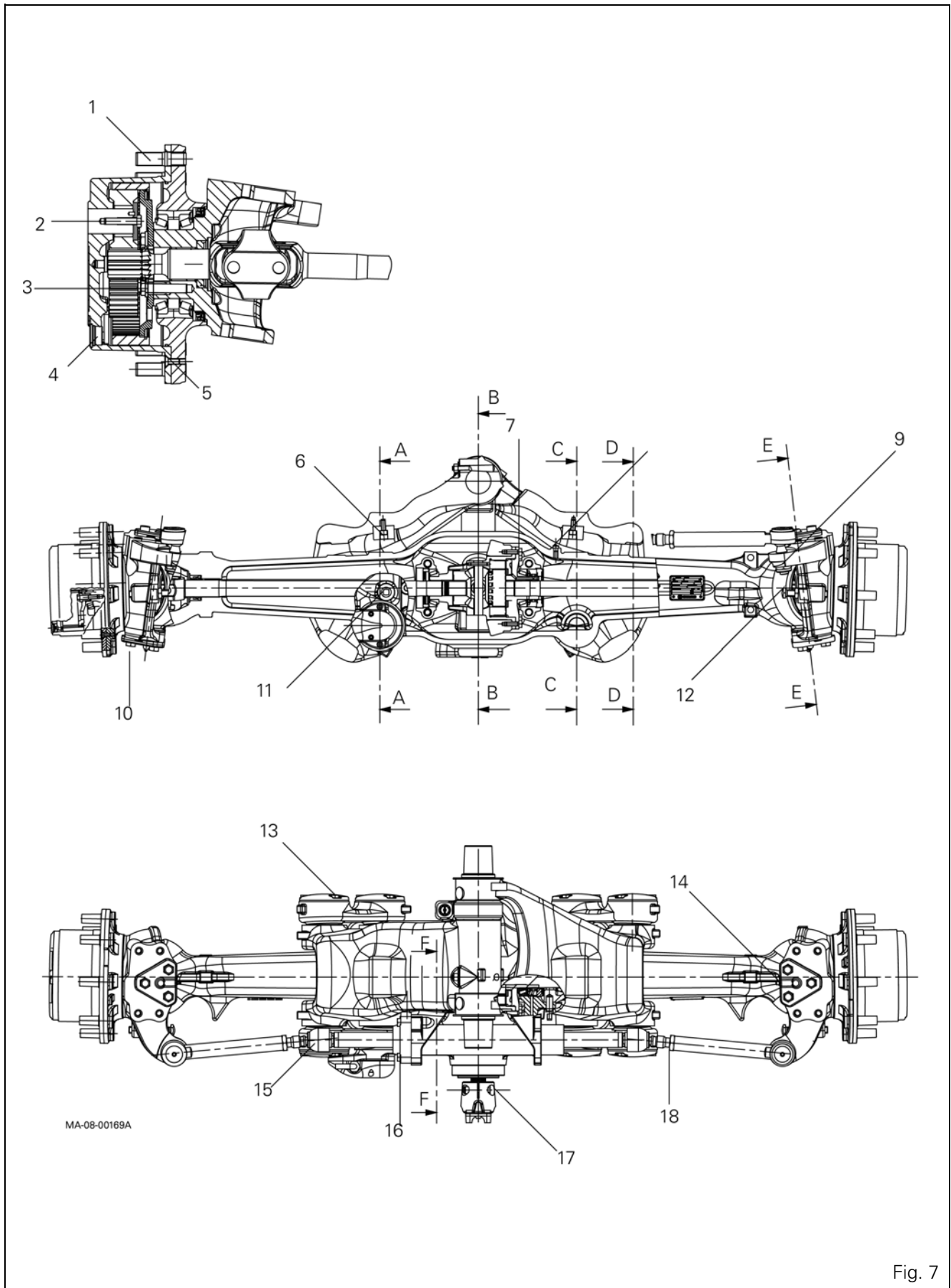


Fig. 7

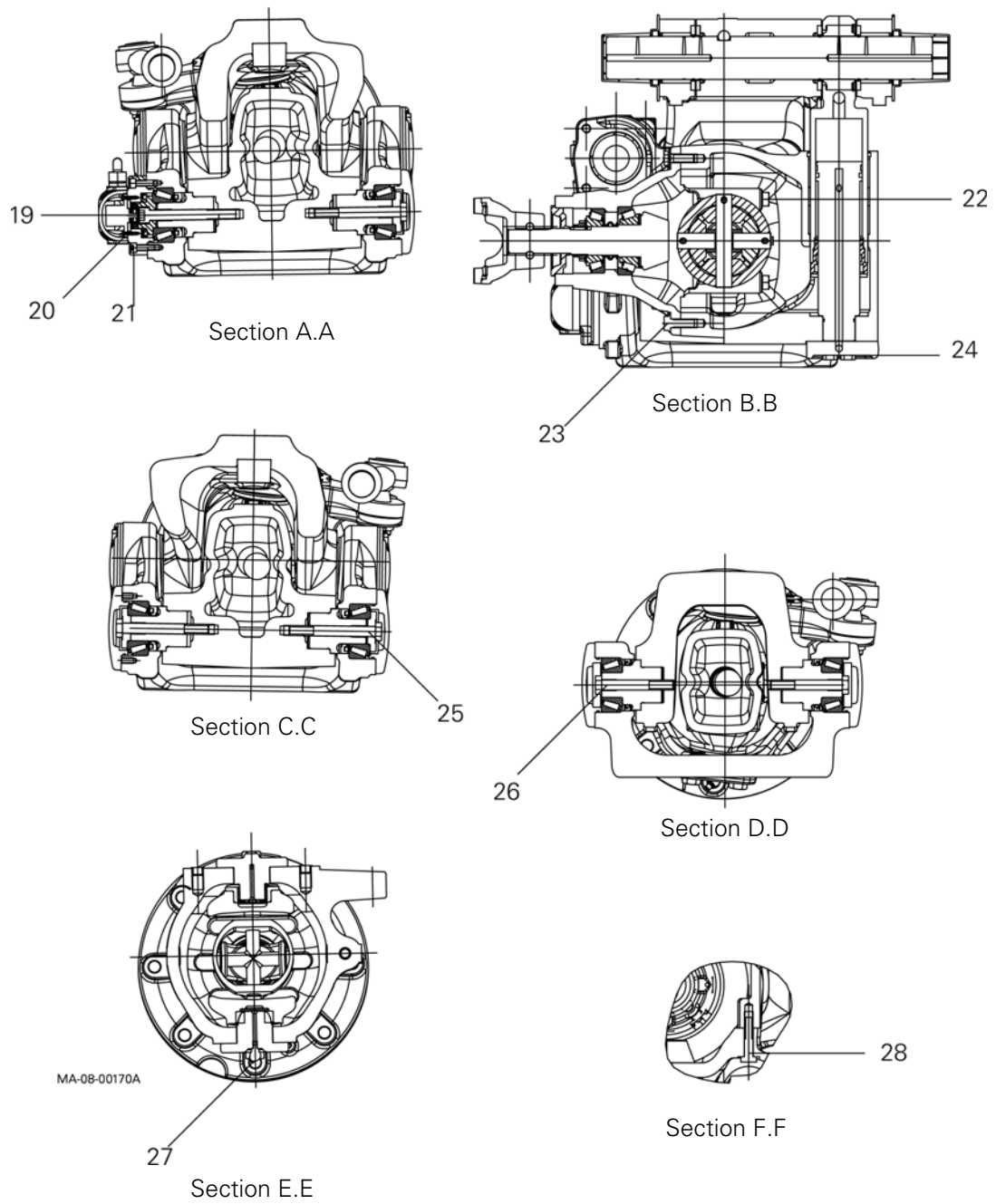
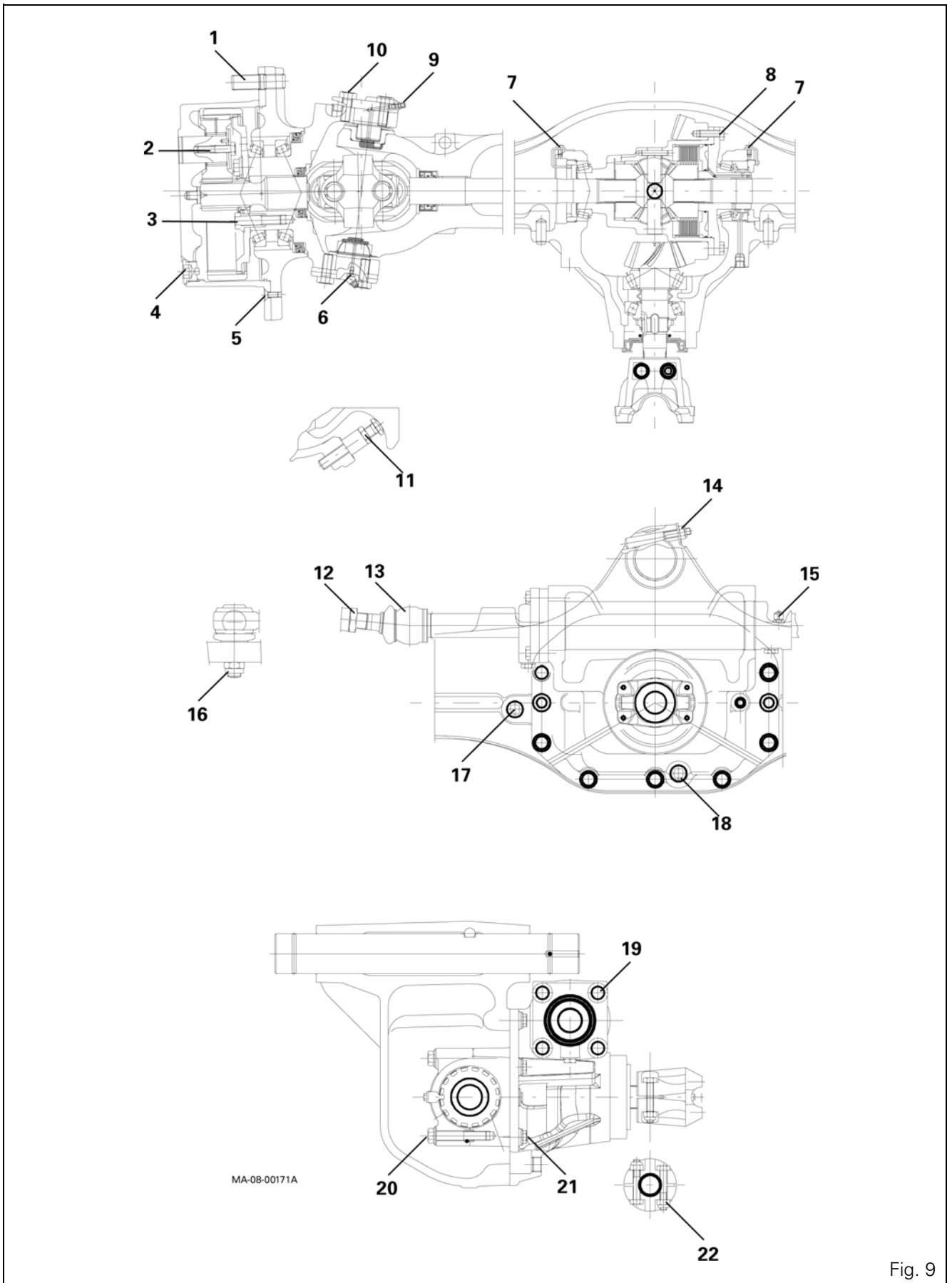


Fig. 8

# General

## Tightening torques for fixed front axles (Fig. 9)

Ref.	Description	Thread	Nm
1	Wheel hub stud	M18 x 69	70
2	Pinion gear attachment screw	M10 x 50	79
3	Ring gear carrier attachment screw	M14 x 65	230
4	Magnetic plug	M30 x 2	60
5	Planet carrier attachment screw	M8 x 20	25
6	Grease nipple	M6 x 1	8
7	Retainer attachment screw	M6 x 16	13
8	Differential unit / ring gear attachment screw	M10 x 30	70
9	Grease nipple	M6 x 1	8
10	Swivel pin attachment screw	M14 x 35	190
11	Steering locknut	M16	150
12	Cover attachment screw	M24 x 30	250
13	Pivot ball	-	300
14	Nut	M10 x 1.5	40
15	Breather pipe	M10 x 1	10
16	Steering arm pivot ball locknut	M20 x 1.5	220
17	Oil filler cap	M24 x 1.5	60
18	Oil drain plug	M24 x 1.5	60
19	Steering ram flange attachment screw	M12 x 45	120
20	Half-bearing attachment screw	M14 x 75	266
21	Differential support attachment screw	M12 x 33	169
22	Flange attachment screw	M10 x 60	57



## General

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Topping up and checking oil levels (Fig. 10  
- Fig. 11)

Specific description	Position
Oil filler and oil level check cap	1
Oil breather	2
Oil filler / drain and check cap in epicyclic drive unit	3
Differential oil drain plug	4
Lubrication points	5

### Routine inspections

- The oil level in the axle must be flush with the level plugs (1) and (3). If not, top up the level with the same oil.
- In case of a leak or any other factor causing the oil level to drop, it is recommended to carry out an immediate check in order to avoid damage to mechanical parts.
- Unscrew and remove the plugs (4) and (3) to drain the oil.

Suspended front axle

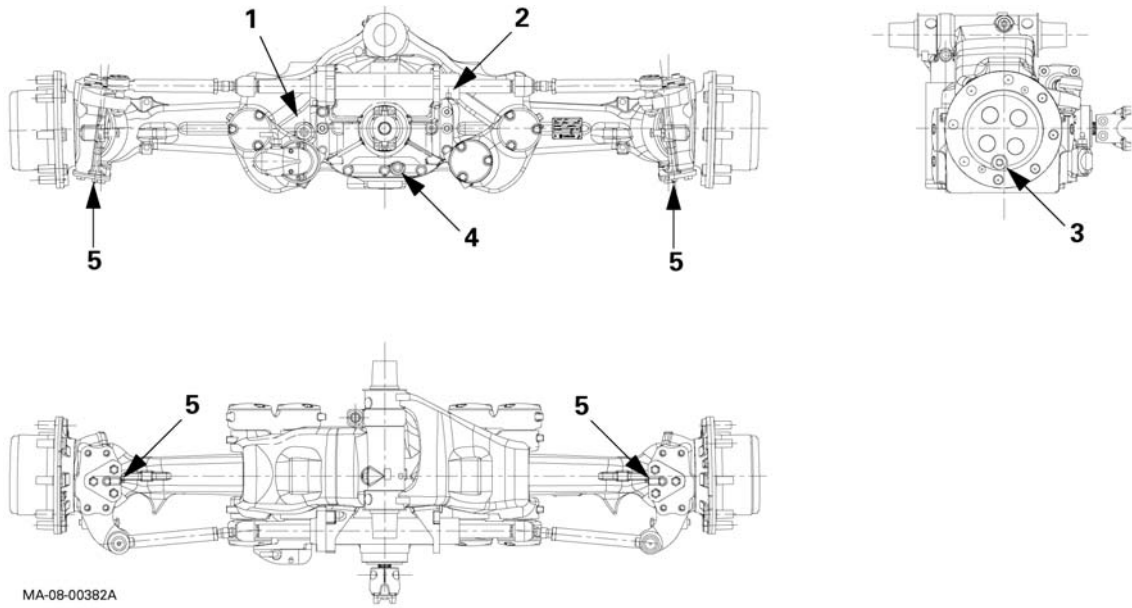


Fig. 10

Fixed front axle

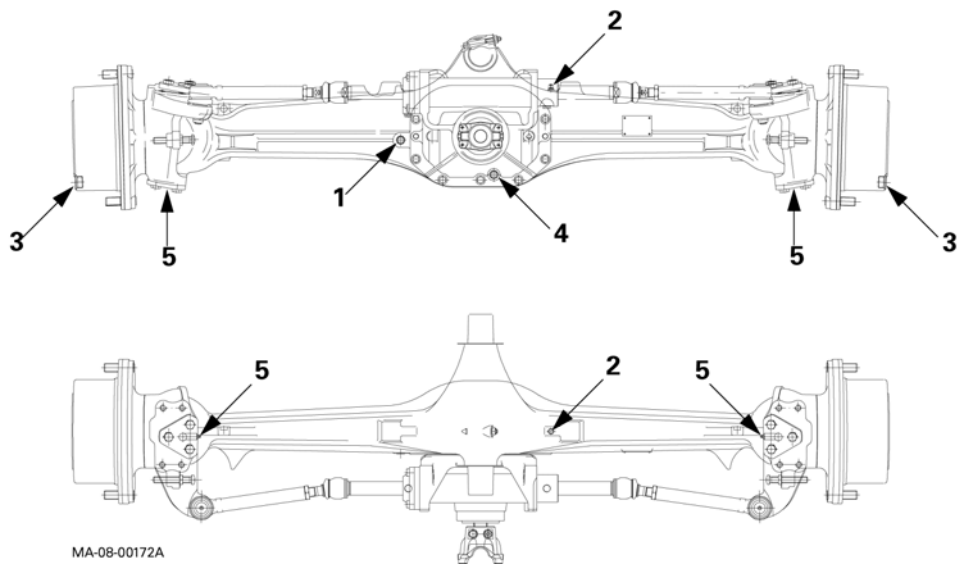


Fig. 11

# General

## General checks

1. The disassembly and reassembly instructions require the tractor axle to be previously removed and installed on a suitable workbench.

Some of the following figures may not show exactly your axle, but the procedure is the same.

After draining the oil, loosen the breather (1) (Fig. 12) to release any internal residual pressure.

Drain the oil through the draining port (2), then tighten the drain plug to the required torque using a torque wrench (see § A) (Fig. 12)

2. Before unscrewing the oil filler cap (3), systematically loosen the breather (1) to release any internal residual pressure (Fig. 13).

Check the oil level and top up if necessary.

Tighten the oil filler cap to the required torque using a torque wrench (see § A).

3. Before draining or topping up the oil in the final drive units, direct the wheel hub so that the filler port (Fig. 14) is at its highest point, then loosen the relevant cap to release any internal residual pressure (Fig. 14)

Position the wheel hub so that the filler port is positioned in the horizontal axis.

Check the oil level and top up if necessary.

Tighten the relevant cap to the required torque using a torque wrench (see § A).

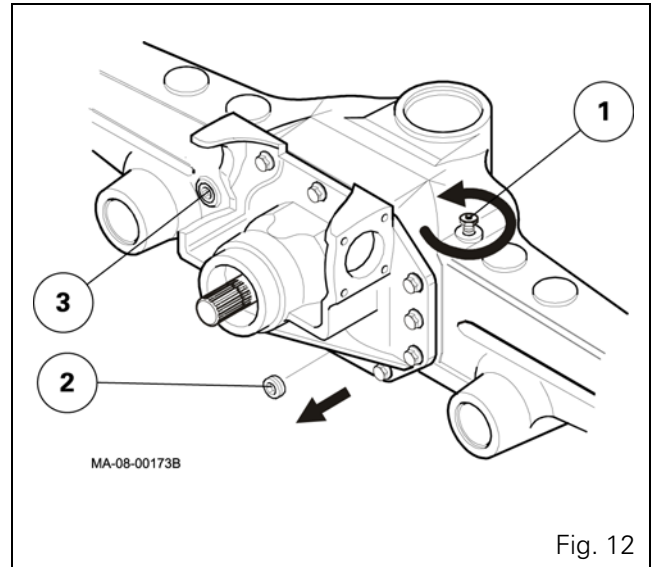


Fig. 12

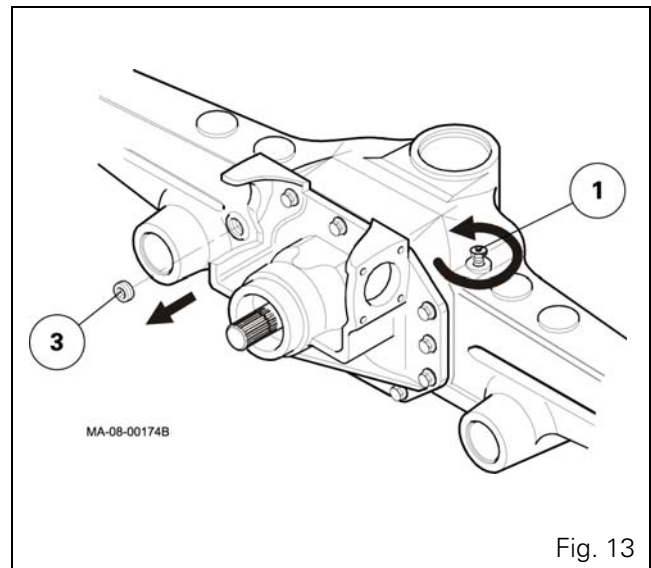


Fig. 13

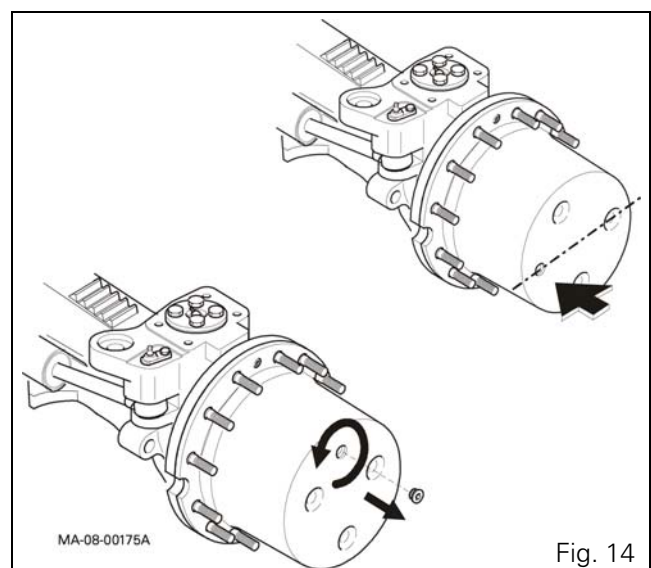


Fig. 14



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## A . Safety instructions

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### Important

- Read this section before carrying out any operation.

### Safety precautions

- Safety and reliability mainly rely on correct use and repair of the axles and their components.
- The recommendations and all procedures described in this manual have been tested and are therefore proven operational methods. For this reason each procedure should be followed with reference both to the text and to the accompanying illustrations.
- Some procedures describe the use of special tools designed for clarity and precision of use.
- These special tools should be used to carry out specific operations.
- It is impossible to provide advice for all working methods, to know all possible methods of carrying out an operation, or to foresee all possible consequences of risks taken at each operation. For this reason, if the operator does not adhere to the procedures or tools recommended in this manual, he puts himself and his assistants in danger and may cause damage to the vehicle.

***Danger: Safety goggles must be worn for all disassembly and reassembly operations.***

- Safety instructions, accident prevention regulations and all general safety regulations in force should be followed at each stage of the operation.
- Before starting any maintenance or repair work, ensure all tools, workbenches, fixtures, levers, extractors and wrenches are in good working condition to make the operation easier.
- In addition, this precaution reduces the risk to parts and components and makes working conditions safer for the operator.
- Carraro disclaims all liability for damage or accidents caused by arbitrary changes made to the product.
- If the product is used for non-recommended purposes, Carraro disclaims all liability. In this case, all consequences shall be borne by the customer.

### Safety rules for maintenance

1. Carry out work in a clean, dry working environment.
2. Do not lubricate, handle or adjust the axle while it is moving.
3. Keep hands, feet, and clothing away from moving parts.

4. Always be prepared for a fire. Keep a fire extinguisher and a first-aid kit close at hand.
5. Keep emergency phone numbers (doctor, ambulance, hospital, fire station) close to the telephone.
6. Suitable protective clothing, for example overalls, gloves and a safety helmet, must be worn.
7. Suitable hearing protection, either earmuffs or ear-plugs, must be worn to protect the ears from noise and prevent any damage to the hearing.  
Prolonged exposure to noise can damage the hearing.
8. The operator must pay special attention to the equipment. He should not wear headphones to listen to music when working on the product or installation.

### Preventing residual risks

- Risk of crushing and shearing by moving parts.

***Warnings:***

- ***All maintenance work should be carried out while the machine is stationary.***
- There is a risk of inhalation of poisonous gases released by melting paintwork when welding.

***Warnings:***

- ***Use workstations fitted with dust, smoke and vapour extraction systems.***
- ***Wait for at least 15 minutes for smoke and vapour to disperse before resuming welding or heating work, or before working on the installation.***

# General

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- Fire risk caused by use of solvents with oil in the axle.

**Warnings:**

- **Remove all heat sources from the working area.**
  - **If solvents or paint removers have been used, remove all traces using soap and water before starting to weld.**
  - **All solvent and paint remover containers and any other flammable product must be removed from the working area.**
- Risk of parts or oil falling, being dropped, splashed, or suddenly thrown or expelled from the axle.

**Warnings:**

- **These residual risks and relevant procedures to apply for their complete remedy are described in detail in the disassembly and reassembly procedures. During maintenance operations, all safety procedures described in this manual should be followed carefully.**

*8A11 - Carraro final drive units*

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## Carraro final drive units

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## A . General

Some of the following pictures may not show your exact axle, but the procedure is the same.

## B . Disassembling the steering ram

### Preliminary operations

1. Chock the rear wheels. Apply the handbrake.

#### Reminder

- Because the 4WD clutch is mechanically engaged when stationary, raise the two front wheels in order to freely turn the hub of the relevant wheel.

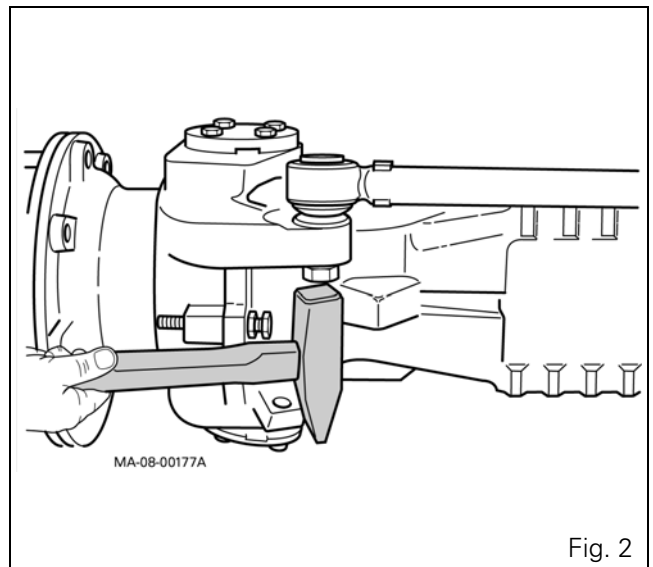
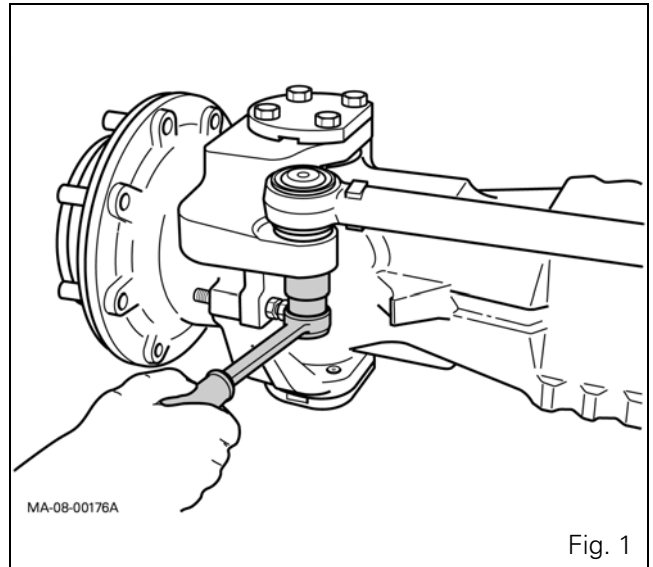
2. Place stands.
3. Remove the wheel concerned.
4. Drain the drive unit.

### Disassembling the steering ram

5. Loosen the selector rail locknut several turns until it is at the same level as the threaded stud (Fig. 1).
6. Hit the nut with a mallet to extract the selector rail from the swivel housing (Fig. 2).

**Note: This operation will destroy the nut.**

To disassemble the steering ram, see section 9K01.



# Carraro final drive units

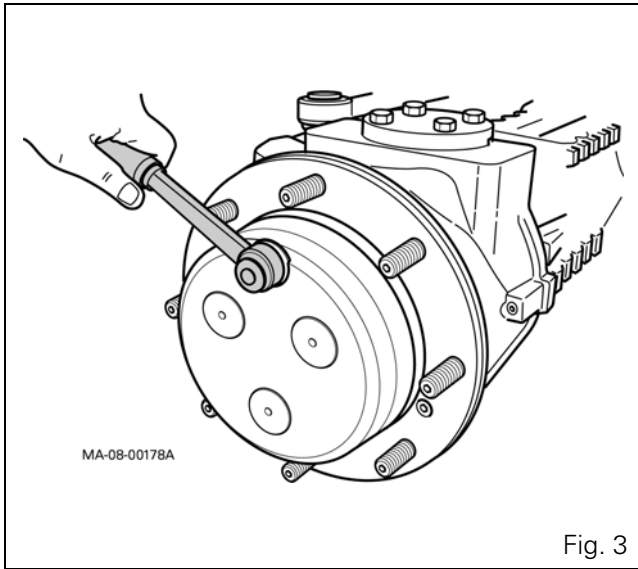


Fig. 3

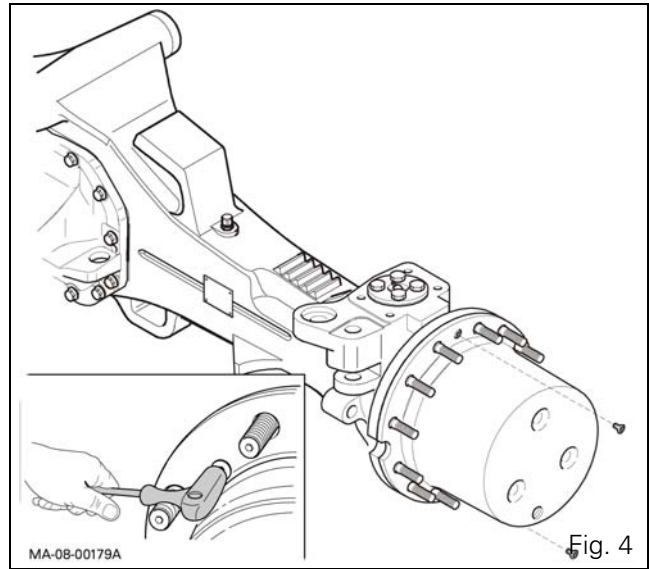


Fig. 4

## C . Removing the epicyclic drive unit

7. Before draining the oil, position the wheel hub with the plug at its highest point and loosen it several turns to release any internal residual pressure, then loosen it completely (Fig. 3). Turn the hub again to position the plug at its lowest point. Completely drain the oil.
8. Loosen and remove the two planet carrier attachment screws using a wrench (Fig. 4). Extract the planet carrier from the wheel hub. Place the planet carrier on a workbench and check it for wear.
9. Replacing pinion gears if necessary:
  - **For models 20.19 and 20.22 (Fig. 5)**
    - remove circlip A from each pinion gear,
    - remove washer B and extract pinion gears D from their pins,
    - recover bearings C and check their condition.
  - **For models 20.29 and 20.43 (Fig. 6)**
    - remove the attachment bolt of each pinion gear,
    - remove washers and extract pinion gears from their pins,
    - recover bearings and washers and check their condition,
    - remove the dust seals.

### Remark:

- **It is recommended to replace the bearings when installing new pinion gears.**

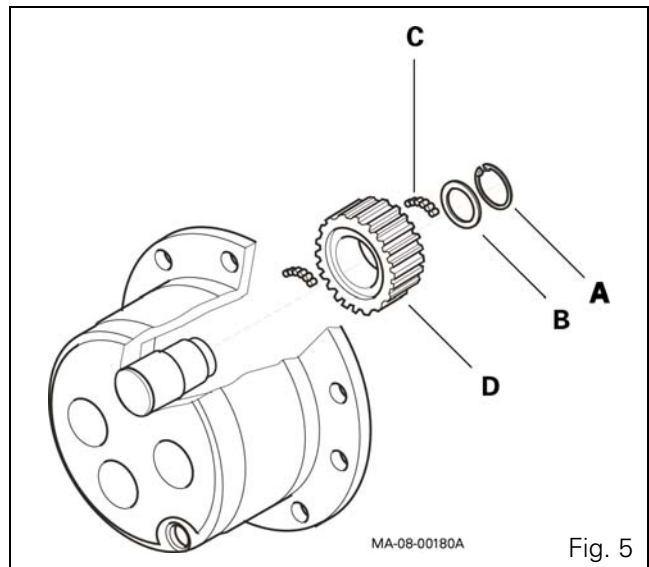


Fig. 5

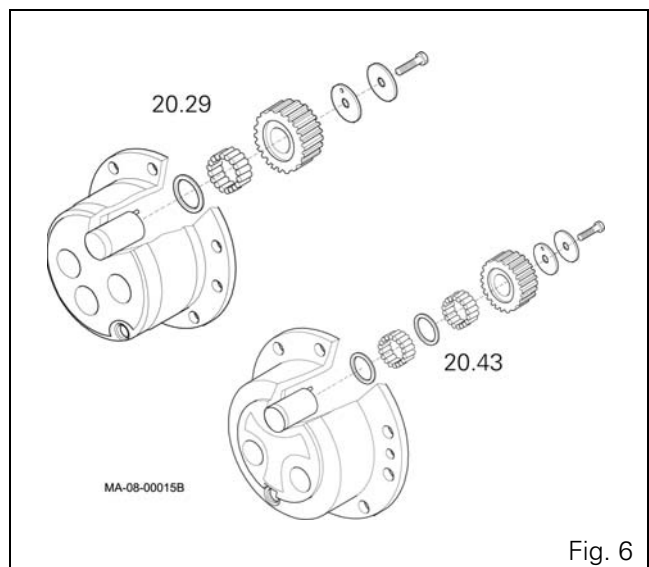
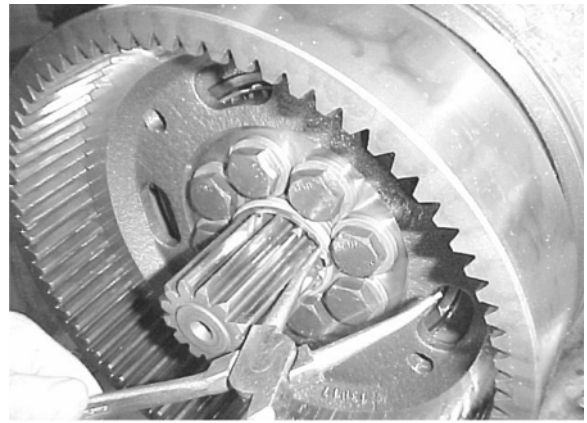


Fig. 6



MA-08-00182A

Fig. 7



MA-08-00183A

Fig. 8

## D . Disassembling the wheel hub

Before disassembling the wheel hub, it is recommended to attach it with a belt or sling to a hoist or another suitable lifting tool to prevent it from accidentally falling, risking injury to the operator and damage to the wheel hub.

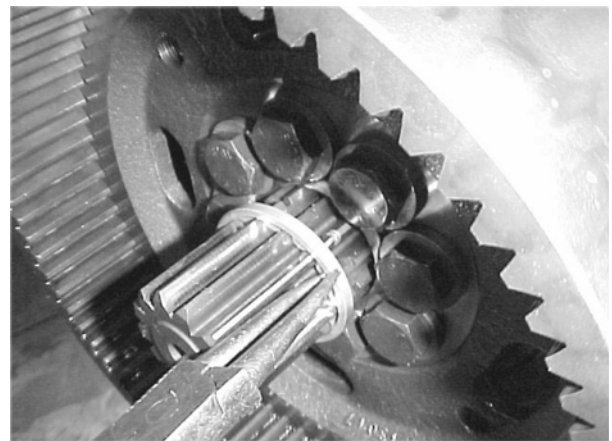
Some of the following pictures may not show your exact axle, but the procedure is the same.

**10.** Insert a lever between the swivel housing and slide it into the universal joint. Push on the seal with the lever in the direction of the final drive unit to remove the circlip more easily (Fig. 7).

Extract and discard the circlip (Fig. 8).

Extract and discard the washer (Fig. 9).

Extract and discard the two star washers (Fig. 10).



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Fig. 9



MA-08-00185A

Fig. 10

## Carraro final drive units

11. Loosen and remove the attachment screws of the ring gear carrier assembly (Fig. 11)
12. To remove the ring gear assembly from its housing, screw at least two of the screws that have just been removed into the threaded extraction holes (Fig. 12). While watching the ring gear ports, avoid positioning the screws on the cast iron slots (Fig. 13).



### Danger

- Do not reuse these two screws when reassembling the ring gear.

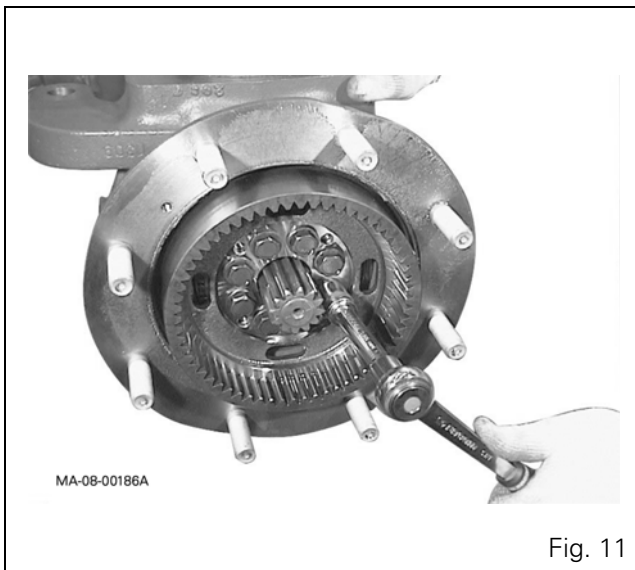


Fig. 11

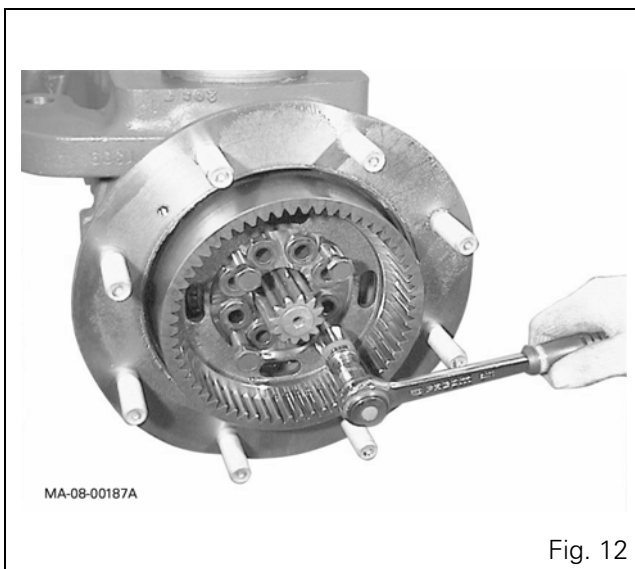


Fig. 12

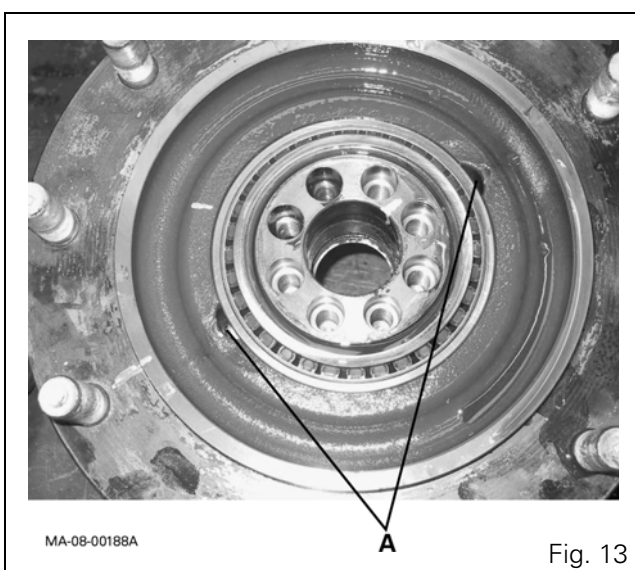


Fig. 13



13. Extract the ring gear carrier with the epicyclic ring gear.

Remove the snap ring and split the ring gear carrier from the epicyclic ring gear (Fig. 14). Check the condition of the parts. If necessary, remove the locating rings from the locking ring gear of the hub using a mallet and special tool ref. CA715027 (see § K).

14. Remove the wheel hub using levers and a mallet to make the operation easier (Fig. 15).

**Remark: Recover the bearing cone.**

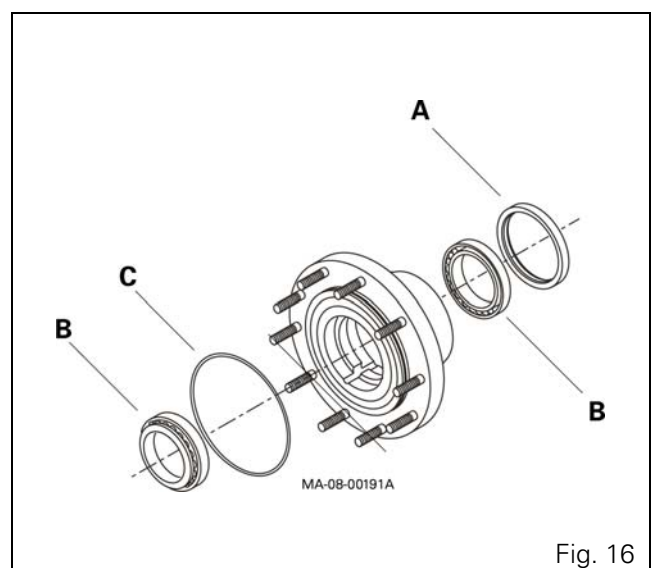
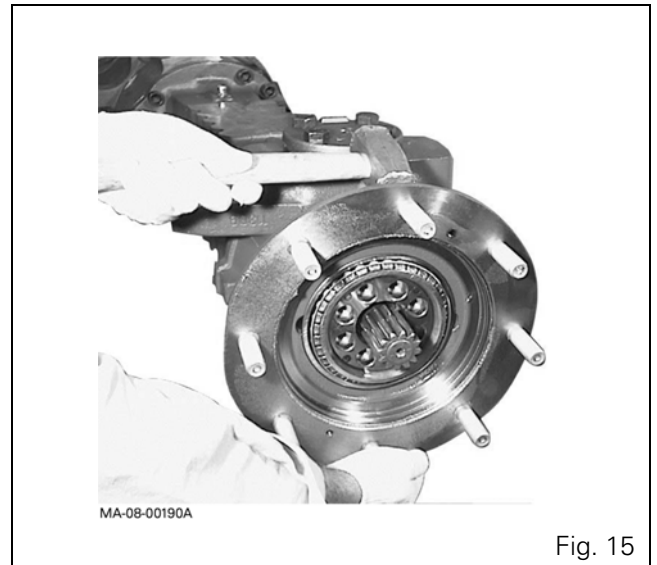
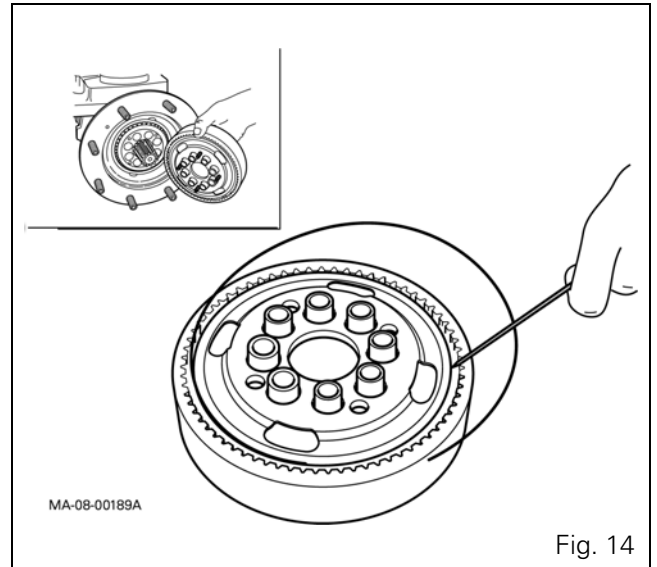
15. Place the wheel hub on a flat surface and extract the sealing ring (A) with a lever.

**Remark: This operation destroys the sealing ring.**

Extract the bearing cups B either side of the hub using a mallet and a suitable extractor.

Extract the bearing cone from the swivel housing side using a suitable extractor.

Extract the O'ring C from the wheel hub (Fig. 16)



# Carraro final drive units

16. Loosen and remove the attachment screws from the upper and lower swivel pins (Fig. 17).



## Danger

- Before removing the swivel pins, attach the swivel housing with a belt or sling to a hoist or another suitable lifting tool.

Remove the swivel pins and recover the Belleville washers.

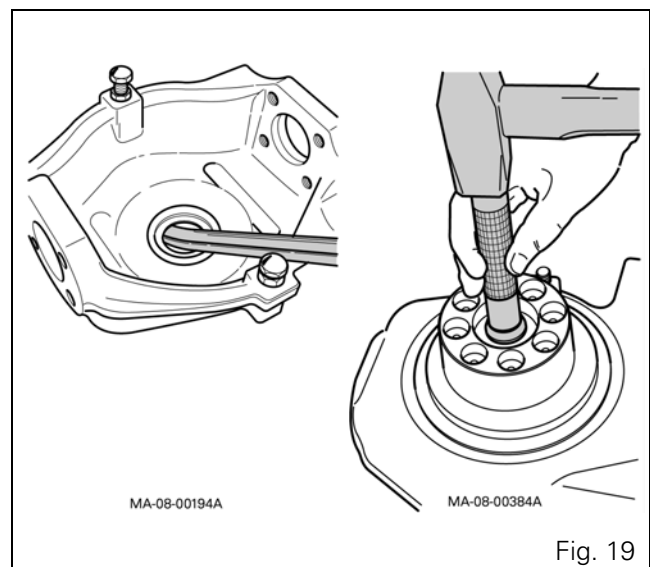
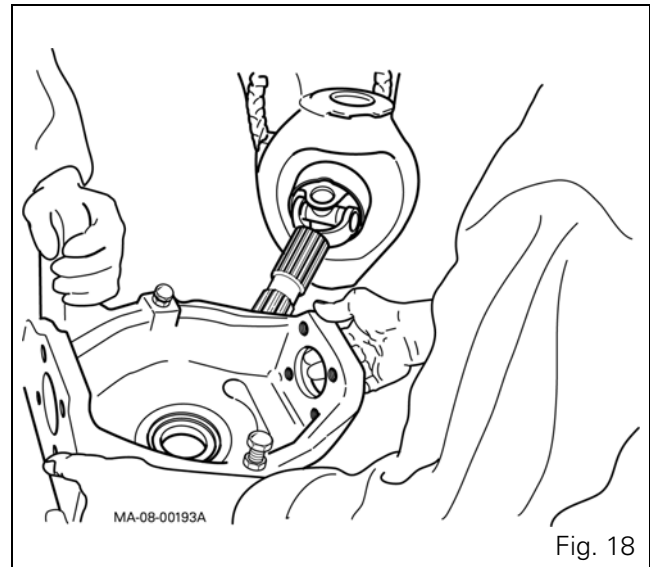
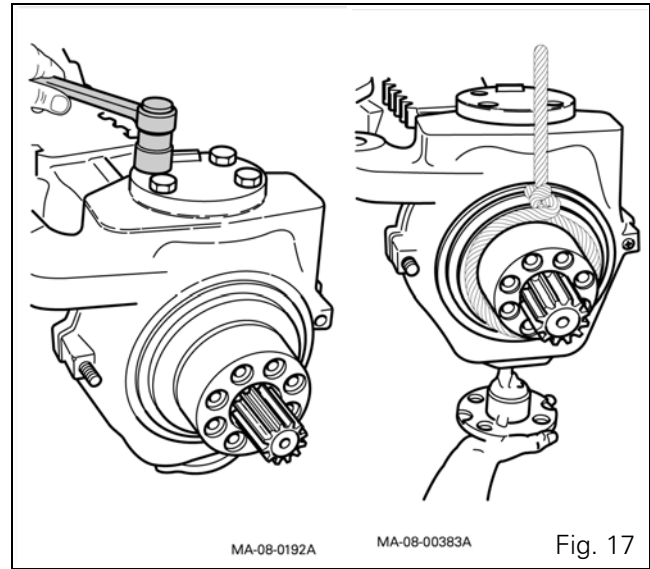
**Remark: Note the positioning of the two Belleville washers, which are not identical.**

17. Remove the swivel housing from the axle beam and the short shaft of the universal joint transmission (Fig. 18).

Place the swivel housing on a flat surface and extract the sealing ring with a lever (Fig. 19).

**Remark: This operation destroys the sealing ring.**

18. Turn the swivel housing to extract the ring with a drift and a mallet (Fig. 19)



## E . Disassembling the axle beam

19. Split the universal joint from the axle beam (Fig. 20).

20. Extract the sealing ring A from the axle beam with a lever.

Remove the Belleville washers C from the swivel pin housings inside the axle beam.

**Remark: Note the positioning of the two Belleville washers, which are not identical. This operation destroys the sealing ring.**

Extract the ring B from the axle beam using a suitable extractor (Fig. 21)

**Remark: Check the ring before reassembling and only replace it in case of excessive wear.**

21. Extract the upper rings D and lower rings E from the swivel pin housings F and swivel pins using a suitable extractor (Fig. 22).

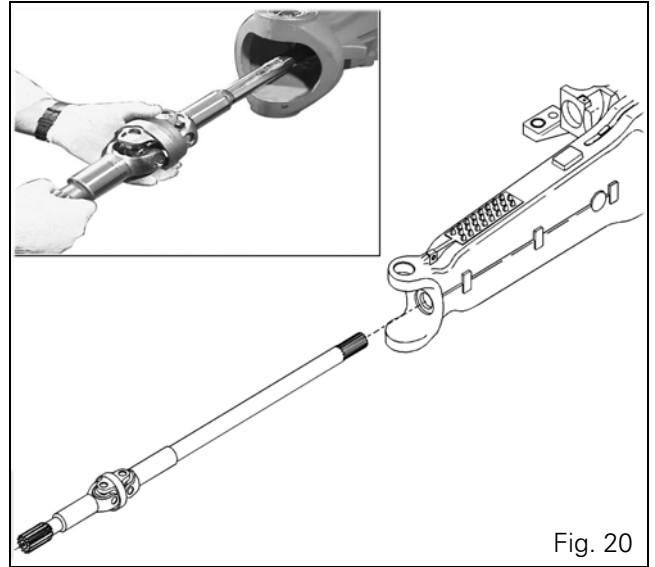


Fig. 20

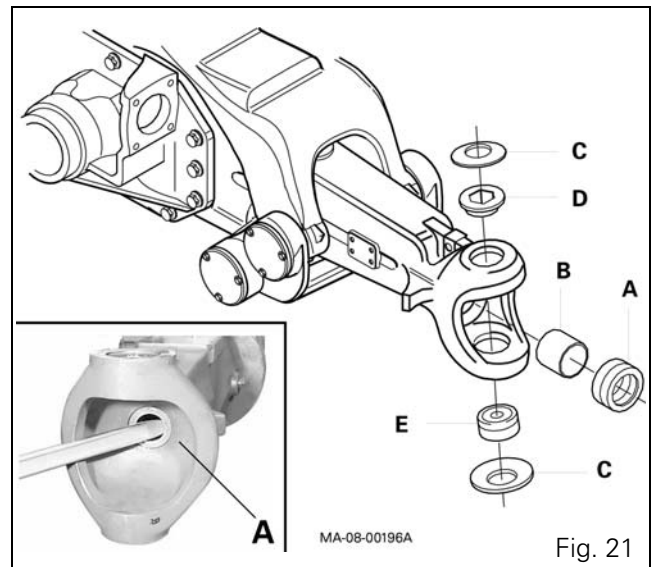


Fig. 21

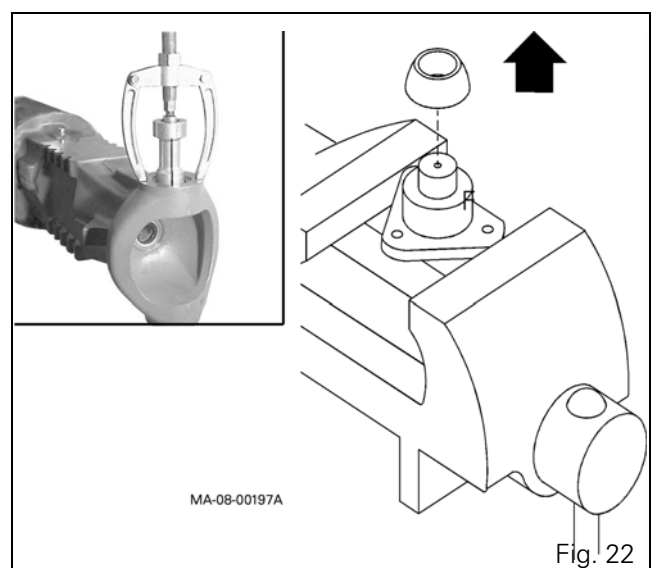
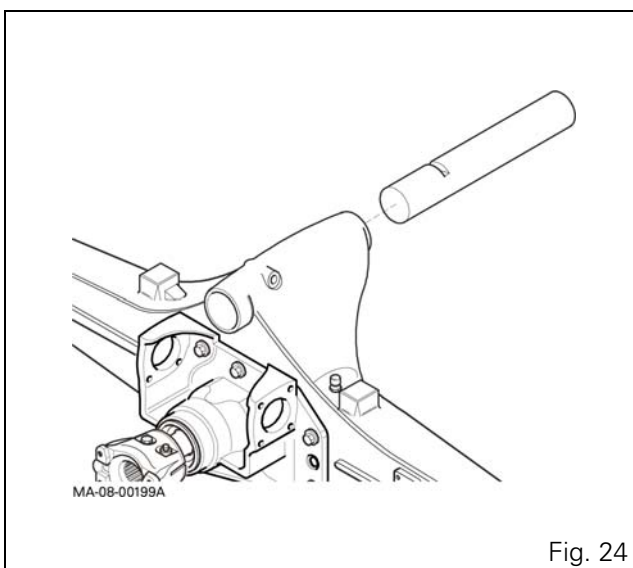
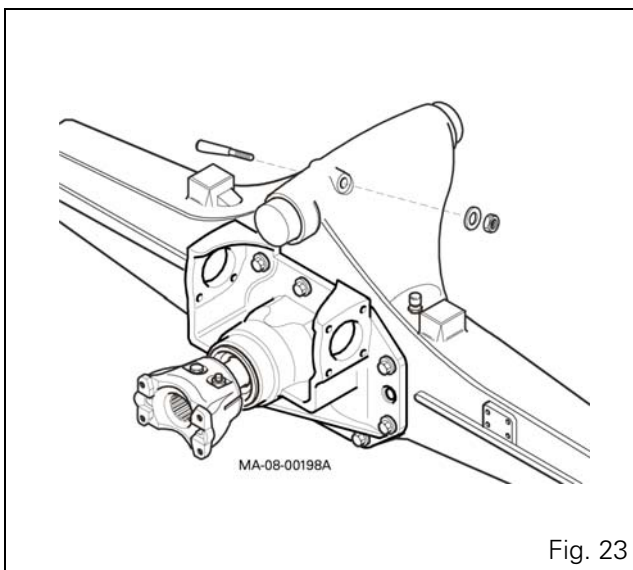


Fig. 22

## Carraro final drive units

For fixed front axles:

22. Extract the nut and retaining washer from the taper pin. Remove the pin with a mallet (Fig. 23).
23. Remove the pivot pin using a mallet or another soft object (Fig. 24).



## F . Reassembling the axle beam

24. Place the ring of the upper swivel pin on the axle beam using special tool ref. CA715034 (see § K) and a mallet.

Insert the bearing cup on the lower part of the axle beam using special tool ref. CA715035 (see § K) and a mallet (Fig. 25)

**Remark: Cool the arm pins to under -100°C before installing them in order to facilitate their assembly. This operation can be carried out by completely dipping the arm pins into liquid nitrogen. To purchase or hire liquid nitrogen, contact the "Air liquide" company.**

**Warning: It is recommended to wear protective gloves.**

25. Place the ring on the axle beam using special tool ref. CA119055 (see § K) and a mallet.

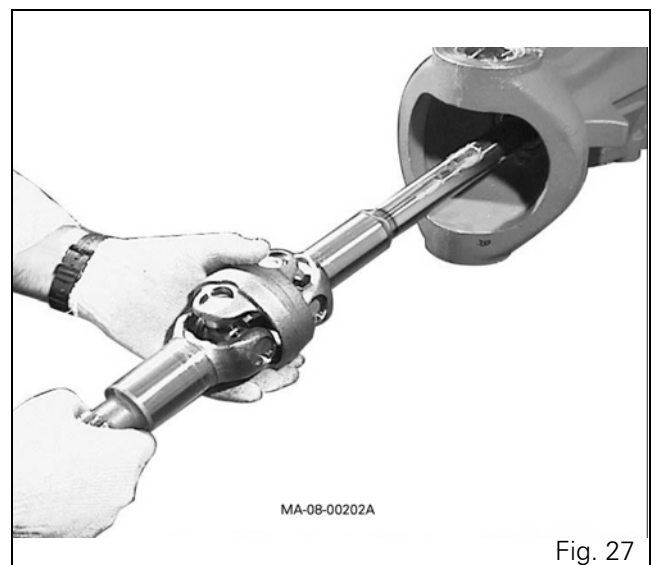
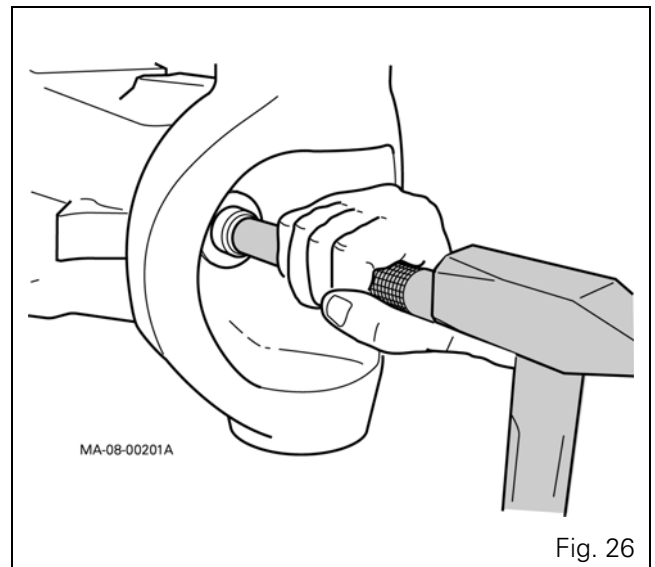
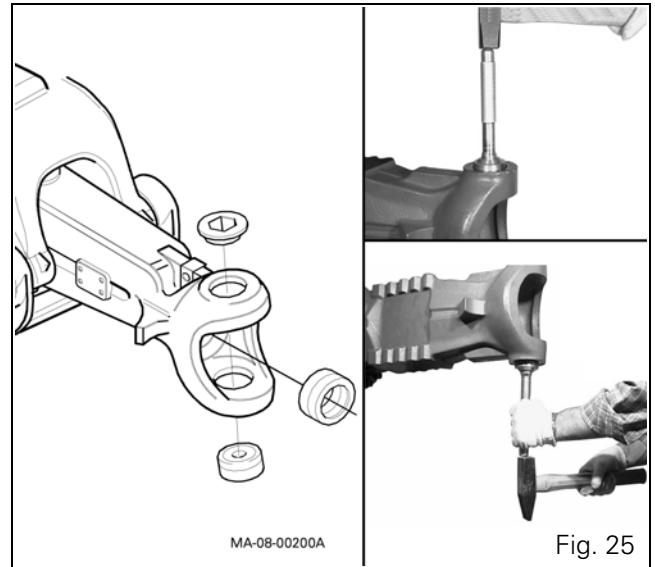
Install the seal on the axle beam using special tool ref. CA119139 or CA 715097 for model 20.29 (see § K) and a mallet (Fig. 26).

Fill the seal housing to three quarters full with grease.

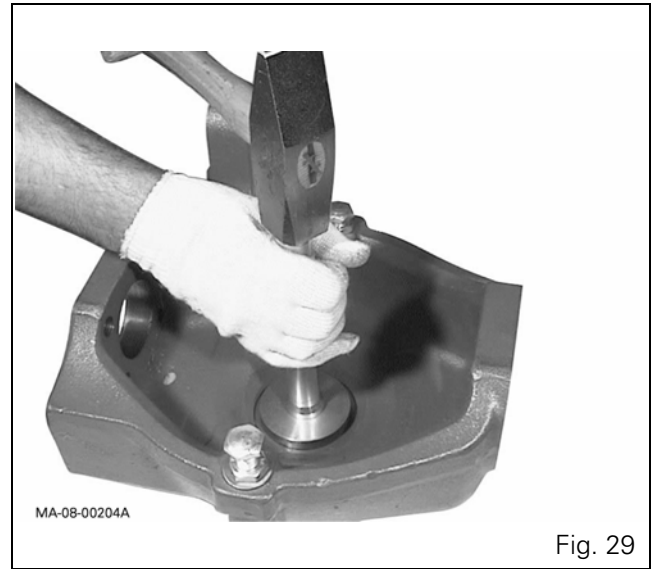
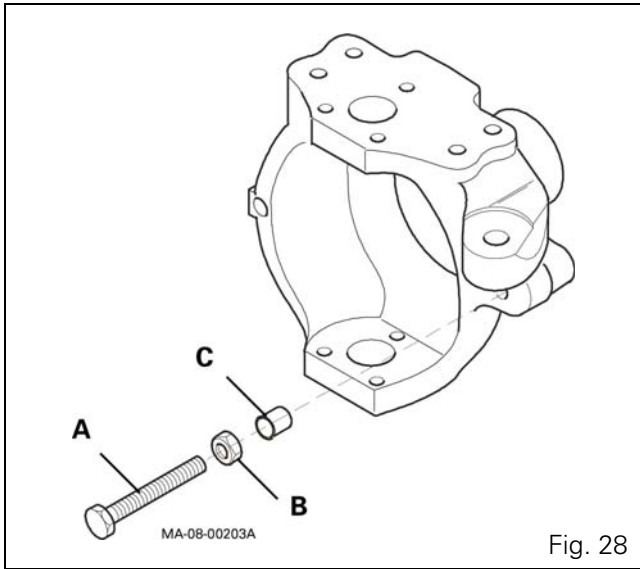
26. Lubricate the ring and the seal lip.

Insert the universal joint into the axle beam. (Fig. 27)

**Warning: Take care to avoid damaging the seal.**



# Carraro final drive units



## G . Reassembling the wheel hub

27. For fixed axles, fit screw A, nut B and washer C (Fig. 28).

**Remark: If washer C is not fitted the axle will be damaged.**

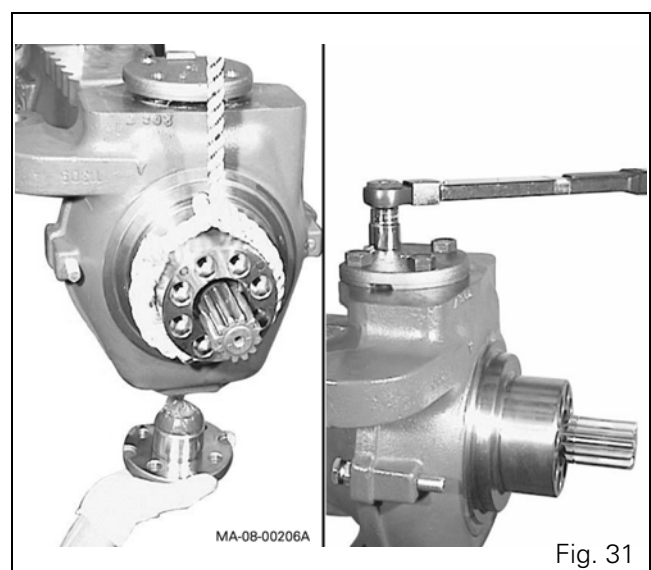
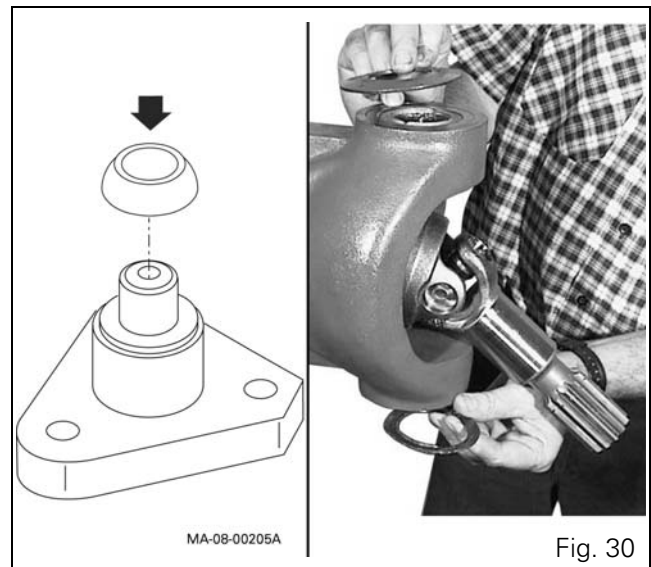
Force fit the ring in the swivel housing using special tool ref. CA715252 for 20.22 and 20.19 models, CA 715108 for 20.29 and 20.43 models, CA 119097 for 20.22 ACP and 20.19 ACP models, and CA 715036 for 20.29 and 20.43 ACP models (see § K) and a mallet or a press. Fit the seal to the swivel housing using special tool ref. CA119139 for 20.22 and 20.19 models and CA 715097 for 20.29 and 20.43 models (see § K) (Fig. 29). Fill the seal housing to three quarters full with grease.

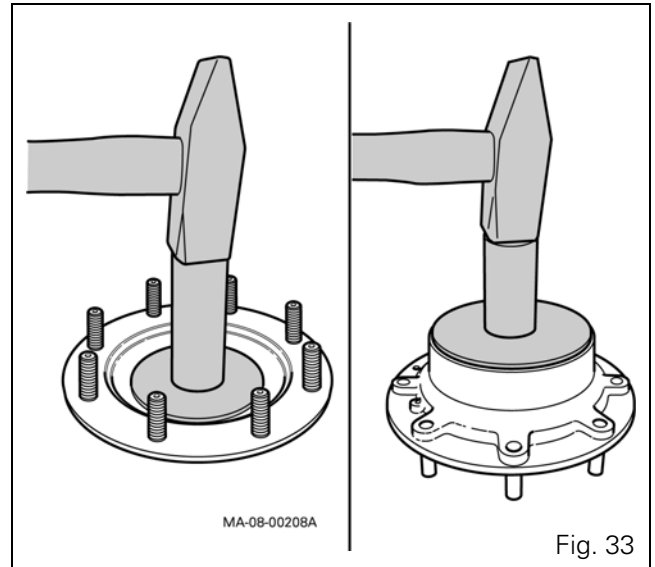
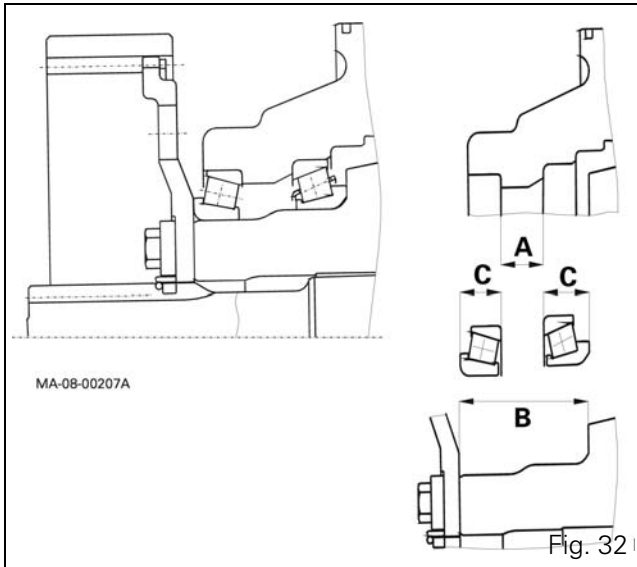
28. Place the lower swivel pin on a workbench and install the ball joint cone using special tool ref. CA715035 (see § K) and a press. Thoroughly grease the swivel pin housings with special grease (see section 8A01 § A). Fit the Belleville washers onto the swivel pin housings (Fig. 30).

29. **Remark: Attach the swivel housing assembly with a sling.**

Lubricate the seal lip and protect the splined end of the shaft by wrapping adhesive tape around it to protect the seal from damage. After assembly, completely remove the adhesive tape. Fit the swivel housing on the axle beam. Install two swivel pins, one upper and one lower, and tighten the attachment screws to the required torque (see section 8A01 § A) using a torque wrench (Fig. 31)

**Remark: Ensure that the Belleville washers remain in place.**





- 30.** The special “Set Right” operation, which consists in shimming the bearings, does not require any specific preload or clearance adjustments. The required values should always be checked before installing new parts (Fig. 32).

**Models 20.19 and 20.22**

- A= 08.450 to 08.500 mm
- B= 54.775 to 54.825 mm
- C= 23.070 to 23.172 mm

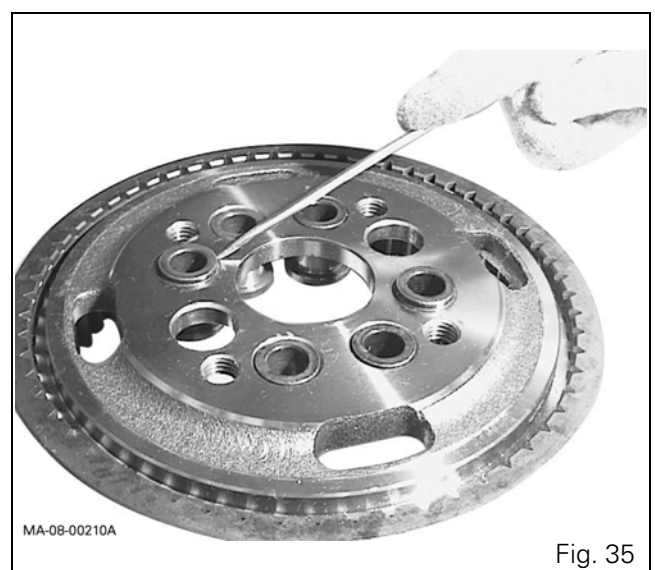
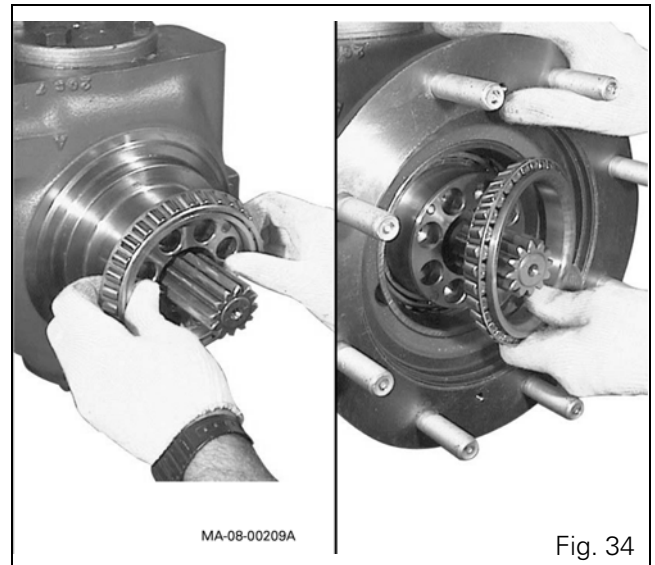
**Models 20.29 and 20.43**

- A= 17.950 to 18.000 mm
- B= 64.275 to 64.325 mm
- C= 23.070 to 23.172 mm

- 31.** Place the wheel hub on a workbench and install the two taper roller bearing cups using the special tool CA715026 (see § K) and a press or a mallet (Fig. 33). Insert the lip seal into the wheel hub using the special tool CA119143 (see § K) and a mallet.

- 32.** Fit the bearing cone at the end of the swivel pin. Assemble the hub on the swivel pin and fit the second bearing cone (Fig. 34).

- 33.** Install the ring gear carrier on a workbench and ensure the rings are flush with the ring gear carrier surface using special tool ref. CA715027 (see § K). The two rings must be positioned slightly higher than the ring gear carrier surface to act as guide pins (Fig. 35).



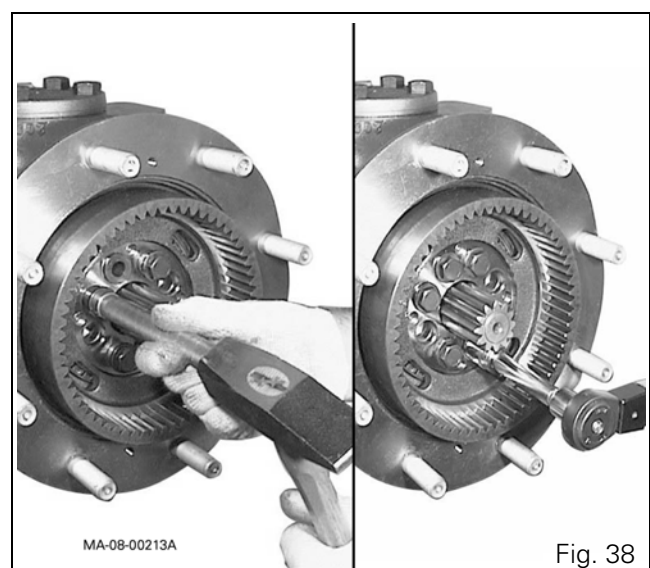
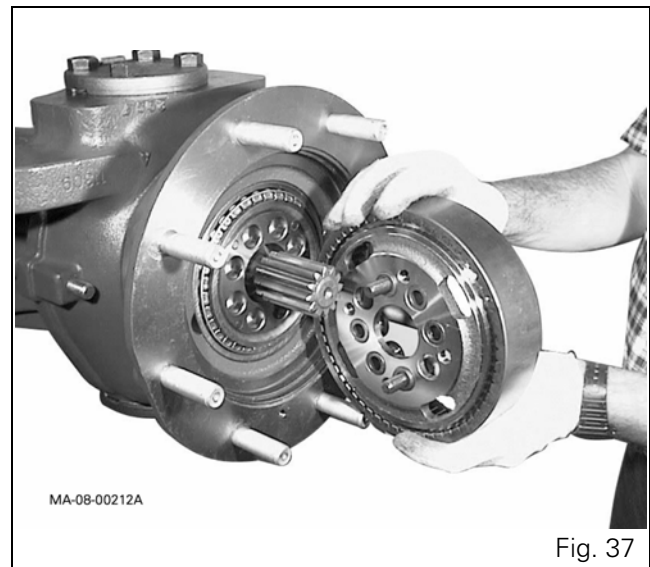
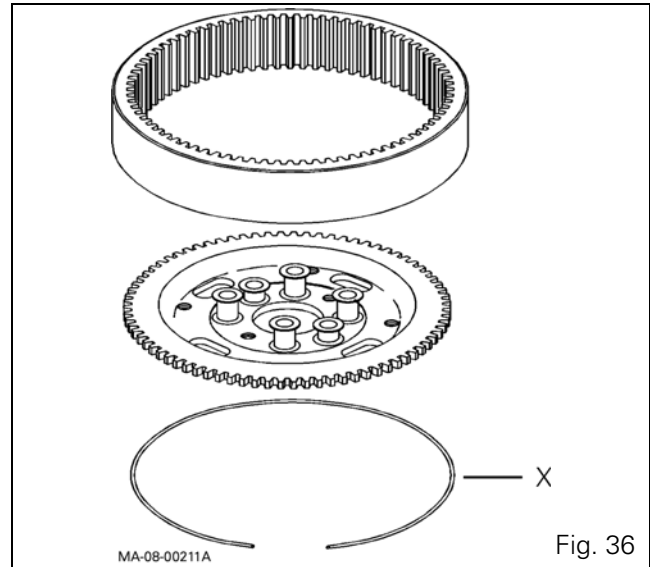
## Carraro final drive units

34. Preposition the assembly comprised of the ring gear carrier and epicyclic ring gear with the special seal X as shown in Fig. 36.
35. Mount the ring gear carrier assembly on the wheel hub using the two shouldered rings as guide pins, and tighten the corresponding screws until the ring gear comes into contact the wheel hub (Fig. 37).



### Danger

- Do not use the two screws that were used to remove the ring gear assembly from its housing when disassembling (see operation 12).
36. Force fit all the rings using the special tool ref. CA715027 (see § K) and a mallet. Fit all attachment screws of the ring gear carrier and tighten to the required torque (see section 8A01 § A) (Fig. 38).





- 37.** Insert a lever between the swivel housing and slide it into the universal joint. Push on the seal with the lever in the direction of the final drive unit to remove the shaft and reassemble the circlip more easily (Fig. 39).

Insert two new star washers on the shaft (Fig. 40).

**Warning:** Check that the two washers are correctly positioned (Fig. 41).



Fig. 39

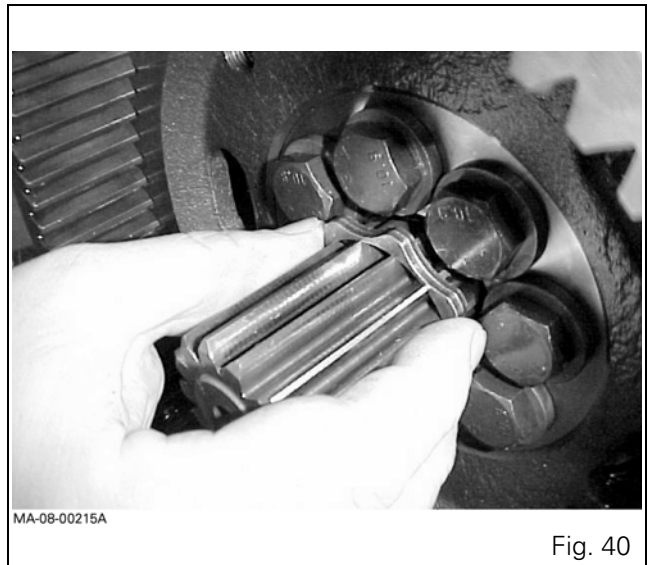


Fig. 40



Fig. 41

## Carraro final drive units

Insert a new washer, so that the groove faces outwards (Fig. 42).

Fit the seal. Take care not to damage it during assembly (Fig. 43).

Carefully push the universal joint and ensure that the circlip is correctly positioned in the groove of the washer (Fig. 44).

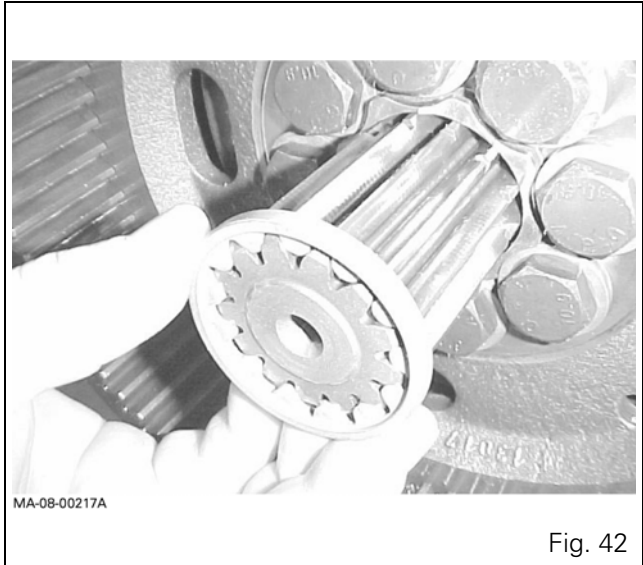


Fig. 42

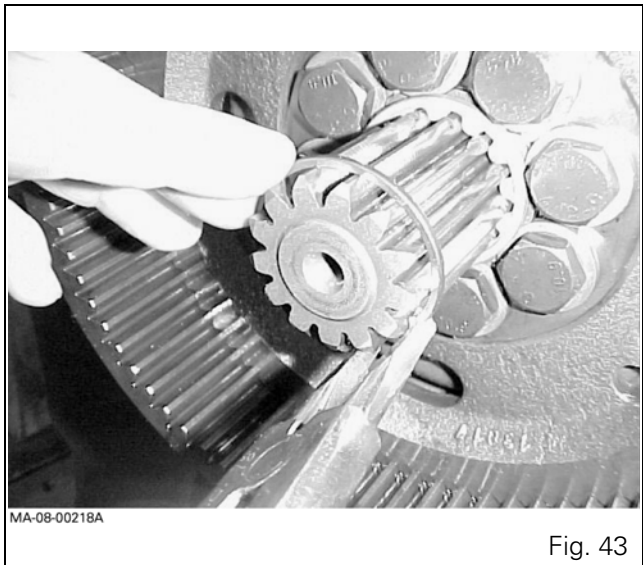


Fig. 43

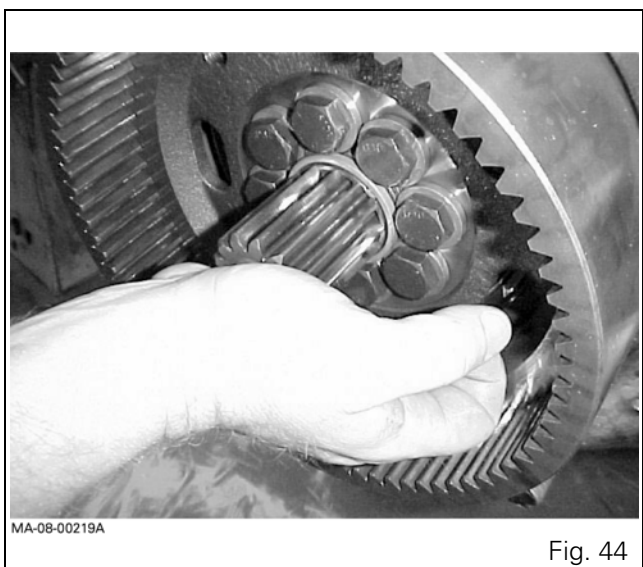


Fig. 44

## H . Reassembling the epicyclic drive unit

38. Recover all epicyclic drive unit parts (Fig. 45).

39. Place the planet carrier on a workbench.

Assemble on the planet carrier pins: the lower bearings, pinion gears and upper bearings.

Fit the thrust washers with their circlips (Fig. 46).

For models 20.29 and 20.43, assemble the lower thrust washer, planet carrier, bearings and both upper thrust washers on the pins of the planet carrier.

**Remarks:**

- **Ensure that the lower thrust bearing is positioned correctly.**
- **Tighten the attachment screws with a torque wrench to the required torque (see section 8A01 § A).**

40. Fit a new O'ring on the wheel hub (Fig. 47).

Fit the epicyclic drive unit on the hub.

Tighten the attachment screws with a torque wrench to the required torque (see section 8A01 § A).

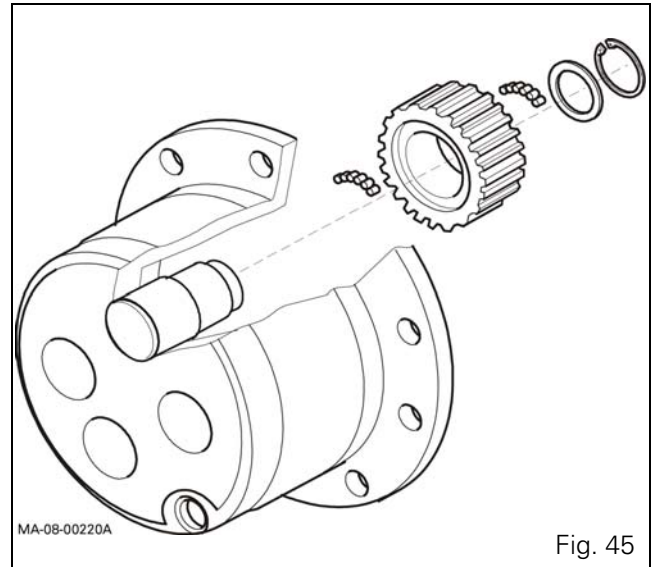


Fig. 45

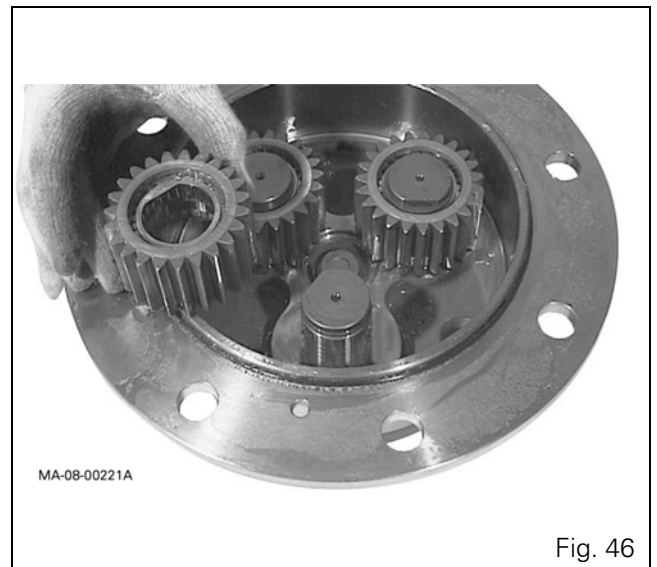


Fig. 46

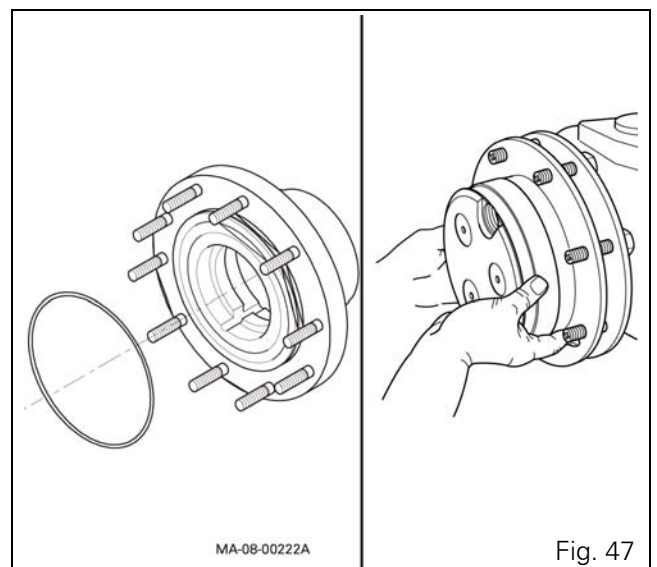


Fig. 47

# Carraro final drive units

## I. Adjusting wheel alignment

41. Place two identical straight bars one metre long each along the sides of the ring gear and lock them on the wheel hub stud with two nuts (Fig. 48).

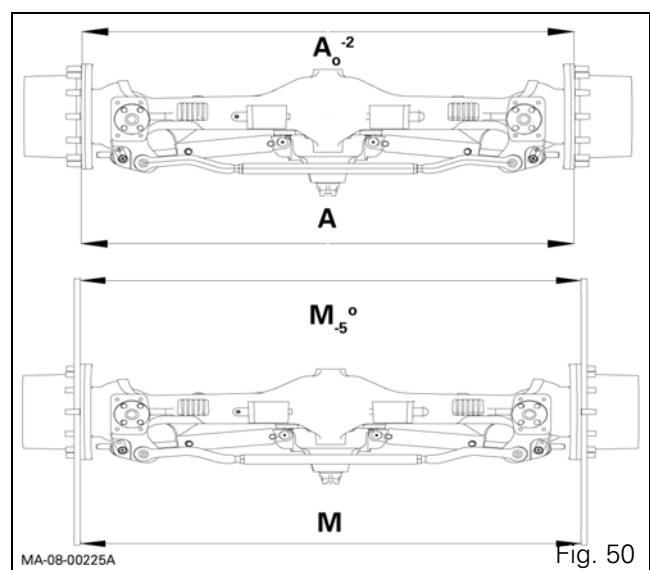
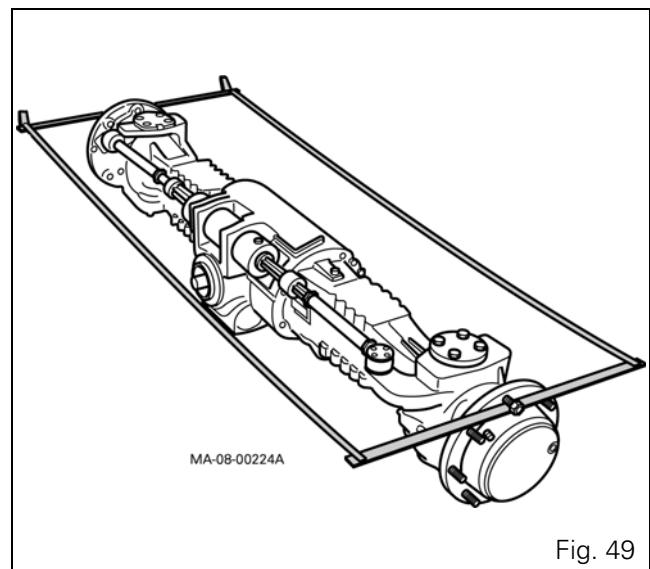
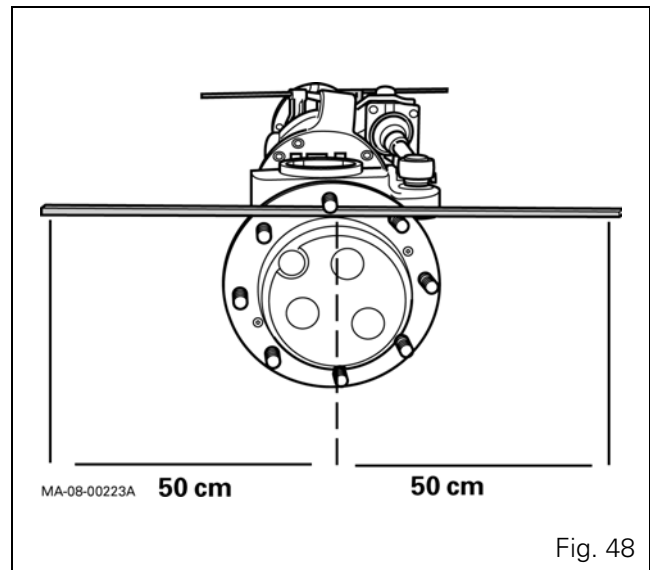
42. Measure the distance M between the ends of the bars (Fig. 50).

**Remark: Keep the minimum value by oscillating the measurement point.**

43. Ensure that the deviation in measurement A between the ends of the wheel hub diameters does not exceed the allowable values (see chapter 8).

Measured value M taken at the ends of the bars must be as a function of the relation between the bar length and the flange diameter.

- wheel alignment (see section 8A01 § A) =  $A0-2$
- measurement deviation =  $M0-5$ .



## Carraro final drive units

44. If wheel alignment is not correct, adjust the selector rails by screwing or unscrewing equally both tie rods, using two wrenches until wheel alignment enters the required values (Fig. 51).
45. When the adjustment is correct, screw the selector rail locknuts to the required torque (see section 8A01 § A) (Fig. 52).

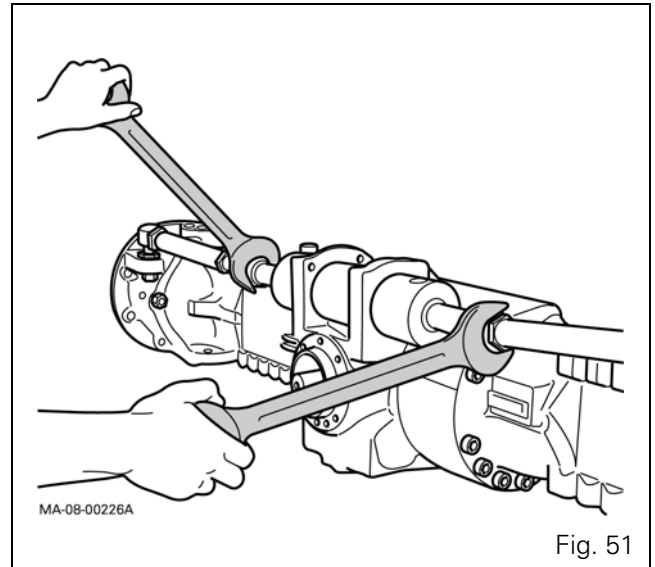


Fig. 51

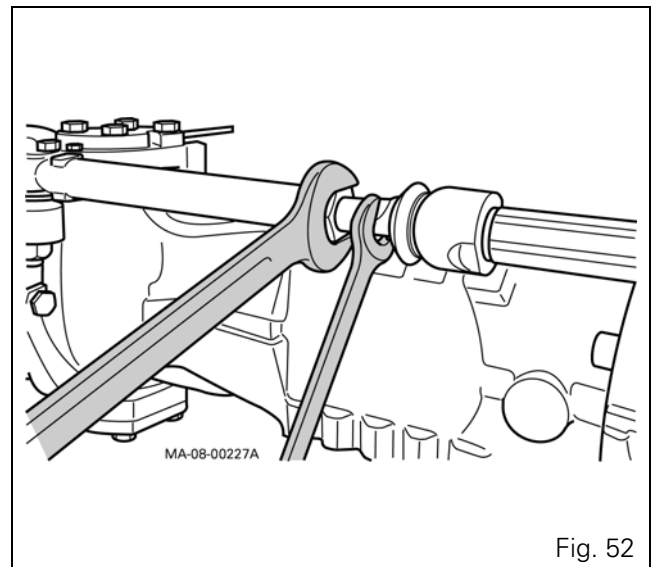


Fig. 52

# Carraro final drive units

## J . Adjusting the steering lock angle

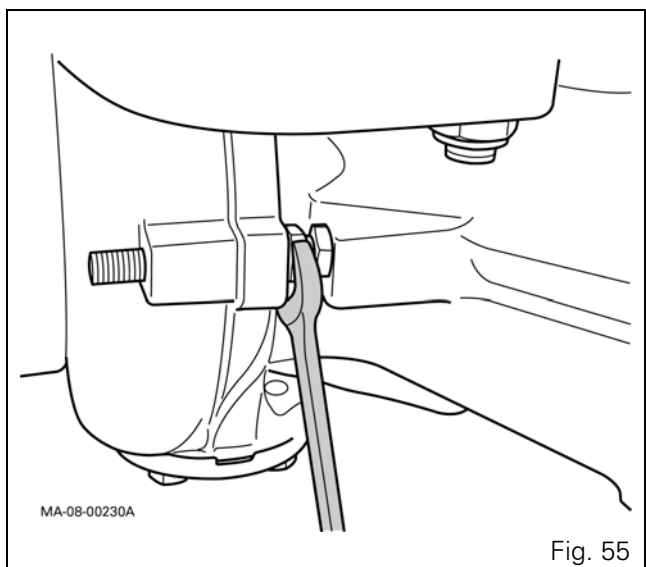
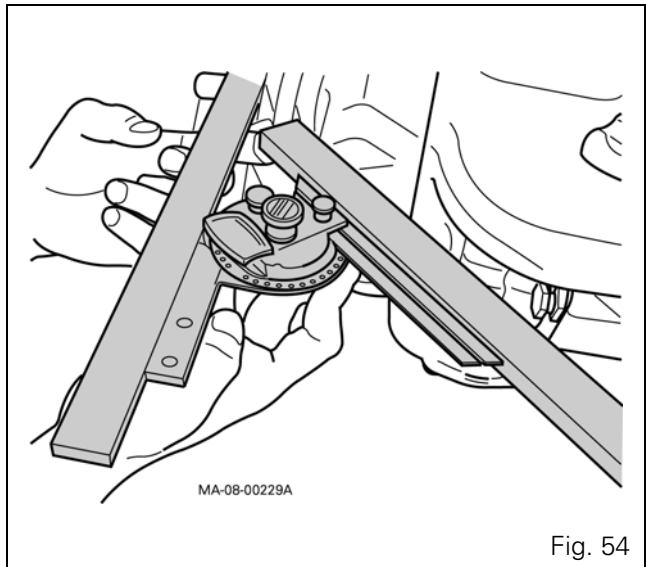
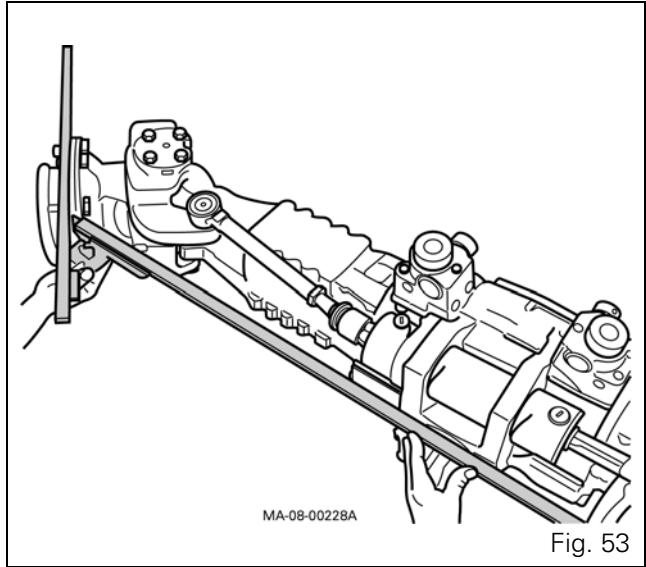
**46.** Use the bars fitted to adjust wheel alignment and a long bar pressing against the machined part of the central body (gear side) so that the two bars form an acute angle corresponding to the maximum steering lock position (Fig. 53).

**47.** Adjust the goniometer to the required steering lock angle (see section 8A01 § A) and position it on the long bar.

Move one side of the ring gear to obtain the angle defined by the goniometer and formed by the ring gear and the long bar (Fig. 54).

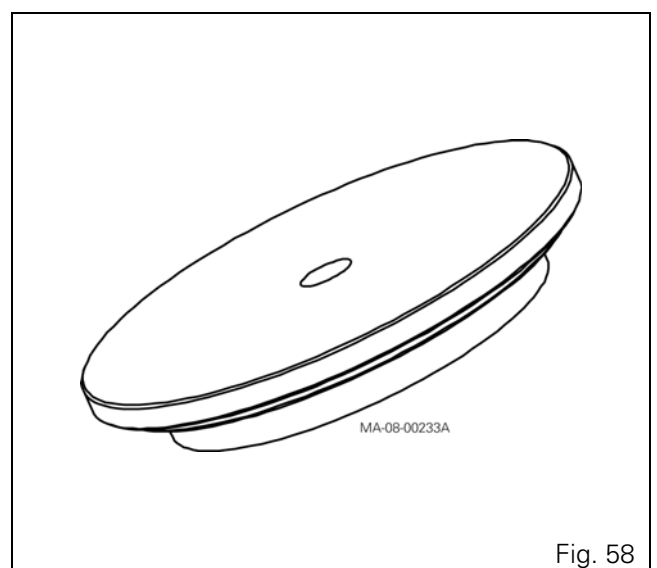
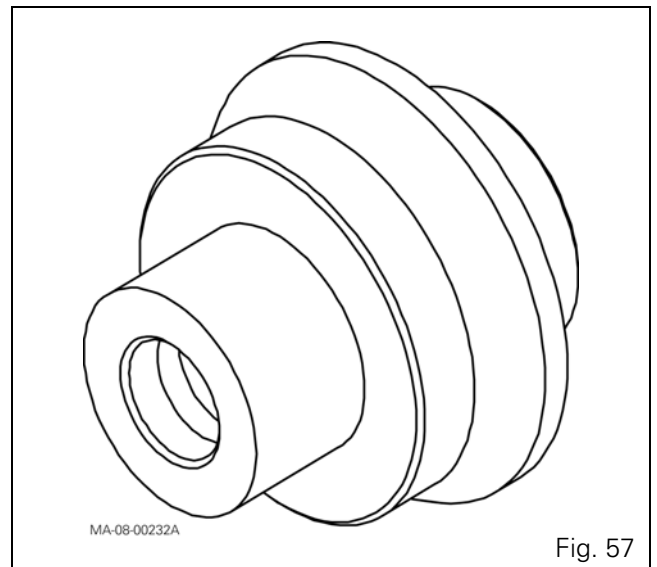
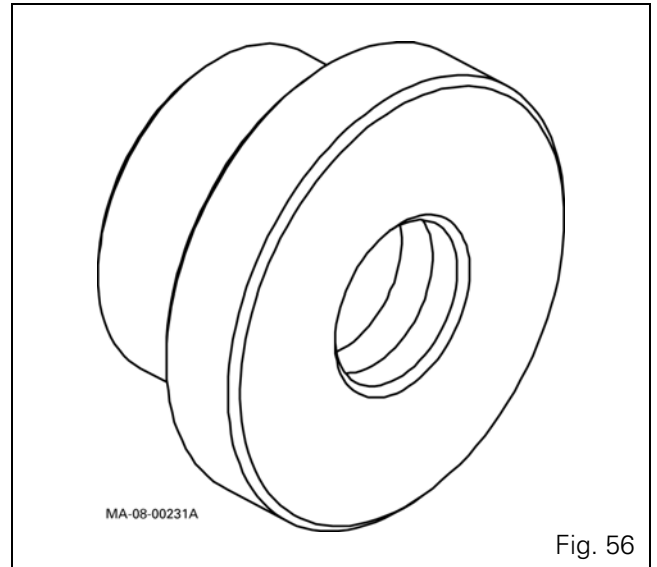
**48.** Adjust the mechanical steering lock retainer by tightening or loosening the special screws (Fig. 55), then lock them to the required torque (see section 8A01 § A) using the locknut.

Lock steering in the other direction and repeat this procedure (Fig. 55).



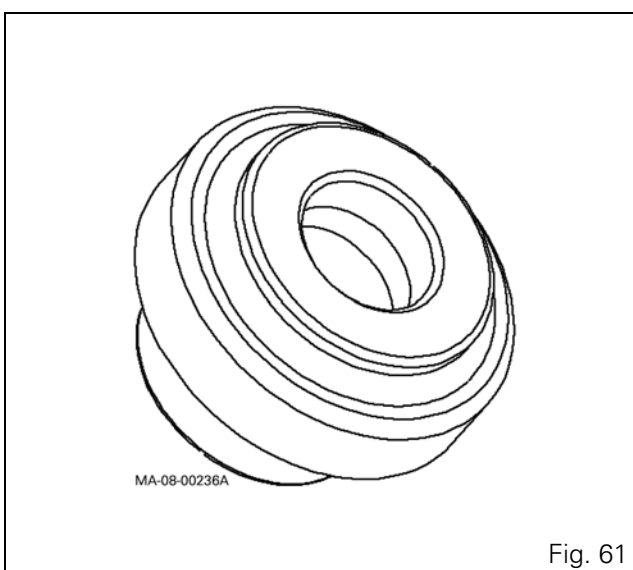
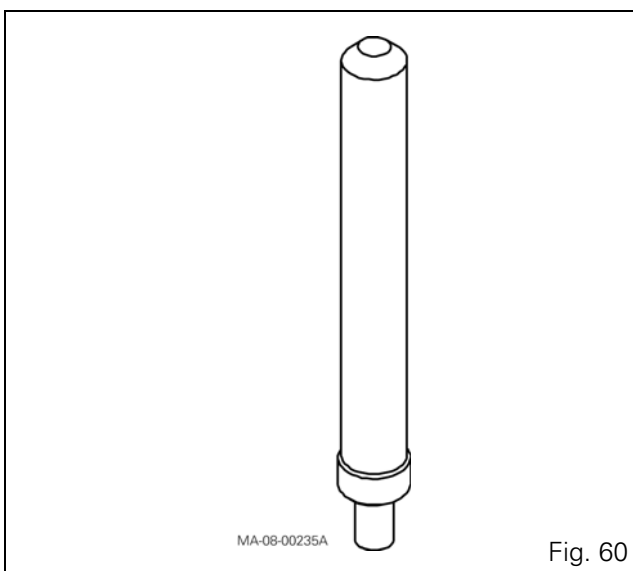
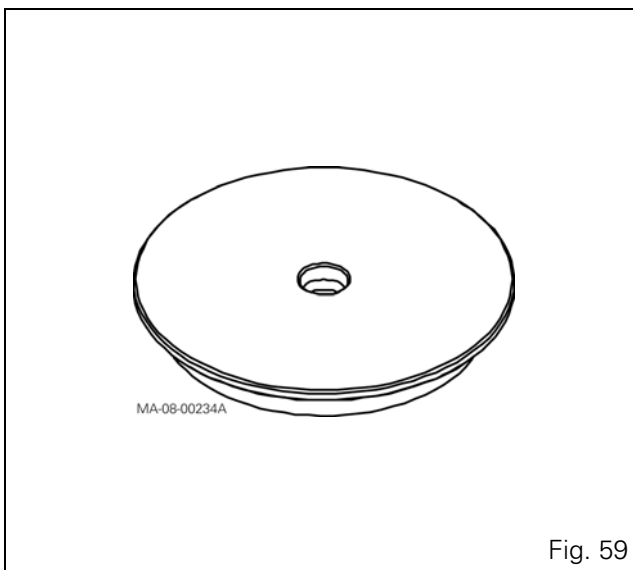
## K . Service tools

- CA 119055 - Ring fitting tool (Fig. 56)
- CA 119139 - CA 715097 - Seal fitting tool (Fig. 57)
- CA 119143 - Seal fitting tool (Fig. 58)



## Carraro final drive units

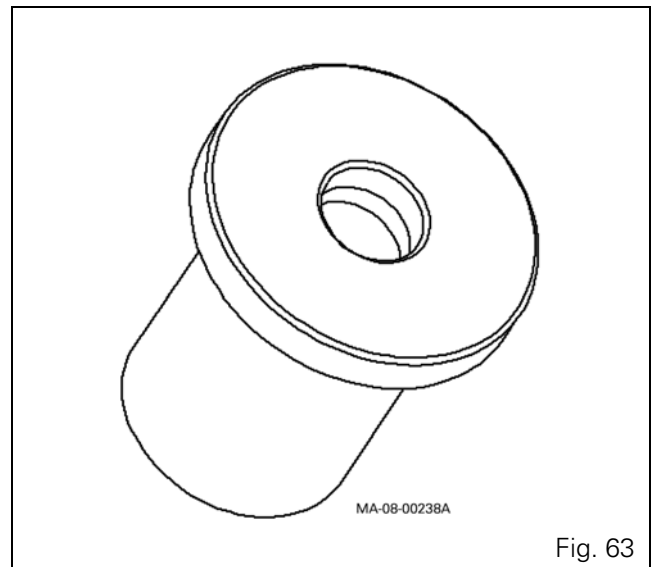
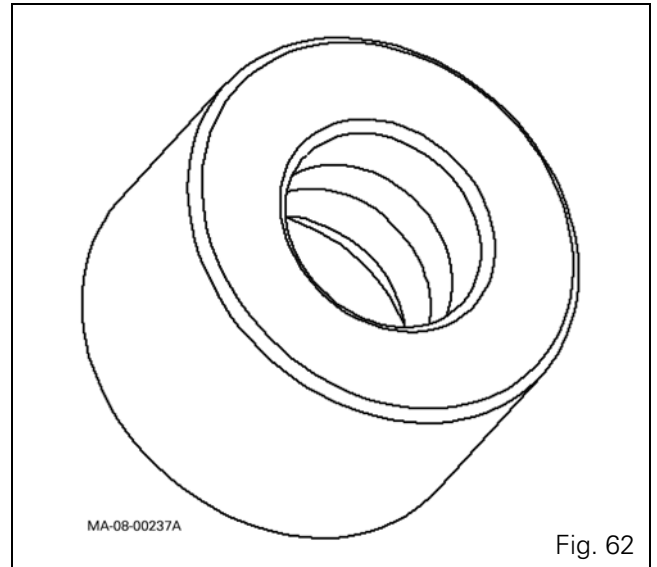
- CA 715026 - Bearing cone fitting tool (Fig. 59)
- CA 715027 - Ring fitting tool (Fig. 60)
- CA 715034 - Ring fitting tool (Fig. 61)





## Carraro final drive units

- CA 715035 - Swivel pin ring fitting tool (Fig. 62)
- CA 715252, CA 715108, CA 119097, CA 715037 - Ring fitting tool (Fig. 63)





*8A12 - Carraro differential*

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## **A . General**

---

Some of the following pictures may not show your exact axle, but the procedure is the same.

---

## **B . Splitting the front axle / frame**

---

1. Drain the axle housing.
2. Separate the axle and its bearings from the front frame (see chapter 8).

---

## **C . Removing the wheel hubs, axle beam assembly and steering ram**

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3. Extract the wheel hubs (see chapter 8).
4. Remove the axle beam assembly (see chapter 8).
5. Remove the steering ram.

# Carraro differential

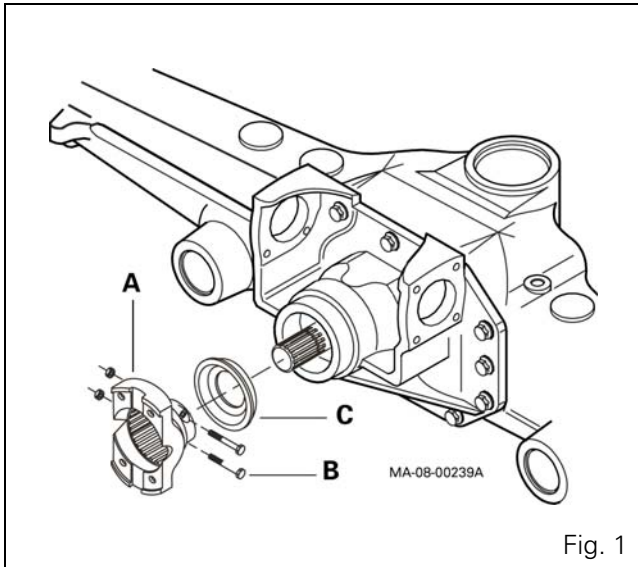


Fig. 1

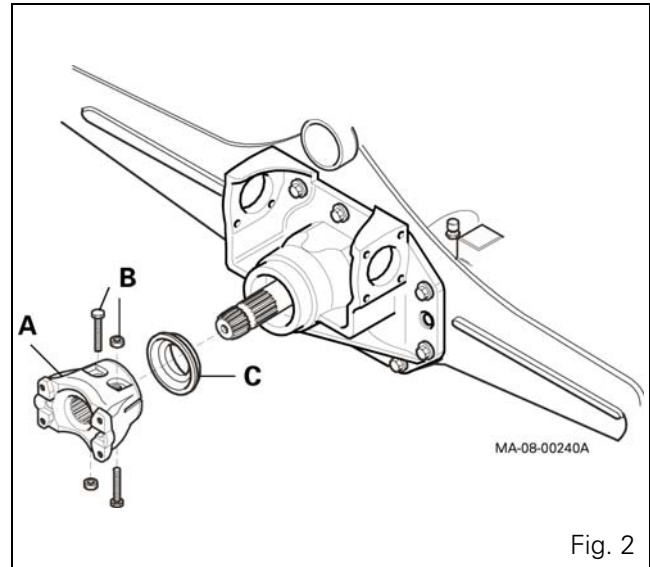


Fig. 2

## D . Disassembling the differential housing assembly

6. Remove the attachment screw B with its nut from the flange A. Extract the flange and recover the seal C.

- for suspended front axles: [Fig. 1](#)

- for fixed front axles: [Fig. 2](#).

**Remark: This operation will destroy the seal.**

7. Loosen and remove the screw from the differential housing.

Remove the differential housing ([Fig. 3](#)).

**Warning: Hold the differential housing in place with a sling or another suitable fixture ([Fig. 3](#)).**

8. Loosen and remove screws A to extract the two nut retainers B ([Fig. 4](#)).

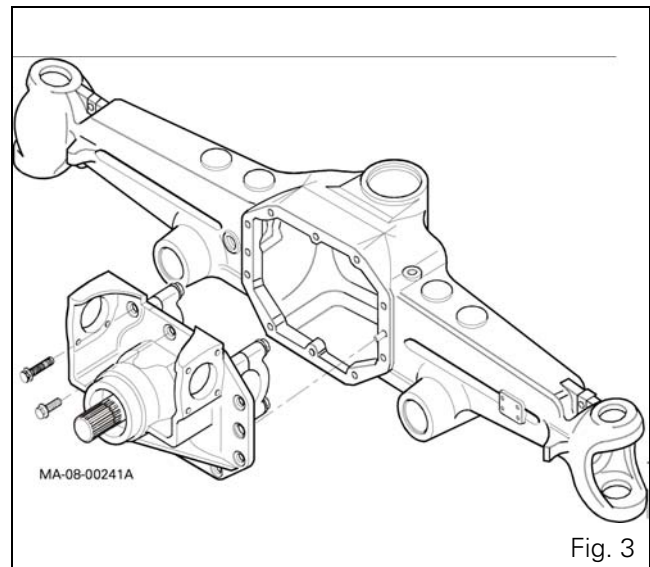


Fig. 3

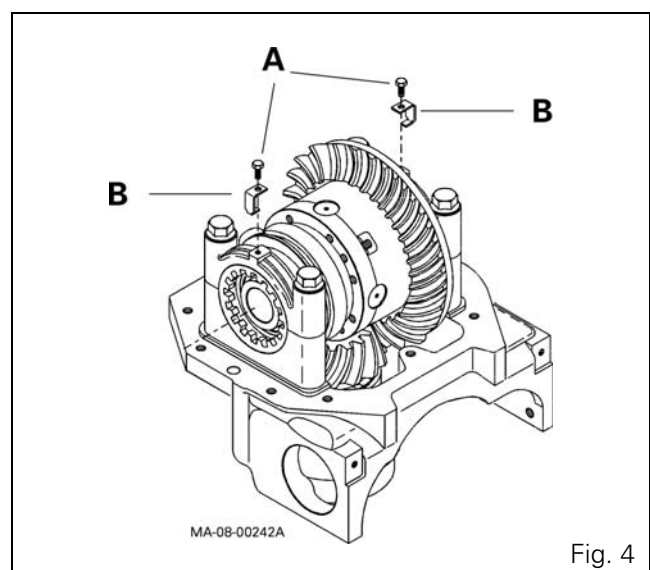
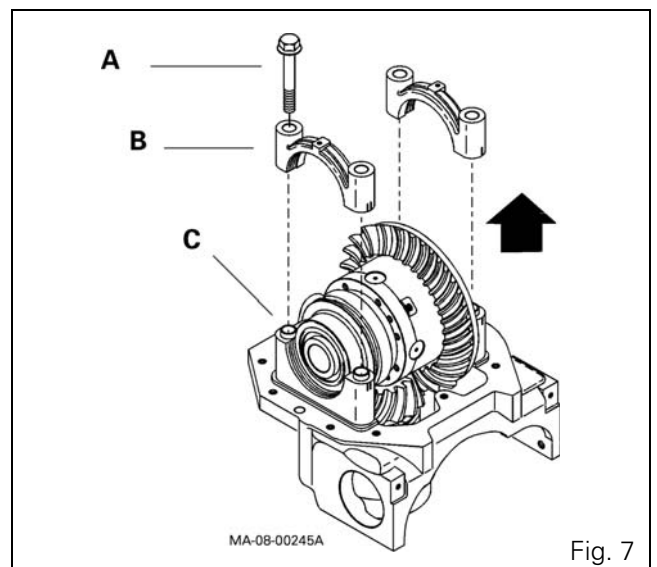
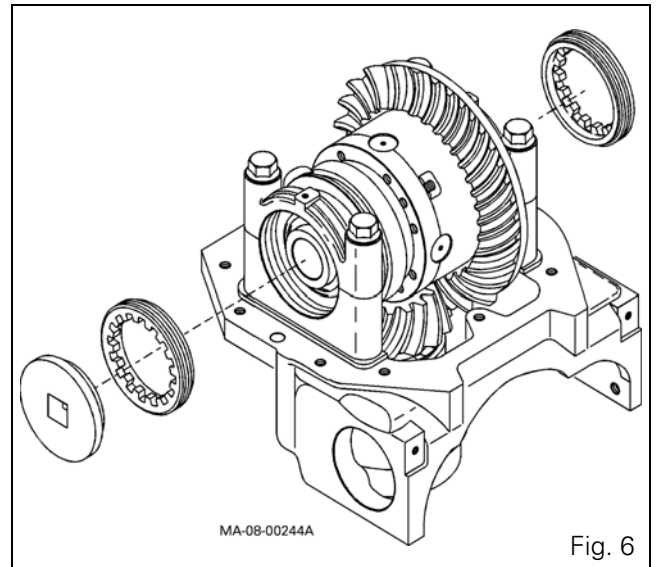
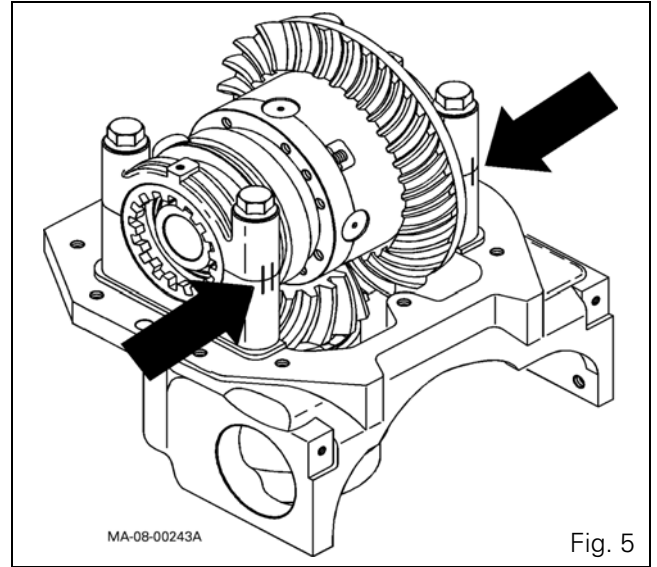


Fig. 4

9. Before removing the screws, make indelible marks to **note the position of the two half-bearings** and the differential housing in order to avoid reassembling in the wrong order. Also mark the area between the nuts and the differential housing (Fig. 5).
10. Loosen the adjusting ring nuts using the tools ref. CA119030 (see § J) and CA119149 (see § J) (Fig. 6).

**Remark: The two nuts are different; mark their position in relation to the bevel ring gear.**

11. Remove the 4 screws A and the two half-bearings B.  
Check that rings C stay in place in their housing (Fig. 7).



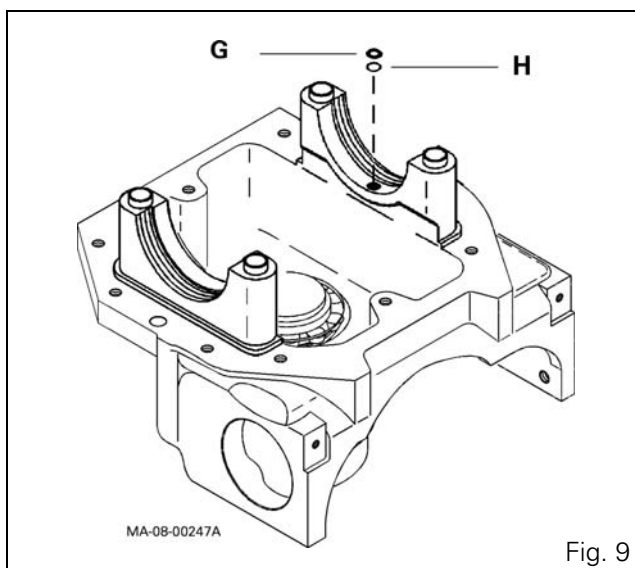
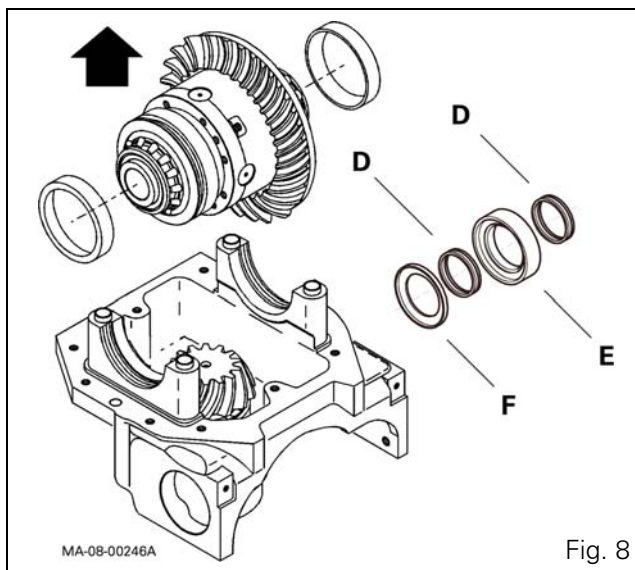
## Carraro differential

### 12. Remove the differential unit.

From the ring gear side extract and recover the spacer E with its set of rings D, the washer F and the bearings removed with the differential housing (Fig. 8).

**Warning: Take care not to invert the bearings if they need to be refitted.**

### 13. Recover the washer G and O'ring H from the bearing seating on the side of the the epicyclic ring gear (Fig. 9).





## E . Disassembling the gear

14. Install the differential assembly in a vice.  
Loosen the locknut using the special tools ref. CA119099 (see § J) and CA715022 (see § J) (Fig. 10).
- Remark: This operation will destroy the nut.**
15. Extract the nut A and recover the retaining washer B (Fig. 11).
16. Extract the bevel gear C using a mallet.  
**Warning: Ensure the gear does not fall out.**  
Recover the washers, the flexible spacer D and the internal cone E of the taper roller bearing (Fig. 12).

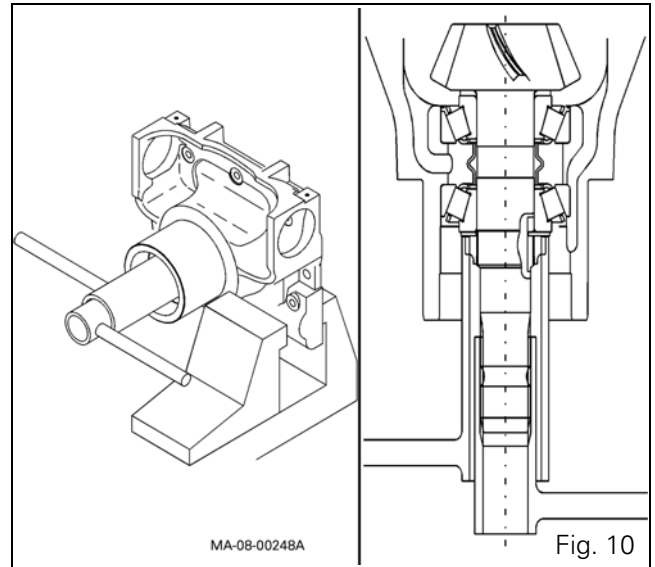


Fig. 10

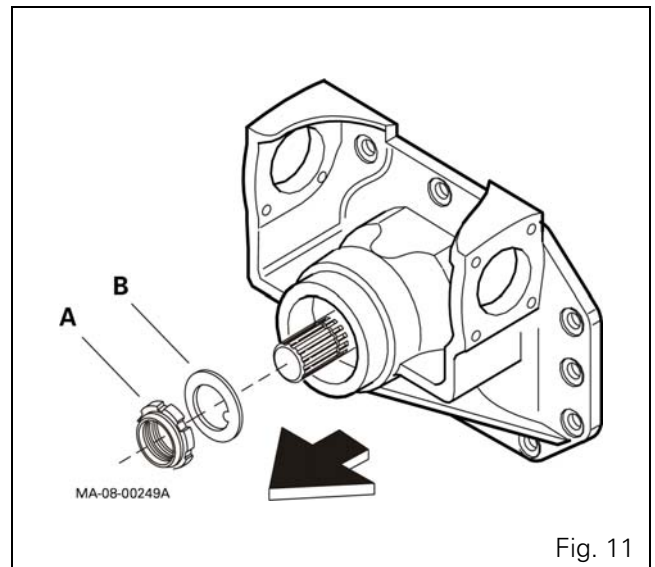


Fig. 11

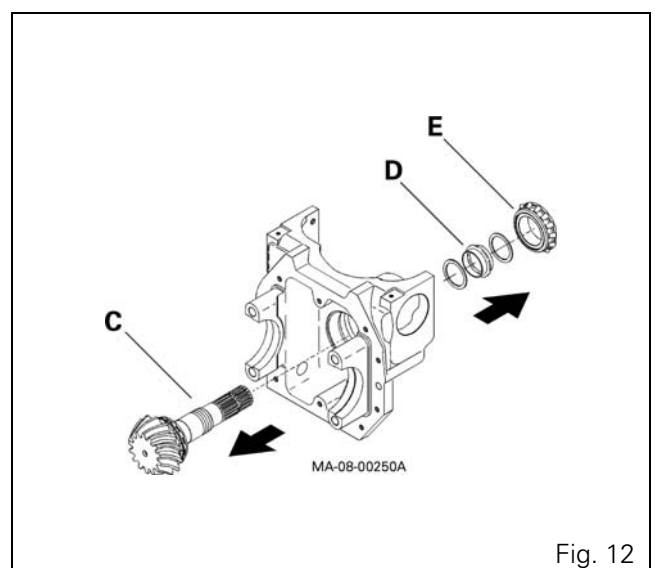
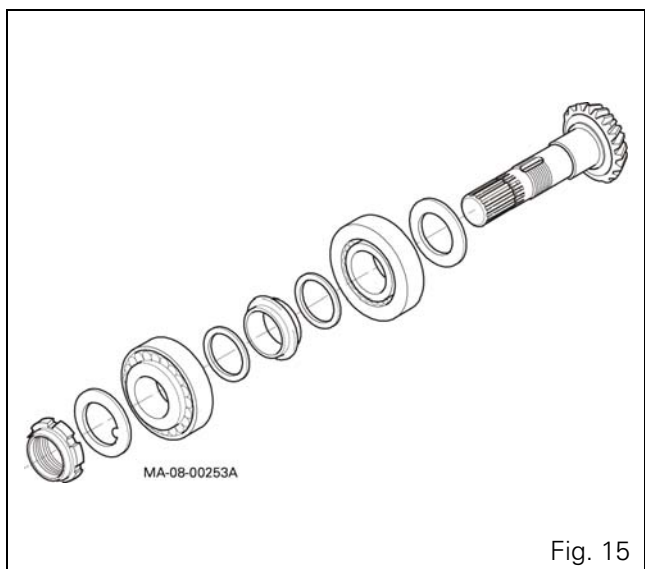
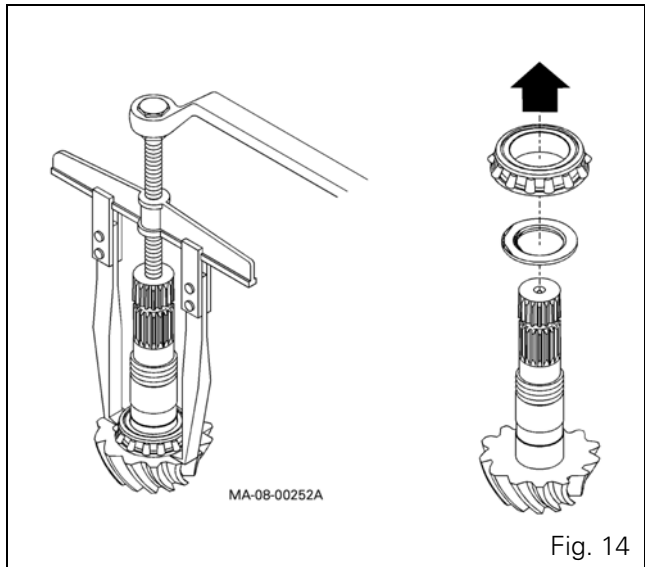
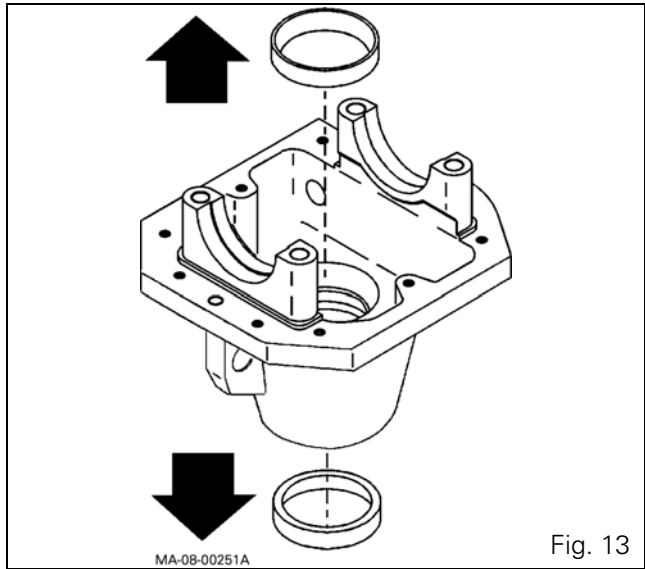


Fig. 12

## Carraro differential

17. Place the differential housing on a flat surface as shown in the figure and extract the external cups of the roller bearing, using a drift or mallet (Fig. 13)
18. Remove the inside cone of the gear taper roller bearing using a standard extractor.  
Recover the bearing cone and the shim located underneath it (Fig. 14)
19. Check all the gear parts for wear condition (Fig. 15).  
The ring nut and the flexible spacer **must be replaced** when refitting the assembly.



## F. Disassembling the differential unit

20. Recover the differential and secure it in a vice.  
Loosen the attachment screws and remove the bevel ring gear (Fig. 16).

**Warnings:**

- **This operation releases the two half-bearings in the differential.**
- **Ensure the internal parts do not fall out.**

21. Split the cover A from the differential unit C, then extract the piston B.

Recover the O'rings from the cover and differential lock piston (internal and external housings) (Fig. 17).

22. Remove the plates, drive discs and sun gear D from the differential unit (Fig. 18).

**Remark: Disassemble the removed parts and examine them carefully, checking for wear and correct operation in particular.**

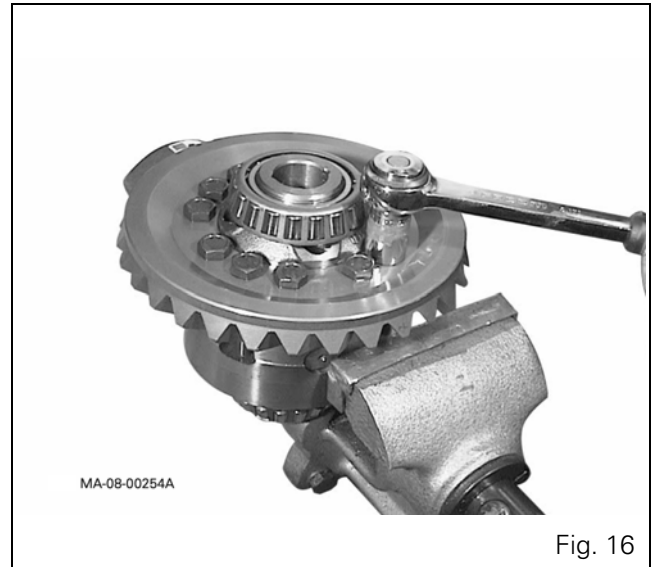


Fig. 16

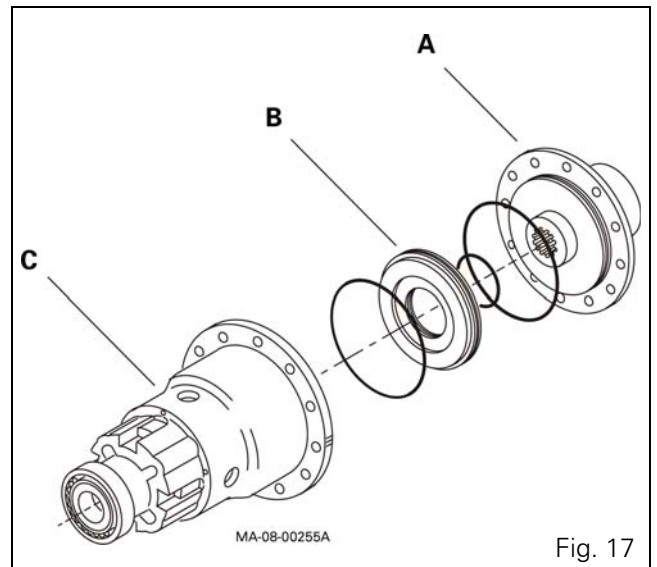


Fig. 17

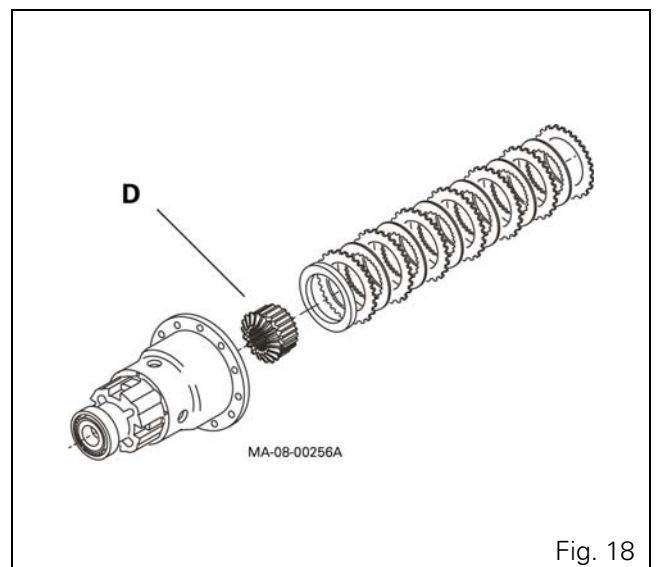
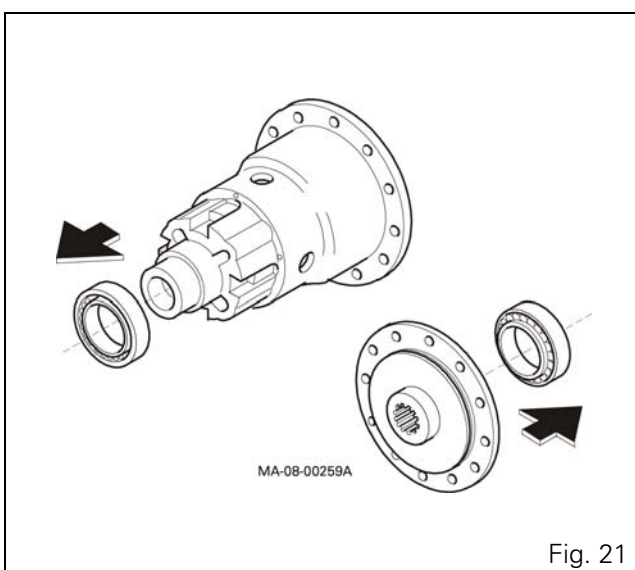
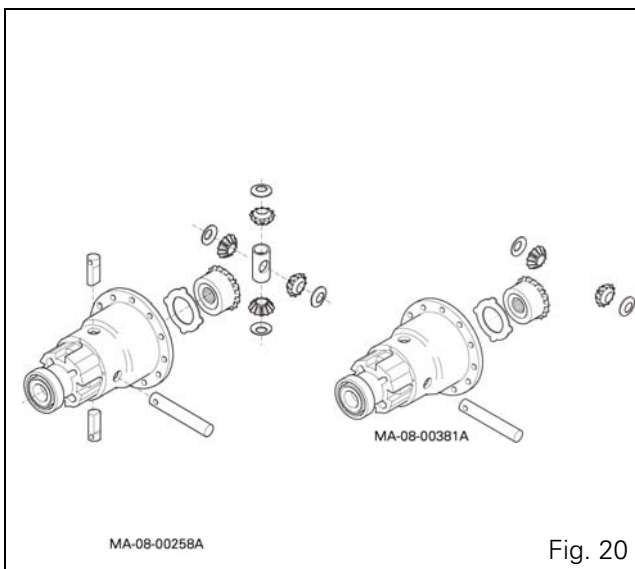
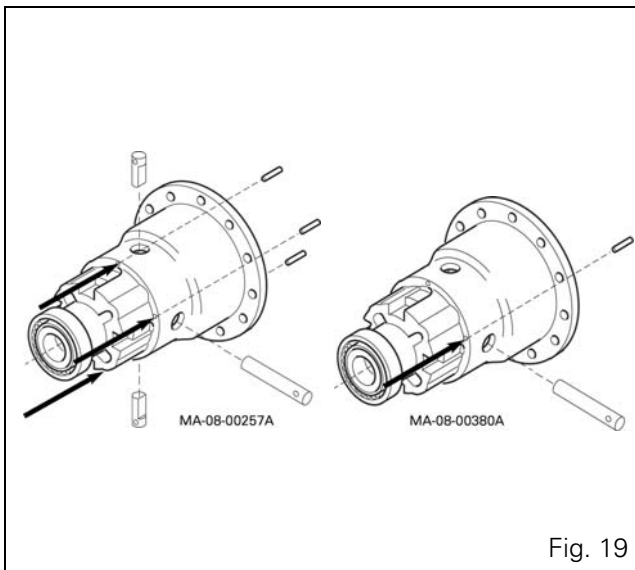


Fig. 18

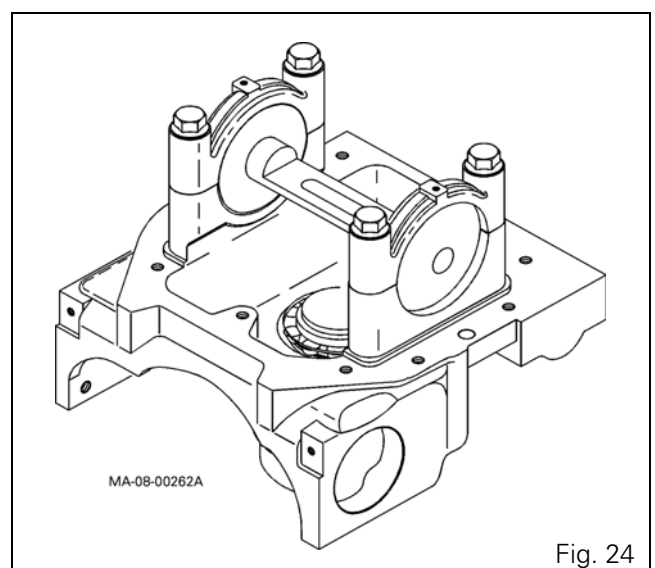
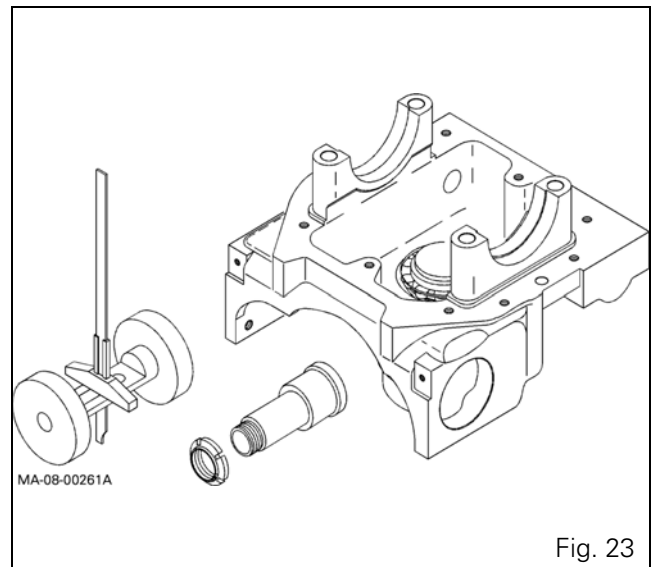
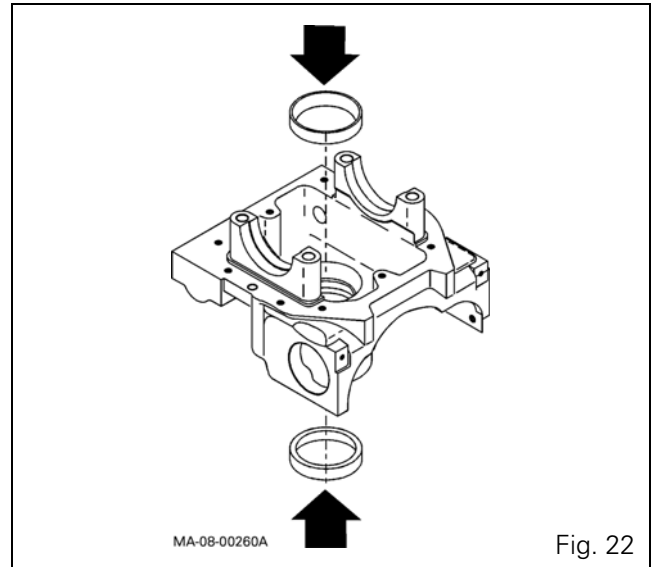
## Carraro differential

23. Extract the three locating pins with a punch to remove the long and short pins (Fig. 19). For model 20.19, use a punch to extract the locating pin in order to remove the long pin (Fig. 19).
24. Remove the planet carrier and recover the internal parts: pinion gears, thrust washers, spider and sun gear (Fig. 20).
- Remark: Check all parts for wear and correct operation.**
25. Extract the bearings from the half-bearings and the cover using a three-point extractor tool (Fig. 21).



## G . Reassembling the gear

26. Place the differential housing on a workbench.  
Install the external cups for the new bearings with special drifts ref. CA119225 (see § J) and CA715092 (see § J) and a mallet (Fig. 22).
27. To measure the distance, use special tool kit ref. CA119202 (see § J) "dummy gear" and CA119182 (see § J) and CA119228 (see § J) "dummy differential unit" (Fig. 23).
28. Using tool ref. CA119202 (see § J), introduce the dummy gear with its bearings and nut into the newly installed roller bearing.  
Tighten without forcing to eliminate the backlash.  
Install the tools ref. CA119182 (see § J) and CA119228 (see § J) on the differential housing supports and tighten the half-bearing screws (Fig. 24).



# Carraro differential

29. Assembly diagram for tools ref. CA119182 (see § J) and CA119228 (see § J) on differential housing supports.

Using a depth gauge, measure the distance B (between the bearing pin and the end point of the gear head or bearing base) (Fig. 25).

30. To determine the necessary thickness S between the gear and bearing, subtract the value V engraved on the gear head (V = required apex distance) from the measured value B (Fig. 26):

$$S = B - V$$

31. Select the required thickness S from the range of shims available and insert the chosen shim under the gear head.

**Remark: Ensure that it is correctly fitted.**

Type of shims										
Thickness	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Quantity	-	-	-	-	-	-	-	-	-	-

32. After inserting the correct shim with its chamfer positioned on the gear side, force fit the bearing at the end of the gear pin using special tool ref. CA715004 (see J) and a press, ensuring it is mounted correctly.

Fit the shims and a new flexible spacer (Fig. 27).

**Remark: Systematically fit a new flexible spacer.**

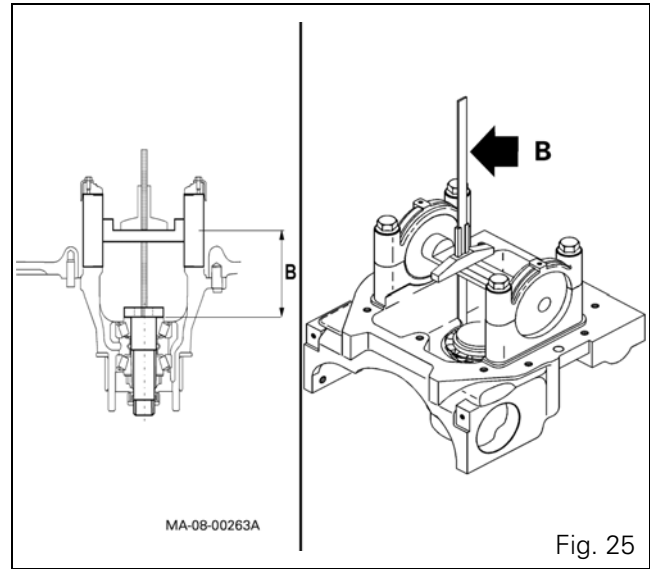


Fig. 25

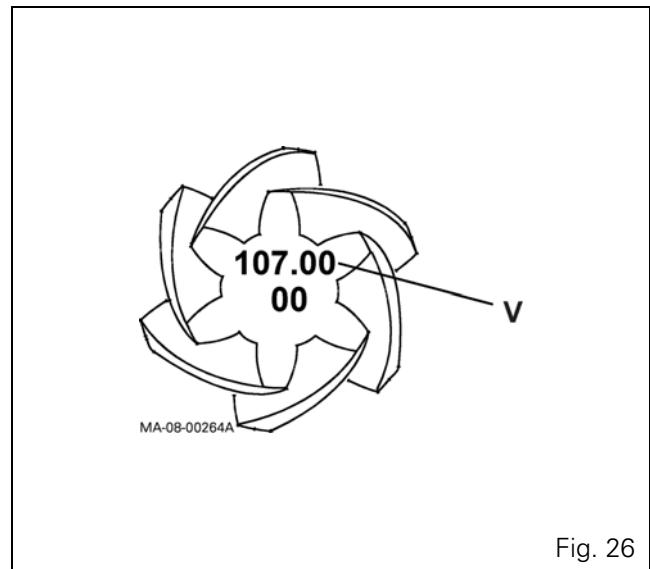


Fig. 26

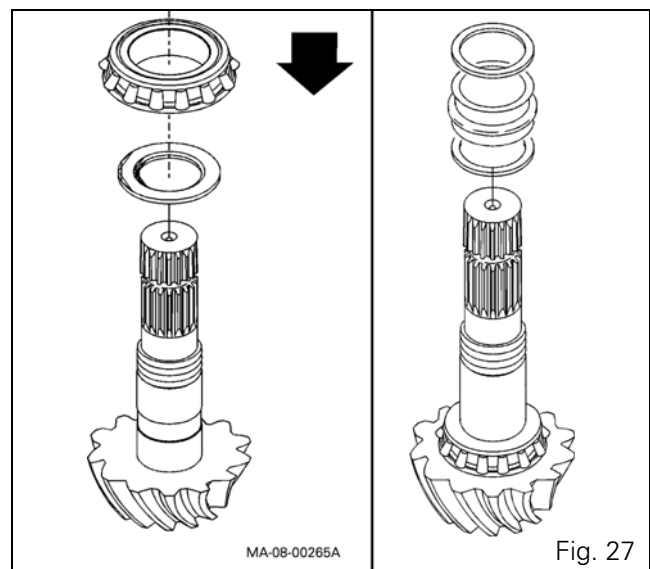


Fig. 27

**33.** Introduce the bevel gear assembly into the differential housing (axle beam internal side) and the second bearing cone at the end of the gear, on the opposite side. Force fit the second bearing using the special tool ref. CA715004 (see § J) and a mallet.

It is recommended to resist the striking action of the tool, for example using a mallet (Fig. 28).

**34.** Place a retaining washer and screw a new nut onto the end of the gear (Fig. 29).

**35.** Screw the nut on with the wrench ref. CA119099 while holding the gear in place with the tool ref. CA715022 (see § J) (Fig. 30)

**Warnings:**

- **The tightening torque is determined by the bearing preload measurement.**
- **Gradually tighten nut.**

**Remark:**

- **If the applied tightening torque is too strong, replace the flexible spacer and restart the operation.**
- **When checking bearing preload, it is recommended to gently tap both ends of the gear with a rubber mallet to make the bearing seating easier.**

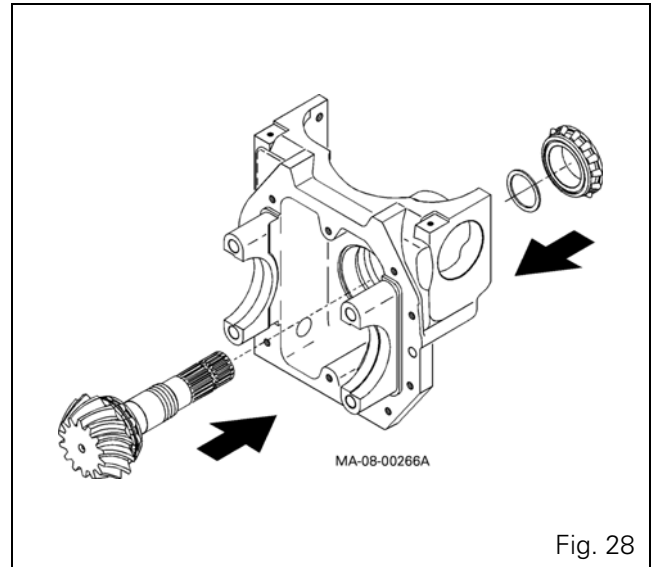


Fig. 28

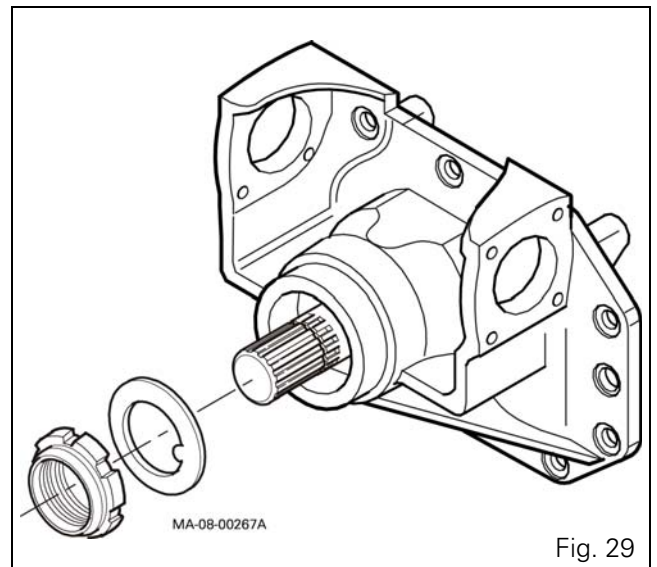


Fig. 29

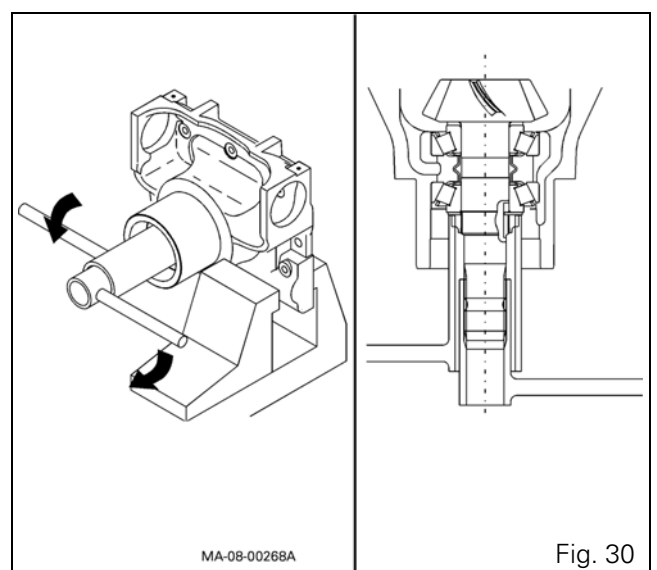


Fig. 30

## Carraro differential

36. Measure the torque P of the taper roller bearings of the gear (Fig. 31).

Shimming is carried out by gradually increasing the tightening torque of the nut, ensuring the recommended value is not exceeded.

**Warning: All torques must be measured without the seal.**

**P = 1.82 to 2.72 Nm**

37. When the torque value is reached,peen the nut with a hammer and a chisel (Fig. 32).



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Fig. 31



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Fig. 32



## H . Reassembling the differential unit

38. Assemble the new taper roller bearings on the half-bearings using the special tool ref. CA115093 and a mallet (see § J) (Fig. 33).
39. Position one of the half-bearings on a workbench and install the internal parts (thrust washer, sun gear, pinion gears, spider) as shown in the figure. Introduce the short pins and the long pin (only the long pin for model 20.19) into their housing, holding the pinion gears and spider correctly in place (Fig. 34).
40. Lock the pins with corresponding locating dowels in the ports provided on the bearing and pins. Manually turn the pins to align the dowels with the bearing ports (Fig. 35) for model 20.19.

**Remark: Definitely position the locating dowels.**

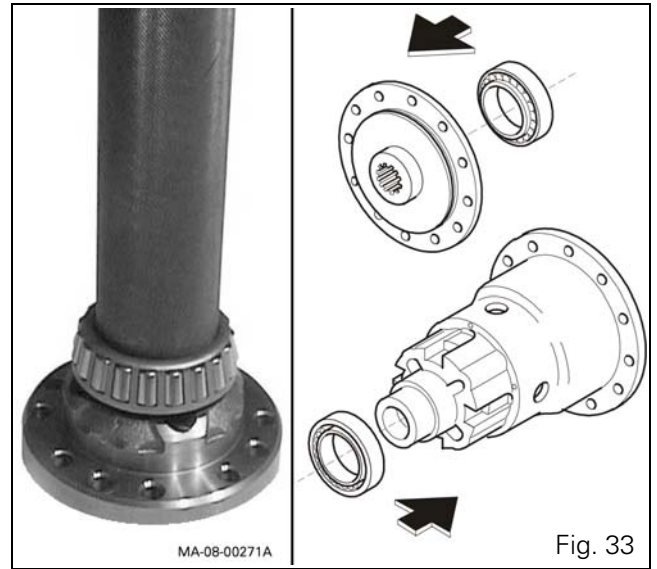


Fig. 33

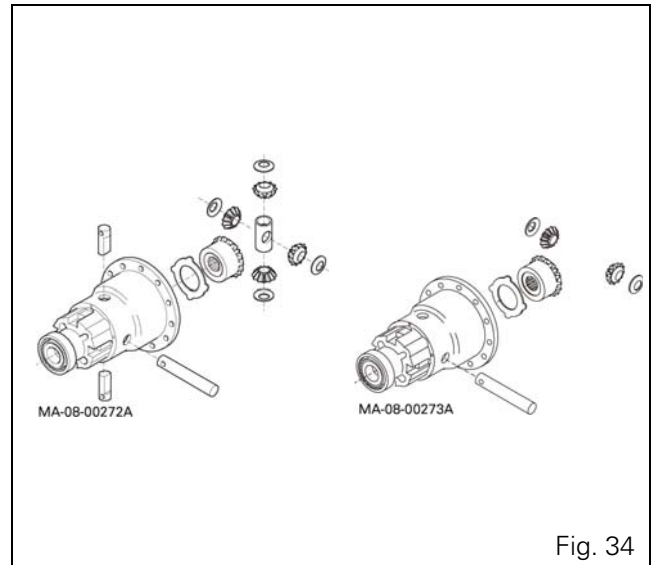


Fig. 34

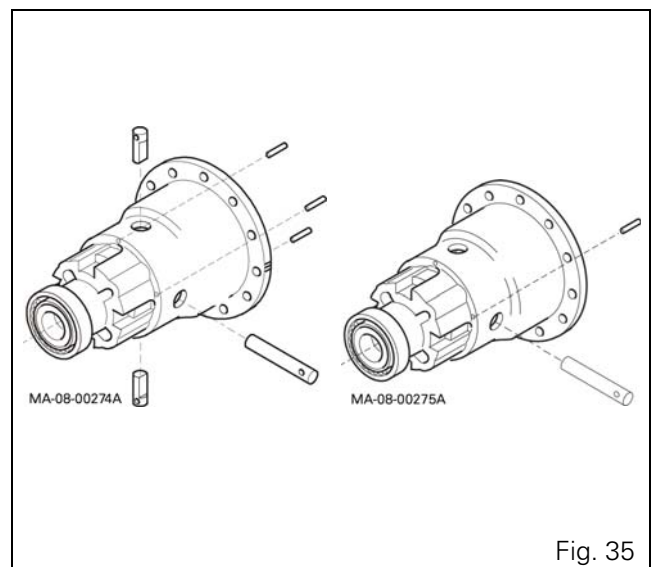


Fig. 35

# Carraro differential

41. Install all internal parts in the bearing: pinion gears, discs and disc heads, as shown in the figure (Fig. 36).
42. Fit new O-rings in the housings provided on the piston and on the differential cover. Introduce the piston and fit the cover in the differential housing (Fig. 37).
43. For fixed front axles, apply a coat of Loctite 476 between the bevel ring gear and the surface of the differential housing.  
For all axles:  
Position the bevel ring gear on the cover, apply Loctite 270 on the threads and attach the assembly, tightening screws to the required torque (see chapter 8) (Fig. 38).

For all axles:

Position the bevel ring gear on the cover, apply Loctite 270 on the threads and attach the assembly, tightening screws to the required torque (see chapter 8) (Fig. 38).

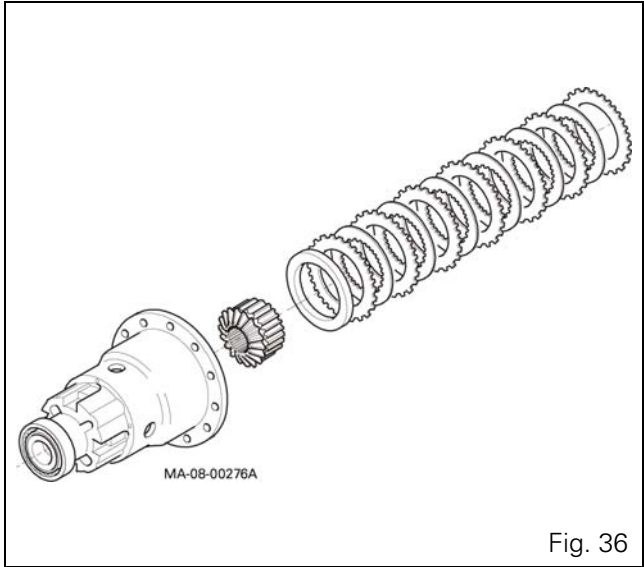


Fig. 36

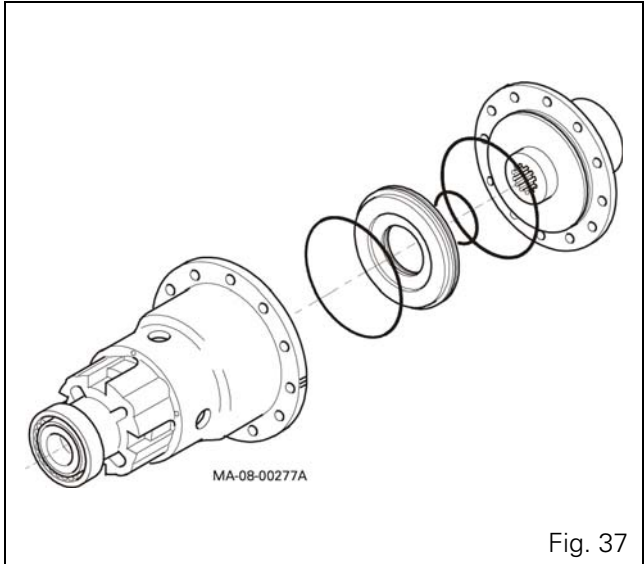


Fig. 37

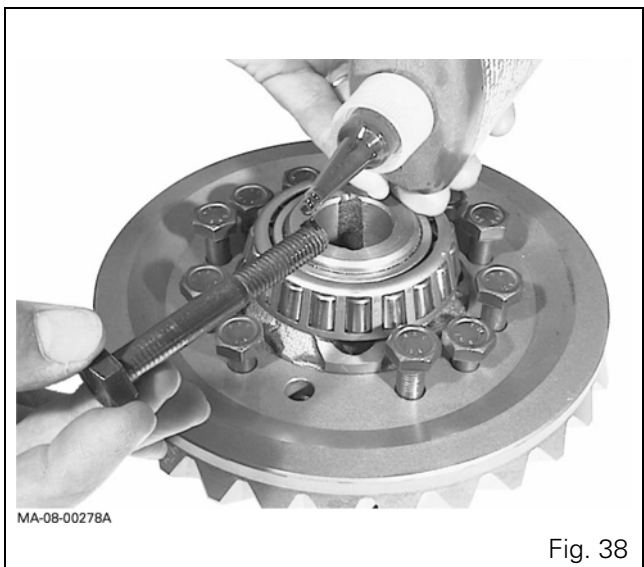


Fig. 38

## I . Reassembling the differential housing

44. Fit the external taper roller bearing cups on the two differential bearings and install, on the bevel gear side, the washer and spacer with new O’rings previously smeared with a thin layer of grease (Fig. 39).

45. Before placing the differential unit in the differential housing, install a new seal B and washer A at the base of the bearing on the bevel ring gear side, on the oil hydraulic port.

Fit the unit assembly on the differential housing (Fig. 40).

**Warning: Take care not to invert the external cups of the taper roller bearings and ensure that the bevel ring gear assembly is fitted on the correct side.**

46. Move the differential assembly so as to position the bevel ring gear over the gear.

Ensure that all rings E are in position in their housings and place the two half-bearings D on their seats, following the marks made at disassembly. Lock the two half-bearings with their attachment screws C (Fig. 41).

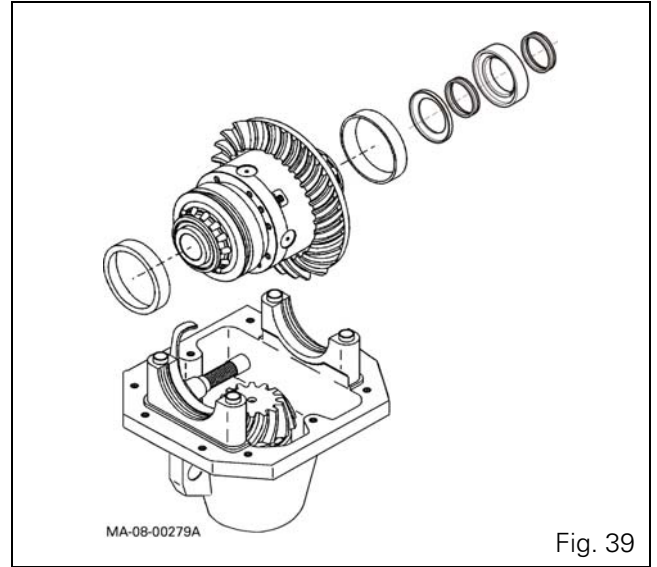


Fig. 39

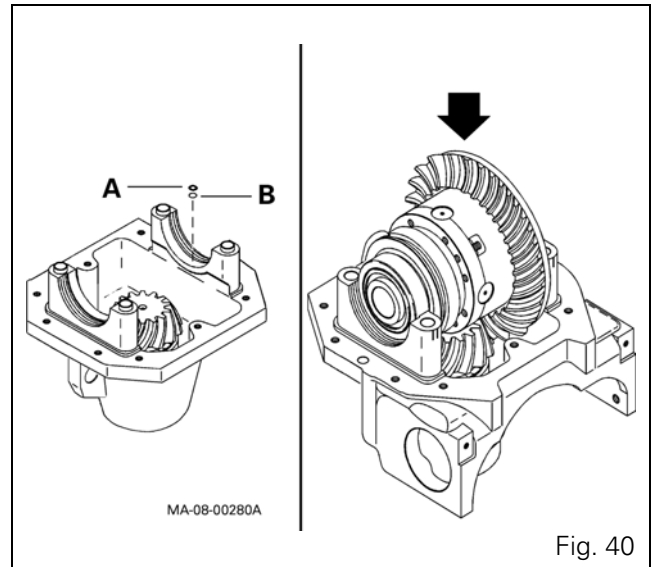


Fig. 40

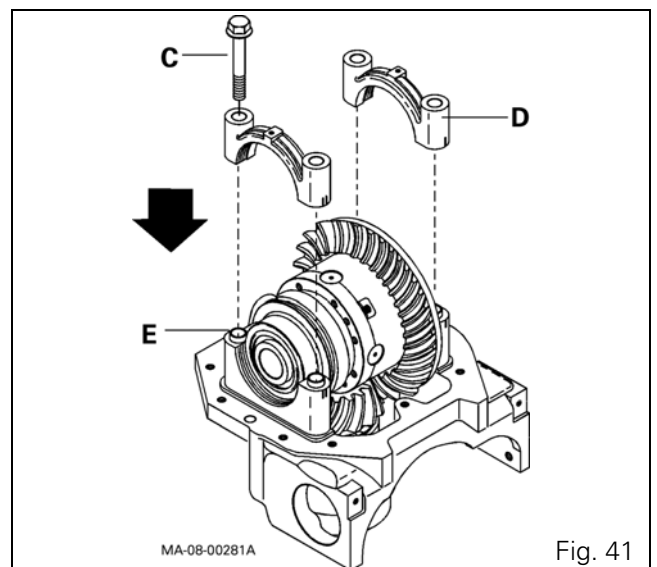


Fig. 41

# Carraro differential

47. Assemble and tighten the two adjustment nuts in the differential housing using special tools ref. CA119030 (see § J) and CA119149 (see § J) to eliminate the backlash and slightly preload the differential bearings (Fig. 42).

**Remarks:**

- **The two nuts are different; take care not to change their assembly order in relation to the bevel ring gear.**
  - **Check that the bearings are correctly mounted in their seats, and if necessary tap them gently with a rubber mallet to position them correctly.**
48. Place a dial gauge with a magnetic stand on the differential housing and move the dial gauge feeler pin until it comes into contact with a ring gear tooth at a 90° angle (Fig. 43).

Lock the gear and move the ring gear alternately to the left and right, using the dial gauge to measure the backlash between the gear and ring gear.

Repeat the operation with at least two teeth, turning the ring gear, to calculate and average value.

Check that the measured backlash value is within the allowable tolerances:

**0.18 to 0.23 mm**

Fine-tune the shimming by adjusting the two nuts with special tools CA119030 and CA119149 (see § J) (Fig. 44).

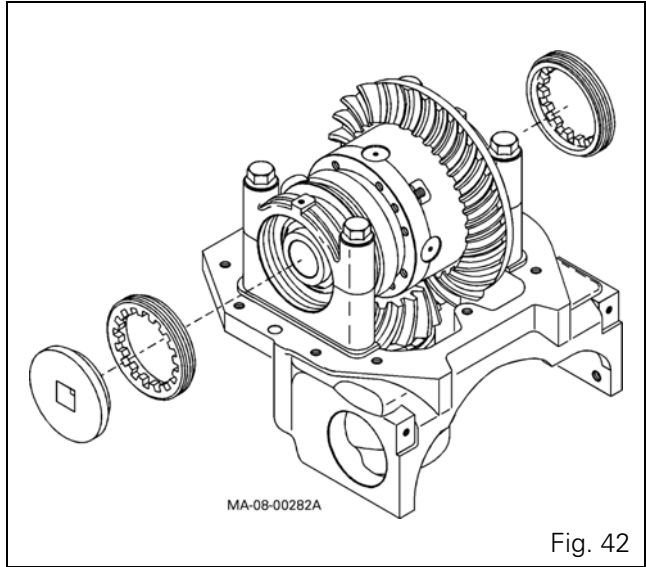


Fig. 42

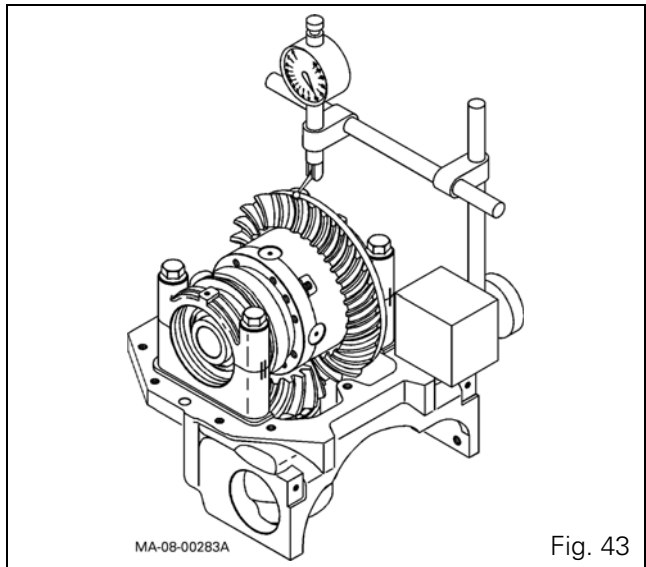


Fig. 43

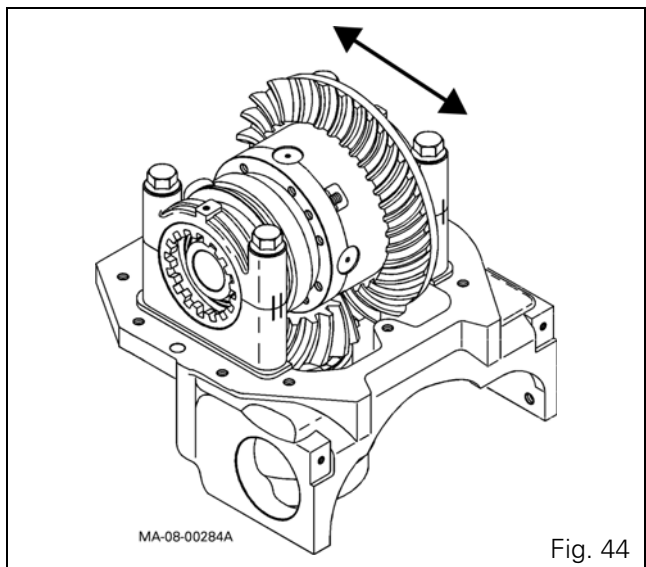


Fig. 44

49. When tightening nuts, always remember that:
- if the measured backlash is lower than the allowable tolerances, the nut on the bevel ring gear side must be loosened and the opposite screw must be screwed to the same value.
  - if the measured backlash is higher than the allowable tolerance, the nut opposite the bevel ring gear side must be loosened and the opposite screw must be screwed to the same value.

50. When the backlash between the gear and ring gear has been adjusted, check that the bearing preload of the differential unit is minimal.

Repeat the sequence of operations described above until the necessary conditions are met.

51. Once correct backlash has been obtained between the gear and ring gear, measure the total bearing torque T (gear - bevel ring gear system). The measured value must remain within the following limits:

$$T = (P + 1.82) \text{ to } (P + 2.12) \text{ N.m}$$

where P represents the actual measured gear torque (see § G).

**Warning: All torques must be measured without the seal.**

If the measured value is outside the allowable tolerance, carefully check the assembly of each part and adjust the differential housing adjustment nuts:

- if the total torque is lower than the allowable value, tighten both nuts identically without modifying the backlash between the gear and ring gear.
- if the total torque is higher than the allowable value, loosen both nuts identically without modifying the backlash between the gear and ring gear.

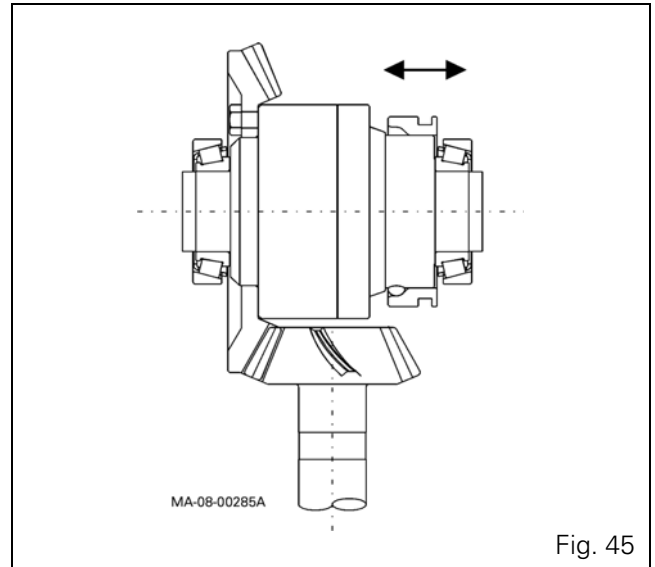


Fig. 45

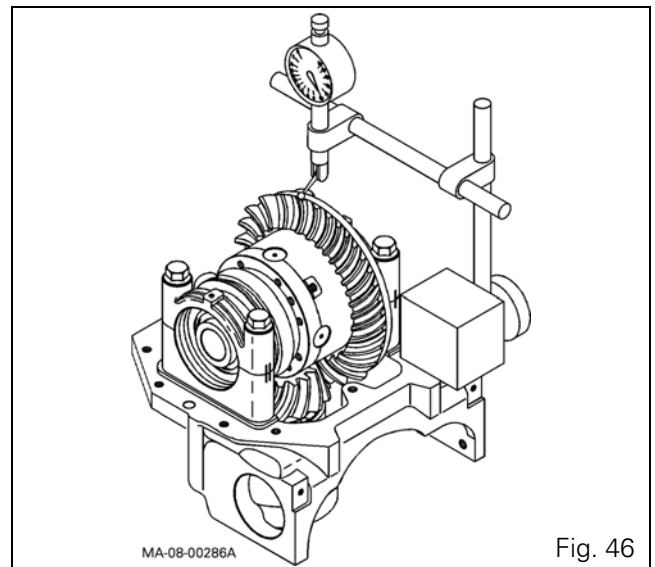


Fig. 46



Fig. 47

# Carraro differential

## General

**52.** To test the marking of the bevel gear teeth, apply minium paint on the ring gear.

This marking test must be carried out systematically on the bevel ring gear teeth and on each face (Fig. 48).

**53. OK = Correct contact**

If the bevel gear is correctly adjusted, a uniform layer of paint is left on the surfaces of the teeth (Fig. 49):

**- Z: Excessive contact at the tip of the teeth**

Move the gear closer to the ring gear, then move the latter further away to correct the backlash.

**- X: Excessive contact at the base of the teeth**

Move the gear further from the ring gear, then move the latter closer to correct the backlash.

**54.** Corrective action (Fig. 50):

1 move the gear in the direction of the arrow to adjust X type contact.

2 move the gear in the direction of the arrow to adjust Z type contact.

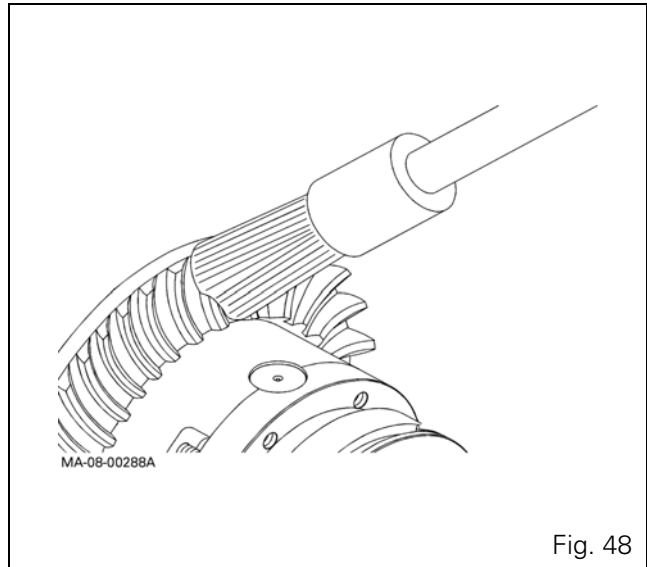


Fig. 48

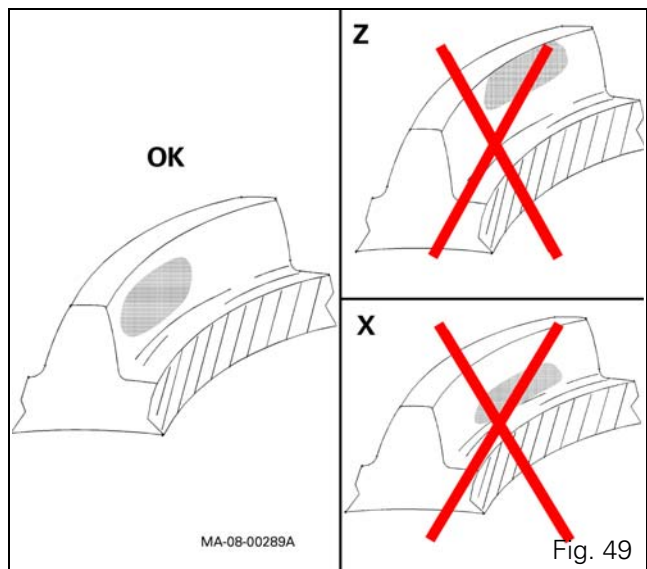


Fig. 49

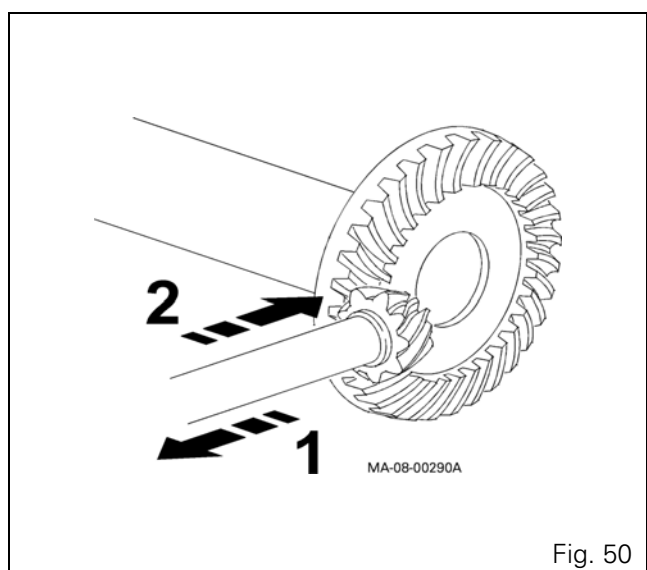


Fig. 50

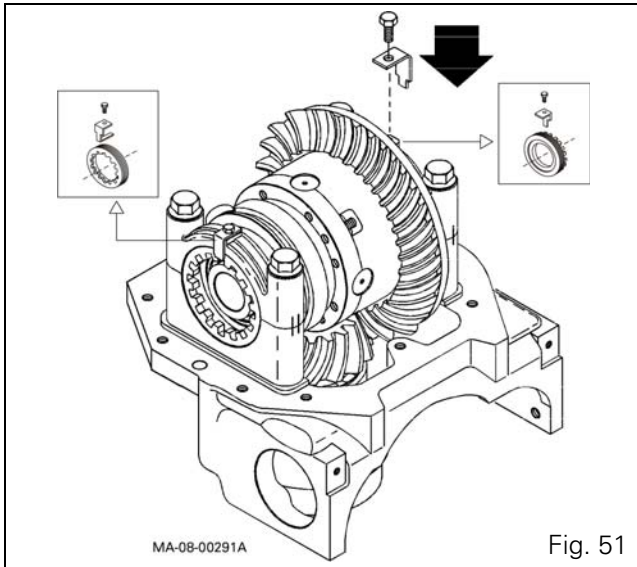


Fig. 51

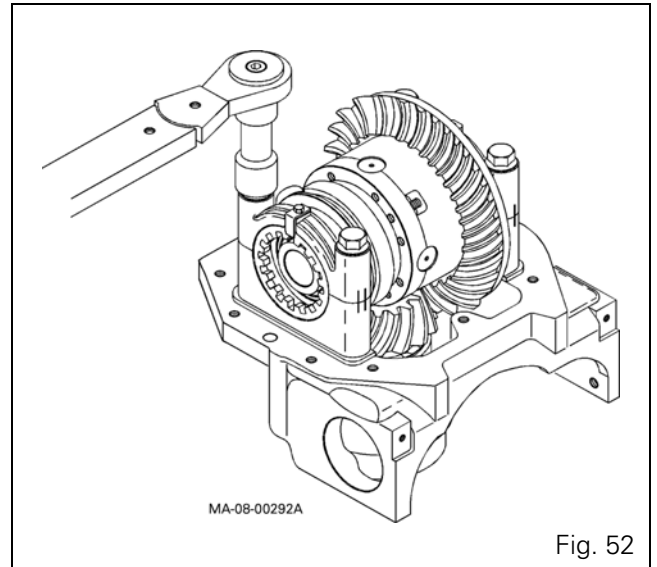


Fig. 52

55. When the shimming procedure is complete, fit the locknuts with their screws and tighten to the required torque (see section 8A01 § A) using a torque wrench (Fig. 51).

**Warning: The nut and its locknut are different on the ring side and the opposite side of the differential unit; turn the nuts slowly to align them with their locknuts.**

56. Tighten the screws of the two half-bearings with a torque wrench to the required torque (see section 8A01 § A) (Fig. 52).

57. Before bringing two surfaces into contact, ensure that both are perfectly clean. Degrease them and clean them with suitable cleaner.

Apply a thin film of Loctite 510 to the mating surface between the axle beam and the differential housing.

Place the differential housing on the axle housing and screw together to the required torque (see section 8A01 § A):

- for suspended front axles: Fig. 53
- for fixed front axles: Fig. 54.

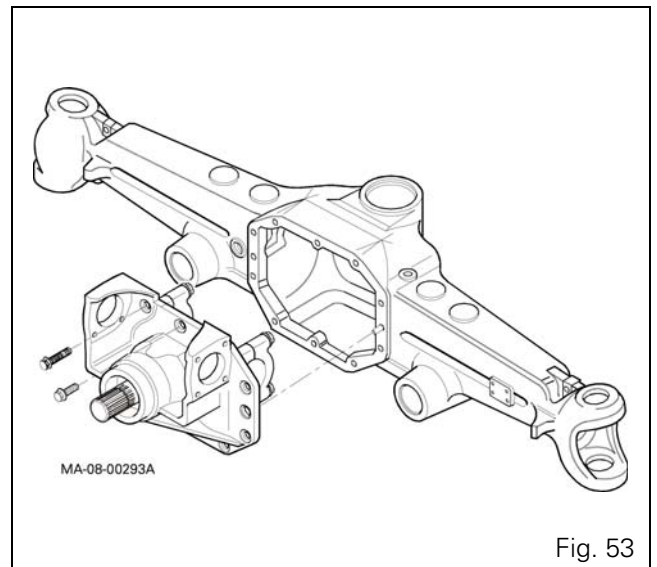


Fig. 53

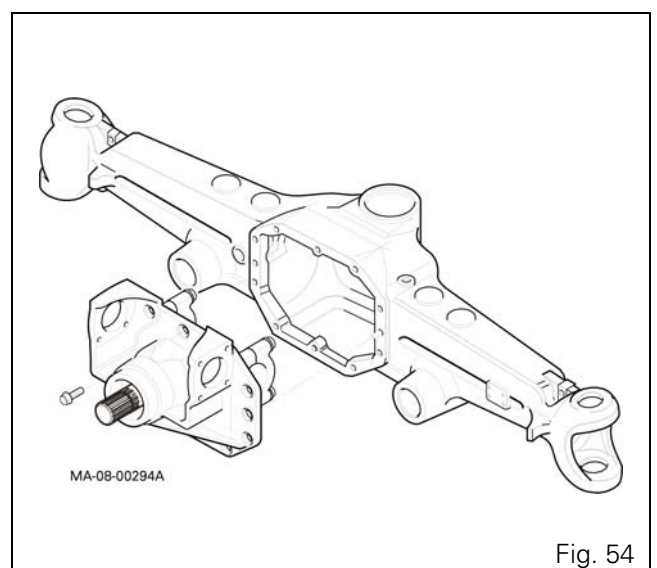


Fig. 54

## Carraro differential

**58.** Assemble the new previously lubricated seal C on the end of the gear using the special tool ref. CA119148 (voir § J), then install the flange A.

Position the flange attachment screws B with their respective nuts.

Tighten the attachment screws and nuts with a torque wrench to the required torque (see section 8A01 § A):

- for suspended front axles: [Fig. 55](#)
- for fixed front axles: [Fig. 56](#).

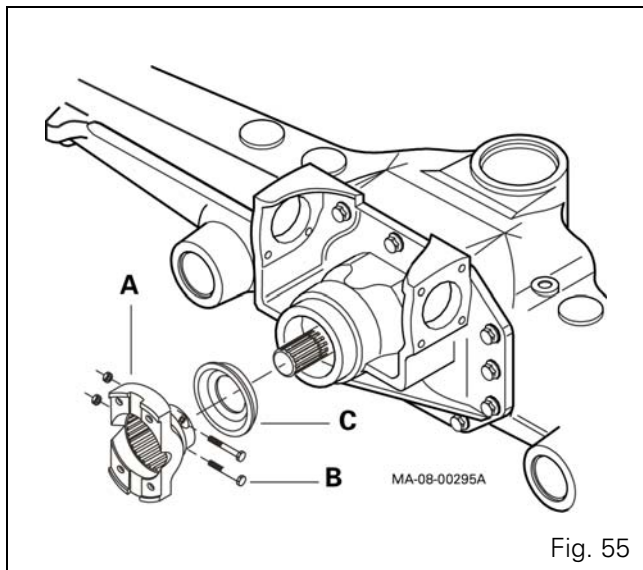


Fig. 55

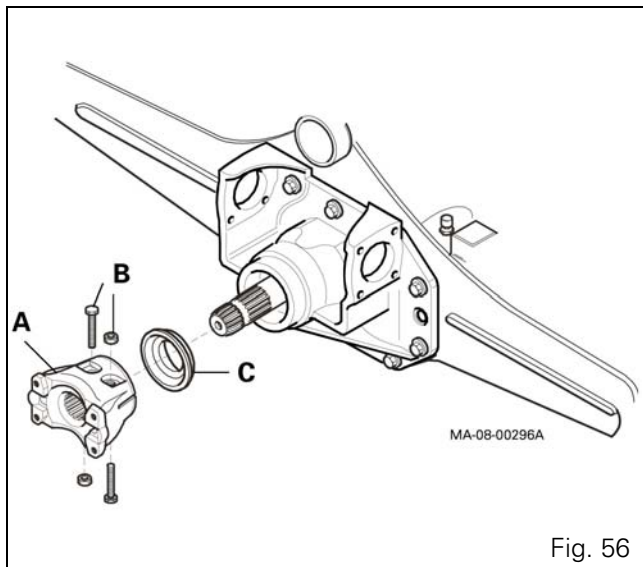
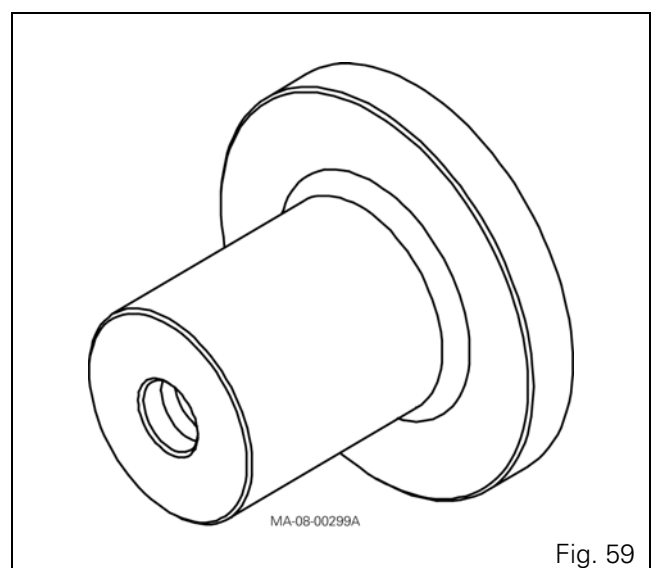
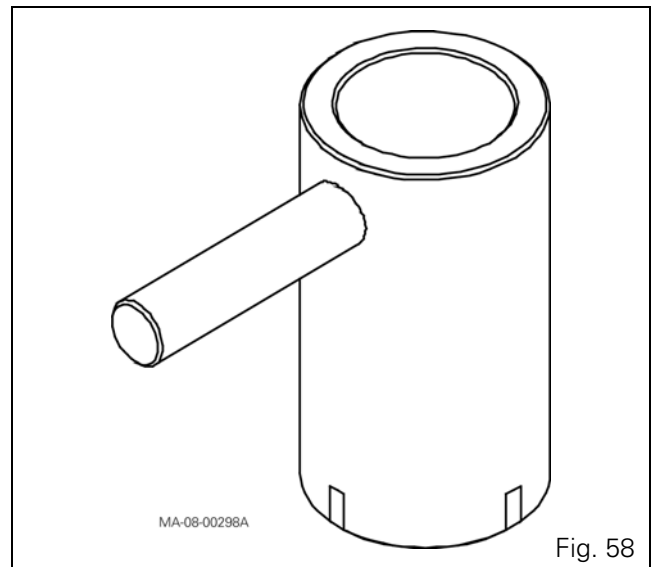
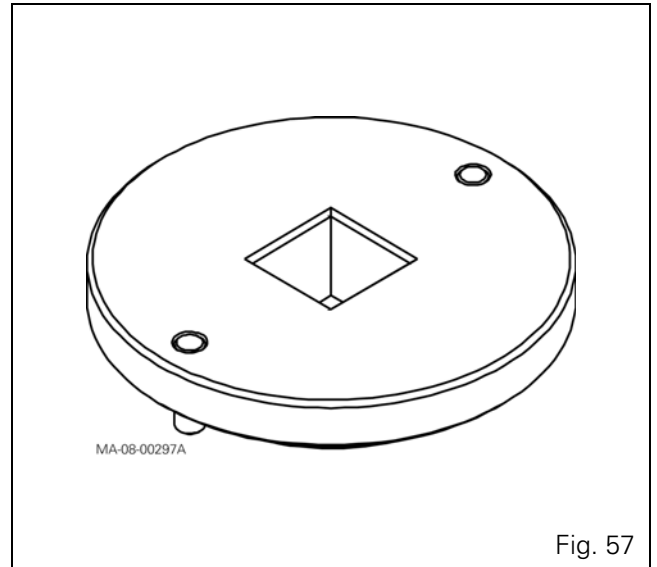


Fig. 56



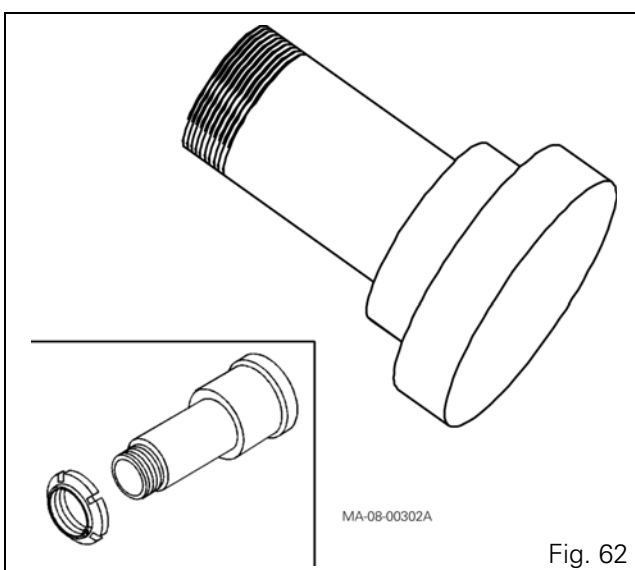
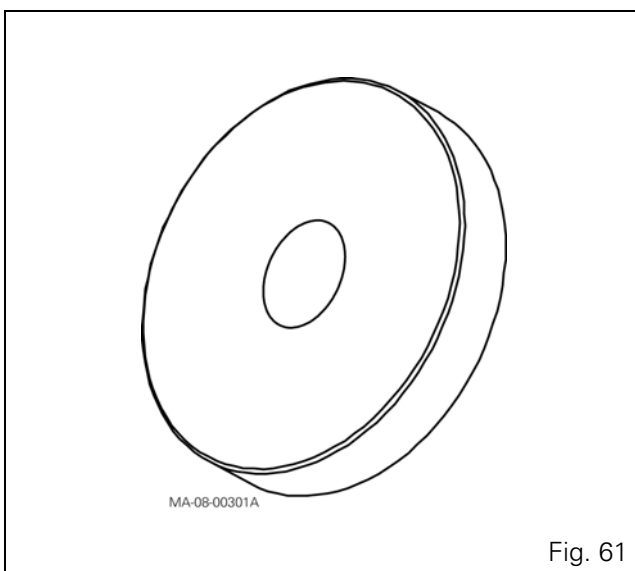
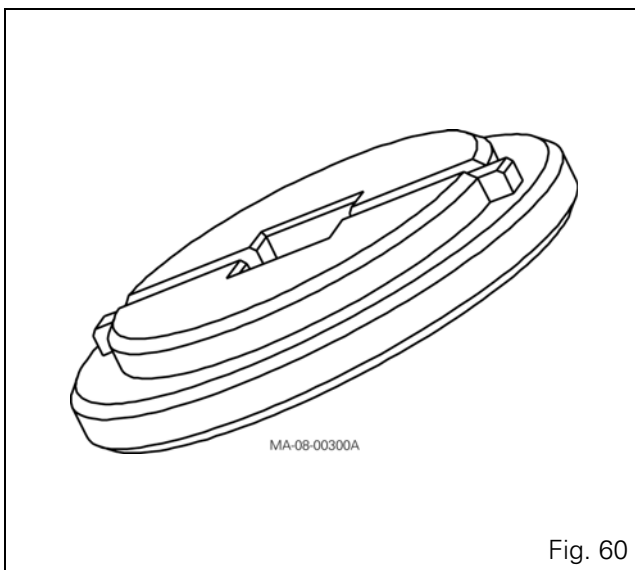
## J . Service tools

- CA 119030 - Square-head wrench (Fig. 57)
- CA 119099 - Gear nut wrench (Fig. 58)
- CA 119148 - Seal fitting tool (Fig. 59)



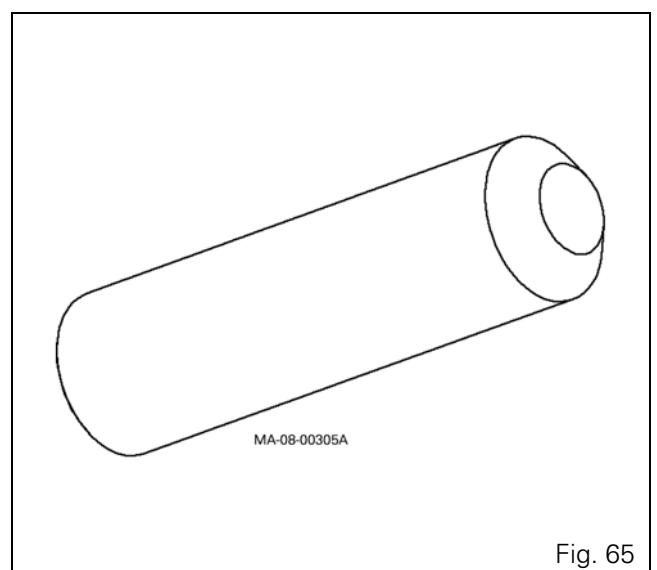
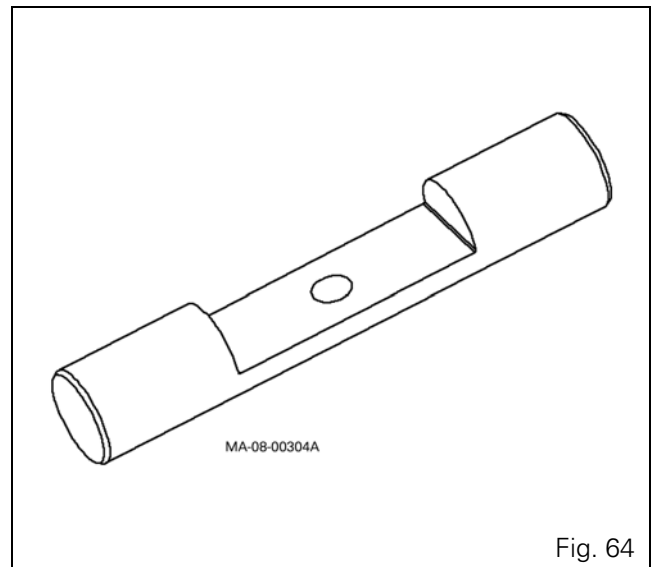
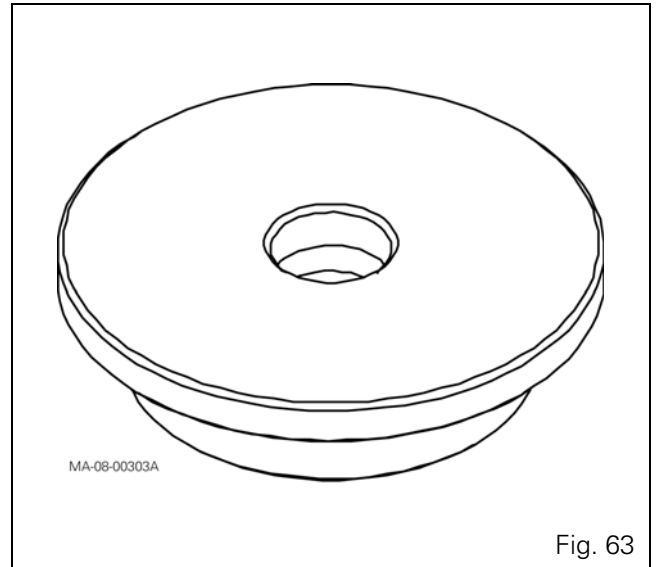
## Carraro differential

- CA 119149 - Square-head wrench (Fig. 60)
- CA 119182 - Dummy differential unit (Fig. 61)
- CA 119202 - Dummy gear (Fig. 62)



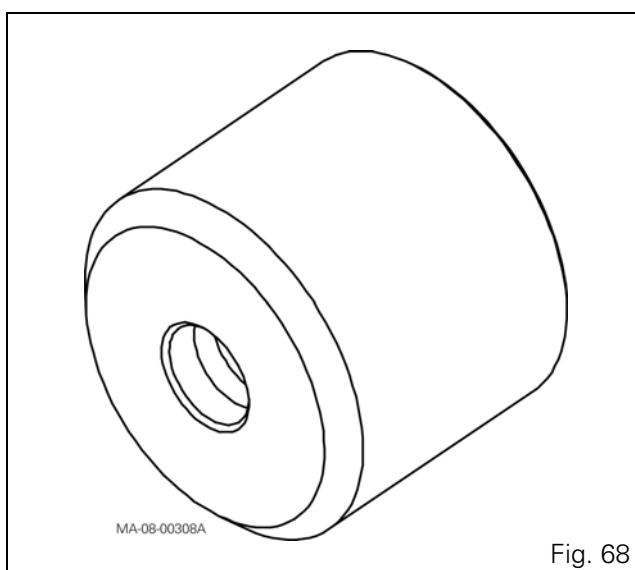
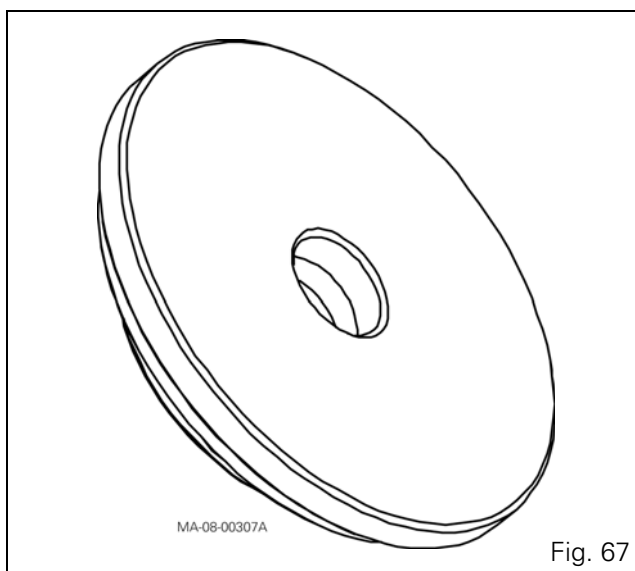
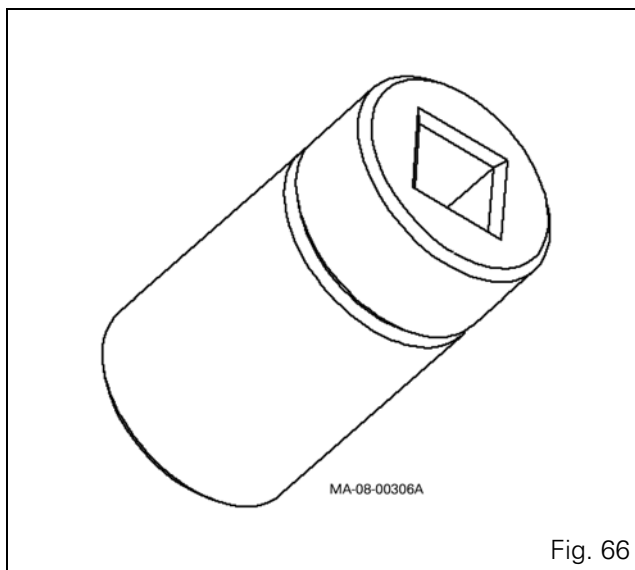
# Carraro differential

- CA 119225 - Bearing cup fitting tool (Fig. 63)
- CA 119228 - Dummy differential unit (Fig. 64)
- CA 715004 - Bearing cone fitting tool (Fig. 65)



## Carraro differential

- CA 715022 - Gear shaft locking wrench ([Fig. 66](#))
- CA 715092 - Bearing cone fitting tool ([Fig. 67](#))
- CA 715093 - Bearing cone fitting tool ([Fig. 68](#))







## *8A13- GPA20 Carraro bearings and transmission shafts*

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## **GPA20 Carraro bearings and transmission shafts**

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## A . General

On MF 6465, 6475, 6480 tractors fitted with a fixed or suspended Carraro axle (Fig. 2 - Fig. 3), the front frame carries out two functions:

- it is the main support for a number of components
- it incorporates the second axle beam pivot bearing.

The first axle pivot bearing is independent from the front frame and can therefore be disassembled.

The 4WD transmission line comprises two shafts: a long straight shaft and a universal joint shaft. These shafts are linked respectively to the 4WD system of the centre housing and to the drive pinion carrier, via a splined sleeve and universal joint spiders (Fig. 2 - Fig. 3).

This transmission line is supported by the bearing and the cast-iron unit fitted at the front under the unit housing.

The rotating assembly is protected by two guards (2) (Fig. 2 - Fig. 3).

### Parts list

- (1) Screw
- (2) Front bearing
- (3) Unions
- (5) Lubricating pipe
- (6) Circlip
- (7) Chamfered washer
- (8) Plug
- (9) Seal
- (10) Friction washer
- (11) Suspension control unit
- (15) Front frame
- (16) Friction washer
- (17) Grease nipple
- (52) Axle housing

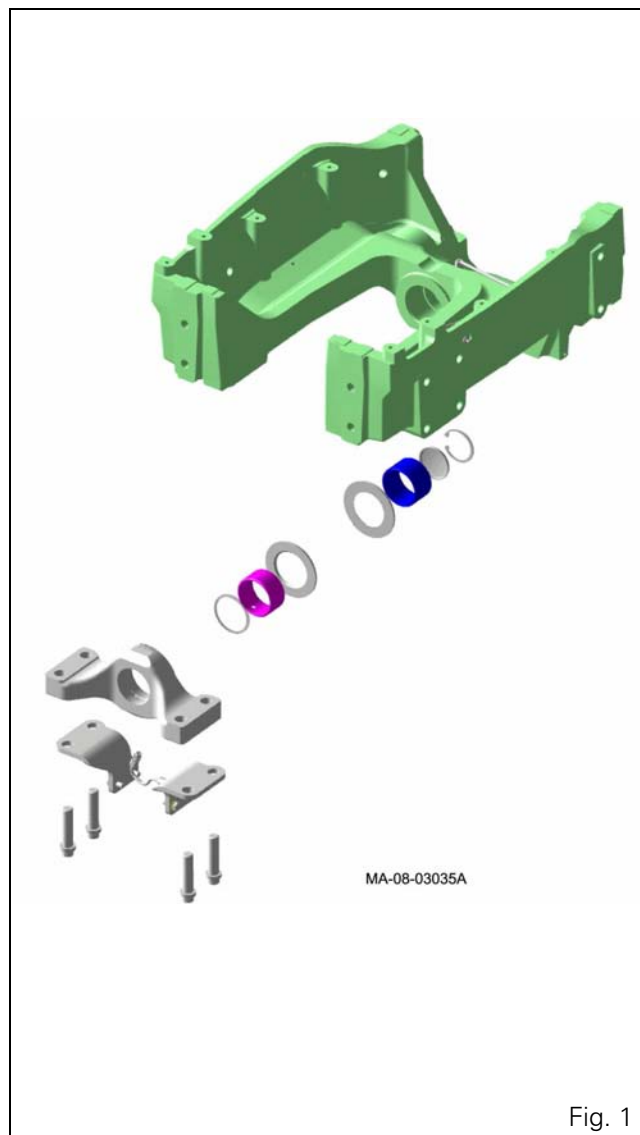
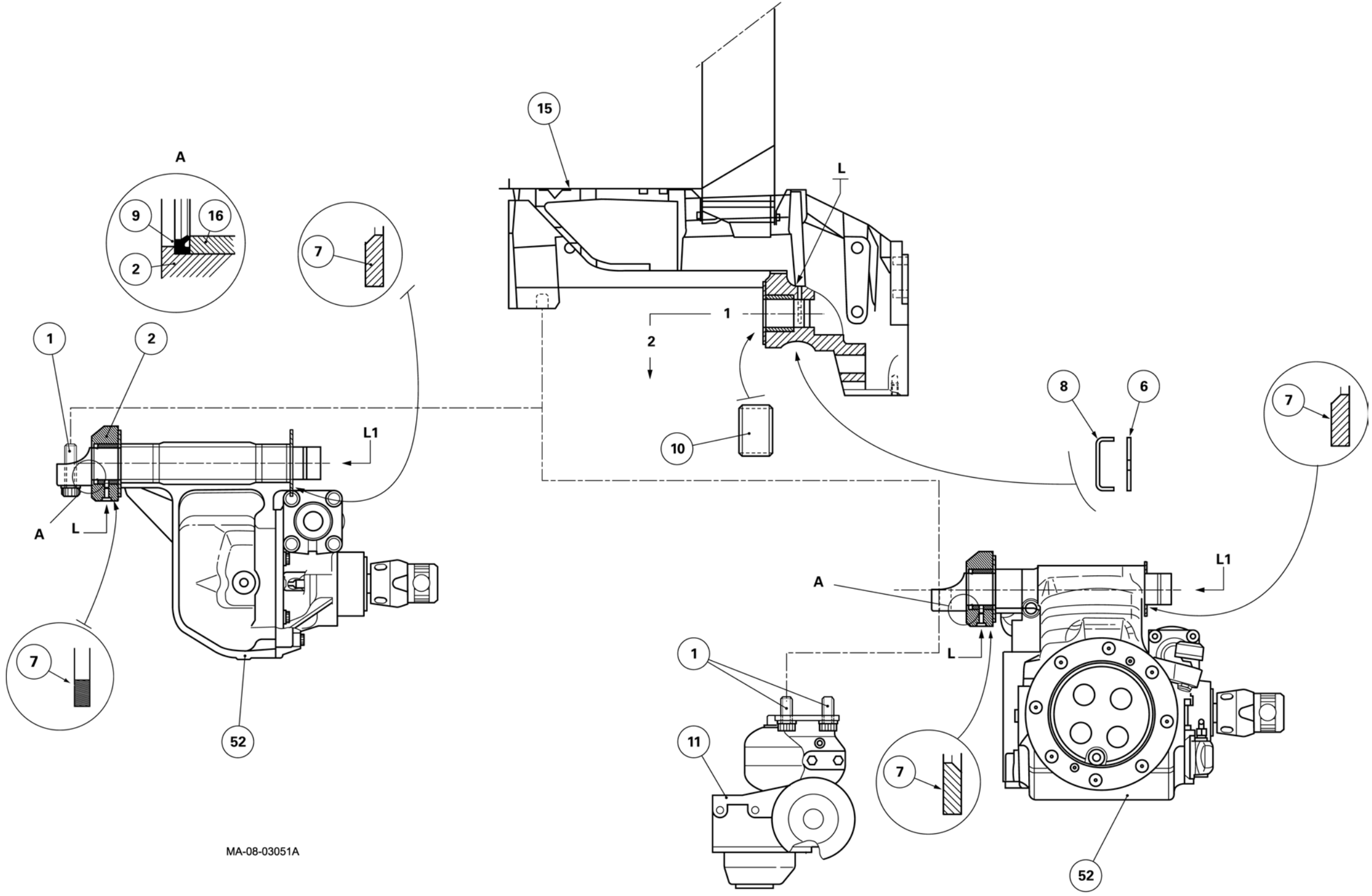


Fig. 1

## **GPA20 Carraro bearings and transmission shafts**

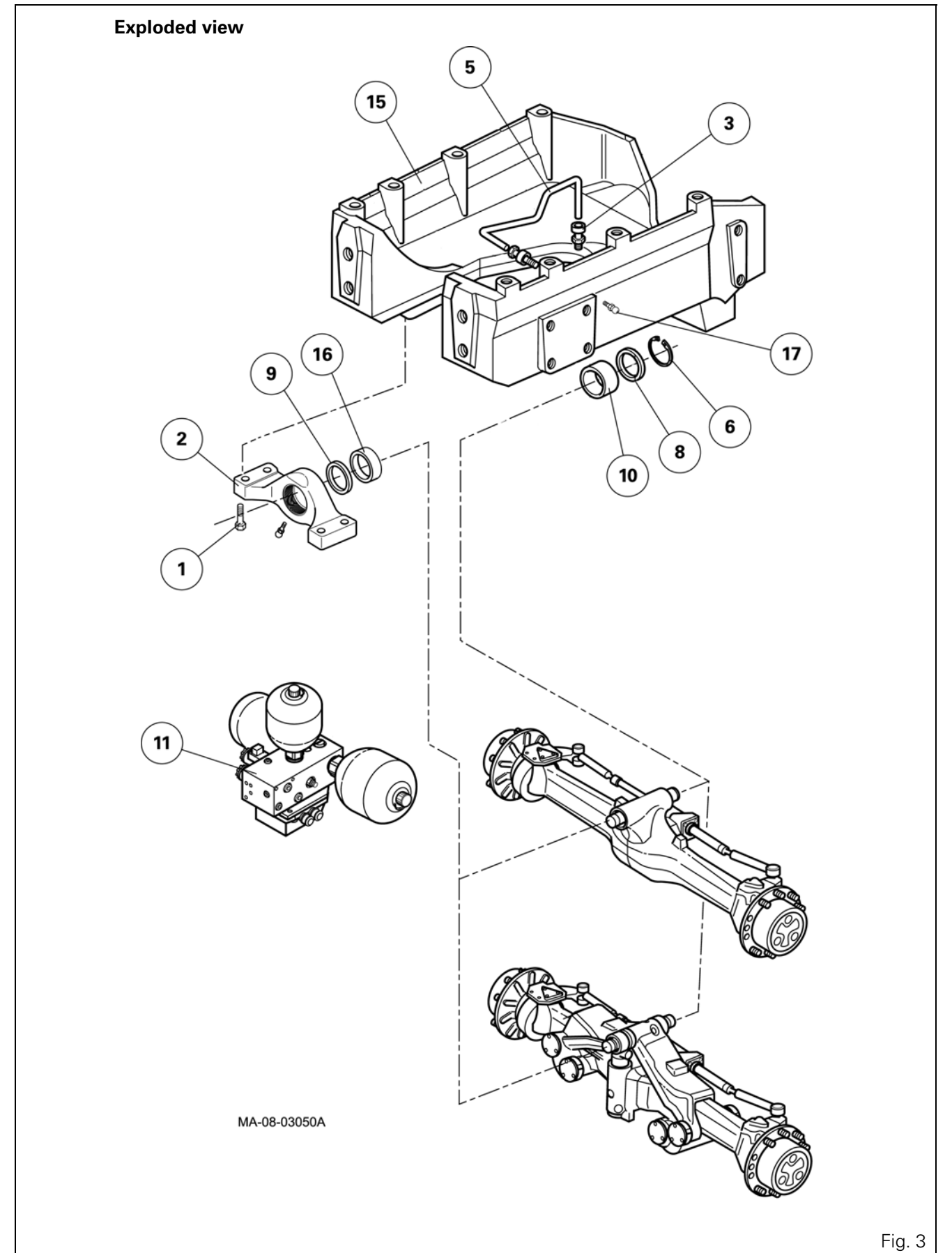
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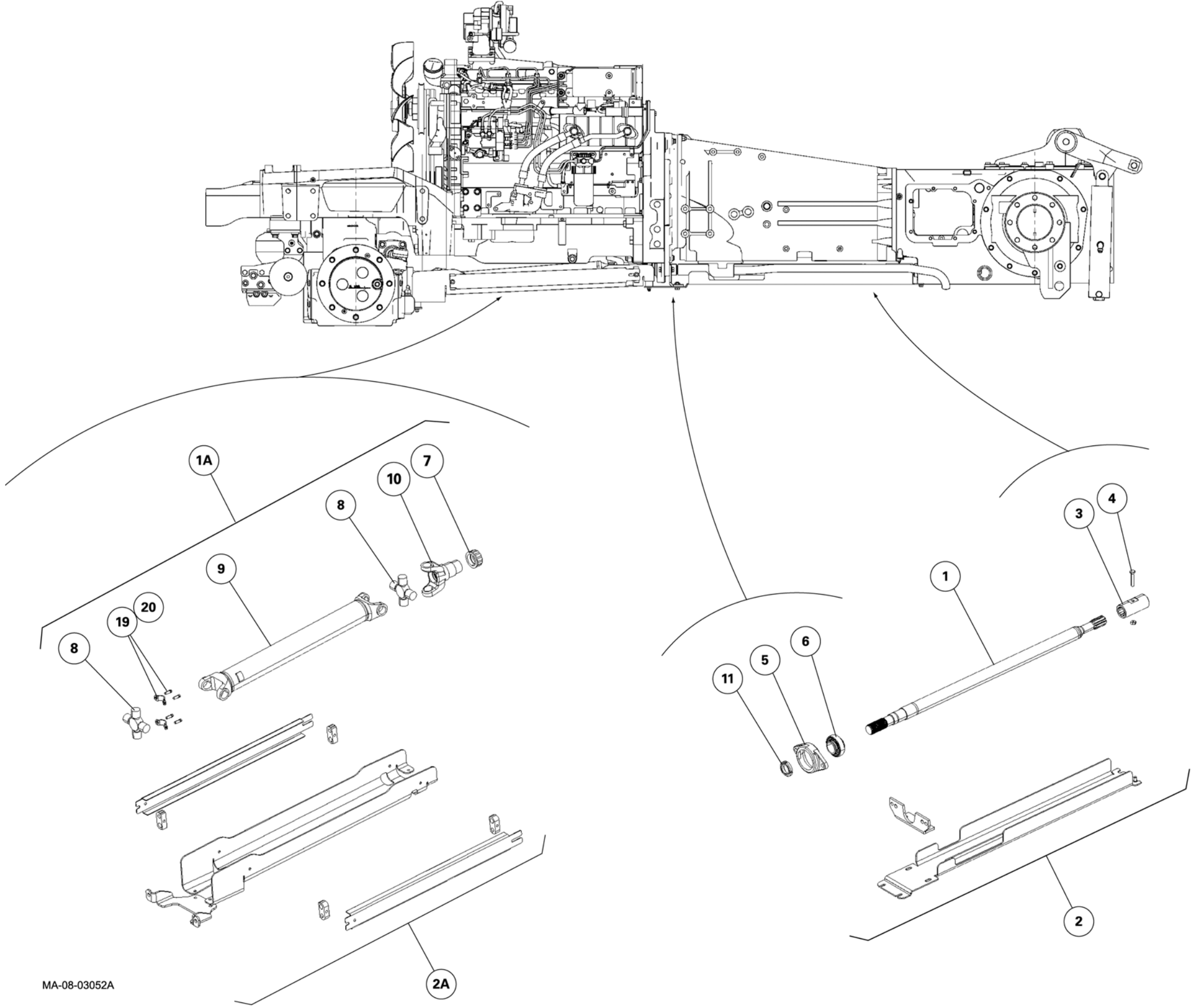
Fig. 2

# GPA20 Carraro bearings and transmission shafts



Parts list

- (1) Long straight shaft
- (1A) Universal joint shaft
- (2) Guard
- (2A) Guard
- (3) Sleeve
- (4) Screw
- (5) Central bearing
- (6) Bearing
- (7) Dust seal nut
- (8) Spider
- (9) Shaft
- (10) Sleeve
- (11) Castellated locknut
- (19) Flanges
- (20) Screw



MA-08-03052A

Fig. 4



## B . Disassembling and reassembling the 4WD transmission shafts and the universal joint spiders

### Universal joint shaft (Fig. 4)

#### Disassembly

1. Chock the rear wheels and put the handbrake on.
2. Remove the guards (2) (2A).
3. Unscrew the dust seal nut (7).
4. Remove the screws (20) and flanges (19).
5. Move the universal joint shaft (1A) and the universal joint spider (8) away from the drive pinion carrier. Remove the shaft (Fig. 4)

#### Remark

- If there is not enough room to push the universal joint backwards, disassemble the central bearing and long straight shaft (1).

#### Reminder

- It is possible to replace the universal joint spiders. Their reference is indicated in the spare parts catalogue.

#### Reassembly

##### Check points

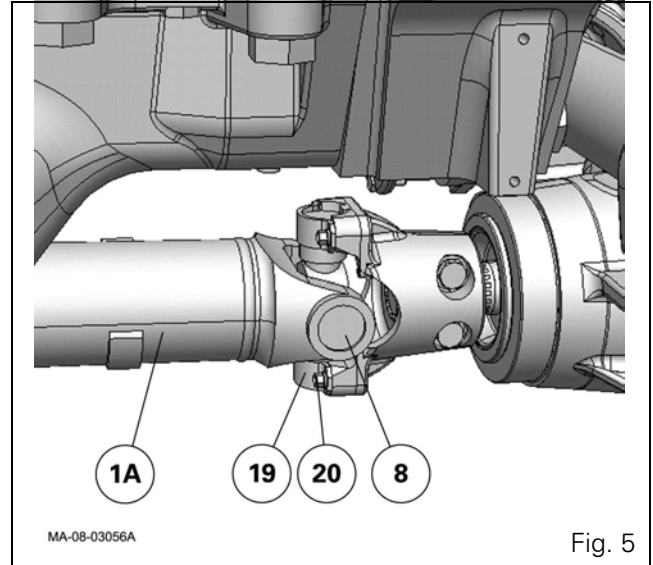
- If the universal joint spiders must be replaced, carefully check the condition of the end clevises at the spider catch location. Remove any traces of impact or sharp edges. Clean the groove of each circlip correctly. After assembly check that the circlips are properly placed in their respective grooves.

#### Remark

- If necessary, to make easier the assembly of the universal joint to the drive pinion carrier, raise the front wheels using a jack with sufficient lifting capacity and positioned along the axis of the axle housing.

6. Replace the dust seal nut (7).

**Note: Use a locally made conical tool to refit the dust seal nut (7) on the shaft (1).**



7. Smear the front splines of the long straight shaft with molybdenum sulphide grease or equivalent. Refit the universal joint shaft (1A).
8. Attach the front universal joint spider (8) on the plate of the drive pinion carrier using flanges (19) and collar screws (20) lightly smeared with Loctite 241 or equivalent and tighten them to a torque of 34 - 41 Nm.
9. Moderately tighten the dust seal nut (7).
10. Using a grease gun, grease sleeve (10) and refit the guards (2) (2A).

# GPA20 Carraro bearings and transmission shafts

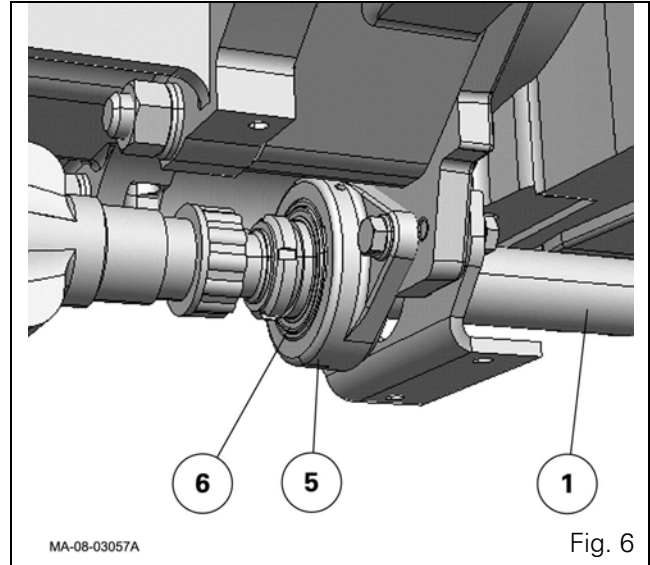
## Long straight shaft and bearing (Fig. 4)

### Disassembly

11. Remove the guards (2) (2A) and the universal joint shaft assembly. Repeat operations 1 to 5.
12. Remove the screw (4) and slide the sleeve (3) towards the front of the long straight shaft.
13. Remove the central bearing assembly (5), bearing (6) and the straight shaft (1) (Fig. 6).
14. Separate support (5) from the bearing (6).
15. Unscrew the castellated nut (11) using a suitable wrench.
16. Remove the bearing from the long straight shaft.

### Reassembly

17. Check the components. Replace any defective parts.
18. Fit bearing (6) on the long straight shaft with the offset turned rearwards. Tighten the nut with a suitable wrench.
19. Assemble support (5) on the bearing (6). Tighten the screws.
20. Refit the central bearing assembly, refit bearing (6) and long straight shaft (1).
21. Smear the rear splines of the long straight shaft (1) with molybdenum sulphide grease or equivalent.
22. Slide the sleeve (3) towards the rear of the long straight shaft. Refit the screw (4). Replace it if it is in a poor condition.
23. Refit the universal joint shaft assembly.  
Carry out operations 6 to 10.  
Refit the guards (2) (2A).





## C . Removing and refitting the bearing support and front axle

Fixed or suspended front axles

Preliminary operations

**24.** Remove the 45kg front weights (if fitted). Immobilise the tractor. Apply the handbrake. Place safety chocks on either side of the rear wheels as shown in Fig. 8.

### Reminder

- Some tractors may be fitted with a front power take off. In this case, it will be necessary to remove it in order to separate the front axle from the frame (15).

### Remark

- In certain conditions, the centre weight (1) of 100 Kg (Fig. 7) can obstruct the removal of the bearing support. In this case, remove the internal parts at the lower part of the grille to gain access to the weight. Take out the central attachment screw M20 (2) (Fig. 7) and lift the weight slightly using a suitable lifting tool to release it from the support.

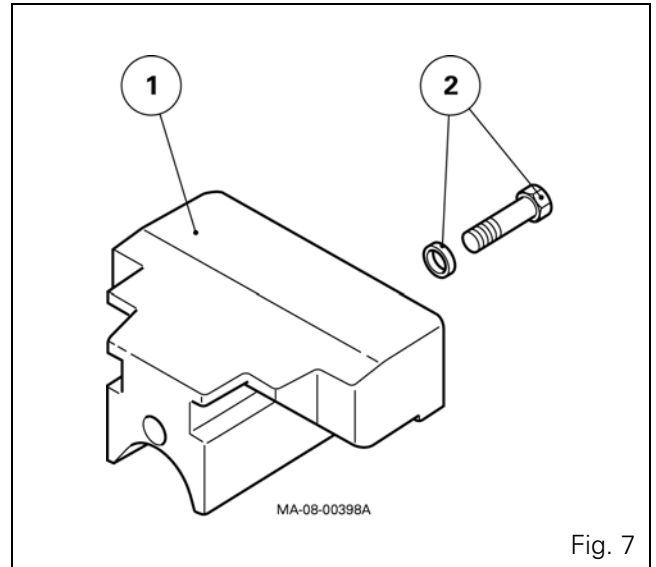


Fig. 7

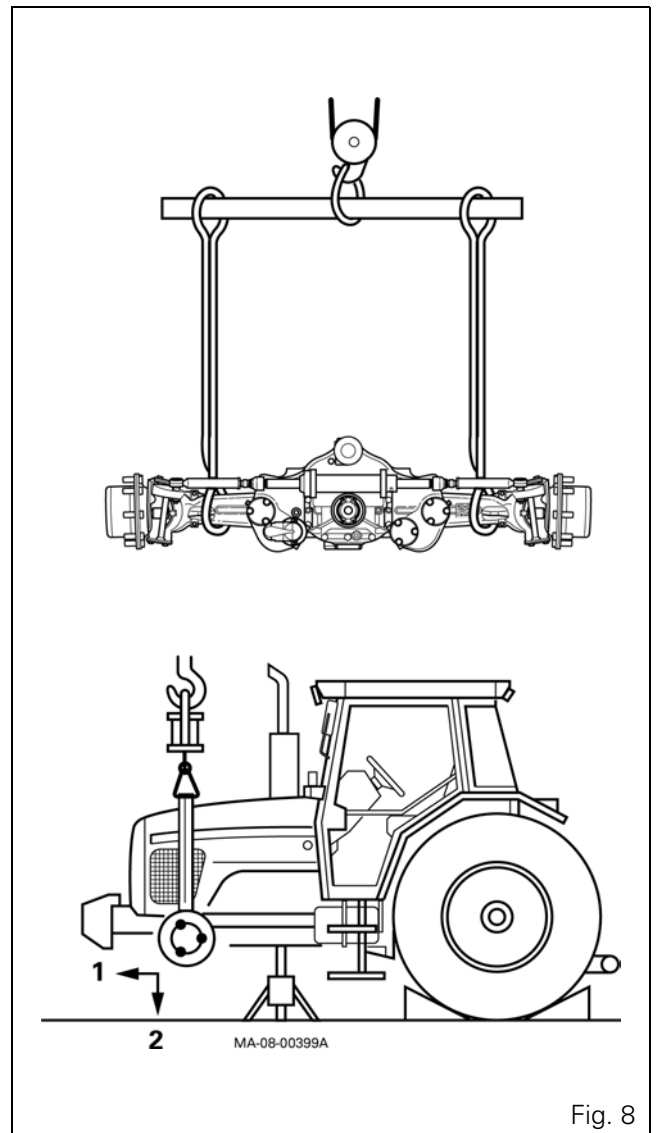


Fig. 8

# GPA20 Carraro bearings and transmission shafts

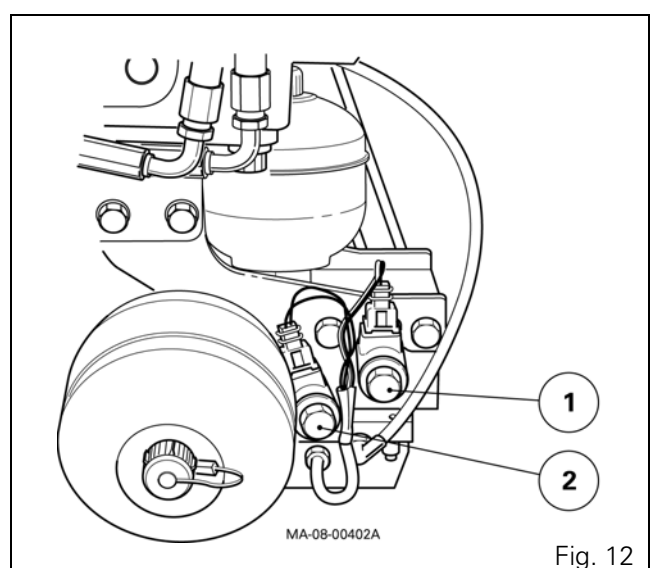
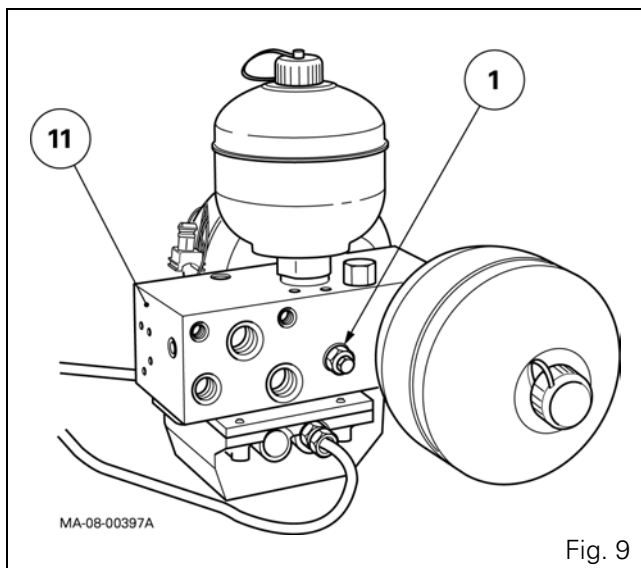
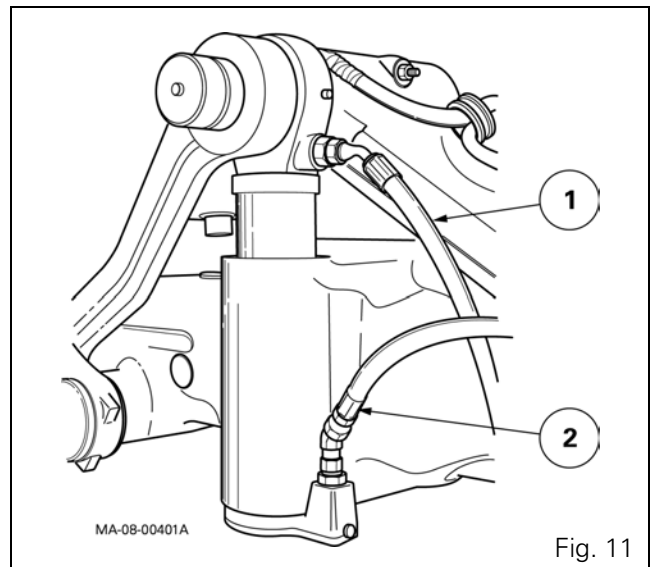
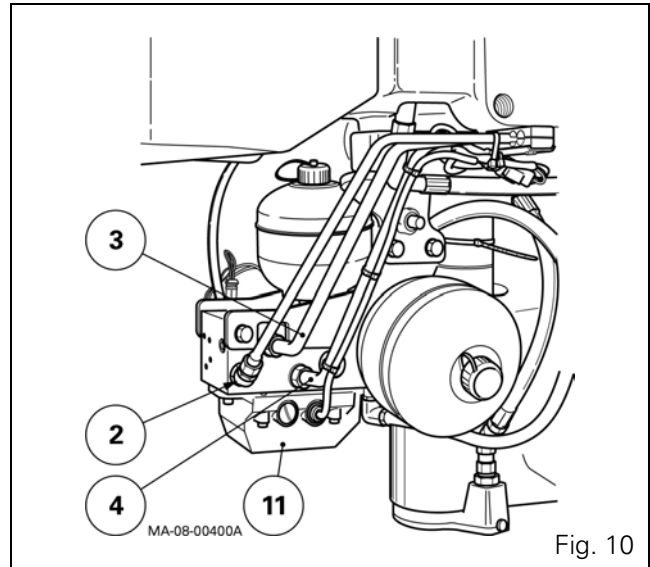
## Suspended front axle

### Removing the hydraulic unit

25. Remove the protective guards.

#### Important

- It is important to unscrew bleed screw (1) (Fig. 9) in order to drop the pressure in the hydraulic unit (11) (Fig. 9) before carrying out any operations on the hydraulic pipes.
26. Locate the Load Sensing (LS) (2), Return (3), and Pressure (4) hydraulic pipes (Fig. 10) connected to the hydraulic unit (11) (Fig. 10) and remove them.
27. Locate and remove the hose pipes (1) (2) connected to the control ram (Fig. 11).
28. Locate and separate the connectors linked to the hydraulic unit electronic device, which are mounted:
- at the front left-hand side of the tractor
  - inside the grille.
29. Mark then disconnect:
- the solenoid valve (1) located at the front of the hydraulic unit, green connector (Fig. 12),
  - the remaining solenoid valve (2), black connector (Fig. 12).
30. Remove the hydraulic unit with the help of another operator or a locally-made fixture fitted to the head of a trolley jack.



## Fixed or suspended front axles

### Removing the support (2) and the front axle

31. Remove the guards (2) (2A) (Fig. 4).
32. Raise the tractor along the axis of the front axle housing using a jack with sufficient lifting capacity. Remove the front wheels.

### Danger

33. Place a fixed axle stand under the lower engine housing.
34. Locate the connections of the steering hoses and separate them from the cylinder.
35. Disconnect the front differential lock control hose.
36. Sling the front axle using suitable straps (Fig. 8).
37. Take out screws (1) (Fig. 2).
38. Pull the front axle assembly complete with bearing support (2) forwards along the axis of the axle beam (Fig. 8) (position 1) and remove the front axle (position 2).
39. Note the features, order and position of washers (7) and chamfers, and remove them (Fig. 8).

### Refitting

#### Check point

40. Clean all components and check the condition of (Fig. 2):
  - the pivot pin at each end
  - the washers (7)
  - the friction rings (10) (16)
  - the seal (9).

### Fixed or suspended front axles

41. Slide the washers (7) slightly smeared with bearing grease onto the front and rear ends of the pivot pin, the chamfer turned towards the front axle.
42. Sling the front axle (Fig. 8). Moderately grease the ends of the pivot pin and mount the support (2) at the front of the pivot pin (Fig. 2)..

#### Remarks

- Before refitting the front axle assembly, check that there is no excess grease in the cavity of the second axle beam pivot on the front frame.
  - When refitting the front axle assembly, any such excess grease will be compressed, making insertion of the axle pivot into its bearing difficult.
43. Refit the front axle and support (2) assembly.
  44. Push the assembly hard until it abuts against the second axle beam pivot.
  45. Thrust the support (2) against the front axle assembly so as to eliminate the clearance between supports and axle housing to the maximum.

# GPA20 Carraro bearings and transmission shafts

46. Fit the screws lightly smeared with Loctite 270 or equivalent and tighten to a torque of 520 - 640 Nm.

### Check point

- Check that the front face of the pivot pin (1) is almost flush with the front edge F of the bearing support (2) (Fig. 13).

47. Check for the presence of the grease nipple on:

### Fixed front axles

- the left-hand side of the front frame (second axle beam pivot),
- support (2) (first axle beam pivot).

### Suspended front axles

- the left-hand side of the front frame (second axle beam pivot),
- the left-hand support of the hydraulic unit (first axle beam pivot).

## Fixed or suspended front axles

48. Reconnect the hoses (using marks made during disassembly):

- of the steering ram
- of the front differential lock.

49. Refit the wheels. Remove the axle stand and take away the jack. Tighten the wheel nuts to a torque of 640 - 680 Nm.

50. Refit the centre weight. Tighten the central screw to a torque of 100 - 150 Nm and the front weights (depending on equipment fit).

51. Refit the universal joint shaft and the guards (see § B).

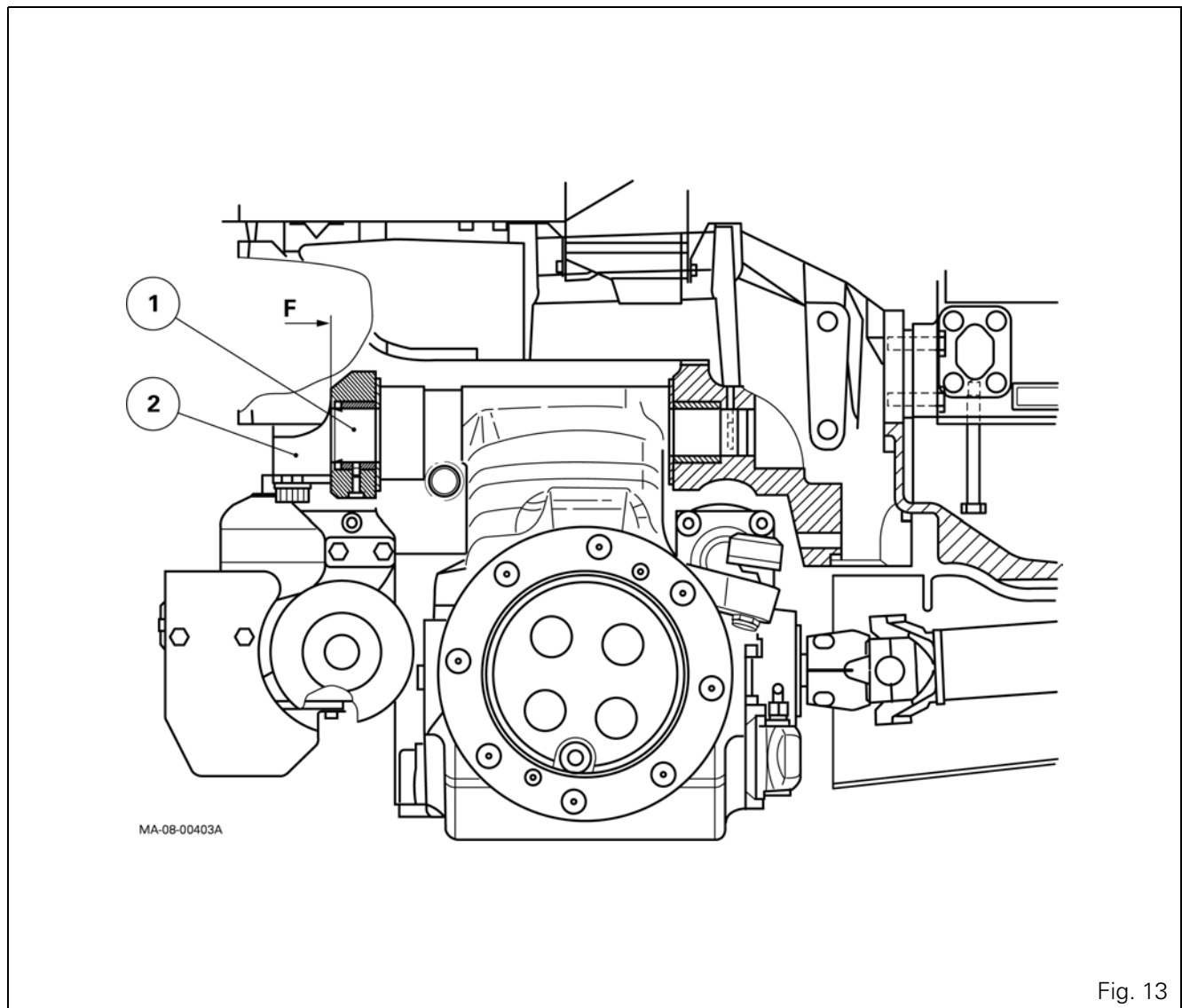


Fig. 13

## Suspended front axles

### Refitting the hydraulic unit

52. Refit the hydraulic unit using the same method used for removal.
53. Reconnect the solenoid valves and the electronic device connectors (according to marks made).
54. Reconnect the hoses to the control cylinder (according to marks made).
55. Reconnect the hydraulic Pressure (4), Return (3) and LS (2) pipes to the hydraulic unit (according to marks made) (Fig. 10).

#### Reminder

- Check that bleed screw (1) (Fig. 9) is properly closed with a view to future use of the tractor.

56. Refit the guards.

### Final operations

57. Remove the safety chocks and release the hand-brake.
58. Using a grease gun, grease the friction rings (10) (16) (Fig. 2) of the axle beam pivots.

## D . Replacing the friction rings and seal

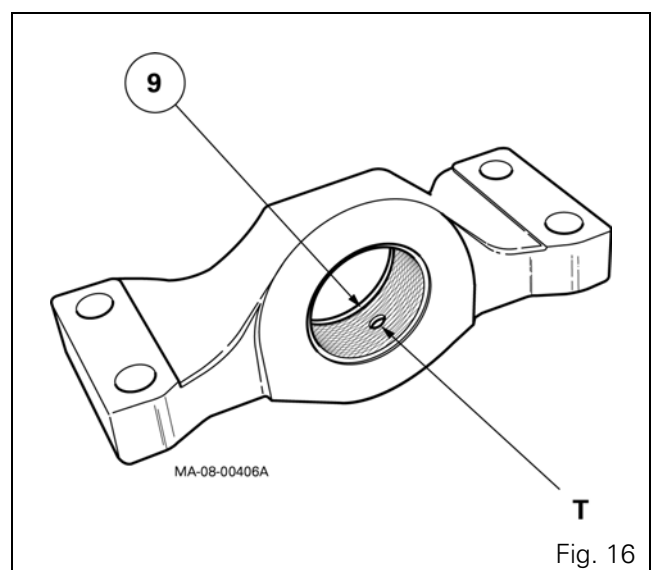
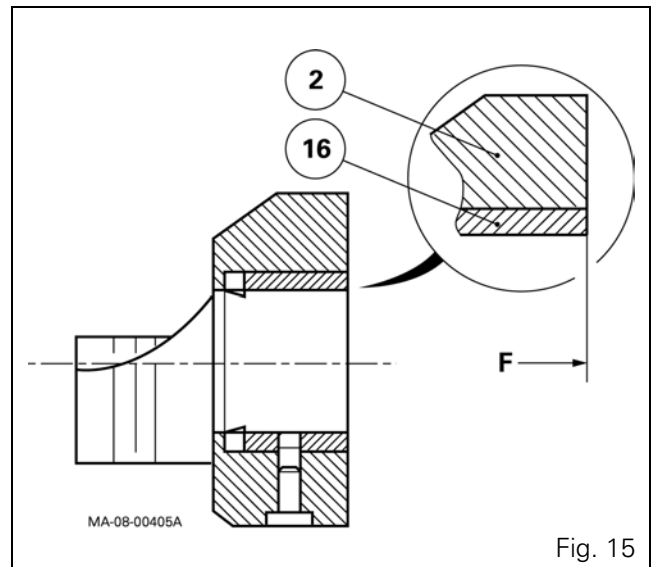
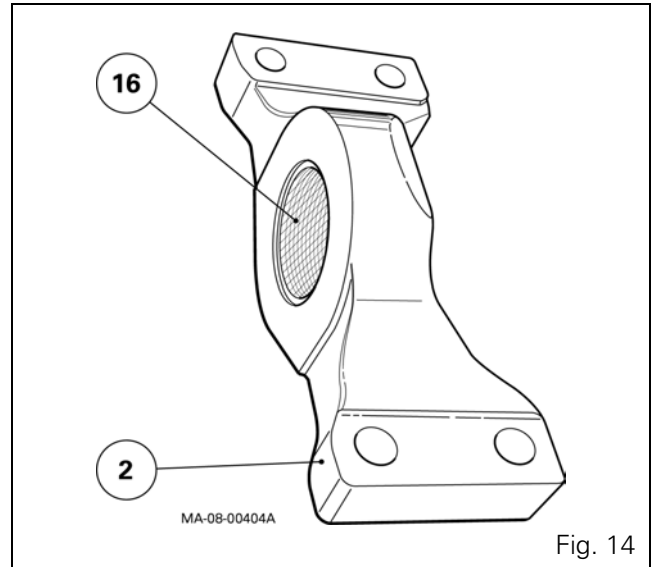
### Front bearing (first axle pivot, Fig. 2)

#### Disassembly

59. Remove only bearing support (2) (see § C).
60. Extract and discard ring (16).
61. Drive out and discard seal (9).

#### Reassembly

62. Clean and check all components. Replace any defective parts. Check that the grease channels in the support are not obstructed.
63. Using a press and a suitable fixture, insert a correctly positioned seal (9) and ring (16) flush with face F of support (2) (Fig. 14 - Fig. 15), the grease hole T linked to the channel (Fig. 16).



## GPA20 Carraro bearings and transmission shafts

Rear bearing (second axle pivot, Fig. 2 and Fig. 3)

### Remark

- To work on ring (10) of the second axle beam pivot, it is first necessary to take off the first axle beam pivot and the front axle (see § C).

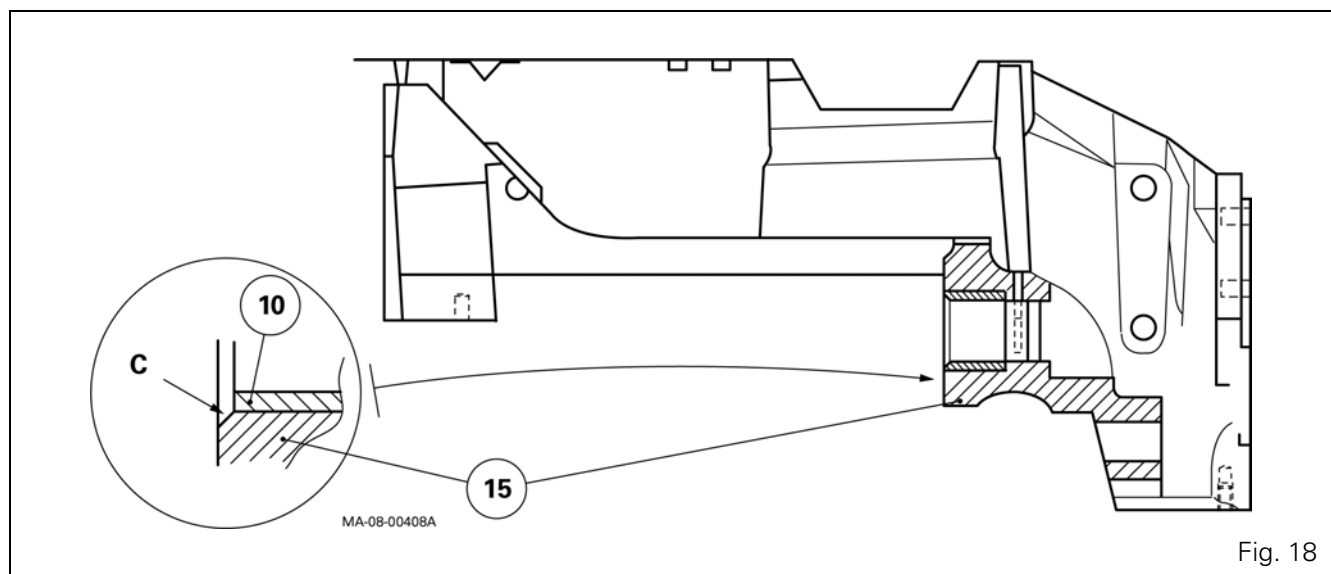
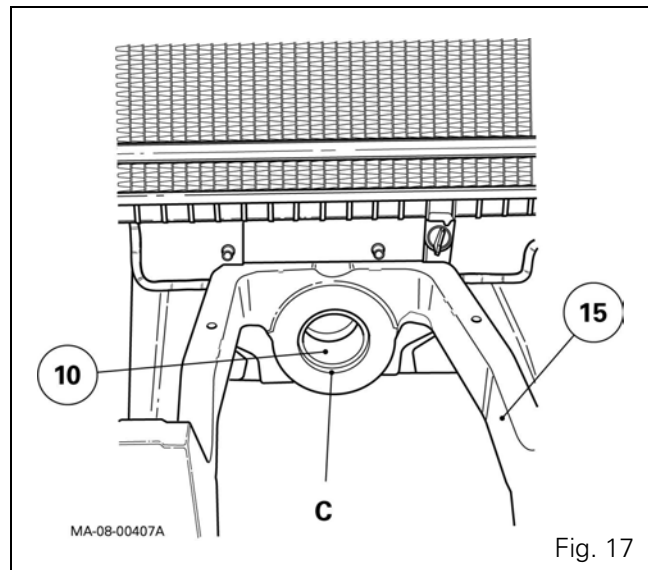
### Disassembly

64. Drive out ring (10) using a locally-made tool.

**Note: The circlip (6) and plug (8) are not considered as wear parts; therefore their replacement is unlikely.**

### Reassembly

65. Using a locally-made drift, insert ring (10) into the frame (15) flush with chamfer C (Fig. 17 - Fig. 18).



## *8A14 - GPA40 Carraro bearings and transmission shafts*

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## **GPA40 Carraro bearings and transmission shafts**

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## A . General

MF 6485, 6490 6495 series tractors are equipped with a Carraro fixed or suspended front axle. The front frame (Fig. 1) carries out two functions:

- it is the main support for a number of components
- it incorporates the second axle beam pivot bearing.

The first axle beam pivot bearing is independent from the front frame and can therefore be disassembled (Fig. 1).

The 4WD transmission line is comprised of two shafts (Fig. 4):

- a long straight shaft
- a universal joint shaft.

These shafts are linked respectively to the rear axle 4WD system and to the drive pinion carrier, via a splined sleeve and universal joint spiders (Fig. 4).

This line is supported by the bearing and the cast-iron unit fitted at the front under the axle housing. The rotating assembly is protected by two guards (2) (2A) (Fig. 4).

### Parts list (Fig. 2 and Fig. 3)

- (1) Screw
- (2) Front bearing
- (3) Front bearing lubricating pipe
- (4) Rear bearing lubricating pipe
- (5) Grease nipple
- (6) Front bearing ring
- (7) Chamfered washer
- (8) Rear bearing ring
- (9) Seal
- (10) Plug
- (11) Circlip
- (12) Front frame
- (13) Fixed front axle
- (14) Suspended front axle
- (15) Suspension control unit
- (16) Support

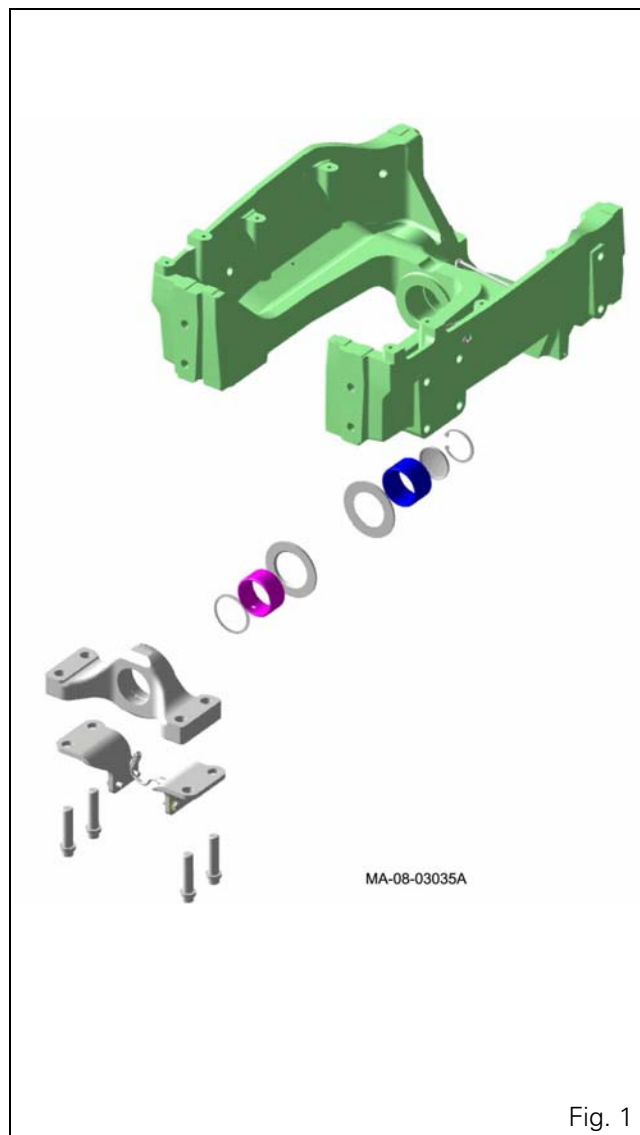
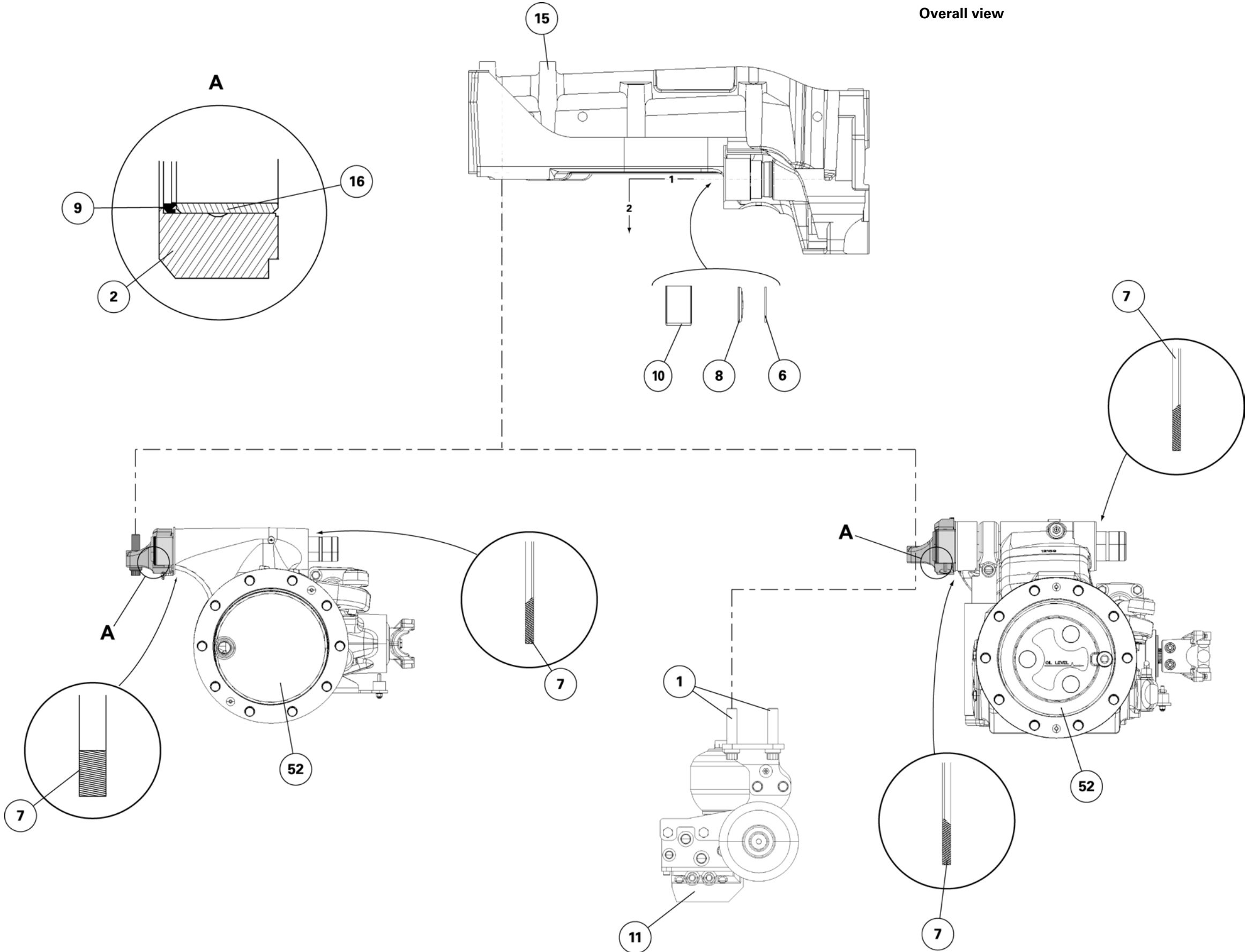


Fig. 1

## **GPA40 Carraro bearings and transmission shafts**

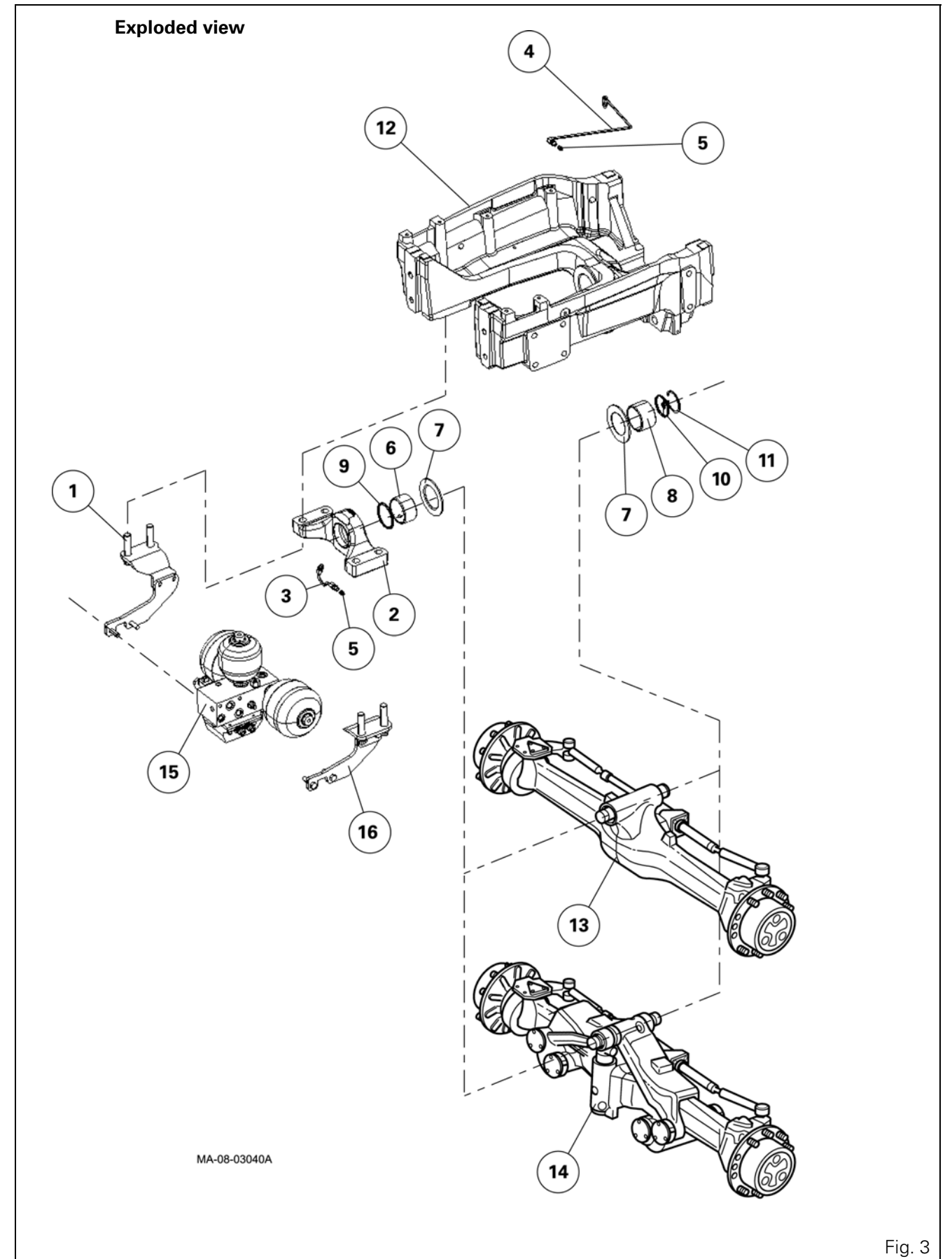
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Fig. 2

# GPA40 Carraro bearings and transmission shafts



Parts list

- (1) Straight shaft
- (1A) Universal joint shaft
- (2) Guards
- (2A) Guards
- (3) Sleeve
- (4) Dust seal
- (5) 1st bearing
- (6) 2nd bearing
- (7) 1st bearing
- (7A) 2nd bearing
- (8) Dust seal nut
- (9) Spider
- (10) Shaft
- (11) Sleeve
- (12) Castellated locknut

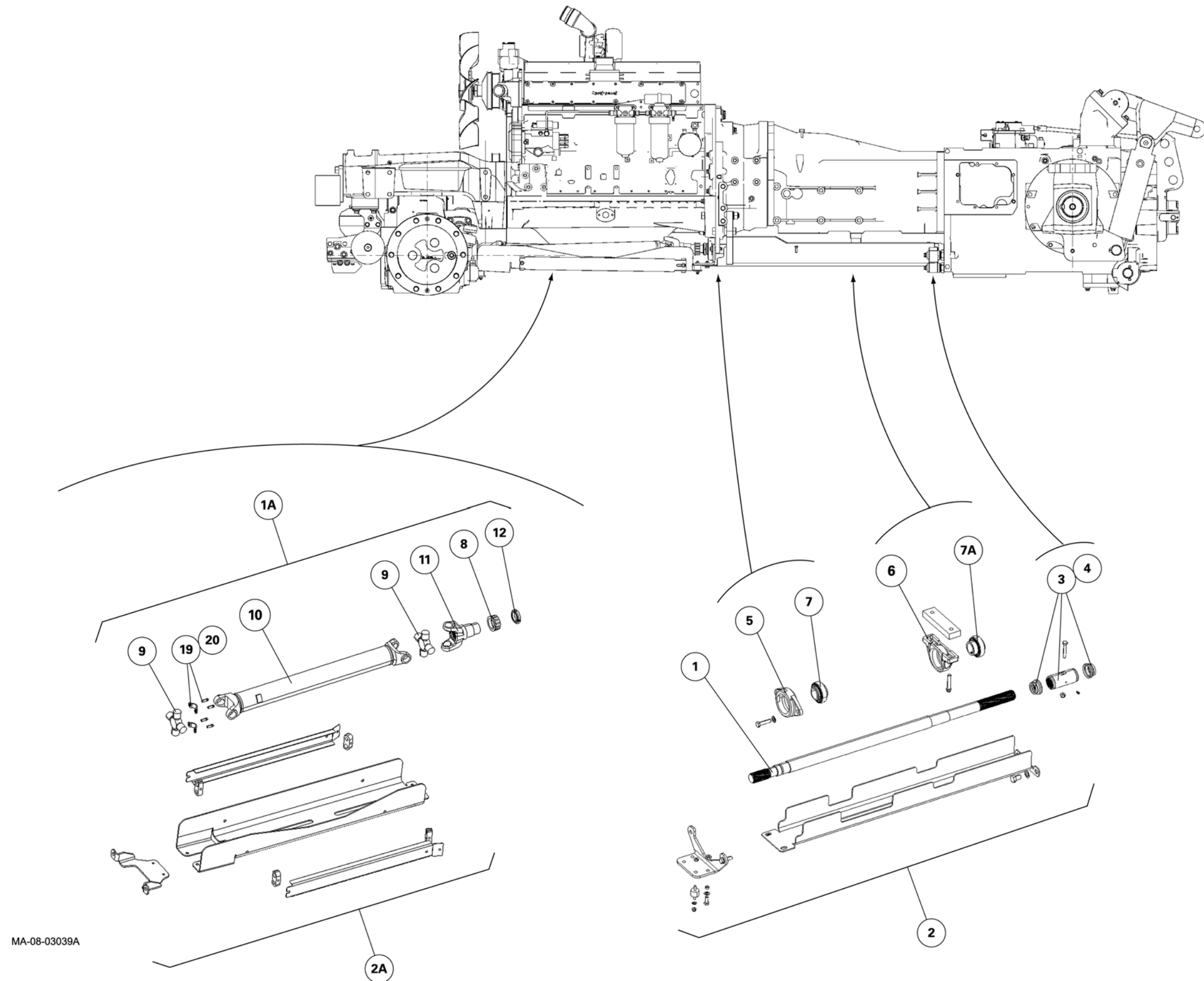


Fig. 4



## B . Disassembling and reassembling the 4WD transmission shafts and the universal joint spiders

### Universal joint shaft (Fig. 4)

#### Disassembly

1. Chock the rear wheels and put the handbrake on.
2. Remove the guards (2) (2A).
3. Unscrew the dust cover nut (8).
4. Remove the screws (20) and flanges (19) (Fig. 5).
5. Move the universal joint shaft assembly (1A) and the universal joint spider (9) away from the drive pinion carrier. Remove the shaft.

#### Remark

- If there is not enough room to push the universal joint backwards for removal, disassemble the central bearing and long straight shaft (1).

#### Reminder

- It is possible to replace the universal joint spiders. Their reference is indicated in the spare parts catalogue.

#### Reassembly

##### Check points

- If the universal joint spiders must be replaced, carefully check the condition of the end clevises at the spider catch location. Remove any traces of impact or sharp edges. Clean the groove of each circlip correctly. After assembly check that the circlips are properly placed in their respective grooves.

#### Remark

- If necessary, to make easier the assembly of the universal joint to the drive pinion carrier, raise the front wheels using a jack with sufficient lifting capacity and positioned along the axis of the axle housing.

6. Replace the dust seal nut (8) if necessary.

**Note: Use a locally made conical tool to refit the dust seal nut (8) on the shaft (1).**

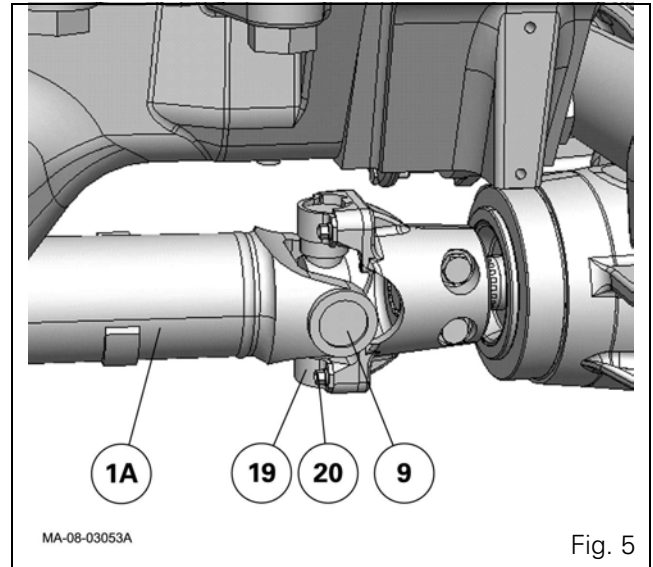


Fig. 5

7. Smear the front splines of the long straight shaft with molybdenum sulphide grease or equivalent. Refit the universal joint shaft (1A).
8. Attach the front universal joint spider (9) on the plate of the drive pinion carrier using flanges (19) and collar screws (20) lightly smeared with Loctite 241 or equivalent and tighten them to a torque of 34 - 41 Nm.
9. Moderately tighten the dust seal nut (8).
10. Using a grease gun, grease sleeve (11) and refit the guards (2) (2A) (Fig. 4).

# GPA40 Carraro bearings and transmission shafts

## Long straight shaft and bearing (Fig. 4)

### Disassembly

11. Remove the guards (2) (2A) and the universal joint shaft assembly. Carry out operations 1 to 5.
12. Remove the screw and its nut. Slide the sleeve (3) and dust seal towards the front of the long straight shaft.
13. Remove the central bearings (5)(6), bearings (7)(7A) and long straight shaft (1) (Fig. 6 and Fig. 7).
14. Split the bearings (5)(6) from their roller bearings (7)(7A).
15. Unscrew the castellated nut (12) (Fig. 4) using a suitable wrench.
16. Remove the bearings (7)(7A) from the long straight shaft (1).

### Reassembly

17. Check the components. Replace any defective parts.
18. Install bearing (7) on the long straight shaft. Tighten the locknut with a suitable wrench.
19. Install 2nd bearing (7A) on the long straight shaft. Rescrew the allen screw onto the internal ring of the bearing.
20. Assemble the supports (5) (6) on their respective bearings (7)(7A). Tighten the screws.
21. Refit the bearing assembly, bearings and long straight shaft (1).
22. Smear the rear splines of the straight shaft (1) with molybdenum sulphide grease or equivalent.
23. Slide the sleeve (3) towards the rear of the long straight shaft. Fit screw and tighten the nut (Fig. 4).
24. Refit the universal joint shaft assembly. Carry out operations 6 to 10.

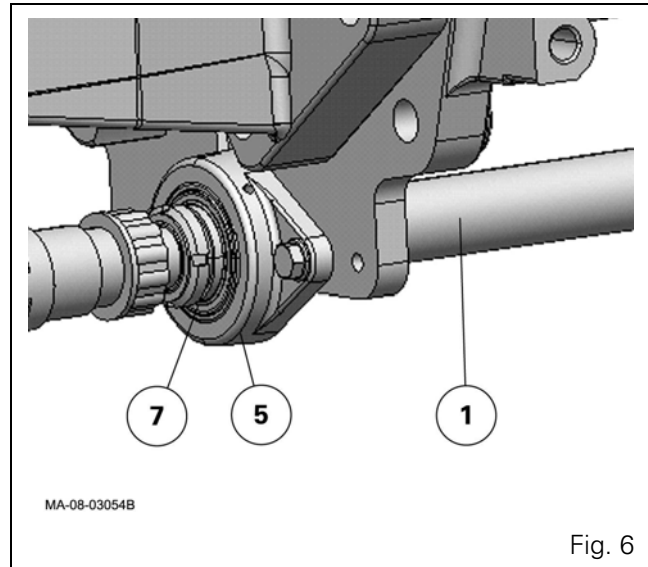


Fig. 6

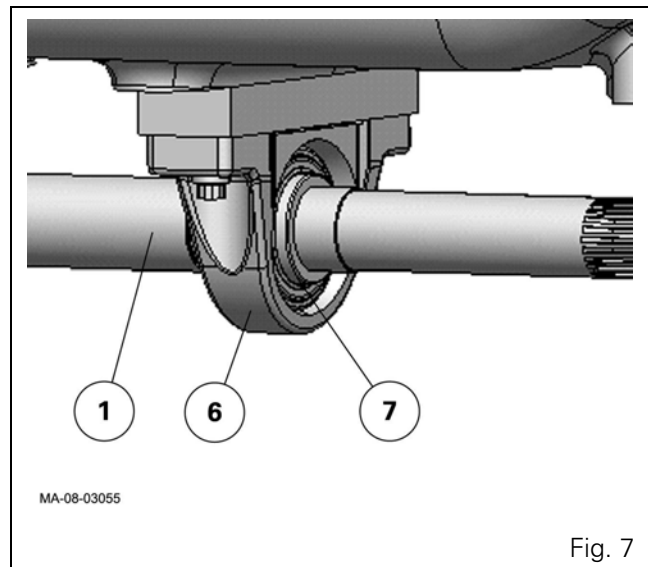


Fig. 7



## C . Removing and refitting the bearing support and front axle

Fixed or suspended front axles

Preliminary operation

25. Remove the front weights (if fitted). Immobilise the tractor. Apply the handbrake. Place safety chocks on either side of the rear wheels as shown in Fig. 9.

### Remark

- The centre weight (1) (Fig. 8) (if fitted) is attached under the front frame and may hinder the removal of bearing support.



### Danger

- The centre weight weighs between 145 and 280 kg (approximately), depending on the option. The removal operation must be carried out carefully with the help of an operator and using a suitable lifting tool.

**To remove the centre weight**, proceed as follows:

- partly remove the internal parts at the bottom of the grille,
- maintain the weight using the tool mentioned above,
- remove the screws (2) (Fig. 8),
- carefully remove the weight from the tractor.

### Reminder

- Some tractors may be fitted with a front power take off. In this case, it will be necessary to remove it before splitting the front axle from the frame.

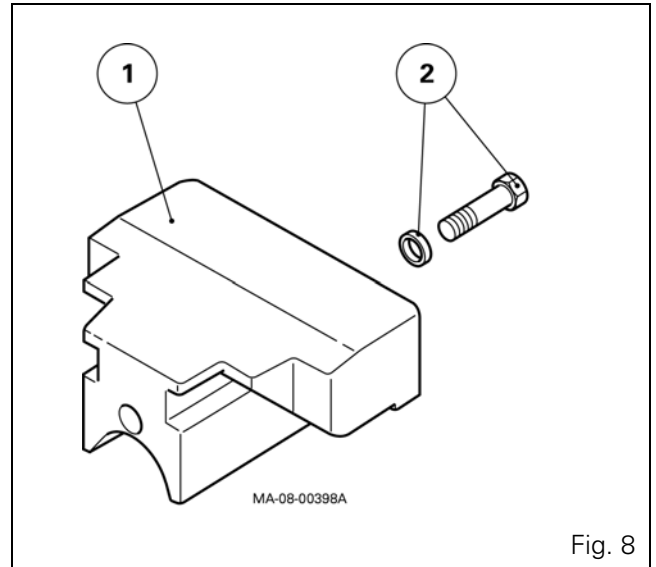


Fig. 8

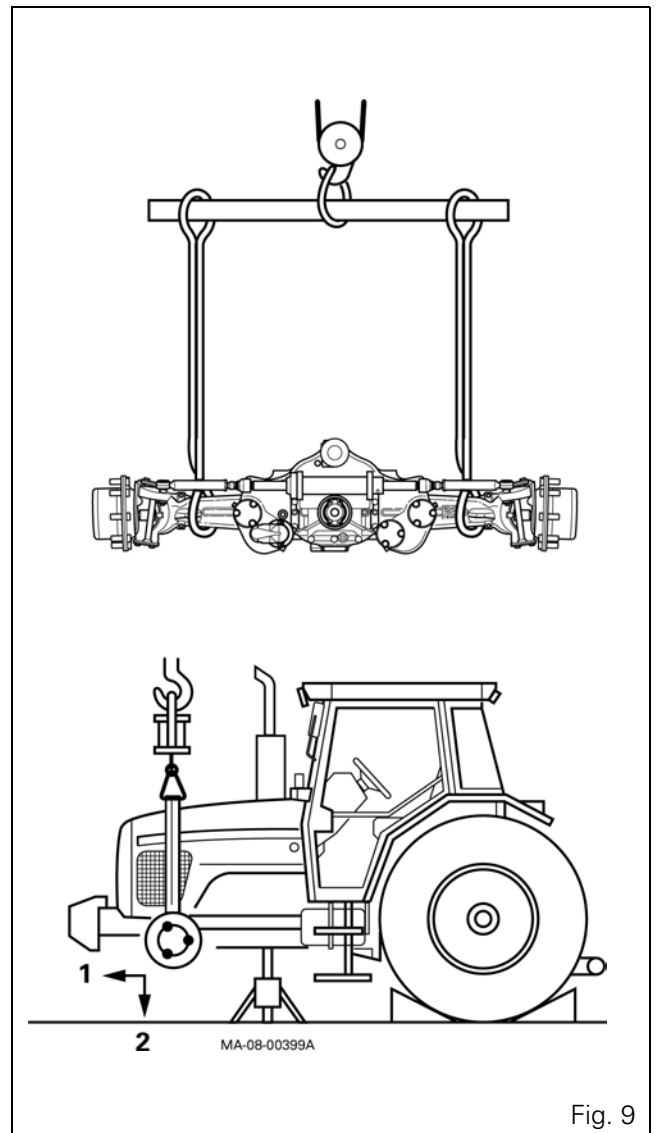


Fig. 9

# GPA40 Carraro bearings and transmission shafts

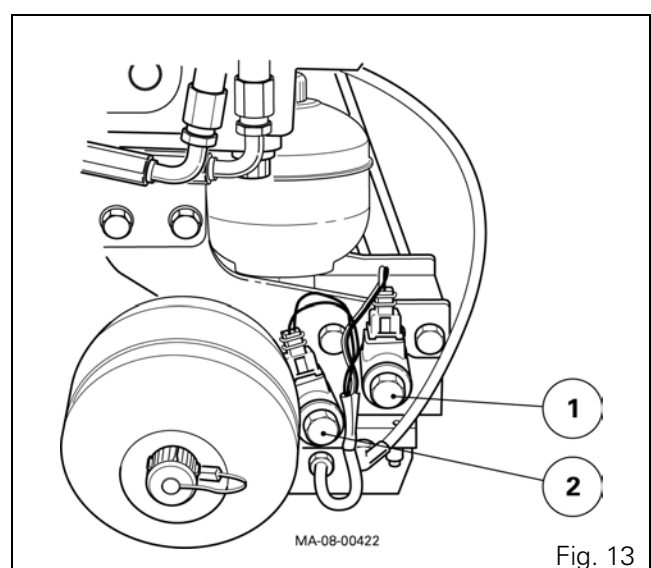
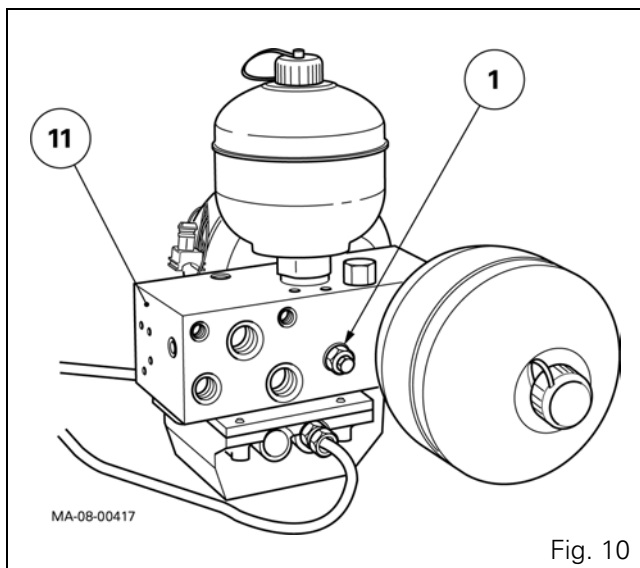
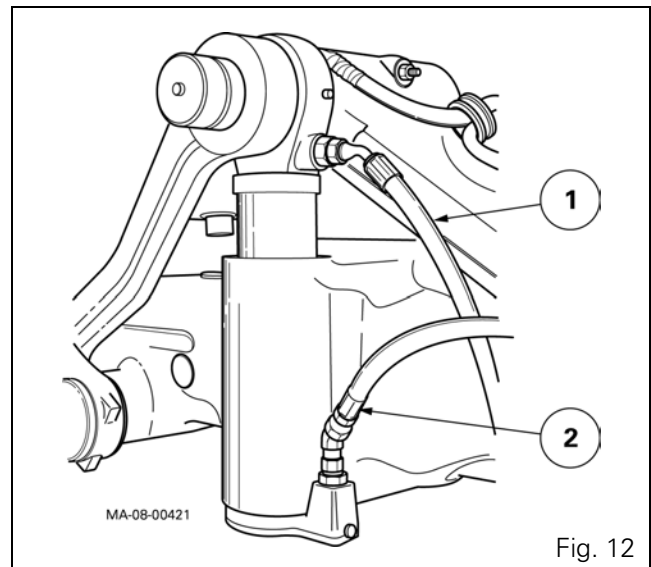
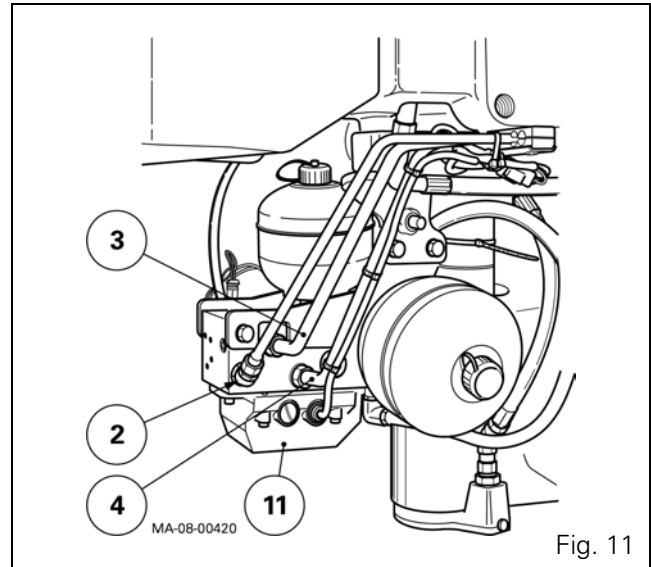
## Suspended front axle

### Removing the hydraulic unit

26. Remove the guard.

#### Important

- It is important to unscrew bleed screw (1) to drop the pressure in the hydraulic unit (11) (Fig. 10) before carrying out any operations on the hydraulic pipes.
27. Locate the Load Sensing (LS) (2), Return (3), and Pressure (4) hydraulic pipes connected to the hydraulic unit (11) (Fig. 11) and remove them.
28. Locate and remove the hose pipes (1) (2) connected to the control ram (Fig. 12).
29. Locate and separate the connectors linked to the hydraulic unit electronic device, which are mounted:
- at the front left-hand side of the tractor beneath the frame,
  - inside the grille.
30. On the hydraulic unit, locate and disconnect:
- the solenoid valve (1), green connector (Fig. 13),
  - the remaining solenoid valve (2), black connector (Fig. 13).
31. Remove the hydraulic unit with the help of another operator or a locally-made fixture fitted to the head of a trolley jack.



## Suspended and fixed front axles

### Removing the support (2) and the front axle

- 32.** Remove guards (2) (2A) (see § B).
- 33.** Raise the tractor along the axis of the front axle housing using a jack with sufficient lifting capacity.
- 34.** Remove the front wheels.



#### Danger

- Place a fixed axle stand under the lower engine housing.
- 35.** Locate the connections of the steering hoses and separate them from the cylinder.
  - 36.** Disconnect the front differential lock control hose.
  - 37.** Sling the front axle using suitable straps (Fig. 9).
  - 38.** Take out screws (1) (Fig. 2).
  - 39.** Pull the front axle assembly complete with bearing support (2) forwards along the axis of the axle beam (position 1) and remove the front axle (position 2) (Fig. 9).
  - 40.** Note the features, order and position of washers (7) and remove them (Fig. 2).

# GPA40 Carraro bearings and transmission shafts

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## Refitting

### Check point

- 41.** Clean all components and check the condition of:
- the pivot pin at each end
  - the washers (7)
  - the friction rings (6) (8)
  - the seal (9)

### Fixed or suspended front axles

- 42.** Slide the washers (7) respectively slightly smeared with bearing grease onto the front and rear ends of the pivot pin, the chamfer turned towards the front axle (Fig. 2).
- 43.** Sling the front axle (Fig. 9). Moderately grease the ends of the pivot pin and mount the support (2) at the front of the pivot pin (Fig. 3).

#### Remarks

- Before refitting the front axle assembly, check that there is no excess grease in the cavity of the second axle beam pivot on the front frame.
  - When refitting the front axle assembly, any such excess grease will be compressed, making insertion of the axle pivot into its bearing difficult.
- 44.** Refit the front axle and support (2) assembly.
- 45.** Push the assembly hard until it abuts against the second axle pivot.
- 46.** Thrust the support (2) against the front axle assembly so as to eliminate the clearance between supports and axle housing to the maximum.

# GPA40 Carraro bearings and transmission shafts

47. Fit the screws lightly smeared with Loctite 270 or equivalent and tighten to a torque of 520 - 640 Nm.

### Check point

- Check that the front face of the pivot pin (1) is almost flush with the front edge F of the bearing support (2) (Fig. 14).

48. Check for the presence of grease nipples on:

### Fixed front axles

- the right-hand side and above the front frame (second axle beam pivot),
- support (2) (first axle beam pivot).

### Suspended front axles

- the right-hand side and above the front frame (second axle beam pivot),
- the left-hand support of the hydraulic unit (first axle beam pivot).

## Fixed or suspended front axles

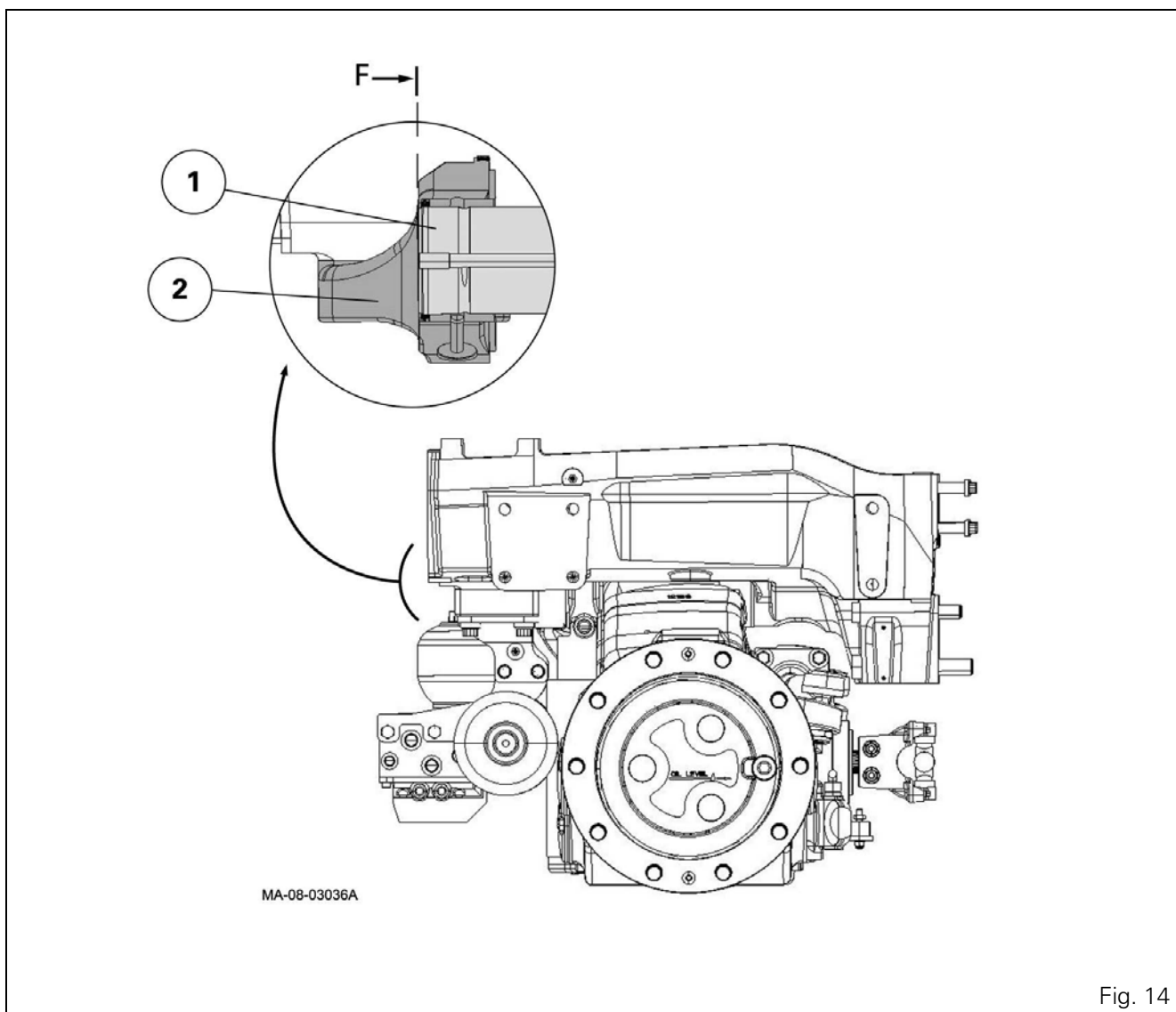
49. Reconnect the hoses (using marks made during disassembly):

- of the steering ram
- of the front differential lock

50. Refit the wheels. Remove the axle stand and take away the jack. Tighten the wheel nuts to a torque of 640 - 680 Nm.

51. Refit the centre weight. Tighten bolts (2) to a torque of 420 - 560 Nm (Fig. 8), after lightly smearing the threads with Loctite 270 or equivalent. Refit the front weights (depending on equipment fit).

52. Refit the universal joint shaft and the guards (see § B).



# GPA40 Carraro bearings and transmission shafts

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## Suspended front axles

### Refitting the hydraulic unit

53. Refit the hydraulic unit using the same method used for removal.
54. Reconnect the solenoid valves and the electronic device connectors (according to marks made).
55. Reconnect the hoses to the control cylinder (according to marks made).
56. Reconnect the Pressure (4), Return (3) and LS (2) hydraulic pipes to the hydraulic unit (according to marks made) (Fig. 11).

#### **Reminder**

- Check that bleed screw (1) (Fig. 10) is properly closed with a view to future use of the tractor.

57. Refit the guard.

### Final operations

58. Remove the safety chocks and release the hand-brake.
59. Using a grease gun, grease the friction rings (6) (8) (Fig. 2) of the axle beam pivots.

## D . Replacing the friction rings and seal

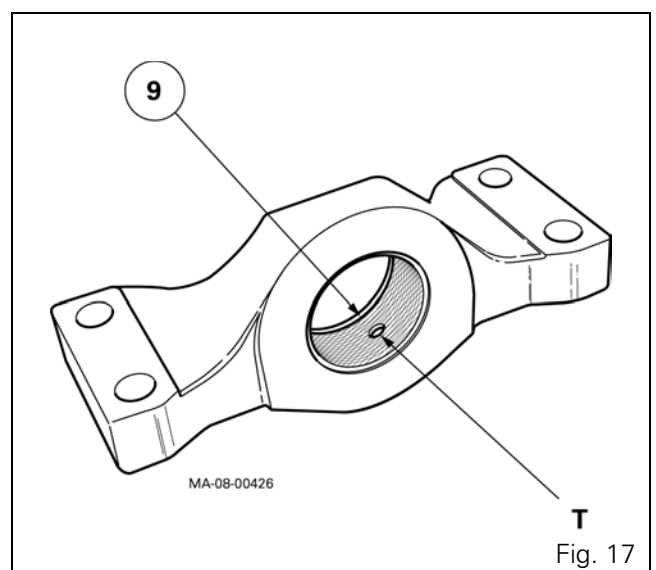
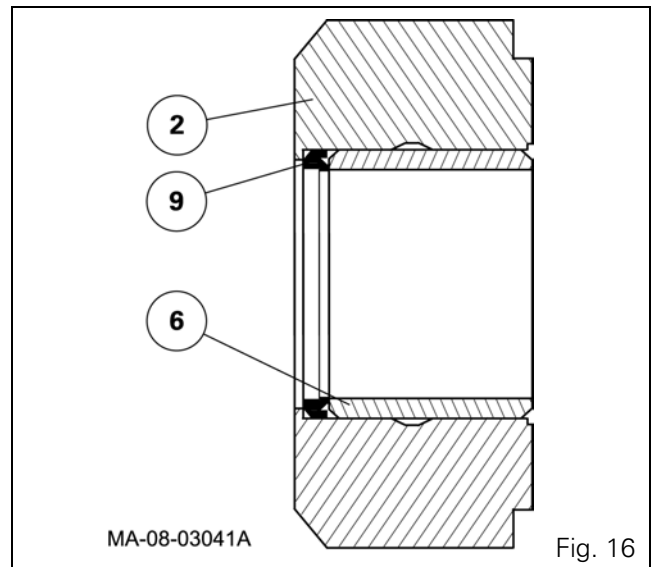
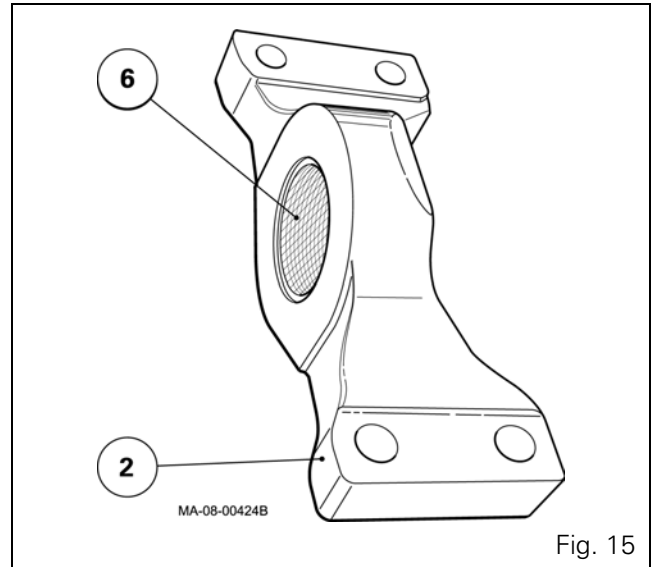
Front bearing (first axle beam pivot, Fig. 3)

### Disassembly

- 60. Remove only bearing support (2) (see § C).
- 61. Extract and discard ring (16).
- 62. Drive out and discard seal (9).

### Reassembly

- 63. Clean and check all components. Replace any defective parts. Check that the grease channels in the support are not obstructed.
- 64. Using a press and a suitable fixture, insert a correctly positioned seal (9) and ring (16) flush with face F of support (2) (Fig. 15 - Fig. 16), the grease hole T linked to the channel (Fig. 17).



# GPA40 Carraro bearings and transmission shafts

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Rear bearing (second axle beam pivot,  
[Fig. 3](#))

## Remark

- To work on ring (8) of the second axle beam pivot, it is first necessary to take off the first axle beam pivot and the front axle (see § C).

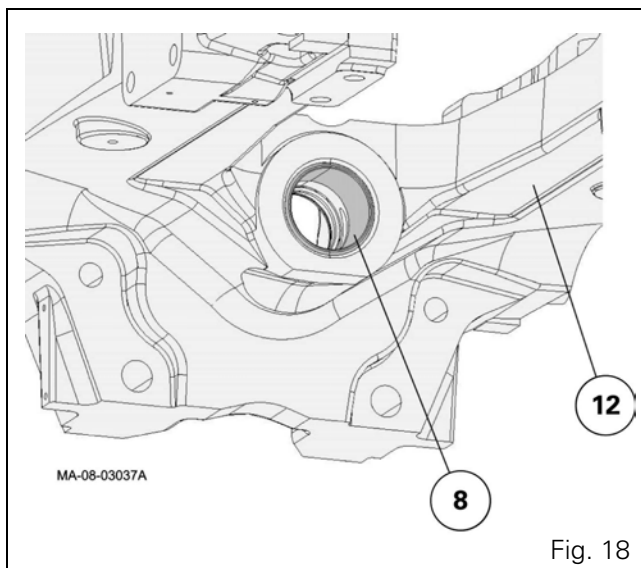
## Disassembly

65. Drive out ring (8) using a locally-made tool.

**Note: The circlips (11) and plug (10) are not considered as wear parts; therefore their replacement is unlikely.**

## Reassembly

66. Using a locally-made drift, insert ring (8) into the frame (12) flush with chamfer ([Fig. 18](#)).





*8A15- GPA20 4WD clutch assembly*

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## **GPA20 4WD clutch assembly**

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## A . General

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The front axle clutch assembly is fitted in the lower part of the rear axle housing. An inspection cover located under the housing provides access to the mechanism, which is comprised of:

- a shaft (25) turning on two taper roller bearings fitted in the groove of the axle housing
- a hydraulic clutch assembly integral with the rotating shaft
- a bell gear (15) centred on the shaft by a ring (43), driving the clutch discs (36).

The helical bell gear (15) is constantly meshed to the pinion (7) on the drive pinion.

The shaft is shimmed to obtain an operating clearance between 0 and 0.1 mm using shims (20) positioned between the cap (22) and the cup (18).

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## B . Operation

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### Declutching

The 4WD solenoid valve sends the 17 bar pressure into the shaft (25) via a channel drilled in the shaft housing, and the ring (11).

The cover (30) moves on the hub (40) and pulls the bell (42) which compresses the Belleville washers (34) and (35), releasing the discs (36). The bell gear (15) integral with the ring (43) turns idle on the shaft.

### Clutch

The pressure drop releases the Belleville washers, which push the bell (42) so that it meshes with the bell gear (15), which in turn drives the shaft (25). The oil then returns to the housing via the solenoid valve.

## Parts list

- (1) Sleeve
- (2) Double pin
- (3) Shaft
- (4) Double pin
- (5) Sleeve
- (6) Circlip
- (7) Pinion
- (8) Plug
- (9) Needle bearing
- (10) Screw
- (11) Ring
- (12) Sealing rings
- (13) Cup
- (14) Cone
- (15) Bell gear
- (16) Clutch assembly
- (17) Cover
- (18) Cup
- (19) Cone
- (20) Shim(s)
- (21) O'ring
- (22) Cap
- (23) Circlip
- (24) Seal
- (25) 4WD drive shaft
- (26) Seal
- (27) Stop screw
- (28) Flange
- (29) O'ring
- (30) Cover
- (31) Circlip
- (32) O'ring
- (33) O'ring
- (34) Belleville washer
- (35) Belleville washer
- (36) Disc
  - A: 4-disc clutch
  - B: 5-disc clutch
- (37) Clutch plate
  - A: 4-disc clutch
  - B: 5-disc clutch
- (38) Cover
- (39) Circlip
- (40) Hub
- (41) Shim(s)
- (42) Bell housing
- (43) Ring

# GPA20 4WD clutch assembly

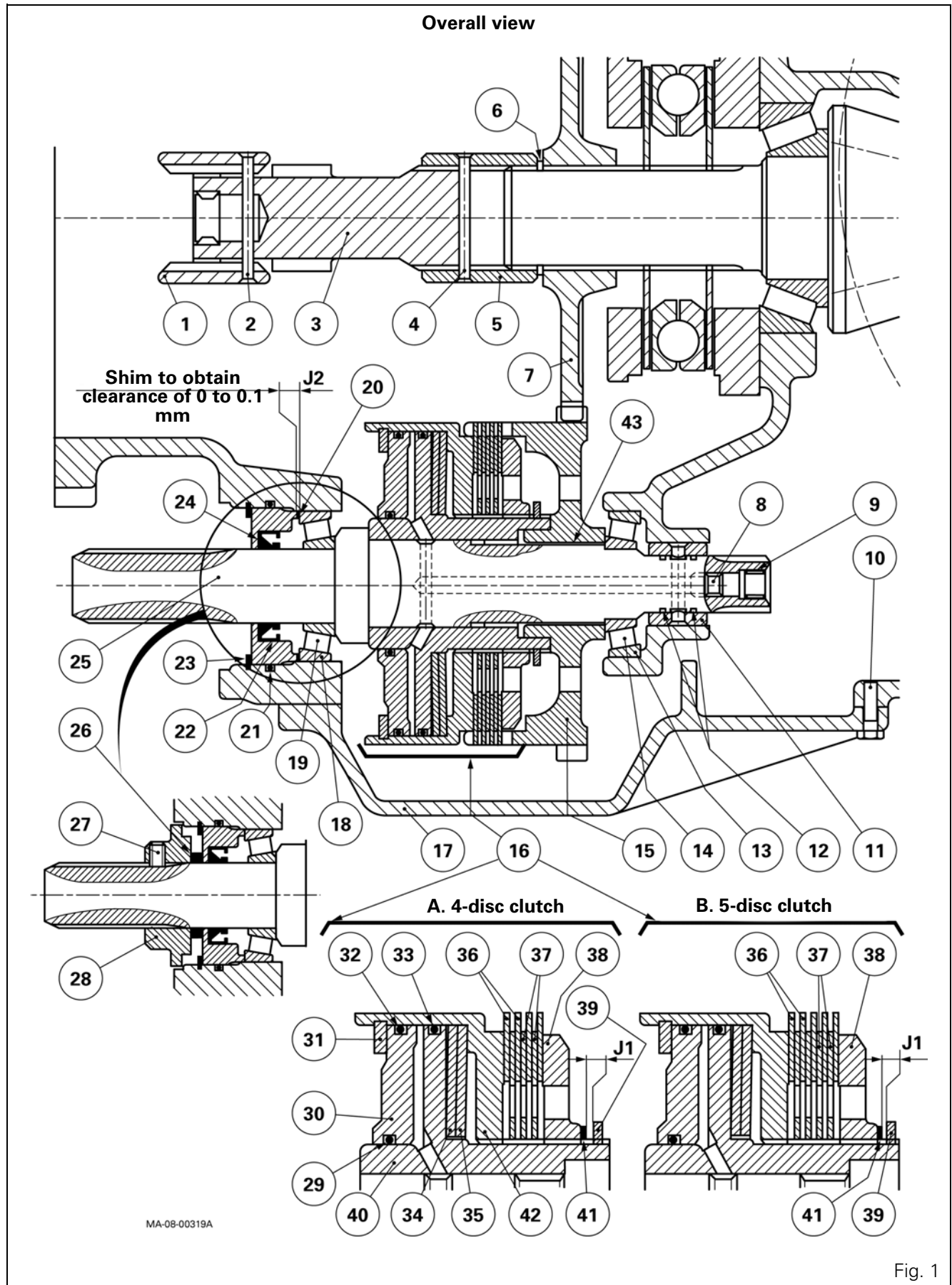


Fig. 1

# GPA20 4WD clutch assembly

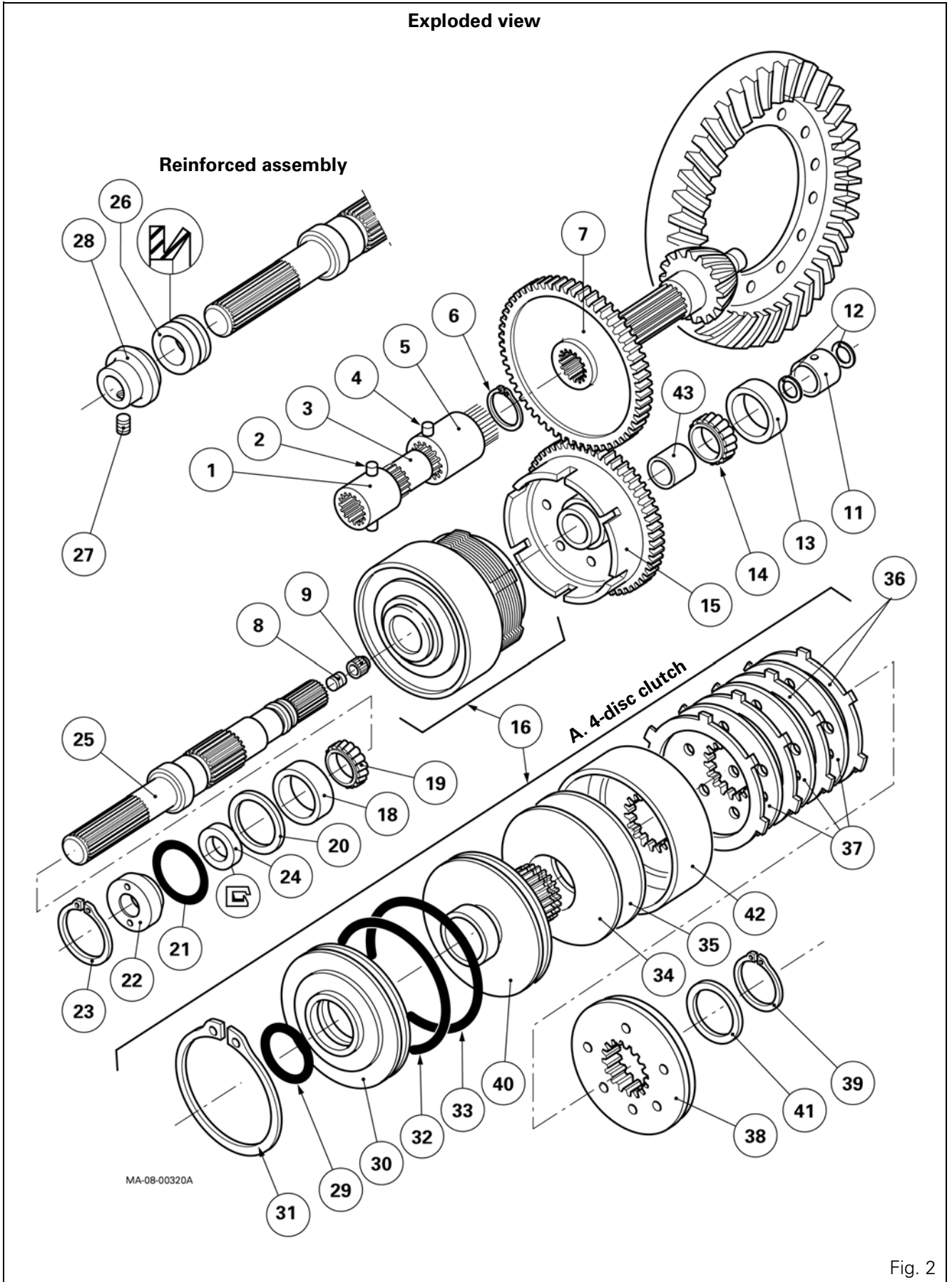


Fig. 2

# GPA20 4WD clutch assembly

## C . Removing the clutch assembly

1. Chock the wheels of the tractor. Drain the rear axle housing.
2. Disconnect the two front differential lock control hoses (plug the pipe channels). Remove the guard and the transmission shaft. Remove the engine clutch or power shuttle (depending on the version) lubricating pipe that is fitted to the lower centre housing covers and the gearbox.
3. Remove the screws (10) and remove the cover (17).

**Note: On tractors fitted with GSPTO, recover the spring (3), locking stud (2) and retainer pipe (1) (Fig. 3).**

**On tractors fitted with a protector with reinforced sealing, remove the screw (27), flange (28) and seal (26).**

4. Take off circlip (23).
5. Protect the splined part of the shaft (25). Extract the cap (22) with its seal (24) with locally made tool (Fig. 4) (see § G). Remove seal (24).
6. Remove the O'ring (21).
7. Remove the shims (20) and the cup (18).

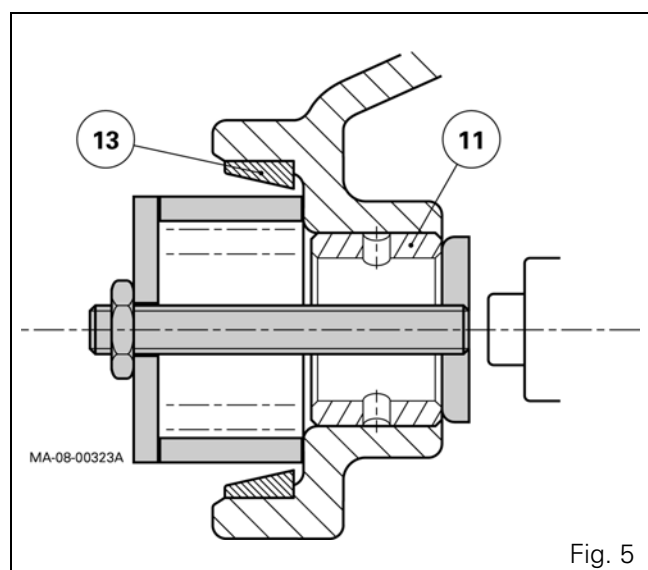
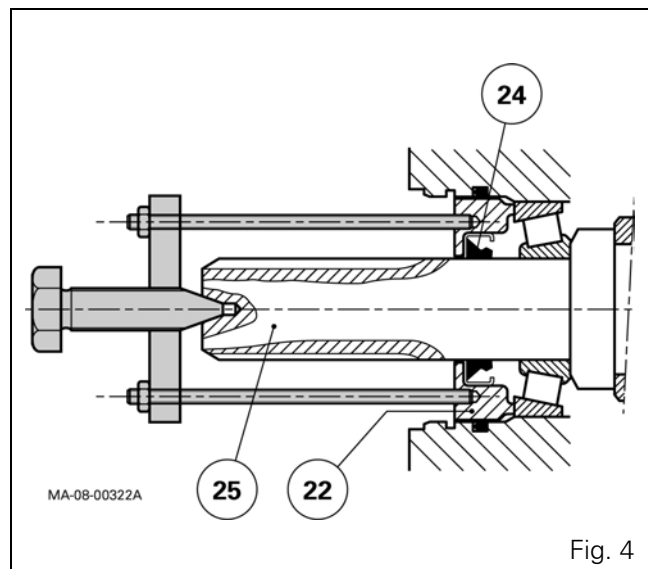
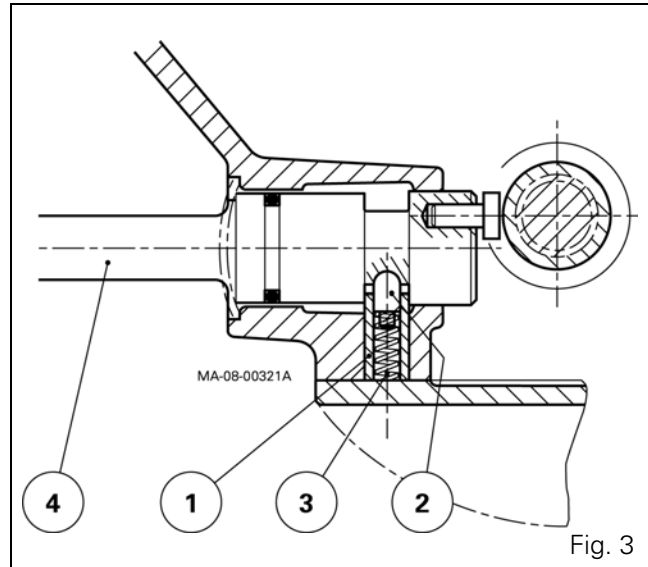
**Note: On tractors fitted with GSPTO, place the control in declutched position.**

8. Extract the shaft assembly (25) and bearing cone (19), holding the clutch assembly (16) and bell gear (15).
9. Remove the clutch assembly (16) with the bell gear (15) and cone (14).
10. Using a locally made tool (see § G), extract the ring (11) (Fig. 5). This tool is mandatory for tractors with GSPTO. If necessary, also remove the cup (13) with a suitable extractor.

**Note: When pinion (7) has removed, it is necessary to remove the right-hand hydraulic cover (see section 9, depending on hydraulic equipment).**

### Tractors with no creeper unit

11. Drive out the double pins (2) (4) from the coupling sleeves (1) (5).
12. Slide the sleeves towards each other on the shaft (3) and remove the shaft - sleeve assembly.
13. Take off circlip (6) and remove the pinion (7).



## Tractors with a creeper unit

14. See section 5H01.
15. Take off circlip (6) and remove the pinion (7).

## D . Disassembling the clutch

16. Split bell gear (15) from the clutch assembly (16).
17. Take off circlip (31).
18. Take off cover (30).
19. Remove the O'rings (29) (32).
20. Using a suitable fixture and a press, compress the Belleville washers (34) (35) (Fig. 6).
21. Take off circlip (39) and the shim(s) (41) (Fig. 6).
22. Remove the suitable fixture.
23. Remove cover (38), discs (36) and intermediate plates (37).
24. Separate the hub (40) from the bell (42).
25. Remove the O'ring (33).
26. Remove the Belleville washers (34) (35).

## Disassembling the shaft

27. Remove the two seals (12).
28. Extract the cone (19) using a press and a suitable fixture.
29. Extract needle bearing (9). Remove plug (8).

## Reassembling the shaft

**Note: Check that the channel in the shaft is not obstructed.**

30. Tighten the plug (8) smeared with Loctite 542 to a torque of 10 Nm.
31. Fit the needle bearing (9) 2.5 mm short of the face F (Fig. 7).
32. Fit the bearing cone (19) against the shoulder on shaft (25).

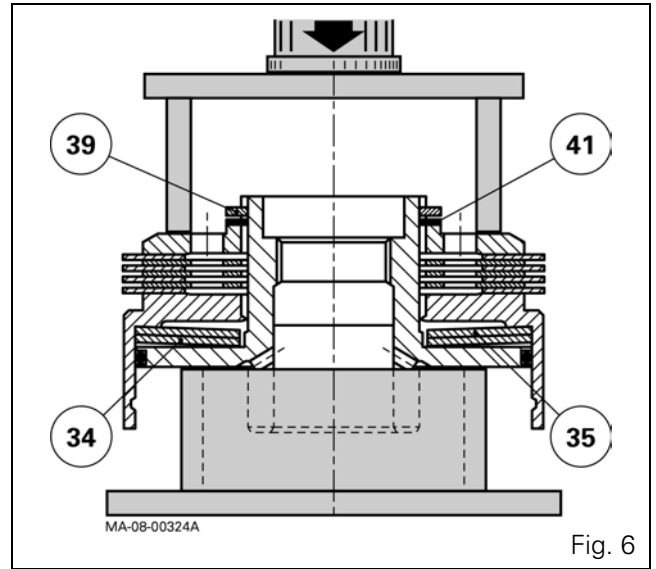


Fig. 6

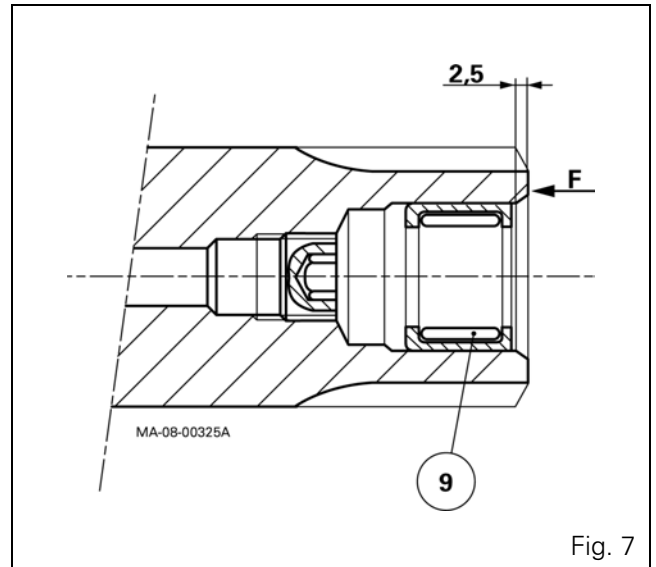


Fig. 7

# GPA20 4WD clutch assembly

## E . Reassembling the clutch

**33.** Check and clean all components. Replace any defective parts. Check that the 17 bar channel in the hub (40) is not obstructed.

**34.** Position the Belleville washers (35) (34) in the bell (42) (Fig. 8).

**Note: Two types of Belleville washers with different markings and different loading efforts can be fitted:**

- **3619147M1 marked 147**

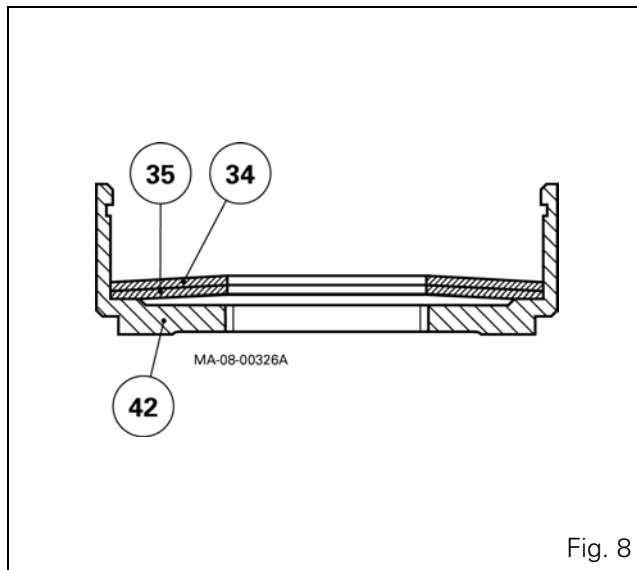
- **3619473M1 marked 473.**

The clutch assembly is normal or reinforced depending on the tractor types (see table below).

**35.** Lubricate and fit the O’ring (33) on the hub (40).

**36.** Position the hub (40) in the bell (42) thrust against the Belleville washers.

**37.** Fit the discs (36), aligning the catches and intermediate plates (37), and fit the cover (38).



Tractors	4WD		4WD with GSPTO	
	N° of discs	Washer type	N° of discs	Washer type
6465	5	147	5	147
6475	5	147	5	147
6480	5	473	5	473

- Discs (36): thickness  $2 \pm 0.05$  mm

- Shims (41): 0.6 - 0.8 - 1.4 - 1.7 mm.



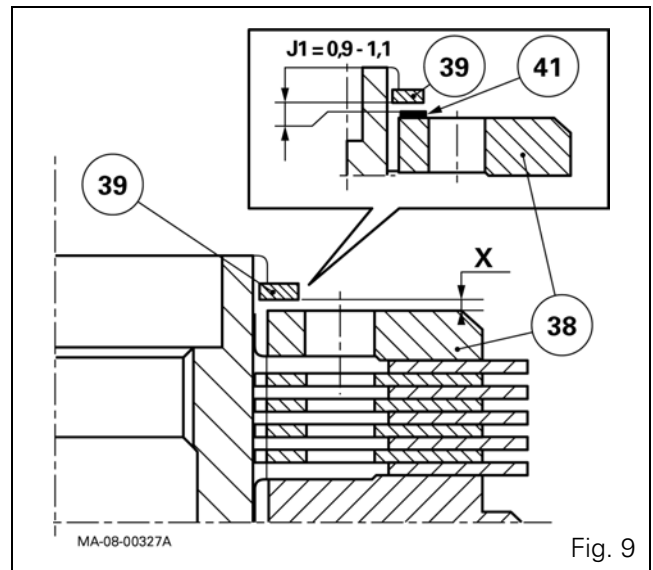
## 38. Adjusting J1 clearance (Fig. 9)

Using a press and suitable fixture (Fig. 6) apply a load of 2000 daN to fully compress the Belleville washers (35) (34).

Fit the circlip (39). Use a set of shims to increase the distance X between the cover (38) and circlip (39). Select the shim(s) (41) to obtain clearance  $J1 = 0.9$  to  $1.1$  mm.

39. Remove circlip (39).
40. Position the shim(s) chosen at operation 38 between the cover and circlip (splined shim on the circlip side).
41. Refit the circlip.
42. Lubricate and fit the O'rings (32) (29) on the cover (30) and refit the latter.
43. Fit the circlip (31).
44. Fit the clutch assembly (16) on the bell gear (15).

**Note: The ring (43) is force fitted in the bell gear (15) and then rebored.**



## F. Refitting the clutch assembly

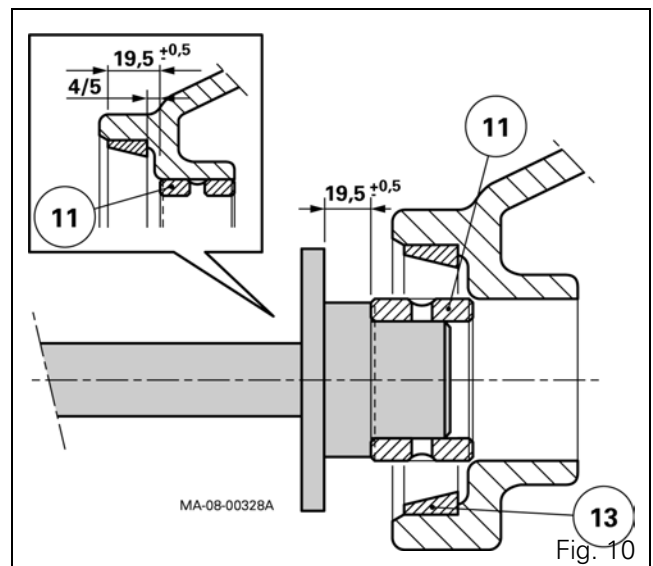
If the pinion (7) has been removed

Tractor with no creeper unit

45. Refit the pinion (7).
46. Position the circlip (6).
47. Refit the link shaft and coupling sleeves. Carry out operations 11 and 12 in reverse order. Replace the double pins.

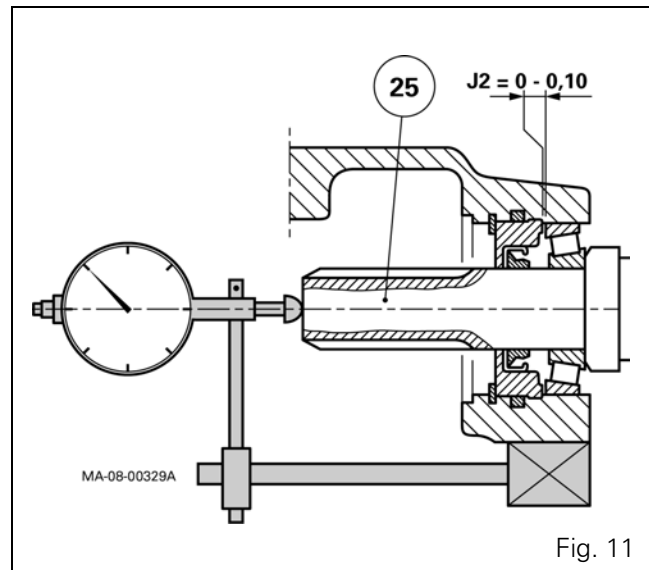
Tractors with a creeper unit

48. Refit the pinion (7).
49. Position the circlip (6).
50. See section 5H01.
51. Refit the right-hand hydraulic cover (see section 9I01 or 9U01).
52. Fit the cup (13) (if removed).
53. Fit the ring (11) with a locally made drift (see § G), so that the ring is positioned 4 to 5 mm short of the cup mating face (13) (Fig. 10). Move the ring until one of its holes opens into the clutch supply channel in the housing.
54. Fit the seal (24) in the cap (22).



## GPA20 4WD clutch assembly

55. In order to correctly "seat" the cones in their bearing cups, to obtain clearance:  
 $J2 = 0$  to  $0.10$  mm, fit the cone (14), the shaft (25), and the cup (18).
56. Protect the splines of the shaft.
57. Fit the bearing (22) and circlip (23).
58. Put a dial gauge feeler pin against the end of shaft (25) (Fig. 11).
59. Pull the shaft, turning it alternately from right to left to correctly seat the cones in the cups.
60. Reset the dial gauge to zero.
61. Repeat operation 59, but this time by pushing.
62. Depending on the clearance measured, select the thickness of shim(s) (20) required to obtain  $J2$ .
63. Remove the circlip (23), cap (22), cup (18) and the shaft (25).
64. Fit the seal rings (12) in the shaft grooves (25) and hook their ends. Ensure that they turn freely.
65. Fit the cone (14) into the bearing cup (13). Install the shaft (25) after positioning the clutch assembly (16) and bell gear (15) in the housing.
66. Fit the cup (18) and shim(s) (20) (smear with grease) selected at operation 62.
67. Fit the O'ring (21) in the housing groove.
68. Fit the cap (22) and circlip (23), remove the spline protection on the shaft.
69. On tractors with reinforced sealing, grease and position the seal (26), with the lip turned towards the cap (22). Remove the protection.
70. Fit the flange (28), ensuring that operational clearance remains between the flange and housing.
71. Tighten the screw (27) after coating it with Loctite 241.
72. Clean and degrease the mating face of the cover (17) and housing.
73. Smear the mating face of the cover with a sealing product (Loctite 510 or equivalent).
74. Screw two opposing guide studs into the housing.
75. On tractors fitted with GSPTO, check the position of the lever (4). Fit the retainer pipe (1), locking stud (2) and spring (3) (Fig. 3).
76. Refit the cover (17).
77. Remove the guide studs, and fit and tighten screws (10) to a torque of 130 - 170 Nm.



78. Smear the two sleeves of the 4WD transmission shaft with "Anti Seize" grease or equivalent.  
Refit the transmission shaft and guard, and reconnect the two front differential lock hoses.  
Refit the lubricating pipe of the power shuttle or engine clutch.
79. Top up the rear axle oil level and remove shims.
80. Check clutch operation and GSPTO control adjustment (if fitted).
81. Check for tightness of:
  - the mating faces of the cover under the rear axle housing
  - the right-hand hydraulic cover (if removed)
  - the hydraulic unions.

**G . Locally made tools**

1. Cap extractor (Fig. 12)

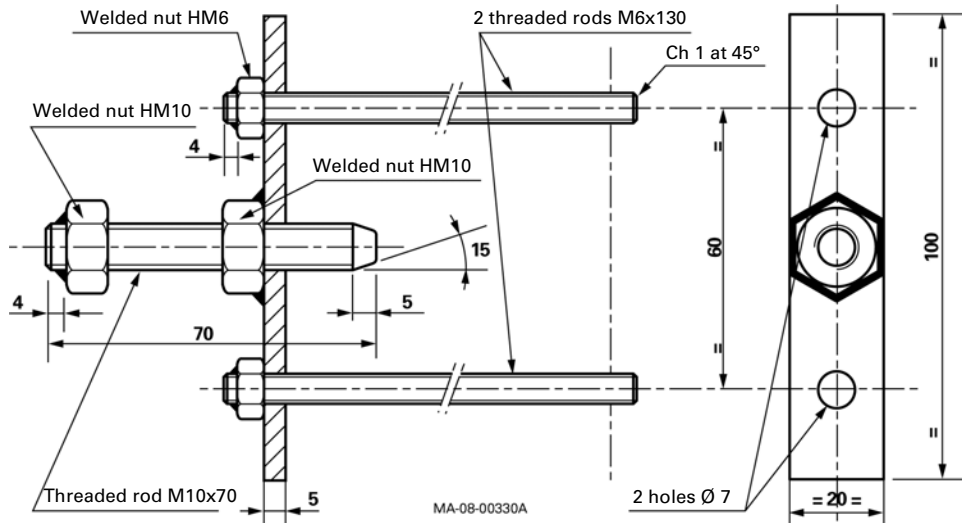


Fig. 12

2. Ring extractor (Fig. 13)

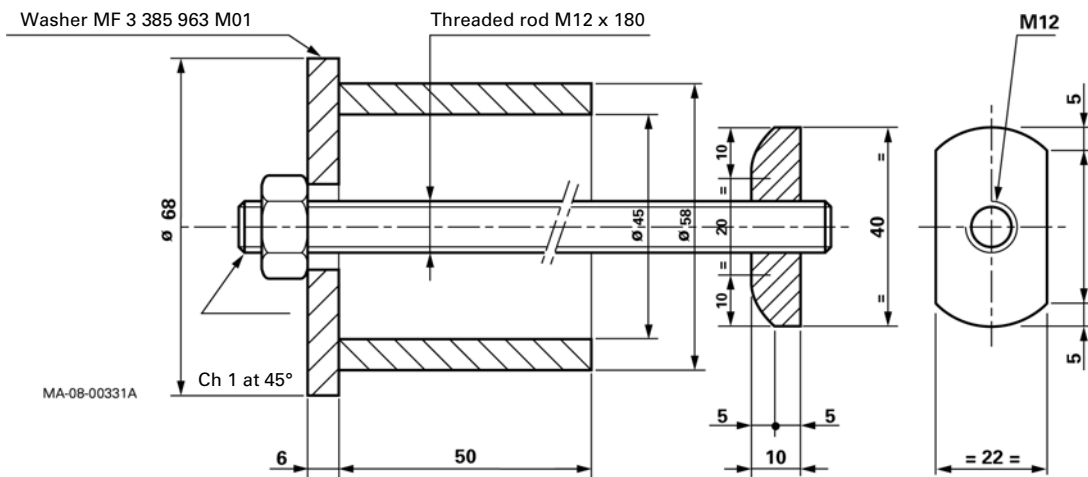


Fig. 13

3. Ring fitting drift (Fig. 14)

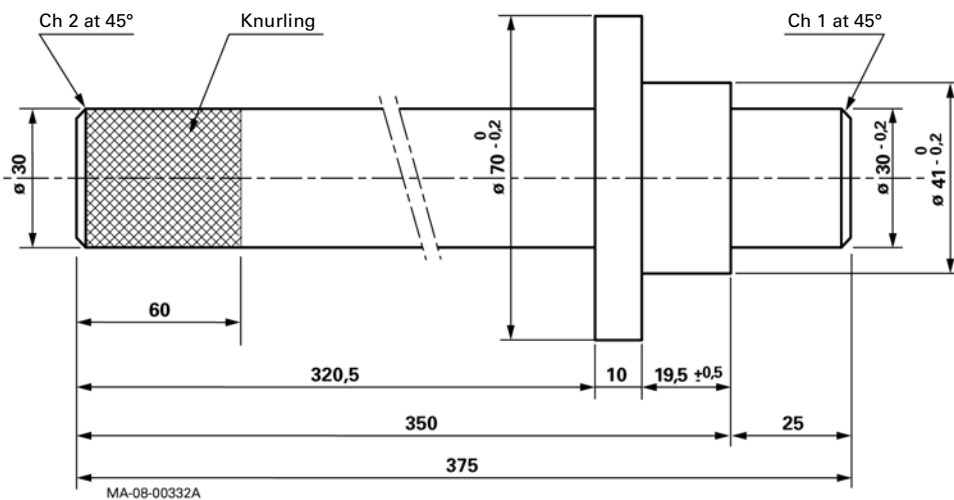


Fig. 14

## **GPA20 4WD clutch assembly**

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*8A16 - 4WD GPA40 clutch*

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## 4WD GPA40 clutch

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### A . General

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The front axle clutch assembly is fitted in the lower section of the GPA40 rear axle. A cover plate mounted underneath the centre housing provides access to the 4WD clutch.

**NOTE:** For tractors fitted with GTA1540 transmission, it is necessary to disconnect the tractor between the gearbox and the rear axle in order to remove the 4WD clutch. Disconnecting the tractor provides access to the circlip (8) and the shaft (34).

The 4WD clutch mechanism comprises (Fig. 2):

- a shaft (34) rotating on two tapered roller bearings (12) (13) and (16) (17) fitted in the centre housing bore;
- a hydraulic clutch assembly (7) attached to the rotating shaft (34);
- a bell gear (6), which drives the clutch discs (28). This gear is centred on the shaft (34) by a friction ring (15).

## 4WD GPA40 clutch

### Construction (Fig. 2)

The helical bell gear (6) is constantly meshed to the driving gear (5) splined to the pinion (2).

The clutch assembly (7) is shimmed in clutch disengaged position (compressed Belleville washers) to obtain a space J1 of 0.9 to 1.1 mm between the circlip (32) and the shim(s) (31) (Fig. 9).

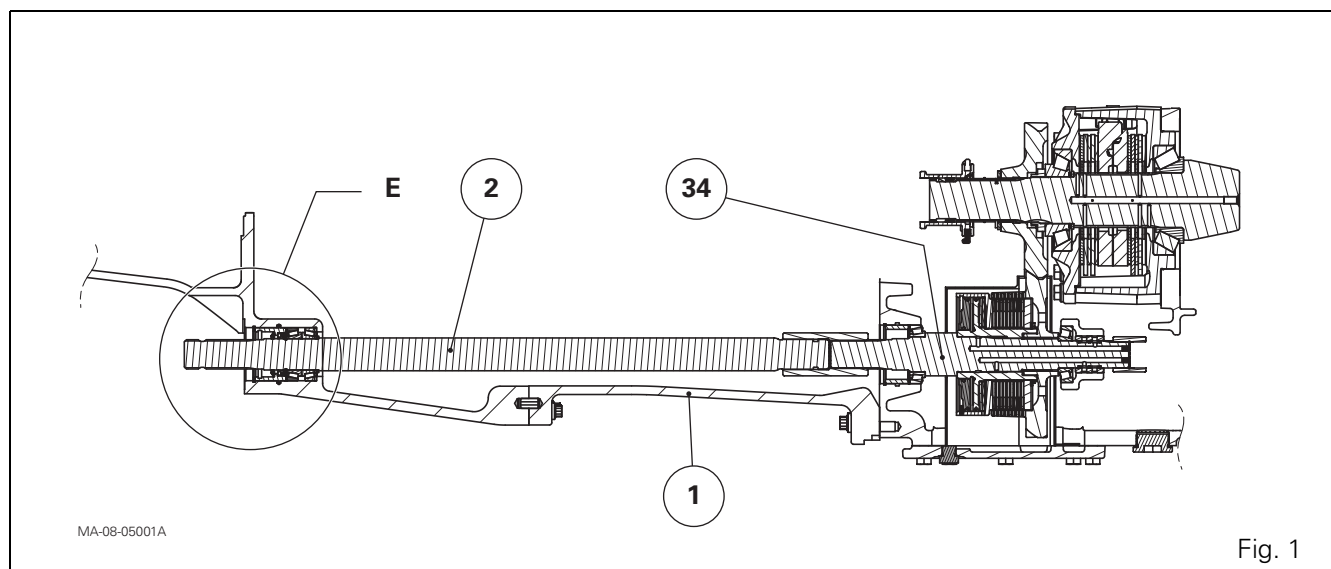
The clutch assembly is in 2WD mode when it is hydraulically engaged (17 or 21 bar pressure) via its solenoid valve: the discs (28) and the intermediate plates (29) are then released by value J1 (0.9 to 1.1 mm).

The clutch assembly is in 4WD mode when the hydraulic pressure (17 or 21 bar) is cut and when the Belleville washers are released to the limit of J1 (0.9 to 1.1 mm), locking the rotation of the discs (28) and the intermediate plates (29) on the shaft (34).

The shaft (34) is shimmed to obtain a clearance of 0 to 0.10 mm using the shim(s) (14) placed between the seal holder (10) (GTA1040) or the spacer (10) (GTA1540) and the cup (12).

The shaft (34) is sealed by a lip seal (11) and a dust seal (35). The housing is sealed by an "O" ring (9).

**NOTE:** On tractors fitted with GTA1540 transmission, the front end of the shaft (34) opens into the GBA15 gearbox housing (1) (Fig. 1). As a result, the shaft is not sealed between the centre housing and the gearbox. Sealing E of the 4WD line is provided on the front end of the connecting shaft (2) (Fig. 1).





### Operation

#### **Clutch disengaged position**

The 4WD solenoid valve fitted on the right-hand hydraulic cover plate is controlled by the tractor's electronic system. It supplies 17 bar (GTA1040) or 21 bar (GTA1540) pressure to the interior of the shaft (34) via channels A or A1 (Fig. 2). The piston (22) moves on the hub (20) and pulls the bell (26). The bell compresses the Belleville washers (27) and releases the discs (28). The bell gear (6) then turns idle on the shaft (34).

#### **Clutch engaged position**

When the pressure is cut, the Belleville washers (27) decompress and push back the bell (26) to compress the discs (28) and the intermediate plates (29). The bell gear (6) then becomes attached to the bell (26), allowing the shaft (34) to rotate.

### Lubrication

Oil from the lubrication system arrives via axial channel B (Fig. 2) and lubricates the discs and intermediate plates.

# 4WD GPA40 clutch

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## Parts list (Fig. 2)

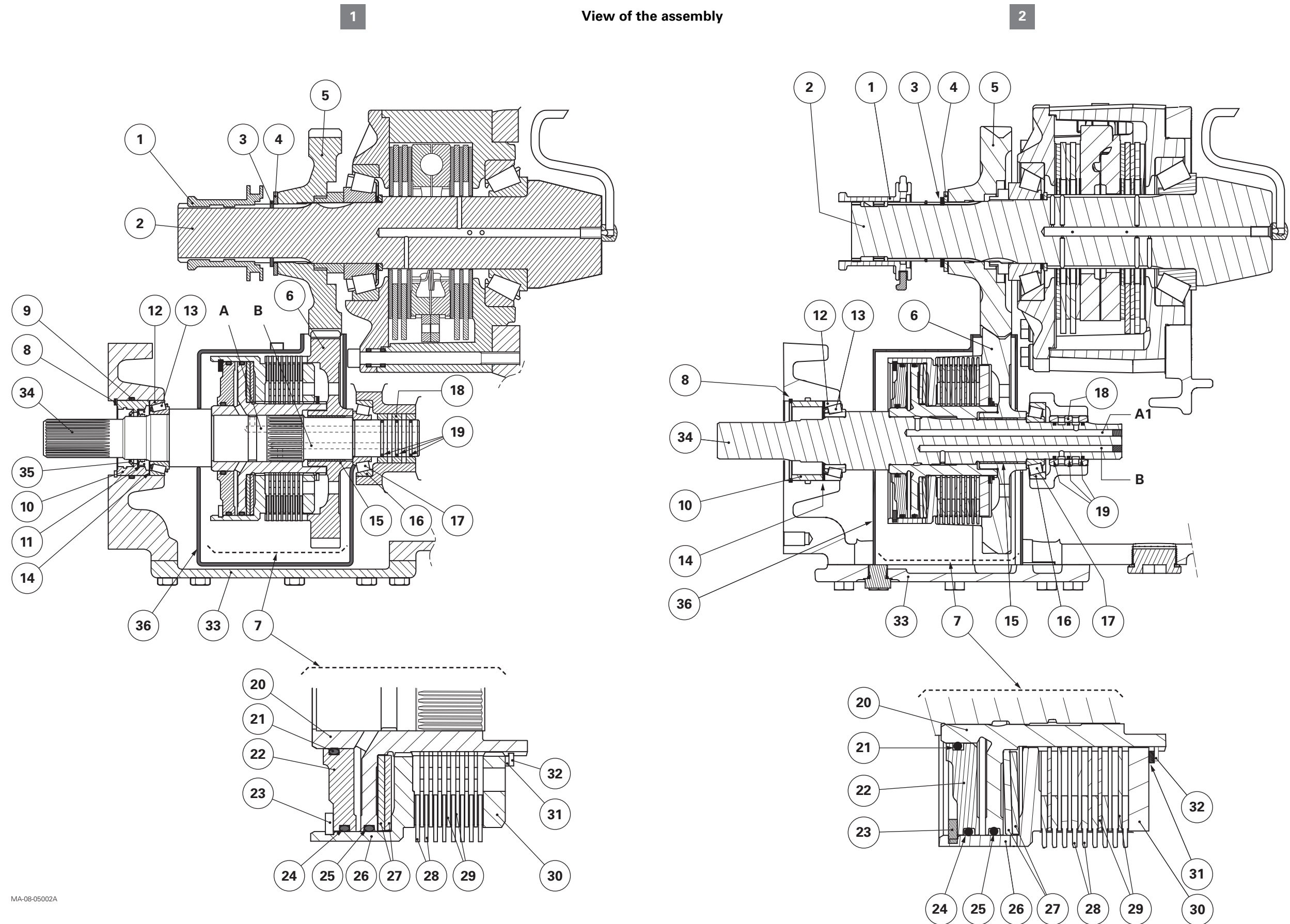
- (1) Sleeve (creeper unit option)
- (2) Pinion
- (3) Circlip
- (4) Washers
- (5) Driving gear
- (6) Bell gear
- (7) Clutch assembly
- (8) Circlip
- (9) "O" ring (GTA1040)
- (10) Seal holder (GTA1040)
- (10) Spacer (GTA1540)
- (11) Lip seal (GTA1040)
- (12) Bearing cup
- (13) Bearing cone
- (14) Shim(s)
- (15) Friction ring
- (16) Bearing cup
- (17) Bearing cone
- (18) Hydraulic ring
- (19) Seal rings
- (20) Hub
- (21) "O" ring
- (22) Piston
- (23) Circlip
- (24) "O" ring
- (25) "O" ring
- (26) Bell
- (27) Belleville washers
- (28) Discs
- (29) Intermediate plates
- (30) Cover plate
- (31) Shim(s)
- (32) Circlip
- (33) Cover plate
- (34) Shaft
- (35) Dust seal (GTA1040)
- (36) Anti-emulsion housing

## Legend

- A Clutch channel (17 bar low pressure GTA1040)
- A1 Clutch channel (21 bar low pressure GTA1540)
- B Disc and intermediate plate lubricating channels

**1** Tractors fitted with GTA1040 transmission

**2** Tractors fitted with GTA1540 transmission



MA-08-05002A

Fig. 2

## 4WD GPA40 clutch

### Parts list (Fig. 3)

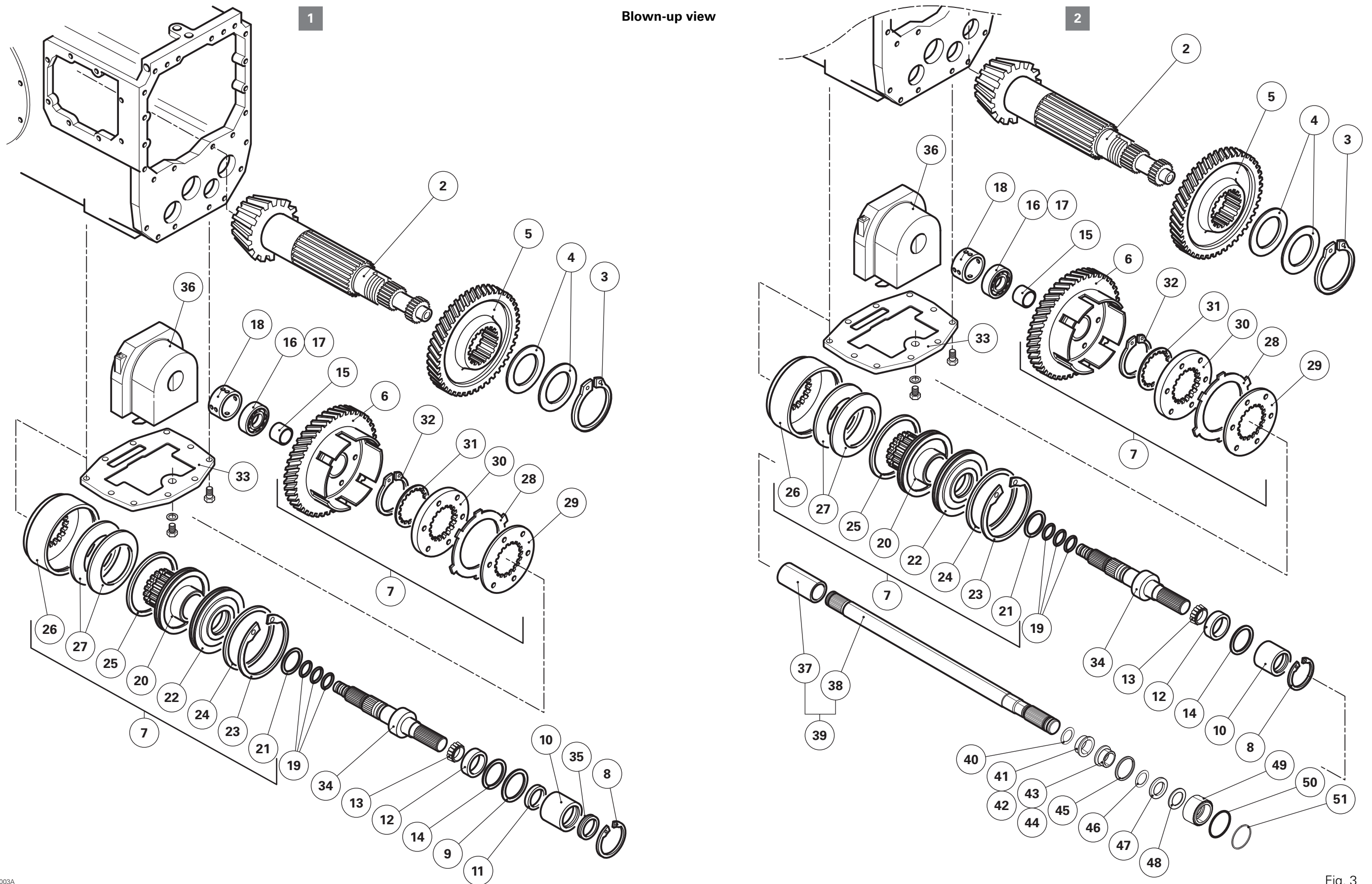
**NOTE:** References (37) to (51) relate to tractors fitted with GTA1540 transmission only.

- (2) Pinion
- (3) Circlip
- (4) Washers
- (5) Driving gear
- (6) Bell gear
- (7) Clutch assembly
- (8) Circlip
- (9) "O" ring (GTA1040)
- (10) Seal holder (GTA1040)
- (10) Spacer (GTA1540)
- (11) Lip seal (GTA1040)
- (12) Bearing cup
- (13) Bearing cone
- (14) Shim(s)
- (15) Friction ring
- (16) Bearing cup
- (17) Bearing cone
- (18) Hydraulic ring
- (19) Seal rings
- (20) Hub
- (21) "O" ring
- (22) Piston
- (23) Circlip
- (24) "O" ring
- (25) "O" ring
- (26) Bell
- (27) Belleville washers
- (28) Discs
- (29) Intermediate plates
- (30) Cover plate
- (31) Shim(s)
- (32) Circlip
- (33) Cover plate
- (34) Shaft
- (35) Dust seal (GTA1040)
- (36) Anti-emulsion housing
- (37) Sleeve
- (38) Shaft
- (39) Sleeve/shaft assembly
- (40) Thrust washer
- (41) Bearing cone
- (42) Bearing cup
- (43) Bearing cone
- (44) Bearing cup
- (45) Circlip
- (46) Shim(s)

- (47) Lip seal
- (48) Dust seal
- (49) Seal holder
- (50) "O" ring
- (51) Circlip

### Legend

- 1** Tractors fitted with GTA1040 transmission
- 2** Tractors fitted with GTA1540 transmission



Blown-up view

MA-08-05003A

Fig. 3

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## **B . Removing and refitting the shaft and the clutch assembly**

---

### Preliminary steps

#### **Tractors fitted with GTA1040 or GTA1540 transmission**

1. Immobilise the tractor.  
Chock the rear wheels.  
If the tractor is not fitted with a ParkLock device, engage the hand brake.
2. Disconnect the hydraulic hoses fixed to the front axle transmission shaft guard.  
Check that no connections have been forgotten, which may hinder removal of the guard.  
Remove:
  - the guard;
  - the transmission shaft.
3. Drain the transmission oil from the rear axle.
4. For tractors fitted with:
  - GTA1040 transmission, proceed to step 5;
  - GTA1540 transmission, proceed to step 6.

#### **Tractors fitted with GTA1040 transmission**

5. Remove:
  - the screws;
  - the cover plate (33).

#### **Tractors fitted with GTA1540 transmission**

6. Disconnect the tractor between the gearbox and the rear axle (see chapter 2).  
***NOTE:** It is essential to disconnect the tractor to remove the 4WD clutch, as the imposing profile of the GBA15 gearbox completely masks the lower section of the front face of the centre housing where the 4WD clutch is located.*
7. Remove:
  - the screws;
  - the cover plate (33).

## 4WD GPA40 clutch

---

### Removal

#### Tractors fitted with GTA1040 transmission

8. Only if the lip seal (11) is to be re-used, fit a flexible cellulose strip lightly smeared with grease over the splined section of the shaft (34).

9. Remove:

- the circlip (8);
- the seal holder (10) fitted with the lip seal (11).

**NOTE:** The seal holder is removed using two makeshift tools fitted with a 90° curved end. These tools are to be fitted in opposition in the seal holder groove, serving as end points for pulling the seal holder from its bore.

10. Discard the dust seal (35).

11. If necessary, extract the lip seal (11) from the seal holder.

12. Remove:

- the "O" ring (9);
- the shim(s) (14);
- the cup (12).

13. Remove the shaft (34) fitted with the bearing cone (13) and the clutch assembly (7), while supporting the clutch assembly and the bell gear (6).

**NOTE:** If the tractor is fitted with a GSPTO (optional), the sleeve (1) provides the link between the GSPTO and the 4WD shaft (34) (Fig. 4).

14. Remove:

- the clutch assembly (7) fitted with the bell gear (6);
- the bearing cone (17).

15. If necessary, extract the cup (16) and the hydraulic ring (18) from the centre housing using a makeshift tool.

16. If necessary, carry out the following operations on the shaft (34):

- remove and discard the seal rings (19);
- extract the bearing cone (13) using a press and a suitable fixture.

17. If work is necessary on the 4WD driving gear (5) (Fig. 2), refer to the section on the GPA40 pinion in chapter 6.

#### Tractors fitted with GTA1540 transmission

18. Remove:

- the circlip (8);
- the spacer (10);
- the shim(s) (14);
- the cup (12).

19. Remove the shaft (34) fitted with the bearing cone (13) and the clutch assembly (7), while supporting the clutch assembly and the bell gear (6).

**NOTE:** If the tractor is fitted with a GSPTO (optional), the sleeve (1) provides the link between

the GSPTO and the 4WD shaft (34) (Fig. 4).

20. Remove:

- the clutch assembly (7) fitted with the bell gear (6);
- the bearing cone (17).

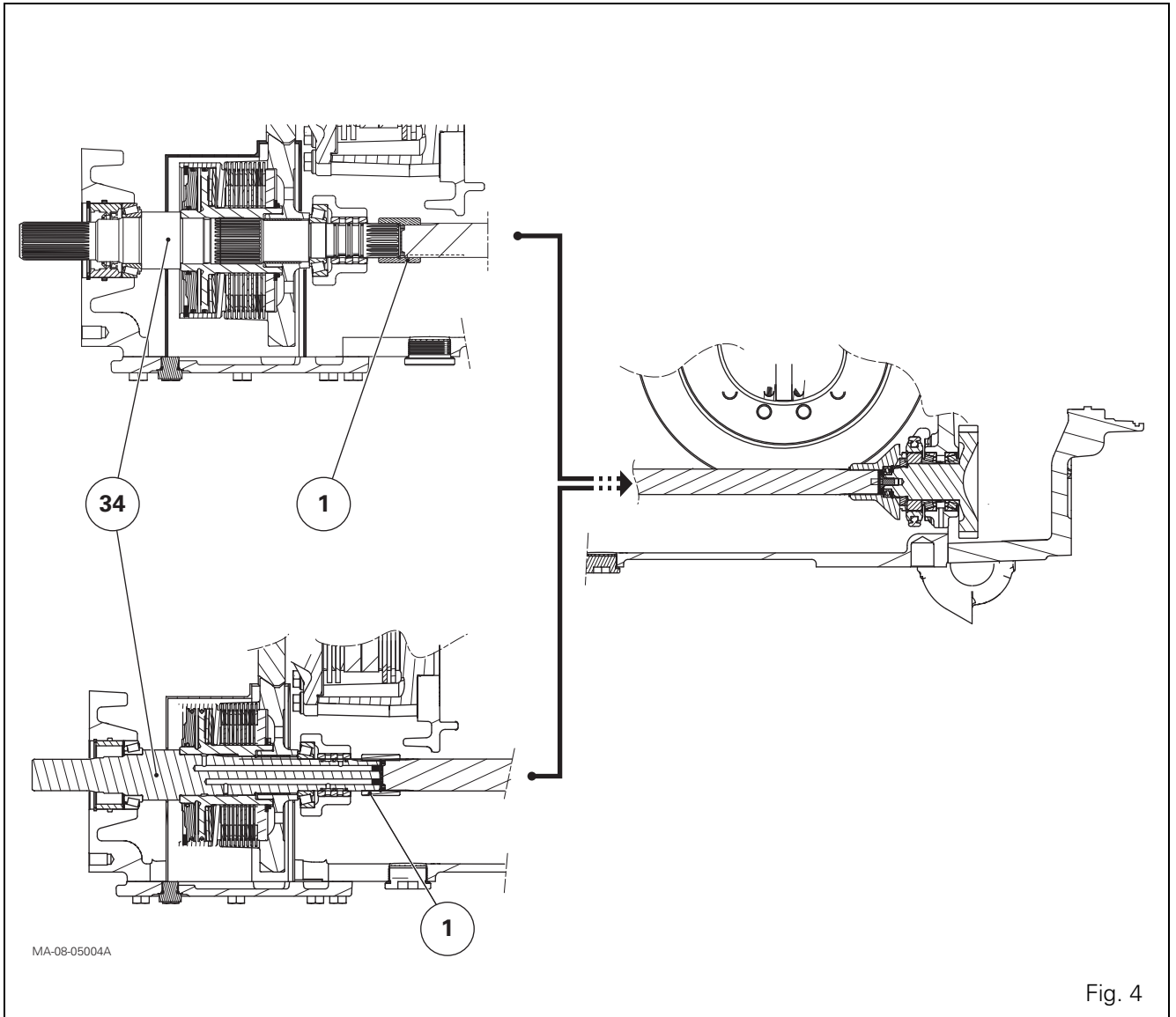
21. If necessary, extract the cup (16) and the hydraulic ring (18) from the centre housing using a makeshift tool.

22. If necessary, carry out the following operations on the shaft (34):

- remove and discard the seal rings (19);
- extract the bearing cone (13) using a press and a suitable fixture.

23. If work is necessary on the 4WD driving gear (5) (Fig. 2), refer to the section on the GPA40 pinion in chapter 6.





# 4WD GPA40 clutch

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## Refitting

### Tractors fitted with GTA1040 or GTA1540 transmission

24. Clean and check all components. Replace those that are defective.
25. On the shaft (34), check that hydraulic channels A or A1 (17 or 21 bar low pressure) and B (lubrication) (Fig. 5):
  - are not blocked;
  - have a rivet a or b on each of their ends.
26. Fit the bearing cone (13) against the shoulder of the shaft (34).
27. Fit the seal rings (19) into the grooves of the shaft (34).
28. If necessary, fit the hydraulic ring (18) into its bore so that its grooves are in line with the hydraulic channels on the centre housing.
29. If necessary, fit the bearing cup (16) against the shoulder of the centre housing.
30. Smear the bearing cone (17) with miscible grease. Fix this cone inside the bearing cup (16).
31. Refit the clutch assembly (7)/bell gear (6).
32. Support the clutch assembly/bell gear. At the same time, engage the shaft (34), fitted with its bearing cone (13) and the lubricated seal rings (19), in the clutch mechanism, the bearing cone (17) and the hydraulic ring (18).
33. Refit the cup (12).

Lightly smear the shims (14) with miscible grease. Fix these shims against the cup.
34. If it is necessary to replace one or more of the following parts, carry out J2 shimming (see § D):
  - the shaft (34);
  - the bearings (16) (17) and (12) (13);
  - the seal holder (10) (GTA1040) or the spacer (10) (GTA1540);
  - the circlip (8).
35. For tractors fitted with:
  - GTA1040 transmission, proceed to step 36;
  - GTA1540 transmission, proceed to step 42.

### Tractors fitted with GTA1040 transmission

36. If necessary, using a press and/or a suitable fixture, fit the lip seal (11) into the seal holder (10).
37. Fit the "O" ring (9) in the groove on the centre housing.
38. To protect the lip seal (11) when fitting the seal holder (10), fit a flexible cellulose strip lightly smeared with grease to the splined part of the shaft (34).

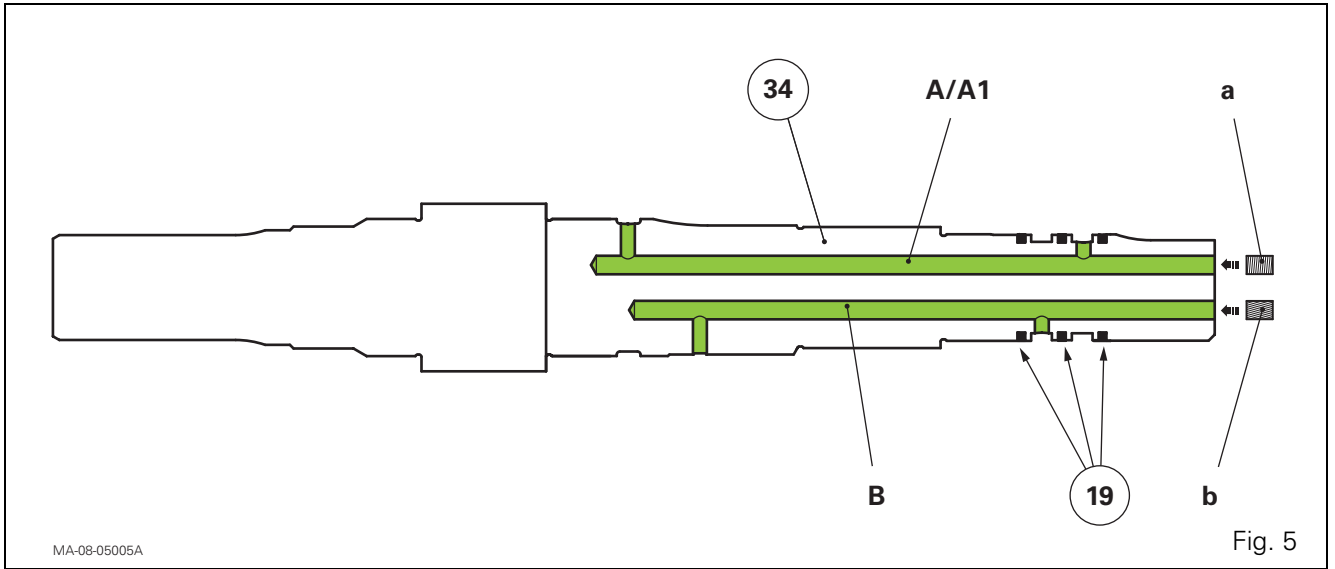
Using a makeshift sleeve, fit the lubricated seal holder (10) onto the shaft (34).  
Remove the flexible cellulose strip.

39. Fit the dust seal (35) on the shaft (34).
40. Refit the circlip (8).
41. Proceed to step 44.

### Tractors fitted with GTA1540 transmission

42. Refit:
  - the spacer (10);
  - the circlip (8).
43. Proceed to step 52.

# 4WD GPA40 clutch



# 4WD GPA40 clutch

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## Final steps

### Tractors fitted with GTA1040 transmission

44. Clean the cover plate (33) and its mating face on the centre housing.
45. Smear the mating face of the cover plate with Loctite 510 or equivalent.
46. Refit the cover plate. Tighten the screws to 70–90 Nm.
47. Top up the oil level in the housings and check it using the sight glass located to the left of the rear PTO housing.
48. Refit:
  - the front axle transmission shaft;
  - the guard.
49. Reconnect the differential lock control channel.
50. Remove the wheel chocks.  
Road test the 4WD clutch.
51. Check tightness of:
  - the mating face of the cover plate (33) under the centre housing;
  - Hydraulic unions

### Tractors fitted with GTA1540 transmission

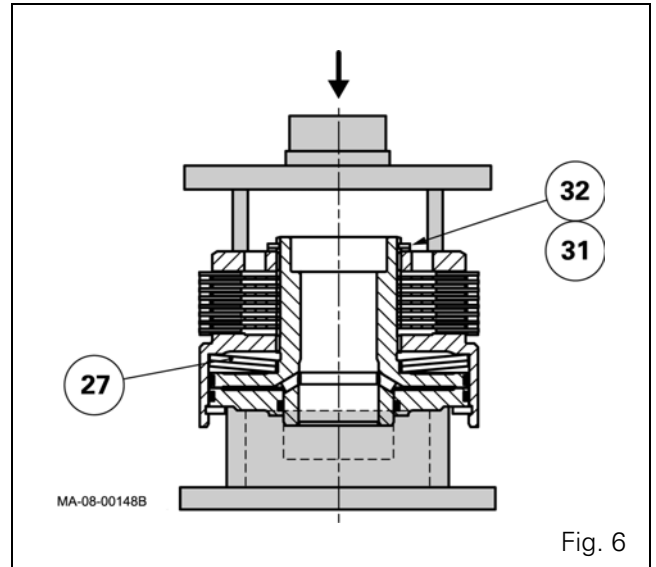
52. Clean the cover plate (33) and its mating face on the centre housing.
53. Smear the mating face of the cover plate with Loctite 510 or equivalent.
54. Refit the cover plate. Tighten the screws to 70–90 Nm.
55. Reconnect the tractor between the gearbox and the rear axle (see chapter 2).
56. Top up the oil level in the housings and check it using the sight glass located to the left of the rear PTO housing.
57. Refit:
  - the front axle transmission shaft;
  - the guard.
58. Reconnect the hydraulic hoses fitted to the transmission shaft guard.
59. Remove the wheel chocks.  
Road test the 4WD clutch.
60. Check tightness of:
  - the mating face between the gearbox and the rear axle;
  - the mating face of the cover plate (33) under the centre housing;
  - Hydraulic unions

## C . Disassembling, reassembling and shimming the clutch

### Disassembly

#### Tractors fitted with GTA1040 or GTA1540 transmission

61. Remove the clutch assembly (see § B).
62. Detach the bell gear (6) from the clutch assembly (7).
63. Remove the circlip (23). Remove the piston (22).
64. Remove the "O" rings (21) (24).
65. Using a press and a suitable fixture, compress the Belleville washers (27) (Fig. 6).
66. Take off the circlip (32) and the shim(s) (31) (Fig. 6).
67. Remove the suitable fixture used in step 65.  
Remove:
  - the cover plate (30);
  - the discs (28);
  - the intermediate plates (29).
68. Separate the hub (20) from the bell housing (26).
69. Remove the "O" ring (25).
70. Remove the Belleville washers (27).



## 4WD GPA40 clutch

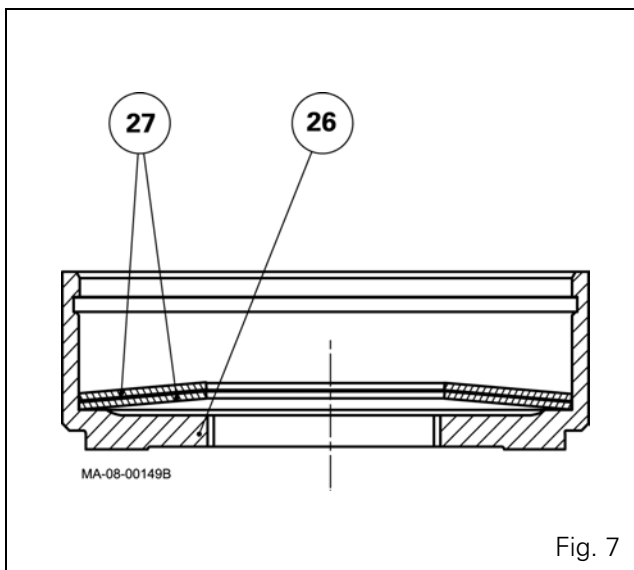
### Reassembly

#### Tractors fitted with GTA1040 or GTA1540 transmission

71. Check and clean all components. Replace those that are defective.  
Ensure that channels A, A1 and B (Fig. 5) are not obstructed.
72. Position the Belleville washers (27) in the bell housing (26) as per (Fig. 7).
73. Lubricate and fit the "O" ring (25) on the hub (20).
74. Place the hub (20) in the bell housing (26), braced against the Belleville washers.
75. Insert the discs (28) and the intermediate plates (29), starting with a disc against the bell housing (26). Fit the discs and intermediate plates alternately until the number removed during disassembly is reached.

Fit the cover plate (30).

**IMPORTANT:** The number of discs and intermediate plates for the 4WD clutch on tractors fitted with a GPA40 rear axle varies according to the transmission type and the GSPTO option (see spare parts catalogue). If it is necessary to change the number of discs and intermediate plates, it is essential to also replace some older 4WD clutch parts relating directly to this change (e.g. the bell gear (6), the bell housing (26), the cover plate (30) etc.) with new parts. An exact list of the parts involved in this change is referenced in the spare parts catalogue.



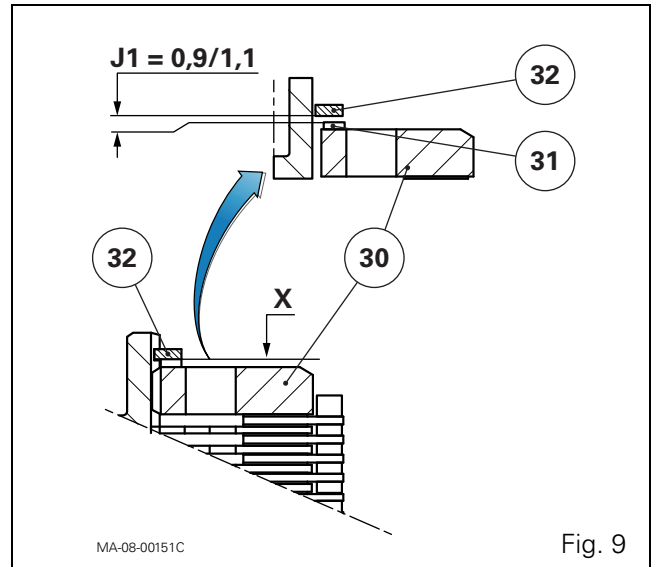
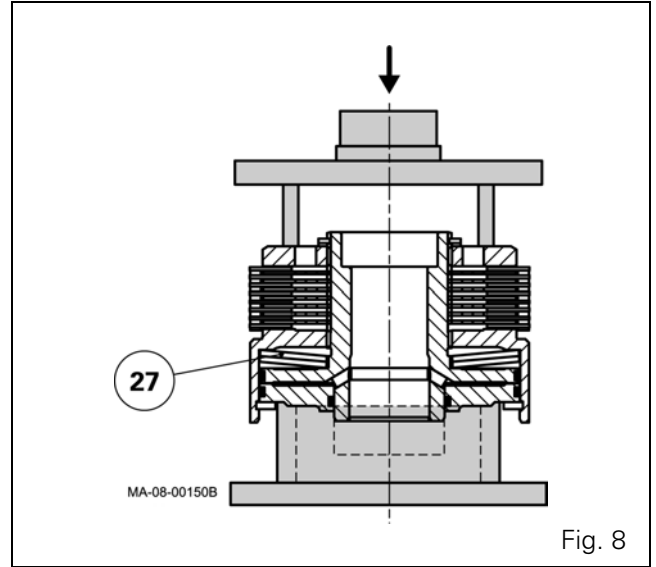
## Shimming

### Tractors fitted with GTA1040 or GTA1540 transmission

76. Using a press and a suitable fixture (Fig. 8), apply a load of 2000 daN to fully compress the Belleville washers (27).
77. Fit the circlip (32). Use a set of shims to increase temporary distance X (Fig. 9) between the cover plate (30) and the circlip (32). Select the shim(s) (31) to obtain a definitive clearance J1 of 0.9 to 1.1 mm (Fig. 9).
78. Remove the circlip (32).
79. Fit the shim(s) selected in step 77 between the cover plate and the circlip.
 

**IMPORTANT:** Fit the splined shim against the circlip.
80. Refit the circlip.
81. Lubricate and fit new "O" rings (21) (24) on the piston (22). Fit the piston (22).
82. Fit the circlip (23).
83. Connect the clutch assembly (7) and bell gear (6).
 

**NOTE:** The bore of ring (15) is created at the factory after it is force-fitted into the bell gear (6).
84. Refit the clutch assembly (7)/bell gear (6) by repeating steps 31 to 35.



# 4WD GPA40 clutch

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## D . Shimming the shaft

---

### Preparing for shimming

#### **Tractors fitted with GTA1040 or GTA1540 transmission**

When the tractor is stationary, the 4WD clutch is mechanically engaged and is attached to the rear axle pinion by the load from the two Belleville washers (27). These Belleville washers compress the discs and intermediate plates, preventing manual rotation of the shaft (34) and therefore the shimming of its bearings (12) (13) and (16) (17). In order to carry out the shimming, it is therefore necessary to test fit the shaft in the centre housing by carrying out steps 85 to 87.

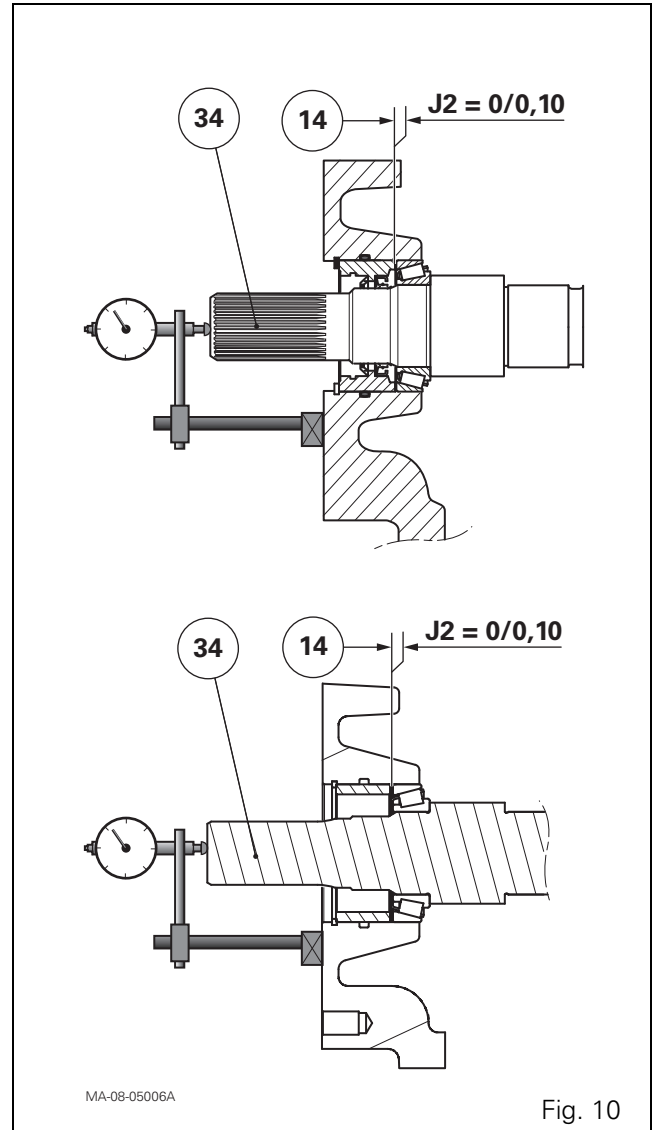
- 85.** Check that the bearing cup (16) is present inside the centre housing.
- 86.** Temporarily exclude:
  - the clutch assembly (7)/gear (6);
  - the shim(s) (14).
- 87.** Temporarily refit:
  - the bearing cone (17);
  - the shaft (34) fitted with the bearing cone (13);
  - the bearing cup (12);
  - the seal holder (10) (GTA1040) or the spacer (10) (GTA1540);
  - the circlip (8).



## Shimming

### Tractors fitted with GTA1040 or GTA1540 transmission

88. Put the dial gauge feeler pin against the end of the shaft (34) (Fig. 10).
89. As access around the shaft is restricted, firmly pull on the shaft using lock-grip pliers, while turning it alternately to the left and right to correctly fit the cones in the bearing cups.
90. Set the dial gauge to zero.
91. Repeat step 89, this time pushing firmly
92. Depending on the clearance value, select a definitive shim (14) thickness to obtain a clearance:  $J2 = 0$  to  $0.10$  mm (Fig. 10).
93. Remove:
  - the circlip (8);
  - the seal holder (10) (GTA1040) or the spacer (10) (GTA1540);
  - the shaft (34);
  - the bearings.
94. Definitively refit the clutch assembly (7)/bell gear (6) and the shaft (34) by repeating steps 31 to 35.



## 4WD GPA40 clutch

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*8A17- Carraro suspension*

CONTENTS

**A . Disassembling the arm assembly ..... 3**

**B . Reassembling the arm assembly ..... 6**

**C . Service tools ..... 15**

## Carraro suspension

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## A . Disassembling the arm assembly

1. Lock the arms using a suitable lifting mechanism to prevent any untimely movement.  
Loosen the nut A and extract the taper pin B.  
Remove the pivot pin C using a rubber mallet or another soft object if required.



### Danger

- **The arms are very heavy; handle with care to avoid injuring the operator.**

2. Remove the pin covers of the upper arms D at the front and rear of the arms, loosening the relevant attachment screws (F).  
Recover the seals and shims if present.  
Note the position of all disassembled elements.  
Remove the bearing G and the clamp ring H of each pin.
3. Remove the attachment screws I of the arm pins and extract the pins J using a suitable extracting tool inserted into the threaded hole provided in the pin for this purpose (screw M16 x 100).

**Warning: This operation releases the arms.**

### Remarks:

- **To make the extraction easier, the arm pin housing can be heated to a maximum temperature of 100°C.**
- **This operation will destroy the seals.**



### Danger

- **If the upper and lower arms are not held firmly enough, they might move and injure the operator.**

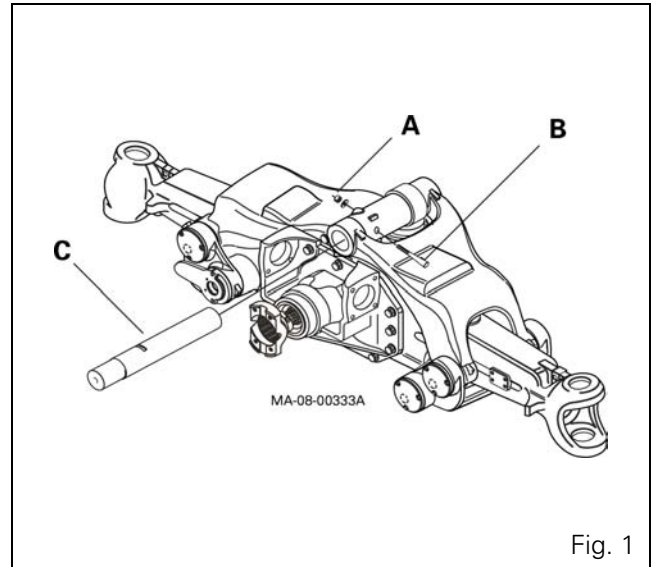


Fig. 1

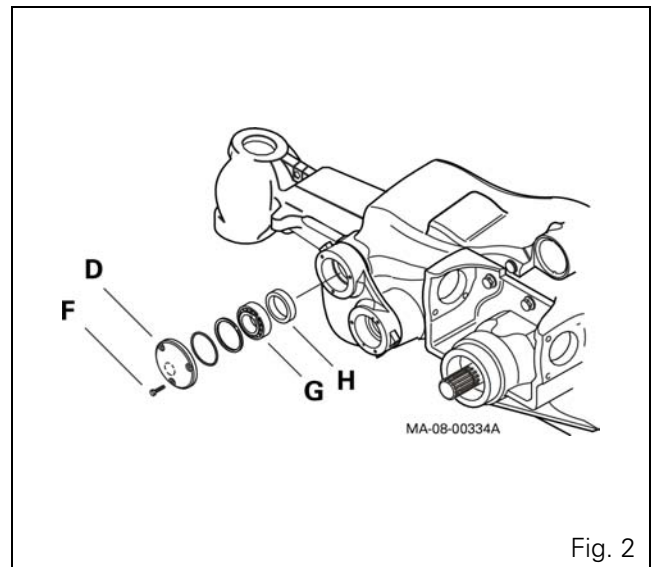


Fig. 2

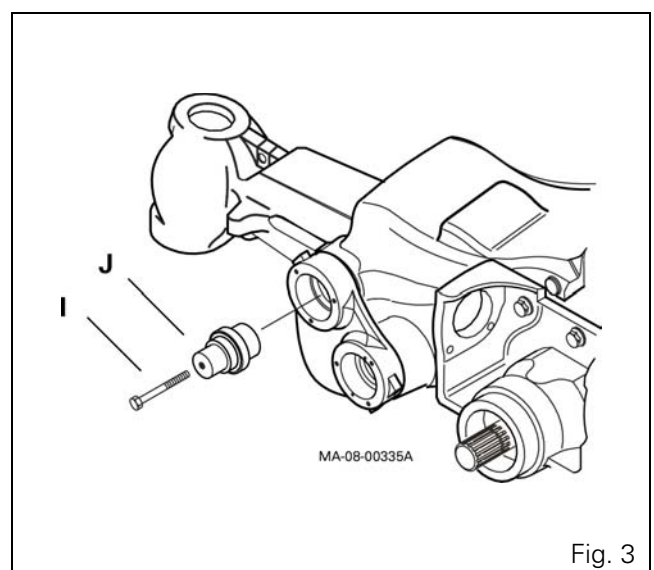


Fig. 3

# Carraro suspension

4. Remove the upper arms with a suitable lifting tool.  
Recover the seals and shims if present.  
Replace the shock absorber pads K if necessary by removing the relevant screws (Fig. 4).



## Danger

- **The lower arms may turn and injure the operator.**
5. Remove the lower arm pin covers and the sensor E plate by loosening the relevant attachment screws F. Recover the rubber guide of the sensor (see section 11).
  6. Remove the attachment screws L of the arm pin bearings and recover the relevant thrust washer M and shims N, if used (Fig. 6).

**Remark: The thrust washer fitted on the sensor pin has a special shape and must not be confused with another washer.**

To reach the attachment screw on the side of the sensor, the mounting bush must be removed from the dust seal.

**Warning: This operation will destroy the seals.**  
Remove the bearings O and seals P (Fig. 6).

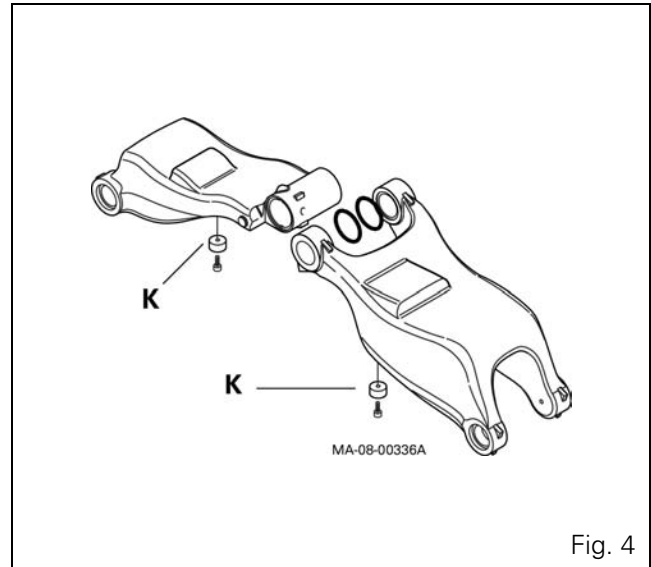


Fig. 4

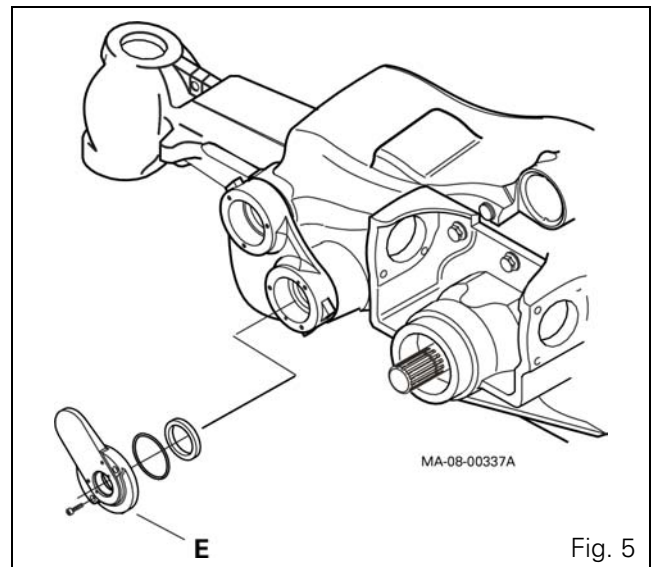


Fig. 5

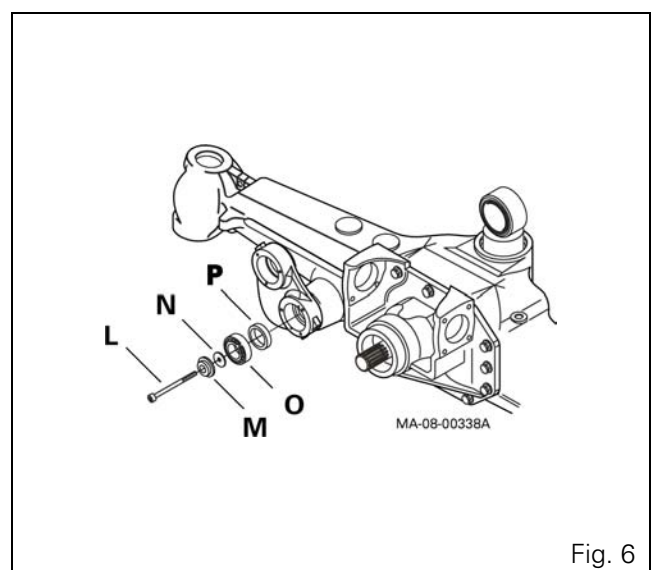


Fig. 6

7. Remove the pins Q from the arms using a suitable extractor inserted into the threaded hole provided for this purpose (screw M16 x 100) (Fig. 7).

**Warning: This operation releases the arms.**



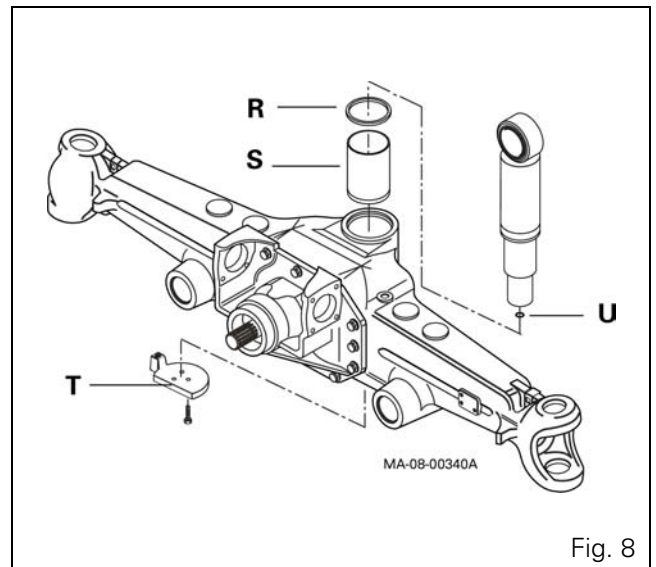
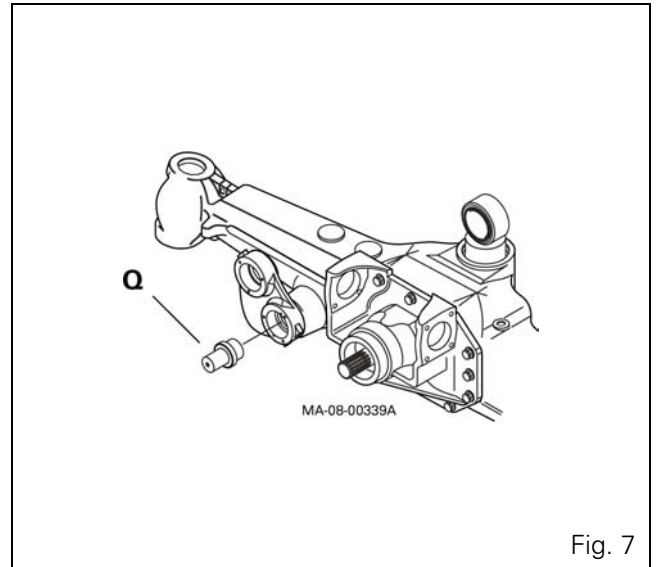
**Danger**

- **If the lower arms are not held firmly enough, they might move and injure the operator.**

8. Take out the attachment screws to remove the lower cover T. Extract the axle beam cylinder (Fig. 8).

Extract the O'ring U from the cylinder and the seal R from its housing in the axle beam.

Do not replace the ring S unless necessary, using a suitable extracting tool (Fig. 8).



# Carraro suspension

## B . Reassembling the arm assembly

9. Fit ring A, previously smeared with Loctite 510, in its position in the control ram housing (Fig. 9).  
Fit the seal B on the axle beam and a new O'ring C lightly smeared with grease in the housing at the bottom of the control ram D.  
Install the ram in the axle beam.

10. Fit the lower cover E on the lower part of the axle beam and tighten the relevant attachment screws to the required torque (see chapter 8) using a torque wrench (Fig. 10).

**Remark: Before installing the cover, make sure that the O'ring is correctly positioned at the bottom of the ram.**

11. Install the lower arms on the axle beam and align the pins by inserting special tool ref. CA715350 (see § C) G into the housing at the side opposite the pin assembly (Fig. 11).

Install the arm pins H into the holes provided in the arms and axle beam, and push them home in their holes using special tool ref. CA715353 (see § C) (Fig. 11).

### Remarks:

- It is advisable to cool the arm pins to under  $-100^{\circ}\text{C}$  before installing them in order to make their assembly easier.
- This operation can be carried out by completely dipping the pins of the arm in liquid nitrogen. - To purchase or hire liquid nitrogen, contact the "Air liquide" company.

**Warning: It is recommended to wear protective gloves.**

**Remark: The arm pin housing can be heated to a maximum temperature of  $+100^{\circ}\text{C}$ .**

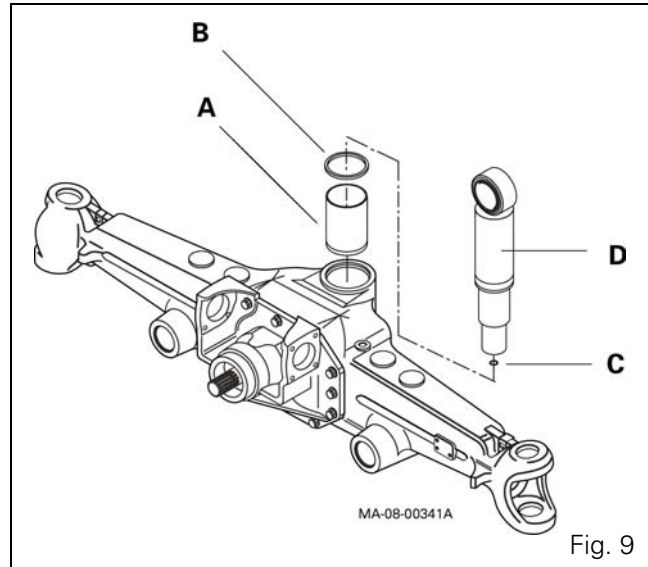


Fig. 9

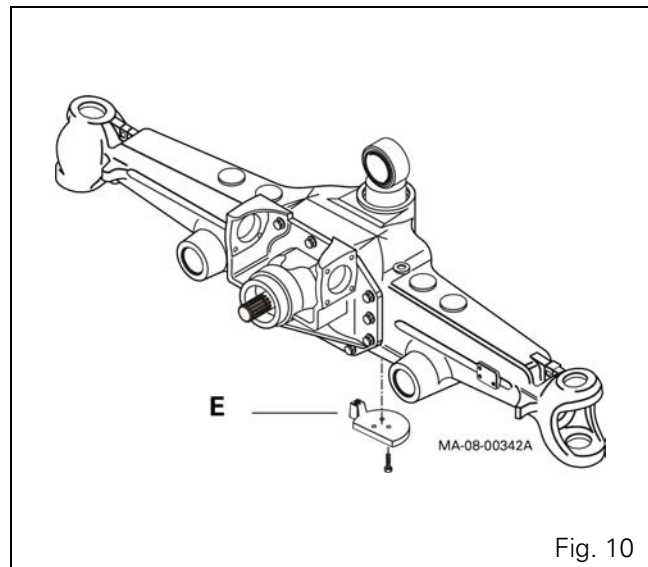


Fig. 10

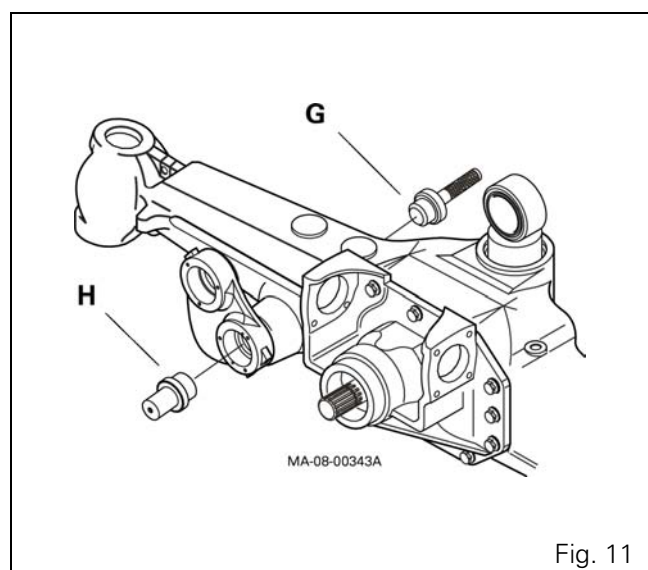


Fig. 11



- 12.** Fit one seal I onto each pin fitted in the lower arm housing using special tool ref. CA715352 (see § C) and a mallet (Fig. 12).

Install a roller bearing J using special tool ref. CA715349 (see § C).

Fit a spacer R (on the drive pinion side) of the correct dimensions (thickness: R=1mm) and install the thrust washer K fitted with the attachment screw L (Fig. 12).

**Warning:** The spacer outside diameter must be smaller than the bearing internal diameter.

**Remark:** The thrust washer fitted on the sensor pin has a special shape and must not be confused with another washer.

Shim the taper roller bearings by moving the axle beam arms and tighten the attachment screws to the required torque using a torque wrench (see chapter 8).

- 13. Warning:** Check the assembly position of the bearings on the arms.

On the lower pins of the arms: the bearing must be fitted with the cup facing inwards (in the arm housing) and the cone facing outwards (on the pin) (Fig. 13).

On the upper arms: the bearing must be fitted with the cone on the inside (on the pin) and the cup on the outside (on the arm housing) (Fig. 13).

- 14.** Place a dial gauge with a magnetic stand on the axle beam and move the dial gauge feeler pin until it comes into contact with the face of the lower arm, then reset the dial gauge to zero.

Install a lever between the arm and the axle beam, push the arm home at each side and measure the clearance using a dial gauge. Repeat this operation several times to obtain an average value X (Fig. 14).

- 15.** To determine the thickness S to obtain the required bearing preload, subtract the measured value X and the recommended value from the known reference value R (see operation 12):

$$S = (R - X) - V$$

$$V = 0.05 \text{ to } 0.15 \text{ mm.}$$

Select from the available shims the number required to obtain the thickness S defined previously.

Types of shims			
Thickness	0,1	0,2	0,5
Quantity	-	-	-

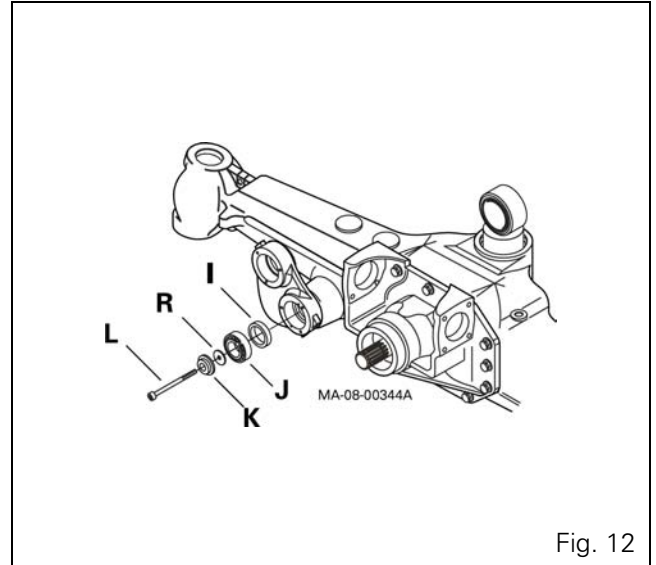


Fig. 12

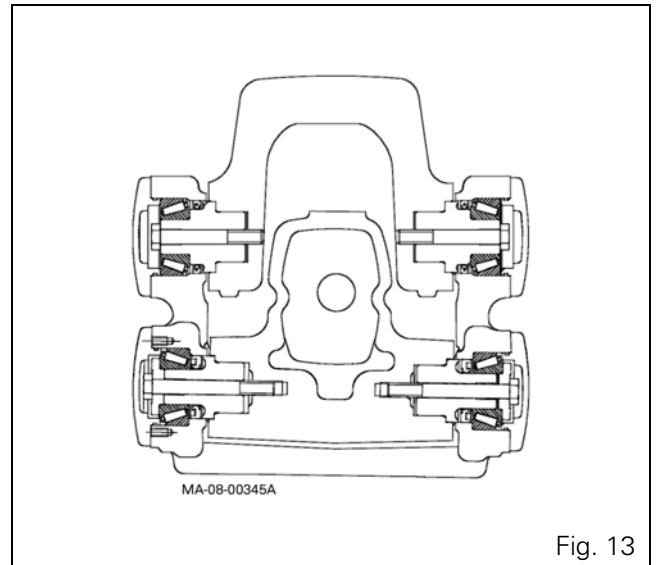


Fig. 13

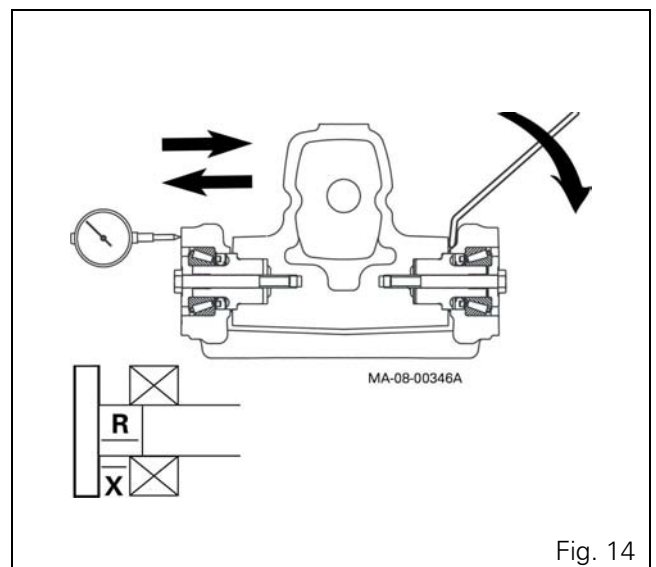


Fig. 14

## Carraro suspension

16. Remove the attachment screws L on the gear side and the reference shim R.

Insert shims S between the stop K and the taper roller bearing J (Fig. 15).

**Warning: All shims must be inserted, and only on the drive pinion side.**

Reassemble the attachment screws: apply Loctite 542 to the threads, then tighten the screws to the required torque (see chapter 8) using a torque wrench.

Repeat the described procedure on the lower arm.

17. Place the upper arms on a workbench with a suitable lifting device.

If shock absorber pad P must be replaced, tighten the attachment screws to the required torque using a torque wrench (see chapter 8) (Fig. 16).



### Danger

- The arms are heavy and must be moved with utmost care to avoid injury to the operator.

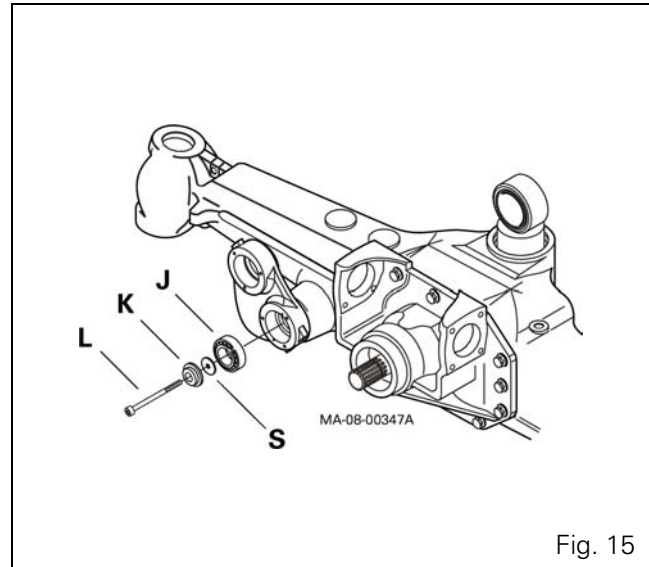


Fig. 15

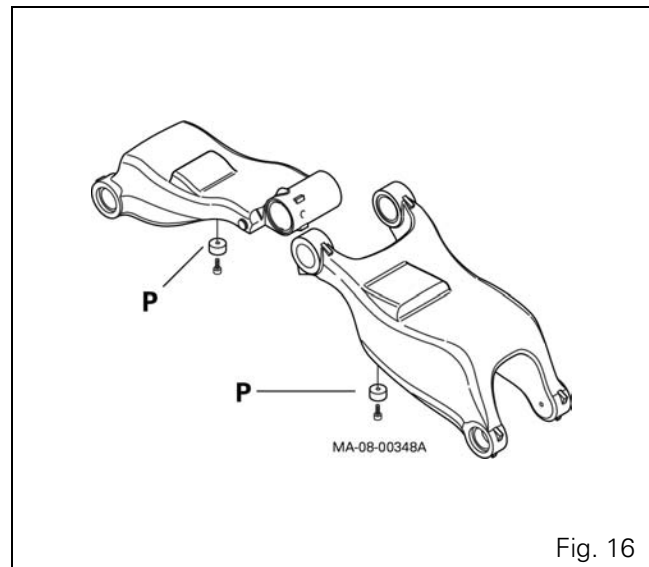


Fig. 16

18. Fit the two rings Q in the pivot pin housings on the fork of the arm using special tool ref. CA715347 for models 20.22 S and 20.19 S, and tool ref. CA715385 (see § C) for model 20.29 S and 20.43 S (see § C), and a mallet.

**Remark: It is advisable to cool the rings to a temperature below  $-100^{\circ}\text{C}$  to make their assembly easier.**

**Warning: It is recommended to wear protective gloves.**

Assemble the seals R using the special tool ref. CA715346 for models 20.22 S and 20.19 S and tool ref. CA715383 for model 20.29 S and 20.43 S (see § C).

Fit the spacers T on the internal side of the fork using special tool ref. CA715348 for models 20.22 S and 20.19 S and tool ref. CA715384 for models 20.29 S and 20.43 S (see § C), and place the corresponding O'ring U into the spacer housings (Fig. 17).

19. Insert the spacer Z into the housing of the other pivot pin using the special tool ref. CA715364 for models 20.22 S and 20.19 S and tool ref. CA715384 for models 20.29 S and 20.43 S (see § C) and the corresponding O'ring V.

On the other side fit the dummy thrust washer W in the spacer housing using the special tool ref. CA715361 for models 20.22 S and 20.19 S and tool ref. CA715381 for models 20.29 S and 20.43 S (see § C) (Fig. 18).

**Remark: Check that the dummy thrust washer remains in position when assembling the arms, then replace it with shims after measuring the spacer clearance.**

20. Using a suitable lifting mechanism, position the upper arms on the axle beam and link them to the lower arms.

Fully insert the pins F in the housings provided in each arm using the special tool ref. CA715353 (see § C) (Fig. 19).

**Remark: It is advisable to cool the arms to a temperature below  $-100^{\circ}\text{C}$  to make their assembly easier. This operation can be carried out by completely dipping the arm pins into liquid nitrogen. To purchase or hire liquid nitrogen, contact the "Air liquide" company.**

**Warning: It is recommended to wear protective gloves.**

Reassemble the attachment screws E. Apply Loctite 542 to the threads, then tighten the screws to the required torque (see chapter 8) using a torque wrench.

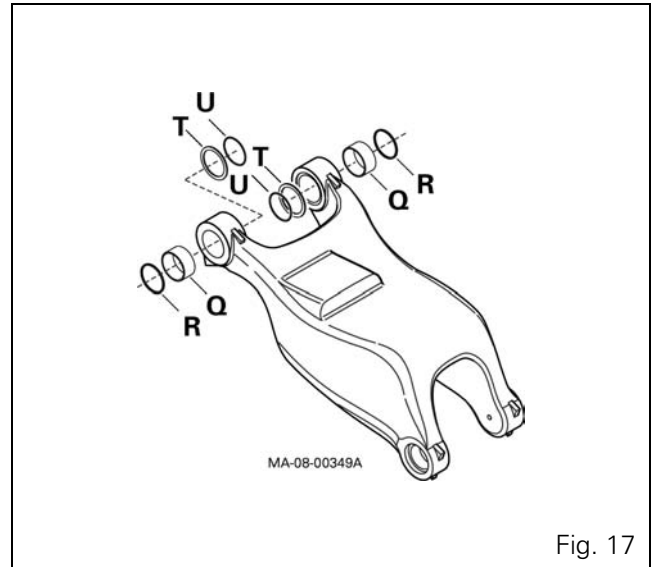


Fig. 17

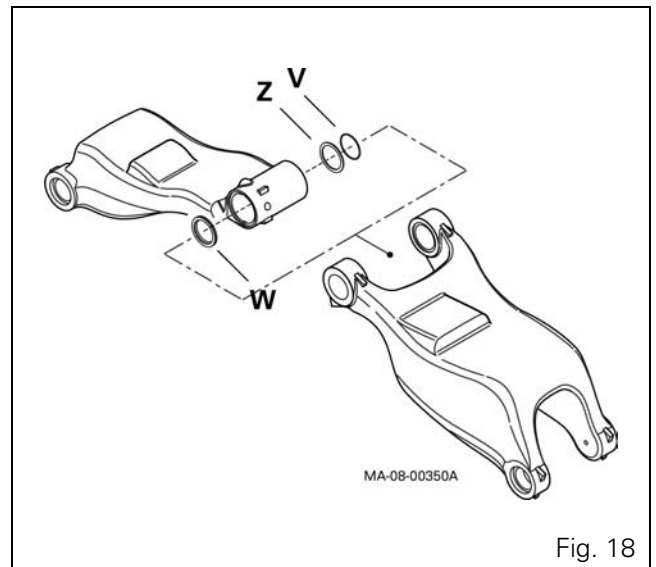


Fig. 18

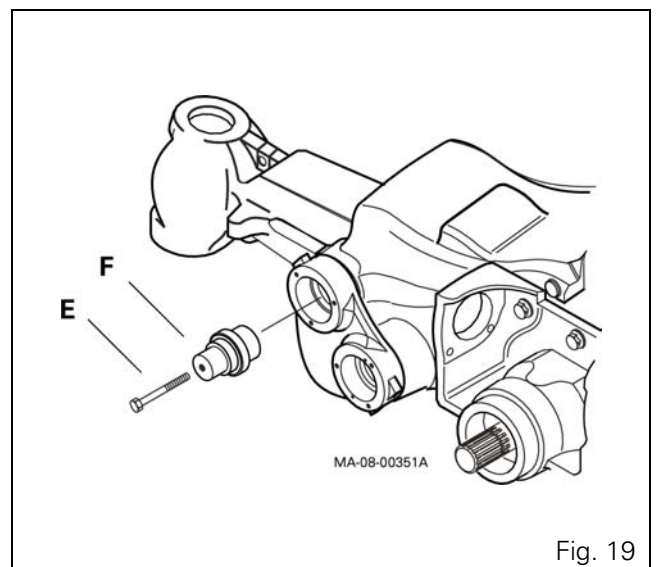


Fig. 19

# Carraro suspension

21. Fit a seal H to each arm pin using the special tool ref. CA715351 (see § C).

Fit a roller bearing I using special tool ref. CA715349 (see § C).

**Warning: Check the position of the bearing assembly on the arm as shown in operation 5.**

Fit the cover J with its attachment screws K.

**Remark: do not fit a spacer under the cover.**

Shim the taper roller bearings by moving the axle beam arms and tighten the attachment screws to the required torque (see chapter 8) using a torque wrench (Fig. 20).

22. Place a dial gauge with a magnetic stand on the upper arm and move the dial gauge feeler pin until it comes into contact with the lower arm, then reset the dial gauge to zero.

Install a lever between the upper and lower arm, push the arm home on each side and measure the clearance X between the bearings and their housings, using the dial gauge. Repeat this operation several times to obtain an average value (Fig. 21).

23. To determine the thickness S required to obtain the required bearing preload, add together the measured value X and the recommended value V:

$$S = X + V$$

$$V = 0.05 \text{ to } 0.15 \text{ mm.}$$

Select from the available shims the number required to obtain the thickness S defined previously.

	Types of shims		
<b>Thickness</b>	0,1	0,2	0,5
<b>Quantity</b>	-	-	-

24. Repeat the described procedure on the other upper arm.

Remove the arm pin covers on the gear side, fit shims S and a new O'ring L and assemble, filling their housing with grease and tightening the attachment screws K to the required torque (see chapter 8).(Fig. 22).

Remove the covers from the side opposite the pinion, fill their housings with grease, then refit with a new O'ring L.

**Warning: Shims must be introduced on the drive pinion side.**

Tighten the attachment screws K with a torque wrench to the requested torque (see chapter 8).

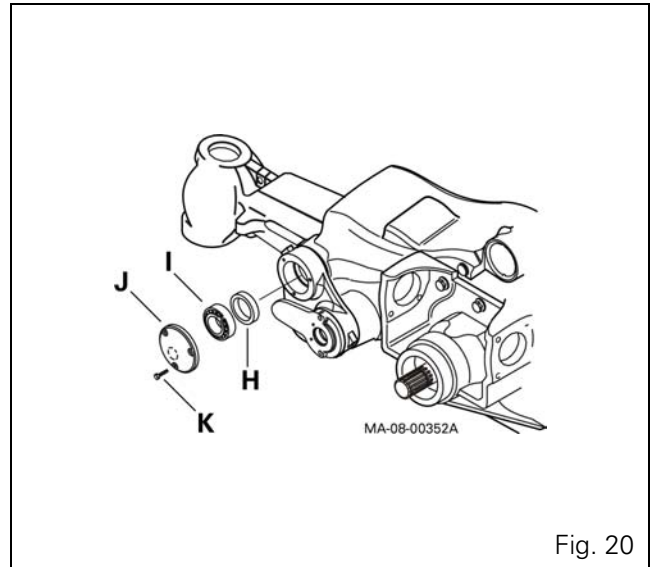


Fig. 20

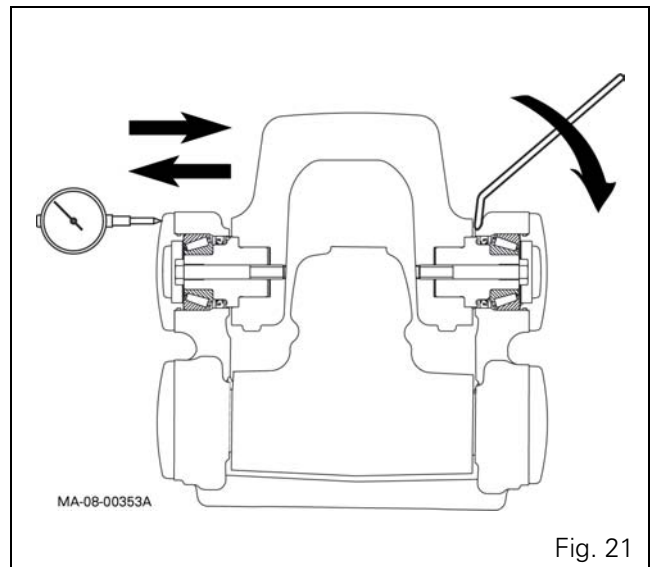


Fig. 21

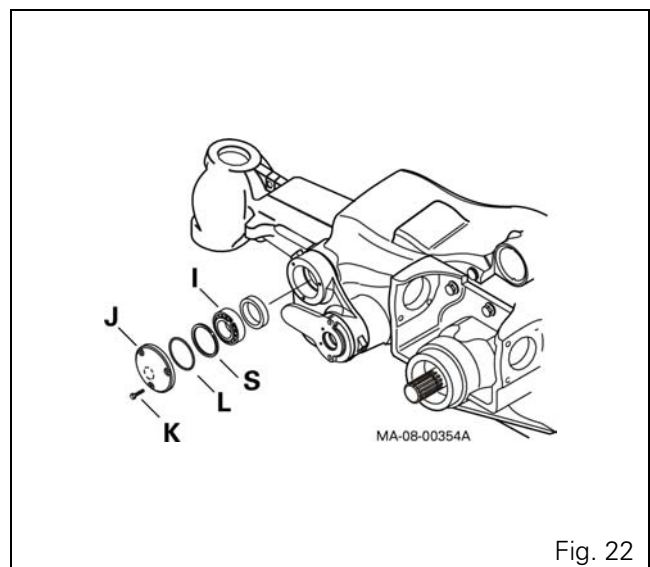


Fig. 22

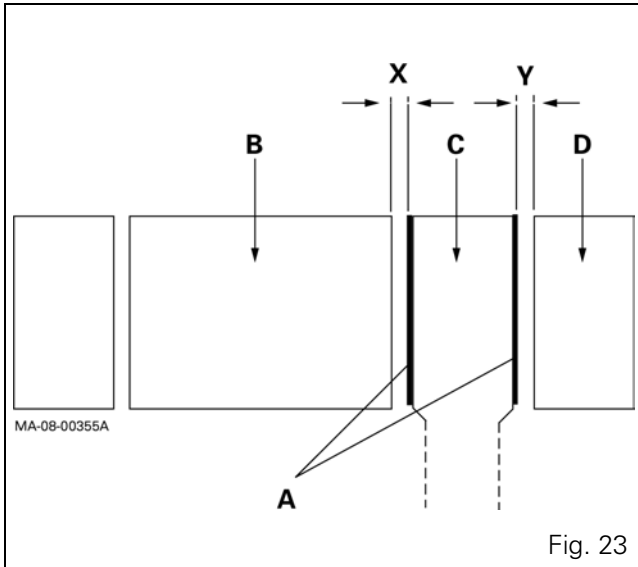


Fig. 23

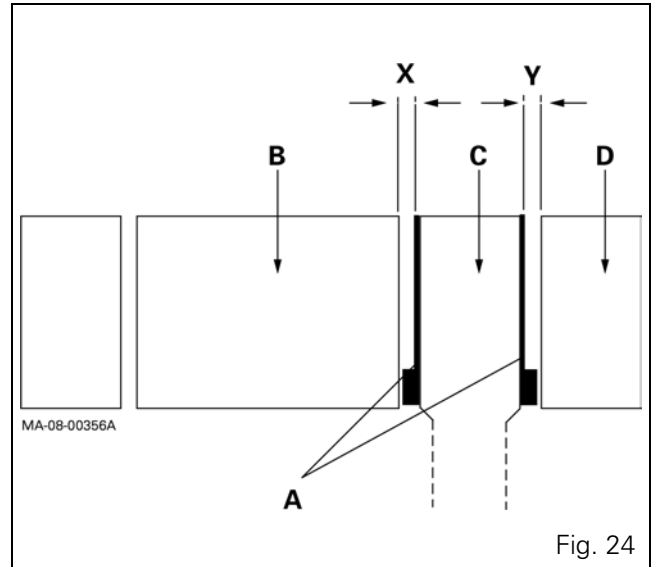


Fig. 24

**25.** Align the arms, ram head holes and washers (if present). Special tool ref.CA715343 can be used for alignment of models 20.22 S and 20.19 S and tool ref.CA715382 for models 20.29 S and 20.43 S, but must be removed after the operation.

**26.** Simultaneously measure the dimensions X between the arm B and ram head C, and Y between the arm D and ram head C. Use two long shims, holding washers A in place (Fig. 23 or Fig. 24 for models with shouldered washers).

The minimum length of shims must be equal to the outer diameter of the ram head.

**27.** The clearance X must be at least 0.10mm. If not, move the shims S in the upper left-hand arm B across to the opposite housing of the same arm (Fig. 25).

The clearance Y must be at least 0.10mm. If not, move the shims S in the upper right-hand arm D across to the opposite housing of the same arm (Fig. 26).

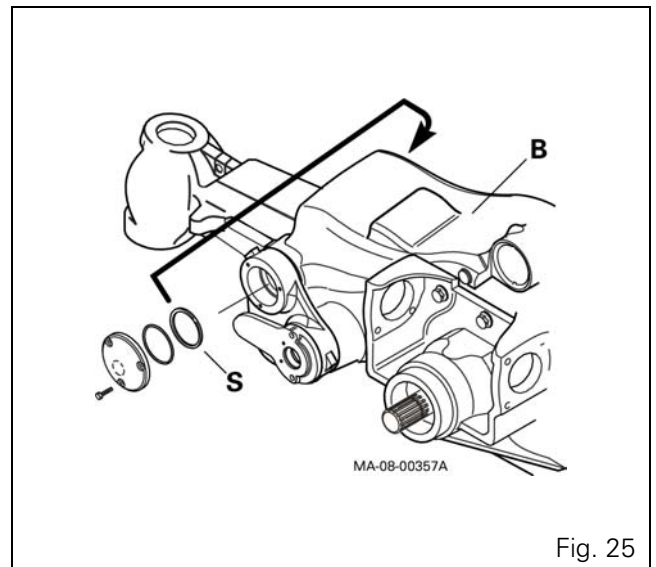


Fig. 25

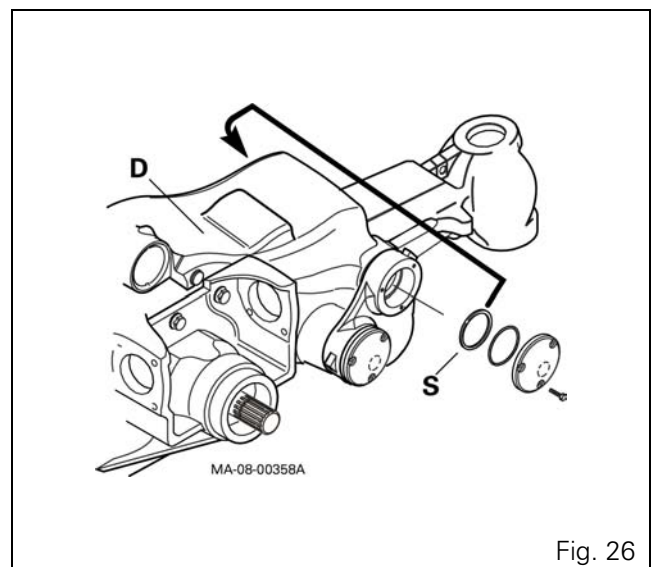


Fig. 26

# Carraro suspension

28. Fit the locating pin ref. CA715343 for models 20.22 S and 20.19 S and tool ref. CA715382 for models 20.29 S and 20.43 S (see § C) and adjust the components.

Using a shim thickness Z, measure the distance between the spacer T and the dummy thrust washer W.

Remove the dummy thrust washer, then extract the locating pin to remove the spacer housings located on the arms (Fig. 27).

29. To determine the thickness S required to obtain the necessary clearance at the arms, calculate:

$$S = Z - V$$

$$V = 0.4 \text{ to } 0.7 \text{ mm.}$$

Select from the available shims the number required to obtain the thickness S defined previously:

Types of shims		
Thickness	0,1	0,3
Quantity	-	-

30. Fit the selected shims S and the spacer D in place of the dummy thrust washer using the special tool ref. CA715348 (see § C) (Fig. 28).

31. Align the ports of the arms and control ram; insert the pivot pin P using special tool ref. CA751343 (see § C), then fit it to the bottom of its housing.

**Warning: Keep the special tool at the opening of the pin housing.**

Lock the pivot pin with the taper pin Q and screw the nut R to the required torque (see chapter 8) using a torque wrench.

 **Danger**

- If the upper and lower arms are not held firmly enough, they might move and injure the operator.

32. Extract the attachment screws from all lower arm pins and refit the assemblies, applying Loctite 542 to the threads then tightening the screws to the required torque (see chapter 8) using a torque wrench.

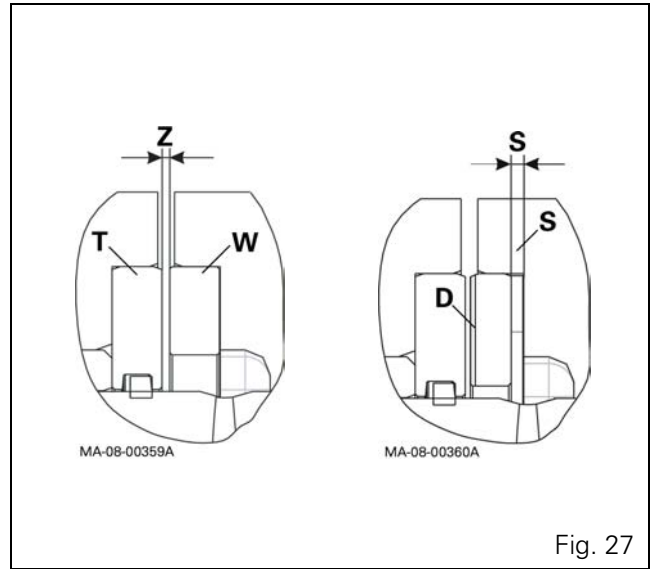


Fig. 27

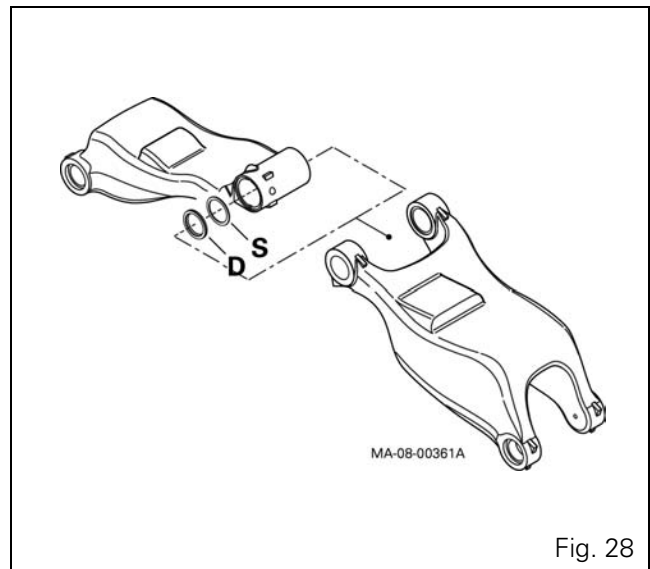


Fig. 28

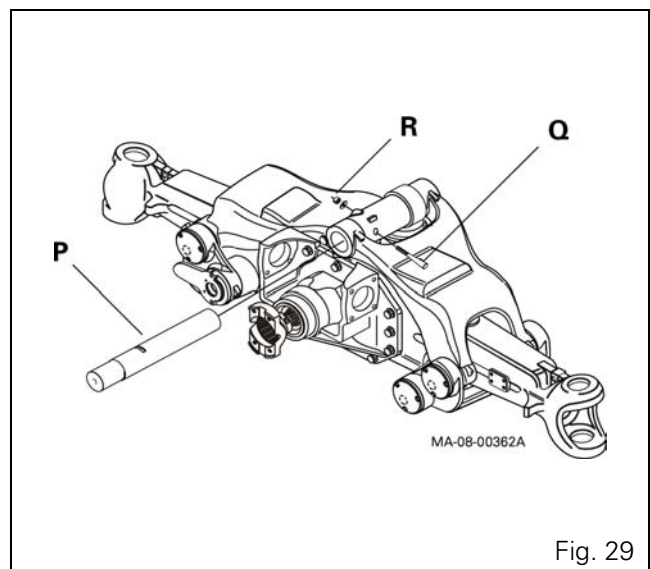


Fig. 29

33. Fit the seal M to the thrust washer of the sensor pin using the special tool ref. CA715345 (see § C) and fit new O-rings in their housing on the covers O of the arms and on the plate N of the sensor.
- Fit the arm pin covers and the sensor plate, fill their housing with grease and tighten the relevant attachment screws to the required torque (see section 8A01§ A) (Fig. 30).

34. Measure the distance  $X_{ac}$  in Axle closed position between the pivot pin centre and the differential housing, choosing an exact reference point P (Fig. 31).

35. Fully raise the axle beam arm and measure the distance  $X_{aa}$  in Axle open position between the pivot pin centre and the selected reference point P (Fig. 32).

**Warning: Lift the arms gradually until they reach their limit. Do not exceed this limit to avoid risking damage to the control ram.**

Check that travel C of the control ram remains within the allowable limits, by subtracting the measured dimensions as follows:

$$C = X_{aa} - X_{ac}$$

$$C = 88 \text{ to } 89 \text{ mm}$$

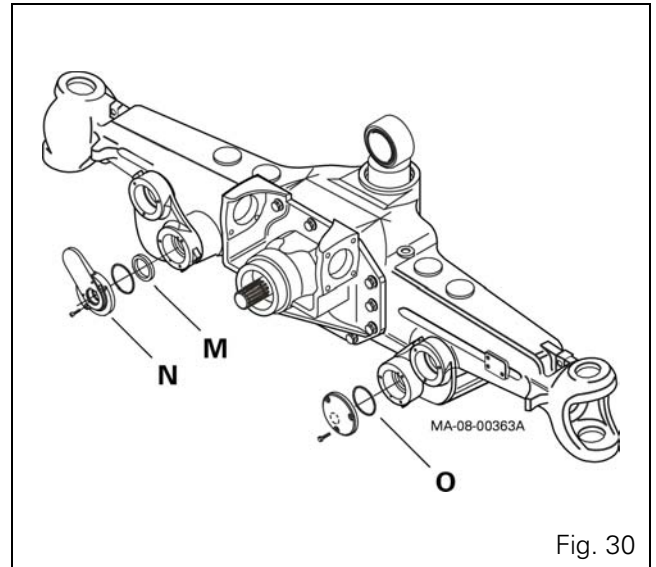


Fig. 30

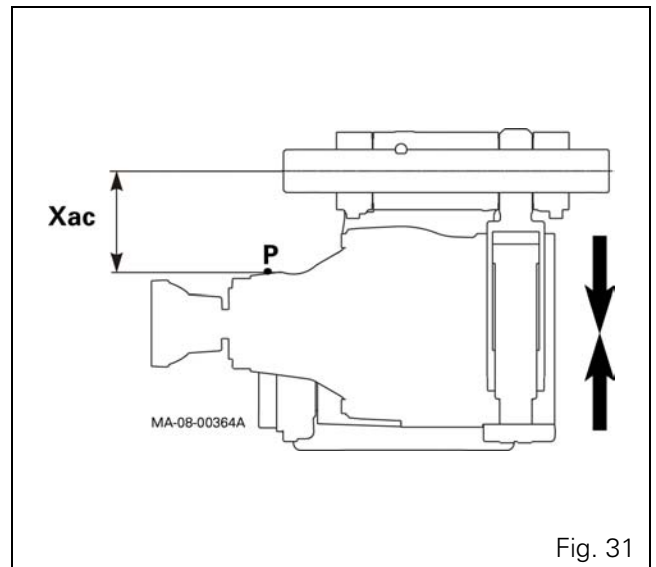


Fig. 31

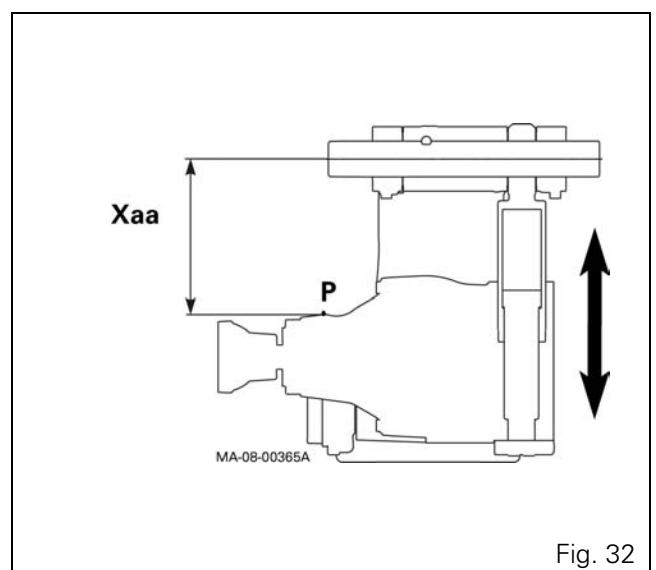


Fig. 32

## Carraro suspension

**36.** If the travel C of the suspension cylinder is not within allowable limits, measure the clearance X between the upper arms at the point of insertion of shims in Axle open position.

**37.** To determine the thickness S required for the correct end-of-travel position for the arms, add the measured value X to the recommended value V:

$$S = X + V$$

$$V = 0.3 \text{ mm.}$$

Select from the available shims the number required to obtain the thickness S defined previously.

	Types of shims			
<b>Thickness</b>	0,05	0,10	0,20	2,00
<b>Quantity</b>	-	-	-	-

**38.** Lower the upper arms of the axle beam (Axle closed position) and insert the shims selected with their attachment screws.

Lift the axle beam to maximum position again (Axle open) to position the arms correctly, then return to the initial position (Axle closed).

Ensure that suspension cylinder travel C remains in the allowable limits (Fig. 34).

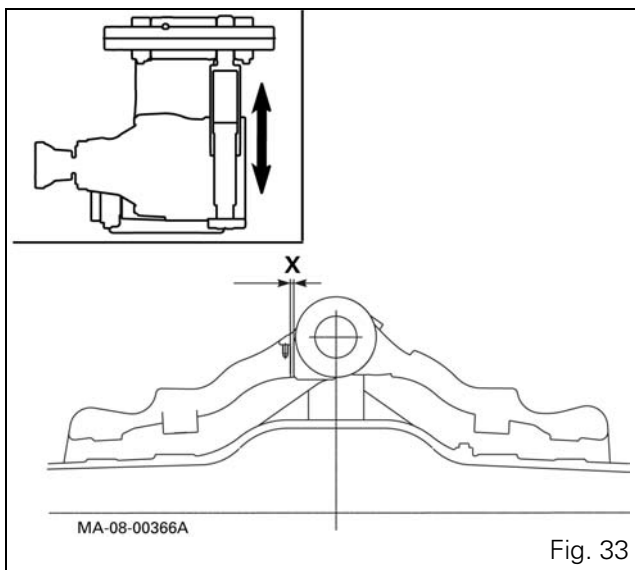


Fig. 33

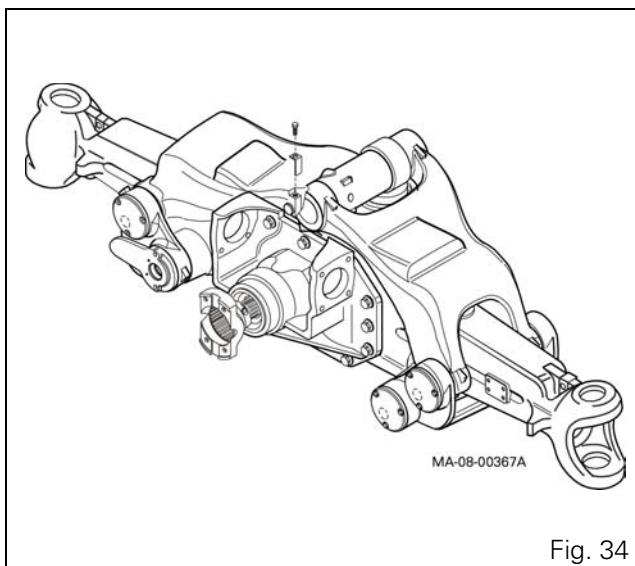


Fig. 34



## C . Service tools

- CA 715343, CA 715382 - Selector rail (Fig. 35)
- CA 715345 - Oil plug (Fig. 36)
- CA 715346, CA 715383 - Seal fitting tool (Fig. 37)

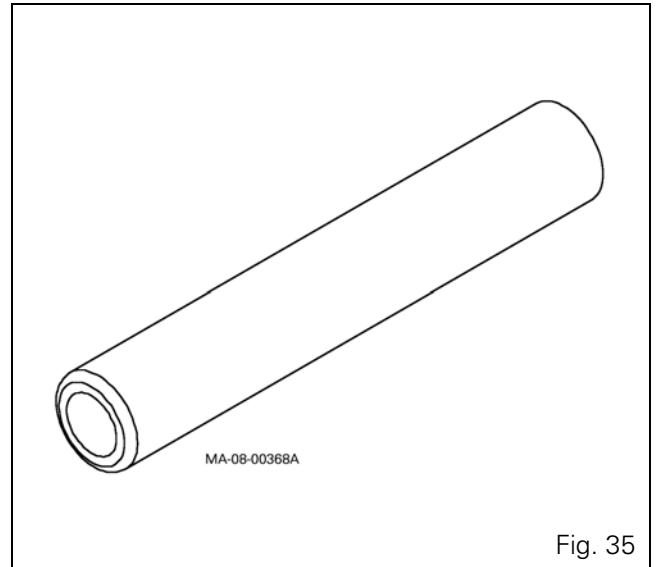


Fig. 35

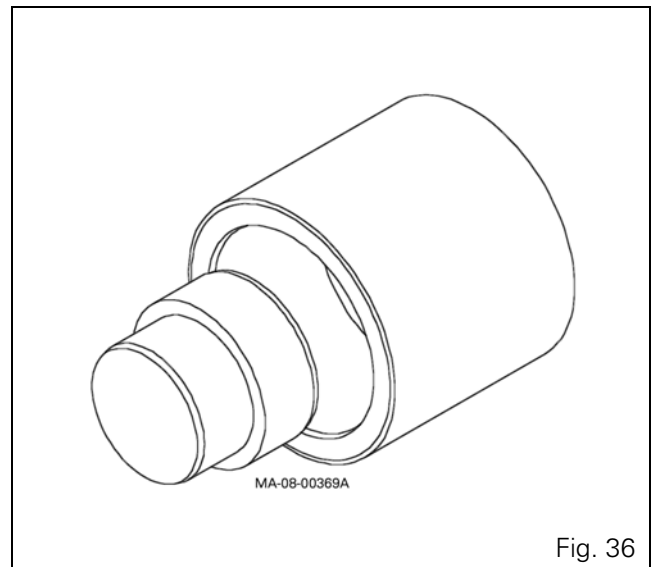


Fig. 36

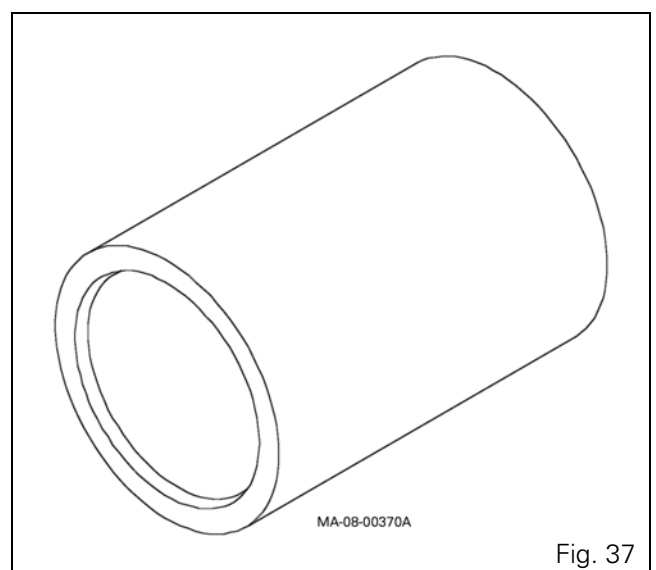
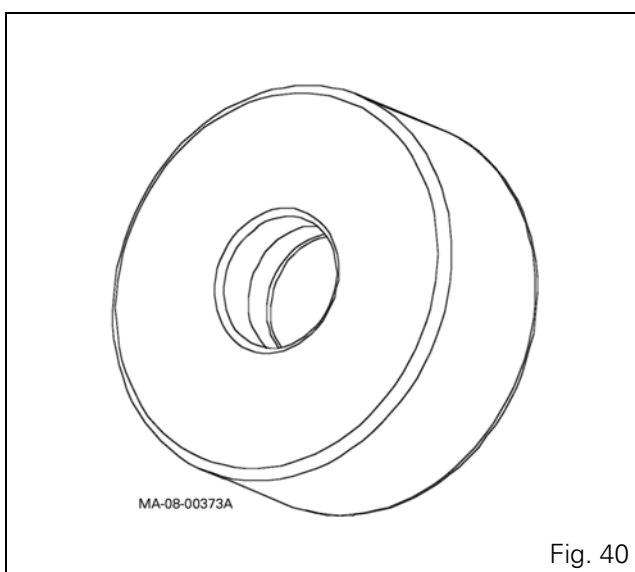
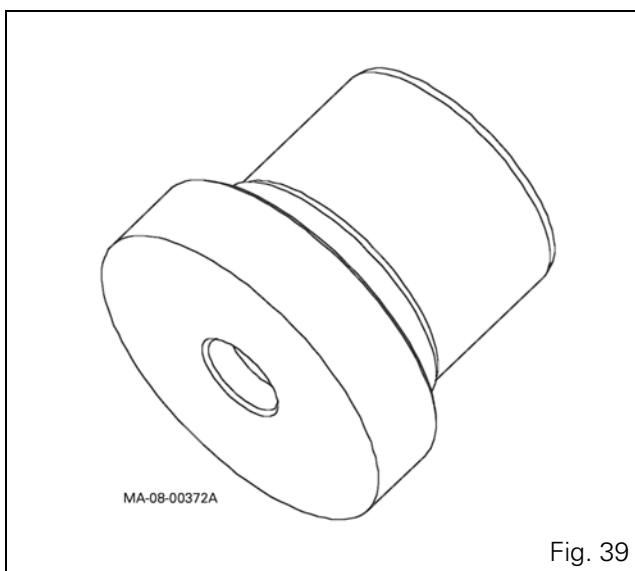
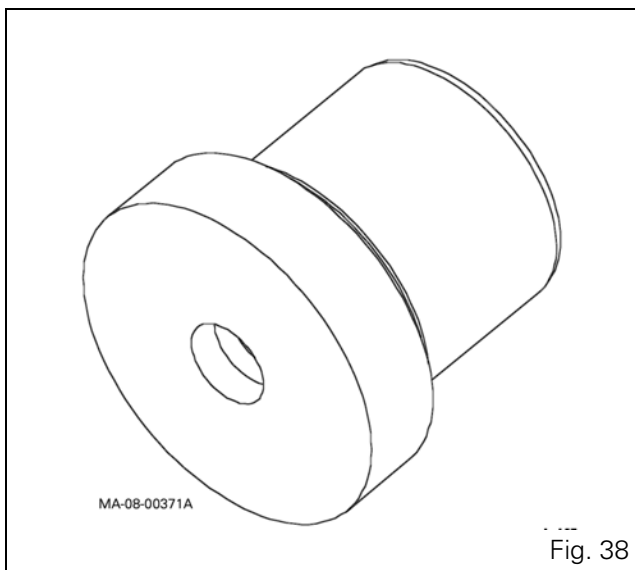


Fig. 37

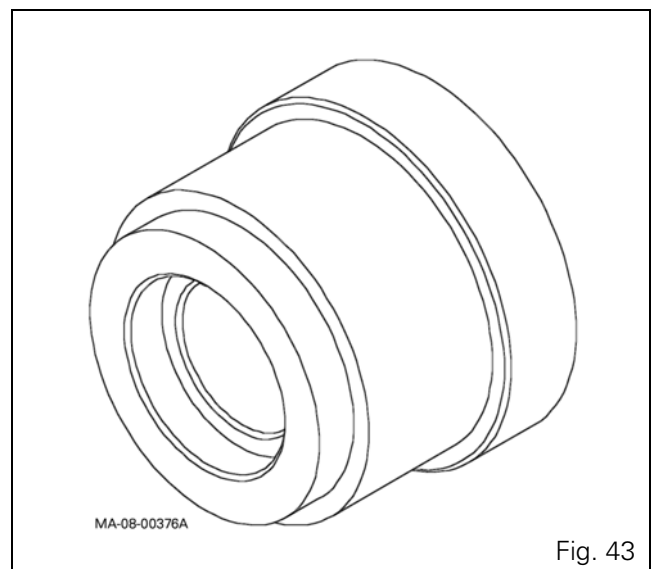
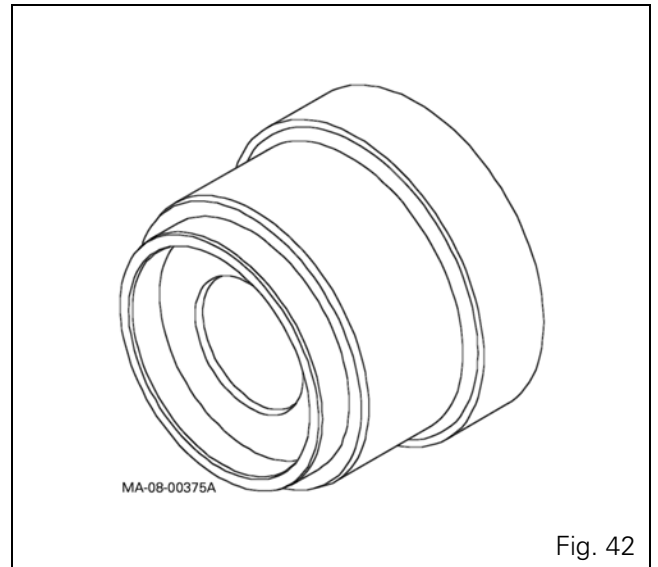
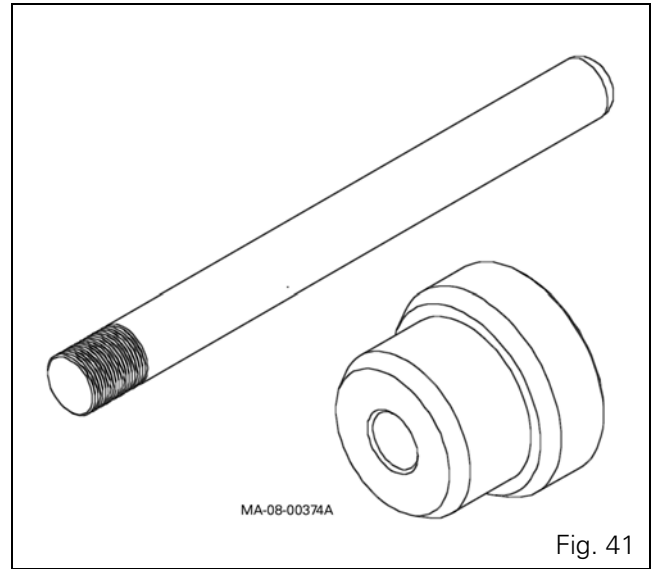
## Carraro suspension

- CA 715347, CA 715385 - Ring fitting tool (Fig. 38)
- CA 715348, CA 715384 - Spacer fitting tool (Fig. 39)
- CA 715349 - Bearing fitting tool (Fig. 40)



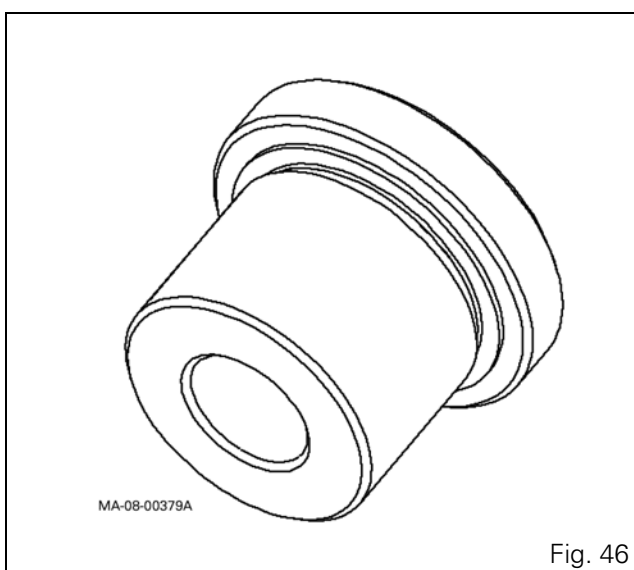
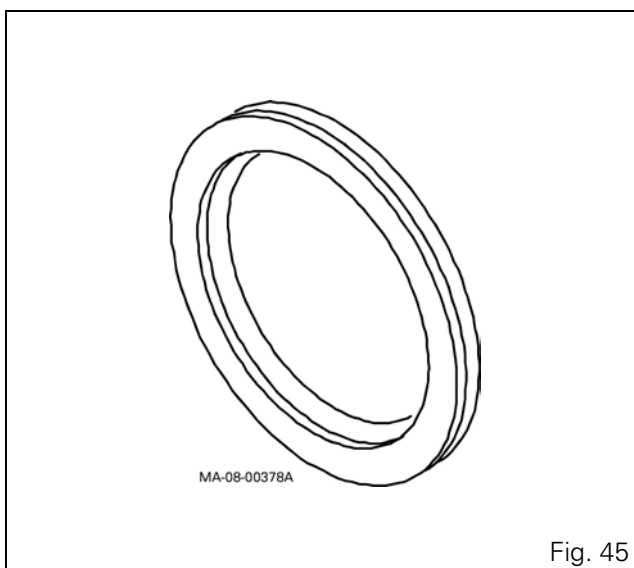
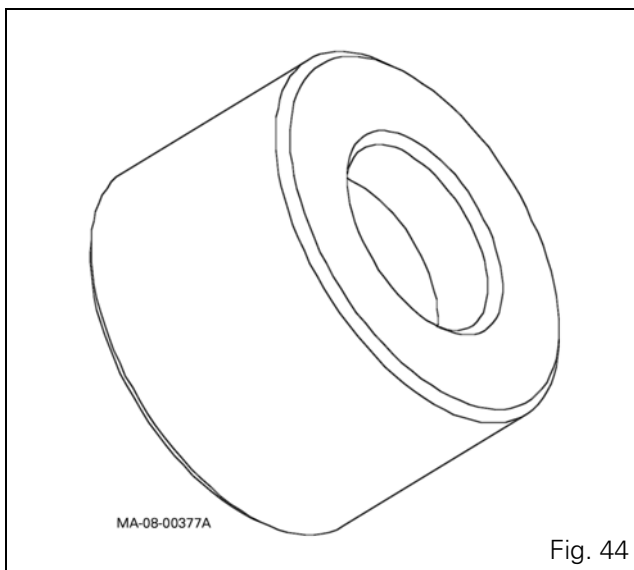
# Carraro suspension

- CA 715350 - Assembling kit (Fig. 41)
- CA 715351 - Seal fitting tool (Fig. 42)
- CA 715352 - Seal fitting tool (Fig. 43)



## Carraro suspension

- CA 715353 - Pin fitting tool (Fig. 44)
- CA 715361, CA 715381 - Dummy thrust washer (Fig. 45)
- CA 715364, CA 715384 - Spacer fitting tool (Fig. 46)





## Carraro suspension

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*8A18 - Carraro troubleshooting*

CONTENTS

**A . General ..... 3**

**B . Troubleshooting ..... 5**

**C . Problem identification and diagnostics ..... 7**





## A . General

The following table identifies problems and their possible causes. Each number corresponds to a suggested remedy.

Problems	Possible causes										
	1	2	3	4	5	6	7	8	9	10	11
Wheel vibration, front tyre resistance, broken stub axle	-	-	-		-						-
Steering difficult, the vehicle keeps on moving straight forward when the wheels are turned	-	-	-	-							-
Differential does not function, it gets jammed when steering	-			-	-						-
Excessive transmission noise	-	-	-	-	-		-		-		-
Excessive tyre wear	-	-	-	-	-	-	-				-
Friction noise	-			-	-			-	-	-	-
Vibration when driving forward, intermittent noise	-										-

### 1. Incorrect installation / Defective axle

Re-install. If differential tests after assembly are not satisfactory, repair or replace the differential.

### 2. Overload / incorrect weight distribution

Remove excess weight and distribute the load as indicated by the instruction supplied by the vehicle manufacturer.

### 3. Different wheel turning radii

If the radius of one wheel is smaller than that of its counterpart, partial wheel slippage can result when force is applied. The other wheel, with larger radius, will support the entire load. Replace the tyre or adjust the pressure to obtain the same radius for both tyres.

### 4. Broken stub axle

It is not recommended to drive with a broken stub axle. The vehicle can only be moved a few metres (engine stopped and at no load).

# Carraro troubleshooting

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## 5. Warped stub axle

Replace the stub axle concerned.

## 6. Differential jammed

Abnormal differential operation or broken or seized-up control mechanism. Check the differential assembly and all its components.

On vehicles with a high steering angle, this failure can cause jerky operation, difficulty steering or excessive tyre wear on narrow turns.

Reduce the steering angle to a minimum and reduce speed when vehicle begins to jerk.

## 7. Incorrect wheel alignment

Check the axle assembly and wheel bearings.

## 8. Broken or worn axle components

Check the condition of the ring gear, pinion, bearings, etc. Replace defective parts.

## 9. Dirty particles in the axle housing or incorrect assembly of certain components

Detect dirty particles. Check the assembly of different axle components.

## 10. Incorrect bevel gear shimming: transmission components worn (transmission gearing, pivot balls, etc.).

Shim or replace the concerned parts.

## 11. Product misuse

Refer to the instructions provided by the vehicle manufacturer.

## B . Troubleshooting

Problem	Cause	Action required
Ring gear teeth damaged on external side	<ol style="list-style-type: none"> <li>1. Excessive load on teeth in relation to design load.</li> <li>2. Incorrect backlash (excessive clearance).</li> <li>3. Loosening of the pinion nut.</li> </ol>	Replace the ring gear and pinion. Carefully follow the recommended adjustment operations for bevel gear clearance.
Ring gear teeth damaged on internal side	<ol style="list-style-type: none"> <li>1. Jerky load</li> <li>2. Incorrect shimming of teeth (insufficient clearance).</li> <li>3. Loosening of the pinion nut.</li> </ol>	Replace the ring gear and pinion. Carefully follow the recommended adjustment operations for bevel gear clearance.
Ring gear teeth and pinion teeth worn or damaged	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Contaminated fluid.</li> <li>3. Lubrication incorrect or containing diluting additives.</li> <li>4. Pinion pin clearance misadjusted and poor contact between pinion and ring gear caused by wear to the pinion bearings.</li> </ol>	Replace the ring gear and pinion. Replace the bearings, ensuring the correct positioning of the ring gear, pinion and bearings preloads. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Ring gear teeth and pinion teeth overheated. Check that the teeth have not lost their colouring	<ol style="list-style-type: none"> <li>1. Prolonged operation at excessive temperatures.</li> <li>2. Incorrect lubrication.</li> <li>3. Low oil level.</li> <li>4. Contaminated fluid.</li> </ol>	Replace the ring gear and pinion. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Pinion teeth corroded	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Insufficient lubrication.</li> </ol>	Replace the ring gear and pinion. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Axle beam warped	<ol style="list-style-type: none"> <li>1. Vehicle overload.</li> <li>2. Vehicle accident.</li> <li>3. Jerky load</li> </ol>	Replace axle beam.
Bearings worn or corroded	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Contaminated fluid.</li> <li>3. Excessive use.</li> <li>4. Normal use.</li> <li>5. Loosening of the pinion nut.</li> </ol>	Replace the bearings. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Oil leak at seals	<ol style="list-style-type: none"> <li>1. Prolonged use at excessive oil temperature.</li> <li>2. Incorrect assembly of oil seal.</li> <li>3. Damaged lip seal.</li> <li>4. Contaminated fluid.</li> </ol>	Replace the seal and mating surface if damaged. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.

# Carraro troubleshooting

<b>Problem</b>	<b>Cause</b>	<b>Action required</b>
Input flange splines excessively worn	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Loosening of the pinion nut.</li> <li>3. Pinion shaft clearance.</li> </ol>	<p>Replace the flange.</p> <p>Check the wear on pinion splines.</p> <p>If necessary replace the ring gear and pinion.</p>
Pinion teeth broken due to fatigue. Check if the rupture is straight (jagged)	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Prolonged overload.</li> </ol>	<p>Replace the ring gear and pinion.</p>
Pinion teeth and ring gear teeth broken	<ol style="list-style-type: none"> <li>1. Differential parts at breaking load.</li> </ol>	<p>Check and replace other differential parts if necessary.</p>
Pinion splines of sun gear excessively worn (excessive backlash)	<ol style="list-style-type: none"> <li>1. Excessive use.</li> </ol>	<p>Replace the pinions throughout the differential.</p> <p>If necessary, replace the stub axle.</p>
Thrust washer mating surface worn or scratched	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Incorrect lubrication.</li> <li>3. Contaminated fluid.</li> </ol>	<p>Replace with a new washer if scratched or if thickness is under 0.1mm.</p> <p>Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.</p>
Taper roller bearing internal diameter worn	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Excessive pinion axial clearance.</li> <li>3. Insufficient lubrication.</li> <li>4. Contaminated fluid.</li> </ol>	<p>Replace bearing. Check pinion axial clearance.</p> <p>Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.</p>
Stub axle warped or broken	<ol style="list-style-type: none"> <li>1. Excessive use or vehicle overload.</li> </ol>	<p>Replace the defective stub axle.</p>
Stub axle broken at wheel side	<ol style="list-style-type: none"> <li>1. Wheel support loose.</li> <li>2. Axle beam warped</li> </ol>	<p>Replace the defective stub axle.</p> <p>Ensure that the axle beam is not warped.</p> <p>Ensure that the wheel support is not worn or misadjusted.</p>

## C . Problem identification and diagnostics

Problem	Cause	Action required
Noise when vehicle is moving	<ol style="list-style-type: none"> <li>1. Excessive backlash between the ring gear and pinion.</li> <li>2. Ring gear or pinion worn.</li> <li>3. Pinion bearings worn.</li> <li>4. Pinion bearings loose.</li> <li>5. Excessive pinion axial clearance.</li> <li>6. Differential bearings worn.</li> <li>7. Differential bearings loose.</li> <li>8. Excessive ring gear out-of-round.</li> <li>9. Hydraulic fluid low.</li> <li>10. Insufficient or incorrect grade lubricant.</li> <li>11. Stub axle warped.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust backlash.</li> <li>2. Replace the defective component.</li> <li>3. Replace the bearings.</li> <li>4. Adjust the bearings.</li> <li>5. Adjust backlash.</li> <li>6. Replace the bearings.</li> <li>7. Adjust the bearings.</li> <li>8. Replace the ring gear.</li> <li>9. Top up level.</li> <li>10. Change lubricant.</li> <li>11. Replace the stub axle.</li> </ol>
Noise when engine is in neutral position	<ol style="list-style-type: none"> <li>1. Noises caused by the axle can generally be heard faintly when the engine is in neutral position.</li> <li>2. Incorrect backlash between the pinion and ring gear (the noise can be heard at the end of deceleration, when the engine starts to accelerate).</li> <li>3. Input flange or pinion excessively worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust or replace (see above).</li> <li>2. Adjust backlash.</li> <li>3. Replace defective parts.</li> </ol>
Intermittent noise	<ol style="list-style-type: none"> <li>1. Ring gear damaged.</li> <li>2. Differential unit bolts loose.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the bevel gear.</li> <li>2. Tighten to the required torque.</li> </ol>
Continuous noise	<ol style="list-style-type: none"> <li>1. Ring gear or pinion damaged.</li> <li>2. Bearings worn.</li> <li>3. Pinion splines worn.</li> <li>4. Stub axle warped.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the bevel gear.</li> <li>2. Replace the bearings.</li> <li>3. Replace the pinion.</li> <li>4. Replace the stub axle.</li> </ol>
Noise when changing steering angle	<ol style="list-style-type: none"> <li>1. Differential pinion gears worn.</li> <li>2. Differential unit and / or spider worn.</li> <li>3. Differential thrust washers worn.</li> <li>4. Stub axle splines worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the pinion gears.</li> <li>2. Replace defective components.</li> <li>3. Replace the bearings.</li> <li>4. Replace the stub axle.</li> </ol>



*8B10- CARRARO 20.48 - General*

CONTENTS

**A . General description . . . . . 3**

**B . Safety instructions . . . . . 19**





## A . General description

---

The axle described in this manual has been designed and produced according to the customer's specifications. It comprises a housing containing the differential in its central section and a wheel hub assembly at each end.

The differential is "Limited slip" type, and is held in place by two half bearings mounted on a suitable support allowing adjustment of the crownwheel and pinion assembly.

The bevel ring gear is adjusted using two nuts fitted opposite one another.

The bevel gear is supported by two bearings and is adjusted using shims.

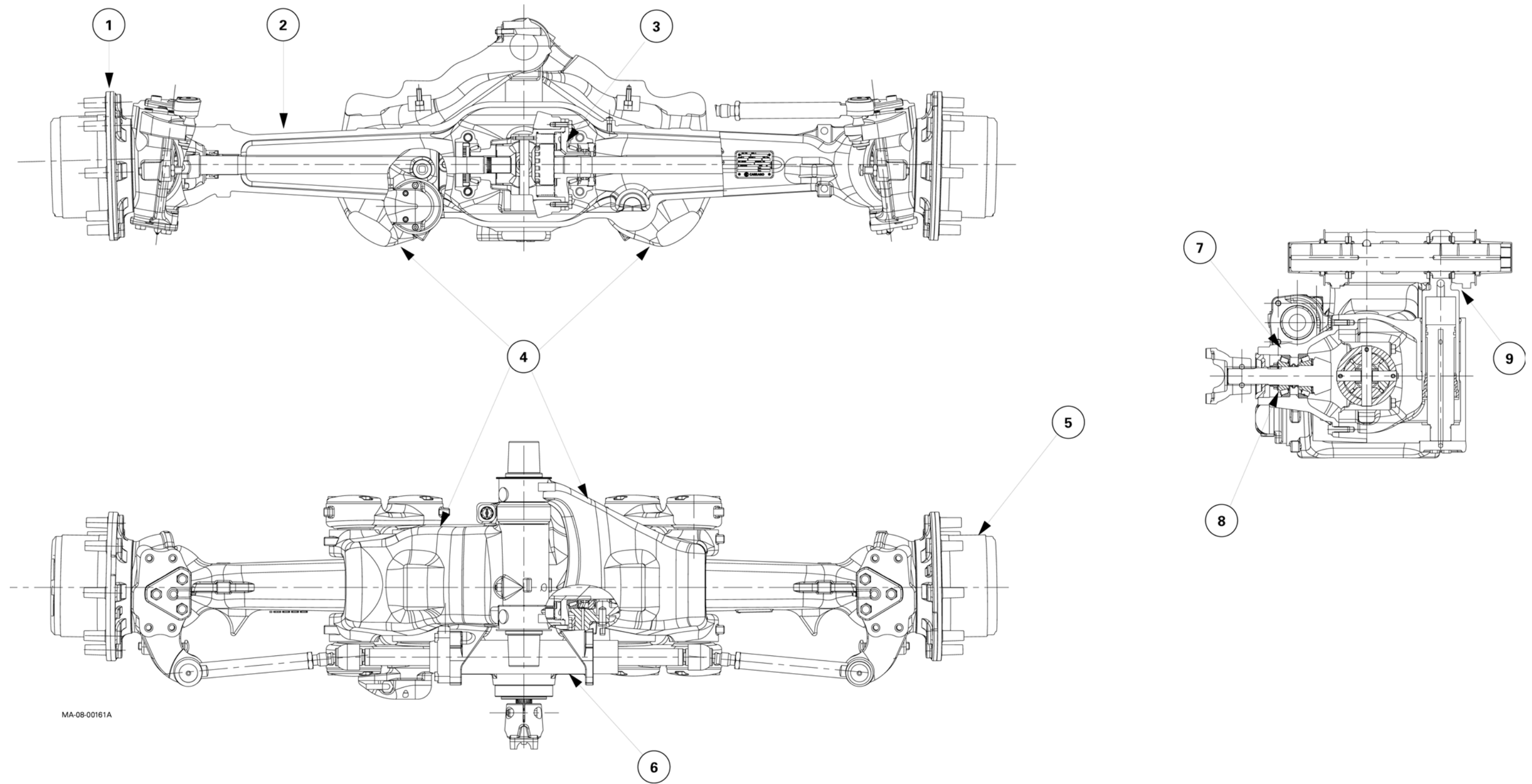
The wheel hubs containing the final drives are held in place by two taper roller bearings and driven by a hydraulically-controlled steering unit.

The axle is fitted with electronically-controlled hydropneumatic suspension (patented by Carraro), which ensures constant contact between the tyres and the ground, regardless of operating conditions.

## Parts list (Fig. 1 and Fig. 2)

- (1) Hub assembly
- (2) Axle beam assembly
- (3) Differential assembly
- (4) Arm assembly
- (5) Final drive assembly
- (6) Steering ram assembly
- (7) Differential housing assembly
- (8) Pinion assembly
- (9) Suspension ram assembly

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Fig. 1

**CARRARO 20.48 - General**

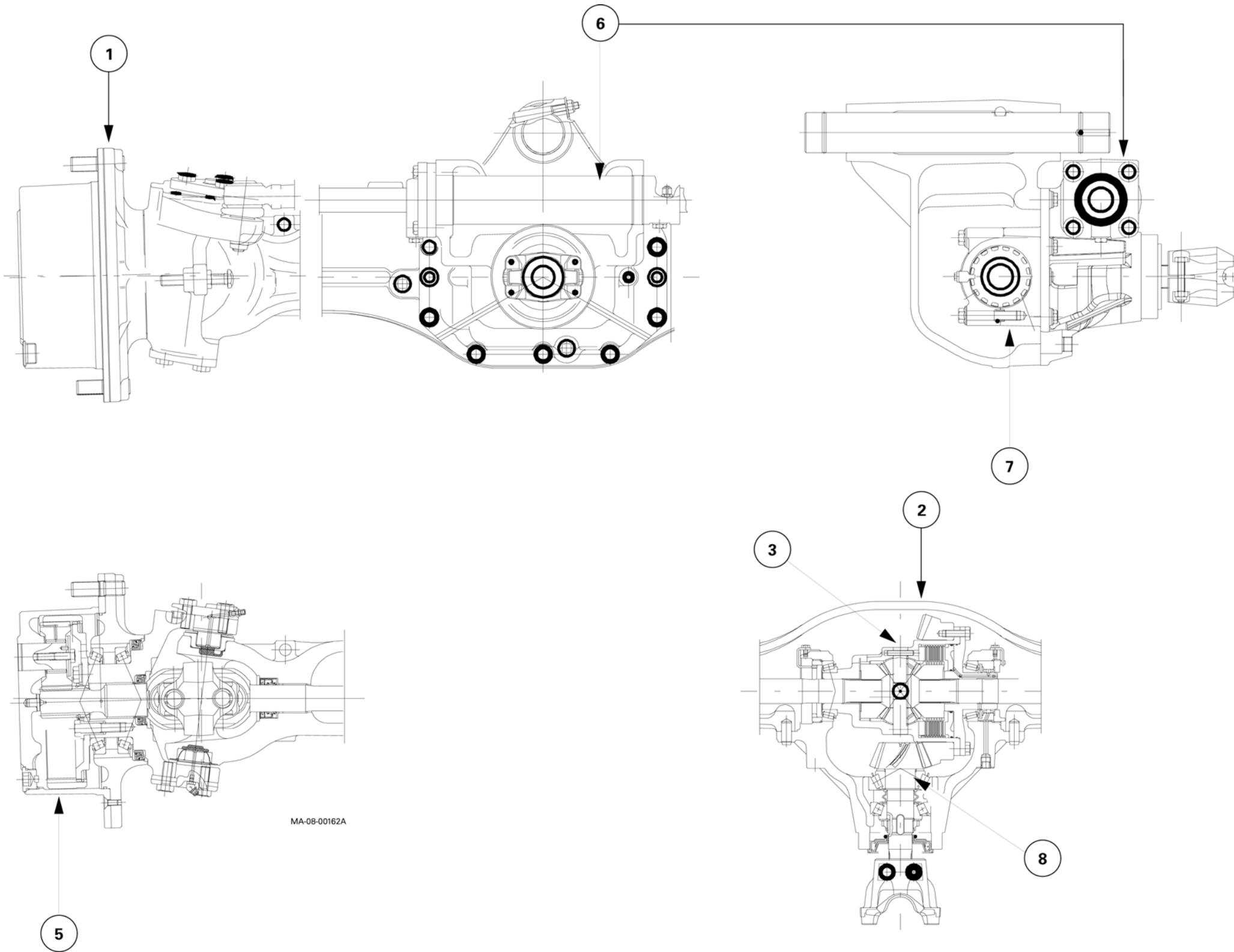


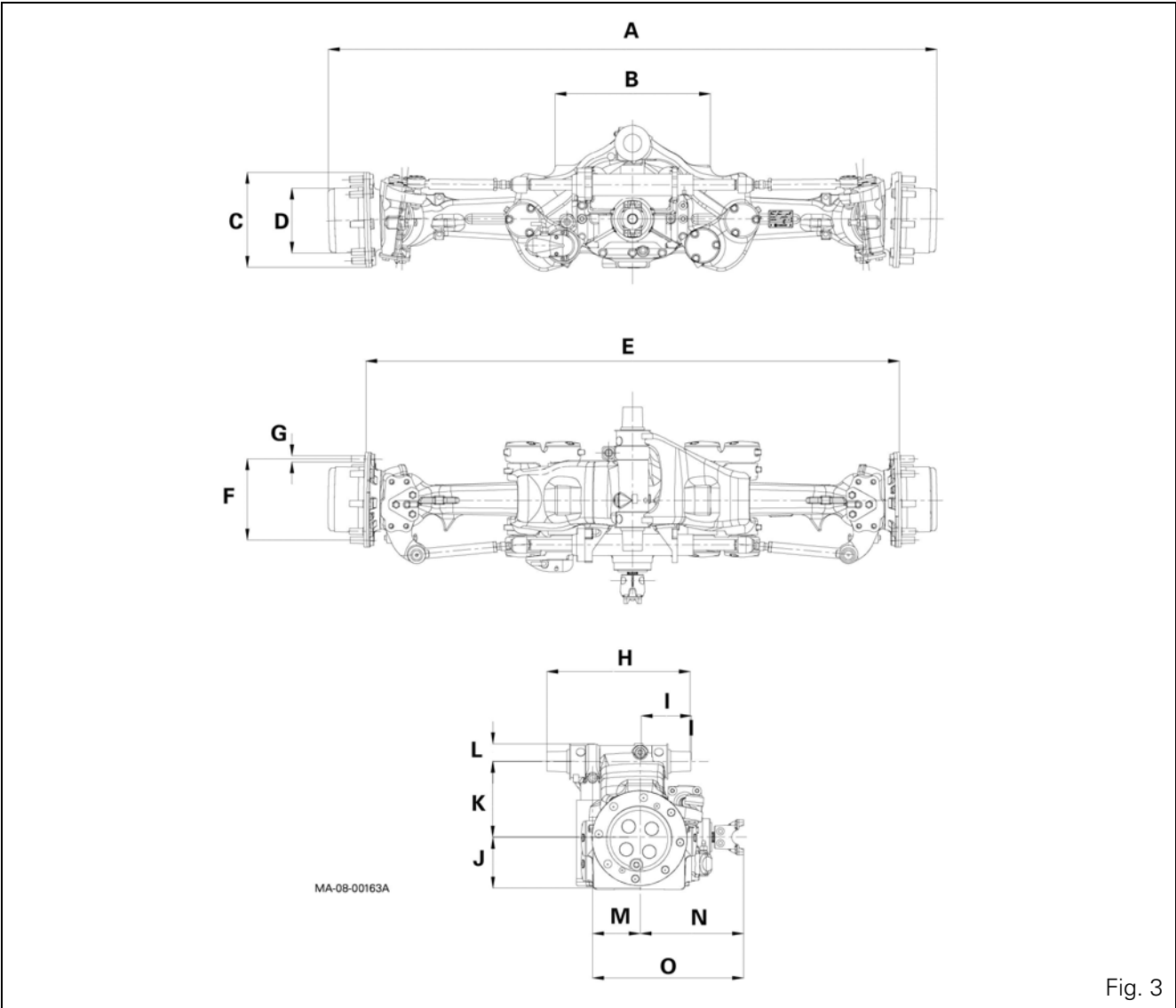
Fig. 2

**Dimensions**

All values in the following tables are given in millimetres.

Dimensions for Model 20.48 S

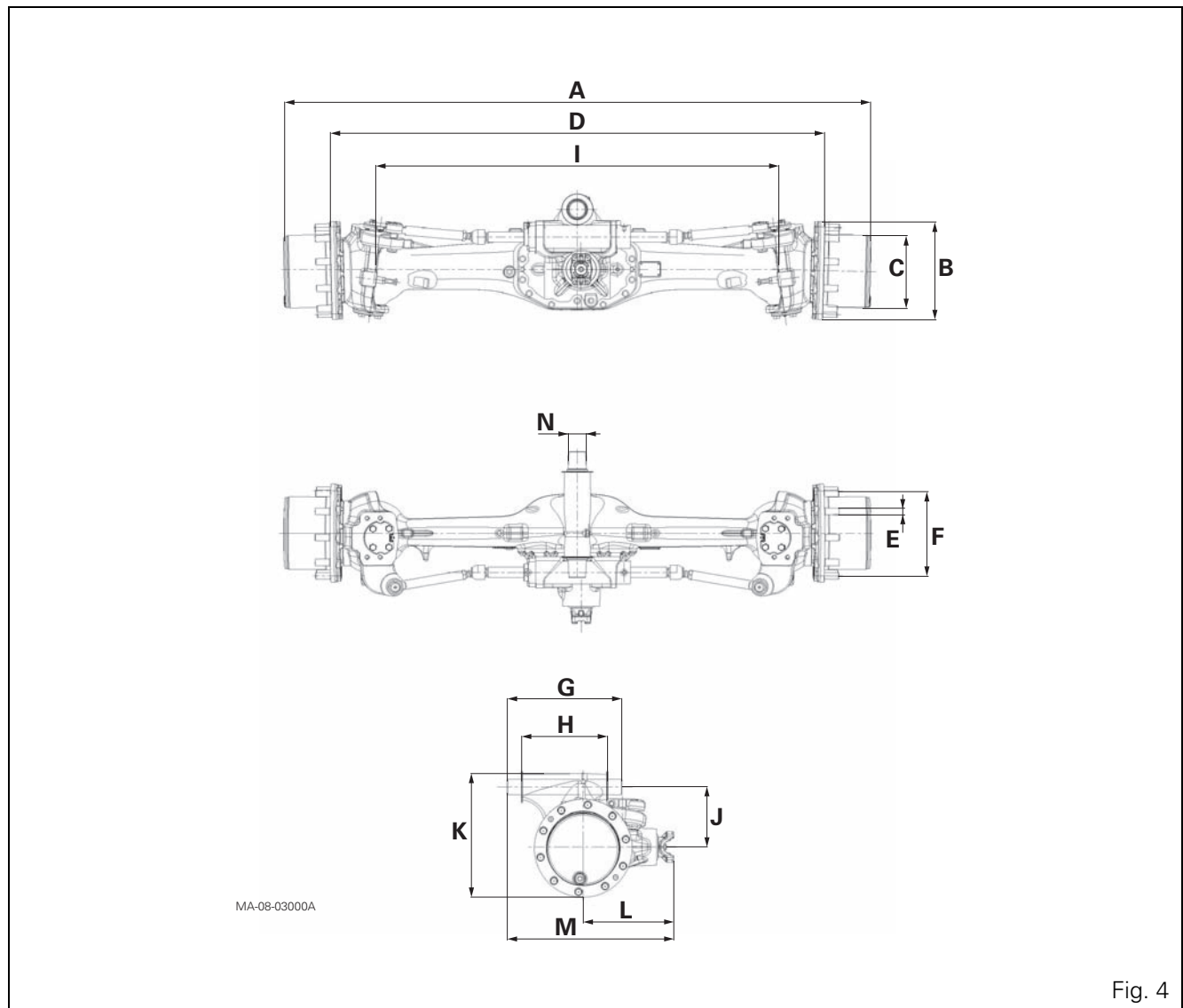
A = 2244	F = Ø 335	K = 270 ± 45
B = 547	G = M22 x 1.5	L = 57
C = Ø 380	H = 457	M = 160
D = Ø 280.8	I = 164	N = 347
E = 1890	J = 183	O = 507



# CARRARO 20.48 - General

Dimensions for Model 20.48 ACP

A = 2245	F = Ø 335	K = 474.6
B = Ø 380	G = 456	L = 347
C = Ø 280.8	H = 324	M = 661
D = 1890	I = 1550	N = Ø 60
E = M22 x 1.5	J = 230	-



## Product identification

The Carraro front axle is identified by a plate on the axle (Fig. 5).

## Parts list

- (1) Axle type
- (2) Serial no.
- (3) Carraro no.
- (4) Customer code
- (5) Total reduction ratio
- (6) Direction of rotation
- (7) Differential type
- (8) Differential oil type
- (9) Differential oil quantity
- (10) Final drive oil type
- (11) Final drive oil quantity

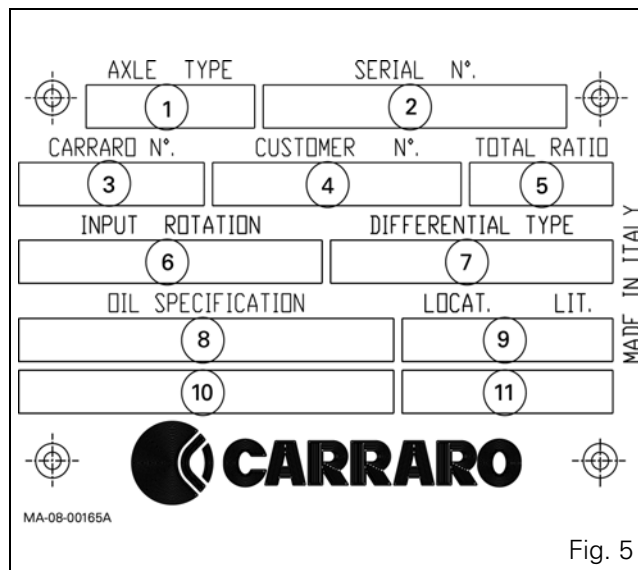


Fig. 5

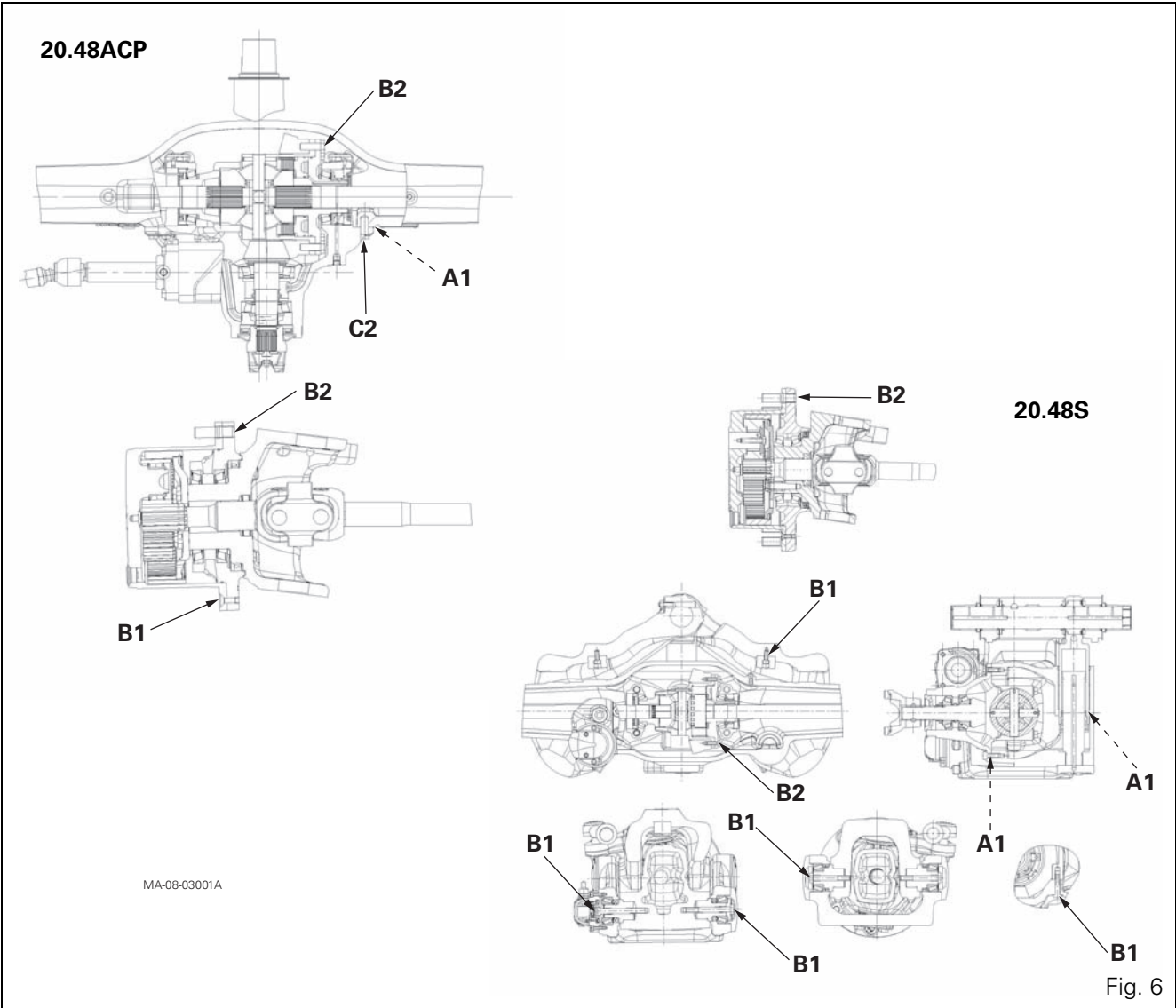
## CARRARO 20.48 - General

### Technical characteristics

DESCRIPTION	VALUES	
	20.48	
	ACP	S
Differential	3.27/1	
Final drive	6.41/1	
Total reduction	20.945/1	
Unloaded weight	480 kg	741 kg
Input rotation	Anticlockwise	
Differential type	Hydraulically-operated multidisc wet clutch	
Maximum steering angle	55°	
Wheel alignment	A O-2	
Oil specifications	SAE 85W-140 EP In compliance with standards API GL4–GL5 respectively MIL-L-2105 and MIL-L-2105D	
Differential oil capacity (litres)	10	10
Final drive oil capacity (litres)	1.9 + 1.9	1.9 + 1.9
Differential lock clutch supply pressure	20 bar	



Retaining compounds and sealing products (Fig. 6)



A1	Loctite 510	B2	Loctite 270
B1	Loctite 542	C2	Loctite 496
Apply to mating surfaces		—	
Apply to screw threads and pins		---	

# CARRARO 20.48 - General

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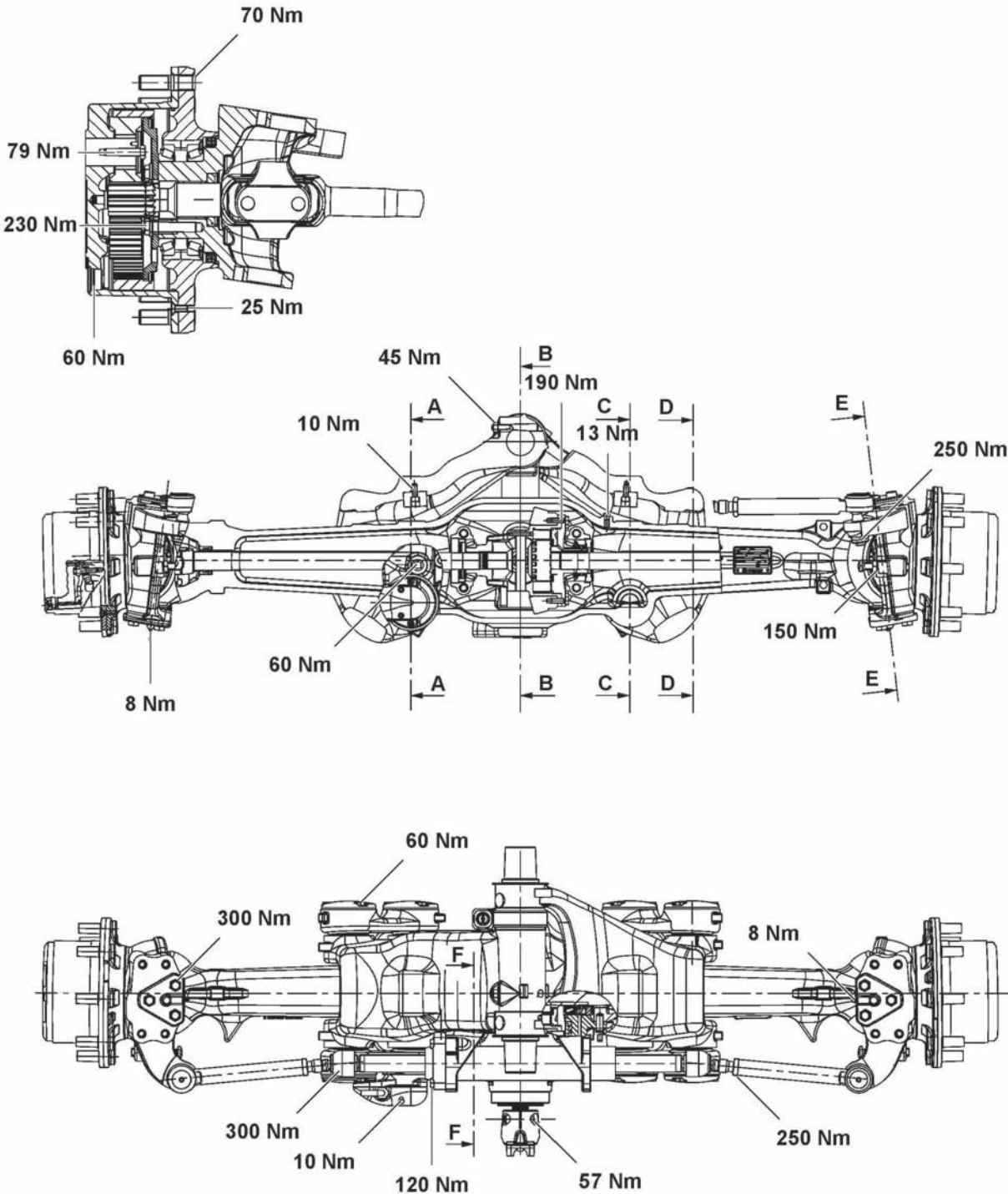
## Tightening torques

References for all tightening torques are given in the following figures:

**Tightening torques for Model 20.48S (Fig. 7 and Fig. 8)**

**Tightening torques for Model 20.48ACP (Fig. 9)**

**Tightening torques 20.48S**

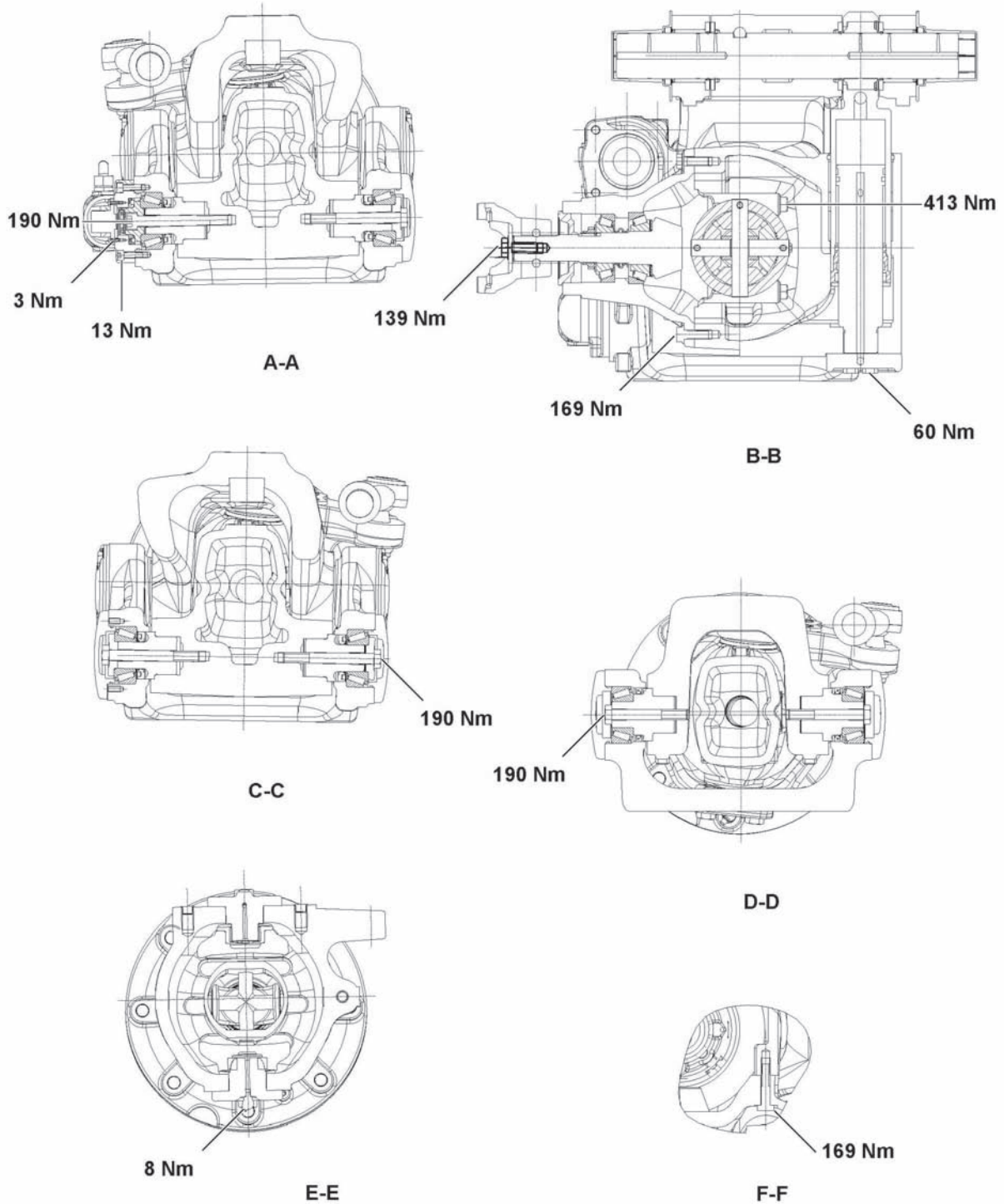


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Fig. 7

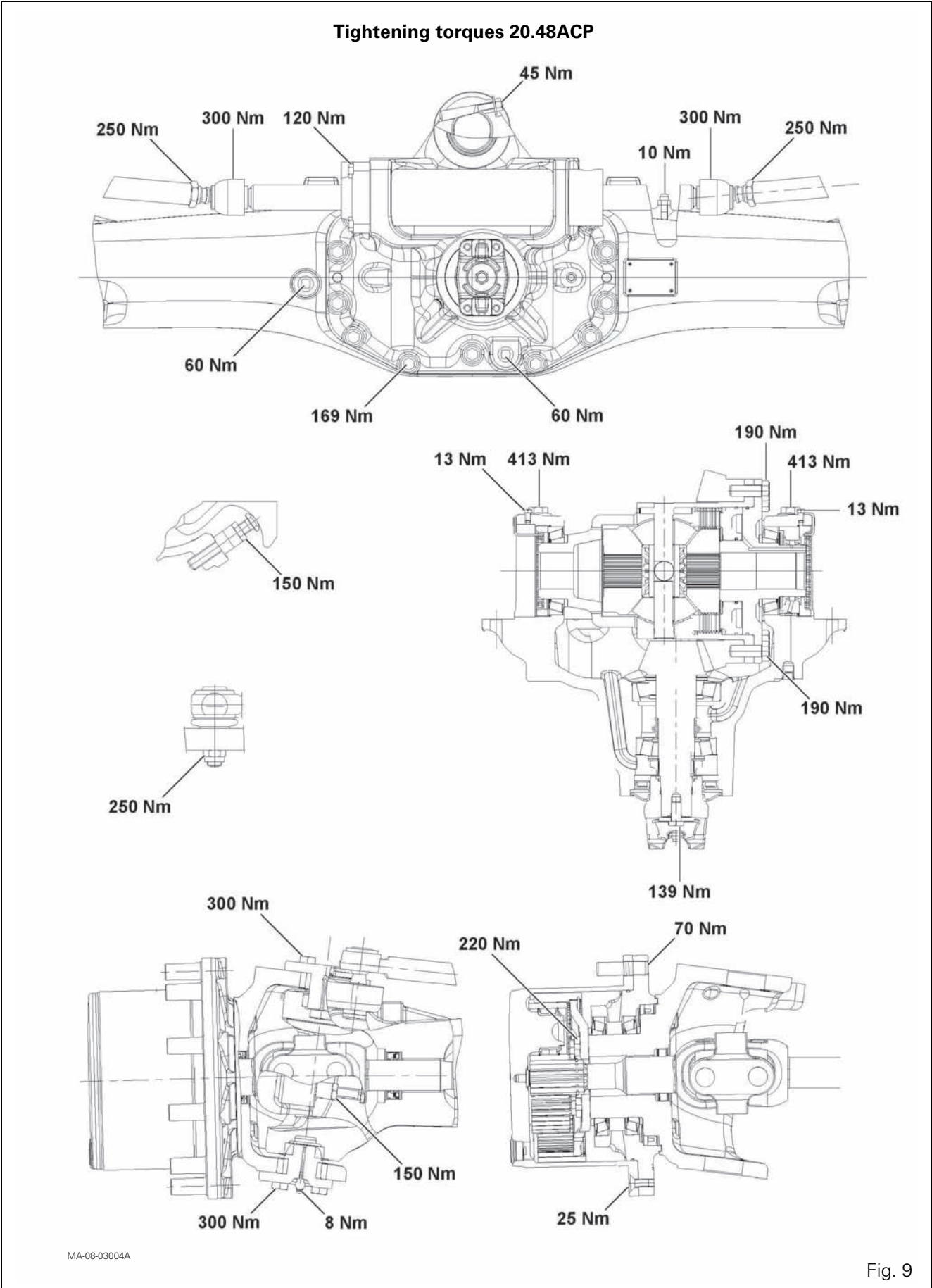
# CARRARO 20.48 - General

## Tightening torques 20.48S



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Fig. 8



## CARRARO 20.48 - General

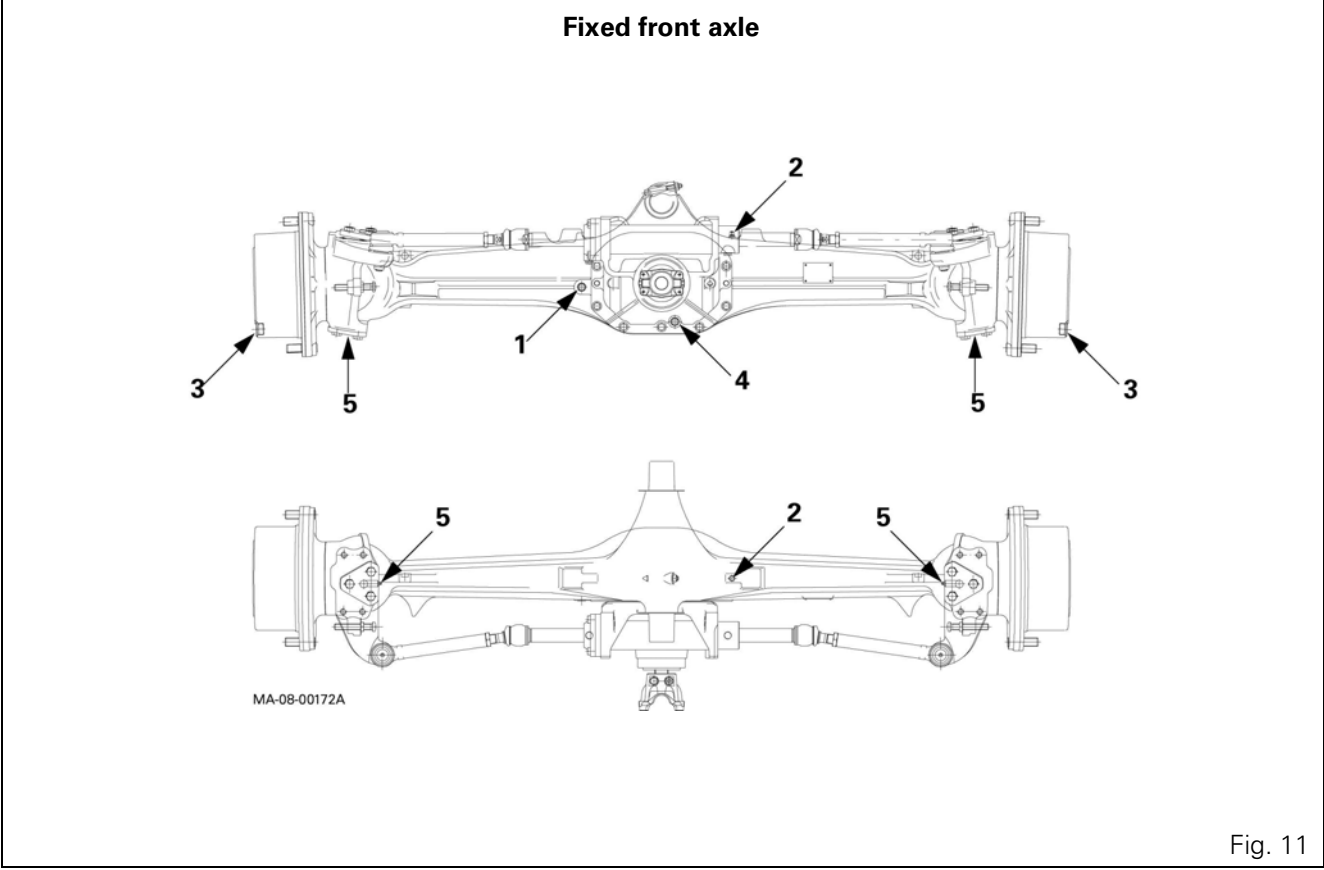
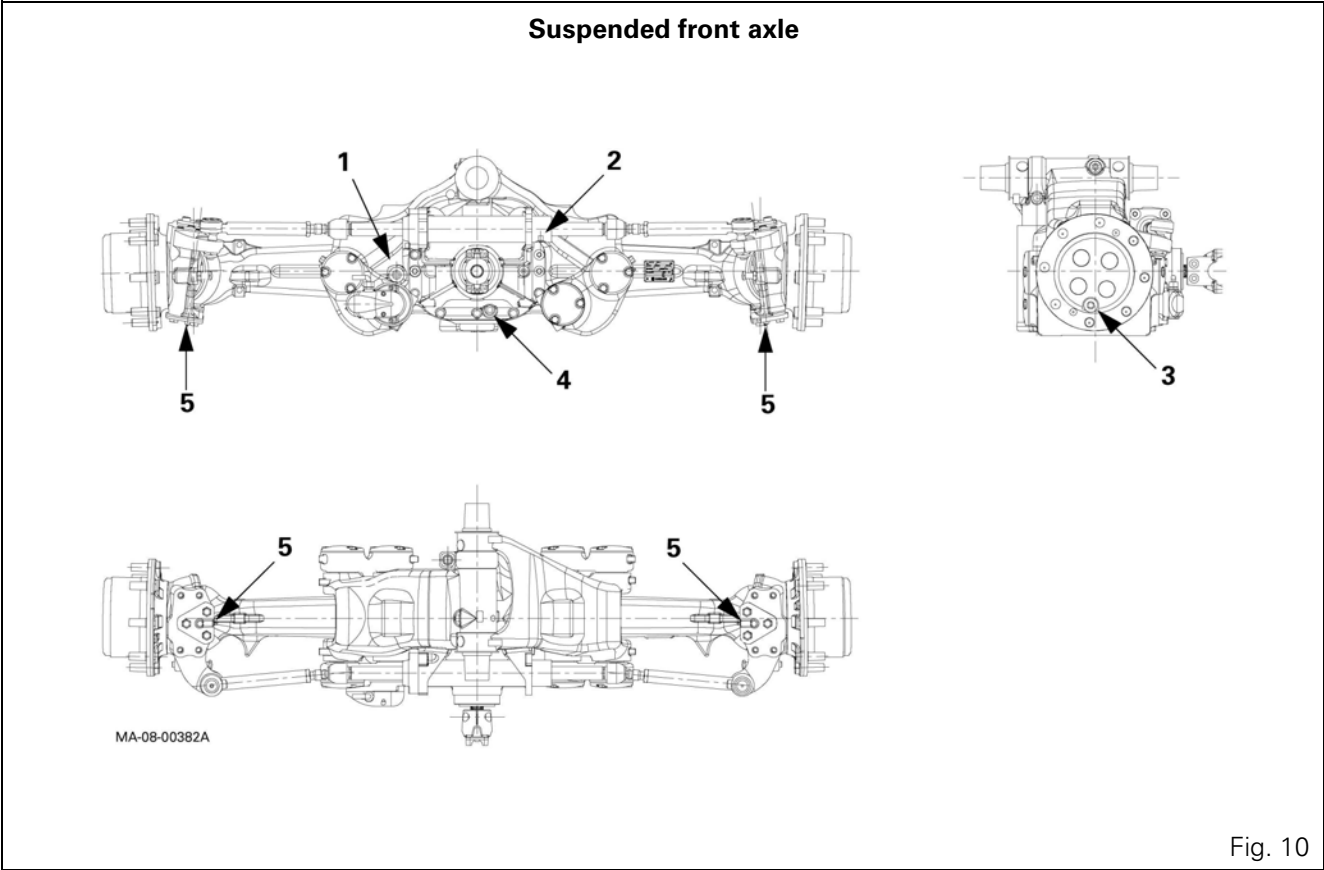
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Topping up and checking oil levels  
(Fig. 10–Fig. 11)

Specific description	Position
Oil filler plug and oil level plug	1
Oil breather	2
Oil filler/drain and level plug in final drive	3
Differential oil drain plug	4
Lubrication points	5

### Routine inspections

- The oil level in the axle must be level with the level plugs (1) and (3). If it is not, top up with the same oil.
- In case of a leak or any other factor causing the oil level to drop, it is recommended to carry out an immediate check to prevent damage to mechanical parts.
- Unscrew and remove plugs (4) and (3) to drain the oil.



# CARRARO 20.48 - General

## General checks

1. The disassembly and reassembly instructions require the tractor axle to be removed beforehand and placed on a suitable workbench.

Some of the following figures may show axles that differ slightly from your model, but the procedure is the same.

Before draining the oil, loosen the breather (1) (Fig. 12) to release any internal residual pressure.

Drain the oil via the draining port (2), then tighten the drain plug to the required torque using a torque wrench (see § A) (Fig. 12).

2. Before unscrewing the oil filler plug (3), systematically loosen the breather (1) to release any internal residual pressure (Fig. 13).

Check the oil level and top up if necessary.

Tighten the oil filler plug to the required torque using a torque wrench (see § A).

3. Before draining or topping up the oil in the final drive units, turn the wheel hub so that the filler port (Fig. 14) is at its highest point, then loosen the relevant plug to release any internal residual pressure (Fig. 14).

Position the wheel hub so that the filler port is in the horizontal axis.

Check the oil level and top up if necessary.

Tighten the plug in question to the required torque using a torque wrench (see § A).

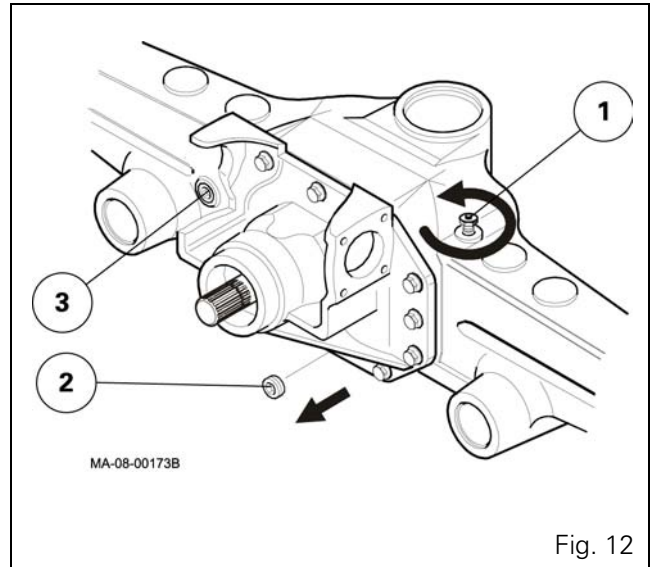


Fig. 12

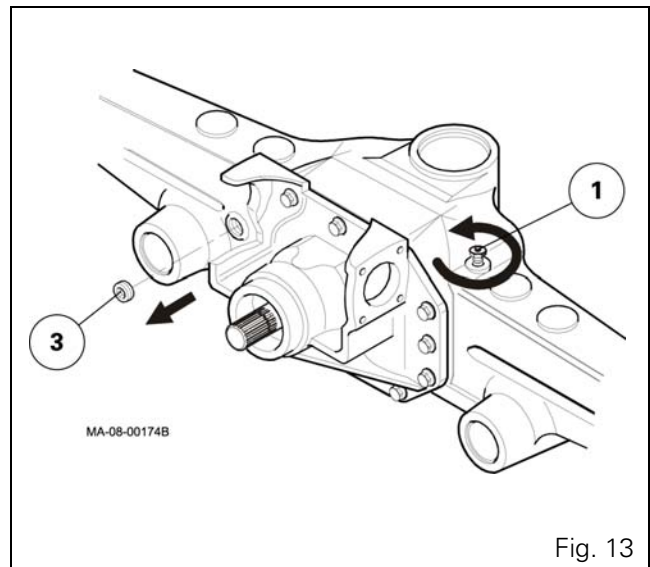


Fig. 13

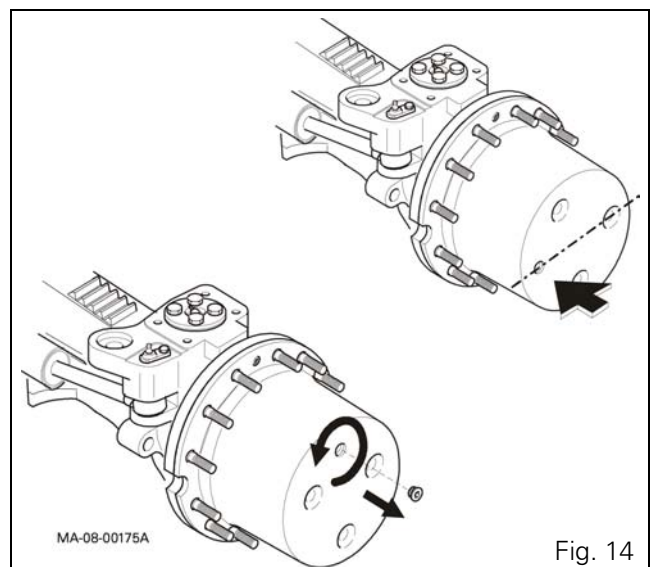


Fig. 14



## B . Safety instructions

### Important

- Read this section carefully before carrying out any operation.

### Safety precautions

- Safety and reliability largely depend on the correct use and repair of the axles and their components.
- The recommendations and all procedures described in this manual have been tested and are therefore proven operational methods. For this reason, each procedure should be followed by referring both to the text and to the accompanying illustrations.
- Some procedures describe the use of specialised tools that are designed to enable tasks to be carried out efficiently and precisely.
- These tools should be used to carry out specific operations.
- It is impossible to provide advice for all working methods, to know all possible methods of performing a task, or to foresee all possible consequences of the risks involved in each task. For this reason, if the operator does not adhere to the procedures or tools recommended in this manual, he puts himself and his assistants in danger and may damage the vehicle.



**CAUTION: Safety goggles must be worn for all disassembly and reassembly operations.**

- Safety instructions, accident prevention regulations and all general safety regulations in force should be followed at each step of the operation.
- Before starting any maintenance or repair work, ensure that all tools, workbenches, fixtures, levers, extractors and wrenches are in good working condition to make the operation easier.
- In addition, this precaution reduces the risk to parts and components and makes working conditions safer for the operator.
- Carraro does not accept any liability for damage or accidents caused by arbitrary changes made to the product.
- Carraro does not accept any liability if the product is used for any purposes other than those prescribed. In this case, all consequences shall be borne by the customer.

### Safety rules for maintenance

1. Carry out work in a clean, dry working environment.
2. Do not lubricate, handle or adjust the axle while it is moving.
3. Keep hands, feet and clothing away from moving parts.
4. Always be prepared in case of fire. Keep a fire extinguisher and a first aid kit close to hand.
5. Keep emergency phone numbers (nearest doctor, ambulance, hospital, fire station) close to the telephone.
6. Suitable protective clothing, for example overalls, gloves and a safety helmet, must be worn.
7. Suitable hearing protection, either earmuffs or earplugs, must be worn to protect the ears from noise and prevent damage to hearing.  
Prolonged exposure to noise can damage the hearing.
8. The operator must pay special attention to the equipment. He should not wear headphones to listen to music while working on the product or installation.

### Preventing residual risks

- Risk of crushing or tearing by moving parts.



**CAUTION: All maintenance work should be carried out while the machine is stationary.**

- There is a risk of inhaling toxic gases released by melting paintwork when welding.



**CAUTION:**

- **Use workstations equipped with dust, smoke and fume extraction systems.**
- **Wait at least 15 minutes for smoke and fumes to disperse before resuming welding or heating work or before working on the installation.**

## CARRARO 20.48 - General

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- Risk of fire associated with use of solvents with oil in the axle.



**CAUTION:**

- **Remove all heat sources from the working area.**
  - **If solvents or paint strippers have been used, remove all traces using soap and water before starting to weld.**
  - **Any containers of solvent, paint stripper or any other flammable product must be removed from the working area.**
- 
- Risk associated with parts or oil falling, being thrown or expelled suddenly from the axle.



**CAUTION: These residual risks and the measures taken to completely eliminate them are described in detail in the disassembly and reassembly procedures. During maintenance operations, all safety procedures described in this manual should be followed with extreme care.**

*8B11 - CARRARO 20.48 - Final drive units*

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## CARRARO 20.48 - Final drive units

---

## A . General

Some of the following pictures may not show your exact axle, but the procedure is the same.

## B . Disassembling the steering ram assembly

### Preliminary steps

1. Chock the rear wheels. Apply the handbrake.  
**NOTE:** Because the 4 WD clutch is mechanically engaged when stationary, raise the two front wheels so that the hub of the wheel in question can be turned freely.
2. Place stands in position.
3. Remove the wheel concerned.
4. Drain the drive unit.

### Disassembling the steering ram assembly

5. Loosen the selector rail locknut by several turns until it is at the same level as the threaded stud (Fig. 1).
6. Strike the nut with a hammer to extract the selector rail from the swivel housing (Fig. 2).  
**NOTE:** This will destroy the nut.  
For disassembling the steering ram, see chapter 9.

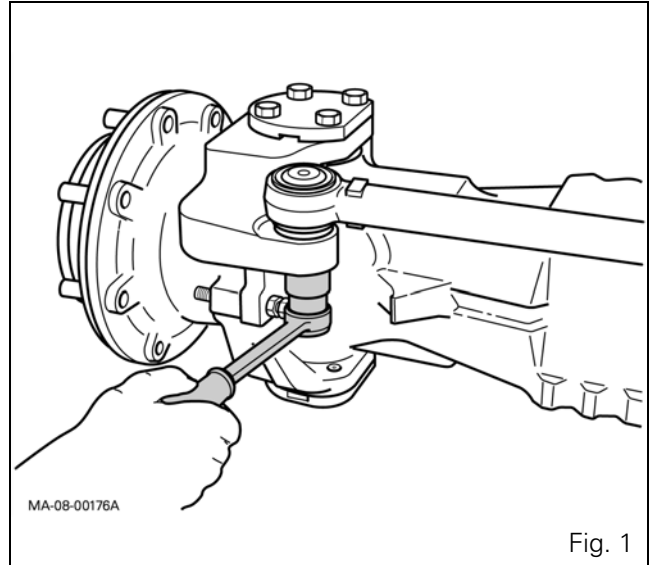


Fig. 1

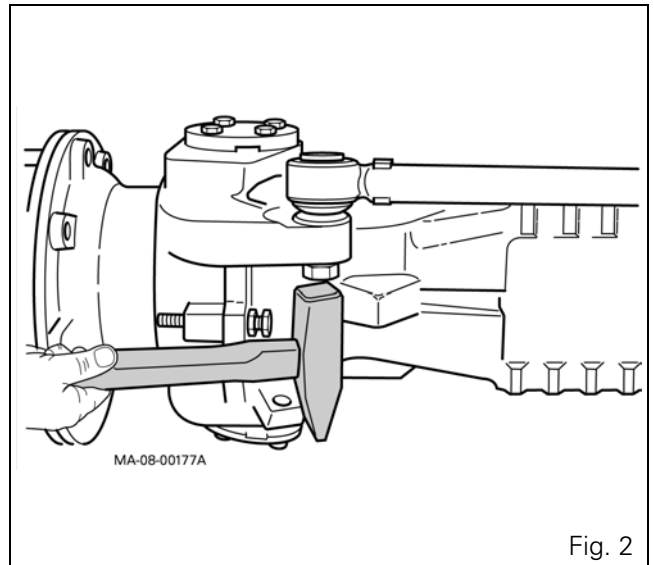
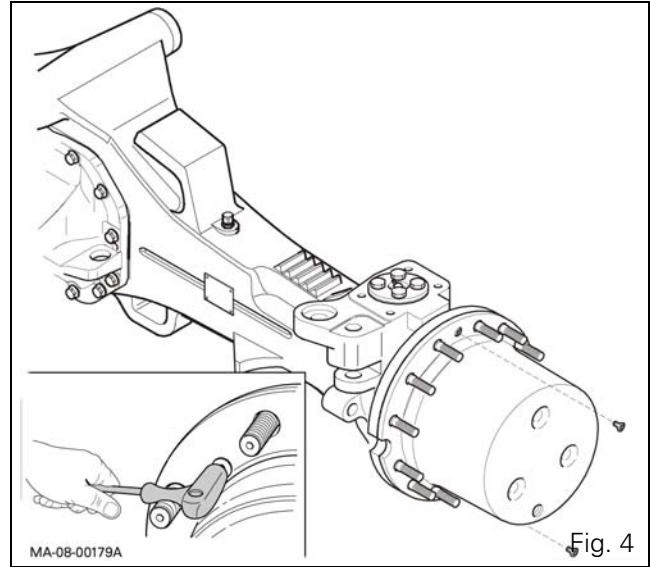
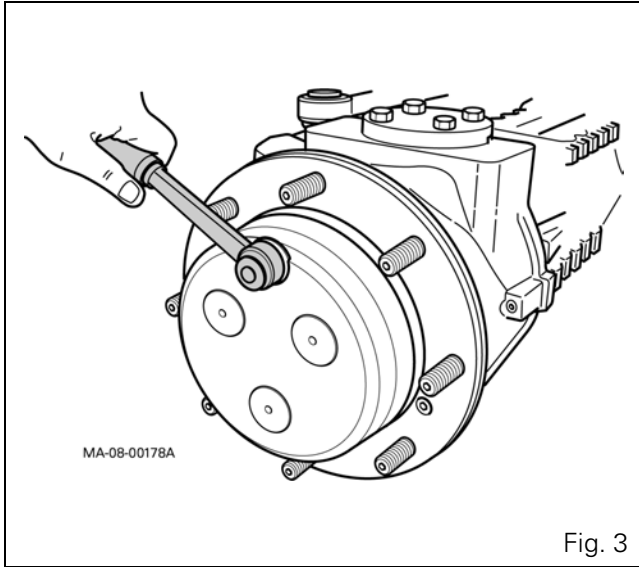


Fig. 2

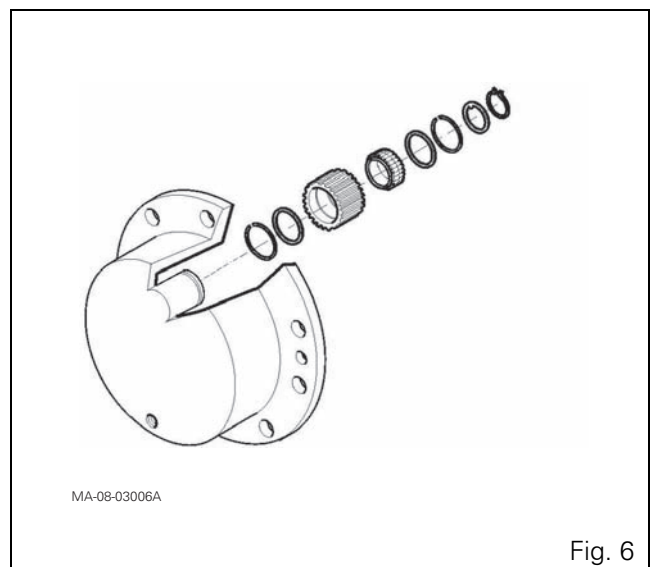
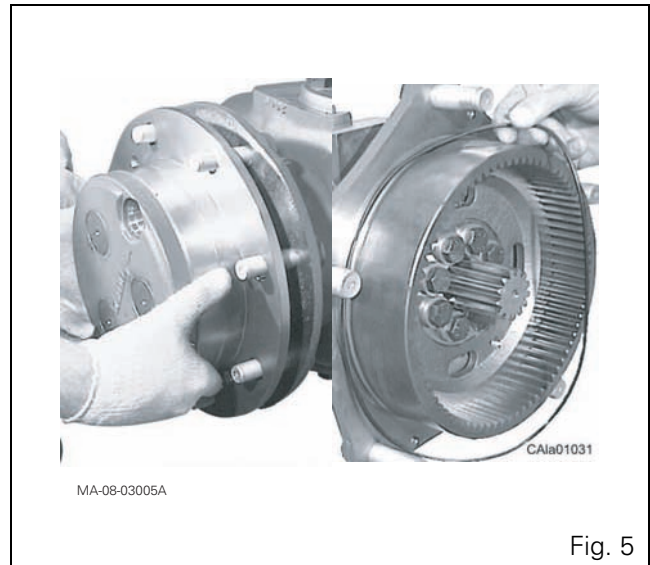
# CARRARO 20.48 - Final drive units



## C . Removing the final drive assembly

7. Before draining the oil, position the wheel hub with the plug at its highest point and loosen the plug by several turns to release any internal residual pressure, then loosen it completely (Fig. 3). Turn the hub again to position the plug at its lowest point. Completely drain the oil.
8. Loosen and remove the two planet carrier screws using a wrench (Fig. 4).  
Extract the planet carrier from the wheel hub and the "O" ring (Fig. 5).  
Place the planet carrier on a workbench and check it for wear.
9. Replace planetary gears as necessary:
  - remove the fixing circlips on each planetary gear
  - remove the tab washer
  - remove the planetary gears from their pins
  - remove the retaining rings that hold the bearings in place from each planetary gear
  - collect the roller bearings and washers and check their condition

**NOTE:** It is recommended that you replace the bearings when installing new planetary gears.



## D . Disassembling the wheel hub

Before disassembling the wheel hub, it is recommended that you attach it with a belt or sling to a hoist or other suitable lifting device to prevent it from falling accidentally, risking injury to the operator and damage to the wheel hub.

Some of the following pictures may not show your exact axle, but the procedure is the same.

**10.** Insert a lever between the swivel housing and slide it into the universal joint. Push on the joint with the lever in the direction of the final drive unit to remove the circlip more easily (Fig. 7).

Remove and discard the circlip (Fig. 8).

Remove the washer (Fig. 9).



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Fig. 7



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Fig. 8



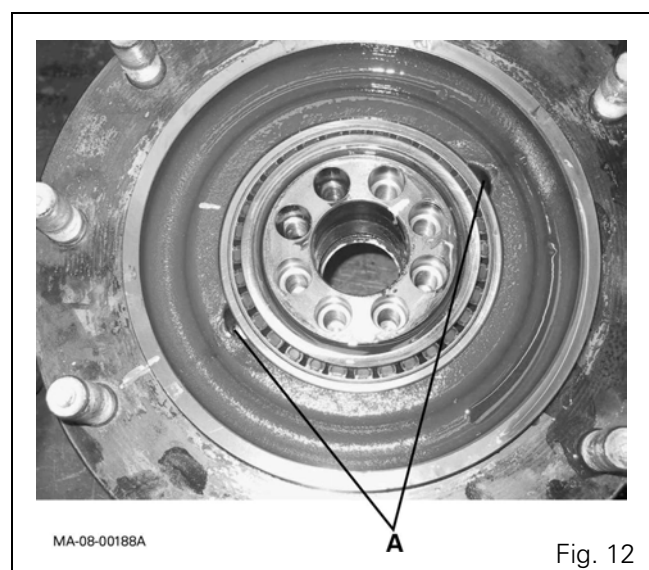
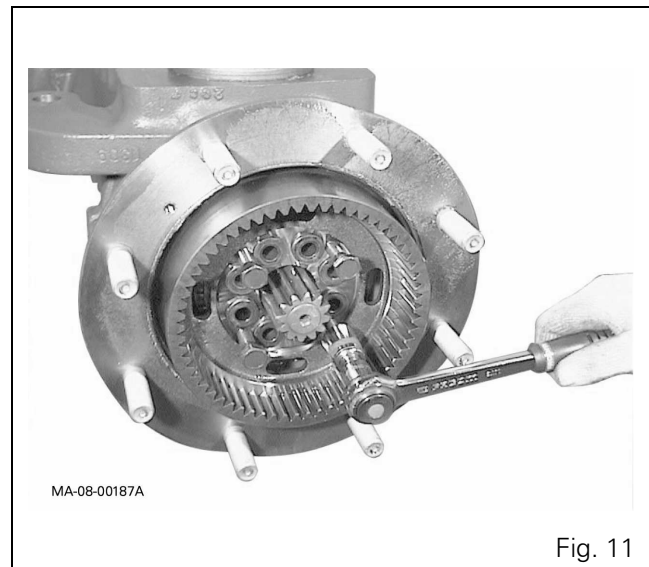
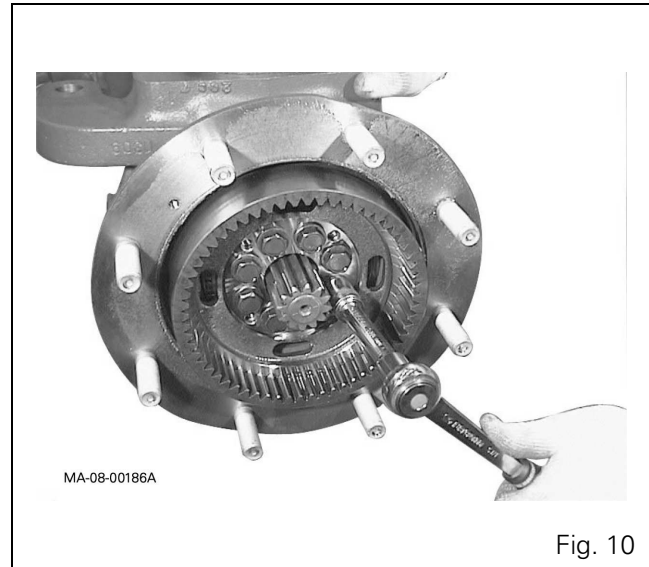
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Fig. 9

## CARRARO 20.48 - Final drive units

11. Loosen and remove the screws from the ring gear carrier assembly (Fig. 10)
12. To remove the ring gear assembly from its seating, screw at least two of the screws that have just been removed into the threaded extraction holes (Fig. 11). While watching the ring gear ports, avoid positioning the screws on the cast iron slots (Fig. 12).

**IMPORTANT:** Do not reuse these two screws when reassembling the ring gear.





- 13.** Remove the ring gear carrier with the epicyclic ring gear.

Remove the snap ring and detach the ring gear carrier from the epicyclic ring gear (Fig. 13). Check the condition of the parts. If necessary, remove the locating rings from the locking ring gear of the hub using a hammer and tool ref. CA715278 (see § K)

- 14.** Remove the wheel hub using levers and a hammer to facilitate the operation (Fig. 14).

**NOTE:** Retain the bearing cone.

- 15.** Place the wheel hub on a level surface and extract the sealing ring (A) with a lever.

**NOTE:** This will destroy the sealing ring.

Remove the bearing cups B on either side of the hub using a hammer and a suitable extractor.

Remove the bearing cone from the swivel housing side using a suitable extractor (Fig. 15).

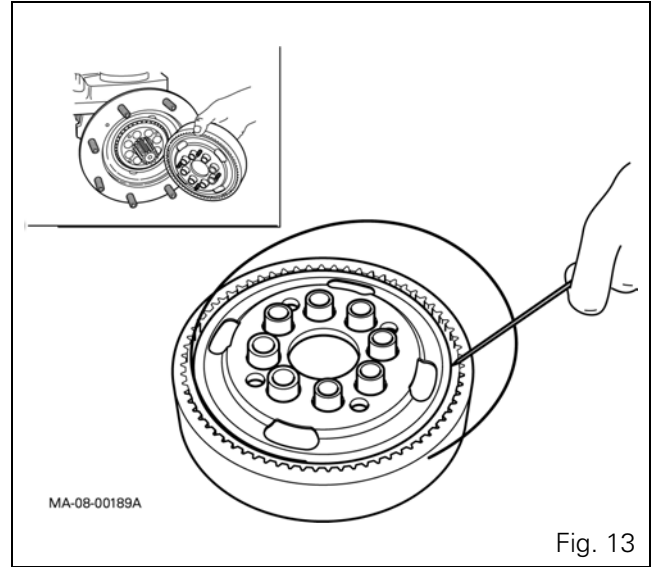


Fig. 13

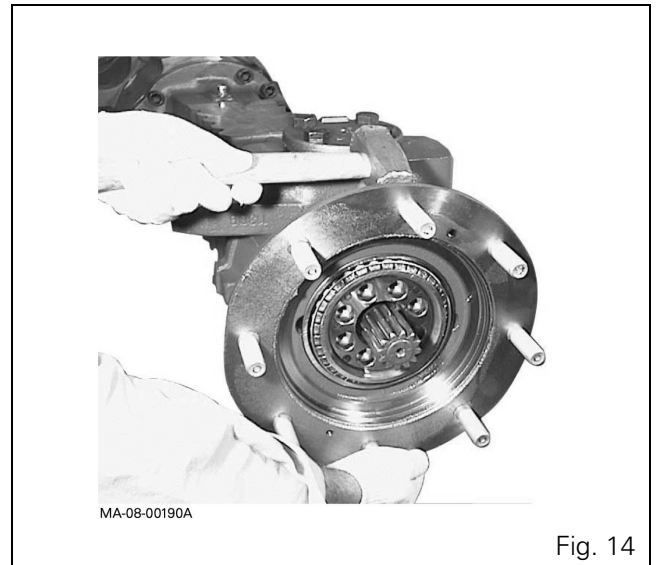


Fig. 14

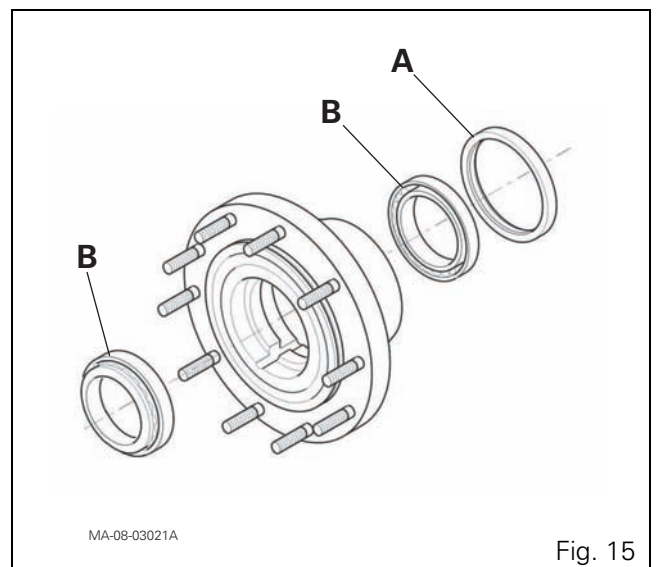


Fig. 15

## CARRARO 20.48 - Final drive units

16. Loosen and remove the screws from the upper and lower swivel pins (Fig. 16).



**DANGER:** Before removing the swivel pins, attach the swivel housing to a hoist or other suitable lifting device with a belt or sling.

Remove the swivel pins and collect the Belleville washers.

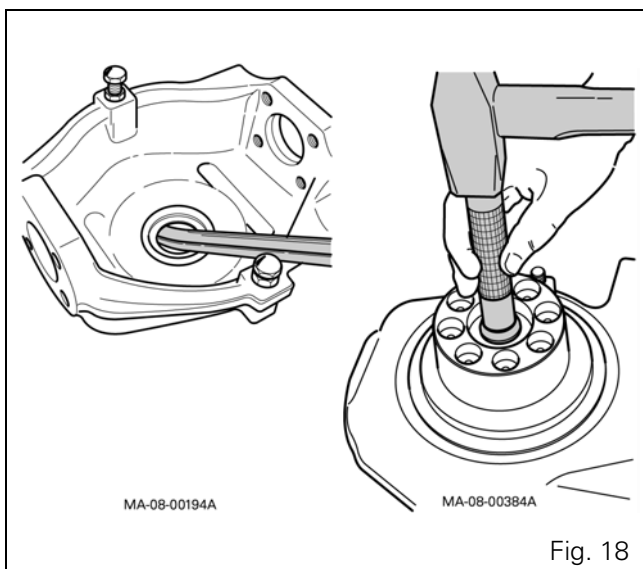
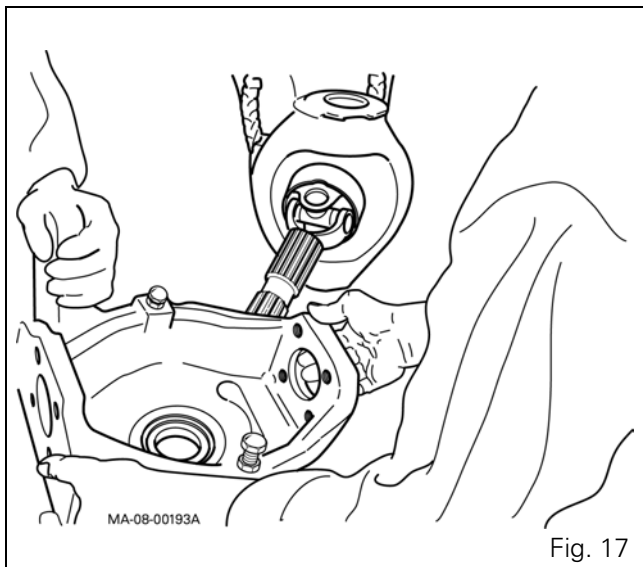
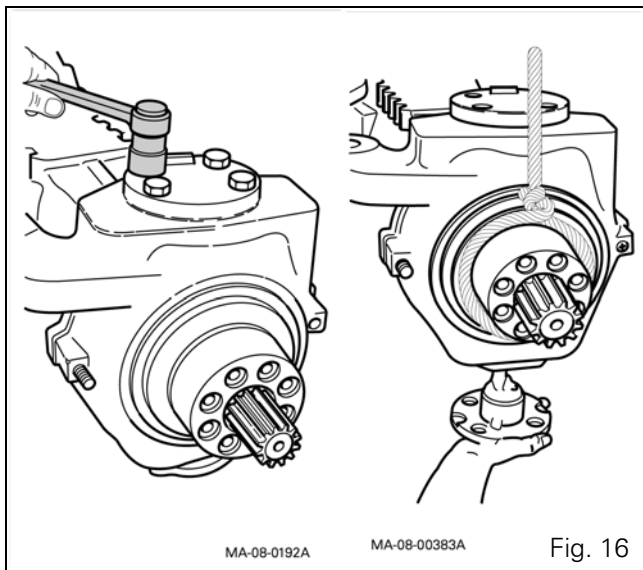
**NOTE:** Make a note of the positioning of the two Belleville washers, which are not identical.

17. Remove the swivel housing from the axle beam and the short shaft of the universal joint shaft (Fig. 17).

Place the swivel housing on a level surface and extract the sealing ring with a lever (Fig. 18).

**NOTE:** This will destroy the sealing ring.

18. Turn the swivel housing to extract the ring with a drift and a hammer (Fig. 18)



## E . Disassembling the axle beam assembly

19. Separate the universal joint shaft from the axle beam (Fig. 19).
20. Extract sealing ring A from the axle beam with a lever (Fig. 20).  
**NOTE:** This will destroy the sealing ring.
21. Extract ring B from the axle beam using a suitable extractor (Fig. 20).  
**NOTE:** Only remove ring B if it needs to be replaced.
22. Remove shim C (Fig. 20).
23. Remove ring D and roller bearing E from the swivel pins using a suitable extractor (Fig. 20).  
**NOTE:** Only remove rings D and E if they need to be replaced.

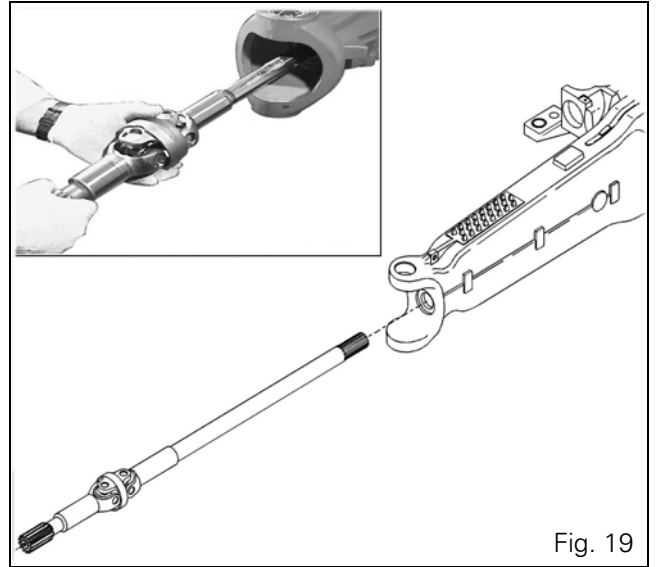


Fig. 19

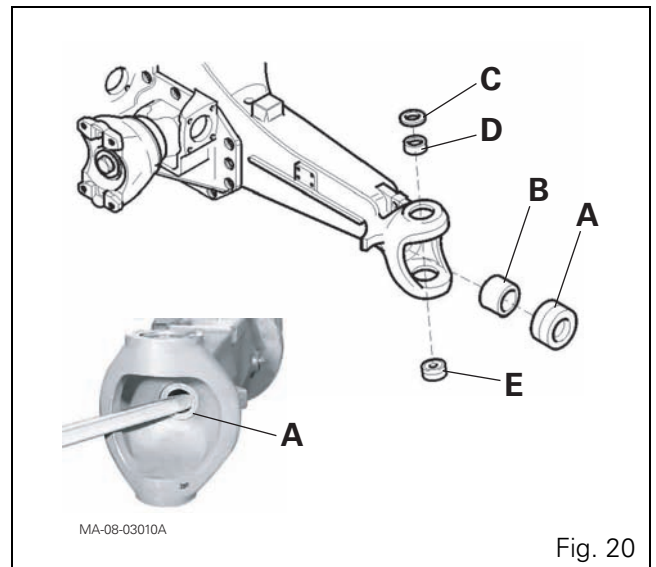
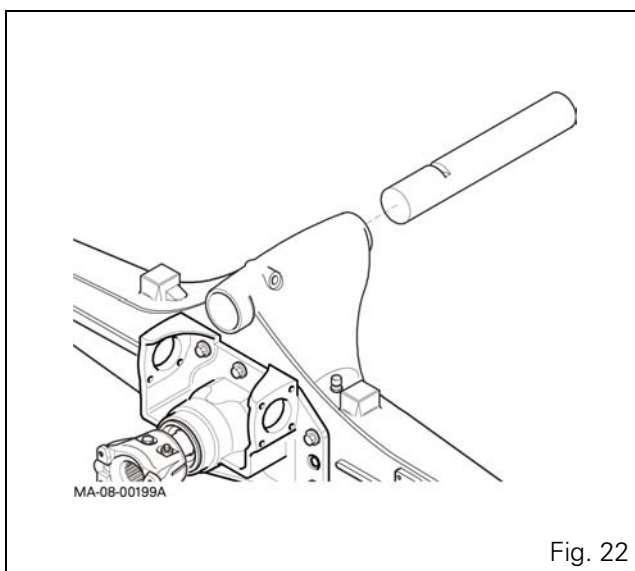
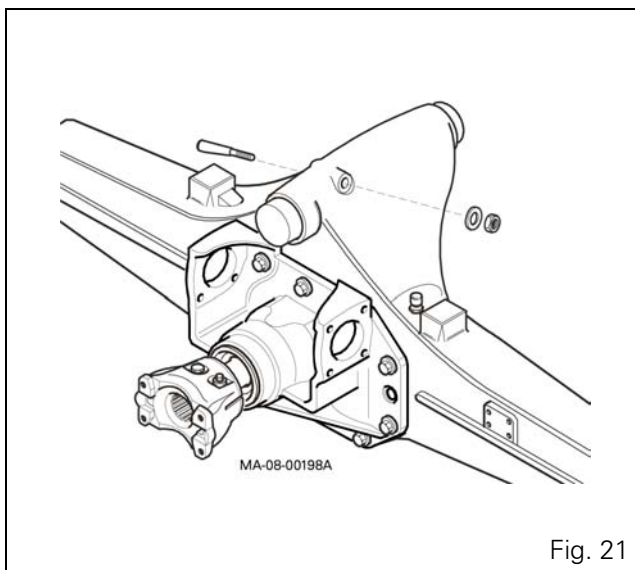


Fig. 20

## CARRARO 20.48 - Final drive units

For fixed front axles:

24. Extract the nut and retaining washer from the taper pin. Remove the pin with a hammer (Fig. 21).
25. Remove the pivot pin using a hammer or other soft object if necessary (Fig. 22).



## F . Reassembling the axle beam assembly

- 26.** Fit the ring of the upper swivel pin on the axle beam using tool ref. CA715039 (see § K) and a hammer.

Insert the roller bearing cup on the lower part of the axle beam using tool ref. CA715039 (see § K) and a hammer (Fig. 23).

**NOTE:** To make assembly easier, cool the pins to below  $-100^{\circ}\text{C}$  before installing them. This can be achieved by completely dipping the pins in liquid nitrogen. To purchase or hire liquid nitrogen, contact the company "Air liquide".



**CAUTION:** It is recommended to wear protective gloves.

- 27.** Fit the ring on the axle beam using tool ref. CA119053 (see § K) and a hammer.

Fit the seal on the axle beam using tool ref. CA715272 (see § K) and a hammer (Fig. 24).

Fill the seal housing three quarters full with grease.

- 28.** Lubricate the ring and the lip of the seal.

Insert the universal joint shaft into the axle beam. (Fig. 25).

**IMPORTANT:** Take care not to damage the seal.

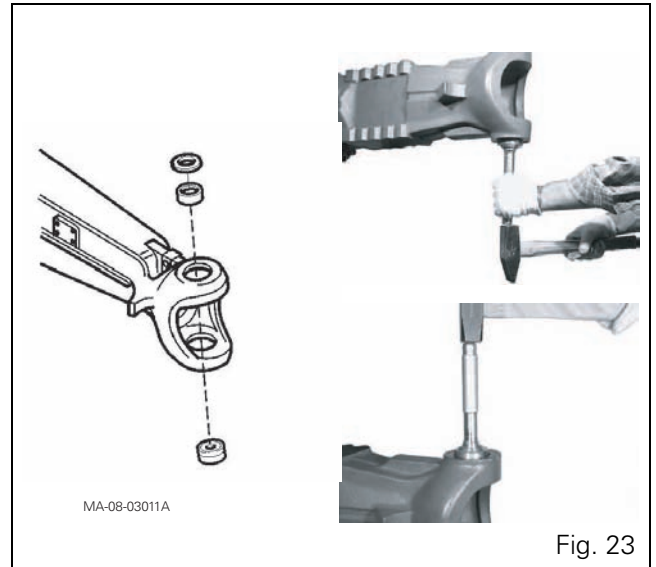


Fig. 23

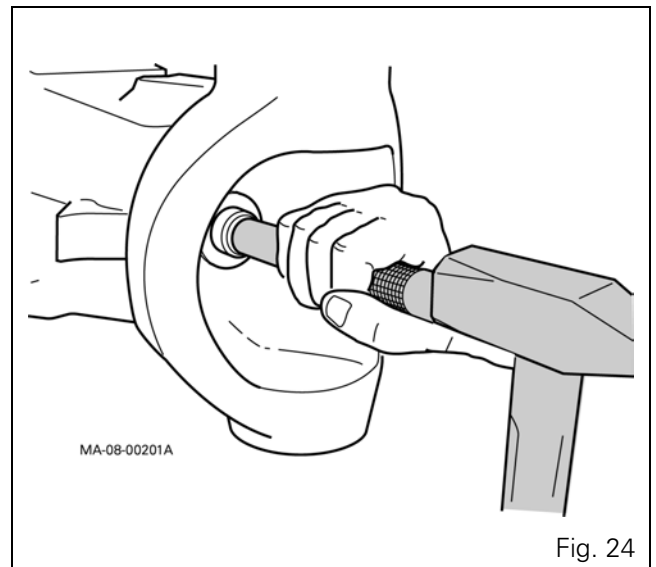


Fig. 24

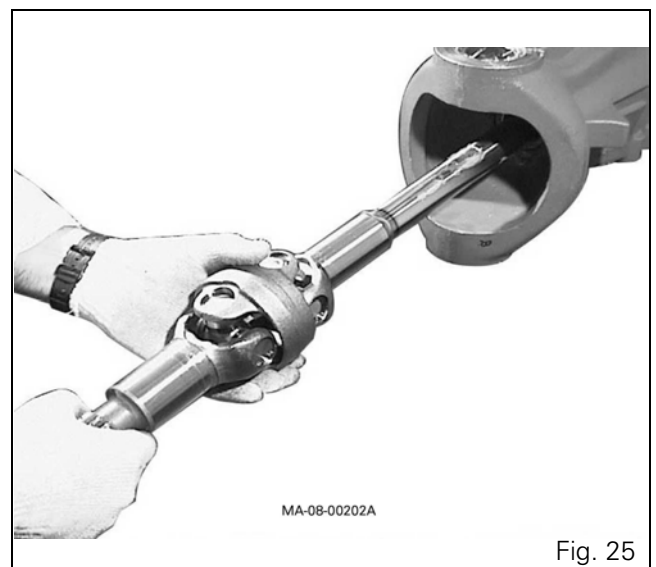


Fig. 25

## CARRARO 20.48 - Final drive units

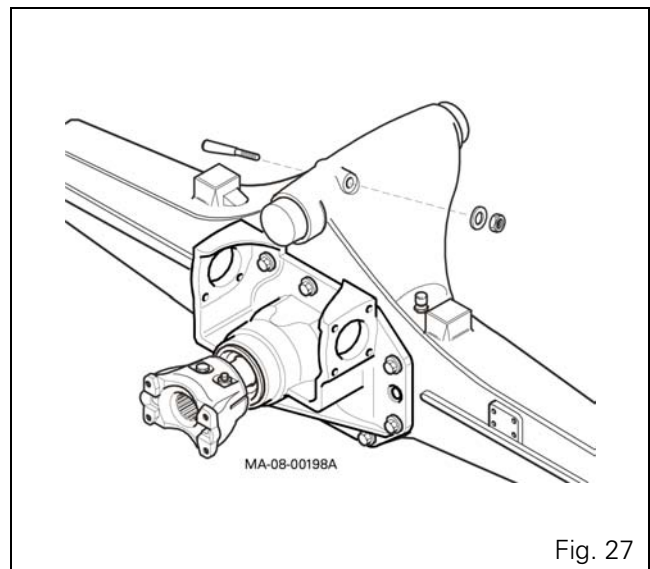
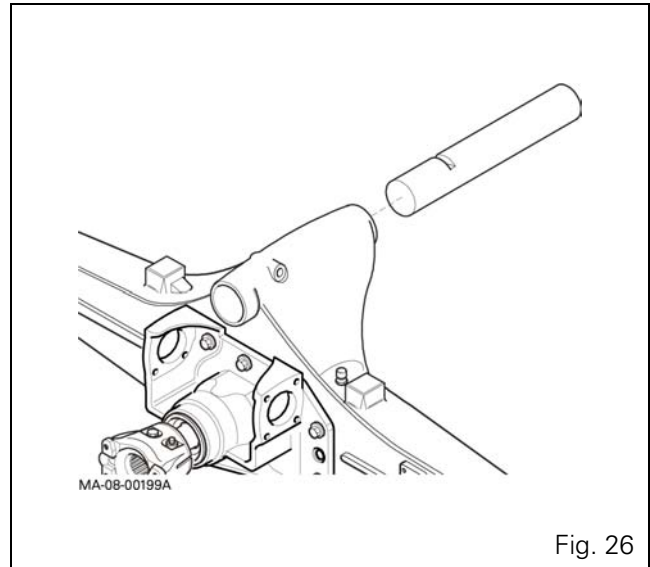
For fixed front axles:

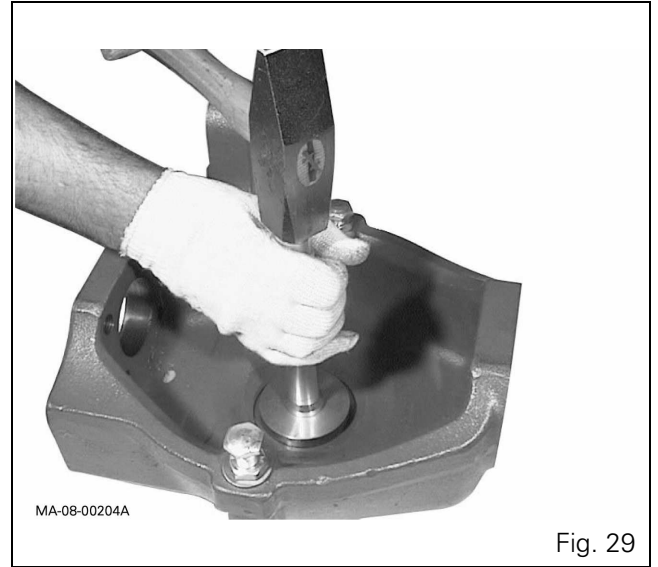
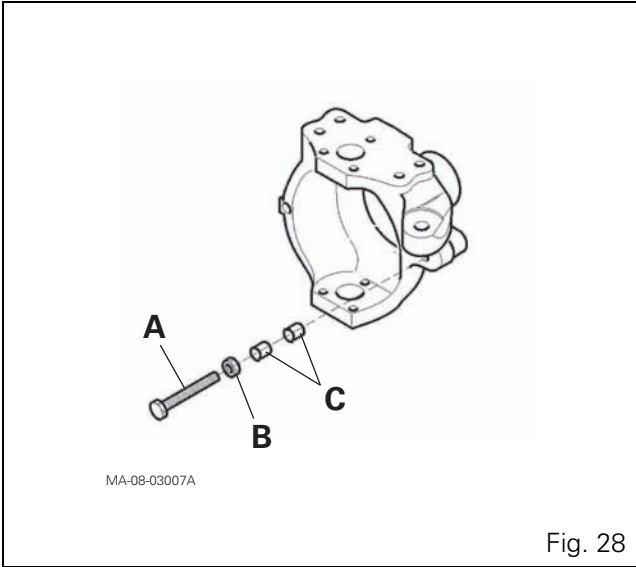
**29.** Refit the pivot pin using a hammer or other soft object if necessary (Fig. 26).

**NOTE:** Align the slot of the pin with the hole in the axle beam support.

**30.** Insert the taper pin into the axle beam using a hammer if necessary (Fig. 27).

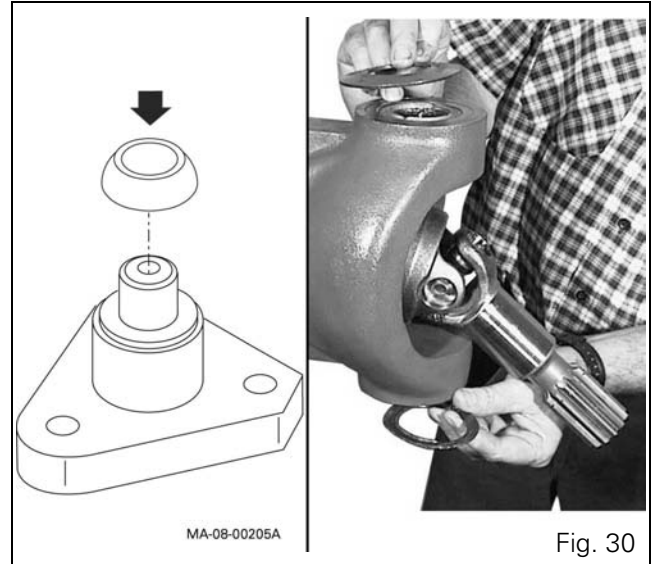
**31.** Position the washer and the nut. Tighten the nut to 45 Nm (Fig. 27).





## G . Reassembling the wheel hub assembly

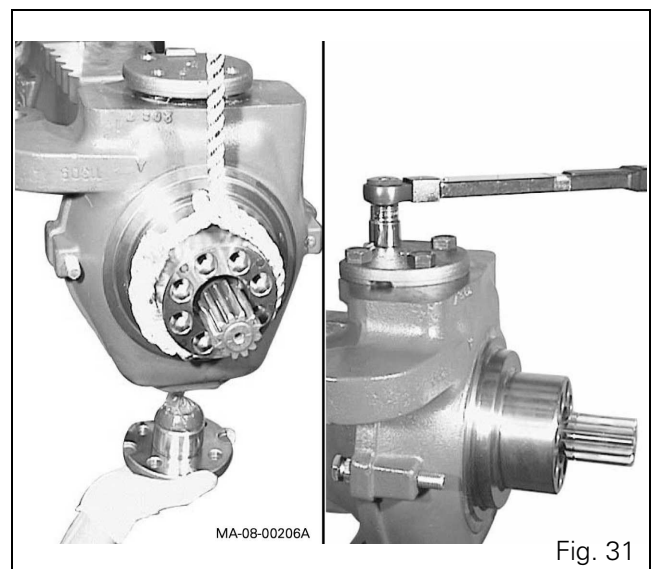
32. Position screw A, nut B and washers C (Fig. 28).  
**NOTE:** The absence of washers C would damage the axle.
33. Force fit the ring in the swivel housing using tool ref. CA715423 (see § K) and a hammer or press.  
Fit the seal on the swivel housing using tool ref. CA715428 (see § K) (Fig. 29).  
Fill the seal housing three quarters full with grease.
34. Place the lower swivel pin on a workbench and install the ball joint cone using tool ref. CA715042 (see § K) and a press.  
Thoroughly grease the swivel pin housings with special grease (see chapter 8). Fit the Belleville washers on the swivel pin housings (Fig. 30).
35. Lubricate the seal lip and protect the splined end of the shaft by wrapping adhesive tape around it to protect the seal from damage. After assembly, completely remove the adhesive tape.



**CAUTION: Attach the swivel housing assembly with a sling.**

Fit the swivel housing on the axle beam. Install the upper and lower swivel pins and tighten the screws to 300 Nm using a torque wrench (Fig. 31).

**NOTE :** Ensure that the Belleville washers remain in place.



## CARRARO 20.48 - Final drive units

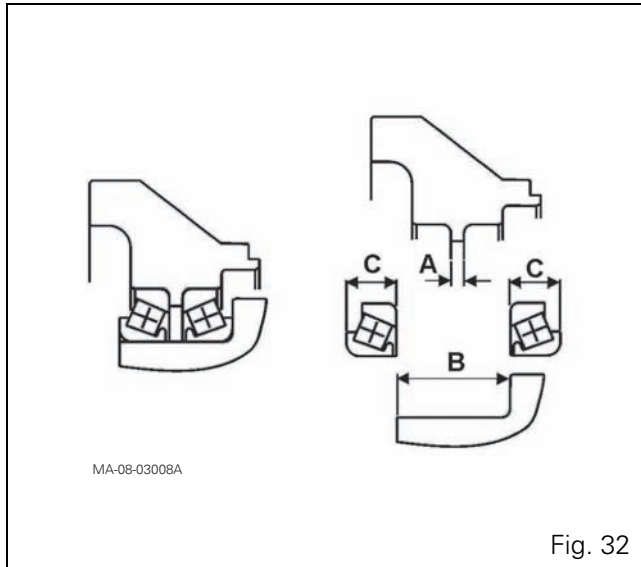


Fig. 32

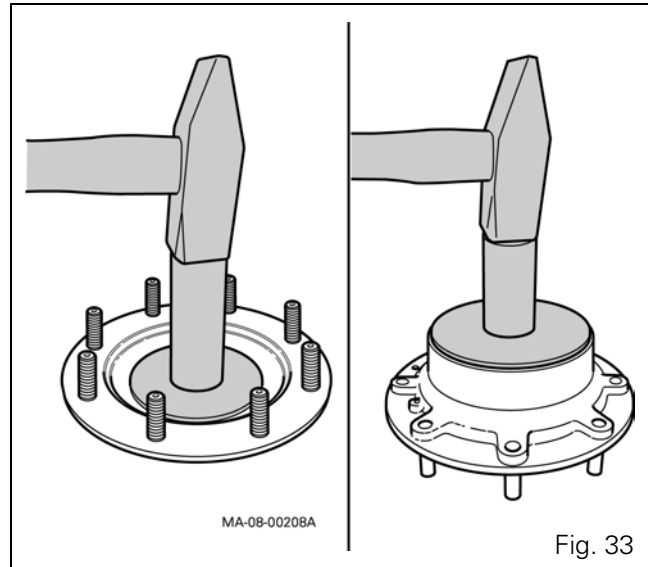


Fig. 33

**36.** The special "Set Right" operation, which consists of shimming the bearings, does not require any specific preload or setting. The required values should always be checked before installing new parts (Fig. 32).

- A= 23.450 to 23.500 mm
- B= 81.675 to 81.725 mm
- C= 29.000 to 29.150 mm

**37.** Place the wheel hub on a workbench and install the two tapered roller bearing cups using tool ref. CA715118 (see § K) and a press or hammer (Fig. 33). Insert the lip seal into the wheel hub using tool ref. CA715513 (see § K) and a hammer.

**38.** Fit the bearing cone at the end of the swivel pin. Assemble the hub on the swivel pin and fit the second bearing cone (Fig. 34).

**39.** Mount the ring gear carrier on a workbench and ensure that the rings are level with the ring gear carrier surface using tool ref. CA715278 (see § K). Two diametrically opposed rings must be positioned slightly higher than the ring gear carrier surface to act as guide pins (Fig. 35).

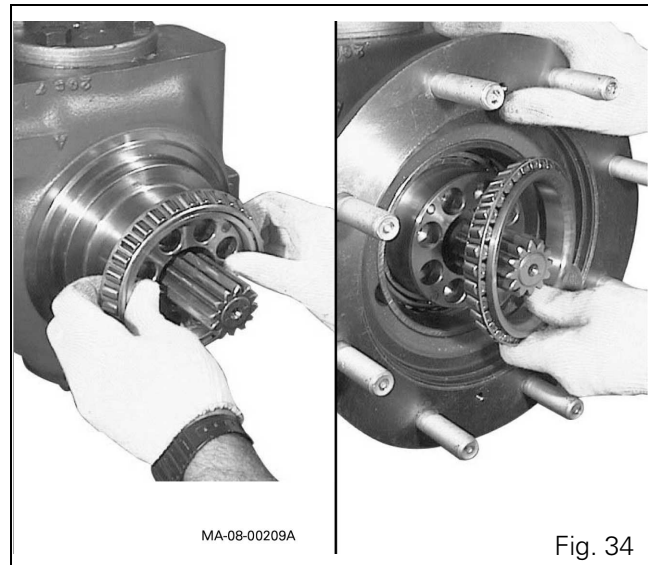


Fig. 34

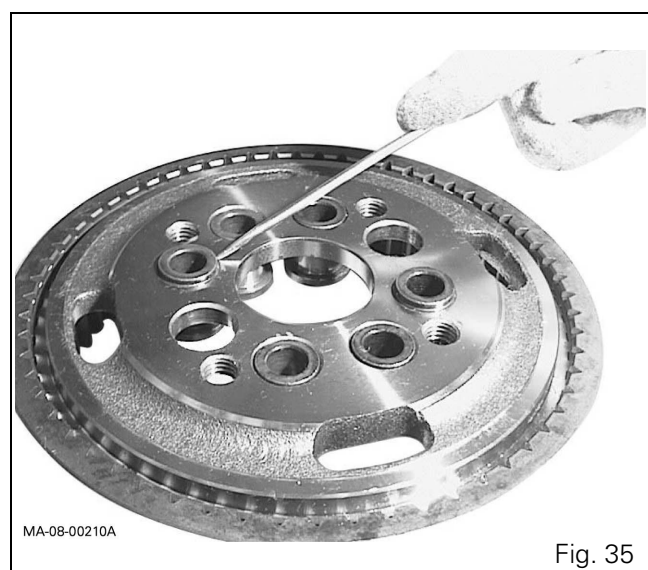


Fig. 35

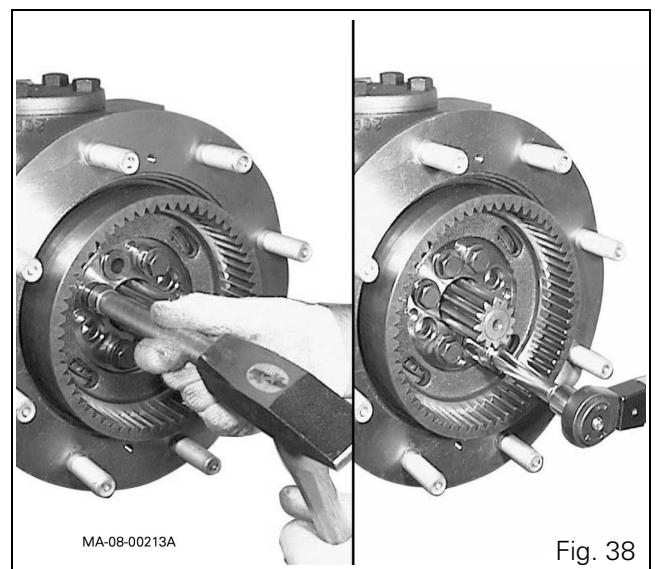
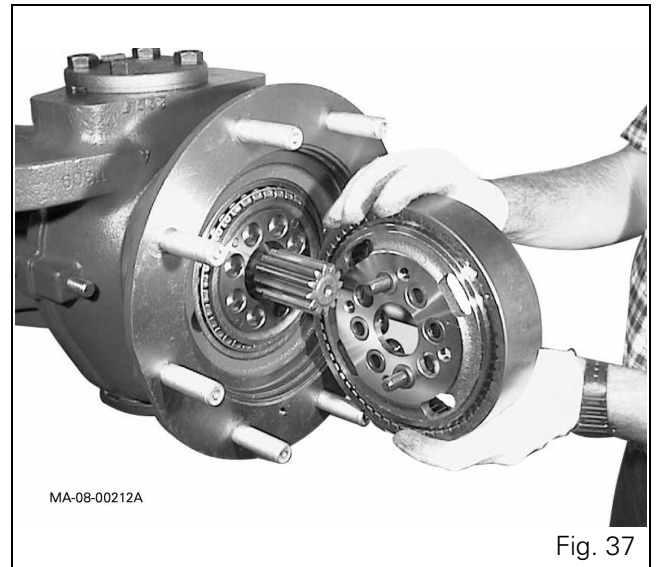
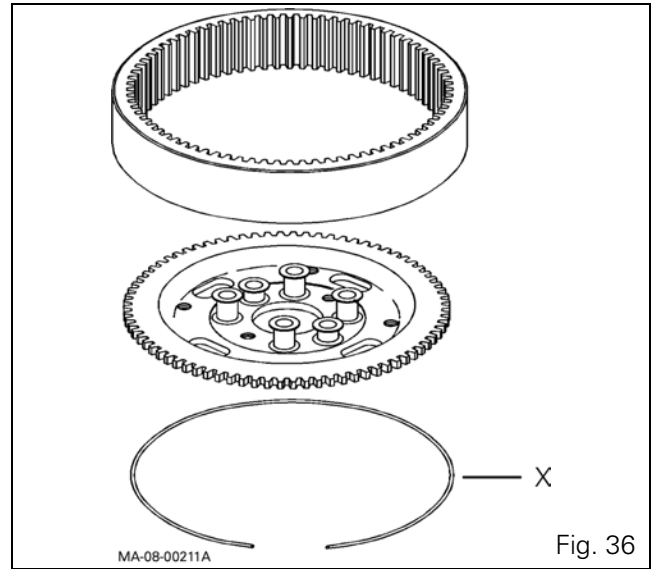


## CARRARO 20.48 - Final drive units

40. Preassemble the assembly consisting of the ring gear carrier and the epicyclic ring gear with special snap ring X as shown in Fig. 36.
41. Mount the ring gear carrier assembly on the wheel hub using the two shouldered rings as guide pins and tighten the corresponding screws until the ring gear comes into contact with the wheel hub (Fig. 37).

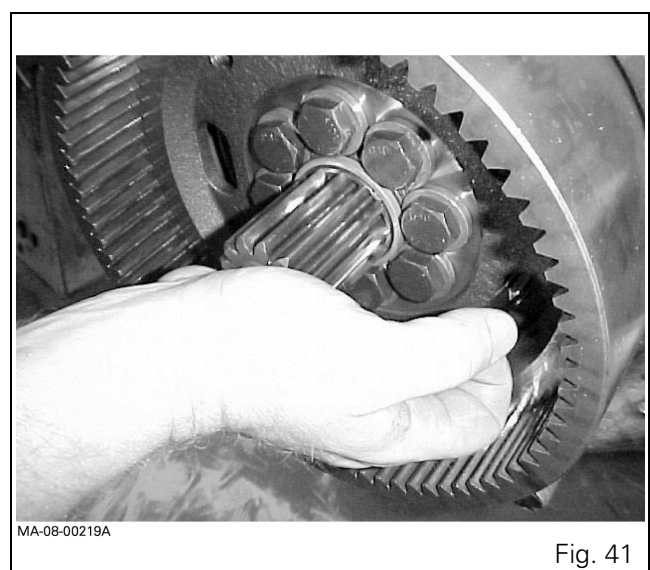
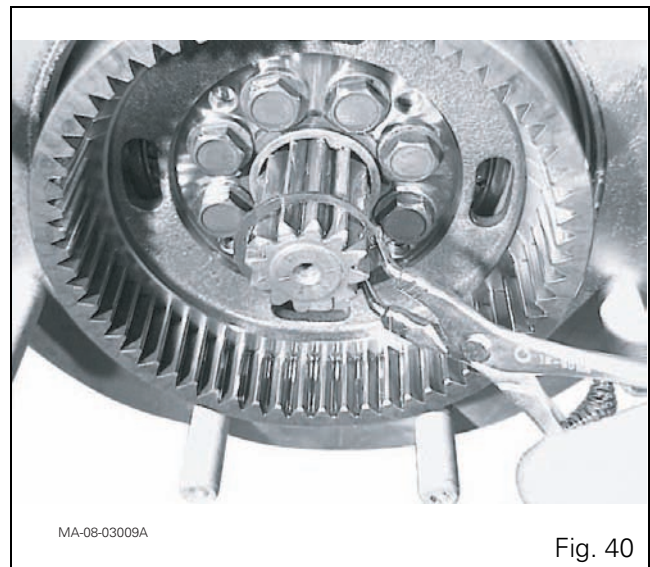
**IMPORTANT:** Do not use the two screws that were used to remove the ring gear assembly from its housing when disassembling (see step 12).

42. Force fit all the rings using tool ref. CA715278 (see § K) and a hammer. Fit the ring gear carrier's (Fig. 38) screws and tighten to:
  - 220 Nm (fixed axle)
  - 230 Nm (suspended axle)



## CARRARO 20.48 - Final drive units

43. Insert a lever between the swivel housing and slide it into the universal joint. Push on the joint with the lever in the direction of the final drive unit to remove the shaft and facilitate reassembling the circlip (Fig. 39).
44. Insert the star washer on the shaft and then position the circlip (Fig. 40).
45. Gently push the universal joint shaft and check that the circlip is positioned correctly (Fig. 41).



## H . Reassembling the final drive assembly

- 46.** Recover all final drive parts (Fig. 42).
- 47.** Place the planet carrier on a workbench.  
Insert into the planet carrier pins (Fig. 43):
- the planetary gears assembled with bearings, washers and retaining rings
  - the tab washers
  - the circlips
- 48.** Fit a new "O" ring on the wheel hub (Fig. 44).  
Fit the final drive on the hub.  
Smear the screws with Loctite 542 (or equivalent) and tighten them to 25 Nm using a torque wrench.

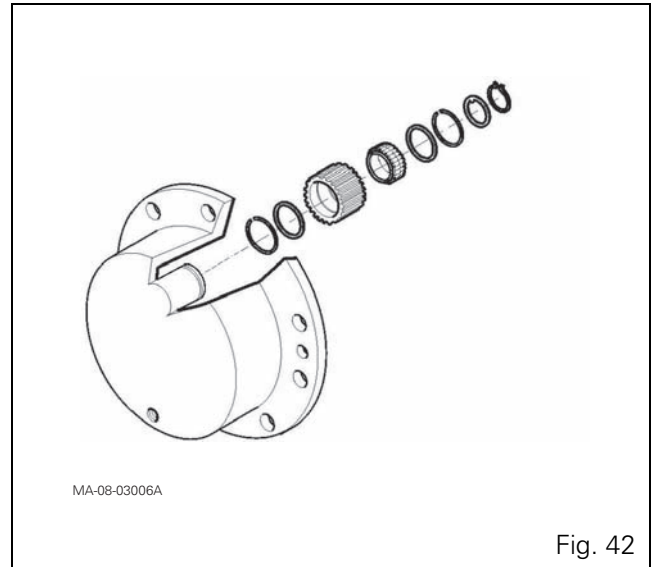


Fig. 42

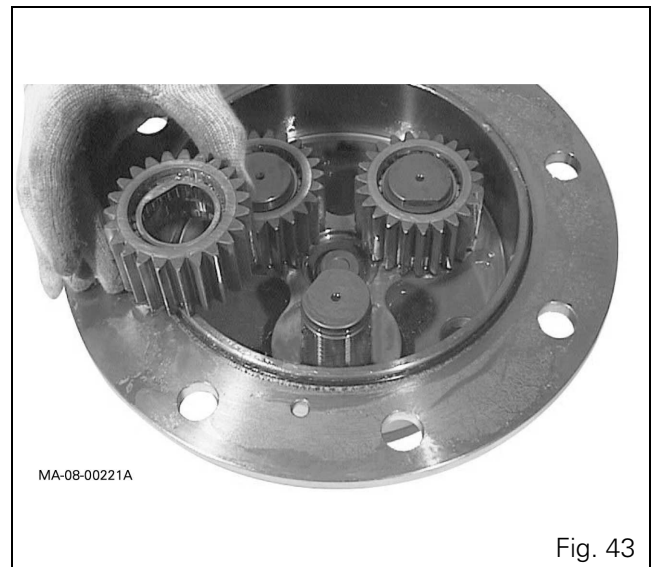


Fig. 43

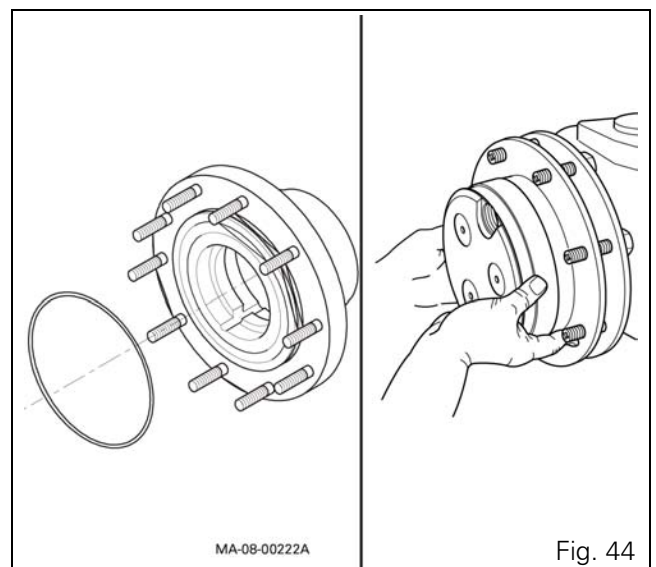


Fig. 44

# CARRARO 20.48 - Final drive units

## I. Wheel alignment

49. Place two identical straight bars, each one metre long, along the sides of the ring gear and lock them on the wheel hub stud with two nuts (Fig. 45).

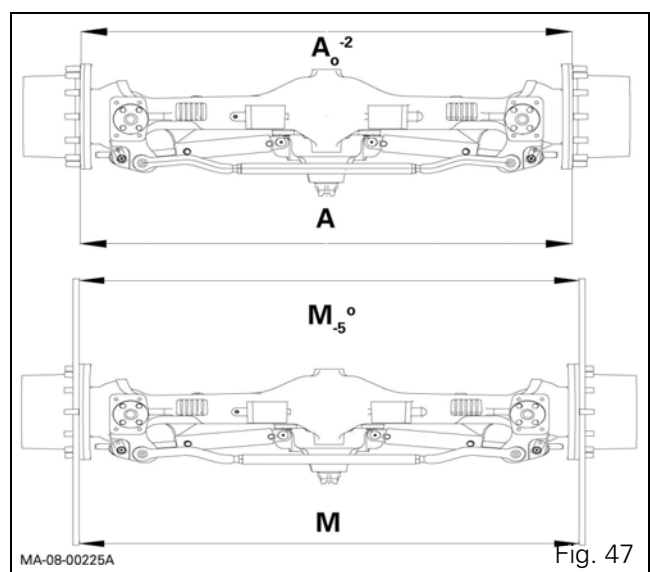
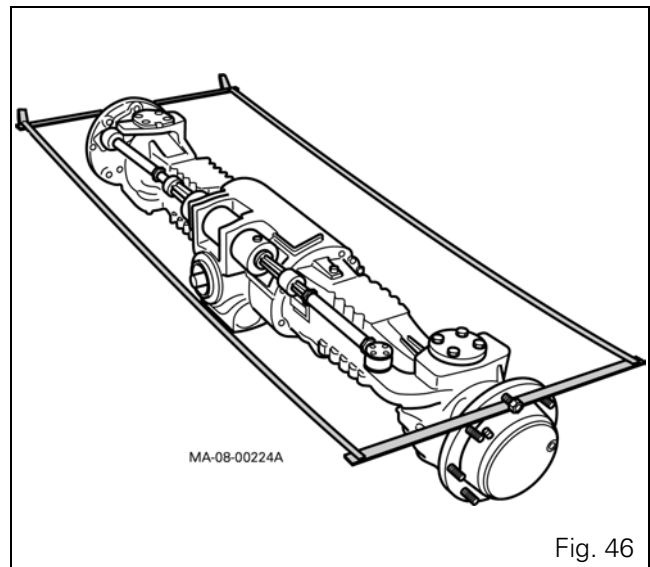
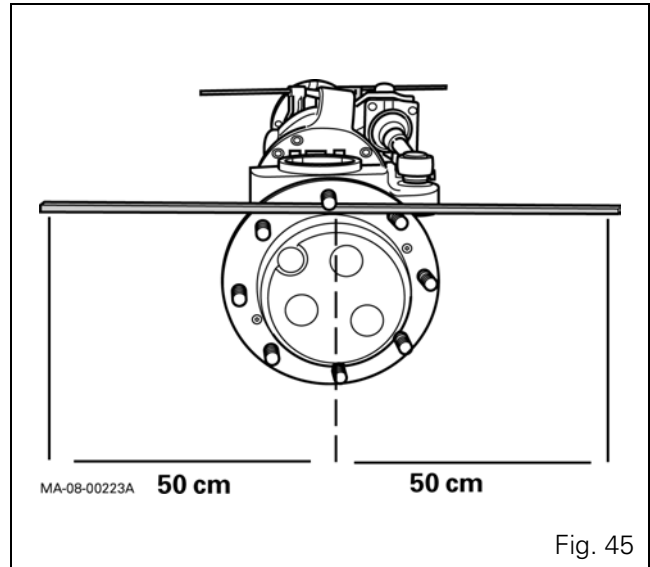
50. Measure the distance M between the ends of the bars (Fig. 47).

**NOTE:** Keep the minimum value by oscillating the measurement point.

51. Ensure that the deviation in measurement A between the ends of the wheel hub diameters does not exceed the permissible values (Fig. 47).

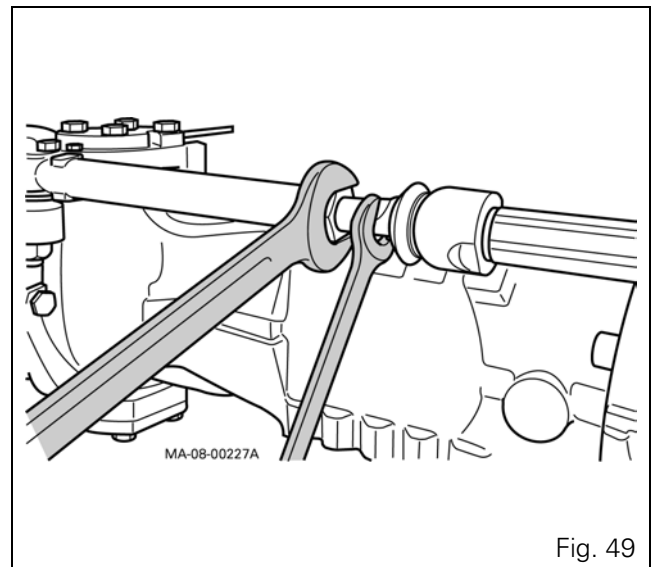
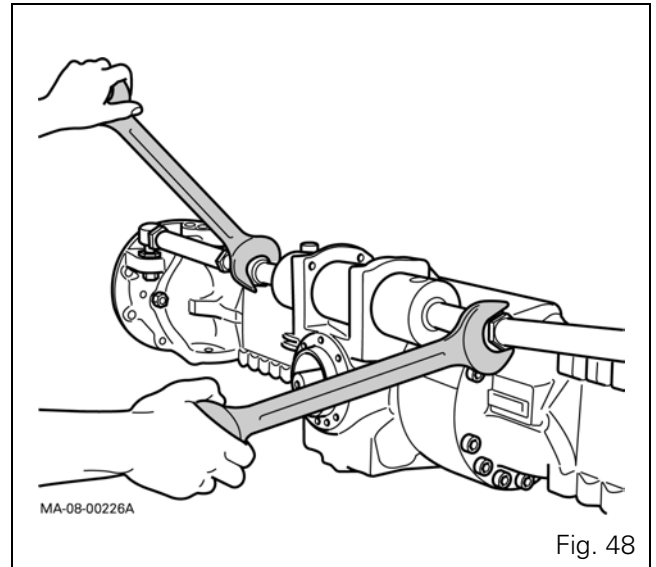
Measured value M taken at the ends of the bars must depend on the ratio between the length of the bar and the diameter of the flange:

- alignment (see chapter 8) =  $A_0 - 2$
- measurement deviation =  $M_0 - 5$ .



## CARRARO 20.48 - Final drive units

52. If the alignment is not correct, adjust the selector rails by screwing or unscrewing both trackrods equally, using two wrenches, until the alignment is within the permitted values (Fig. 48).
53. Once adjustment is complete, screw the locknuts of the selector rails and tighten to 250 Nm (Fig. 49).



# CARRARO 20.48 - Final drive units

## J . Adjusting the steering lock angle

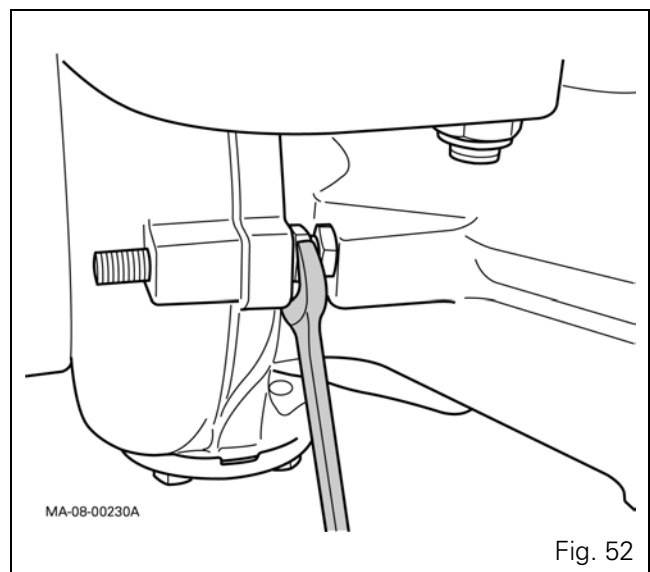
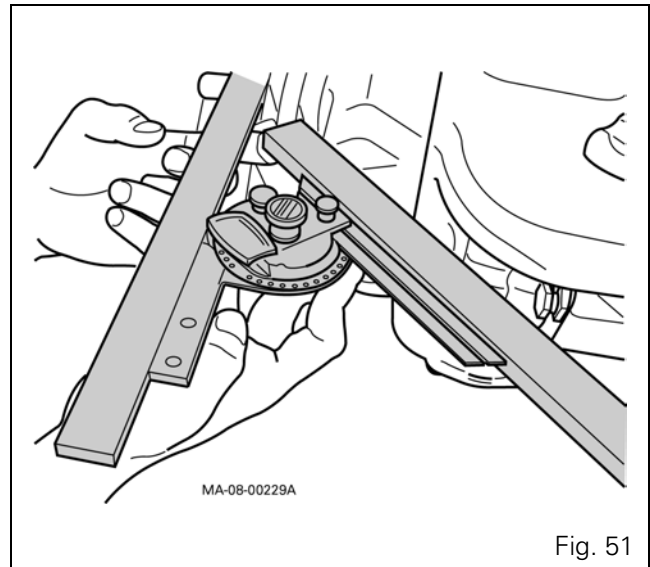
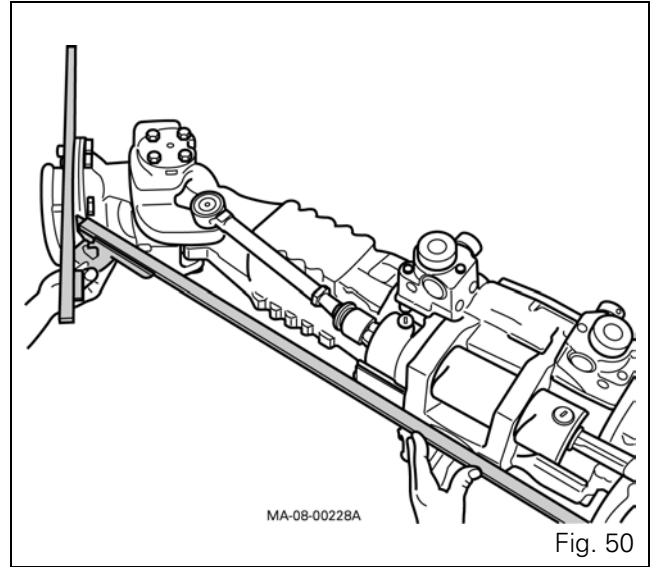
54. Use the bars fitted to adjust alignment and a long bar pressing against the machined part of the central body (pinion side) so that the two bars form an acute angle corresponding to the maximum steering lock position (Fig. 50).

55. Adjust the goniometer to the required steering lock angle (see chapter 8) and position it on the long bar.

Move the spindle to obtain the angle defined by the goniometer and formed by the ring gear and the long bar (Fig. 51).

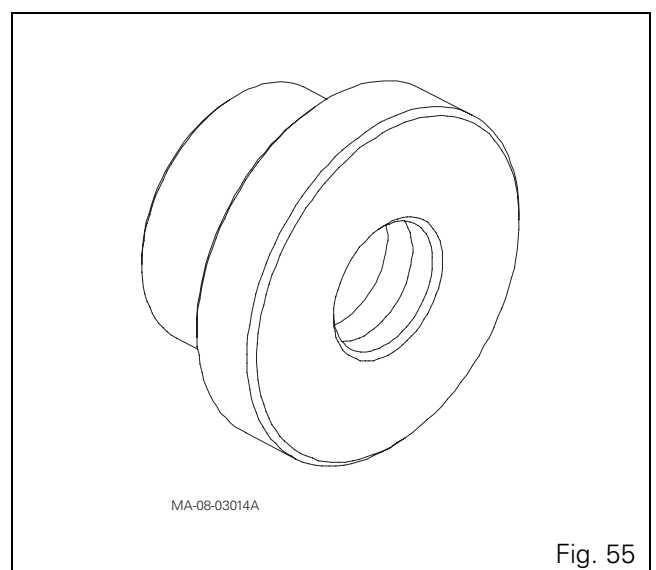
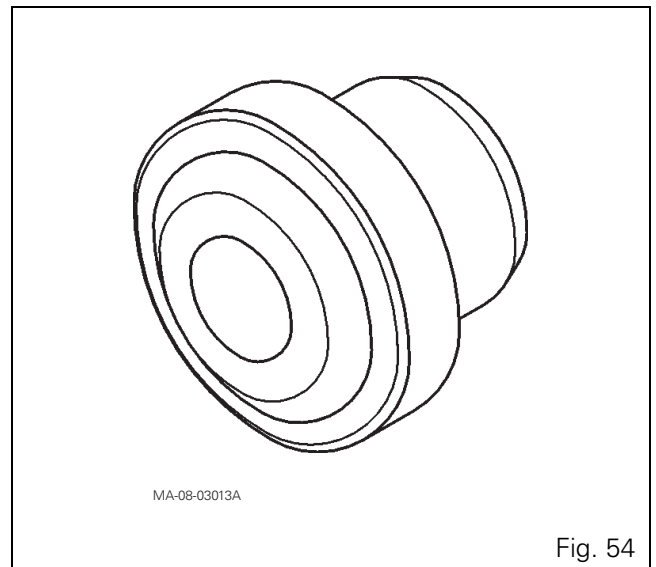
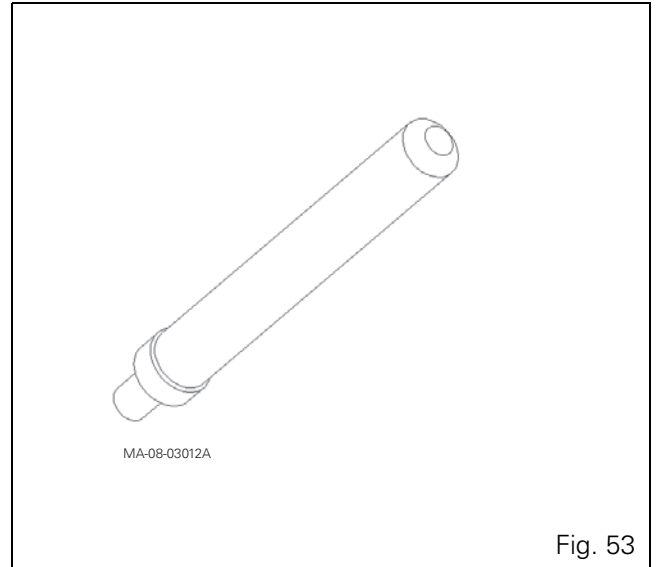
56. Adjust the mechanical steering lock by tightening or loosening the special screws (Fig. 52), then lock them by tightening the locknut to 150 Nm.

Lock steering in the other direction and repeat this procedure (Fig. 52).



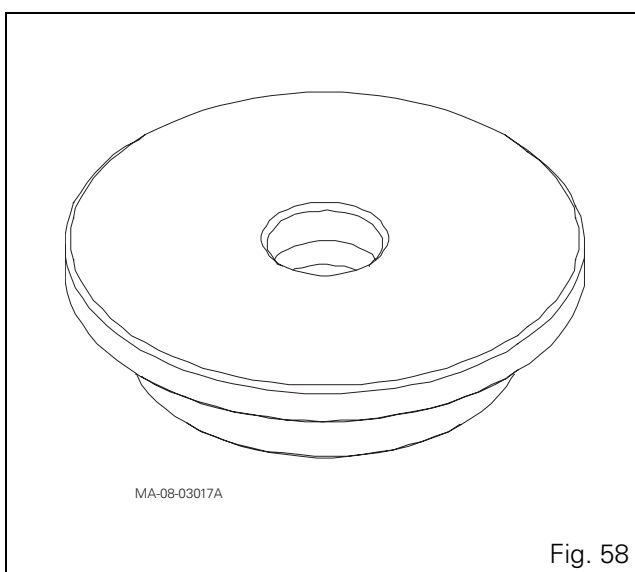
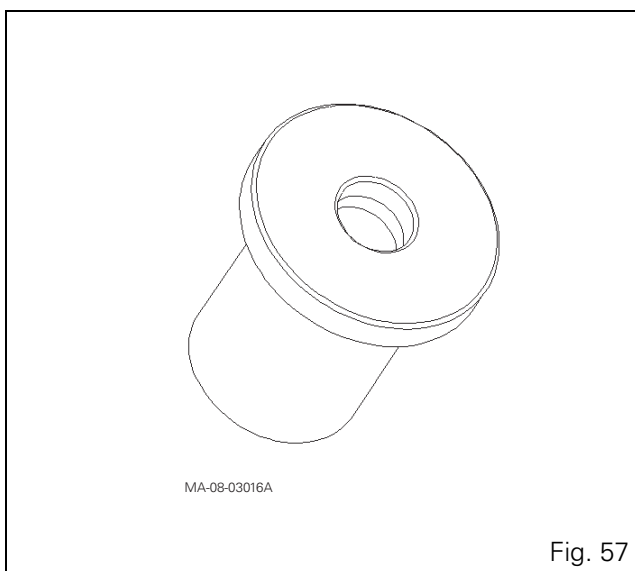
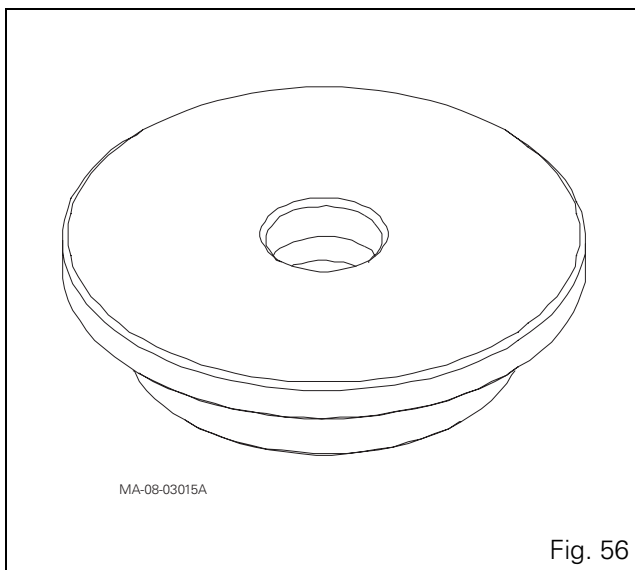
## K . Service tools

- CA715278—ring fitting tool (Fig. 53)
- CA715039—swivel pin ring fitting tool (Fig. 54)
- CA119053—axle beam ring fitting tool (Fig. 55)



## CARRARO 20.48 - Final drive units

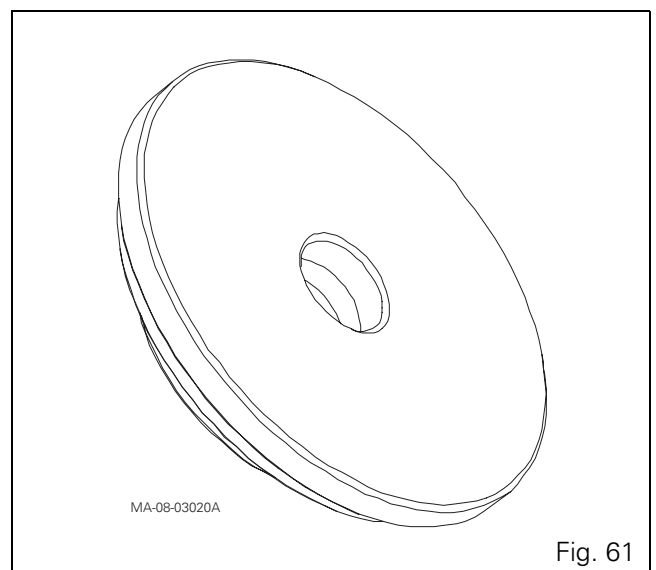
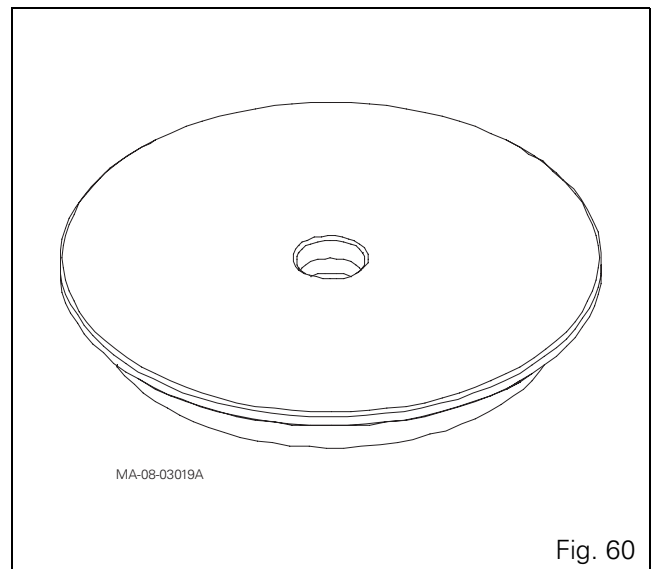
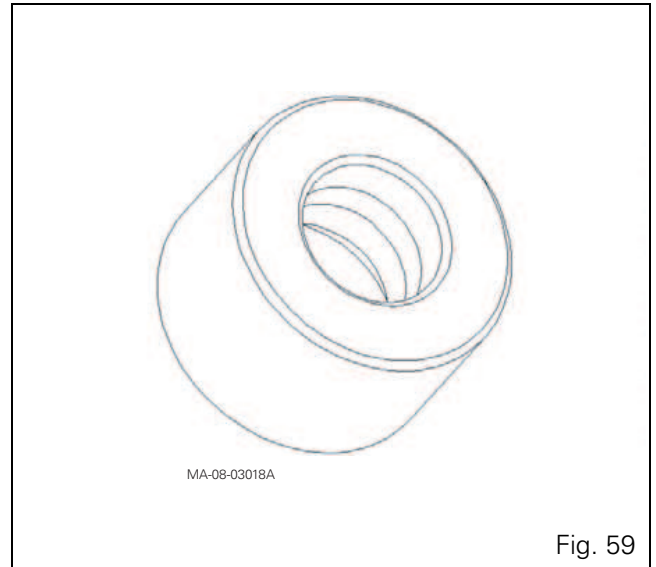
- CA715272—axle beam seal fitting tool (Fig. 56)
- CA715423—swivel housing ring fitting tool (Fig. 57)
- CA715428—swivel housing seal fitting tool (Fig. 58)





## CARRARO 20.48 - Final drive units

- CA715042—ball joint cone fitting tool (Fig. 59)
- CA715118—hub bearing cup fitting tool (Fig. 60)
- CA715513—hub lip seal fitting tool (Fig. 61)



## **CARRARO 20.48 - Final drive units**

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*8B12 - CARRARO 20.48 - Differential*

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## A . General

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Some of the following pictures may not show your exact axle, but the procedure is the same.

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## B . Disconnecting the front axle/frame

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1. Drain the axle housing.
2. Disconnect the axle and its bearings from the front frame (see chapter 8).

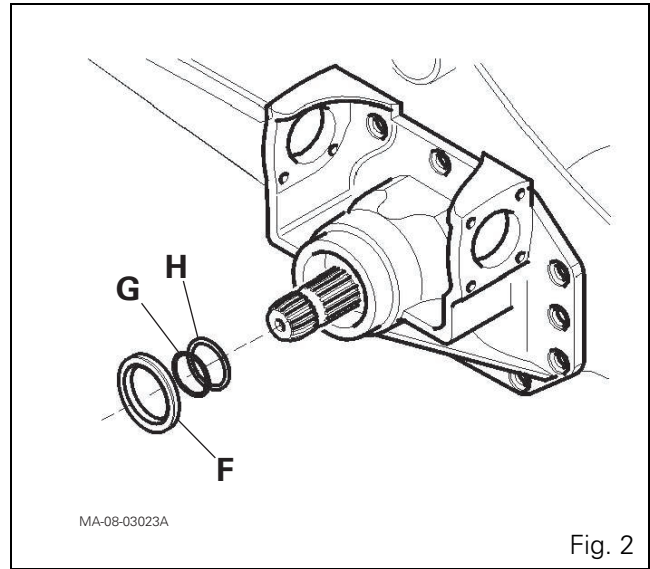
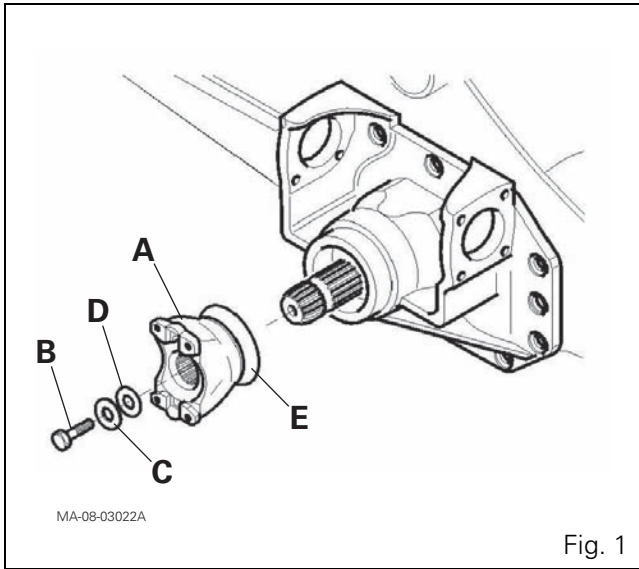
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## C . Removing the wheel hubs, axle beam assembly and steering ram

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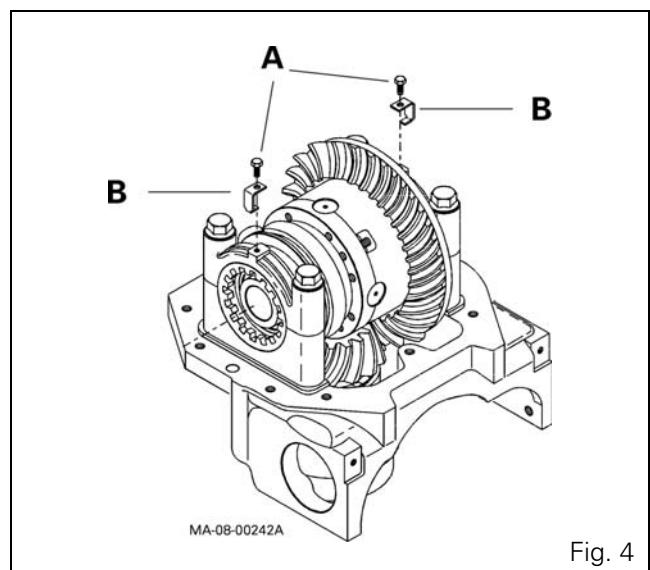
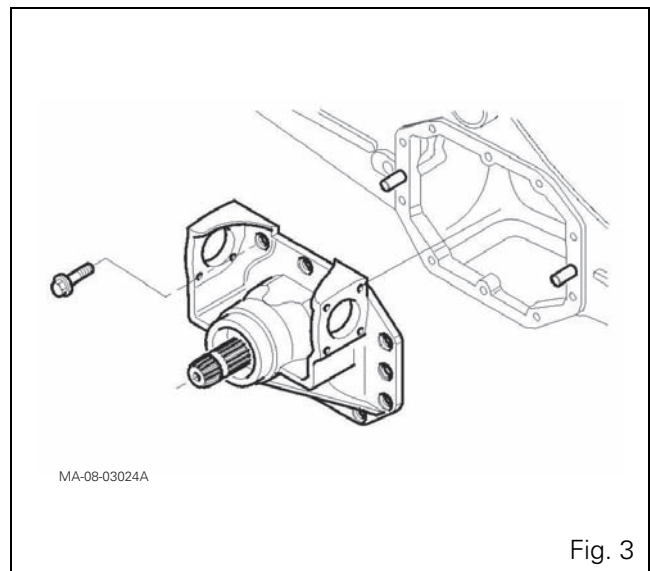
3. Extract the wheel hubs (see chapter 8).
4. Remove the axle beam assembly (see chapter 8).
5. Remove the steering ram (see chapter 8).

# CARRARO 20.48 - Differential

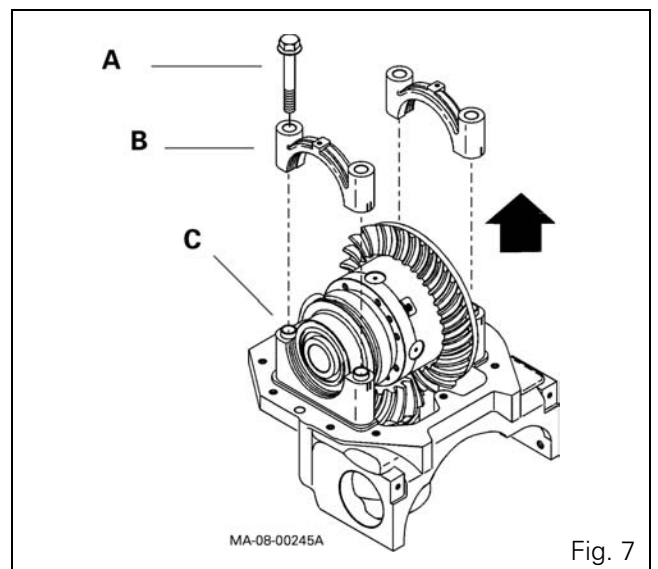
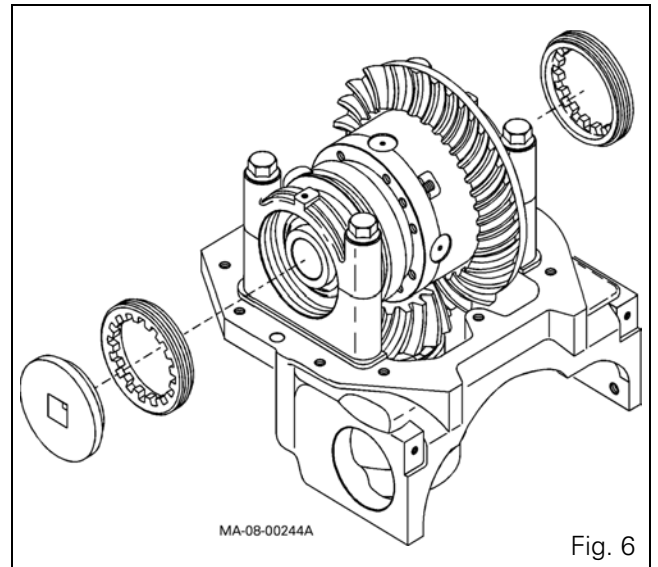
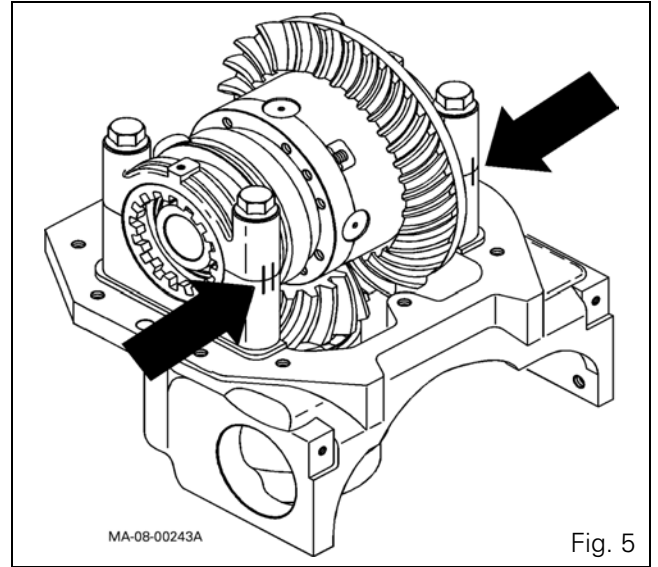


## D . Disassembling the differential housing assembly

6. Remove screw B. Keep washer C and shim D, then extract flange A with protection E (Fig. 1).  
**NOTE:** Only remove protection E if necessary.
7. Remove seal F using a lever. Retain "O" ring G and washer H from the pinion.
8. Loosen and remove the screws from the differential housing.
9. Remove the differential housing (Fig. 3).  
**NOTE:** Hold the differential housing in place with a sling or other suitable device (Fig. 3).
10. Loosen and remove screws A to extract the two nut retainers B (Fig. 4).



11. Before removing the screws, make indelible marks to **mark the position of the two half-bearings** and the differential housing to avoid reassembling the wrong way round. Also mark the area between the adjusting nuts and the differential housing (Fig. 5).
12. Loosen the nuts on the adjusting rings using tools CA715270 and CA715271 (see § J) (Fig. 6).  
**NOTE:** As the two nuts are different, mark their position relative to the bevel ring gear.
13. Remove the 4 screws A and the two half-bearings B.  
**NOTE:** Check that rings C remain in position in their seatings (Fig. 7).



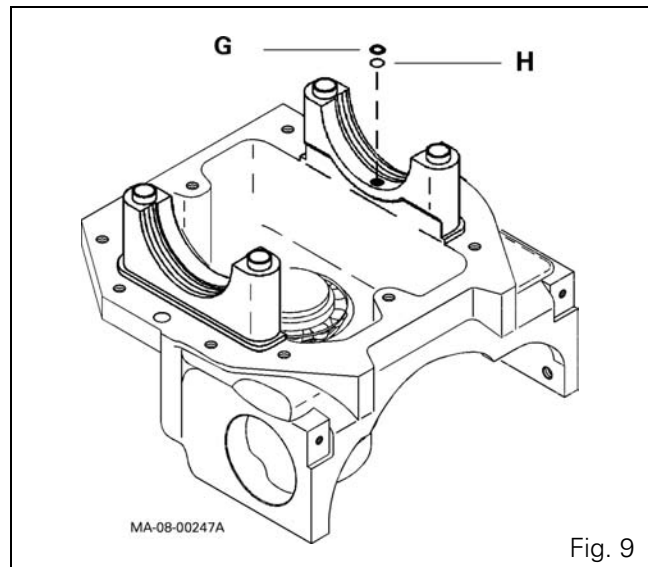
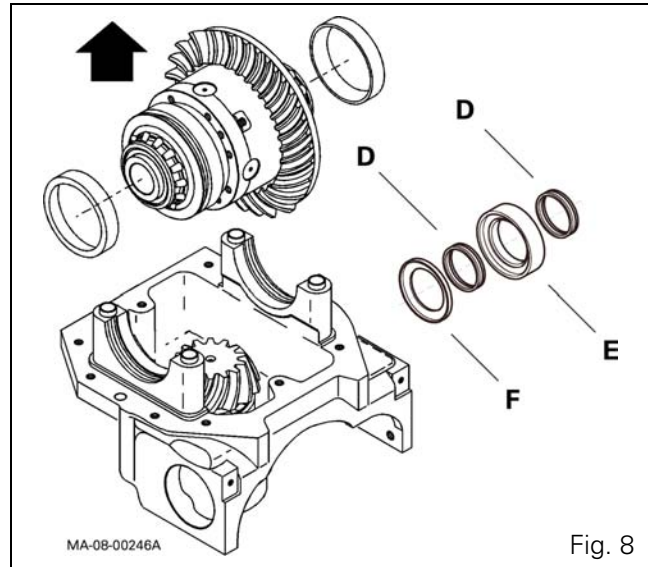
## CARRARO 20.48 - Differential

### 14. Remove the differential unit.

From the ring gear side, remove and retain spacer E with its set of seals D, washer F and the bearings removed with the differential unit (Fig. 8).

**NOTE:** Ensure that the bearings are returned to their original position if they need to be refitted.

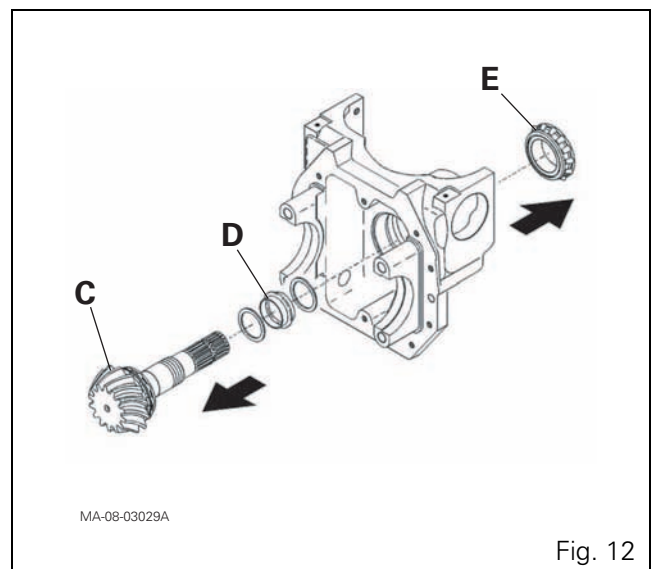
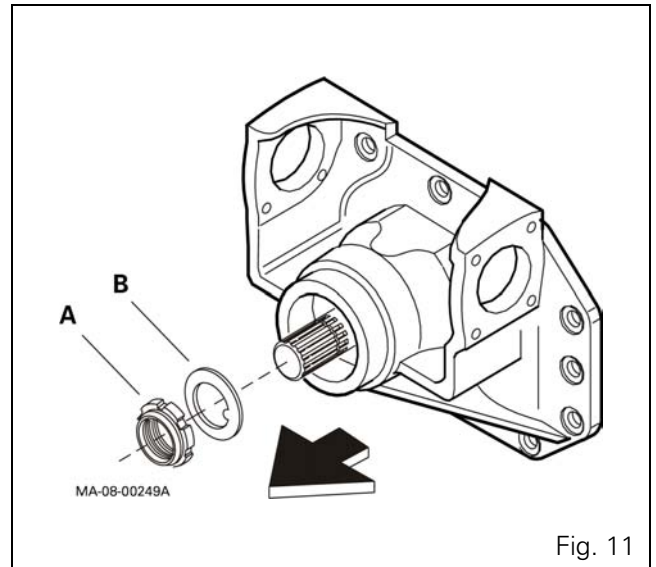
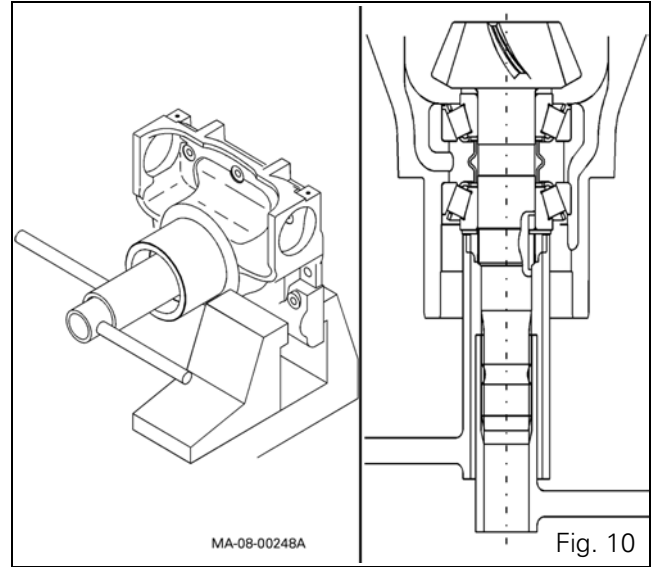
### 15. Collect washer G and "O" ring H from the bearing seating on the side of the epicyclic ring gear (Fig. 9).





## E . Disassembling the pinion assembly

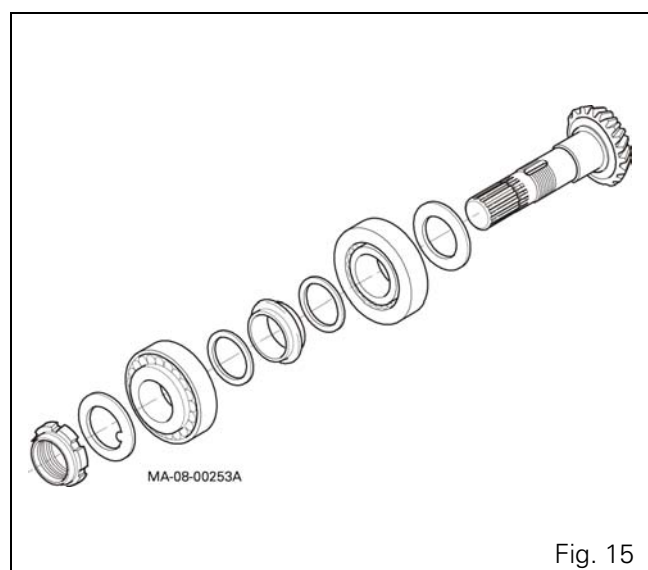
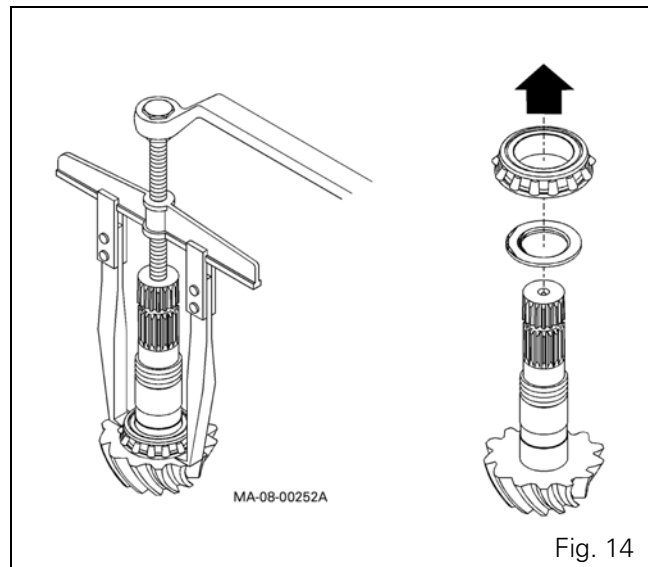
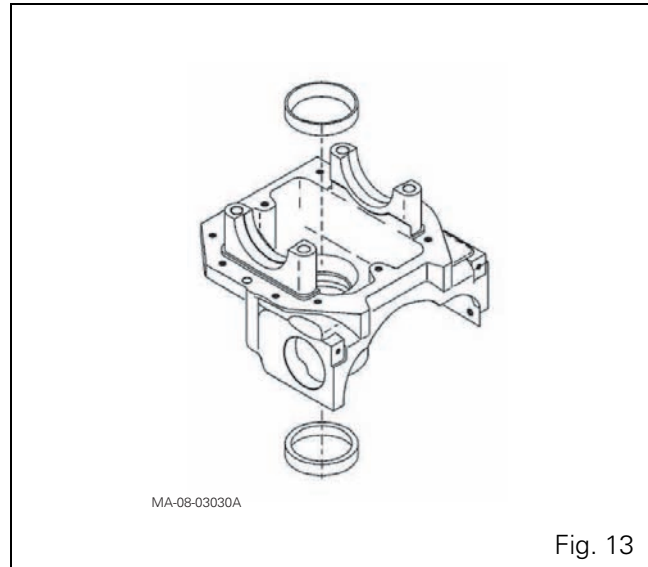
16. Place the differential support in a vice.  
Loosen the locknut using the tools ref. CA119060 and CA715269 (see § J) (Fig. 10).  
**NOTE:** This will damage the nut irreparably.
17. Extract nut A and keep the retaining washer B (Fig. 11).
18. Extract the bevel gear C using a hammer.  
**NOTE:** Ensure that the pinion does not fall out.
19. Collect the washers, flexible spacer D and internal cone E of the tapered roller bearing (Fig. 12).



## CARRARO 20.48 - Differential

20. Place the differential housing on a level surface as shown in the figure and extract the roller bearing's external cups using a drift or hammer (Fig. 13)
21. Remove the pinion tapered roller bearing's inside cone using a standard extractor.
22. Retain the bearing cone and the shim located underneath it (Fig. 14).
23. Check all the pinion parts for wear (Fig. 15).

**IMPORTANT:** The ring nut and the flexible spacer must be replaced when refitting the assembly.



## F . Disassembling the differential assembly

24. Take the differential and secure it in a vice.
25. Loosen the screws and remove the bevel ring gear (Fig. 16).  
*NOTE: This releases the two half-bearings in the differential. Ensure that the internal parts do not fall out.*
26. Detach the cover A from the differential unit C, then extract piston B.
27. Collect the "O" rings on the cover and the differential lock piston (internal and external housings) (Fig. 17).
28. Remove the plates, drive discs, washer and sun gear D from the differential unit (Fig. 18).

*NOTE: Disassemble the parts that have been removed and examine them carefully, checking in particular for wear and if they are functioning correctly.*

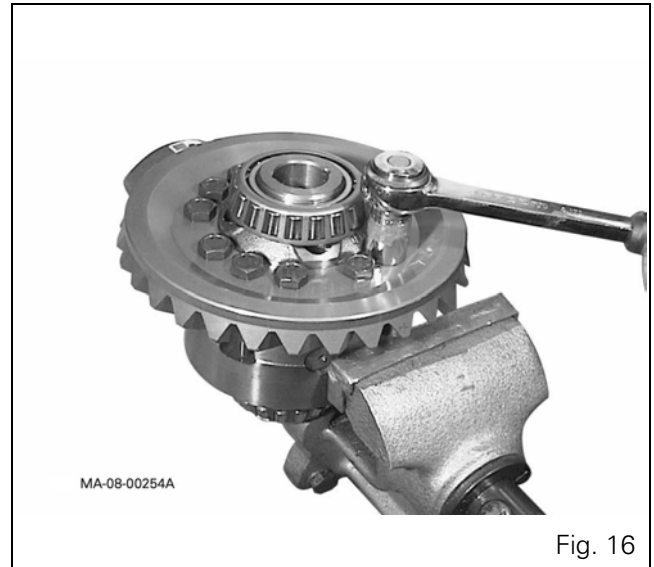


Fig. 16

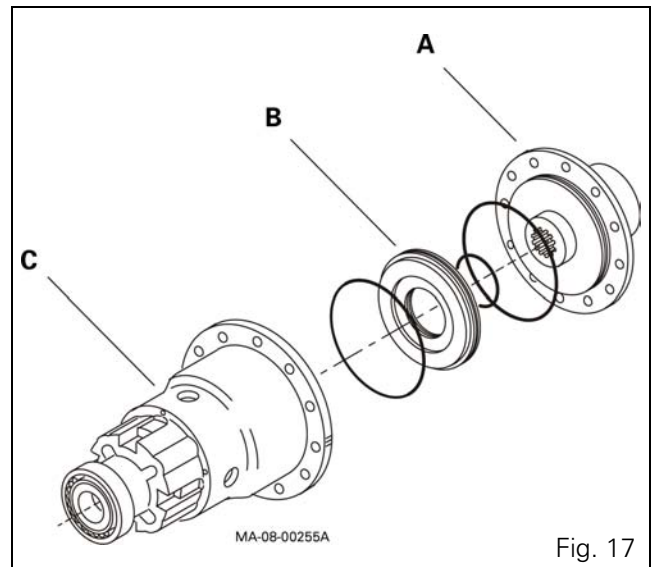


Fig. 17

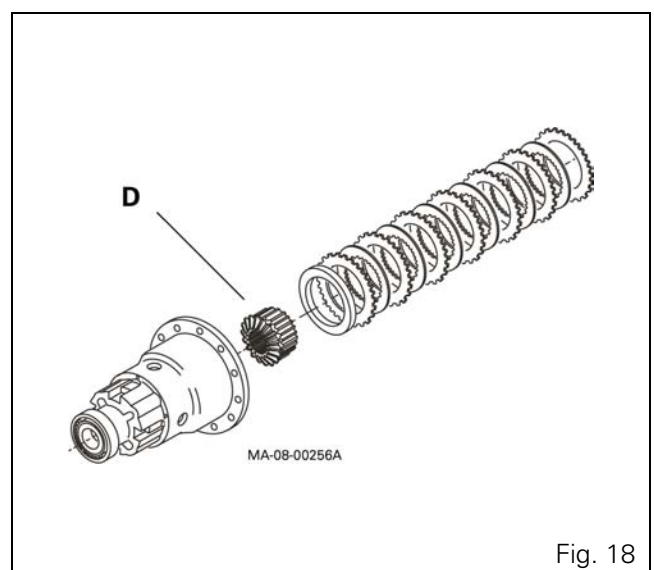
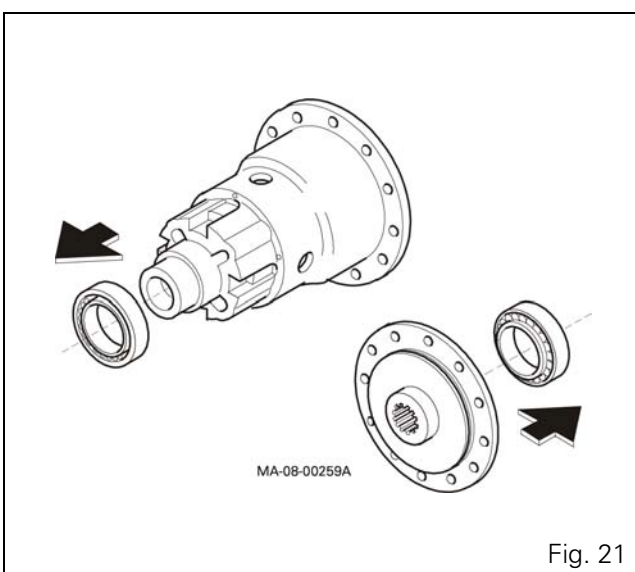
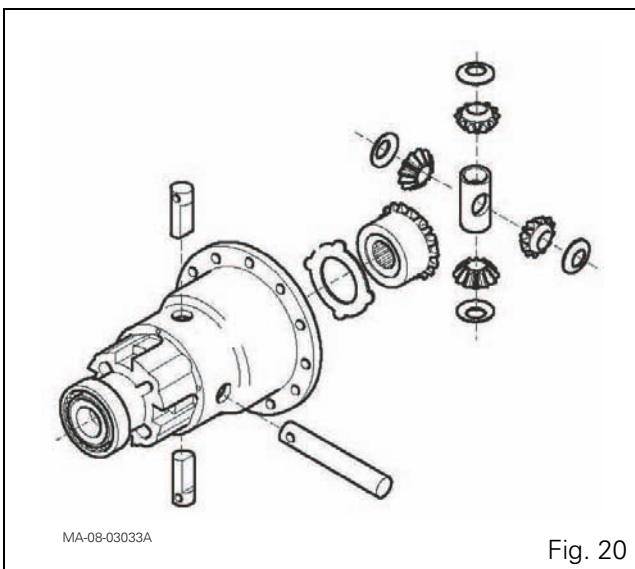
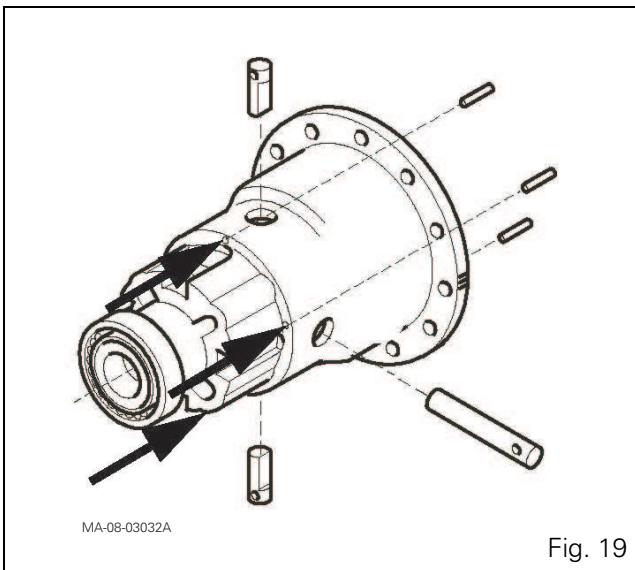


Fig. 18

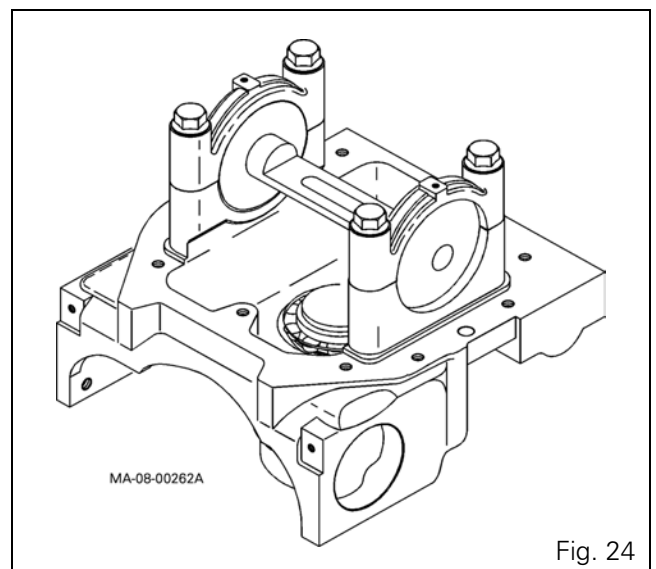
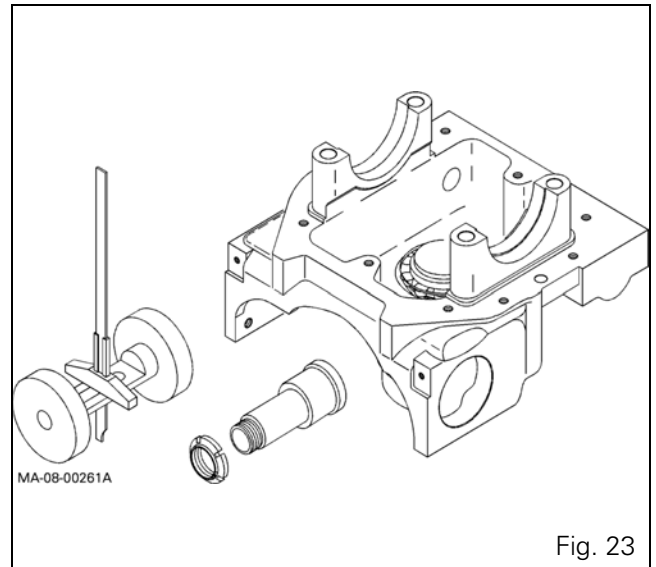
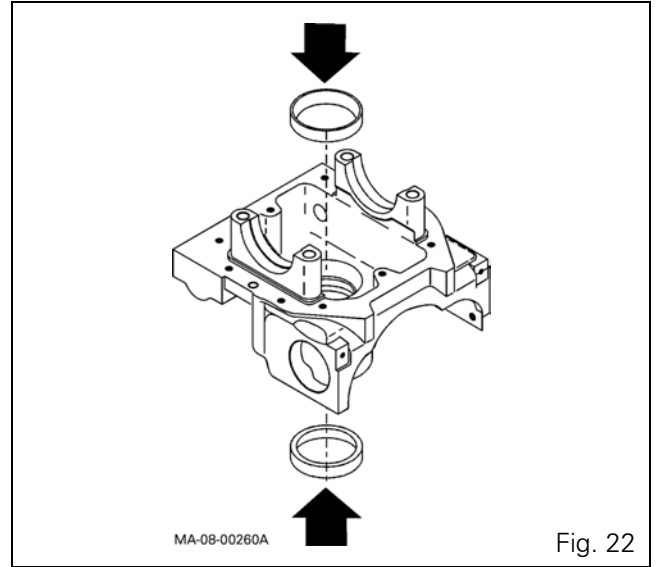
## CARRARO 20.48 - Differential

29. Extract the three locating pins with a punch to remove the long and short pins (Fig. 19).
30. Disassemble the planet carrier and collect the parts it contains—planetary gear, thrust washers, spider, sun gear (Fig. 20).  
**NOTE:** Check all parts for wear and if they are functioning correctly.
31. Extract the bearings from the half-bearings and the cover using a three-point extractor tool (Fig. 21).



## G . Reassembling the pinion assembly

32. Place the differential housing on a workbench.  
Install the external cups for the new bearings with special drifts ref. CA715511 and CA715064 (see § J) and a hammer (Fig. 22).
33. To measure the distance, use the tool kit, ref. CA119196 "dummy gear", CA715268 and CA715512 "dummy differential unit" (see § J) (Fig. 23).
34. Using tool ref. CA119196 (see § J), insert the dummy gear with its bearings and nut in the newly installed roller bearing.  
Tighten without forcing to eliminate the backlash.  
Mount tools ref. CA715268 and CA715512 (see § J) on the differential housing supports and tighten the half-bearing screws (Fig. 24).



# CARRARO 20.48 - Differential

35. Assembly diagram for tools ref. CA715268 and CA715512 (see § J) on the differential housing supports.

Using a depth gauge, measure the distance B (between the bearing pin and the end point of the pinion head or bearing base) (Fig. 25).

36. To determine the necessary thickness S between the pinion and bearing, subtract the value V engraved on the pinion head (V = specified apex distance) from the measured value B (Fig. 26):

$$S = B - V$$

37. Select the required thickness S from the range of shims available and insert the chosen shim under the pinion head.

**NOTE:** Ensure that it is fitted correctly.

Type of shims										
Thickness	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4
Quantity	-	-	-	-	-	-	-	-	-	-

38. After inserting the correct shim with its chamfer facing the pinion, force fit the bearing at the end of the pinion pin using tool ref. CA715433 (see § J) and a press, ensuring that it is seated correctly. Fit the shims and a new flexible spacer (Fig. 27).

**NOTE:** Systematically fit a new flexible spacer.

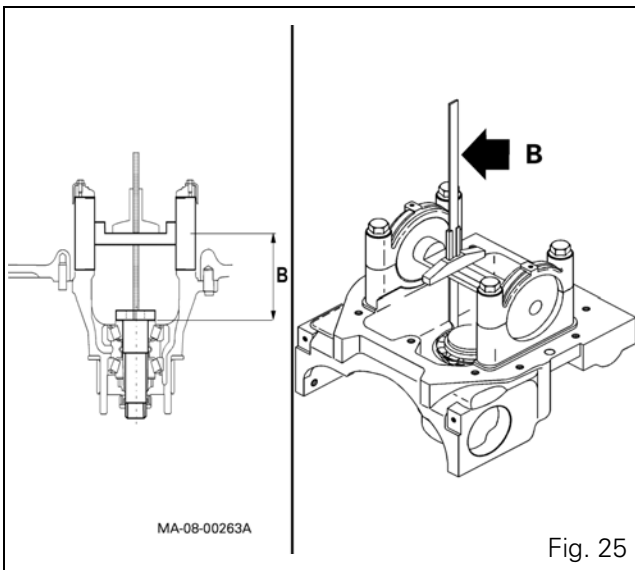


Fig. 25

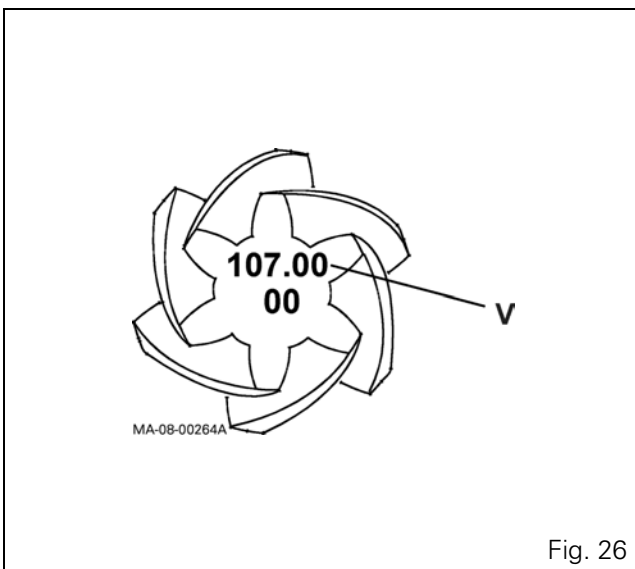


Fig. 26

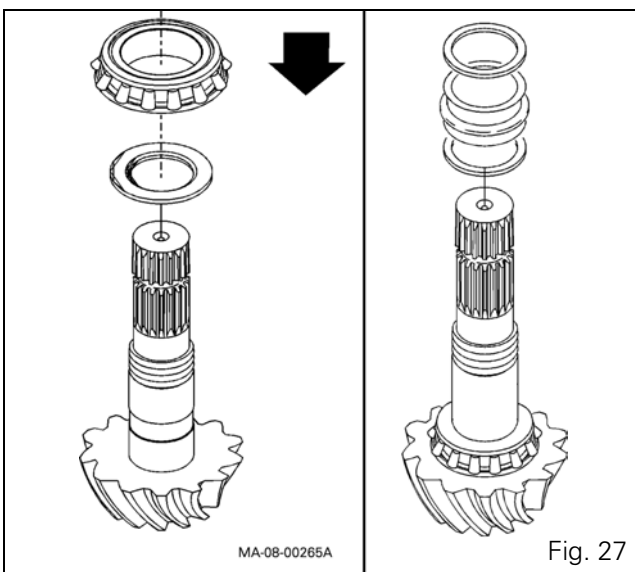


Fig. 27

39. Insert the bevel gear assembly into the differential housing (axle beam internal side) and the second bearing cone at the end of the pinion, on the opposite side. Force fit the second bearing using tool ref. CA715433 (see § J) and a hammer.

**NOTE:** It is recommended to exert a resistance to the striking action of the tool, by using a hammer for example (Fig. 28).

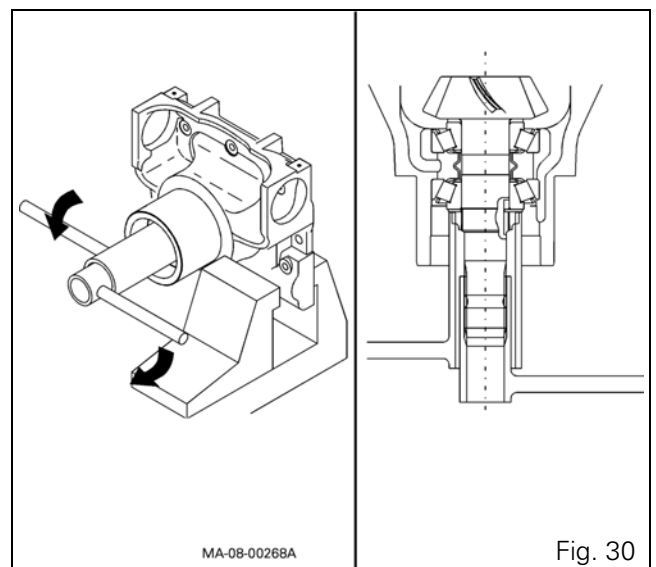
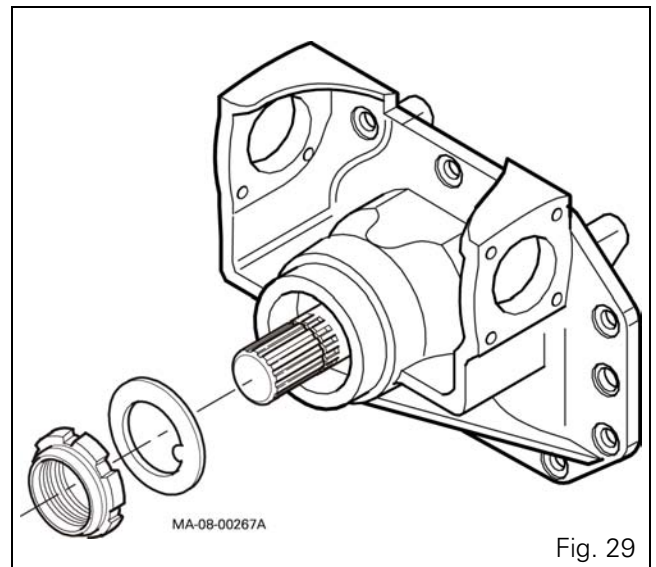
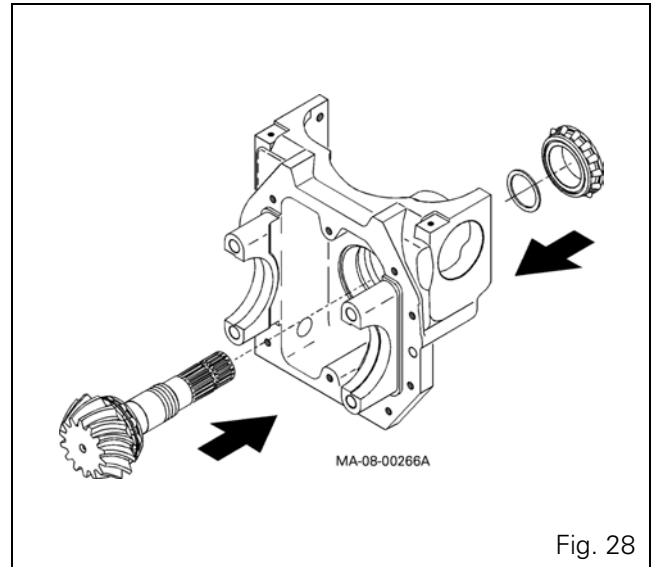
40. Place a retaining washer and screw a new nut onto the end of the pinion (Fig. 29).
41. Screw the nut on with wrench ref. CA119060 while holding the gear in place with tool ref. CA715269 (see § J) (Fig. 30)

**NOTE:**

- The tightening torque is determined by the bearing preload measurement.
- Gradually tighten the nut.

**NOTE:**

- If too much tightening torque is applied, replace the flexible spacer and restart the operation.
- When checking bearing preload, it is recommended to gently tap both ends of the pinion with a rubber hammer to make the bearing seating easier.



## CARRARO 20.48 - Differential

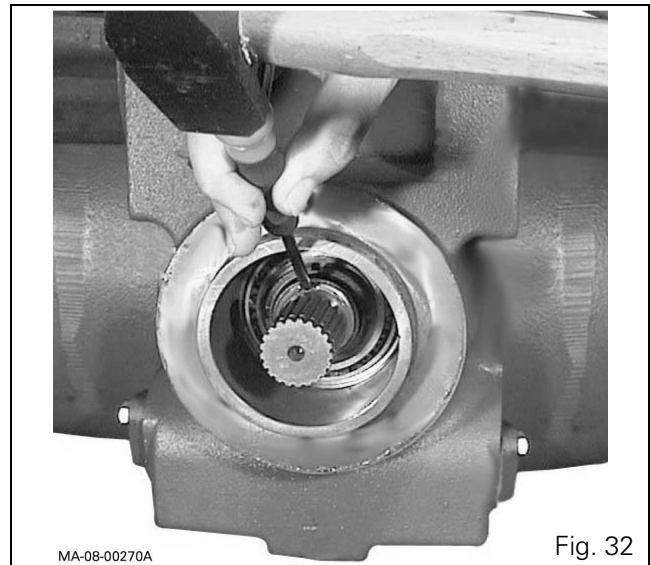
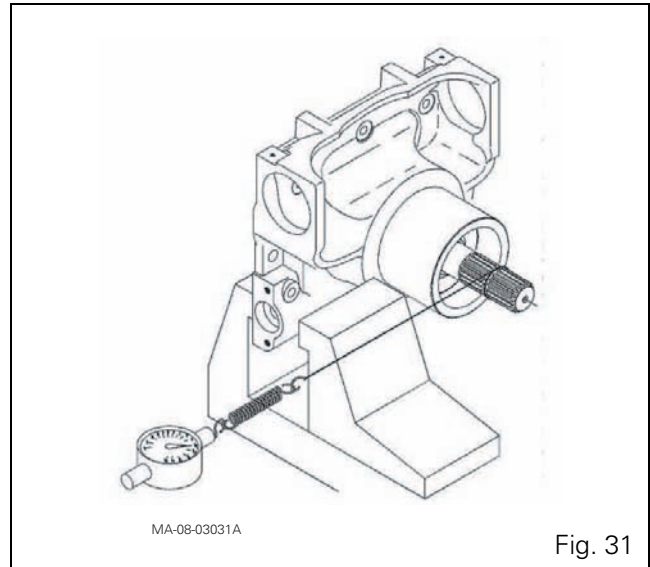
42. Check the preload  $P$  of the pinion's tapered roller bearings (Fig. 31) using a torque gauge.

Shimming is carried out by gradually increasing the tightening torque of the nut, taking care not to exceed the recommended value.

**NOTE:** All preloads must be measured without the seal.

**$P = 8$  to  $12$  daN**

43. When the torque value is reached,peen the nut with a hammer and chisel (Fig. 32).

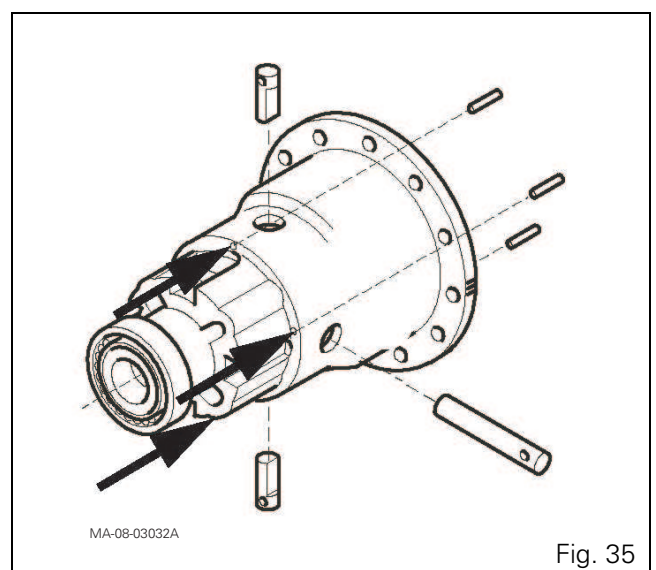
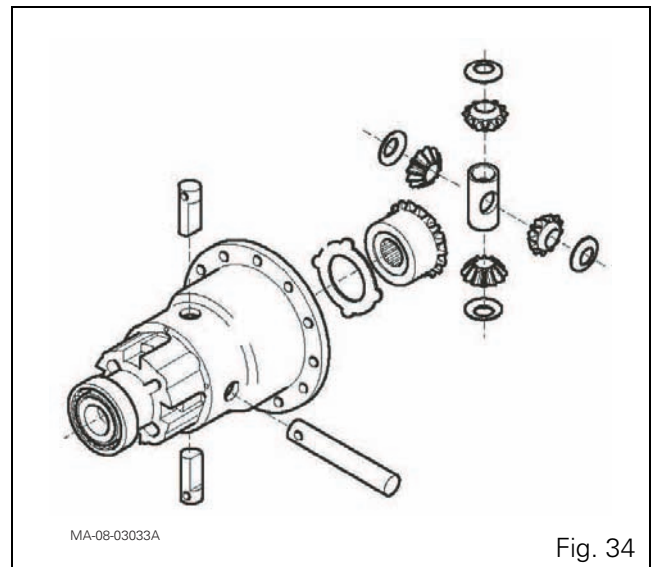
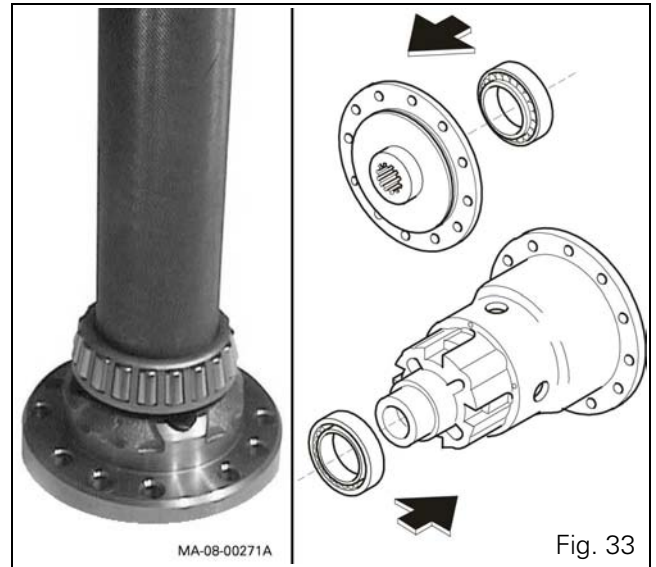




## H . Reassembling the differential assembly

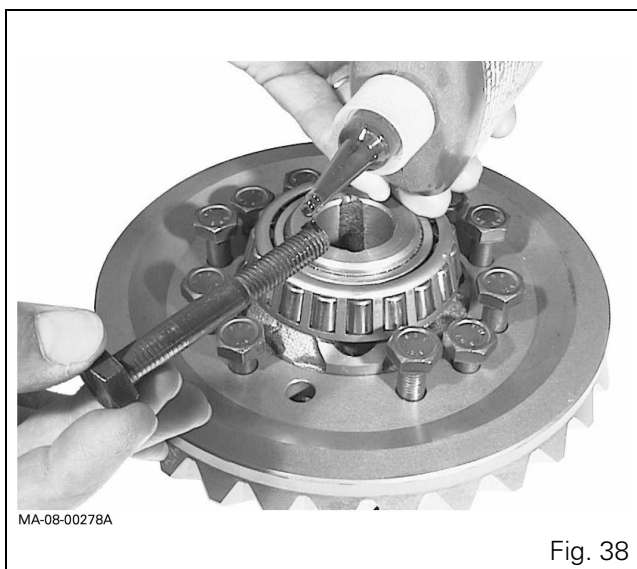
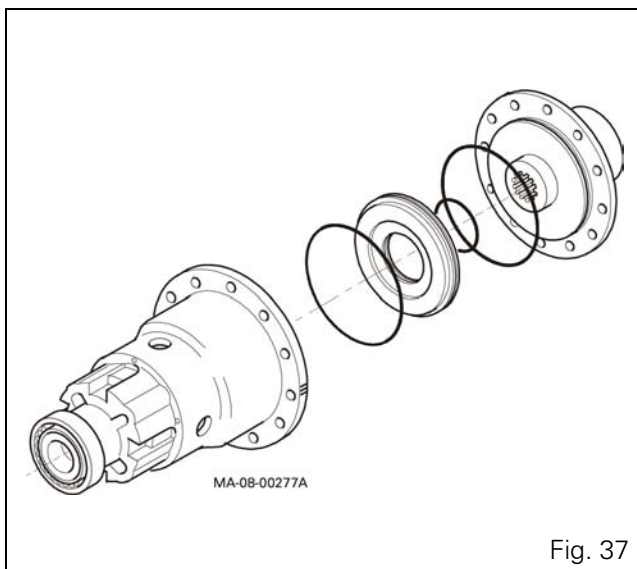
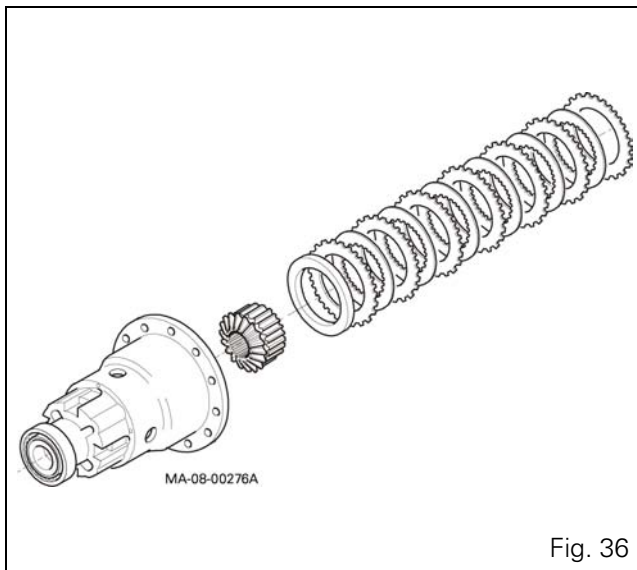
44. Mount the new tapered roller bearings on the half-bearings using tool ref. CA715145 and a hammer (see § J) (Fig. 33).
45. Place the half-bearing on a workbench and install the internal parts (thrust washer, sun gear, planetary gears, spider) as shown in the figure.
46. Insert the short pins and the long pin in their seatings, taking care to hold the planetary gear and the spider in the correct position (Fig. 34).
47. Lock the pins with corresponding locating dowels in the ports provided on the bearing and pins. Turn the pins manually to align the ports of the dowels with those of the bearing (Fig. 35).

**NOTE:** Fix the locating dowels into a permanent position.



## CARRARO 20.48 - Differential

48. Position all the internal parts in the bearing—planetary gears, washer, discs and intermediate discs as shown in the figure (Fig. 36).
49. Lubricate and fit new "O" rings in the seatings provided on the piston and the differential cover. Insert the piston and fit the cover in the differential housing (Fig. 37).
50. Position the bevel ring gear on the cover, apply Loctite 270 to the threads and attach the assembly, tightening screws to a torque of 190 Nm (Fig. 38).



## I . Reassembling the differential housing assembly

51. Fit the external tapered roller bearing cups on the two differential bearings and install the washer and spacer on the crownwheel and pinion side with new seals, previously smeared with a thin layer of grease (Fig. 39).

52. Before positioning the differential unit in the differential housing, install a new seal B and washer A at the bearing base on the bevel ring gear side, over the oil hydraulic port.

53. Fit the unit assembly on the differential housing (Fig. 40).

**NOTE:** Take care not to invert the external cups of the tapered roller bearings and ensure that the bevel ring gear assembly is fitted on the correct side.

54. Move the differential assembly to position the bevel ring gear over the pinion.

55. Ensure that all rings E are in position in their seatings and place both half-bearings D on their seats, following the marks made during disassembly. Lock the two half-bearings with their screws C (Fig. 41).

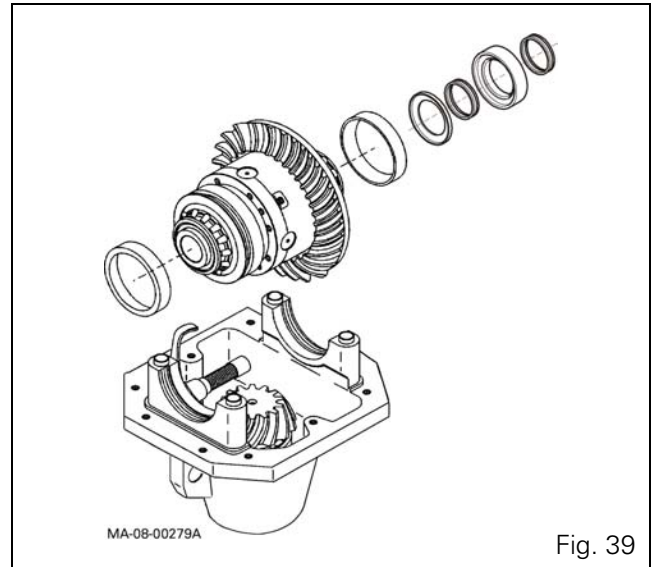


Fig. 39

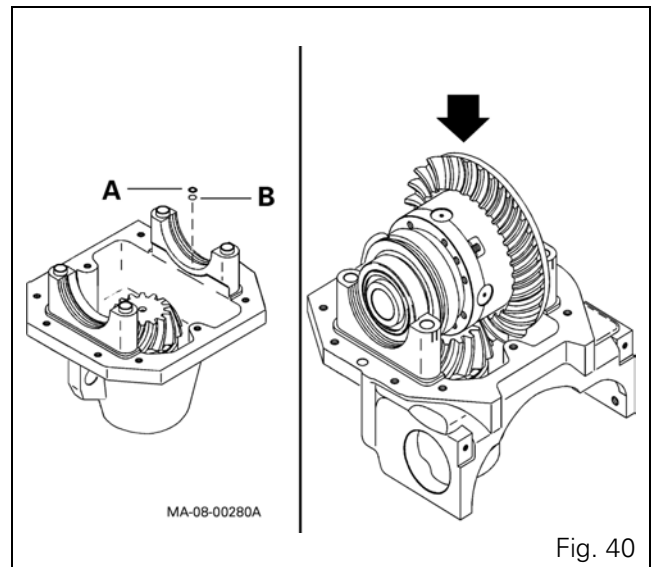


Fig. 40

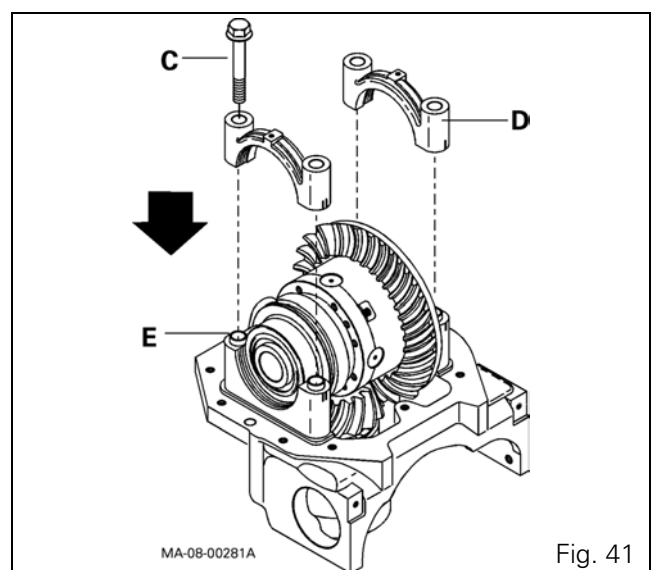


Fig. 41

## CARRARO 20.48 - Differential

56. Assemble and tighten the two adjustment nuts in the differential housing using tools ref. CA715270 (see § J) and CA715271 (see § J) to eliminate the backlash and slightly preload the differential bearings (Fig. 42).

**NOTE:**

- As the two nuts are different, take care to return them to their original positions relative to the bevel ring gear.
- Check that the bearings are correctly mounted in their seats, and tap them gently with a rubber hammer to position them correctly if necessary.

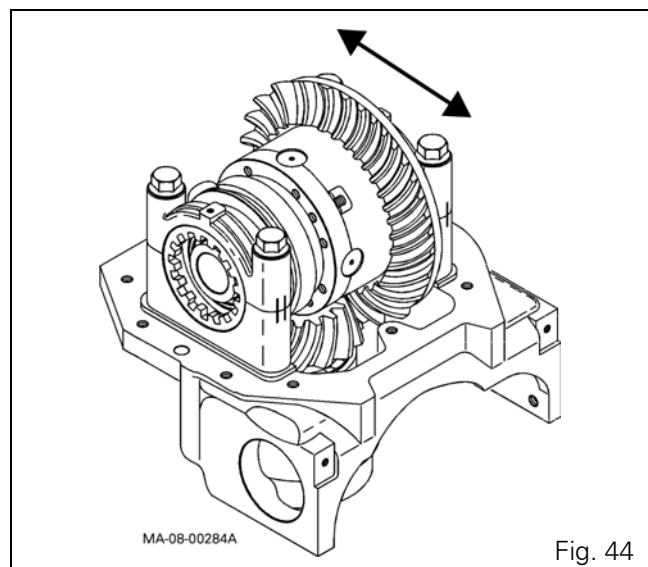
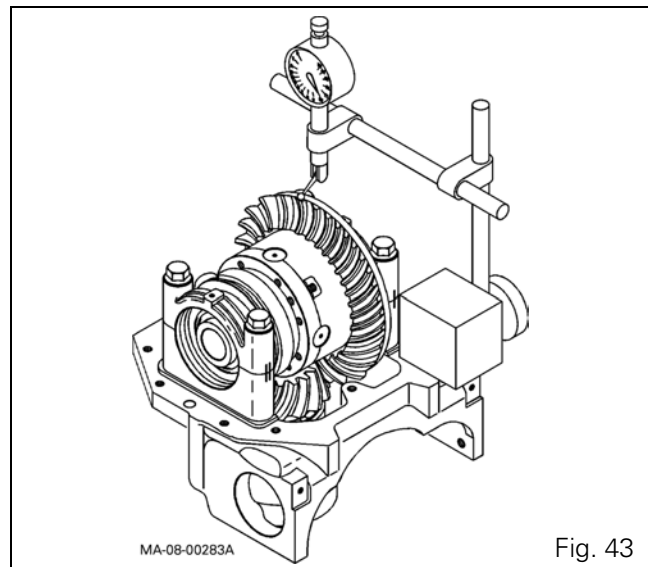
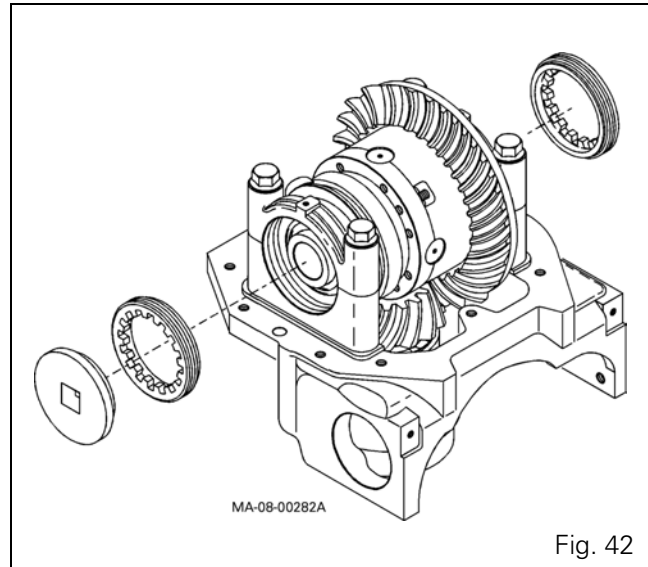
57. Place a dial gauge with a magnetic stand on the differential housing and move the dial gauge feeler pin until it comes into contact with a ring gear tooth at a 90° angle (Fig. 43).

58. Lock the pinion and move the ring gear alternately to the left and right, using the dial gauge to measure the backlash between the pinion and ring gear.

59. Repeat the operation with at least two teeth, turning the ring gear, to calculate an average value. Check that the measured backlash value is within the permissible tolerances:

**0.18 to 0.23 mm**

60. Fine-tune the shimming by adjusting the two nuts with tools CA715270 and CA715271 (see § J) (Fig. 44).



**61.** When tightening nuts, always remember that:

- if the measured backlash is lower than the permissible tolerance, the nut on the bevel ring gear side must be loosened and the opposite screw must be screwed to the same value.
- if the measured backlash is higher than the permissible tolerance, the nut opposite the bevel ring gear side must be loosened and the opposite screw must be screwed to the same value.

**62.** When the backlash between the pinion and ring gear has been adjusted, check that the bearing preload of the differential unit is minimal.

**63.** Repeat the sequence of steps described above until the required conditions are met.

**64.** Once the backlash between the pinion and the ring gear has been adjusted, measure the total preload  $T$  of the bearings (pinion-bevel ring gear system) using a torque gauge (Fig. 47). The measured value must remain within the following limits:

$$T = (P + 9.5) \text{ to } (P + 11.5) \text{ daN}$$

where  $P$  represents the measured value of the pinion (see § G).

**NOTE:** All preloads must be measured without the seal.

If the measured value is outside the permissible tolerance, check the assembly of each part carefully and adjust the differential housing adjustment nuts:

- if the total torque is lower than the permissible value, tighten both nuts identically without modifying the backlash between the pinion and ring gear
- if the total torque is higher than the permissible value, loosen both nuts identically without modifying the backlash between the pinion and ring gear.

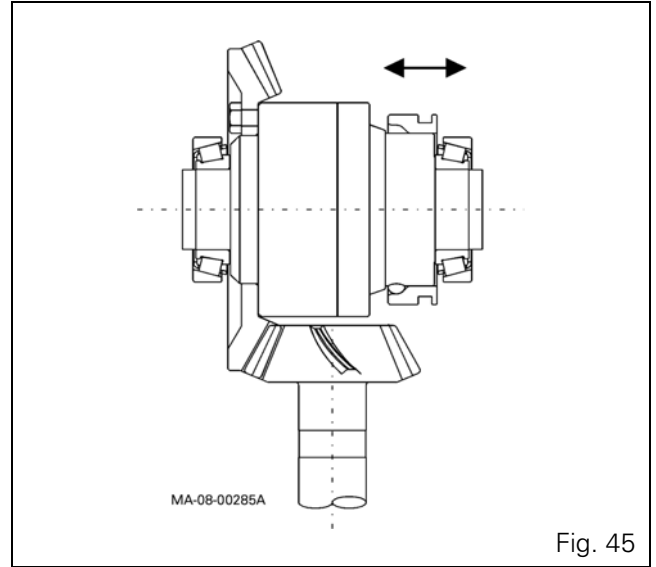


Fig. 45

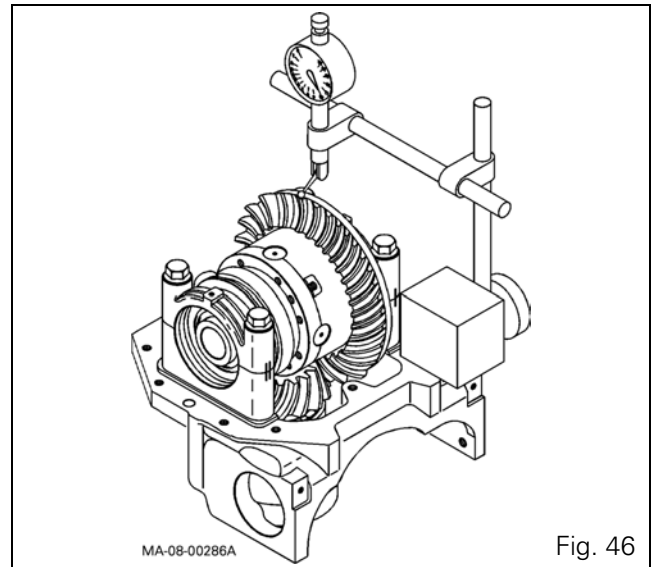


Fig. 46

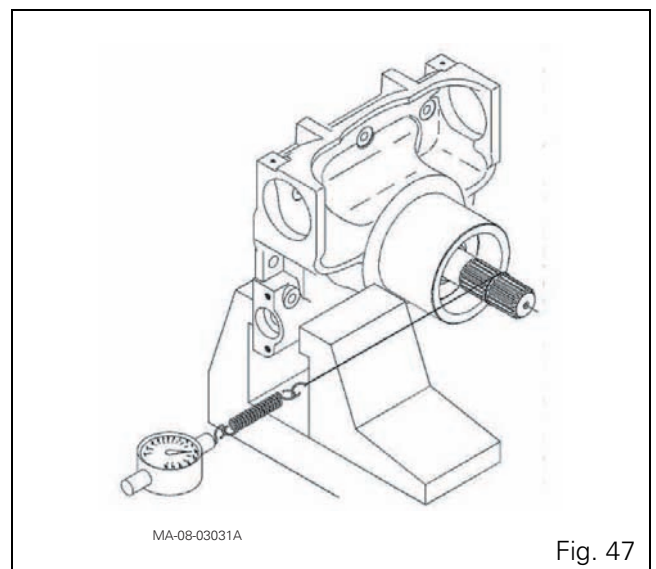


Fig. 47

# CARRARO 20.48 - Differential

## General information

**65.** To test the marking of the crownwheel and pinion teeth, apply the smallest amount of paint to the ring gear.

This marking test must be carried out systematically on the bevel ring gear teeth and on each face (Fig. 48).

### OK = Correct contact

If the crownwheel and pinion are adjusted correctly, a uniform layer of paint is left on the surfaces of the teeth (Fig. 49):

#### - Z: Excessive contact at the tip of the teeth

Move the pinion closer to the ring gear then move the ring gear away to correct the backlash.

#### - X: Excessive contact at the base of the teeth

Move the pinion away from the ring gear, then move the ring gear closer to correct the backlash.

### Corrective action (Fig. 50):

1 Move the pinion in the direction of the arrow to adjust an X type contact.

2 Move the pinion in the direction of the arrow to adjust a Z type contact.

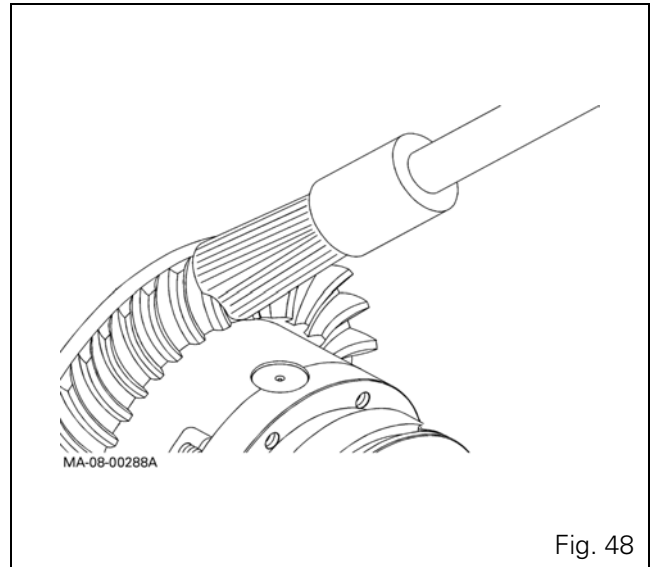


Fig. 48

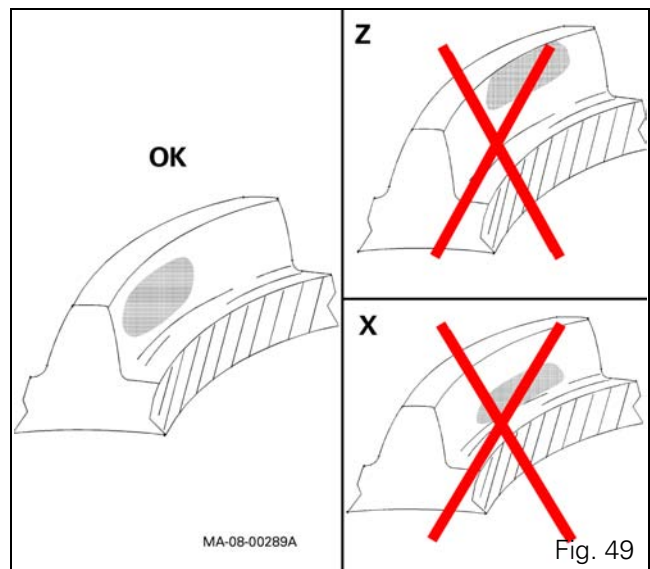


Fig. 49

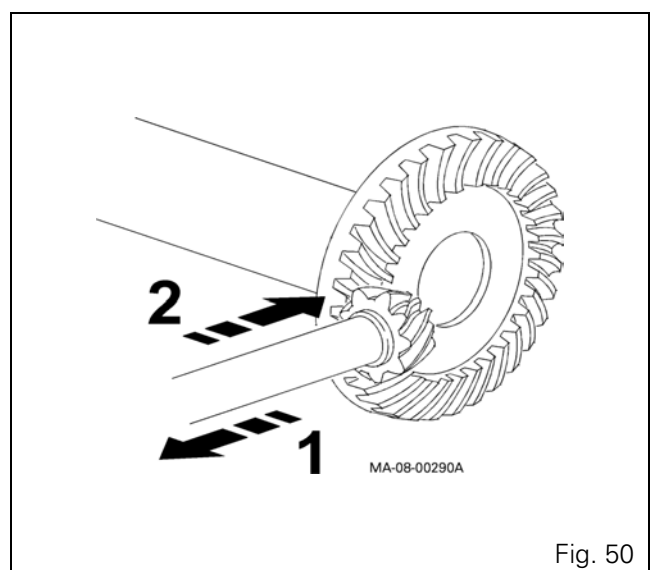


Fig. 50

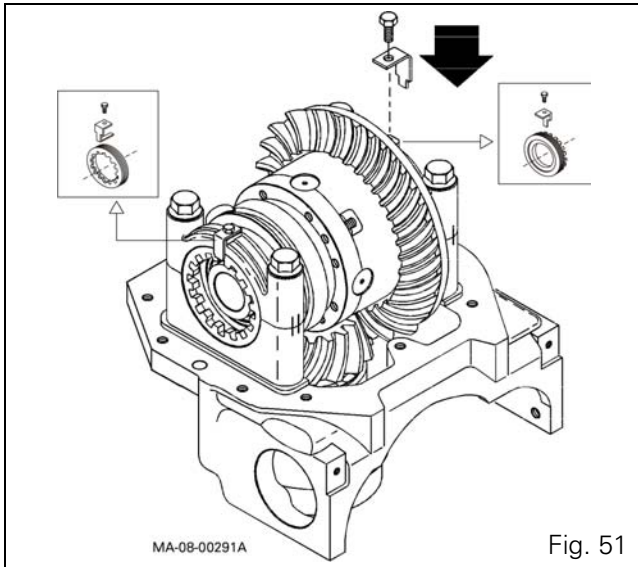


Fig. 51

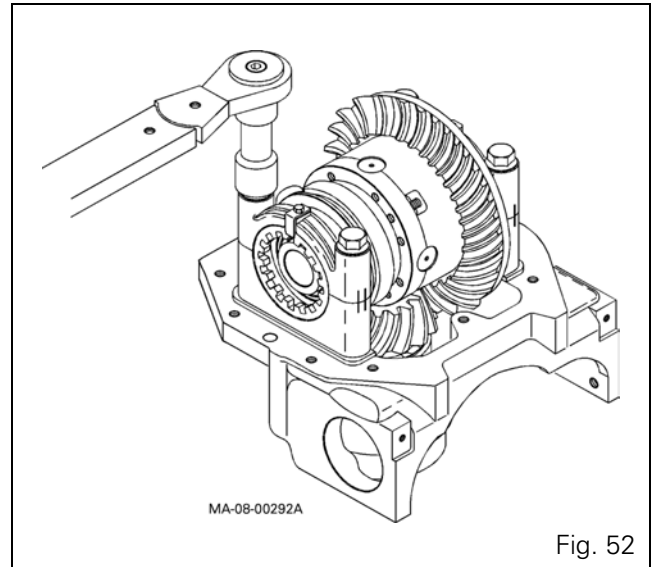


Fig. 52

66. When the shimming procedure is complete, fit the locknuts with their screws and tighten them to 13 Nm using a torque wrench (Fig. 51).

**NOTE:** The nut and its locknut are different on the ring side and the opposite side of the differential unit; turn the nuts slowly to align them with their locknuts.

67. Tighten the screws of the two half-bearings to 413 Nm using a torque wrench (Fig. 52).
68. Before bringing two surfaces into contact, ensure that both are perfectly clean. Degrease and clean them with suitable cleaning products.
69. Apply a thin film of Loctite 510 to the mating surface between the axle beam and the differential housing.

**NOTE:** Check that the centring pins are present.

70. Place the differential housing on the axle housing and screw to 169 Nm.

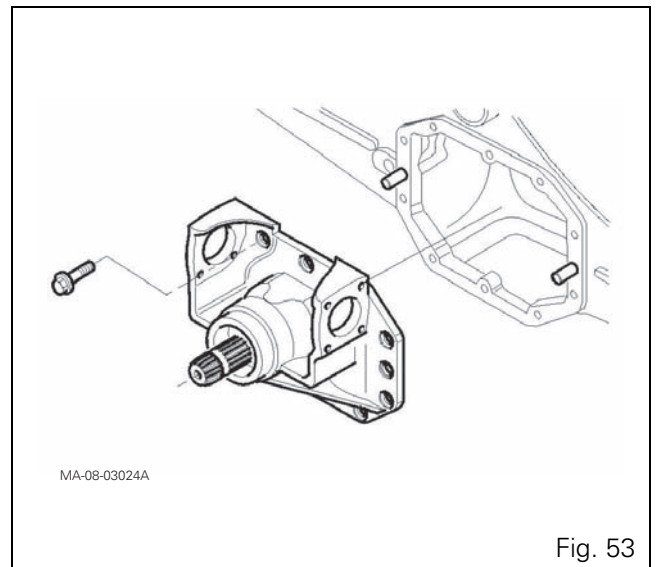


Fig. 53

## CARRARO 20.48 - Differential

71. Fit the new, previously lubricated seal C on the end of the pinion using tool ref. CA715266 (see § J) (Fig. 54).

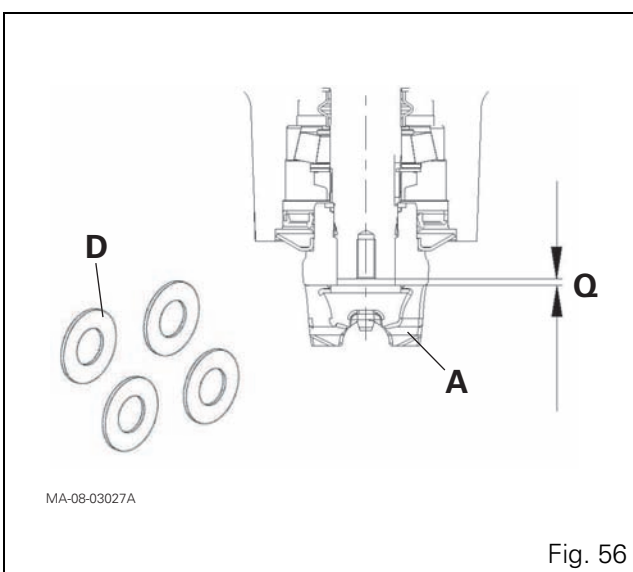
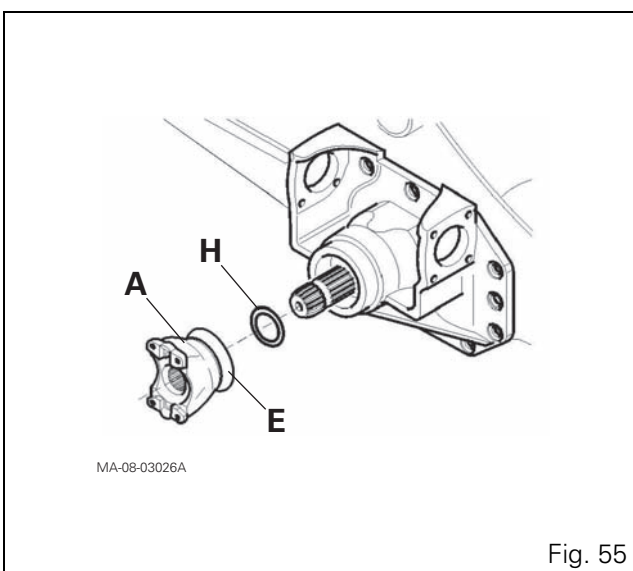
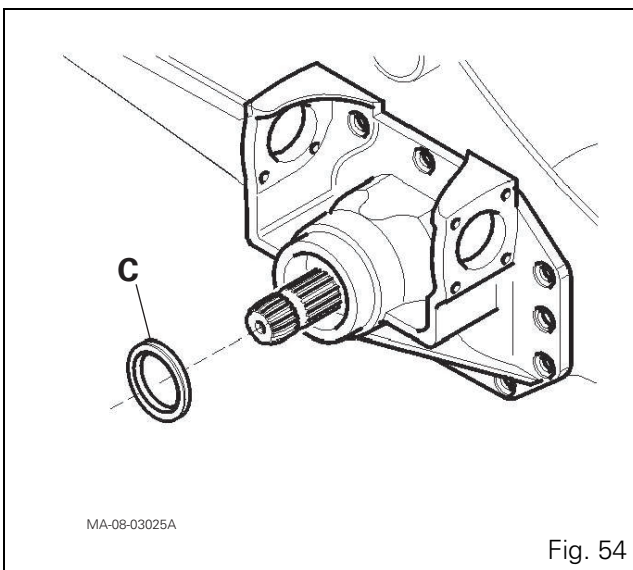
72. Assemble washer H with flange A and protection E (Fig. 55).

**NOTE:** Do not fit the "O" ring.

73. Check that the flange is fully inserted in the pinion. Measure value Q (Fig. 56) between the end of the pinion and the shoulder of flange A for washer C.

Choose shim D to obtain the following clearance:

**0.00 to 0.05 mm**





74. Remove flange A, leaving washer H on the pinion.
75. Position a new "O" ring G on the pinion, then assemble flange A with its protection E.
76. Refit screw B with the shim D selected in step 73 and washer C.

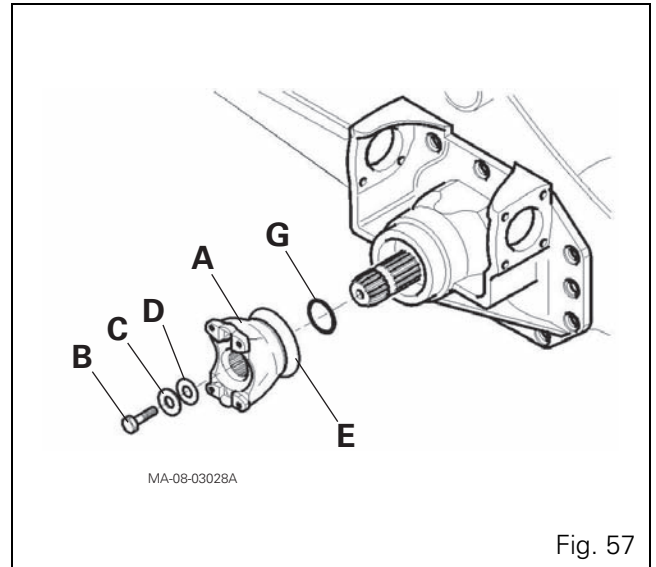
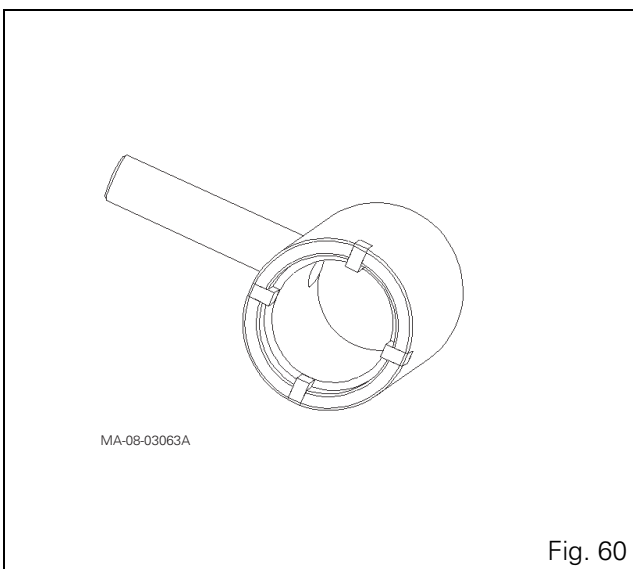
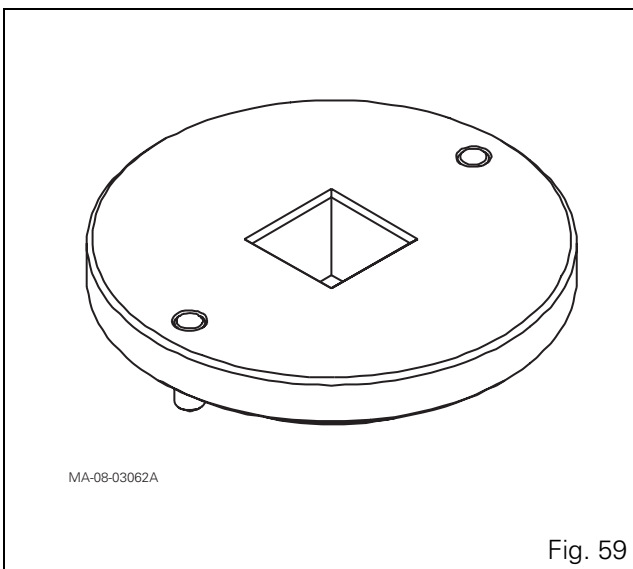
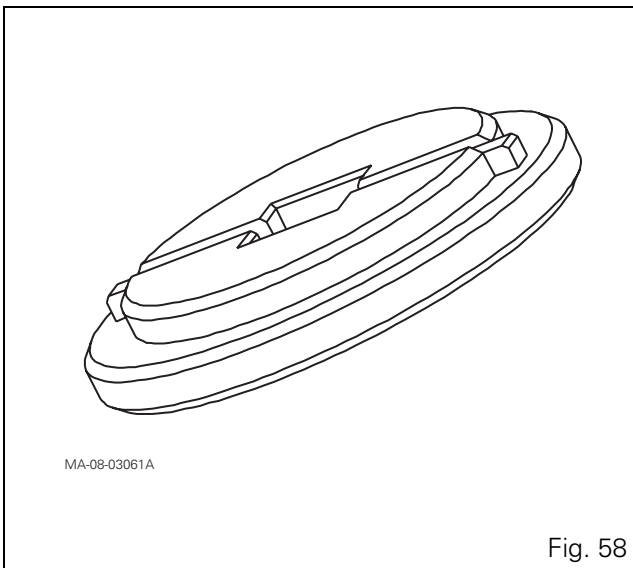


Fig. 57

# CARRARO 20.48 - Differential

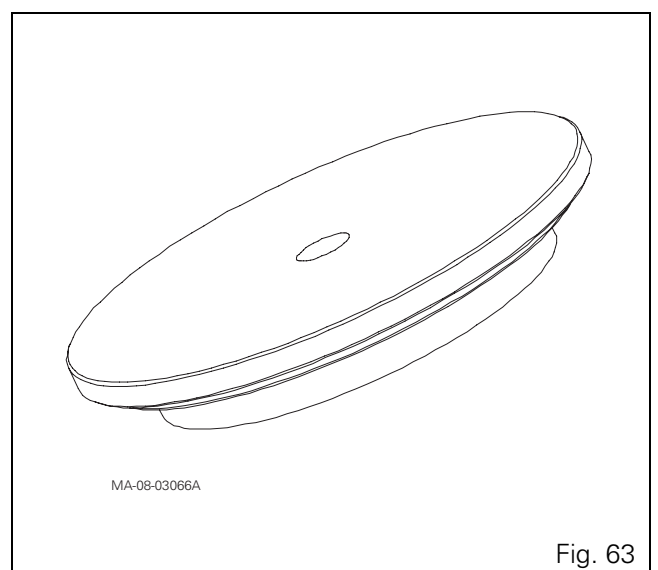
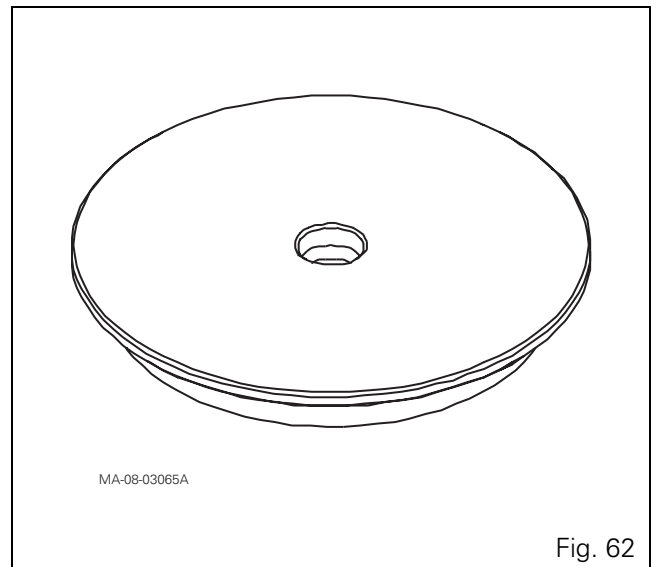
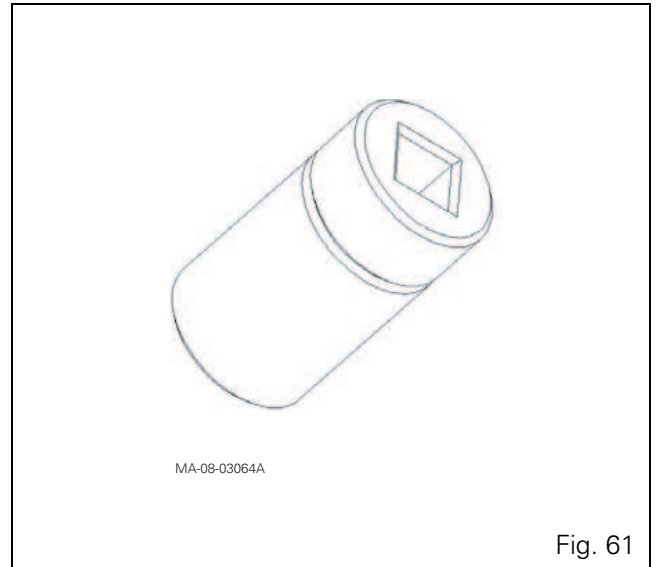
## J . Service tools

- CA715270—adjusting nut wrench (Fig. 58)
- CA715271—adjusting nut wrench (Fig. 59)
- CA119060—pinion nut wrench (Fig. 60)



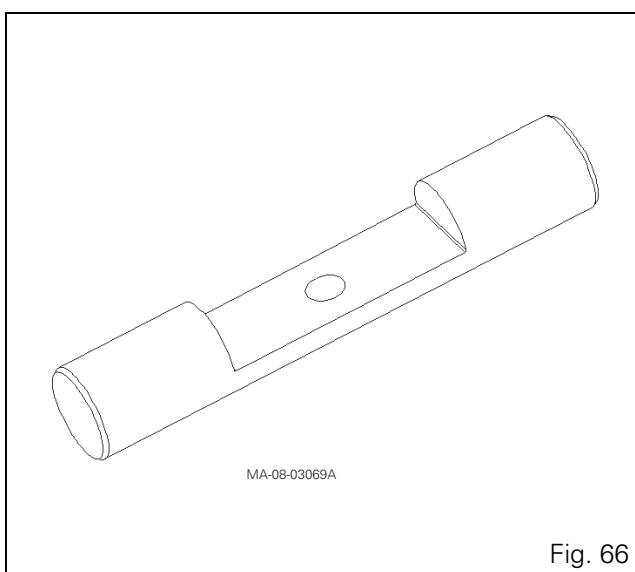
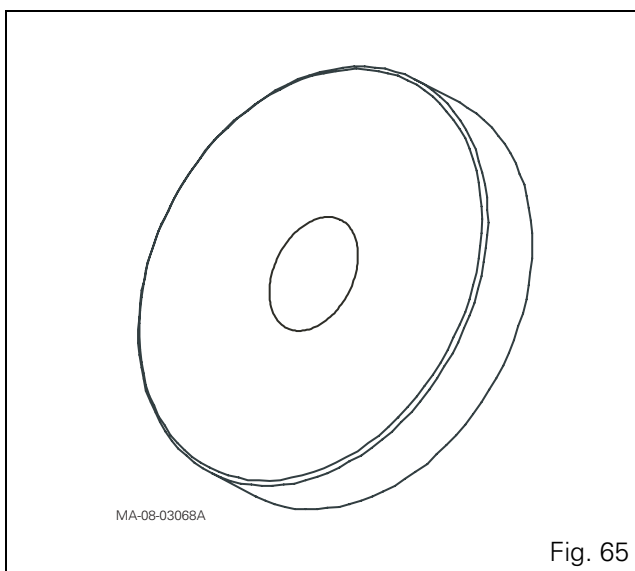
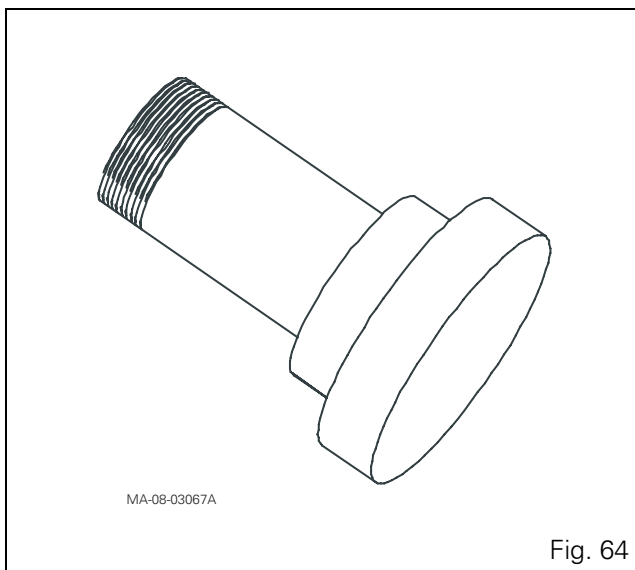
## CARRARO 20.48 - Differential

- CA715269—pinion nut wrench (Fig. 61)
- CA715511—bearing cup fitting tool (Fig. 62)
- CA715064—bearing cup fitting tool (Fig. 63)



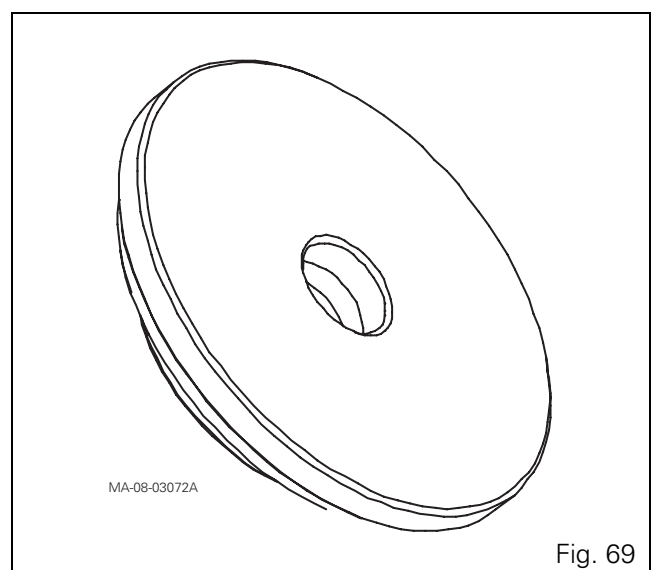
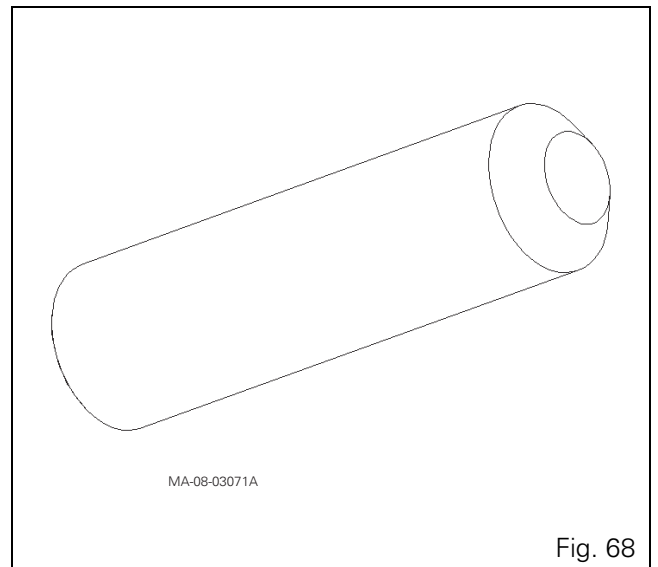
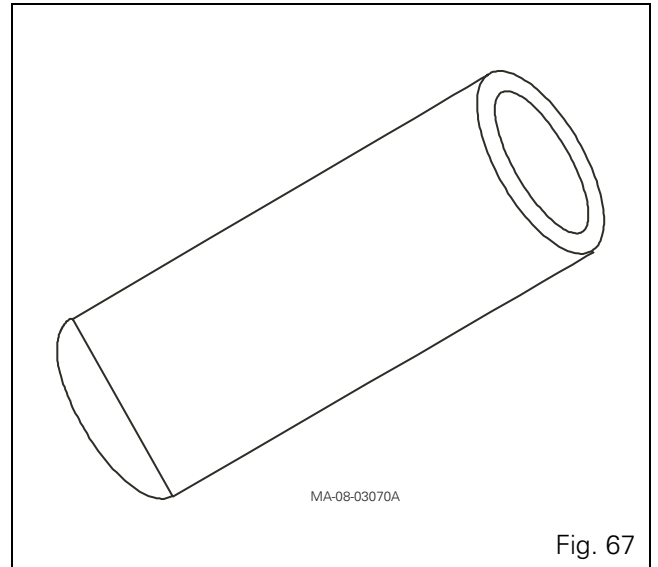
## CARRARO 20.48 - Differential

- CA119196—dummy pinion (Fig. 64)
- CA715268—dummy differential unit (Fig. 65)
- CA715512—dummy differential unit (Fig. 66)



## CARRARO 20.48 - Differential

- CA715433—pinion bearing fitting tool (Fig. 67)
- CA715145—bearing cone fitting tool (Fig. 68)
- CA715266—pinion seal fitting tool (Fig. 69)





## *8B13 - CARRARO 20.48 - GPA30 Transmission shaft and bearing*

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## **CARRARO 20.48 - GPA30 Transmission shaft and bearing**

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# CARRARO 20.48 - GPA30 Transmission shaft and bearing

## A . General

MF6400 series tractors with a GPA30 rear axle are fitted with a fixed or suspended Carraro 20.48 front axle. The front frame (Fig. 1) has two functions:

- it is the main support for a number of components
- it incorporates the second axle beam pivot

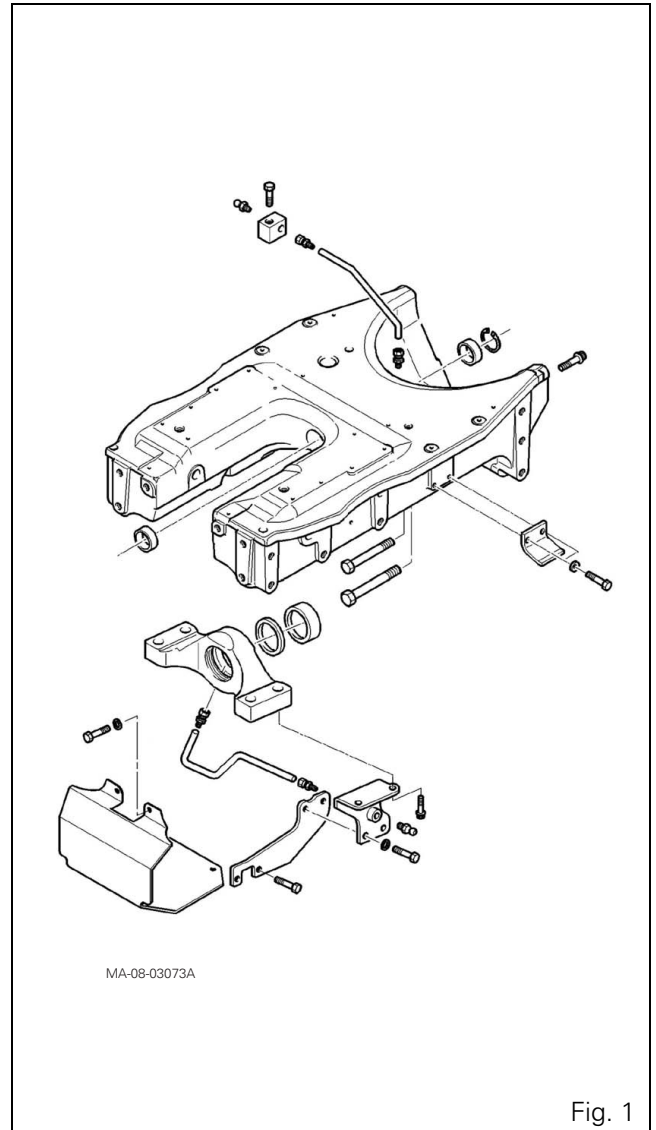
The first axle beam pivot is independent of the front frame and can therefore be disassembled (Fig. 1).

The 4 WD drive line consists of two shafts (Fig. 4):

- a long straight shaft
- a universal joint shaft.

These shafts are linked respectively to the rear axle 4 WD system and to the front drive pinion carrier via a grooved sleeve and spiders (Fig. 4).

This line is supported by the bearing and the cast-iron unit fitted at the front under the axle housing. The rotating assembly is protected by two guards (2) (2A) (Fig. 4).



# CARRARO 20.48 - GPA30 Transmission shaft and bearing

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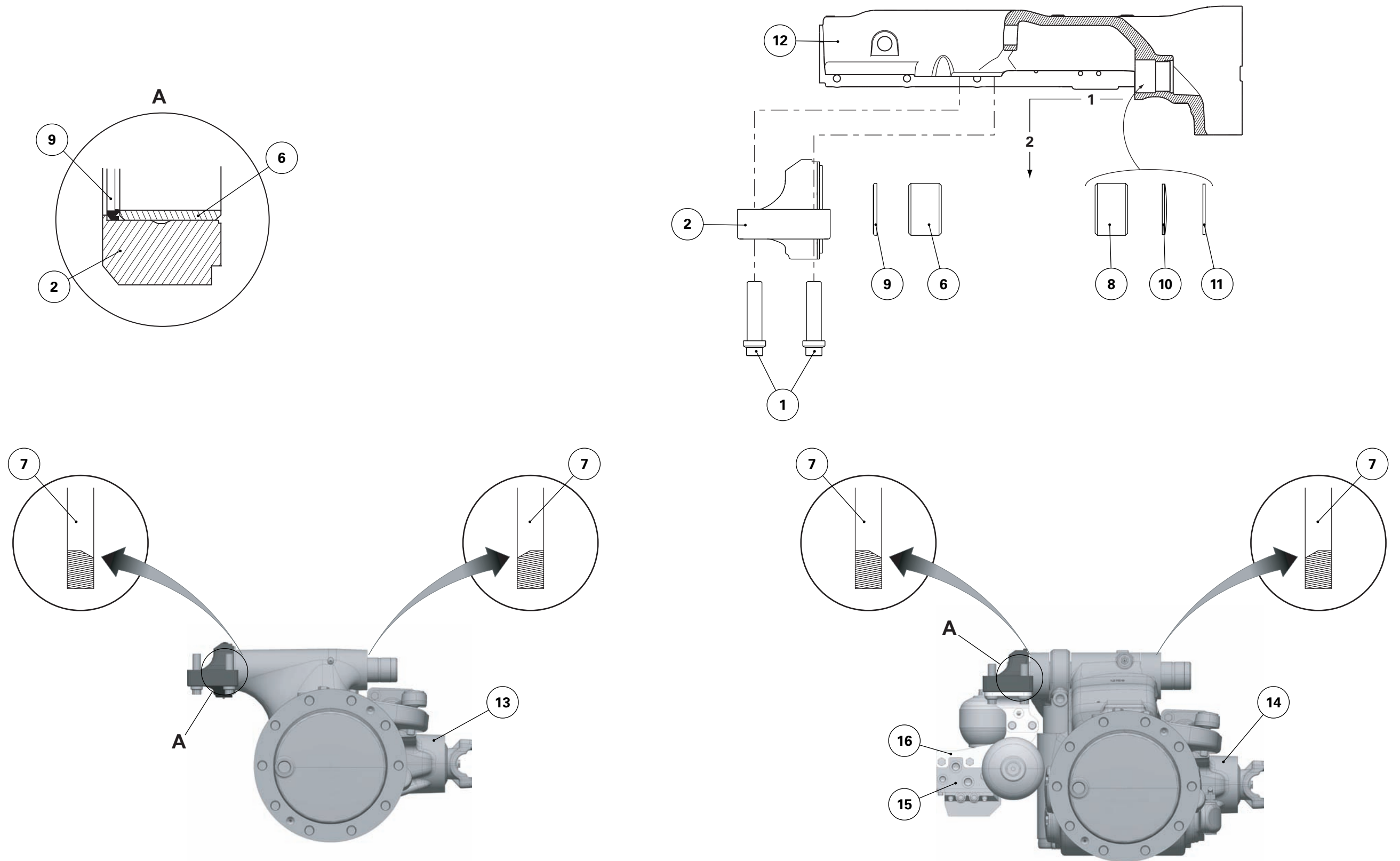
## Parts list (Fig. 2 and Fig. 3)

- (1) Screw
- (2) Front frame
- (3) Front bearing lubricating pipe
- (4) Rear bearing lubricating pipe
- (5) Grease nipple
- (6) Front bearing ring
- (7) Chamfered washers
- (8) Rear bearing ring
- (9) Seal
- (10) Plug
- (11) Circlip
- (12) Front frame
- (13) Fixed front axle
- (14) Suspended front axle
- (15) Suspension control unit
- (16) Support

## Parts list (Fig. 4)

- (1) Long straight shaft
- (1A) Universal joint shaft
- (2) Guards
- (2A) Guards
- (3) Sleeve
- (4) Dust seal
- (5) 1st bearing
- (6) 2nd bearing
- (7) 1st roller bearing
- (7A) 2nd roller bearing
- (8) "Dust seal" nut
- (9) Spider
- (10) Shaft
- (11) Sleeve
- (12) Castellated locknut
- (19) Flange
- (20) Screw

View of the bearing assembly



MA-08-03077A

Fig. 2

**CARRARO 20.48 - GPA30 Transmission shaft and bearing**

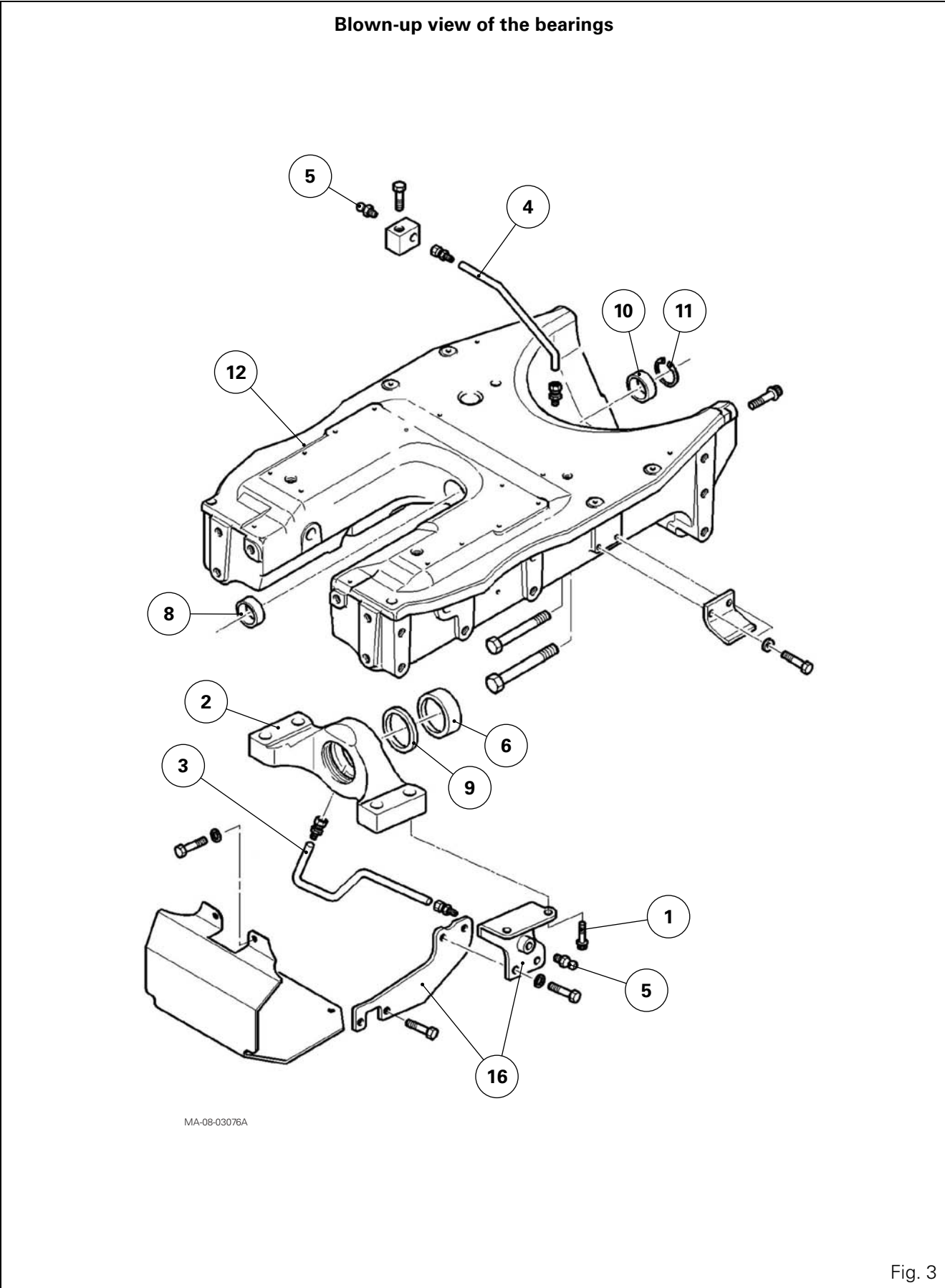
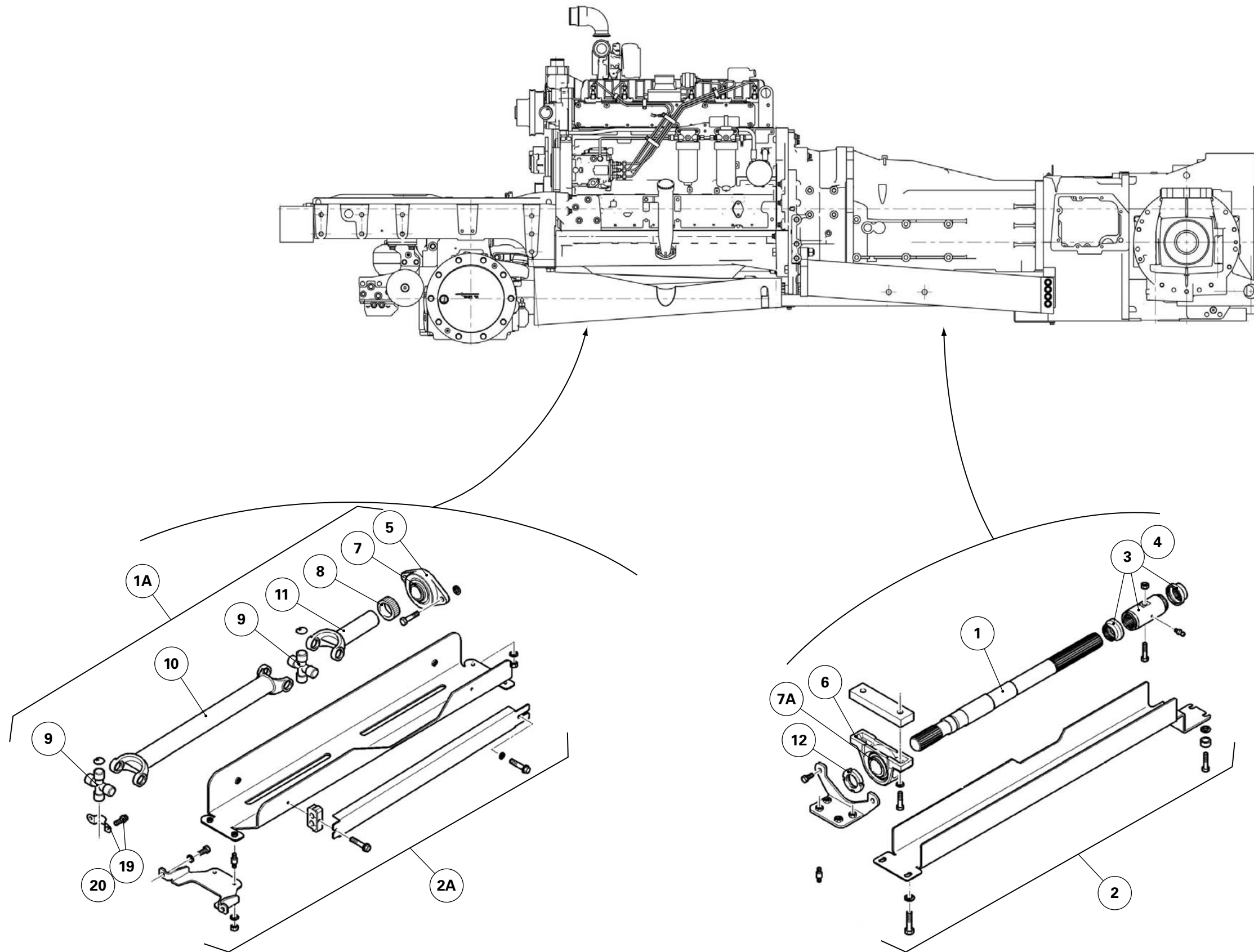


Fig. 3

View of the transmission shaft assembly



MA-08-03039A

Fig. 4

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## B . Disassembling and reassembling the 4 WD transmission shafts and the spiders

### Universal joint shaft (Fig. 4)

#### Disassembly

1. Chock the rear wheels and apply the handbrake.
2. Remove the guards (2) (2A).
3. Unscrew the dust seal nut (8).
4. Remove screws (20) and flanges (19) (Fig. 5).
5. Move the universal joint shaft assembly (1A) and the spiders (9) away from the drive pinion carrier. Remove the shaft.

**NOTE:** If there is not enough room to push the universal joint shaft backwards for removal, disassemble the central bearings and long straight shaft (1).

**NOTE:** The spiders are replaceable. They are listed in the spare parts catalogue.

#### Reassembly

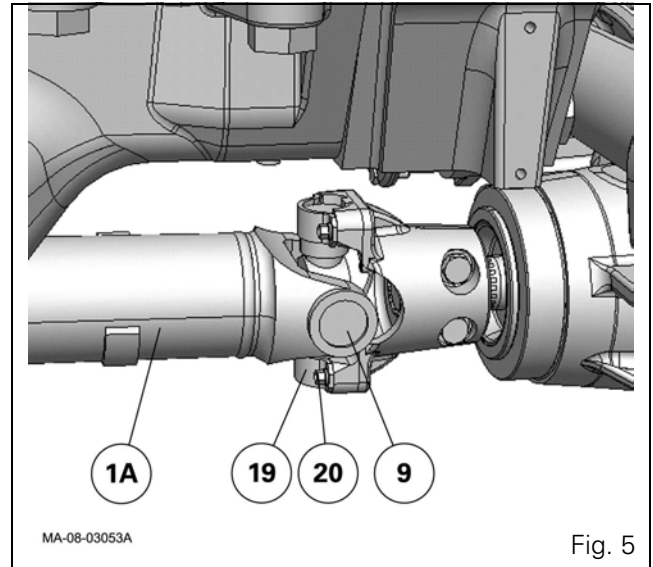
##### Check points

- If the spiders need to be replaced, carefully check the condition of the end clevises at the spider catch location. Remove any traces of impact or sharp edges. Clean the groove of each circlip properly. After assembly, check that the circlips are properly positioned in their respective grooves.

**NOTE:** If necessary, and to facilitate mounting the universal joint shaft on the drive pinion carrier, use a jack with sufficient lifting capacity and position it along the axis of the axle housing to raise the front wheels.

6. Replace the dust seal nut (8) if necessary.

**NOTE:** Use a locally made conical tool to refit the dust seal nut (8) on the shaft (1).



7. Smear the front splines of the long straight shaft with molybdenum sulphide grease or equivalent. Refit the universal joint shaft (1A).
8. Attach the front spider (9) to the plate of the drive pinion carrier using flanges (19) and shoulder screws (20) that have been lightly smeared with Loctite 241 or equivalent and tightened to a torque of 33 Nm.
9. Moderately tighten the dust seal nut (8).
10. With a grease gun, grease the sleeve (11) and refit the guards (2) (2A) (Fig. 4).

# CARRARO 20.48 - GPA30 Transmission shaft and bearing

## Long straight shaft and roller bearing (Fig. 4)

### Disassembly

11. Remove the guards (2) (2A) and the universal joint shaft assembly. Repeat steps 1 to 5.
12. Remove the screw from the sleeve (3). Slide the sleeve (3) and the dust seals towards the front of the long straight shaft.
13. Remove the central bearings (5)(6), roller bearings (7)(7A) and the long straight shaft (1) (Fig. 6 and Fig. 7).
14. Detach bearings (5)(6) from their roller bearings (7)(7A).
15. Unscrew castellated nut (12) (Fig. 4) using a suitable wrench.
16. Remove roller bearings (7)(7A) from the long straight shaft (1).

### Reassembly

17. Check the components. Replace those that are defective.
18. Mount the roller bearing (7) on the long straight shaft. Tighten the locknut with a suitable wrench.
19. Fit the 2nd roller bearing (7A) on the long straight shaft. Screw the Allen screw back onto the internal ring of the roller bearing.
20. Assemble the supports (5) (6) on their respective roller bearings (7)(7A). Tighten the screws.
21. Refit bearings (5)(6), roller bearings (7)(7A) and straight shaft (1) (Fig. 4).
22. Smear the rear splines of the straight shaft (1) with molybdenum sulphide grease or equivalent.
23. Slide the sleeve (3) towards the rear of the long straight shaft. Fit the screw and tighten the nut.
24. Refit the universal joint shaft assembly. Repeat steps 6 to 10.

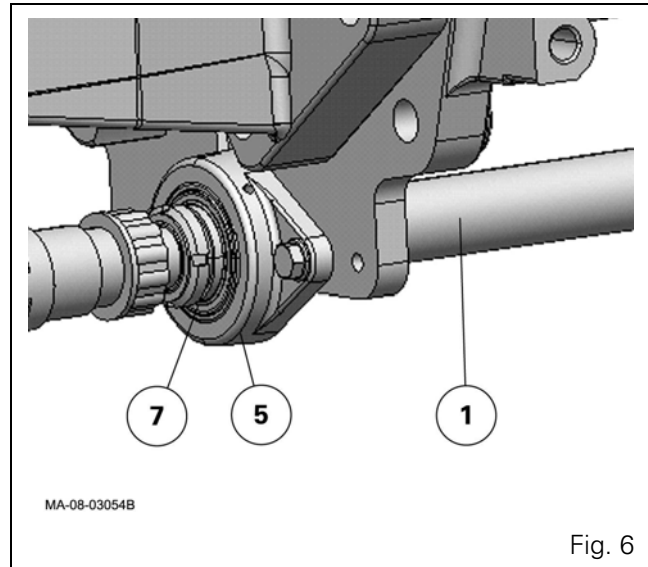


Fig. 6

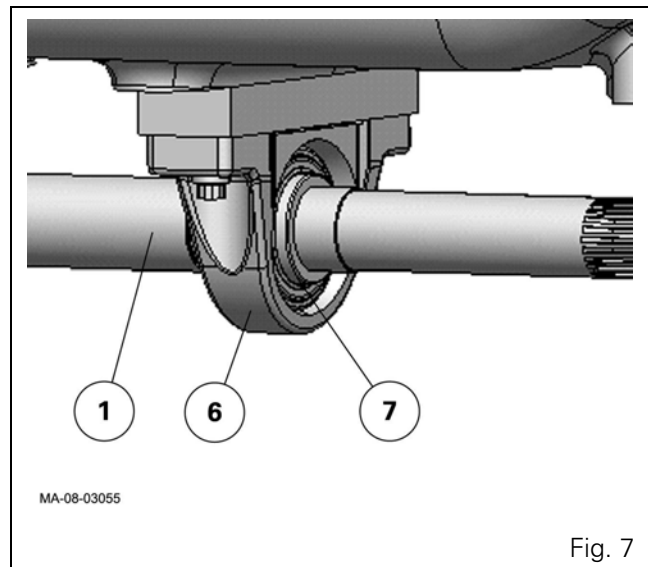


Fig. 7



## C . Removing and refitting the bearing support and front axle

Fixed or suspended front axles

Preliminary step

**25.** Remove the front weights (if fitted). Immobilise the tractor. Apply the handbrake. Place safety chocks on either side of the rear wheels as shown in Fig. 9.

**NOTE:** If fitted, the centre weight (1) (Fig. 8) is attached under the front frame and may hinder removing the bearing support.



**CAUTION:** The centre weight weighs between 180 and 405 kg depending on the option. The removal operation must be carried out carefully with the help of an operator and by using a suitable lifting tool.

**Removing the centre weight:**

- partly remove the internal parts at the bottom of the grille
- support the weight using the suitable lifting tool
- remove the screws (2) (Fig. 8)
- carefully remove the weight from the tractor

**NOTE:** Some tractors may be fitted with a front power take-off. In this case, it will be necessary to remove it before detaching the front axle from the frame.

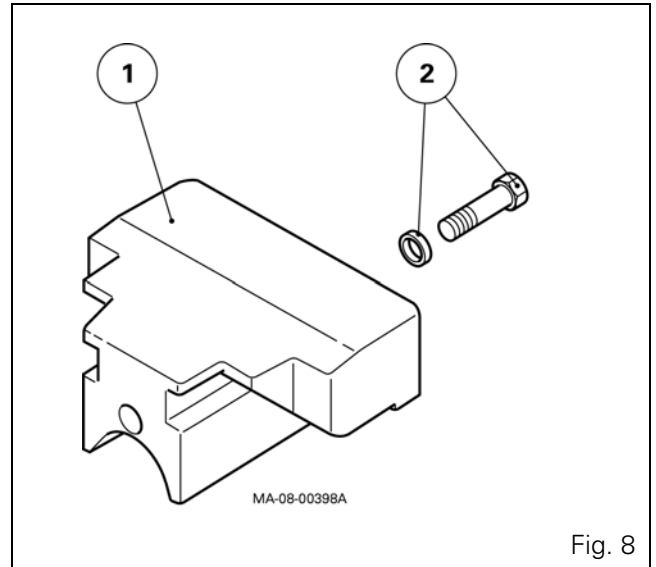


Fig. 8

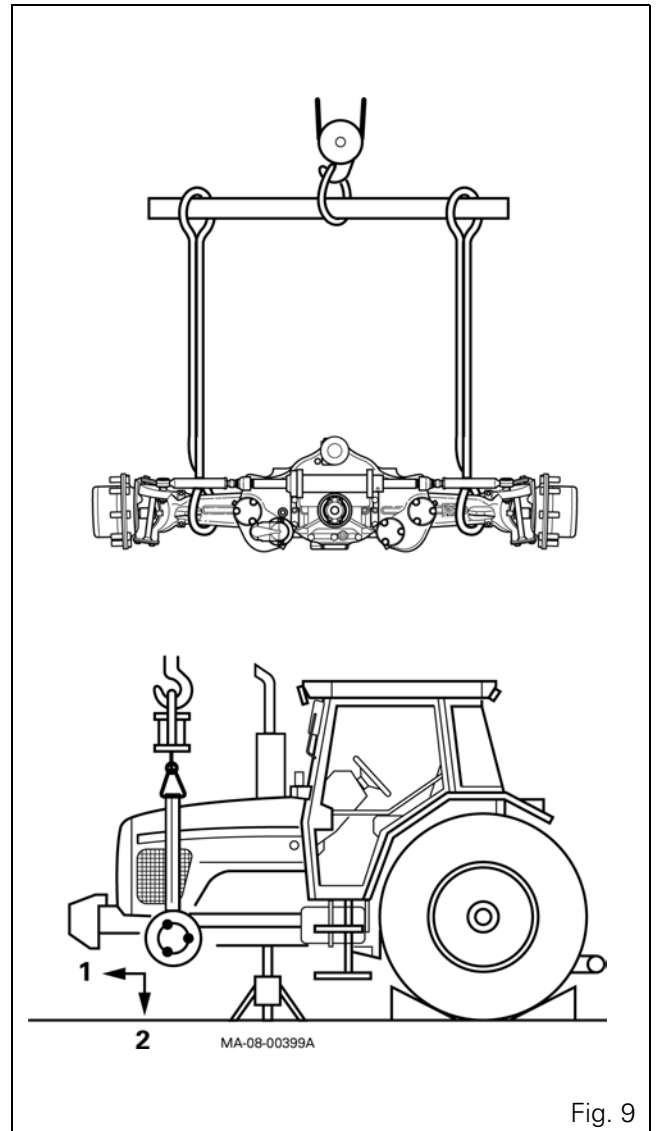
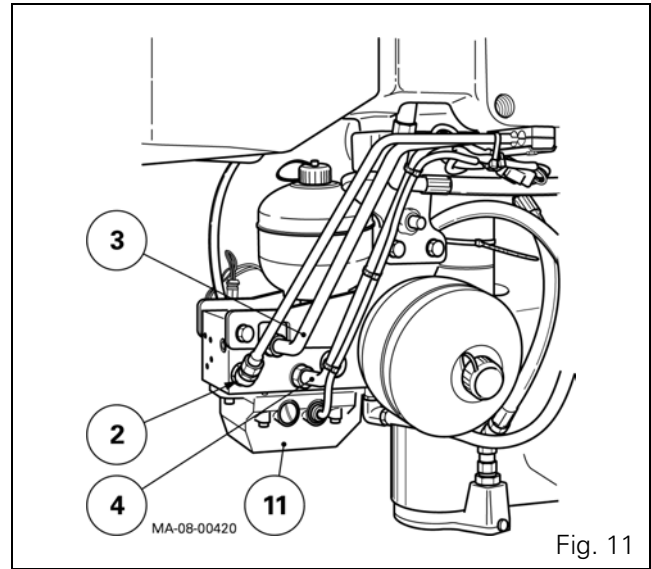
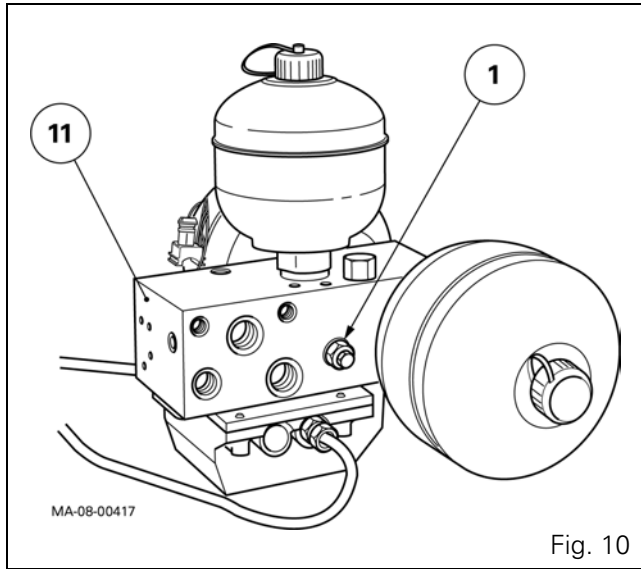


Fig. 9

# CARRARO 20.48 - GPA30 Transmission shaft and bearing



## Suspended front axles

### Removing the hydraulic unit

26. Remove the guard.



**CAUTION: Bleed screw (1) must be unscrewed to relieve the pressure in the hydraulic unit (11) (Fig. 10) before carrying out any operations on the hydraulic pipes.**

27. Locate the connection of the Load Sensing (LS) (2), Return (3), and Pressure (4) hydraulic pipes connected to the hydraulic unit (11) (Fig. 11) and remove them.

28. Locate and remove the hoses (1) (2) connected to the suspension ram (Fig. 12).

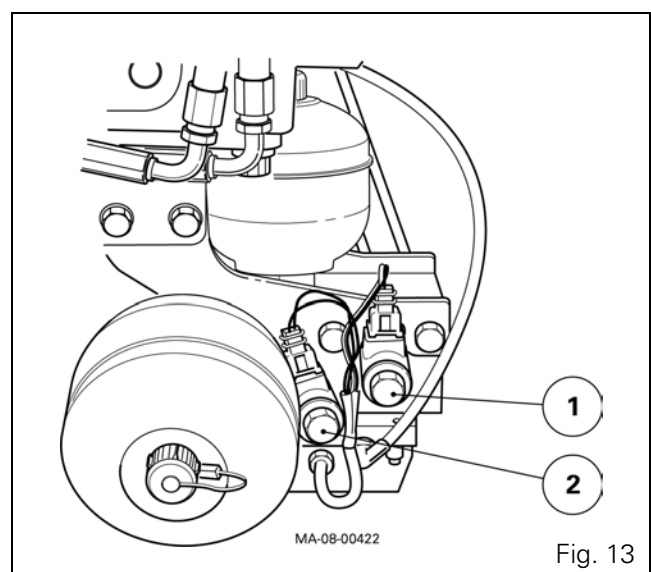
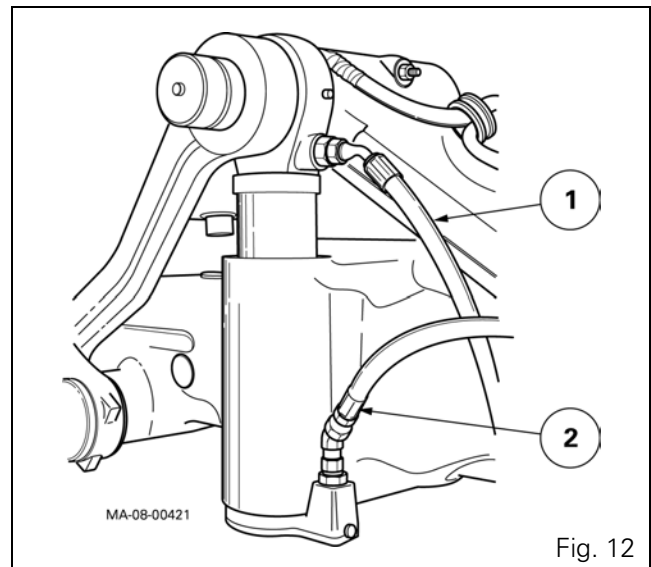
29. Locate and separate the connectors linked to the hydraulic unit electronic device, which are mounted:

- at the front left-hand side of the tractor beneath the frame
- inside the grille

30. On the hydraulic unit, locate and disconnect:

- the solenoid valve (1), green connector (Fig. 13)
- the remaining solenoid valve (2), black connector (Fig. 13)

31. Remove the hydraulic unit with the help of another operator or a locally-made fixture fitted to the head of a trolley jack.



## Fixed and suspended front axles

### Removing the support (2) and the front axle

32. Remove the guards (2) (2A) (see § B).
33. Raise the tractor along the axis of the front axle housing using a jack with sufficient lifting capacity.
34. Remove the front wheels.



***DANGER: Place a fixed axle stand under the lower engine housing.***

35. Locate the steering hoses connection and detach them from the ram.
36. Disconnect the front differential lock control hose.
37. Sling the front axle using suitable straps (Fig. 9).
38. Remove screws (1) (Fig. 2).
39. Pull the front axle assembly complete with bearing support (2) forwards along the axis of the axle beam (position 1) and remove the front axle (position 2) (Fig. 9).
40. Note the features, order and position of the washers (7) and remove them (Fig. 2).

# CARRARO 20.48 - GPA30 Transmission shaft and bearing

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## Refitting

### Check point

41. Clean all components and check the condition of:
- the pivot pin at each end
  - the washers (7)
  - the friction rings (6) (8)
  - the seal (9)

### Fixed or suspended front axles

42. Slide the washers (7), lightly smeared with bearing grease, onto the front and rear ends of the pivot pin, each chamfer facing towards the front axle (Fig. 2).
43. Sling the front axle (Fig. 9). Moderately grease the ends of the pivot pin and mount the support (2) at the front of the pivot pin (Fig. 3).

#### **NOTE:**

- *Before refitting the front axle assembly, check that there is no excess grease in the cavity of the second axle beam pivot on the front frame.*
  - *When refitting the front axle assembly, any such excess grease will be compressed, making insertion of the pivot pin into its bearing difficult.*
44. Refit the front axle and support (2) assembly.
45. Push the assembly hard until it comes into contact with the second axle beam pivot.
46. Thrust the support (2) against the front axle assembly to eliminate the clearance between supports and axle housing as much as possible.

## CARRARO 20.48 - GPA30 Transmission shaft and bearing

47. Fit and tighten screws (1), lightly smeared with Loctite 270 or equivalent, to a torque of 560 Nm.

**Check point**

- Check that the front face of pivot pin (1) is almost level with the front edge "F" of the bearing support (2) (Fig. 14).

48. Check for the presence of grease nipples on:

**Fixed front axles**

- the right-hand side and above the front frame (second axle beam pivot)
- the support (2) (first axle beam pivot).

**Suspended front axles**

- the right-hand side and above the front frame (second axle beam pivot)
- the left-hand support of the hydraulic unit (first axle beam pivot).

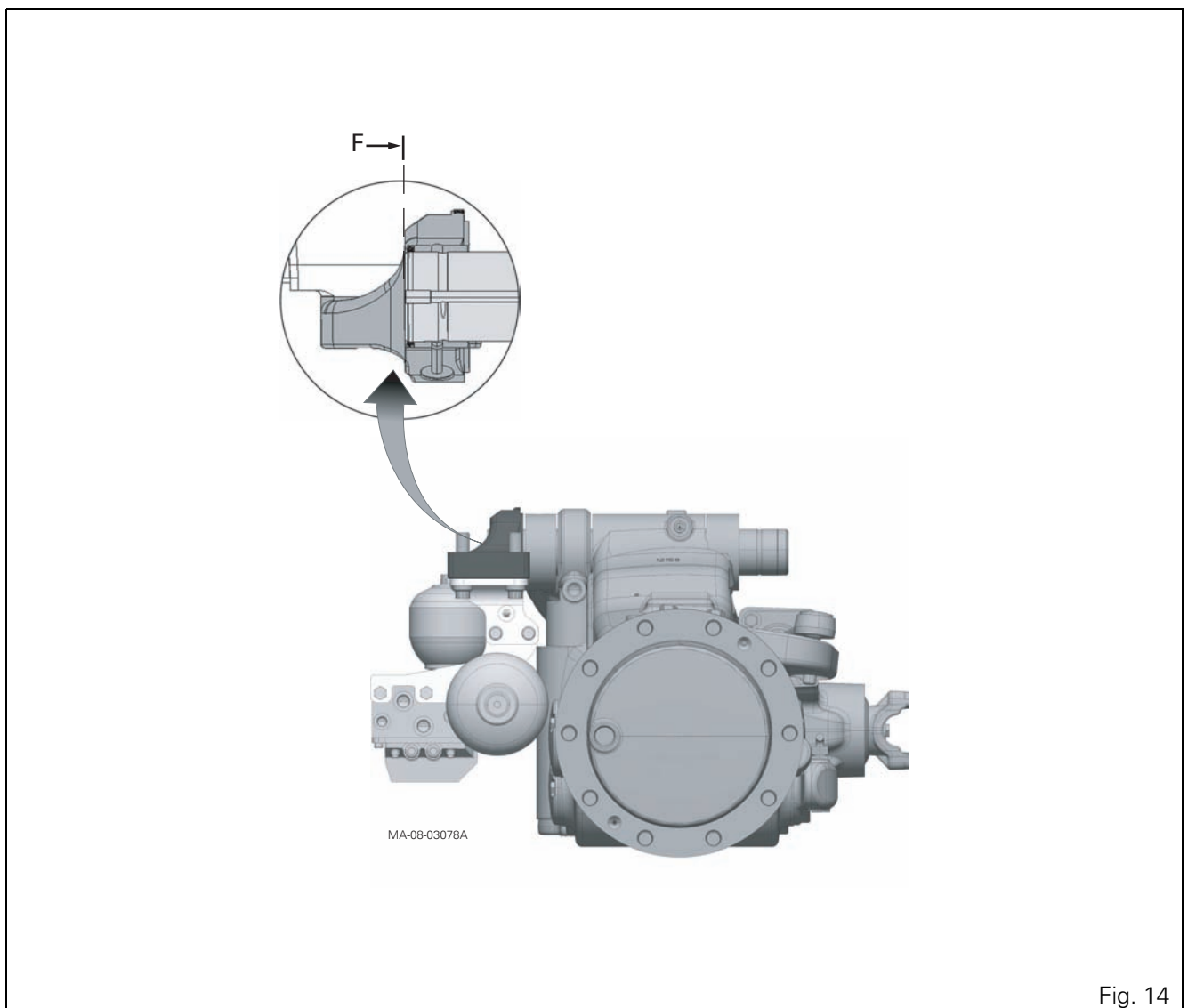


Fig. 14

# CARRARO 20.48 - GPA30 Transmission shaft and bearing

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## Fixed or suspended front axles

49. Reconnect the hoses (using marks made during disassembly)
  - of the steering ram
  - of the front differential lock
50. Refit the wheels. Remove the axle stand and take away the jack. Tighten the wheel nuts to a torque of 640—680 Nm.
51. Refit the centre weight. Tighten screws (2) to a torque of 420—560 Nm (Fig. 8), after lightly smearing the threads with Loctite 270 or equivalent. Refit the front weights (depending on equipment fitted).
52. Refit the universal joint shaft and the guards (see § B).

## Suspended front axles

### Refitting the hydraulic unit

53. Refit the hydraulic unit by reversing the procedure for removal.
54. Reconnect the solenoid valves and the electronic device connectors (according to marks made).
55. Reconnect the hoses to the suspension ram (according to marks made).
56. Reconnect the Pressure (4), Return (3) and LS (2) hydraulic pipes to the hydraulic unit (according to marks made) (Fig. 11).

**REMINDER:** Check that the bleed screw (1) (Fig. 10) is properly closed.
57. Refit the guard.

## Final steps

58. Remove the safety chocks.
59. Using a grease gun, grease the friction rings (6) (8) on the axle beam pivots (Fig. 2).

# CARRARO 20.48 - GPA30 Transmission shaft and bearing

## D . Replacing the friction rings and seal

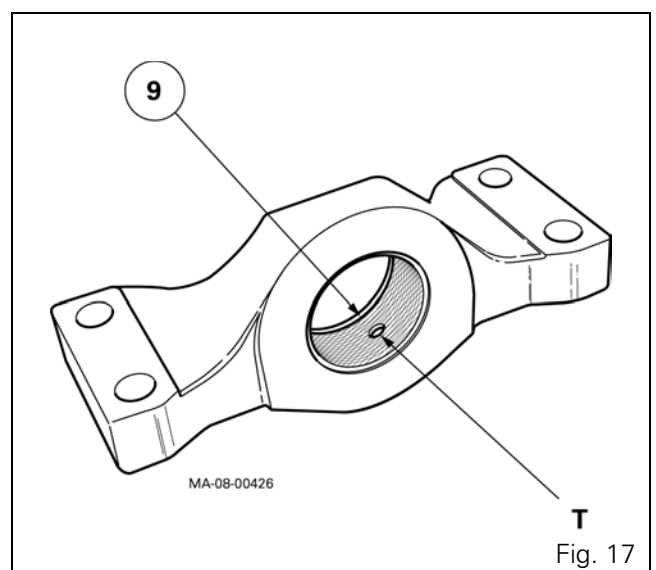
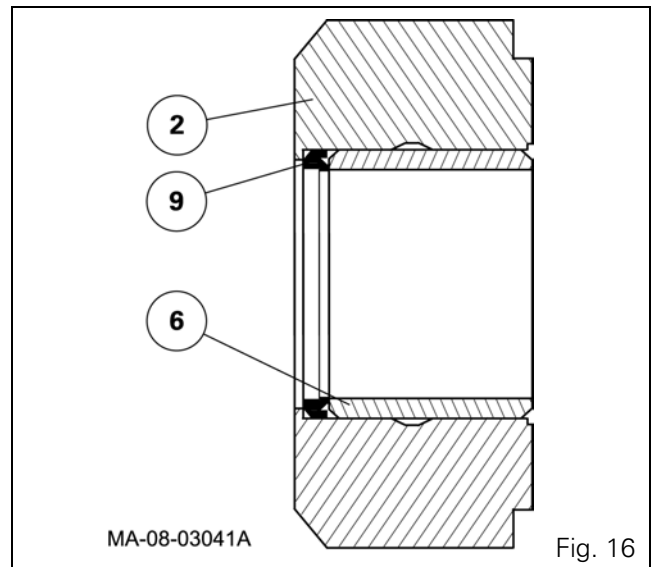
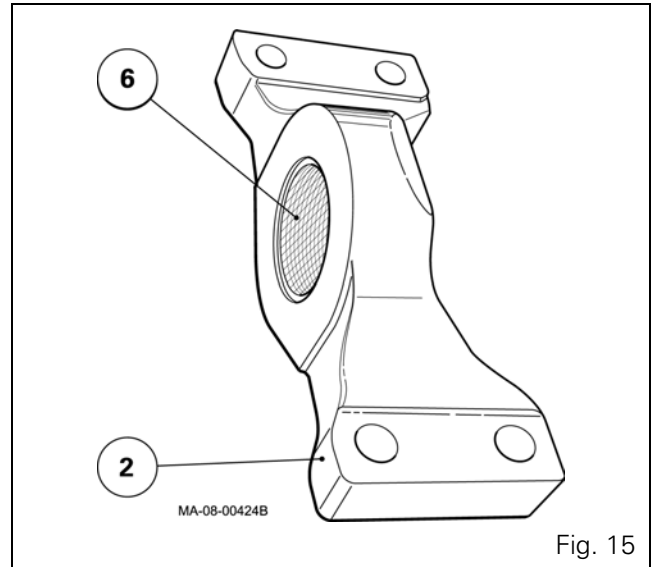
Front bearing (first axle beam pivot, Fig. 3)

### Disassembly

- 60. Only remove bearing support (2) (see § C).
- 61. Extract and discard ring (16).
- 62. Drive out and discard seal (9).

### Reassembly

- 63. Clean and check all components. Replace those that are defective. Check that the greasing lines in the support are not blocked.
- 64. Using a press and a suitable fixture, insert the seal (9) and ring (6) positioned such that they are level with face "F" of support (2) (Fig. 15–Fig. 16), and greasing port "T" connects with the channel (Fig. 17).



# CARRARO 20.48 - GPA30 Transmission shaft and bearing

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Rear bearing (second axle beam pivot,  
[Fig. 3](#))

## Note

- To work on the second axle beam pivot ring (8), the first axle beam pivot and the front axle (see [§ C](#)) must be removed first.

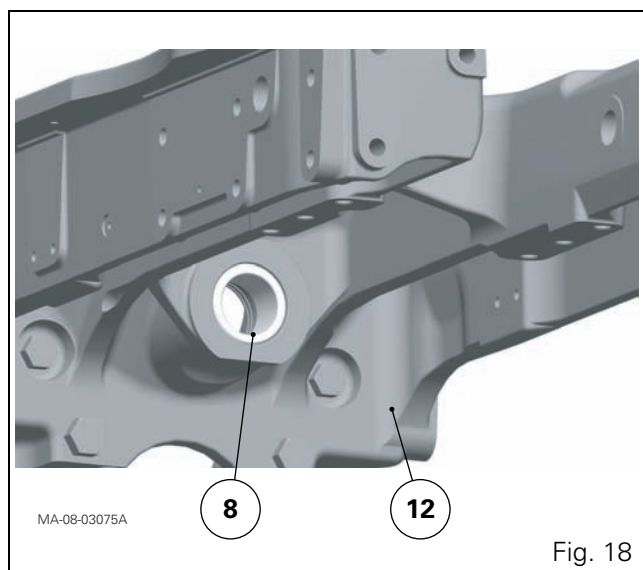
## Disassembly

**65.** Drive out ring (8) using a locally made tool.

**NOTE:** Circlips (11) and plug (10) are not considered to be wearing parts. It is therefore unlikely that they will need replacing.

## Reassembly

**66.** Using a locally-made drift, insert the ring (8) into the frame (12) level with the chamfer ([Fig. 18](#)).





*8B14- 4 WD GPA30 Clutch*

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## 4 WD GPA30 Clutch

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## A . General

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On 6400 series tractors, the front axle clutch assembly is fitted in the lower part of the intermediate housing. A cover located under the housing provides access to the mechanism, which comprises:

- a shaft (2) rotating on two taper roller bearings (8) (9) and (4) (16) fitted in the housing bore
- a hydraulic clutch assembly integral with the rotating shaft
- a bell gear (10) centred on the shaft by a friction ring (6), driving the clutch discs (36)

The helical bell gear (10) is constantly meshed with the driving gear by splines on the pinion (17).

The shaft is shimmed to obtain an operating clearance between 0 and 0.1 mm using shim(s) (18) positioned between the seal holder (20) and the cup (4).

The clutch assembly (15) is shimmed to obtain a clearance of 0.9 to 1.1 mm between the circlip (34) and shim(s) (35) in disengaged position (solenoid valve actuated).

A ring (7) held by the transfer pipe (28) supplies the clutch with a pressure of 17 bar from the union (27).

The shaft seal is ensured by a lip seal (1) and a dust seal (41); the housing is sealed by an "O" ring (19).

## Operation

### Clutch disengaged position

The 4 WD solenoid valve, fitted to the right-hand hydraulic cover and controlled by the tractor electronic system, supplies 17 bar pressure inside the shaft via channel "A" (Fig. 1). The pressure is maintained by the seal rings (32). The piston (39) moves on the hub (30) and pulls the bell housing (23) compressing the Belleville washers (26) and releasing the discs (36). The bell gear (10) then turns idle on the shaft.

### Clutch engaged position

When the pressure is released, the Belleville washers (26) decompress and push the bell housing (23) back, engaging the bell gear (10) and enabling the shaft (2) to rotate.

### Lubrication

The oil from the lubricating circuit is fed through the restrictor union (22) and lubricates the friction discs (36) via a transfer pipe (21) and a perforated channel "B" in shaft (2) (Fig. 1).

## 4 WD GPA30 Clutch

---

### Parts list (Fig. 1 and Fig. 2)

- (1) Lip seal
- (2) 4 WD drive shaft
- (3) Circlip
- (4) Bearing cup
- (5) Circlip
- (6) Ring
- (7) Ring
- (8) Bearing cup
- (9) Bearing cone
- (10) Bell gear
- (11) Cover
- (12) Bolt
- (13) Plug
- (14) Seal
- (15) Clutch assembly
- (16) Bearing cone
- (17) Driving gear
- (18) Shim(s)
- (19) "O" ring
- (20) Seal holder
- (21) Transfer pipe (lubrication)
- (22) Restrictor union and seal
- (23) Bell housing
- (24) "O" ring
- (25) "O" ring
- (26) Belleville washers
- (27) Union with seal
- (28) Transfer pipe (17 bar)
- (29) Cover
- (30) Hub
- (31) "O" ring
- (32) Seal rings
- (33) Circlip
- (34) Circlip
- (35) Shim(s)
- (36) Friction discs
- (37) Intermediate plates
- (38) Circlip
- (39) Piston
- (40) "O" ring
- (41) Dust seal

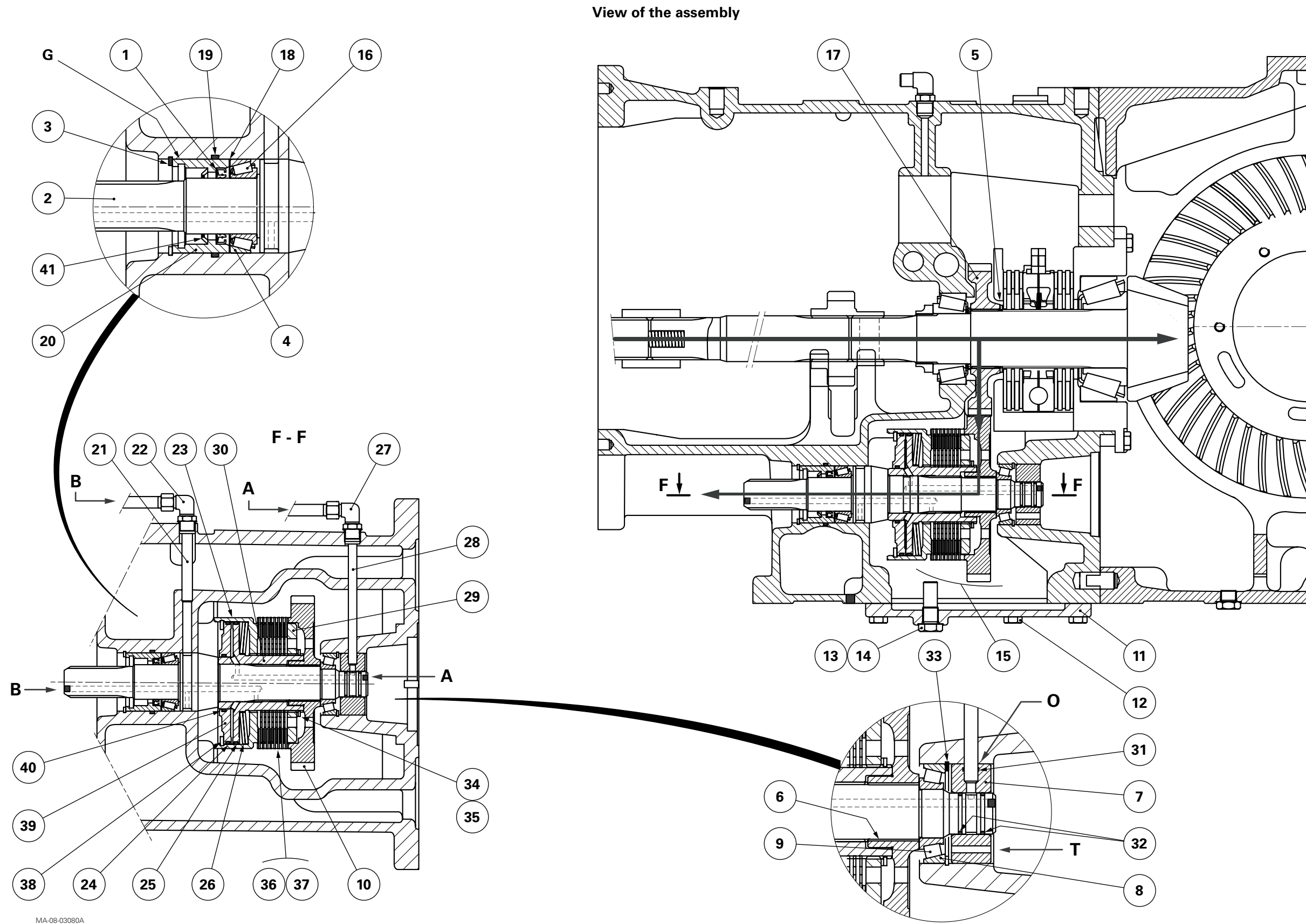
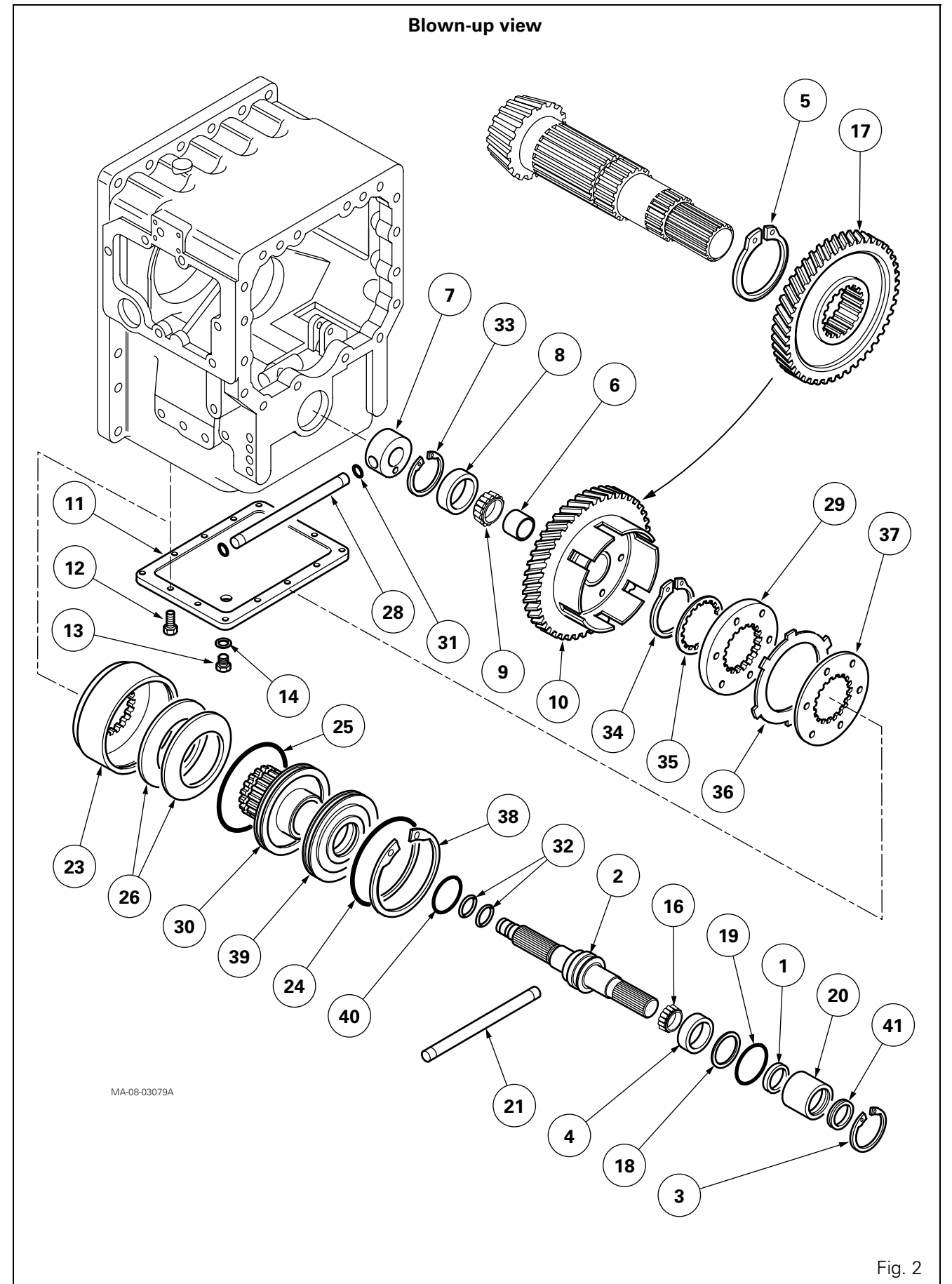


Fig. 1

# 4 WD GPA30 Clutch



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### B . Preliminary steps

---

1. Immobilise the tractor. Chock the rear wheels. Apply the handbrake.
2. Disconnect the front differential lock control channel (if fitted) (block channel). Remove the transmission shaft.
3. Drain the intermediate housing.
4. Remove the bolts (12). Release and remove the cover (11).

---

### C . Removing and refitting the clutch assembly and shaft

---

**NOTE:**

- Ring (7) is held only by the transfer pipe (28). If only the transfer pipe needs to be removed, ensure that the ring is not moved accidentally.
- This ring has a hole "T" (Fig. 1), which points downwards to decompress the bearing.

#### Removal

5. Remove the circlip (3).
6. Fit a flexible cellulose strip over the splined part of the shaft (2). Remove the dust seal (41). Remove the seal holder (20) fitted with seal (1) using two locally made bent-ended hooks placed in seal holder inner groove "G" (Fig. 1). Remove the seal (1).
7. Remove the "O" ring (19).
8. Remove the shim(s) (18) and cup (4).
9. Withdraw the shaft assembly (2) fitted with bearing cone (16) and holding the clutch assembly (15) and bell gear (10).
10. Remove the clutch assembly, the bell gear and bearing cone (9).
11. Extract the cup (8). Remove the circlip (33).

**NOTE:** To access the driving gear (17), remove the unit assembly together with the pinion (see chapter 6).
12. Remove the 4 WD clutch 17 bar supply pipe, union (27) and transfer pipe (28) using external retaining ring pliers. Remove ring (7). Remove "O" ring (31).

#### Stripping the shaft

13. Remove the seal rings (32).
14. Extract the bearing cone (16) using a press and a suitable fixture.

#### Cladding the shaft

15. Ensure that channels "A" and "B" (Fig. 1) are not obstructed. Check for rivets at each end of the shaft.
16. Slide the bearing cone (16) level against the shoulder on the shaft (2).
17. Place the seal rings (32) in the shaft grooves. Hook their ends. Ensure that they turn freely.

## 4 WD GPA30 Clutch

---

### Refitting the clutch assembly and shaft

18. Clean and check all components. Replace those that are defective.
19. Position ring (7) fitted with a new "O" ring (31), with port "O" of the ring facing the transfer pipe (28) and hole "T" on the face pointing downwards (Fig. 1). Fit the pipe. Screw the union fitted with its seal. Refit the clutch supply pipe.
20. Refit the circlip (33). Fit the cup (8).
21. Smear the bearing cone (9) with miscible grease and insert into cup (8).  
**NOTE:** *If it is necessary to replace the intermediate housing, shaft (2), bearings (8) (9) and (4) (16), seal holder (20) and circlips (3) (33), J2 clearance must be adjusted (see § D).*
22. Refit the clutch assembly (15) and bell gear (10).
23. Hold the clutch assembly and bell gear in position. Insert the shaft (2), fitted with its bearing cone (16), and the lubricated seal rings (32) in the clutch mechanism, bearing cone (9) and ring (7).
24. Position the cup (4). Lightly smear the shims (18) with miscible grease and stick them against the flange.
25. Using a suitable fixture and a press, insert the lip seal (1) into the seal holder (20).
26. Fit the "O" ring (19).
27. Protect the splined part of the shaft (2). Install the seal holder fitted with its lubricated seal (1) using a locally made sleeve. Remove the protection.
28. Fit the circlip (3).



## D . Disassembling, reassembling and shimming the clutch

### Disassembly

29. Remove the clutch assembly (see § C).
30. Detach the bell gear (10) from the clutch assembly (15).
31. Remove the circlip (38). Remove the piston (39).
32. Remove the "O" rings (24) (40).
33. Using a suitable fixture and a press, compress the Belleville washers (26) (Fig. 3).
34. Take off the circlip (34) and shim(s) (35) (Fig. 3).
35. Remove the fixture. Remove the cover (29), discs (36) and intermediate plates (37).
36. Separate the hub (30) from the bell housing (23).
37. Remove the "O" ring (25).
38. Remove the Belleville washers (26).

### Reassembly

39. Check and clean all components. Replace those that are defective. Ensure that channels "A" and "B" (Fig. 1) are not obstructed.
40. Position the Belleville washers (26) in the bell housing (23) (Fig. 4).
41. Lubricate and fit the "O" ring (25) on the hub (30).
42. Place the hub (30) in the bell housing (23) braced against the Belleville washers.
43. Fit discs (36), aligning the catches and intermediate plates (37), and fit the cover (29).

**NOTE:** Depending on the assembly option, the cover (29) and the number of discs and intermediate plates may be different.

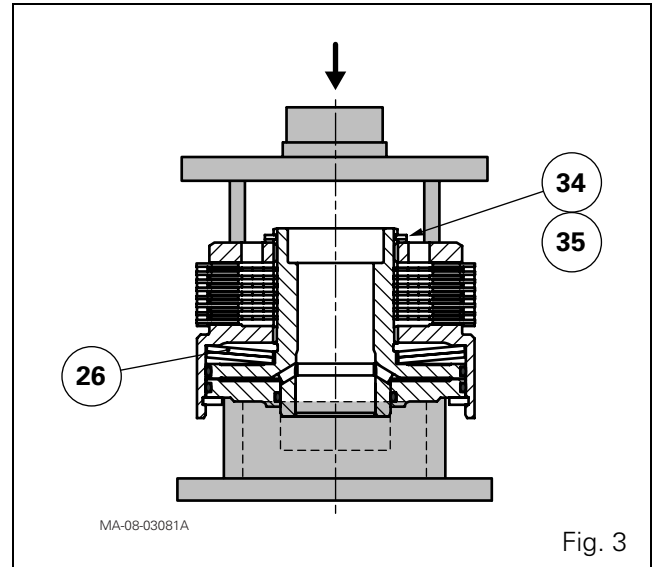


Fig. 3

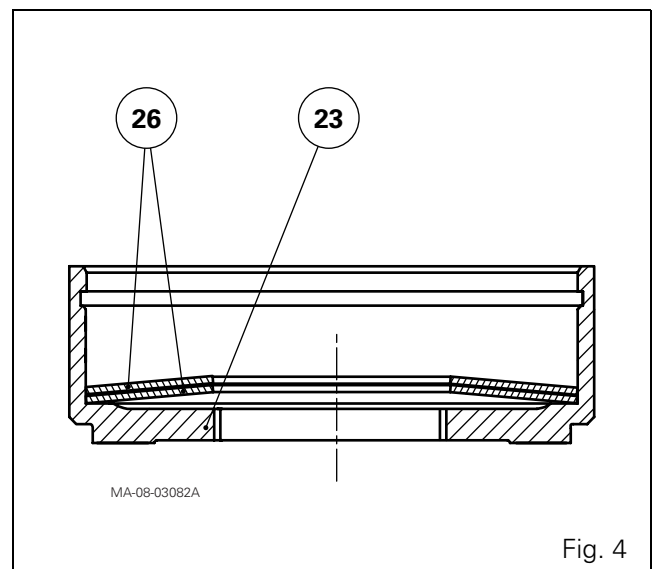


Fig. 4

## 4 WD GPA30 Clutch

### Shimming the clutch

#### Adjusting J1 clearance

44. Using a press and suitable fixture (Fig. 5), apply a load of 2000 daN to fully compress the Belleville washers (26).
45. Fit the circlip (34). Use a set of shims to increase the distance X (Fig. 5) between the cover (29) and the circlip (34). Select the shim(s) (35) to obtain a clearance (Fig. 6):  
**J1 = 0.9 to 1.1 mm**
46. Remove the circlip (34).
47. Fit the shim(s) selected in step 45 between the cover and the circlip.  
**NOTE:** Fit the splined shim closest to the circlip.
48. Refit the circlip.
49. Lubricate and fit the "O" rings (24) (40) on piston (39) and refit the latter.
50. Fit the circlip (38).
51. Assemble the clutch assembly (15) and bell gear (10).  
**NOTE:** The ring (6) is force fitted in the bell gear and then rebores.
52. Refit the clutch assembly (15) and bell gear (10). Repeat steps 21 to 28 (see § C).

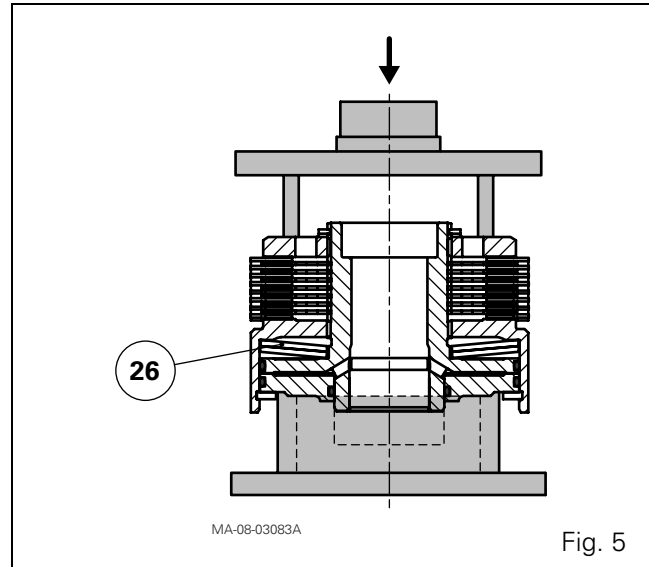


Fig. 5

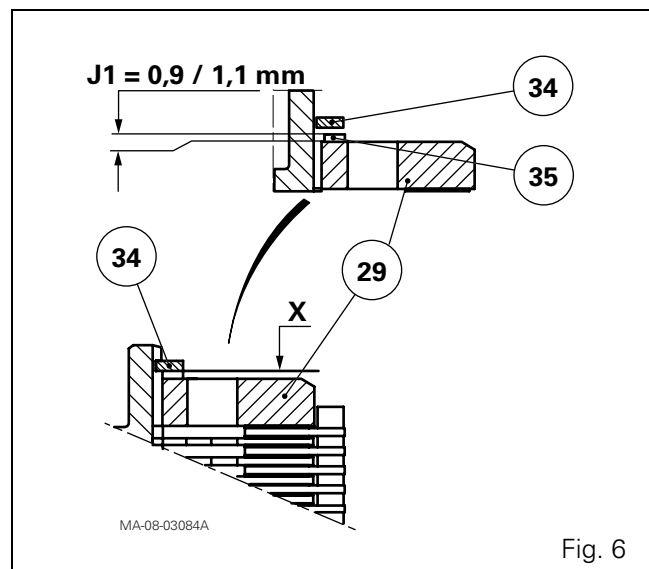


Fig. 6

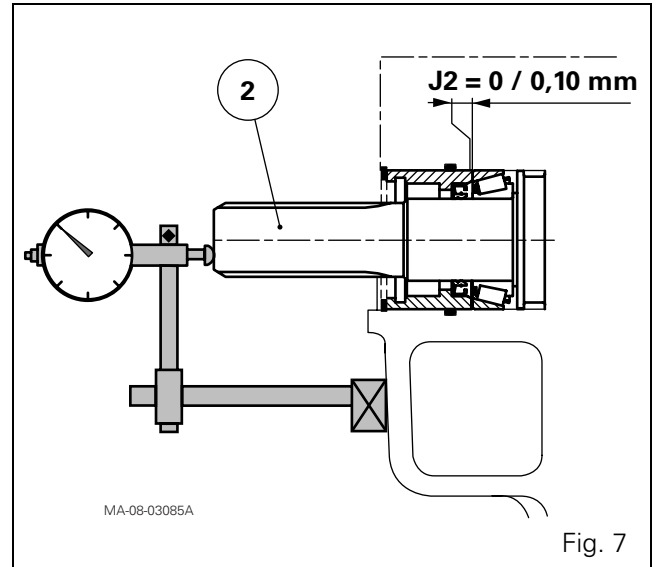
## E . Shimming the shaft

**NOTE:** When stationary, the 4 WD clutch is mechanically engaged by the load from the Belleville washers and the link with the rear axle pinion, making it impossible to turn the driven shaft (2).

To adjust J2 clearance, provisionally place the bearing cone (9) and shaft (2) fitted with bearing cone (16) without fitting the clutch assembly (15), bell gear (10) and shims (18). Fit the cup (4), seal holder (20) and circlip (3).

### Adjusting J2 clearance

53. Put the dial gauge feeler pin against the end of shaft (2) (Fig. 7).
54. Access is limited around the shaft, so it must be pulled hard with a pair of lock-grip pliers while turning it alternately to the right and left to correctly "seat" the cones and the cups.
55. Set the dial gauge to zero.
56. Repeat step 54, this time pushing.
57. Depending on the measured clearance, select a shim thickness (18) necessary to obtain a clearance (Fig. 7):  
**J2 = 0 to 0.10 mm**
58. Remove the circlip (3), seal holder (20), shaft (2) and the bearings.
59. Definitively assemble the clutch assembly (15), bell gear (10) and shaft (2). Repeat steps 21 to 28 (see § C).



## 4 WD GPA30 Clutch

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### F . Final steps

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60. Clean the cover (11) and its mating face on the housing.
61. Smear the mating face of the cover with Loctite 510 or equivalent.
62. Refit the cover. Tighten screws (12) to 70-90 Nm.
63. Top up the oil level in the housings.
64. Refit the transmission shaft (see chapter 8).
65. Reconnect the differential lock control channel (if fitted).
66. Remove the wheel chocks.  
Carry out a road test of the 4 WD clutch.
67. Check tightness of:
  - the cover (11) mating face under the intermediate housing
  - the hydraulic unions

*8B15 - CARRARO 20.48 - Suspension*

CONTENTS

<b>A . Disassembling the arm assembly</b> .....	<b>3</b>
<b>B . Reassembling the arm assembly</b> .....	<b>6</b>
<b>C . Service tools</b> .....	<b>16</b>

## CARRARO 20.48 - Suspension

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## A . Disassembling the arm assembly

1. Lock the arms using a suitable lifting mechanism to prevent any untimely movement.  
Loosen nut (40) and remove taper pin (42) (Fig. 1).  
Remove pivot pin (57) using a rubber hammer or other soft object if necessary.



**DANGER: The arms are very heavy; handle with care to avoid injuring the operator.**

2. Remove arm covers (14) and (24) on the front and rear of the arms by loosening the corresponding screws (15) and (25).

Retain the seals and shims if present.

Note the position of all disassembled elements (Fig. 2).

Remove the bearing (11) and sealing ring (10) from each upper pivot pin.

3. Remove screws (9) from the upper arm pins and extract pins (8) using a suitable extracting tool inserted into the threaded hole provided in the pin for this purpose (Fig. 3).



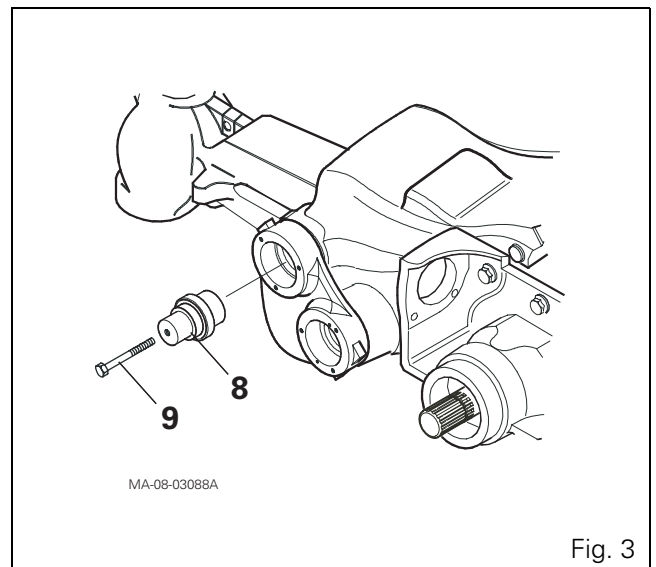
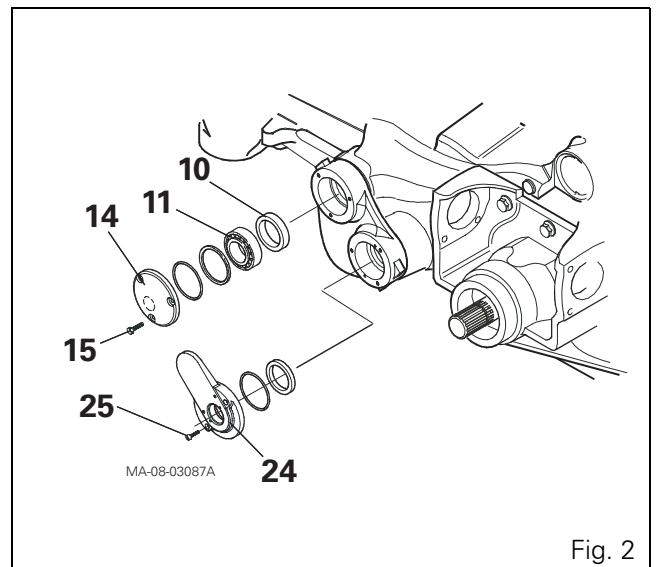
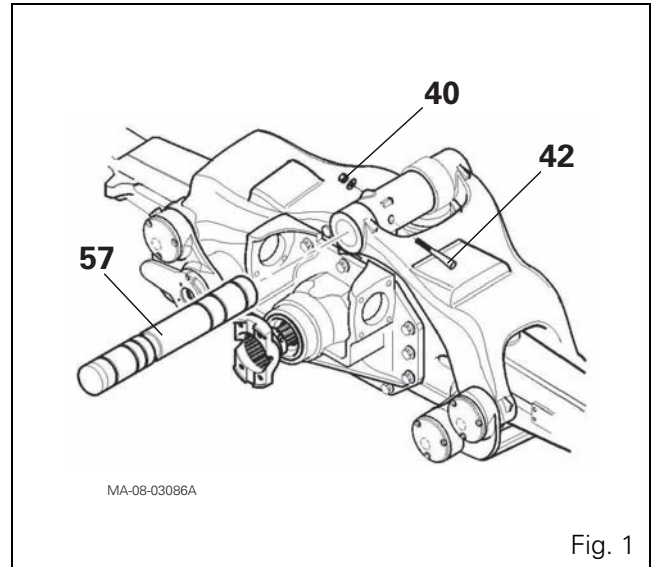
**DANGER: This releases the arms.**

### NOTE:

- To make the extraction easier, the arm pin housing can be heated to a maximum temperature of 100°C.
- This will destroy the seals.



**DANGER: If the upper and lower arms are not restrained properly, they may shift and injure the operator.**



## CARRARO 20.48 - Suspension

4. Remove the upper arms with a suitable lifting tool. Retain the seals and shims if present. Replace the shock absorber pads (7) if necessary by removing the corresponding screws (Fig. 4).



**DANGER: The lower arms may turn and injure the operator.**

5. Remove screws (21) from the arm pin bearings and retain the corresponding thrust washers (20), as well as any shims (19) (Fig. 5).

**NOTE: The thrust washer fitted on the sensor pin is specially shaped and cannot be confused with any other washers.**

Remove bearings (18) and seals (17) (Fig. 5).

**NOTE: This will destroy the seals.**

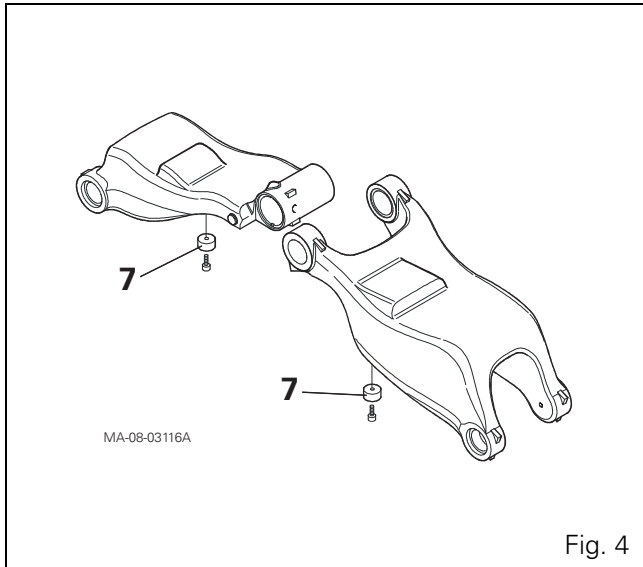


Fig. 4

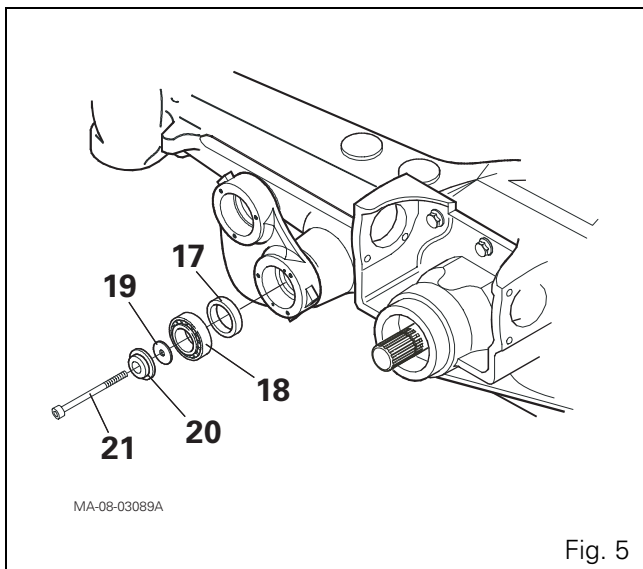


Fig. 5



6. Remove pins (16) from the arms using a suitable extractor inserted into the threaded hole provided in the pins for this purpose (Fig. 6). Remove the arms.



**DANGER: This releases the arms.**

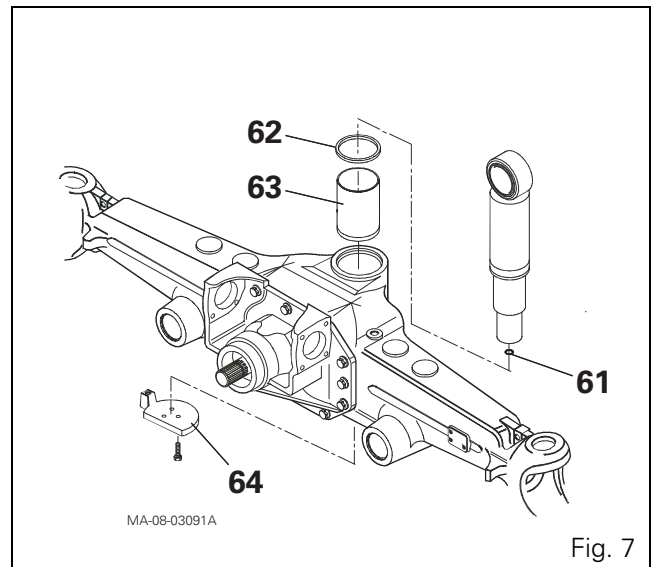
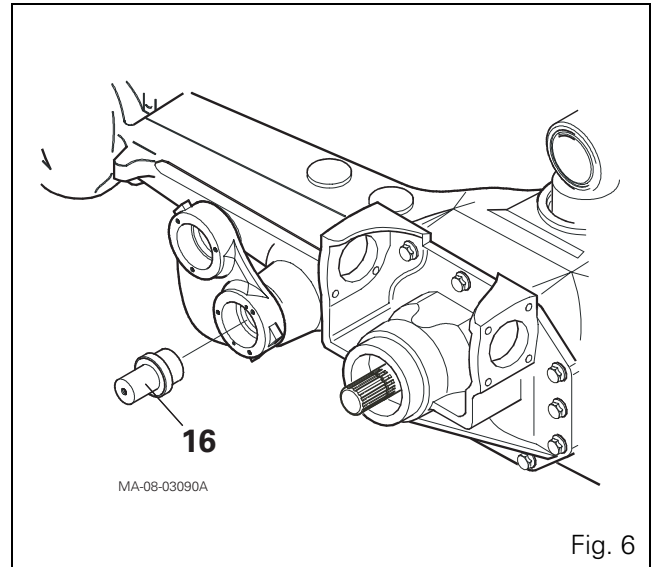


**DANGER: If the lower arms are not restrained properly, they may shift and injure the operator.**

7. Remove the screws to disassemble the lower cover (64). Remove the ram from the axle beam (Fig. 7).

Remove the "O" ring (61) from the ram and the seal (62) from its seating in the axle beam.

Do not replace the ring (63) unless it is necessary. If it needs to be replaced, use a suitable extracting tool (Fig. 7).



# CARRARO 20.48 - Suspension

## B . Reassembling the arm assembly

8. Fit ring (63), previously smeared with Loctite 510, in its position in the suspension ram housing (Fig. 8).

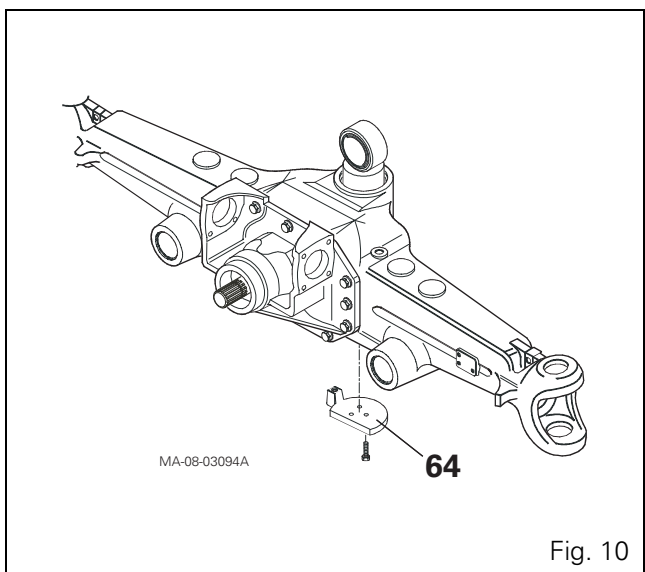
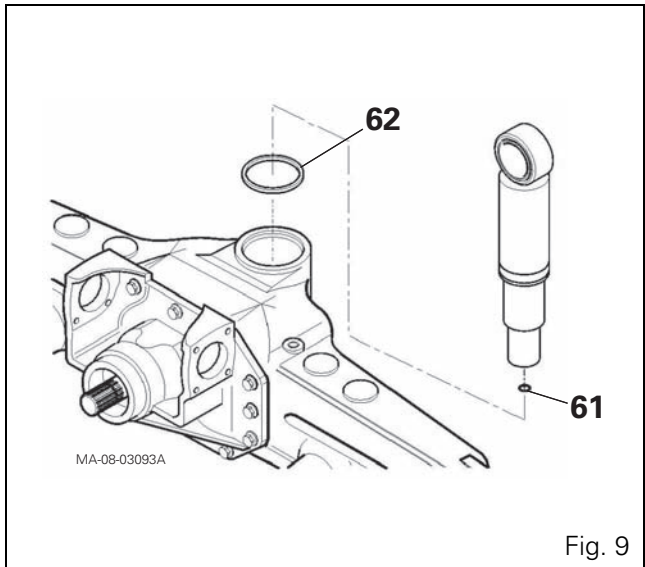
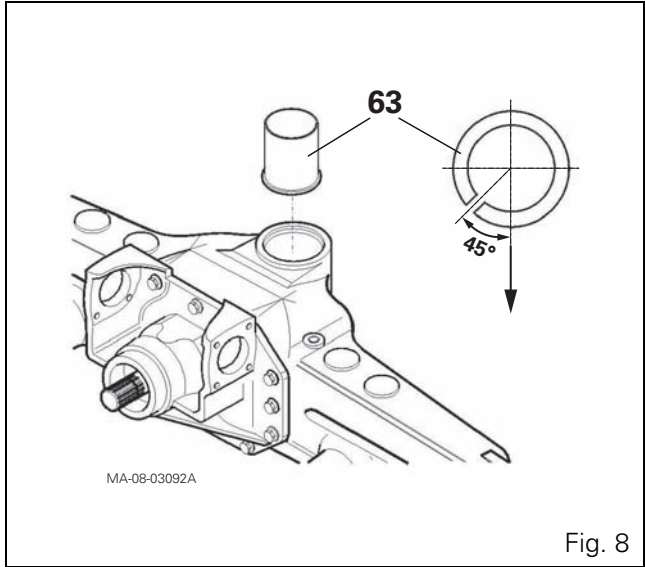
**NOTE:** Position ring (63) with the slot at an angle of 45° to the pinion (arrow).

9. Fit seal (62) on the axle beam and a new "O" ring (61) lightly smeared with grease in the housing at the bottom of the suspension ram.

Install the lubricated ram in the axle beam (Fig. 9).

10. Mount lower cover (64) on the bottom part of the axle beam and tighten the screws to 60 Nm with a torque wrench (Fig. 10).

**NOTE:** Before installing the cover, ensure that the "O" ring is correctly positioned at the bottom of the ram.



- 11.** Install the lower arms on the axle beam and align the pins by inserting tool ref. CA715350 (see § C) into the housing at the side opposite the pin assembly (Fig. 11).

Insert arm pins (16) into the holes provided in the arms and axle beam, and push them into their holes using tool ref. CA715353 (see § C) (Fig. 11).

**NOTE**

- It is advisable to cool the arm pins to under  $-100^{\circ}\text{C}$  before installing them in order to facilitate their assembly.
- This can be carried out by completely dipping the pins of the arm in liquid nitrogen. To purchase or hire liquid nitrogen, contact the company "Air liquide".



**CAUTION: It is recommended to wear protective gloves.**

**NOTE:** The arm pin housing can be heated to a maximum temperature of  $+100^{\circ}\text{C}$ .

- 12.** Fit one seal (17) onto each pin fitted in the lower arm housing using tool ref. CA715352 (see § C) and a hammer (Fig. 12).

Fit the tapered roller bearing (18) using tool ref. CA715349 (see § C).

**IMPORTANT:** Ensure that the tapered roller bearings are mounted in the correct direction, on the lower pins, the bearings must be inserted with the cup facing inwards (in the arm) and the cone facing outwards (on the pin) (see Fig. 13).

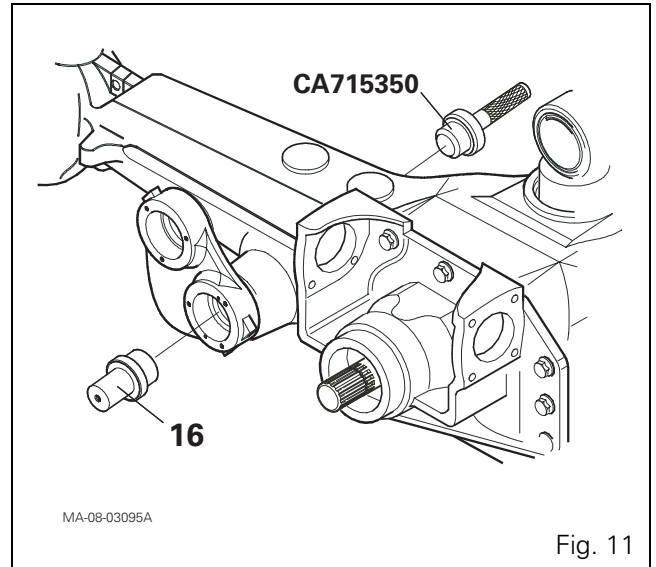


Fig. 11

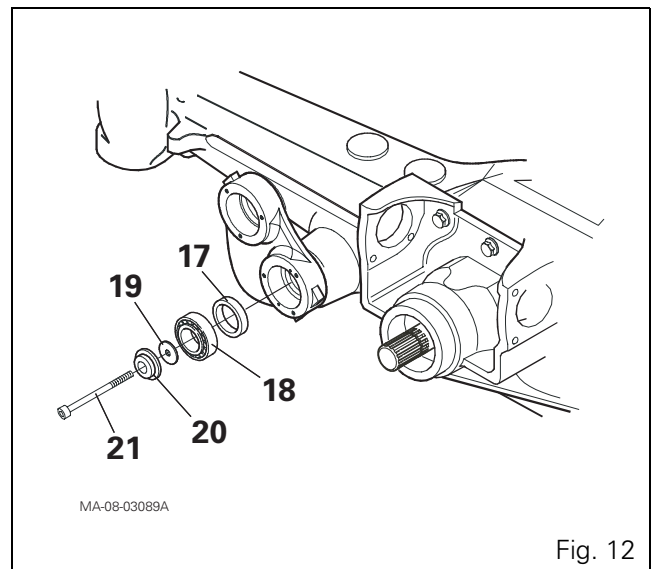


Fig. 12

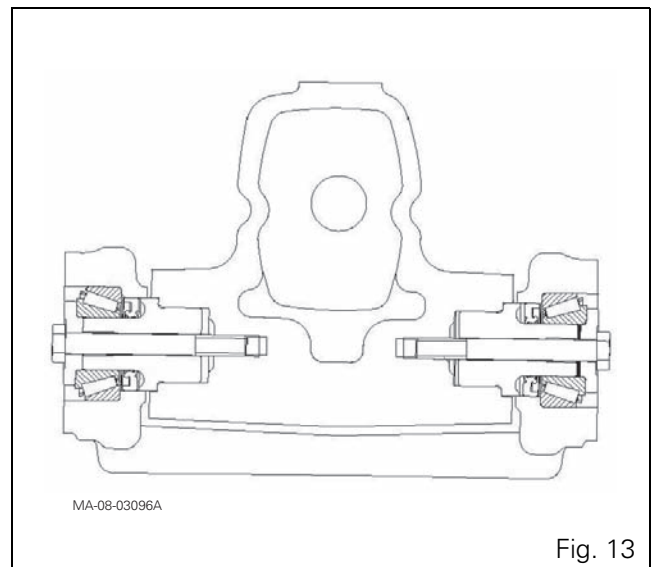


Fig. 13

## CARRARO 20.48 - Suspension

- 13.** Place a laminated reference shim (R) (Fig. 14) (1 mm shim) on the lower pins on the side of the pinion.

Fit a thrust washer (20) on each of the lower pivot pins, followed by a screw.

**IMPORTANT:** The shim's diameter must be smaller than the bearing's internal diameter.

**NOTE:** The thrust washer fitted on the position sensor pin is specially shaped and must not be confused with any other washers.

Adjust the tapered roller bearings by shifting the arms, then tighten screws (21) to 190 Nm using a torque wrench.

- 14.** Place a dial gauge with a magnetic stand on the axle beam and move the dial gauge feeler pin until it comes into contact with the face of the lower arm, then reset the dial gauge to zero. (Fig. 15).

Install a lever between the arm and the axle beam, push in the arm at each side and measure the clearance using a dial gauge. Repeat this several times to obtain an average value X (Fig. 15).

- 15.** To determine thickness S, which is necessary to obtain the required bearing preload, subtract measured value X and the specified value from the known reference value R (see step 14):

$$S = (R - X) - V$$

$$V = 0.2 \text{ to } 0.3 \text{ mm.}$$

Select the number required from the available shims to obtain the thickness S defined previously.

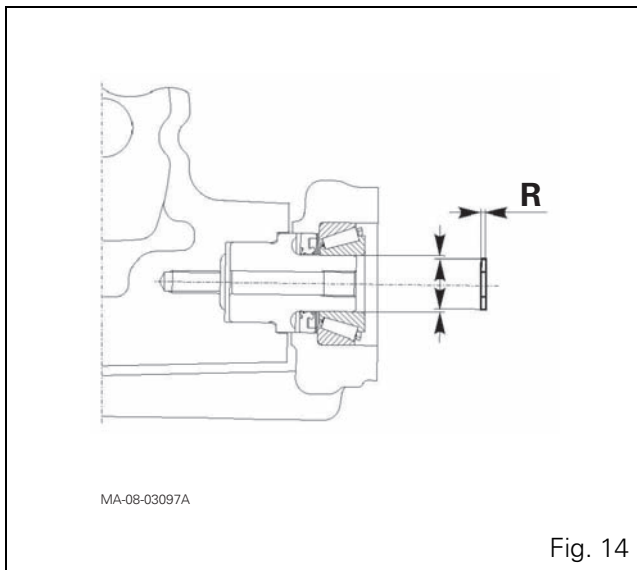


Fig. 14

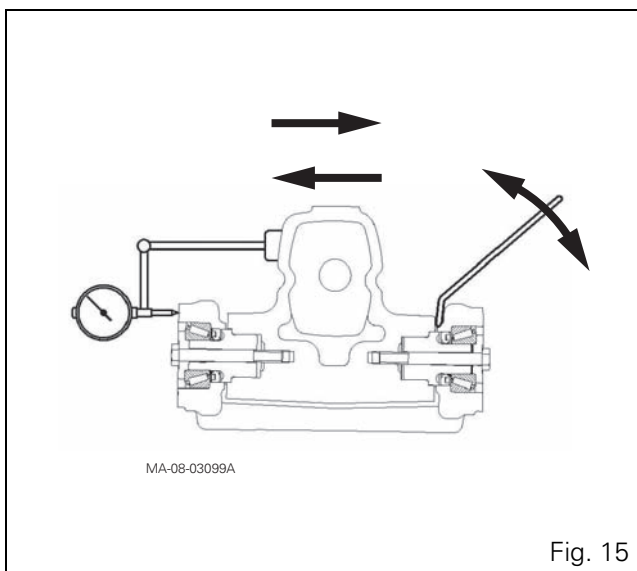


Fig. 15

Types of shims		
<b>Thickness</b>	0.1	0.3
<b>Quantity</b>	-	-

- 16.** Remove screws (21) on the pinion side and the reference shim R.

Insert shims S between the stop (20) and tapered roller bearing (18) to the thickness calculated in step 15 (Fig. 16).

**IMPORTANT:** All shims must be inserted, and only on the pinion side.

Refit the screws, apply Loctite 542 to the threads and then tighten the screws (21) to 190 Nm using a torque wrench.

Repeat the described procedure for the other lower arm.

- 17.** Fit seal (22) using tool ref. CA715345 (see § C) (Fig. 17). Fit new "O" rings (23) on all covers.

Assemble the covers after packing the cavities with grease. Insert and tighten screws (25) and (34) to 13 Nm using a torque wrench.

- 18.** Place the upper arms on a workbench with a suitable lifting device.

If shock absorber pads (7) must be replaced, tighten the screws to 10 Nm using a torque wrench (Fig. 18).



**DANGER:** The arms are heavy and must be moved with utmost care to avoid injury to the operator.

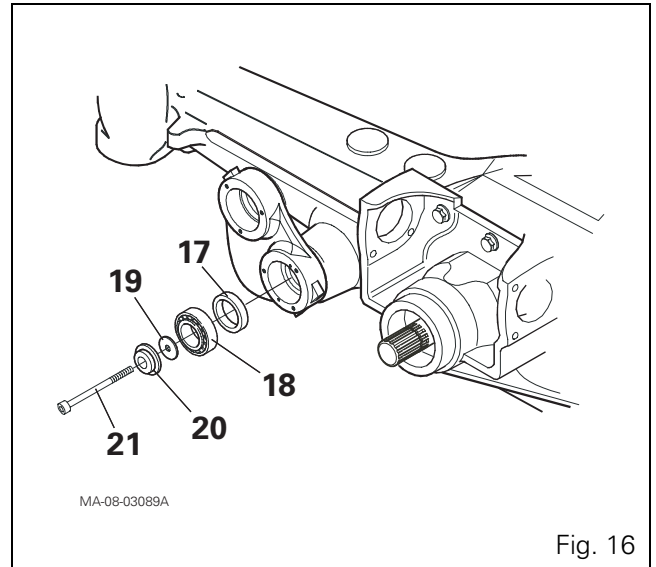


Fig. 16

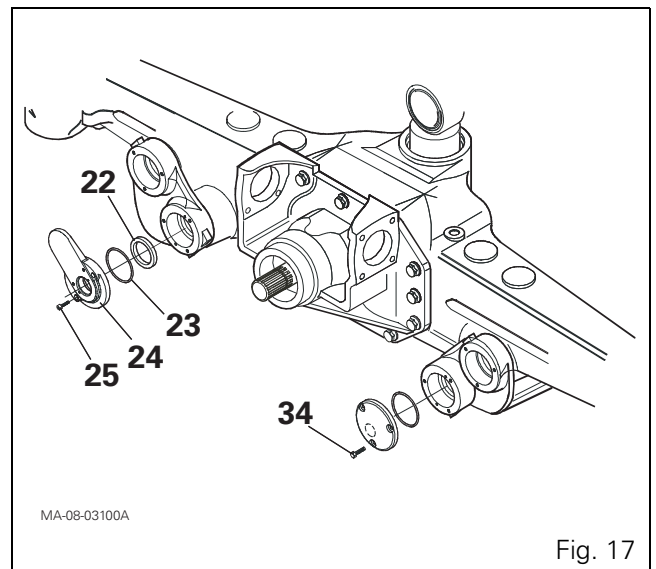


Fig. 17

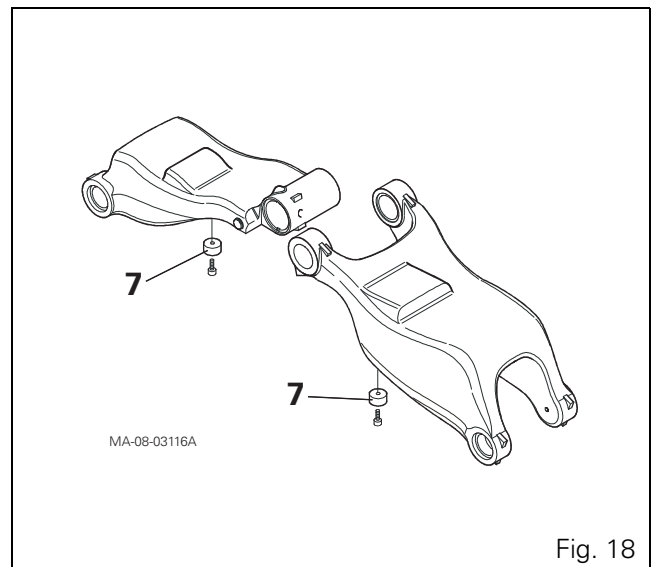


Fig. 18

## CARRARO 20.48 - Suspension

19. Fit the two rings (55) and (51) in the pivot pin seatings on the fork of the arm using tool ref. CA715385 (see § C) and a hammer.

**NOTE:** It is advisable to cool the rings to a temperature below  $-100^{\circ}\text{C}$  to facilitate their assembly.



**CAUTION:** It is recommended to wear protective gloves.

Fit seals (56) and (50) using tool ref. CA715383 (see § C).

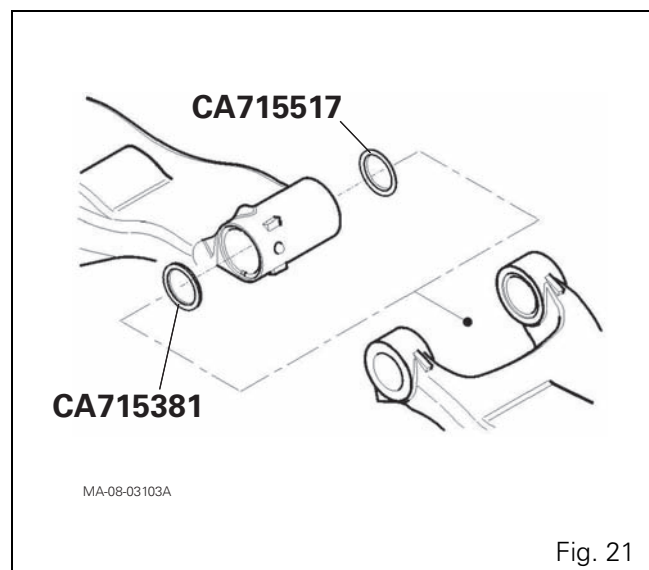
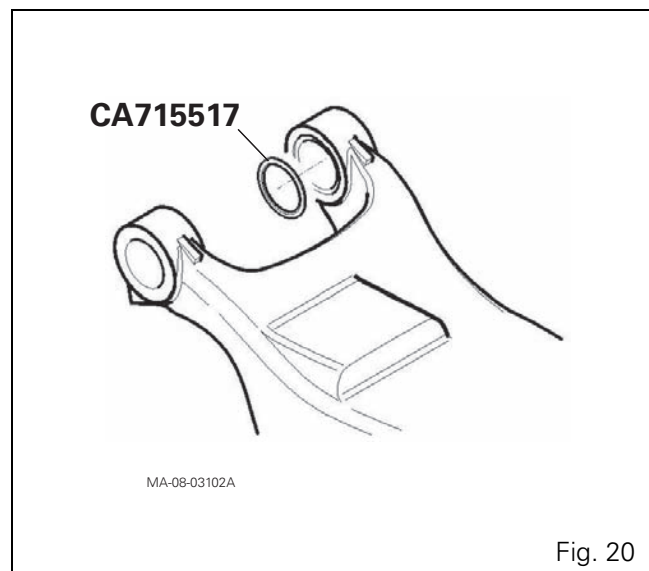
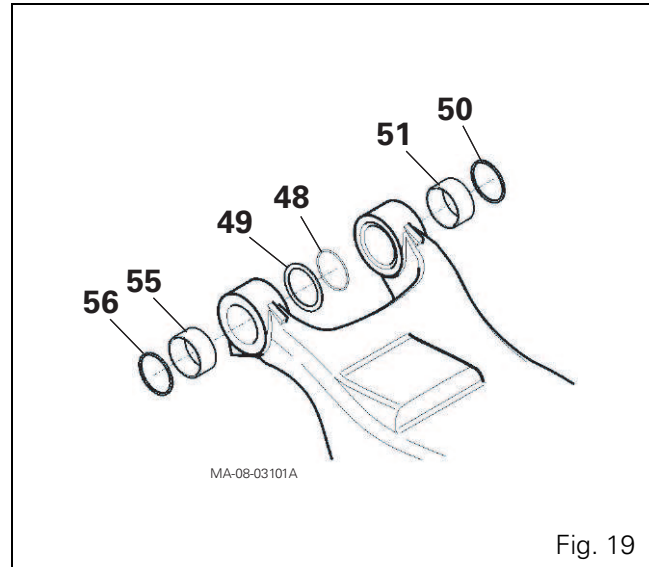
Fit spacer (49) from the internal side of the fork using tool ref. CA715384 (see § C) and position the corresponding "O" ring (48) in the spacer seating (Fig. 19).

20. Insert spacer, tool ref. CA715517 (see § C), from the internal side of the fork (Fig. 20).

**NOTE:** The spacer tool is used to define shim thickness. It will be removed before final assembly.

21. Place spacer CA715517 (tool) (see § C) in the suspension arm. Insert the dummy thrust washer CA715381 (tool) from the other side (see § C) (Fig. 21).

**NOTE:** The spacer and the dummy washer (tools) are used to define shim thickness. They will be removed before final assembly.



22. Using a suitable lifting device, mount the upper arms on the axle beam and assemble them with the lower arms and the suspension ram.

Insert pins (8) fully into the holes provided in the arms using tool ref. CA715353 (see § C).

**NOTE:** It is advisable to cool the arm pins to below  $-100^{\circ}\text{C}$  before installing them in order to facilitate their assembly.



**CAUTION:** It is recommended to wear protective gloves.

Fit screws (9) for pins (8), coated with Loctite 542, and tighten them to a torque of 190 Nm (Fig. 22).

23. Fit seal (10) using tool ref. CA715351 (see § C) (Fig. 23).

Fit tapered roller bearing (11) using tool ref. CA715349.

Check that the bearings are positioned and assembled correctly (see Fig. 24).

24. Fit cover (14) and its screws (Fig. 23).

**IMPORTANT:** Do not fit any shims under cover D.

Adjust the tapered roller bearings by moving the arms and tightening the screws.

**IMPORTANT:** Ensure that the tapered roller bearings are mounted in the correct direction, on the lower pins, the bearings must be inserted with the cup facing inwards (in the arm) and the cone facing outwards (on the pin) (see Fig. 24).

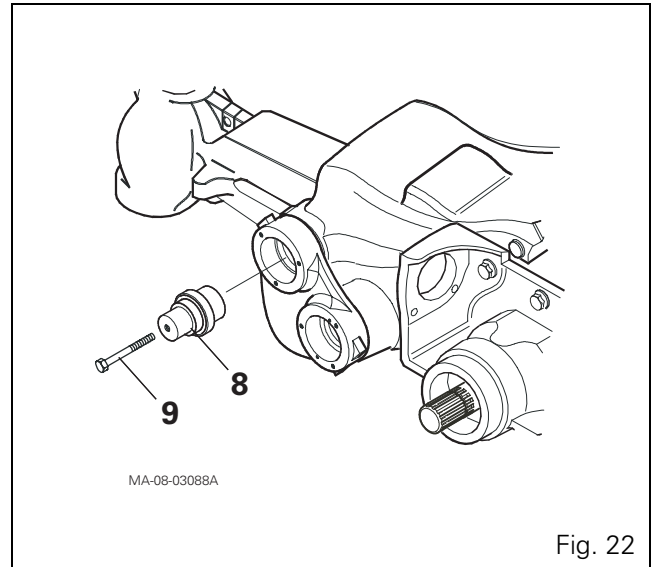


Fig. 22

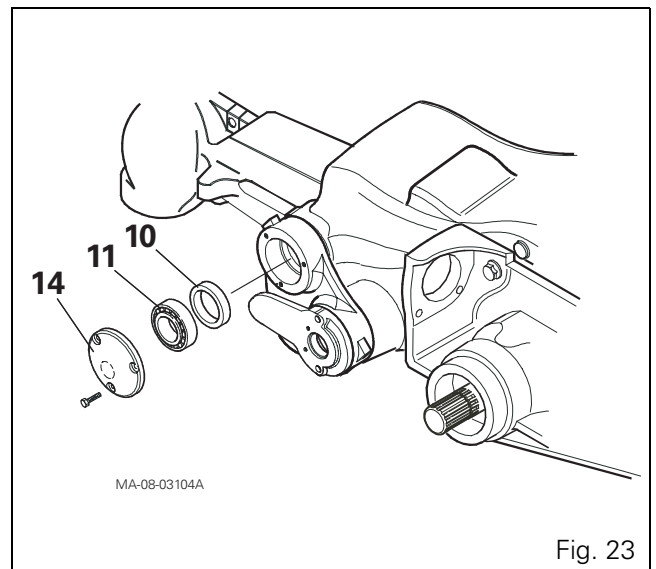


Fig. 23

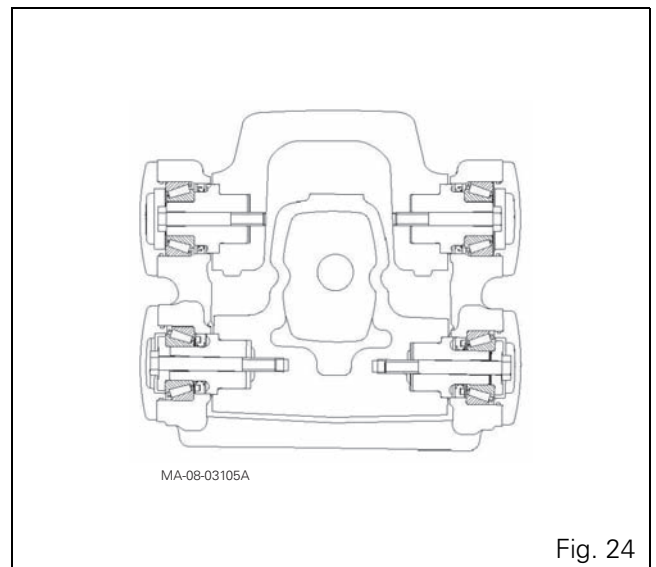


Fig. 24

# CARRARO 20.48 - Suspension

25. Place a dial gauge with a magnetic stand on the upper arm and move the dial gauge feeler pin until it comes into contact with the lower arm, then reset the dial gauge to zero (Fig. 25).

Install a lever between the arms, push in the arm at each side and measure the clearance using a dial gauge. Repeat this several times to obtain an average value Y (Fig. 25).

26. To determine thickness S, which is necessary to obtain the required bearing preload, add measured value Y to specified value V (see step 25):

$$S = Y + V$$

$$V = 0.2 \text{ to } 0.3 \text{ mm.}$$

Select the number required from the available shims to obtain the thickness S defined previously.

Types of shims			
Thickness	0.1	0.2	0.5
Quantity	-	-	-

27. Repeat the operation for each pin.

Remove the covers from pins (14) on the side of the pinion. Insert the shims selected in step 26 and a new "O" ring (13) (Fig. 26).

Refit the cover (14) after packing its cavities with plenty of grease (Fig. 26).

**NOTE:** The shims are only placed on the side of the pinion.

28. Remove the pin covers (14) on the side of the pinion, fit a new "O" ring (13).

Refit the cover (14) after packing its cavities with plenty of grease.

29. Align the holes in the central pivot pin on the upper arms by inserting locating pin ref. CA715382 (Fig. 27).

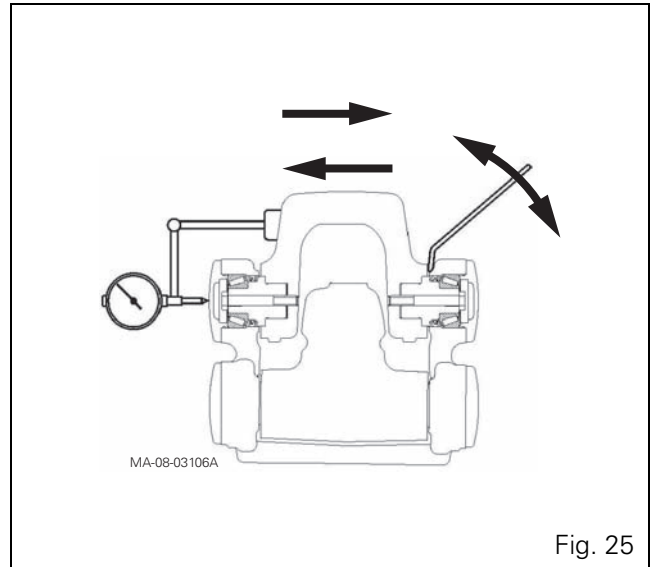


Fig. 25

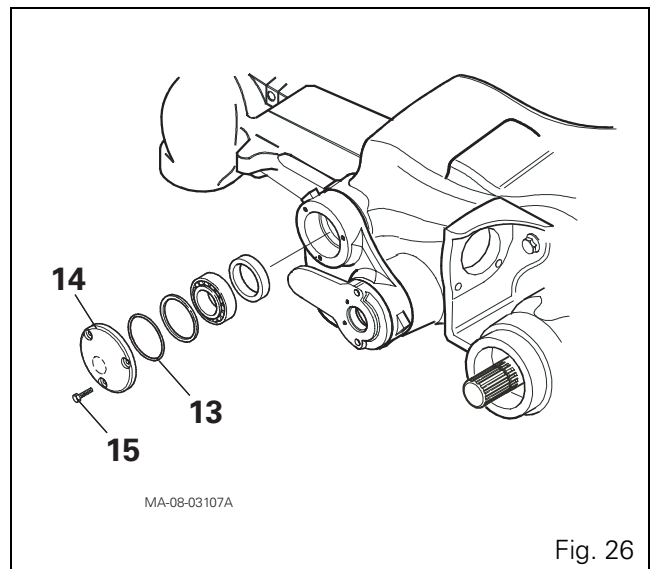


Fig. 26

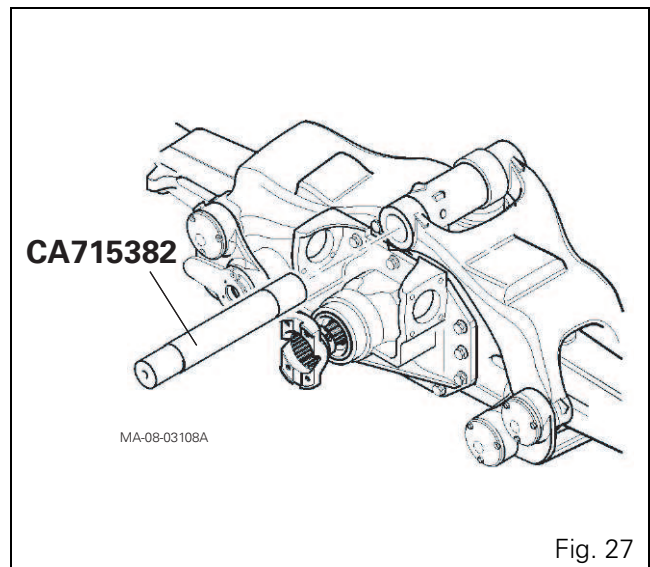


Fig. 27



30. Measure clearance X using thickness shims between the spacer (49) and the dummy thrust washer CA715381 (Fig. 28).

31. To determine the thickness P, which is required to obtain the necessary clearance G at the arms, calculate:

$$P = X - G$$

$$G = 0.5 \text{ to } 0.6 \text{ mm}$$

Select the number required from the available shims to obtain the thickness P defined previously.

Types of shims		
Thickness	0.1	0.3
Quantity	-	-

32. Measure clearances Y and Z using thickness shims between the two spacers CA715517 and the suspension ram (Fig. 29).

33. To determine thickness U, which is required to obtain the necessary clearance G, calculate:

$$U = (Y + Z - 2G) / 2$$

$$G = 0.15 \text{ to } 0.25 \text{ mm}$$

Select the number required from the available shims to obtain thickness U defined previously.

Types of shims		
Thickness	0.1	0.3
Quantity	-	-

34. Loosen the screws (15) on covers (14) (Fig. 30).

**NOTE:** This is necessary for releasing the upper arms from the head of the suspension ram.

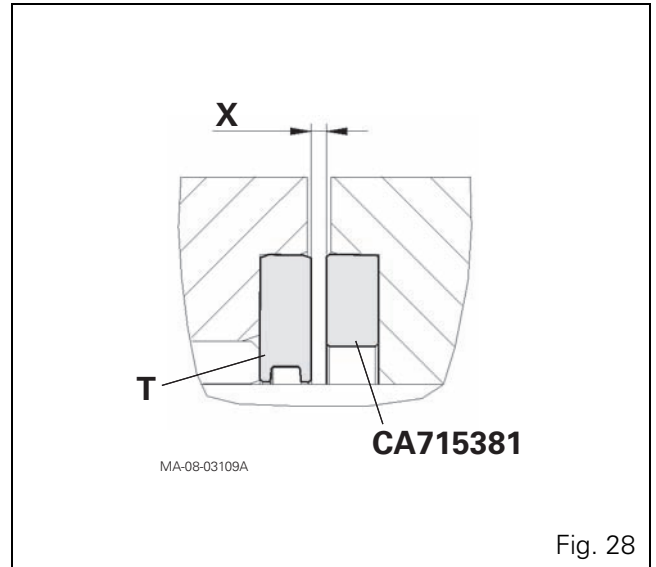


Fig. 28

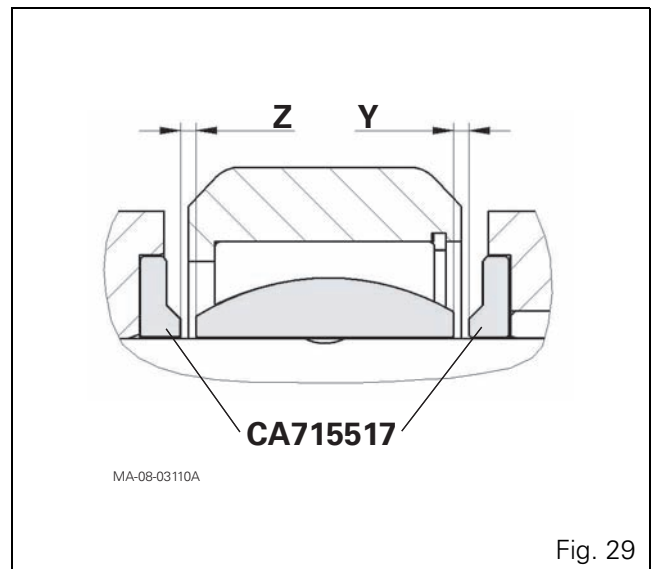


Fig. 29

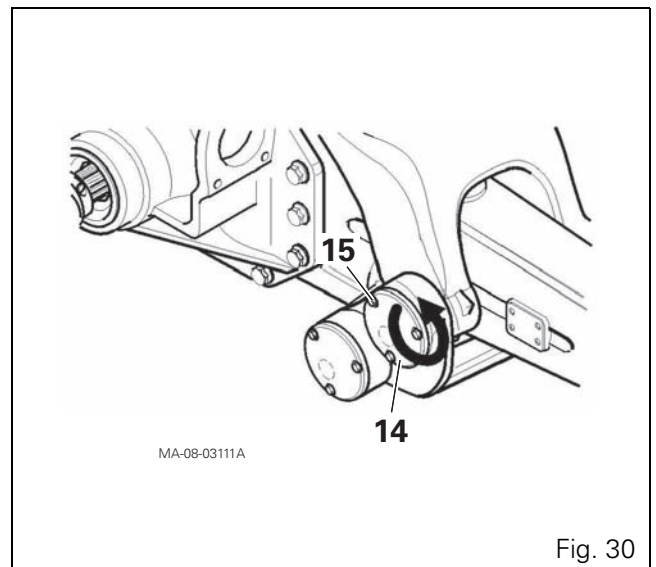


Fig. 30

## CARRARO 20.48 - Suspension

- 35.** Remove locating pin CA715382. Replace dummy thrust washer CA715381 with the shims P selected in step 31 and spacer (47) (Fig. 31). Insert spacer (47) with the aid of tool ref. CA715527.

**NOTE:** Position spacer (47) with the slots facing outwards.

- 36.** Remove spacers CA715517 (tools) from the pins in both upper arms.

Insert the shims U selected in step 33 and spacers (44) and (53) (Fig. 32). Insert spacers (44) and (53) with the aid of tool ref. CA715384.

**NOTE:** Divide the shim thickness into two equal thicknesses on both arms.

Fit new, pre-lubricated "O" rings (43) and (54) inside each spacer.

- 37.** Align the arms and the suspension ram using tool ref. CA715382. Remove the tool gradually and then insert pin (57) (Fig. 33).

**IMPORTANT:** Hold the tool at the opening of the hole for the pin.

Fit taper pin (42). Fit the washer, mount and tighten nut (40) to 45 Nm (Fig. 33).

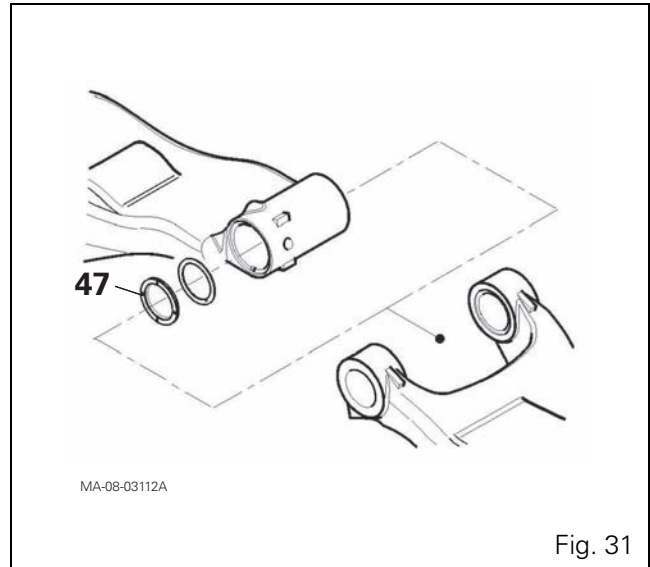


Fig. 31

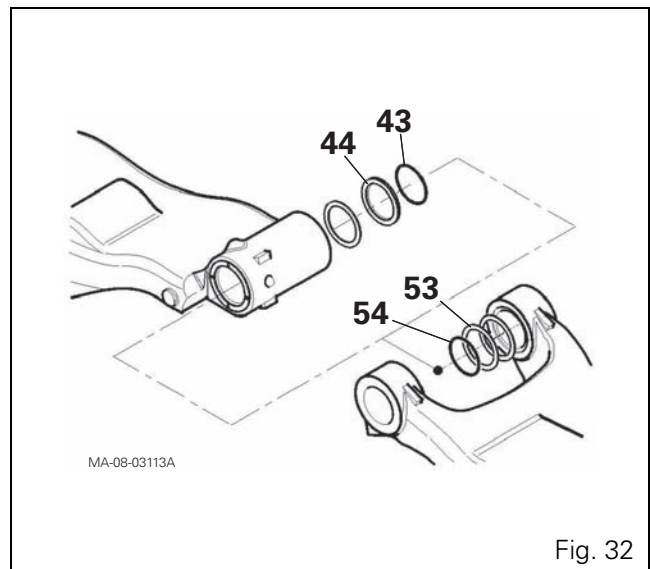


Fig. 32

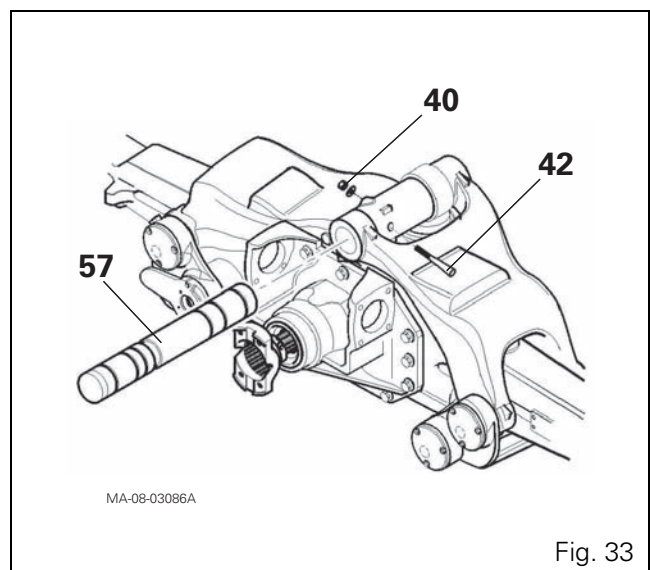


Fig. 33

## CARRARO 20.48 - Suspension

38. Re-tighten the pin covers (14) on the upper arms to 13 Nm (Fig. 34).

39. Use a depth gauge to check dimensions A, B and C between the spacers and the ram head (Fig. 35). If the dimensions are outside following tolerances, start again from step 29:

**A = 0.4 to 0.7 mm**

**B = C = 0.1 to 0.3 mm**

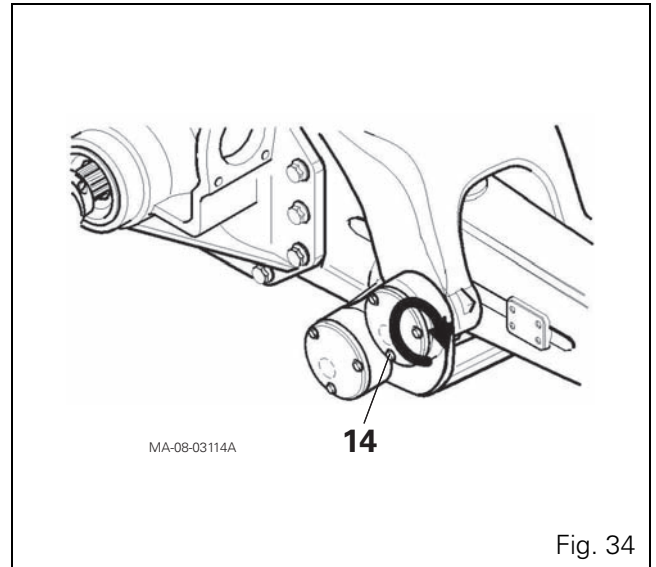


Fig. 34

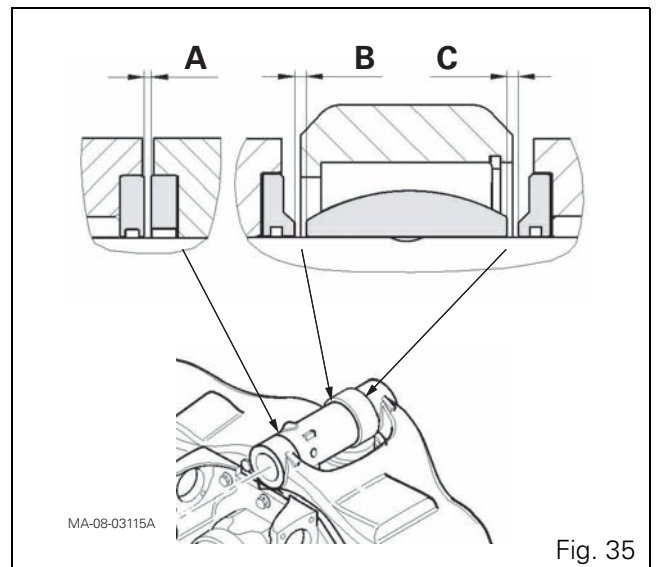
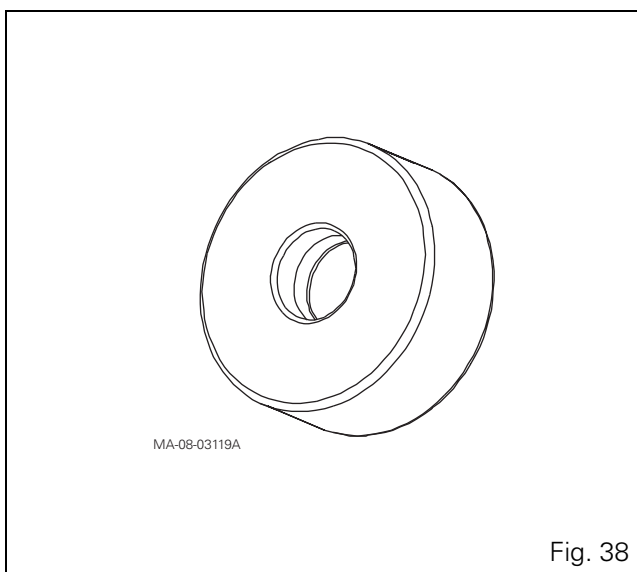
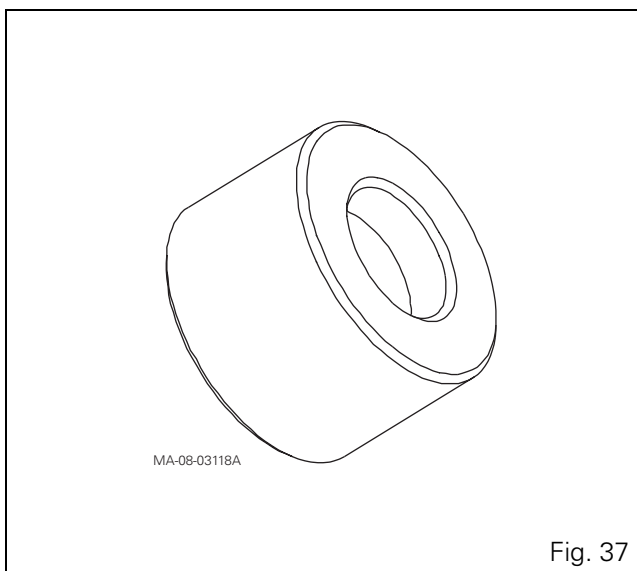
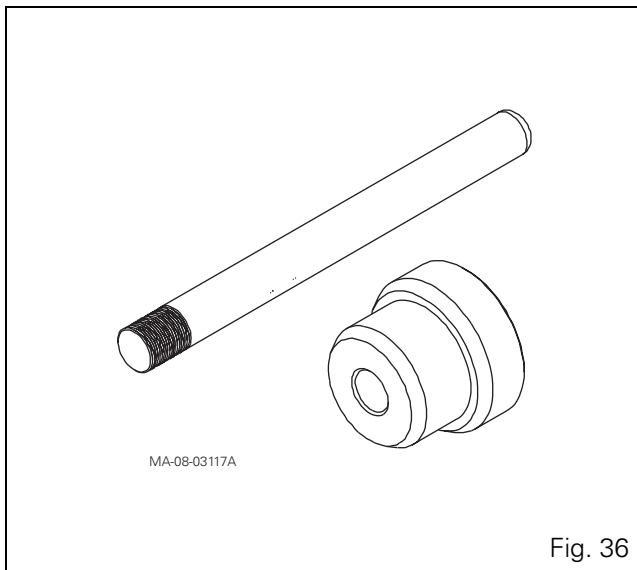


Fig. 35

# CARRARO 20.48 - Suspension

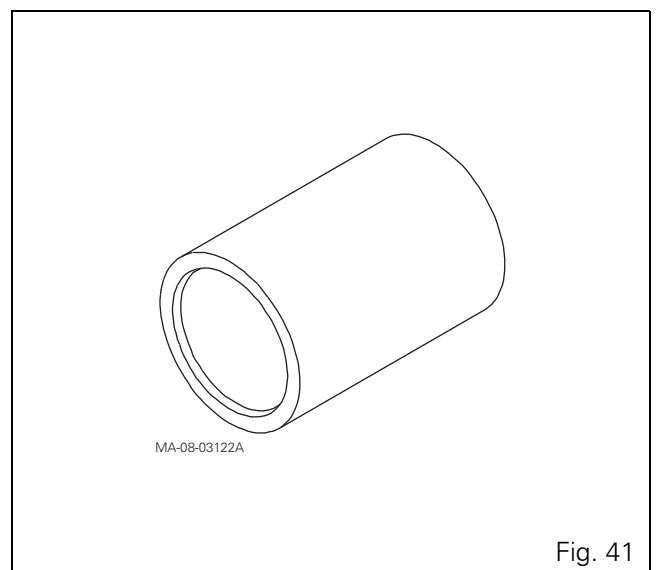
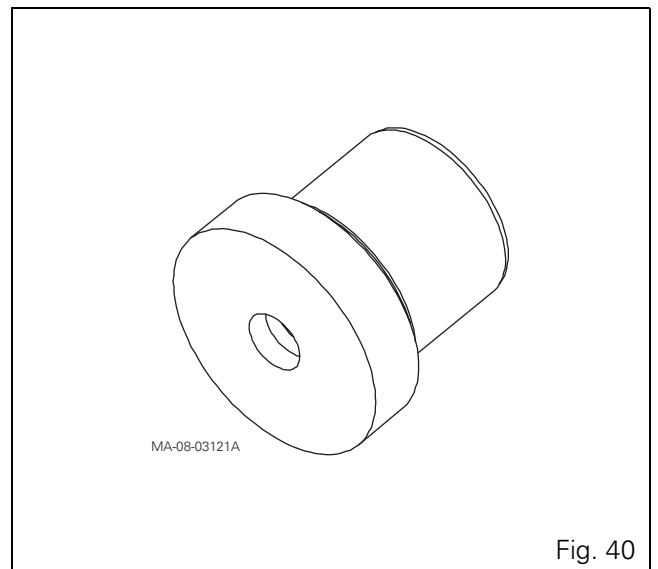
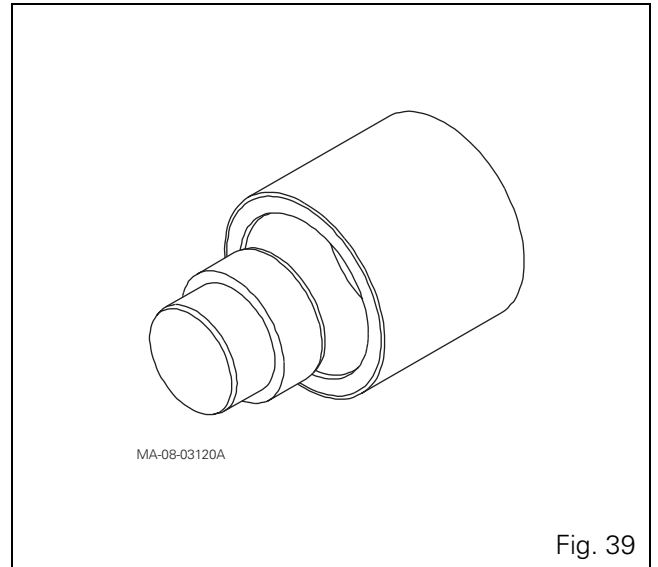
## C . Service tools

- CA715350—suspension arm alignment tool (Fig. 36)
- CA715353—suspension pin fitting tool (Fig. 37)
- CA715349—suspension bearing fitting tool (Fig. 38)



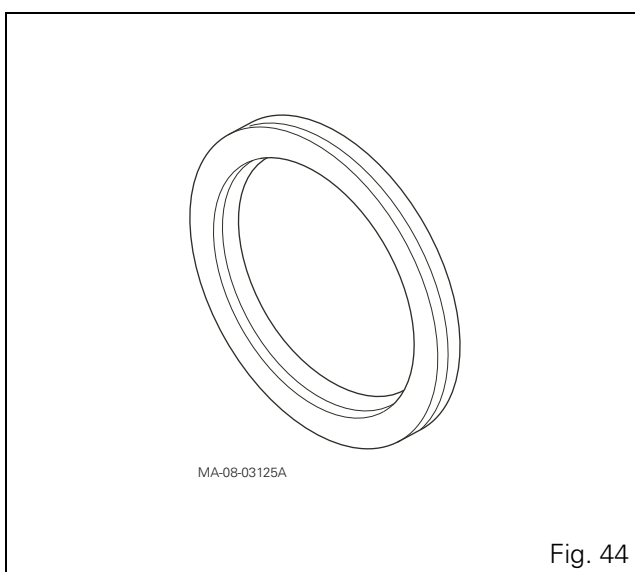
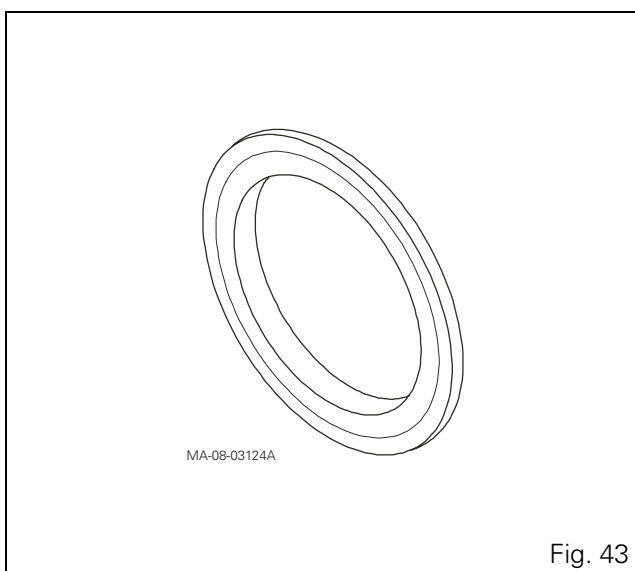
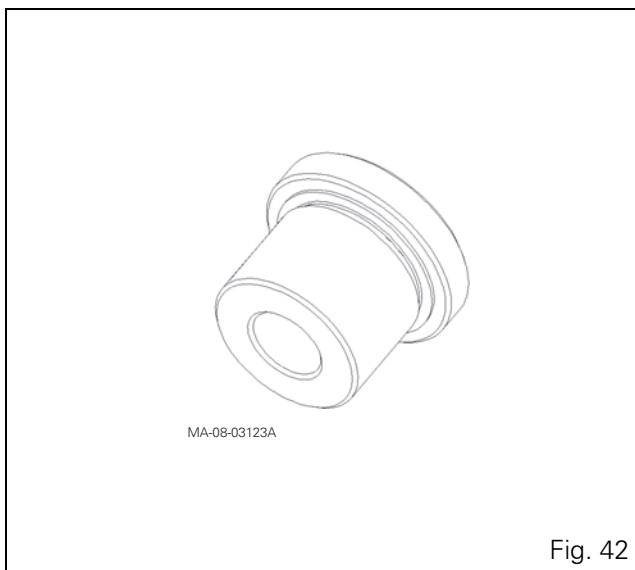
## CARRARO 20.48 - Suspension

- CA715345—seal fitting tool (Fig. 39)
- CA715385—central pivot pin fitting tool (Fig. 40)
- CA715383—seal fitting tool (Fig. 41)



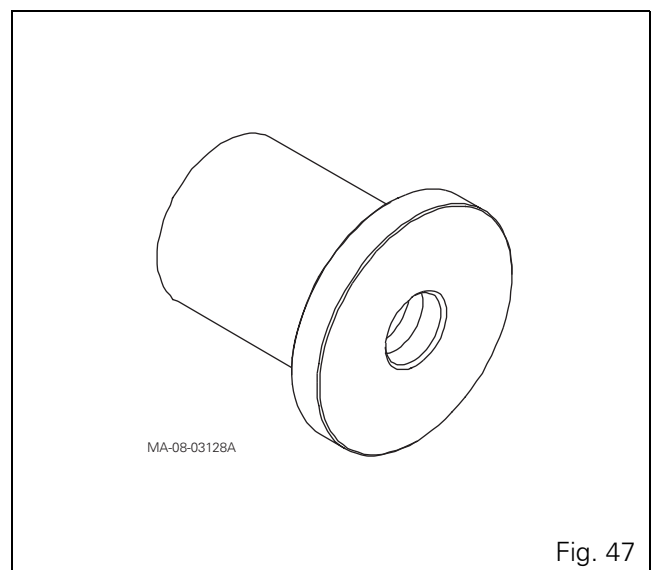
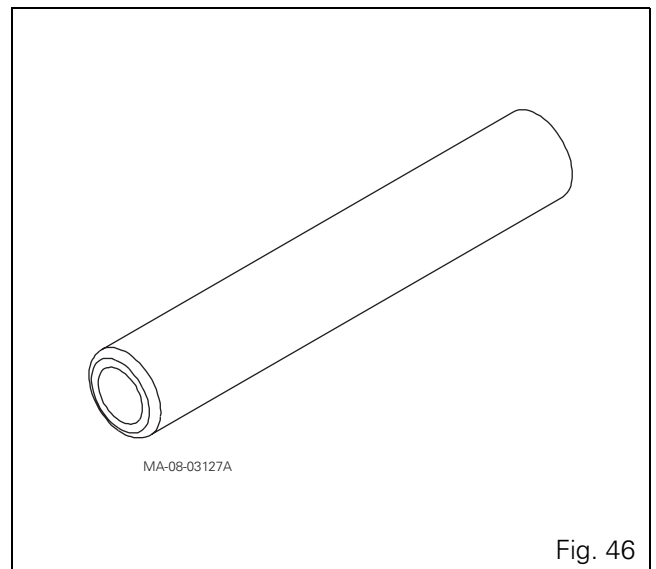
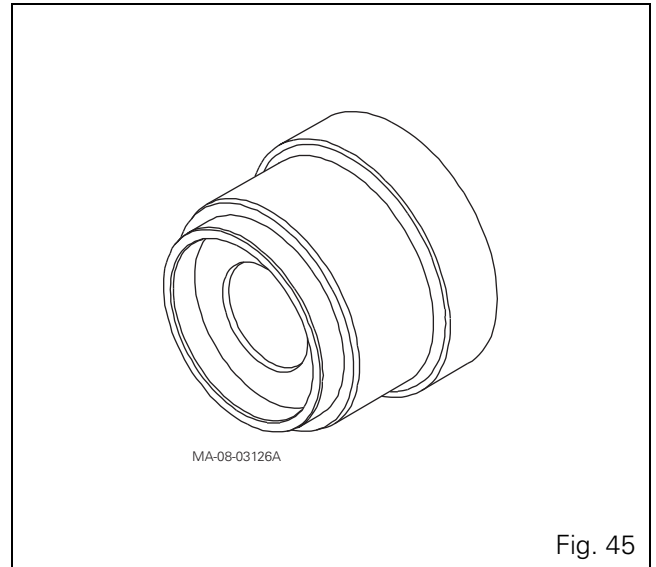
## CARRARO 20.48 - Suspension

- CA715384—spacer fitting tool (Fig. 42)
- CA715517—dummy shimming spacer (Fig. 43)
- CA715381—dummy thrust washer (Fig. 44)



## CARRARO 20.48 - Suspension

- CA715351—seal fitting tool (Fig. 45)
- CA715382—pivot pin centring tool (Fig. 46)
- CA715527—spacer fitting tool (Fig. 47)



## **CARRARO 20.48 - Suspension**

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*8B16 - CARRARO 20.48 - Trouble shooting*

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<b>B . Troubleshooting</b> .....	<b>5</b>
<b>C . Problem identification and diagnostics</b> .....	<b>7</b>

## CARRARO 20.48 - Trouble shooting

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## A . General

The following table identifies problems and their possible causes. Each number corresponds to a suggested solution to the problem.

Problems	Possible causes										
	1	2	3	4	5	6	7	8	9	10	11
Wheel vibration, front tyre resistance, broken stub axle	-	-	-		-						-
Steering difficult, the vehicle keeps moving straight forward when the wheels are turned	-	-	-	-							-
Differential does not work, jams when steering	-			-	-						-
Excessive transmission noise	-	-	-	-	-		-		-		-
Excessive tyre wear	-	-	-	-	-	-	-				-
Friction noise	-			-	-			-	-	-	-
Vibration when driving forward, intermittent noise	-										-

### 1. Incorrect installation/defective axle

Re-install. If differential tests after assembly are not satisfactory, repair or replace the differential.

### 2. Overload/incorrect weight distribution

Remove excess weight and distribute the load as indicated in the instructions supplied by the vehicle manufacturer.

### 3. Different tyre turning radii

If the radius of one tyre is smaller than that of its counterpart, partial wheel slip may occur when force is applied. The other tyre, having a larger radius, will then support the entire load. Replace the tyre or adjust the pressure to obtain the same radius for both tyres.

### 4. Broken stub axle

It is not recommended to drive with a broken stub axle. The vehicle can only be moved a few metres (engine stopped and unloaded).

# CARRARO 20.48 - Trouble shooting

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## 5. Stub axle buckled

Replace the stub axle in question.

## 6. Differential jammed

Abnormal differential operation or broken or seized control mechanism. Check the differential assembly and all its components.

On vehicles with a high steering angle, this failure can cause jerky operation, difficulty in steering or excessive tyre wear on tight turns.

Reduce the steering angle to a minimum and reduce speed when vehicle begins to jerk.

## 7. Incorrect wheel alignment

Check the axle assembly and wheel bearings.

## 8. Broken or worn axle components

Check the condition of the ring gear, pinion, bearings etc... Replace defective parts.

## 9. Dirt in the axle housing or incorrect assembly of certain components

Locate dirt. Check the assembly of the various axle components.

## 10. Crownwheel and pinion shimmed incorrectly—transmission components worn

(transmission gearing, ball joints, etc.).

Shim or replace the parts in question.

## 11. Incorrect use of the product

Refer to the instructions provided by the vehicle manufacturer.

## CARRARO 20.48 - Trouble shooting

### B . Troubleshooting

Problem	Cause	Action required
Ring gear teeth damaged on exterior.	<ol style="list-style-type: none"> <li>1. Excessive load on teeth in relation to design load.</li> <li>2. Incorrect pitch of teeth (excessive play).</li> <li>3. Loosening of the pinion nut.</li> </ol>	Replace the ring gear and pinion. Carefully follow the recommended setting operations for the crownwheel and pinion.
Ring gear teeth damaged on interior.	<ol style="list-style-type: none"> <li>1. Jerky load.</li> <li>2. Incorrect pitch of teeth (insufficient play).</li> <li>3. Loosening of the pinion nut.</li> </ol>	Replace the ring gear and pinion. Carefully follow the recommended setting operations for the crownwheel and pinion.
Ring gear teeth and pinion teeth worn or damaged.	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Contaminated fluid.</li> <li>3. Lubrication incorrect or contains degraded additives.</li> <li>4. Pinion pin clearance unset and poor contact between pinion and ring gear caused by wear to the pinion bearings.</li> </ol>	Replace the ring gear and pinion. Replace the bearings, ensuring correct positioning of the ring gear, pinion and bearing pre-loads. Use suitable lubricants, top up levels as required and change the lubricant as indicated in the recommended maintenance schedule.
Ring gear teeth and pinion teeth overheated. Check that the teeth have not lost their colouring.	<ol style="list-style-type: none"> <li>1. Prolonged operation at excessive temperatures.</li> <li>2. Incorrect lubrication.</li> <li>3. Low oil level.</li> <li>4. Contaminated fluid.</li> </ol>	Replace the ring gear and pinion. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Pinion teeth corroded.	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Insufficient lubrication.</li> </ol>	Replace the ring gear and pinion. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Axle beam buckled.	<ol style="list-style-type: none"> <li>1. Vehicle overload.</li> <li>2. Vehicle accident.</li> <li>3. Jerky load.</li> </ol>	Replace axle beam.
Bearings worn or corroded.	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Contaminated fluid.</li> <li>3. Excessive use.</li> <li>4. Normal wear.</li> <li>5. Loosening of the pinion nut.</li> </ol>	Replace the bearings. Use suitable lubricants, top up level when required and change the lubricant as indicated in the recommended maintenance schedule.
Oil leak at seals.	<ol style="list-style-type: none"> <li>1. Prolonged use with excessively high oil temperature.</li> <li>2. Incorrect assembly of oil seal.</li> <li>3. Damaged seal lip.</li> <li>4. Contaminated fluid.</li> </ol>	Replace the seal and mating surface if damaged. Use suitable lubricants, top up levels as required and change the lubricant as indicated in the recommended maintenance schedule.

## CARRARO 20.48 - Trouble shooting

Problem	Cause	Action required
Inlet flange splines excessively worn.	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Loosening of the pinion nut.</li> <li>3. Pinion shaft clearance.</li> </ol>	<p>Replace the flange.</p> <p>Check wear on pinion splines.</p> <p>If necessary replace the ring gear and pinion.</p>
Pinion teeth broken due to fatigue. Check whether the rupture is straight (jagged).	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Prolonged overload.</li> </ol>	Replace the ring gear and pinion.
Pinion teeth and ring gear teeth broken.	<ol style="list-style-type: none"> <li>1. Differential parts at breaking load.</li> </ol>	Check other differential parts and replace if necessary.
Sun gear splines worn (excessive play).	<ol style="list-style-type: none"> <li>1. Excessive use.</li> </ol>	<p>Replace the entire differential gearing.</p> <p>If necessary, replace the stub axle.</p>
Thrust washer mating surface worn or scratched.	<ol style="list-style-type: none"> <li>1. Insufficient lubrication.</li> <li>2. Incorrect lubrication.</li> <li>3. Contaminated fluid.</li> </ol>	<p>Replace with a new washer if scratched or if thickness is less than 0.1 mm.</p> <p>Use suitable lubricants, top up levels as required and change the lubricant as indicated in the recommended maintenance schedule.</p>
Internal diameter of taper roller bearing worn.	<ol style="list-style-type: none"> <li>1. Excessive use.</li> <li>2. Excessive axial play of pinion.</li> <li>3. Insufficient lubrication.</li> <li>4. Contaminated fluid.</li> </ol>	<p>Replace bearing. Check axial play of pinion.</p> <p>Use suitable lubricants, top up levels as required and change the lubricant as indicated in the recommended maintenance schedule.</p>
Stub axle buckled or broken.	<ol style="list-style-type: none"> <li>1. Excessive use or vehicle overload.</li> </ol>	Replace the defective stub axle.
Stub axle broken at wheel side.	<ol style="list-style-type: none"> <li>1. Wheel support loose.</li> <li>2. Axle beam buckled.</li> </ol>	<p>Replace the defective stub axle.</p> <p>Check that the axle beam is not buckled.</p> <p>Check that the wheel support is not worn or badly adjusted.</p>

## CARRARO 20.48 - Trouble shooting

### C . Problem identification and diagnostics

Problem	Cause	Action required
Noise when vehicle is moving.	<ol style="list-style-type: none"> <li>1. Excessive play between the ring gear and pinion.</li> <li>2. Ring gear or pinion worn.</li> <li>3. Pinion bearings worn.</li> <li>4. Pinion bearings loose.</li> <li>5. Excessive axial play of pinion.</li> <li>6. Differential bearings worn.</li> <li>7. Differential bearings loose.</li> <li>8. Excessive ovality of ring gear.</li> <li>9. Hydraulic fluid low.</li> <li>10. Incorrect or insufficient lubricant.</li> <li>11. Stub axle buckled.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust play.</li> <li>2. Replace the defective part.</li> <li>3. Replace the bearings.</li> <li>4. Adjust the bearings.</li> <li>5. Adjust play.</li> <li>6. Replace the bearings.</li> <li>7. Adjust the bearings.</li> <li>8. Replace the ring gear.</li> <li>9. Top up lubricant.</li> <li>10. Change lubricant.</li> <li>11. Replace the stub axle.</li> </ol>
Noise when engine is in neutral.	<ol style="list-style-type: none"> <li>1. Noises caused by the axle can generally be heard faintly when the engine is in neutral.</li> <li>2. Incorrect play between the pinion and ring gear (the noise can be heard at the end of deceleration, when the engine starts to accelerate).</li> <li>3. Inlet flange or pinion excessively worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust or replace (see above).</li> <li>2. Adjust play.</li> <li>3. Replace defective parts.</li> </ol>
Intermittent noise.	<ol style="list-style-type: none"> <li>1. Ring gear damaged.</li> <li>2. Differential unit bolts loose.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the crownwheel and pinion.</li> <li>2. Tighten to the required torque.</li> </ol>
Continuous noise.	<ol style="list-style-type: none"> <li>1. Ring gear or pinion damaged.</li> <li>2. Bearings worn.</li> <li>3. Pinion splines worn.</li> <li>4. Stub axle buckled.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the crownwheel and pinion.</li> <li>2. Replace the bearings.</li> <li>3. Replace the pinion.</li> <li>4. Replace the stub axle.</li> </ol>
Noise when changing steering angle.	<ol style="list-style-type: none"> <li>1. Differential planetary gears worn.</li> <li>2. Differential unit and/or spider worn.</li> <li>3. Differential thrust washers worn.</li> <li>4. Stub axle splines worn.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace the planetary gears.</li> <li>2. Replace defective parts.</li> <li>3. Replace the washers.</li> <li>4. Replace the stub axle.</li> </ol>

## **CARRARO 20.48 - Trouble shooting**

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*8C10- DANA front axle - General:*

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<b>E . Hydraulics</b> .....	<b>11</b>

## **DANA front axle - General:**

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## A . General description

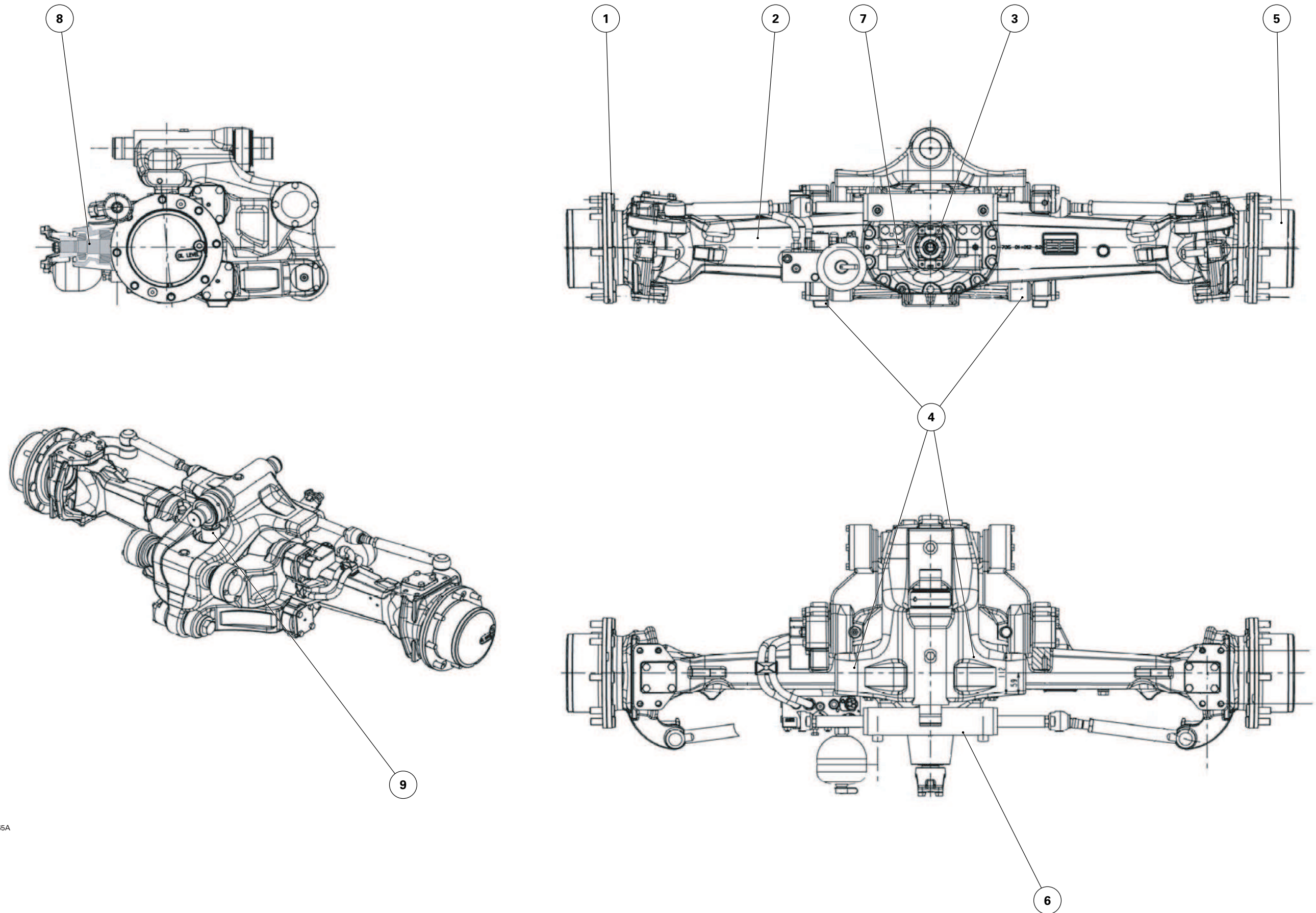
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Tractors in the 6400 range are fitted with 2 new front axles, identical to the axles fitted to the 7400 range respectively, depending on model. The only difference is the bevel gear assembly, which is adapted to the transmission type. These new front axles are suspended type. The suspension system is electronically controlled by an Autotronic 5 controller.

## Parts list

- (1) Hub assembly
- (2) Axle beam assembly
- (3) Differential assembly
- (4) Arm assembly
- (5) Final drive assembly
- (6) Steering ram assembly
- (7) Differential housing assembly
- (8) Pinion assembly
- (9) Suspension ram assembly

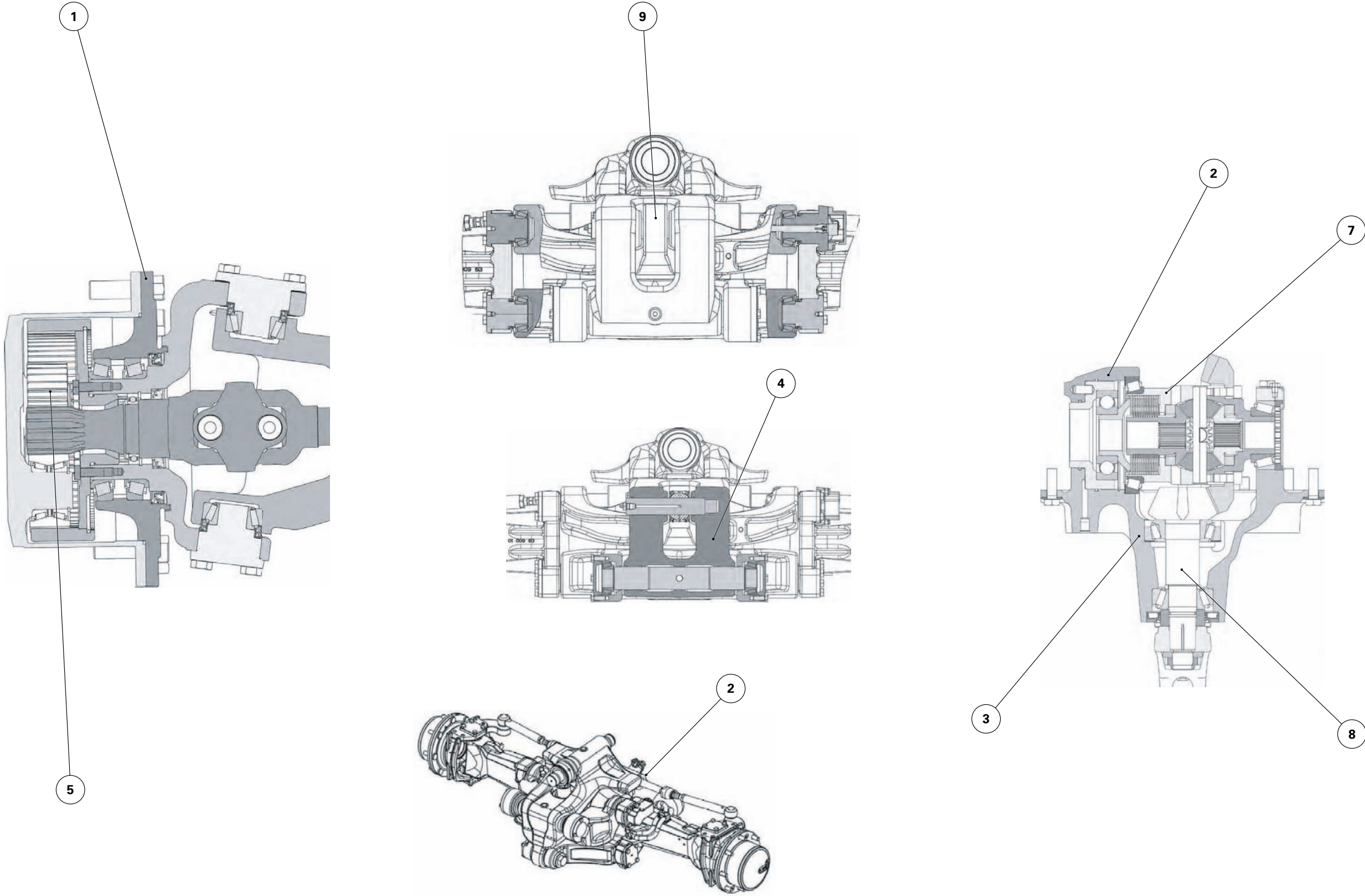
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MA-08-04465A

Fig. 1

DANA front axle - General



MA-08-04466A

Fig. 2

## B . Dimensions

All values in the following tables are given in millimetres.

Dimensions for models 735 and 740 (Fig. 3)

A = 1998	F = Ø 275	K = 443
B = Ø 310	G = 440.5	L = 337
C = Ø 220	H = 149	M = 169
D = Ø 1800	I = 278	N = 112
E = M18x1.5	J = 136	

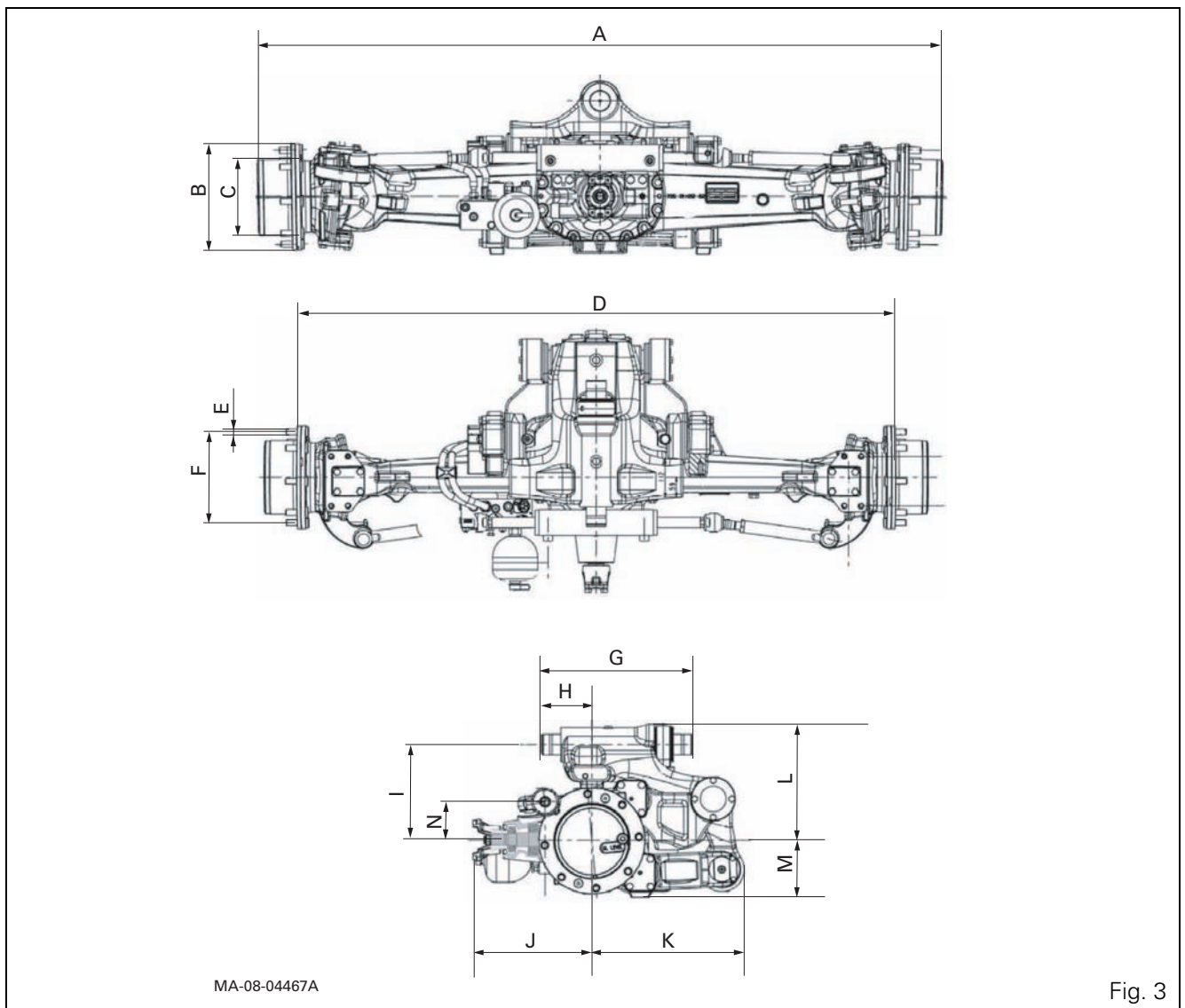


Fig. 3

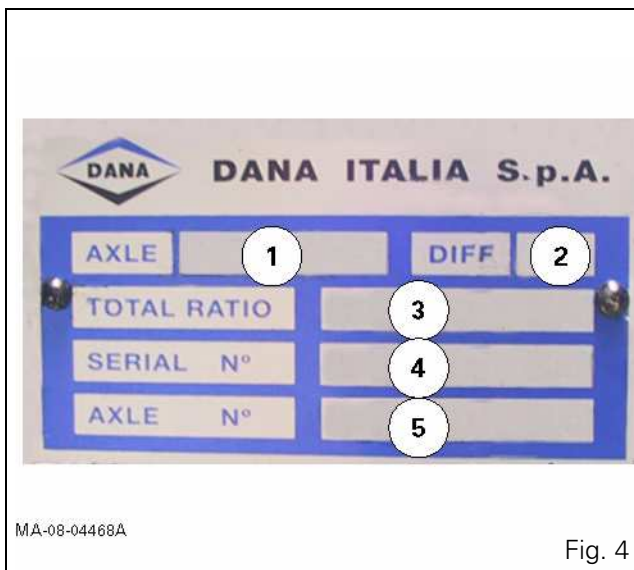
## DANA front axle - General

### Product identification

The DANA front axle is identified by a plate fitted to the housing (Fig. 4). This plate indicates the main references.

### Parts list

- (1) Axle type
- (2) Differential type
- (3) Total reduction ratio
- (4) Serial number
- (5) DANA number





## C . Technical specifications

<b>Axle model</b>	735/522	735/604	735/525	735/603	740/540	740/605
<b>Tractor</b>	6465		6475		6480	
<b>Axle type</b>	Fixed	Suspended	Fixed	Suspended	Fixed	Suspended
Length between flanges (mm)	1800		1800		1784	
External length (mm)	1998		1998		2088	
Length between steering pivots (mm)	1520		1520		1520	
Pivot angle	5.5°		5.5°		5.5°	
Castor angle	5°		5°		5°	
Camber	1°		1°		1°	
Weight filled with oil (kg)	312	600	312	600	380	620
Differential oil capacity (litres)	9		9		9	
Oil capacity per final drive (litres)	0.8		2		2	
Oil specifications	API GL5/SAE 90					
Pivot shaft diameter (mm)	60		60		60	
Wear ring	no		no		no	
Distance from the centre of the pivot in relation to the centre of the wheels (mm)	215	278±45	215	278±45	215	278±45
Wheel studs	8 M18x1.5 studs		8 M22x1.5 studs		10 M22x1.5 studs	10 M22x1.5 studs
Stud useful length (mm)	34		34		50	
Stud distribution diameter (mm)	275		275		335	
Rim centring diameter (mm)	220.6 +0/-0.3		220.6 +0/-0.3		280.6 +0/-0.3	
Mudguard mounting		4 M16 at 50.8x150		4 M16 at 50.8x150		4 M16 at 50.8x150
Input shaft	2 jaws of 1410		2 jaws of 1410		2 jaws of 1410	
Rotational direction	anti-clockwise		anti-clockwise		anti-clockwise	
Total ratio	15.5		17		17	
Driving torque (daNm)	1093		1235		1336	
Driving torque peak (daNm)	2558		2805		3389	

## DANA front axle - General

Axle model	735/522	735/604	735/525	735/603	740/540	740/605
Tractor	6465		6475		6480	
Axle type	Fixed	Suspended	Fixed	Suspended	Fixed	Suspended
Differential	Multidisc (12) 4 sun gears		Multidisc (12) 4 sun gears		Multidisc (12) 4 sun gears	Multidisc (12) 4 sun gears
Hydraulic port	M14x1.5 ISO6149		M14x1.5 ISO6149		M14x1.5 ISO6149	M14x1.5 ISO6149
Bevel gear	12/31		12/34		12/34	
Final drive	14x27x70 teeth		14x27x70 teeth		14x27x70 teeth	
Number of sun gears	4		4		3	
Contact width (in mm)	43		43		48	
4WD clutch torque (daNm)	165		165		198	
Bearing type	lubricated for life		lubricated for life		lubricated for life	
Between-wheel interior/exterior angle	55°/39.2°		55°/39.2°		55°/39.2°	
Assistance ram diameter (in mm)	68x32		68x32		72x38	
Hydraulic port	M14x1.5 ISO6149		M16x1.5 ISO6149		M16x1.5 ISO6149	
Volume of oil for steering (cm <sup>3</sup> )	125		125		125	
Number of steering wheel turns from stop to stop	4.7		4.7		4.7	
Suspension ram diameter (mm)		65x60		65x60		65x60
Max. pressure (bar)		250		250		250
Axle nominal load (daN)	2687		2696		2876	
Maximum front axle load before breakage (daN)	7164		7188		7668	
Sealing	Cassette seal		Cassette seal		Cassette seal	

## D . Suspension

### Suspension unit

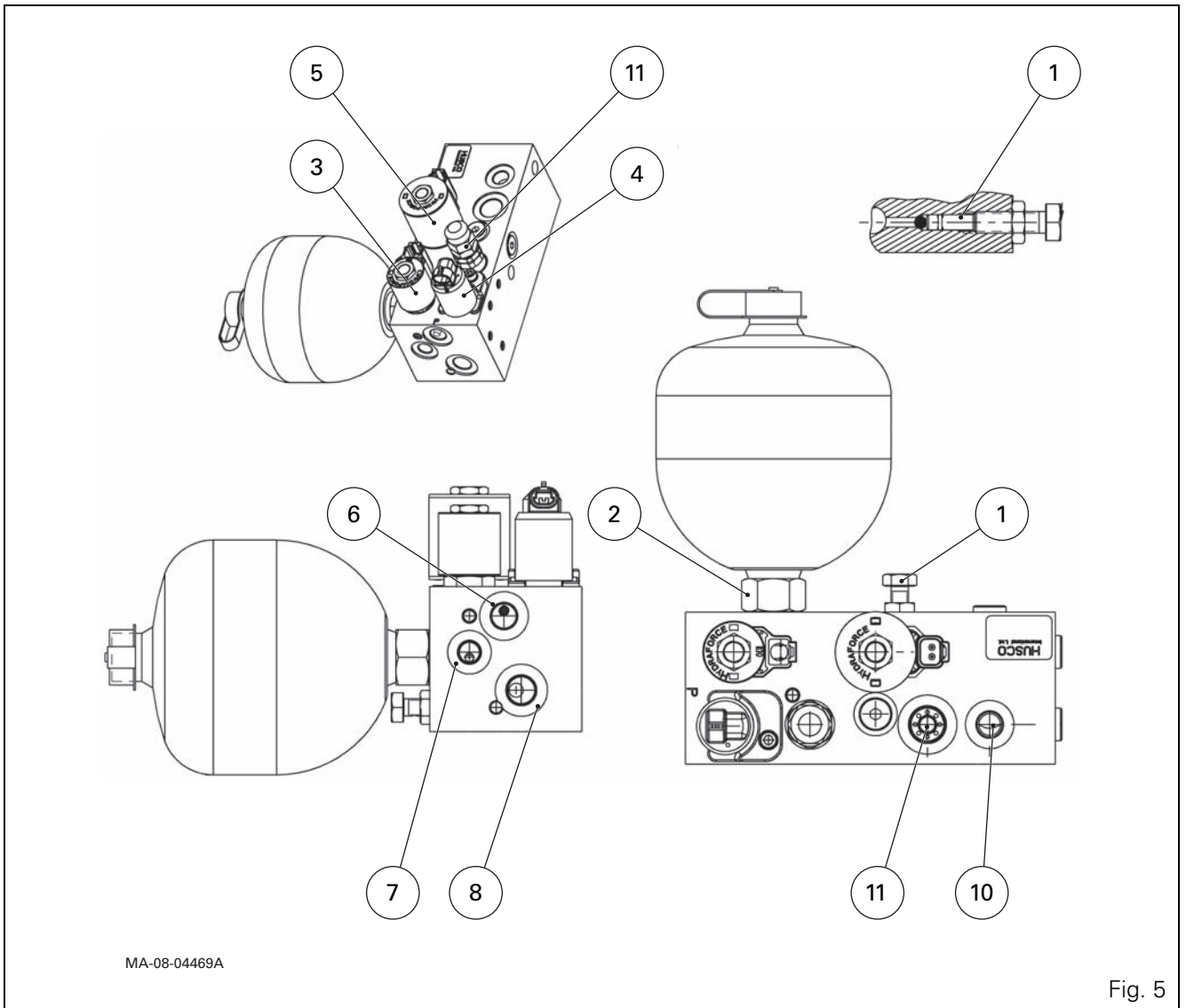
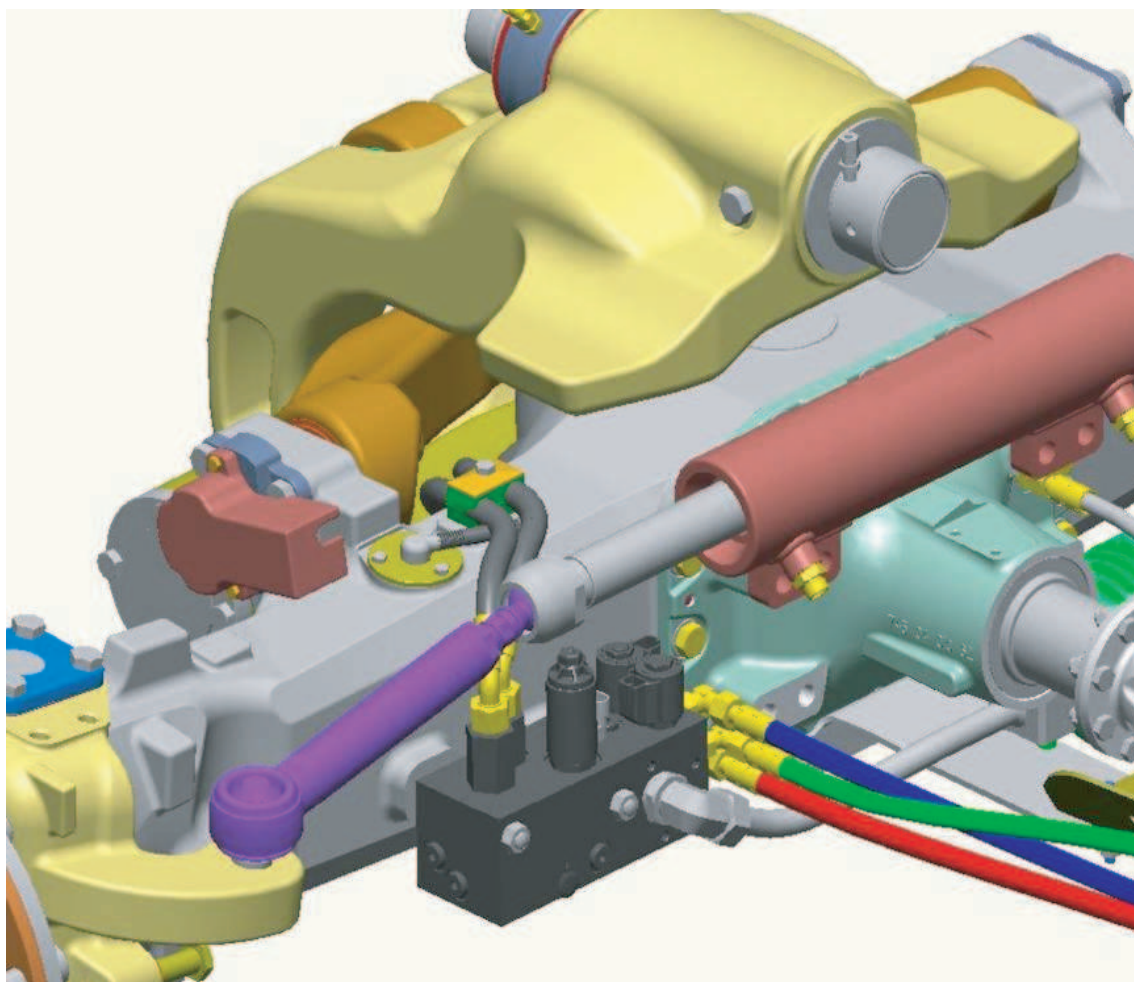


Fig. 5

1	Manual bleed screw	7	Connection for LS information
2	Accumulator connection	8	Return to tank
3	Lowering solenoid valve	9	Ram large chamber
4	Lifting solenoid valve	10	Ram small chamber
5	Suspension solenoid valve	11	Relief valve
6	Pressure connection		

## DANA front axle - General



MA-08-04470A

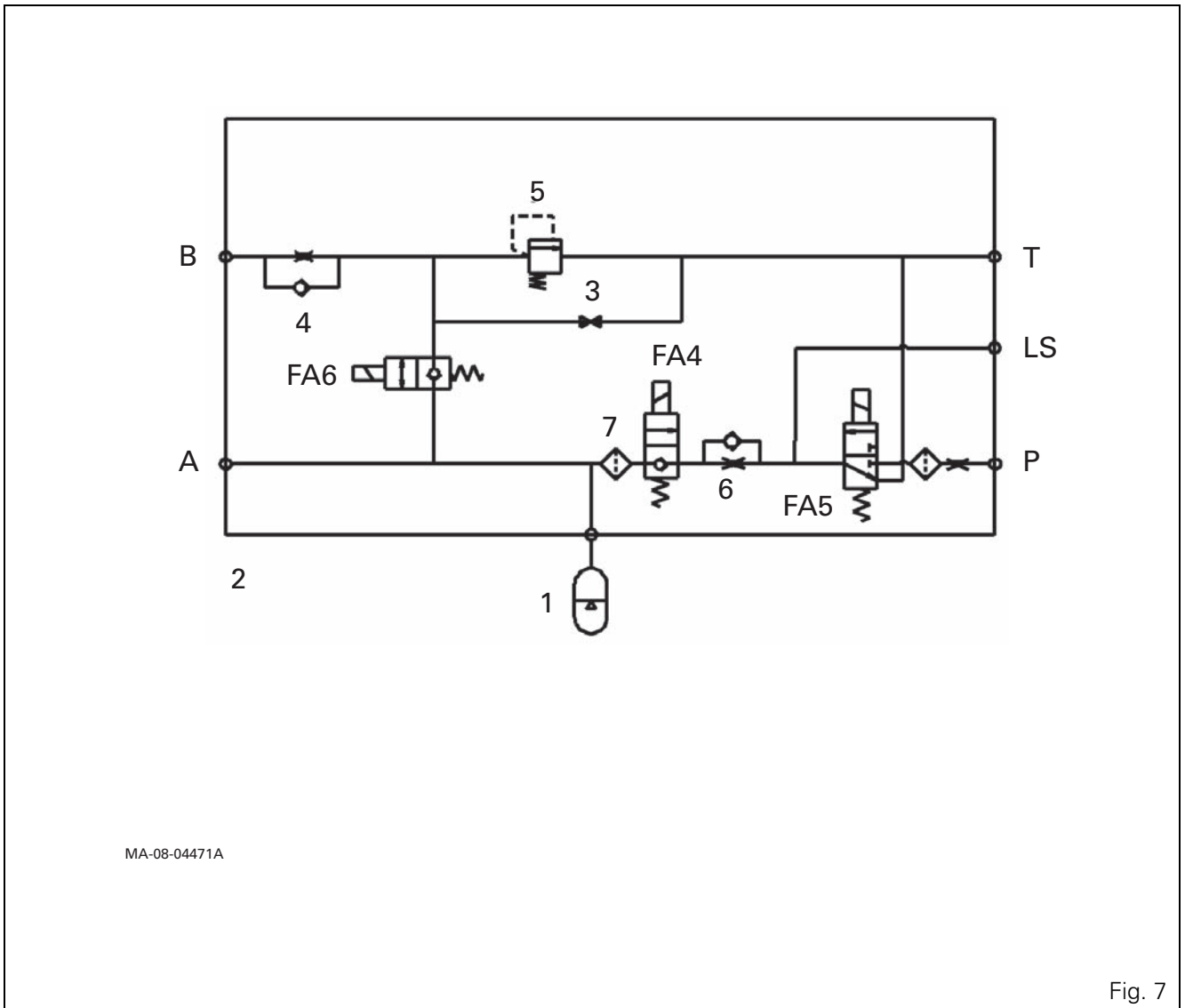
Fig. 6

Description	Values
Nominal pressure	210 bar
Oil type	SAE 10W
Operating temperature	-30° to 120°
Port (P)	M16 x 1.5
Port (T)	M18 x 1.5
Port (LS)	M14 x 1.5
Voltage	9-16 Volt
Accumulator capacity	1 l
Accumulator pressure	20 bar
Lifting solenoid valve resistance	10.5 Ohms (20°C)
Lowering solenoid valve resistance	8.8 Ohms (20°)
Locking solenoid valve resistance	7.3 Ohms (20°)

## E . Hydraulics

The hydraulic system is identical to the system for the DANA suspended axle on lower model range tractors.

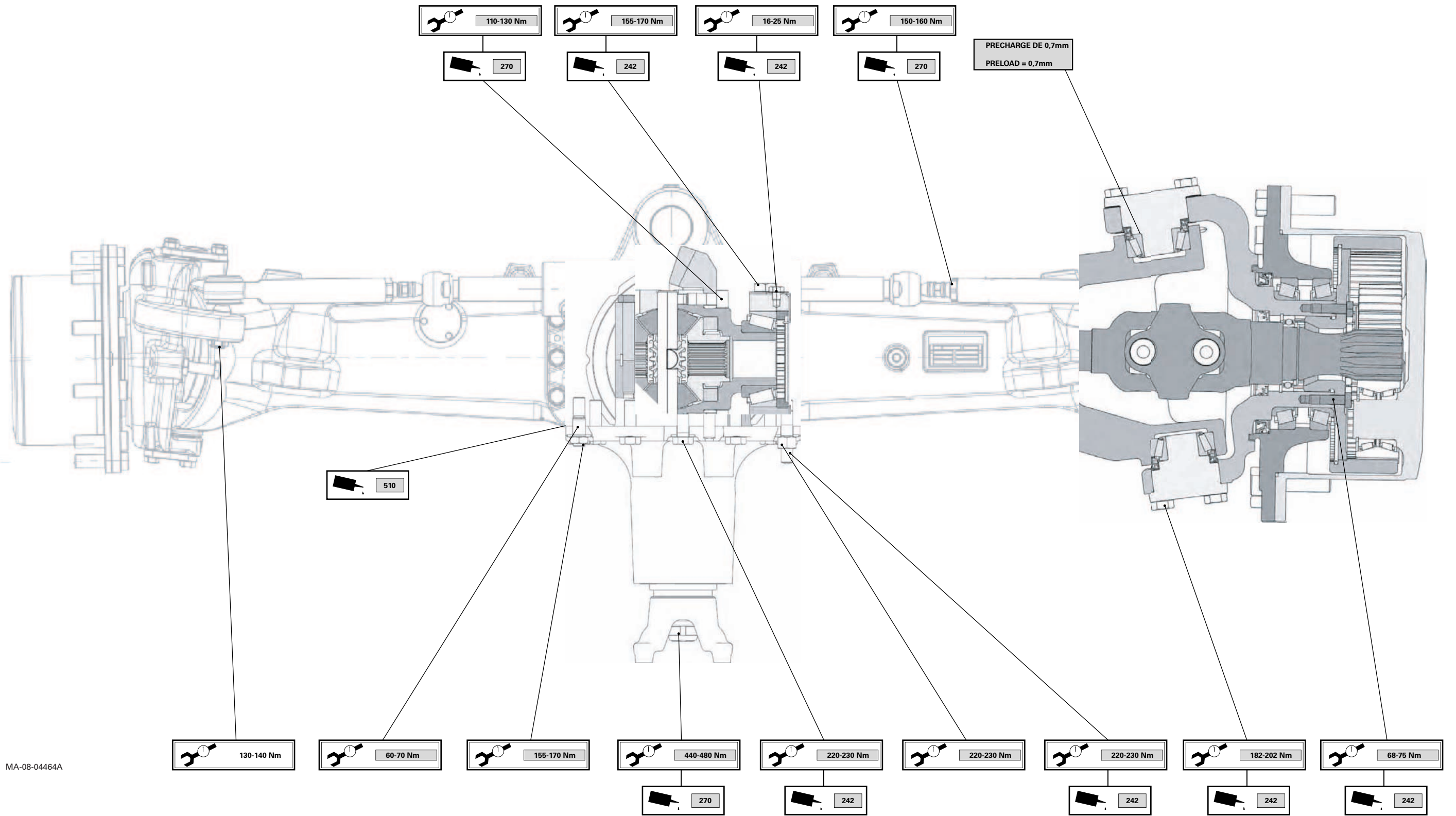
### Hydraulic system



FA4	Lowering solenoid valve	4	Non-return valve
FA5	Lifting solenoid valve	5	Relief valve (210 bar)
FA6	Suspension solenoid valve	6	Restrictor
1	Accumulator	7	Filter
2	Suspension unit	A	Ram large chamber
3	Manual bleed screw	B	Ram small chamber

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Tightening torques and assembly products



MA-08-04464A

Fig. 8

## DANA front axle - General

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*8D10- 2WD front axle beam*

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<b>G . Adjusting wheel alignment</b> .....	<b>14</b>

## 2WD front axle beam

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### A . General

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The front axle beam consists of the following assemblies:

- a cast iron support identical to the 4WD version, whose lower part incorporates a fixed bearing holding the 2nd axle beam pivot,
- a bearing fixed to the cast iron support, holding the 1st axle beam pivot,
- an arm support beam,
- two axle outer arms,
- two pin / axle spindle assemblies fitted in the axle outer arm bores,
- a double-acting cylinder linked to the axle spindle pins via ball joints and link rods.

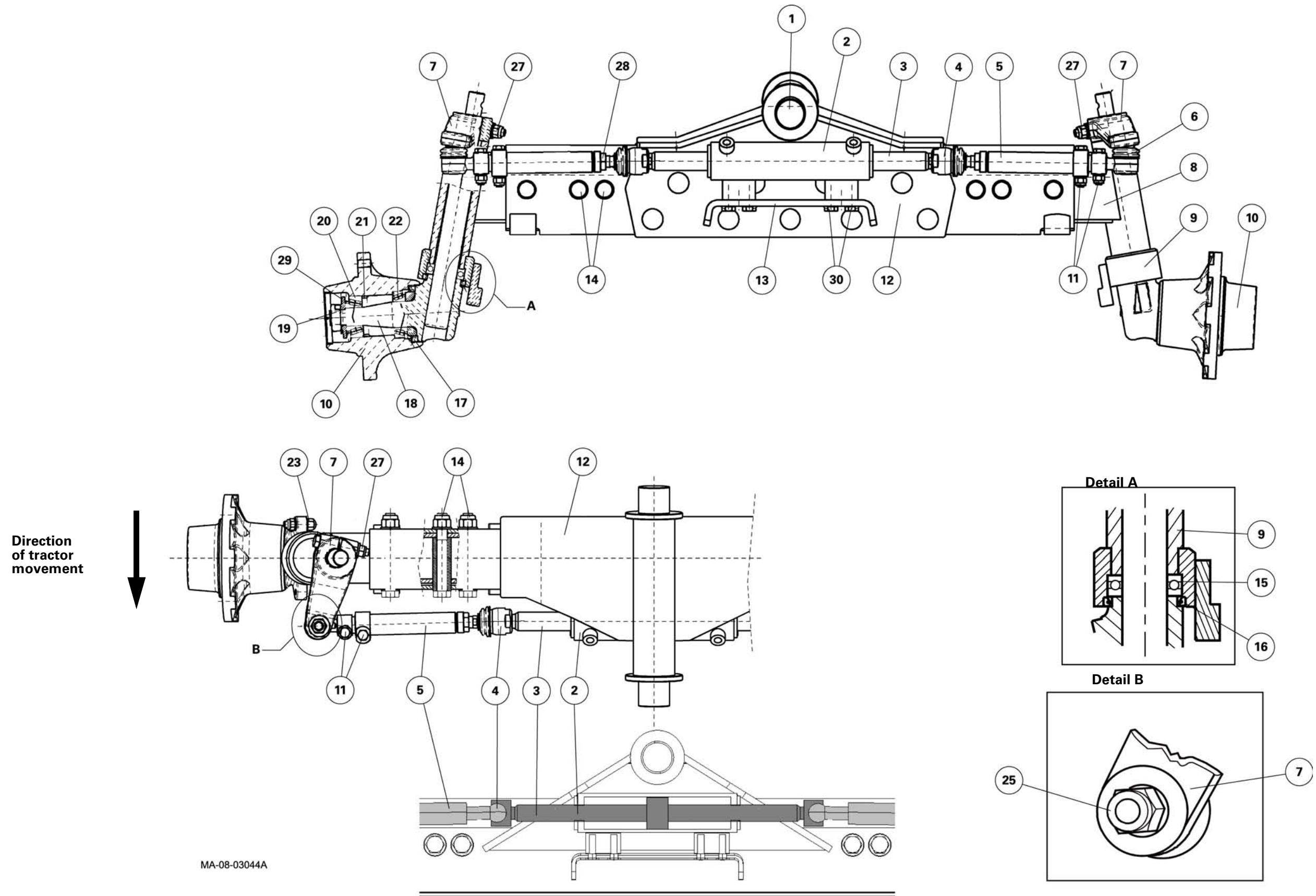
### Parts list (Fig. 1 and Fig. 2)

- (1) swivel pin
- (2) steering ram
- (3) steering ram rod
- (4) ram / link rod ball joint
- (5) link rod
- (6) link rod / lever ball joint
- (7) steering lever
- (8) axle outer arms
- (9) steering ram
- (10) hub
- (11) link rod adjustment screws
- (12) central support
- (13) ram support
- (14) screw
- (15) bearing
- (16) seal
- (17) seal
- (18) spindle
- (19) hub tightening nut
- (20) bearing
- (21) seal
- (22) bearing
- (23) steering lock
- (25) nut
- (26) pin
- (27) steering lever tightening screw
- (28) link rod adjustment nuts
- (29) washer
- (30) ram attachment screw

## 2WD front axle beam

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Overall view

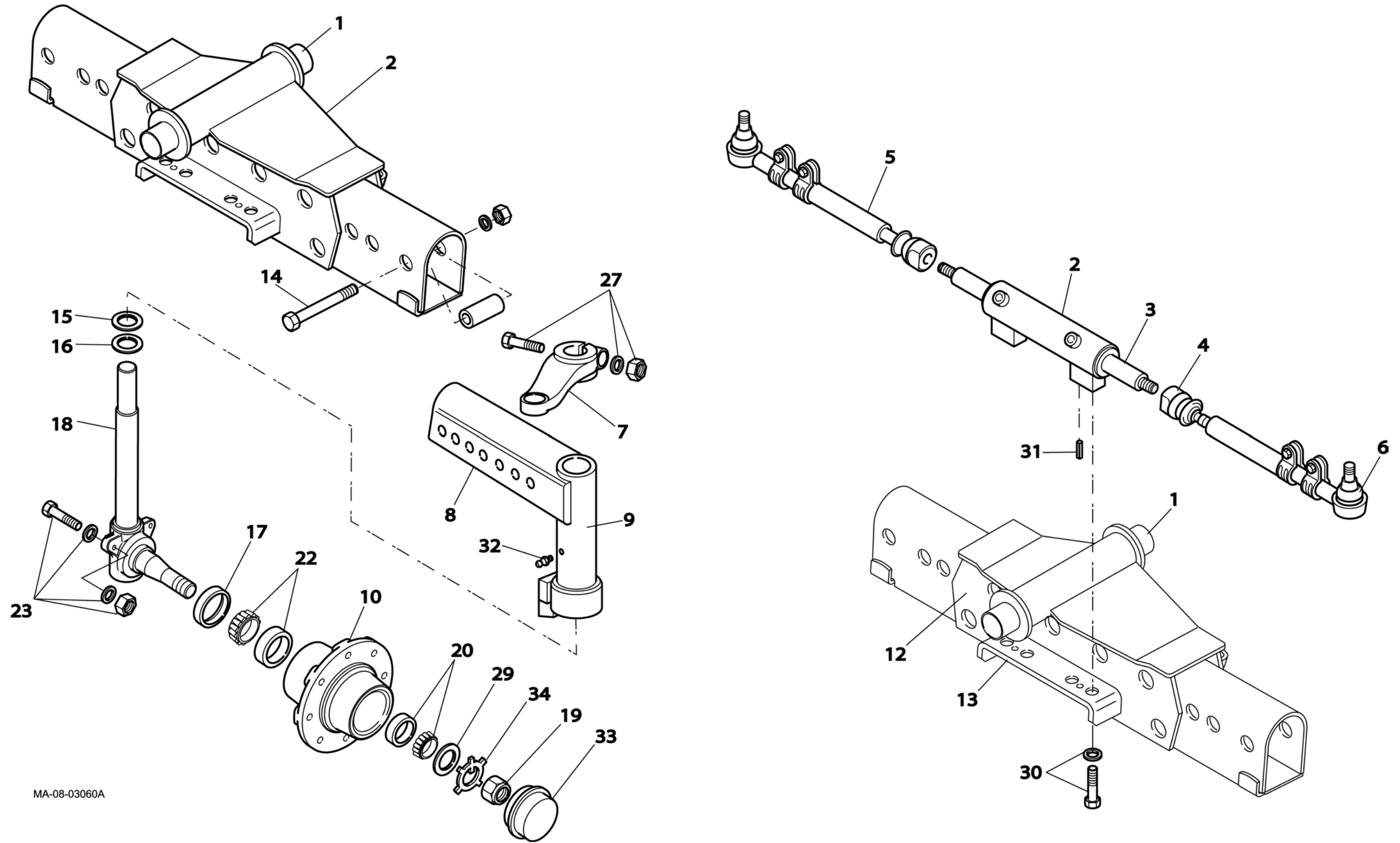


MA-08-03044A

Fig. 1

# 2WD front axle beam

Exploded view



MA-08-03060A

Fig. 2

## 2WD front axle beam

Tightening torques and dimensions for wide and standard 2WD front axles

### Tightening torques (Fig. 3)

Ref.	Description	Thread	Nm
1	Ram attachment screw	M14 X 2 X 40	120 Nm
2	Steering lock screw	M12	70 Nm
3	Steering lever attachment screw	M14 X 2 X 100	70 Nm
4	Beam width adjustment screw	M20 X 2.5 X 150	260 Nm
5	Steering ball joint	M20	120 Nm
6	Steering link rod tightening collar	-	70 Nm
7	Steering link rod locknut	-	220 Nm
8	Ball joint tightening	-	220 Nm
9	Hub tightening nut	M30 x 1.5	140 Nm, loosen then retighten to 40 Nm

### Dimensions (mm)

Ref.	Dimension	
	Standard	Wide
A	1660 - 2060	1892 - 2392
B	1360	1592
C	Ø 152.2 +/- 0.1	
D	Ø 60	
O	60	
F	324	
G	Ø 203.2	
H	50	

# 2WD front axle beam

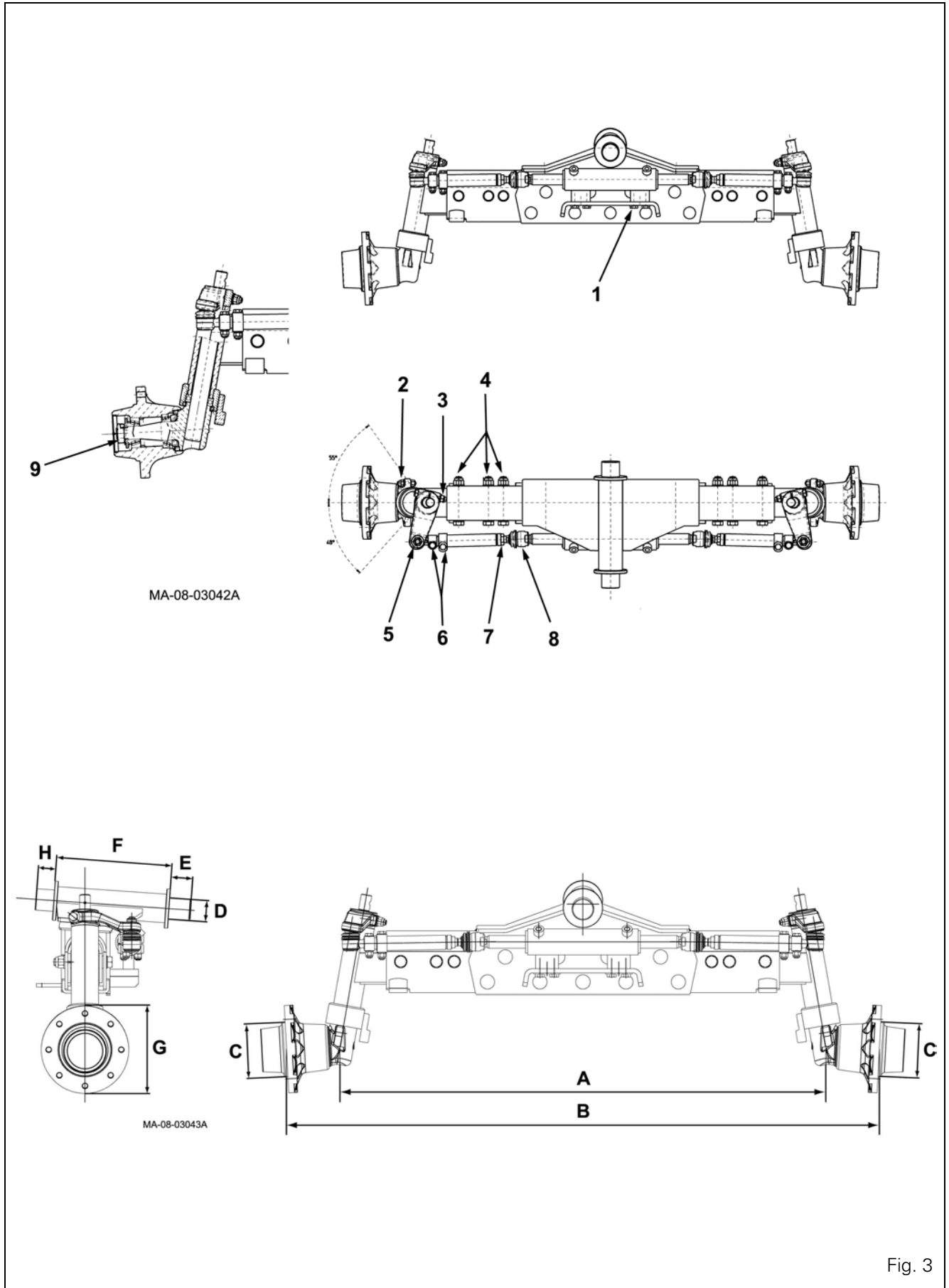


Fig. 3



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### B . Removing and refitting the steering link rod

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#### Removal

1. Chock the rear wheels and put the handbrake on.
2. Lift the relevant wheel using a jack. Remove nut (25).
3. Extract the ball joint (6) from the lever (7).
4. Loosen the ball joint (4) and separate it from the ram rod (3).

#### Refitting

5. Check and clean all components. Replace any defective parts.
6. Reassemble the ball joint (4) on the ram rod (3). Tighten to a torque of 220 Nm.
7. Fit the ball joint (6) in the lever (7). Fit the nut (25). Tighten to a torque of 120 Nm.
8. Remove the jack.
9. Remove the shims and release the handbrake.
10. Adjust the wheel alignment (see § F).

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### C . Removing and refitting the hub, spindle and axle outer arm

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#### Preliminary operations

11. Chock the rear wheels and put the handbrake on.
12. Raise the front of the tractor using a jack positioned at the centre of the axle beam and install stands.
13. Take off the wheel concerned.

#### Removing the hub

14. Extract cover (33).  
Release and loosen the nut (19), remove the retainer (34) and washer (29).
15. Remove the bearing cone (20).
16. Extract the hub (10) from the spindle (18).
17. Extract the sealing ring (17) and remove the bearing cone (22).
18. Extract the bearings cups (20) and (22).

#### Removing the spindle

19. Remove nut (25). Extract the ball joint (6) from the lever (7). Take off lever (7).
20. Extract spindle (18) from the axle outer arm.
21. Split the bearing (15) from the spindle.
22. Extract the sealing ring (16) from the axle outer arm (8).

#### Removing the axle outer arm

23. Remove the screws and nuts (14).
24. Extract the axle outer arm (8) from the axle beam (2), and remove the grease nipple (32).

## 2WD front axle beam

### Refitting the axle outer arm

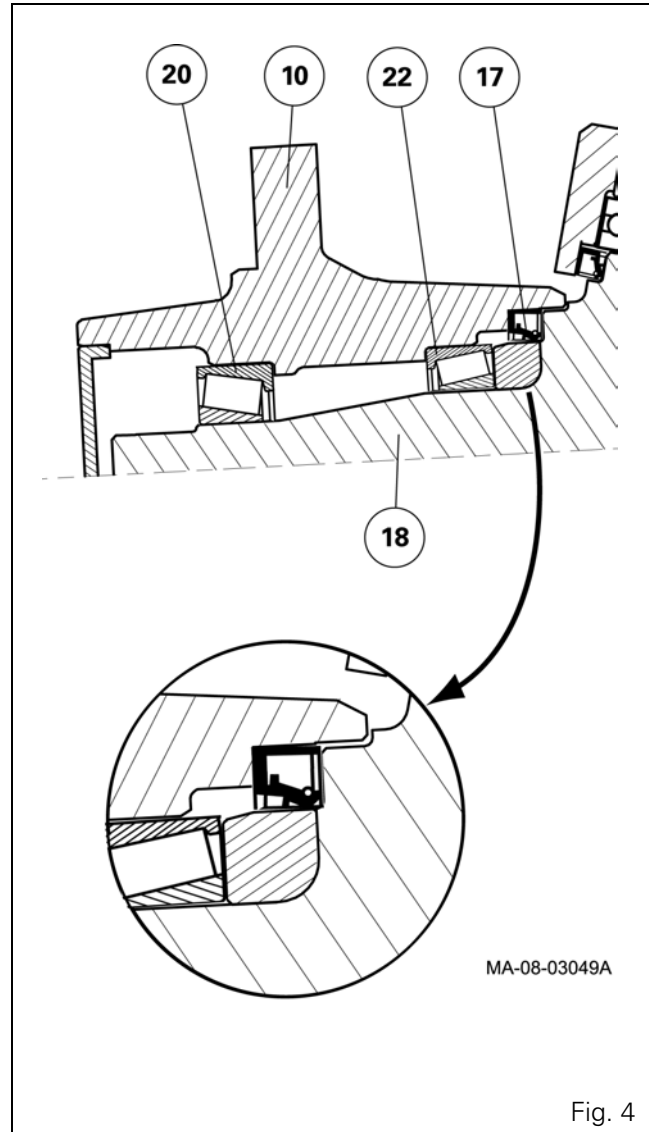
25. Check and clean all components. Replace any defective parts.
26. Assemble and fix the axle outer arm (8) in the axle beam (2) using screws and nuts (14) inserted in the suitable holes. Tighten the screws to a torque of 260 Nm.

### Refitting the spindle

27. Using a suitable assembly, position the sealing ring (16) up against the shoulder of the axle outer arm, with the lip turned inwards.
28. Position the bearing (15) in the steering pivot (9).
29. Insert the spindle (18) in the axle outer arm.
30. Position the lever (7) with its attachment screw (27). Tighten the screw to a torque of 110 Nm.

### Refitting the hub

31. Using a press and a suitable fixture, insert bearing cups (20) - (22) fully up against the shoulder on the hub.
32. Smear the cone (22) with bearing grease and place it in its corresponding cup.
33. Using a suitable fixture, fit the sealing ring (17) in its housing fully up against the shoulder, with the lip turned outwards (Fig. 4).
34. Fill the hub cavity (10) with bearing grease.
35. Assemble the hub on the spindle (18).
36. Smear the bearing cone (20) with bearing grease and fit it on the spindle up against its cup.
37. Position the washer (29), retainer (34) and nut (19). After tightening the nut to a torque of 140 Nm, loosen and tighten to 40 Nm.
38. Close the retainer tab (34) over the nut (19).
39. Check that the hub turns freely.
40. Fill the hub cavity (10) (nut side) with bearing grease.
41. Close the hub with the cover (33).
42. Fit the grease nipple (32) on the axle outer arm (8).



### Final operations

43. Reassemble the wheel, remove the stands and tighten screws to a torque of 200 - 260 Nm. Grease the ring and axle outer arm bearing (8).
44. Remove the shims and release the handbrake.
45. Adjust the wheel alignment (see § F).

### D . Removing and refitting the steering ram

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#### Removal

46. Chock the rear wheels and put the handbrake on. Raise the front of the tractor using a jack positioned at the centre of the axle beam.
47. Mark and disconnect the hoses on the ram.
48. Take the link rod (5) out of the steering ram rod (3).
49. Unscrew the screws (30).
50. Remove the steering ram assembly.

#### Refitting

51. Check and clean all components. Replace any defective parts.
52. Refit the ram assembly on the support (13), ensuring it is correctly positioned using locating pins (31).
53. Tighten the screws (30) to a torque of 120 Nm.
54. Couple the link rods (5) to the steering rod (3).
55. Connect the ram supply hoses according to the marks made at operation 47.
56. Remove the jack. Remove the shims and release the handbrake.
57. Check wheel alignment (see § F).
58. Check the oil tightness of the ram unions.

## 2WD front axle beam

### E . Removing and refitting the front axle beam

#### Removal

59. Chock the rear wheels and put the handbrake on.
60. Raise the tractor using a jack positioned at the centre of the axle beam.
61. Position a stand under the engine sump.
62. Remove the front wheels.
63. Remove the screws and nuts (14).
64. Take the ball joints (6) out of the steering levers (7).
65. Remove the two stub axles (1) (Fig. 5).
66. Mark and disconnect the hydraulic steering hoses.
67. Remove screws (30), and remove the ram (2) from the axle beam (12).
68. Sling the axle beam (12) (Fig. 6).

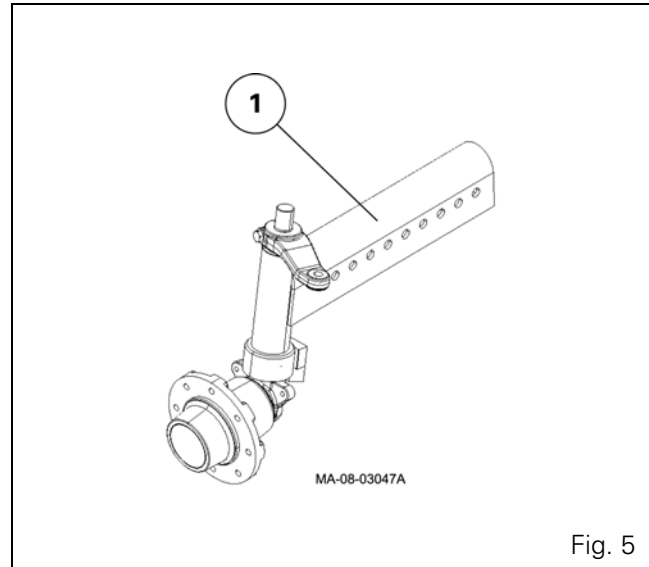


Fig. 5

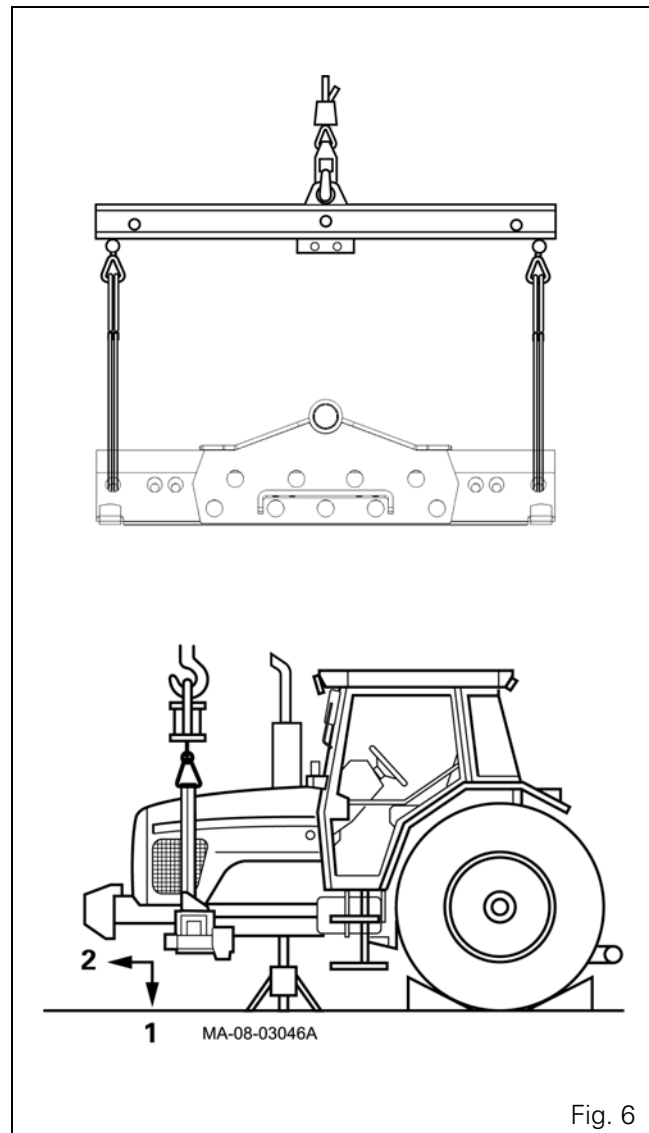


Fig. 6

- 69.** Remove screws (1) and grease nipple (3). Remove front bearing (2) and washers (9)(10) (Fig. 7).
- 70.** Remove front axle beam by releasing it from the front frame (8) (Fig. 7).

### Refitting

- 71.** Check and clean all components. Replace any defective parts.
- 72.** Sling and engage the axle beam in the front frame bearing (8) after previously turning the chamfer of washers (5) (6) towards the axle beam (Fig. 7).
- 73.** Position the washers (9)(10) (with chamfer turned towards the axle beam) (Fig. 7). Fit the front bearing (2) to reduce to a minimum the clearance between the washers and axle beam.
- 74.** Lightly smear screws (1) with Loctite 270 or equivalent (Fig. 7) and tighten them to a torque of 520 - 640 Nm. Remove the sling.
- 75.** Reassemble the ram (2) on the axle beam (12).
- 76.** Refit the hydraulic steering hoses according to the marks made previously.
- 77.** Fit the grease nipples (Fig. 7).
- 78.** Grease the two bearings (Fig. 7).
- 79.** Fit the nuts and screws (14) to a torque of 260 Nm.
- 80.** Fit the screws (11) to couple the link rods (5) and ball joints (6) and tighten nuts to a torque of 70 Nm.
- 81.** Refit the front wheels and remove the stand.
- 82.** Remove the chocks and release the handbrake.
- 83.** Check wheel track (see § F).

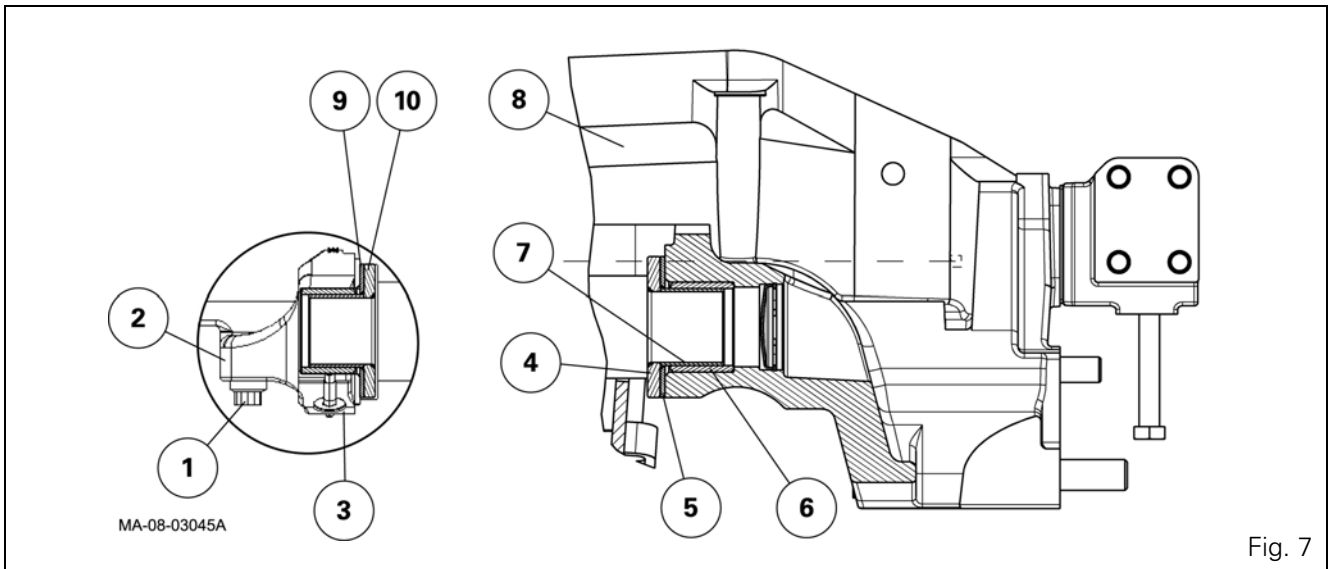


Fig. 7

## 2WD front axle beam

### F . Adjusting wheel alignment

84. Put steering in neutral position. Adjustment is carried out by moving the link rods. Unscrew the screws (11) to adjust the link rod lengths and obtain toe-in of 0 to 14 mm.

This toe-in is measured at points A, A' and B, B' determined by a diameter of 895 mm marked on the sides of the tyres (Fig. 8).

It is obtained by calculating the difference between values L and D.

**Note: If the toe-in is measured on a diameter different to 895 mm, adjust its value proportionally. Having carried out the adjustment, tighten screws (11) to a torque of 70 Nm.**

### G . Adjusting wheel alignment

85. Raise the front of the tractor using a trolley jack positioned at the centre of the axle beam.

86. Take out the screws (14) and nuts (Fig. 9).

87. Position the axle outer arms in the required position.

88. Fit screws (14) and tighten to a torque of 260 Nm.

89. Adjust link rods (5) according to the position of the arms.

Install screws (11) and tighten to a torque of 70 Nm.

