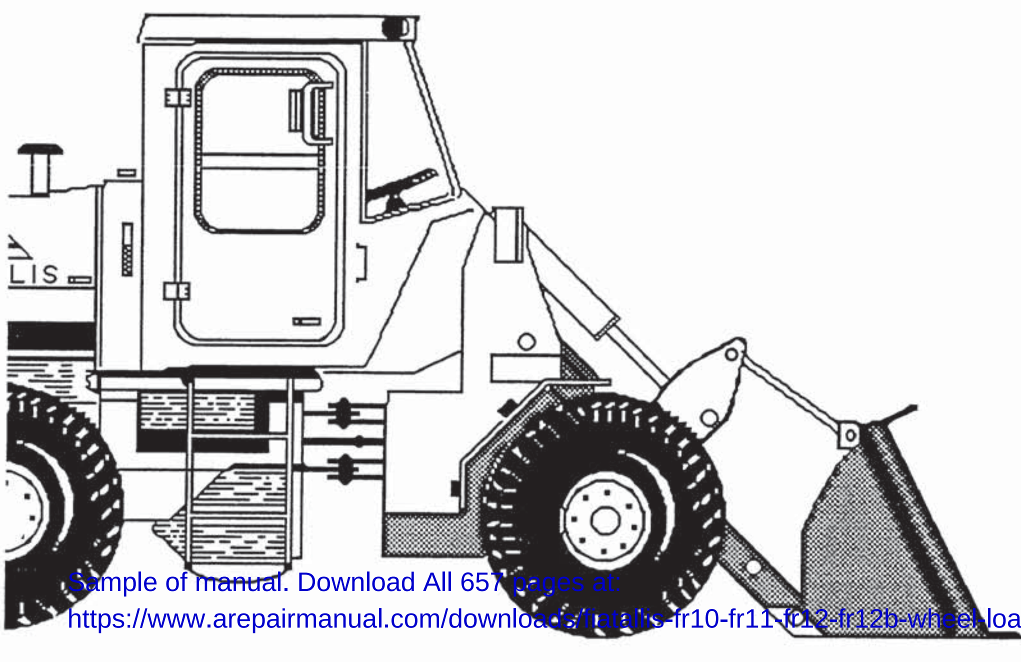
FIATALLIS®

FR7, FR9, FR10
FR12, FR15

WHEEL LOADER

AXLES

SERVICE MANUAL



Form 60406384
7/92

AXLES

FR7 - FR9
FR10 - FR10B
FR12 - FR12B
FR15 - FR15B
wheel loaders

Service manual

Form 604.06.384

IMPORTANT

On FR10 - FR12 - FR15 models, the axles herewith described are effectively installed as specified below:
FR10 - Unit serial No. 525395 and up, including S/N 525372, excluding S/N 525405
FR12 - Unit serial No. 550281 and up, including S/N 550267, excluding S/N 550303, 550304
FR15 - Unit serial No. 575403 and up, excluding S/N 575404, 575405, 575406, 575438, 575448

WARNING

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING, OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

The Operation and Maintenance instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

Read and heed all safety instructions carrying the signal words WARNING and DANGER.

Machine monted safety signs have been color coded yellow with black border and lettering for WARNING and red with white border and lettering for DANGER points.

IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional optional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

NOTE

Additional publications pertaining to this model and to all other FIAT ALLIS products are available through FIAT ALLIS dealers. Publications are generally available in several languages. Refer to Service Publications Index for all such publications; this index is available from FIAT ALLIS.

FOREWORD

This Manual provides the instructions for repair and servicing of FR7 - FR9 - FR10 - FR12 - FR15 wheel loader, axles and beginning with section 8, it is the continuation of Service Manual print No. 604.06.385.

Regarding such topics as "General Notes". "Operation" and "Troubleshooting" refer to Sections 1 and 2 in above Manual print No. 604.06.385.

Axle removal from machine is described in the Service Manual covering the machine on which the axle involved is mounted.

METRIC TO ENGLISH CONVERSIONS

The chart below is designed to assist the users not yet fully familiar with the metric system.

Quantity	S.I. Unit Multiplicant	Multiplier	Result
Length................	mm	0.03937	in
	m	1.09361	yd
	km	0.62137	mile
Area	cm^2	0.15500	sq in
	m^2	1.19599	sq yd
Volume................	cm^3	0.06102	cu in
	m^3	1.30795	cu yd
Capacity	L	0.26418	US gal
	L	0.21998	UK gal
Mass (Weight)/Force	g	0.03527	oz
	daN	2.24809	lb
	ton	1.10231	US ton
Torque	daN m	7.37572	lb ft
Pressure...............	bar	14.50377	psi
Temperature	°C	1.8 + 32	°F

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GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fueling or servicing machine.

Machine-mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

Do not allow unauthorized personnel to service or maintain this machine. Do not perform any work on equipment that is not authorized. Follow the Maintenance and Service procedures. Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling or servicing this machine.

Always wear safety glasses with side shields.

Do not wear rings, wrist watches, jewelry, or loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vest, or respirators. Consult your employer for specific safety equipment requirements.

Do not use controls or hoses as handholds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls may also be inadvertently moved causing accidental machine or equipment movement.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand, in contact with steps and grab-rails and handles at all times.

Machine should not be serviced with anyone in the operator's seat unless they are qualified to operate the machine and are assisting in the servicing.

Keep operator's compartment, stepping points, grabrails and handles clean of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Never attempt to operate the machine or its tools from any other position than seated in the operator's seat.

Keep operator's compartment clear of loose objects.

If movement of an attachment by means of the machine's hydraulic system is required for service or maintenance, do not raise or lower attachments from any position other than when seated in the operator's seat.

Before starting machine or moving attachment or tool, make sure to set brakes, sound horn and call for an all clear. Raise attachment slowly.

Always block with external support any linkage, parts, or machine according to local or national requirements.

Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

Never place head, body, limbs, fingers, feet or hands into an exposed portion between uncontrolled or unguarded scissor points of machine without first providing secure blocking.

Never lubricate, service or adjust a machine with the engine running, except as called for in the Operation and Maintenance Instruction Manuals. Do not wear loose clothing or jewelry near moving parts.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platform are not available, use the machine handholds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platform and ladders used to maintain or service machinery should be constructed and maintened according to local or national requirements.

Never check or fill fuel tanks, storage batteries or use starter fluid near lighted smoking materials or open flame due to the presence of flammable fluid.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Always place the fuel nozzle against the side of the filler opening before starting and during fuel flow. To reduce the change of a static electricity spark, keep contact until after fuel flow is shut off.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of drawbars, cables or chains under load.

To move a disabled machine, use a trailer or low boy truck if available. If towing is necessary, provide warning signals as required by local rules and regulations and follow operation and maintenance instruction manual recommendations. Load and unload on a level area that gives full support to the trailer wheels. Use ramps of adequate strength, low angle and proper height. Keep trailer bed clean of clay, oil and all materials that become slippery. Tie machine down securely to truck or trailer bed and block tracks (or wheels) as required by the carrier.

Never align holes with fingers or hands. Use the proper aligning tool.

Remove sharp edges and burrs from reworked parts.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Lift and handle all heavy parts with a lifting device of propre capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

Never place gasoline or diesel fuel in an open pan.

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 2 bar (30 psi) according to local or national requirements.

Do not smoke or permit any open flame or spark near when refueling, or handling highly flammable materials.

Do not use an open flame as a light source to look for leaks or for inspection anywhere on the machine.

Be sure all mechanic's tools are in good condition. DO NOT use tools with mushroomed heads. Always wear safety glasses with side shields.

Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hat, safety glasses, safety shoes, ear protectors.

When making equipment checks that require of the engine, have an operator in the operator seat at all times with the mechanic in sight. Place the transmission in neutral and set the brakes and lock. Keep hands and clothing away from moving parts. Shut off engine and disengage the Power Take-Off Lever before attemting adjustments or service.

Never use the bucket as a man lift.

The articulation point between frames will not clear a person. Stay clear when engine is running. Support, using device provided when servicing. Return support to carry position and secure before moving machine after servicing. See Operation and Maintenance Instruction Manual.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Guard against kinking chains or cables. Do not lift or pull through a kinked chain or cable. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENTS OF MACHINES INVOLVED ARE PROPERLY GUARDED against accidental cable or chain backlash.

Keep maintenance area CLEAN and DRY. Remove water or oil slicks immediately.

DO NOT pile oily, greasy rags – they are a fire hazard. Store in a closed metal container.

Before starting machine or moving attachment check and adjust and lock operator's seat. Be sure all personnel in the area are clear before starting or moving machine and any of its attachments. Sound horn.

Rust inhibitors are volatile and flammable. Prepare parts in well-ventilated place. Keep open flame away – DO NOT SMOKE. Store container in a cool well-ventilated place secured against unauthorized personnel.

Do not carry loose objects in pockets that might fall unnoticed into open compartments.

Keep clutches and brakes on machine and attachments such as Power Control Units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturer at all times. DO NOT adjust machine with engine running except ad specified.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Wear welder's protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding. Wear dark safety glasses near welding. DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support for the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

Inspect your seat belt at least twice a year for signs of fraying, wear, or other weakness that could lead to failure.

Where it is necessary to use diesel fuel as a lubricant make sure all smoking material and open flames are extinguished or that no sparks are near. Place all parts in a closed container of clear diesel fuel for use as needed.

To minimize dangers of fire and explosion, it is recommended that before any welding is done on a fuel tank, the tank be completely drained of fuel, fuel lines disconnected and the ends closed to protect them, and the tank be steam cleaned. All traces of fuel must be removed before welding is started. Flood the tank with carbon dioxide (CO_2) before and during welding. Caps must be removed and vents and other openings left open during welding.

Dry ice (solid carbon dioxide) is extremely cold and will freeze flesh on contact. Use care to prevent contact with skin, eyes, or other parts of the body to avoid personal injury.

When work is required under or between components, block with an external support capable of holding the components in place according to local or national requirements.

START UP

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.
Do not place head, body, limbs, feet, fingers, or hands near a rotating fan or belts. Be especially alert around a pusher fan.
STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. DO NOT PUNCTURE OR BURN CONTAINERS. Follw the recommendation of the manufacturer for storage and disposal.

ENGINE

Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.
Do not run engine when refueling and use care if engine is hot due to the incresed possibility of a fire if fuel is spilled.
Never attempt to check or adjust fan belts when engine is running.
Do not adjust engine fuel pump when the machine is in motion.
Never lubricate a machine with the engine running. Avoid running engine with open unprotected air inlets. If such running is unavoidable for service reasons, place protective screen over all inlet openings before servicing engine.

ELECTRICAL

Be sure to connect the booster cables to the proper terminals (+ to +) and (− to −) at both ends. Avoid shorting clamps. Follow the Operation and Maintenance Instruction Manual procedure.
Always turn the master switch (key switch if so equipped) to the off position when maintaining or servicing machine.
BATTERY GAS IS HIGHLY FLAMMABLE. Leave battery box open to improve ventialtion when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks or open flame away from batteries. Do not smoke near battery to guard against the possibility of an accidental explosion.
Check for fuel or battery electrolyte leaks before starting service or maintenance work. Eliminate leaks before proceeding.
Do not charge batteries in a closed area. Provide proper ventilation to guard against an accidental explosion from an accumulation of explosive gases given off in the charging process.
Disconnect batteries before working on electrical system or repair work of any kind.

HYDRAULIC

Fluid escaping under pressure from a very small hole can be almost invisible and can have sufficient force to penetrate the skin. Use a piece of cardboard or wood to search for suspected pressure leaks. DO NOT USE HANDS. If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.
Shutt off engine and be sure all pressure in system has been relieved before removing panels, housing, covers, and caps. See Operation and Maintenance Instruction Manual.
When making pressure checks use the correct gage for expected pressure. See Operation and Maintenance Instruction Manual or Service Manual for Guidance.

ATTACHMENTS

Keep head, body, limbs, feet, hands and fingers away from blade, bucket or ripper when in raised position. Use authorized blocking as a safety measure before proceeding with service or maintenance according to local or national requirements.
If movement of an attachment by means of the machine's hydraulic system is required for service or maintenance do not raise or lower attachments from any position other than when seated in the operator's seat.
Before starting machine or moving attachments or tools, make sure to set brakes, sound horn and call for an all clear. Raise attachment slowly.
Do not use machine to carry loose objects by means other than attachments for carrying such objects.
Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.
Keep clutches and brakes on machine and attachments as power control units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the Manufacturer at all times. DO NOT adjust machine with engine running except as specified.

TIRES (APPLICABLE MACHINES)

Be sure tires are properly inflated to the manufacturer's specified pressure. Inspect for damage periodically. Stand to one side when changing inflation of tires. Check tires only when the machine is empty and tires are cool to avoid overinflation. Do not use reworked wheel parts. Improper welding, heating or brazing weakens them and can cause failure.
Never cut or weld on the rim of an inflated tire. Inflate a spare tire only enough to keep rim parts in place – a fully inflated tire might fly apart when it is not installed on a machine.
Use care if you must transport (haul) a fully inflated tire.
When servicing tires block the machine in front and back of all wheels. After jacking up, place blocking under machine to protect from falling according to local or national requirements.
Deflate tires before removing objects from the tread.
Never inflate tires with flammable gases. Explosion and personal injury could result.

8. DISASSEMBLY, SERVICING AND REASSEMBLY - FR7 AND FR9

IMPORTANT — The descriptions provided for disassembly and relevant illustrations cover the FR9 loader axles.

They are however applicable also to the FR7 axles except that reference should be made in this case to Figure 8.1 below.

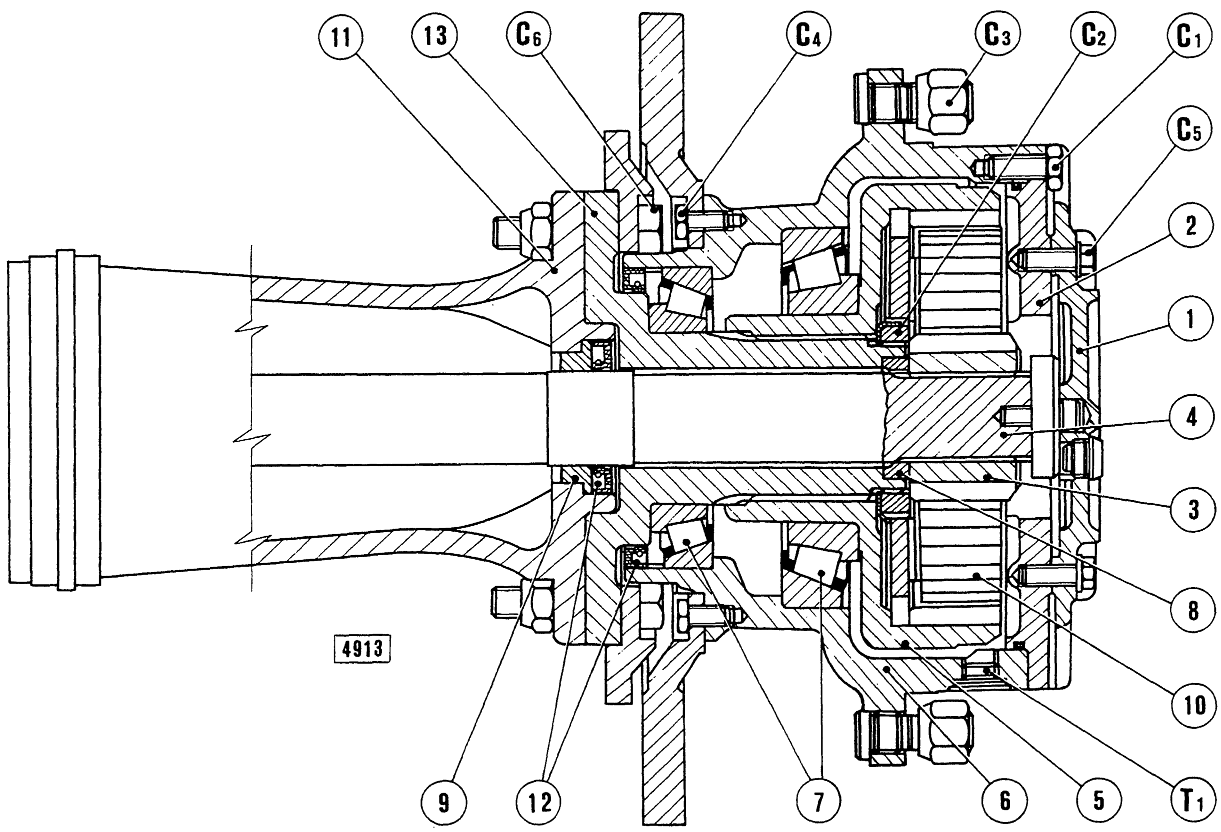

Fig. 8.1 - Section through a side final drive — FR7 Loader

C_1. Planet gear carrier mounting screws - C_2. Toothed drum hub ring nut - C_3. Wheel nuts - C_4. Brake disc screws - C_5. Cover (1), screws - C_6. Final drive case to axle housing screws - T_1. Oil filler/drain plug - 1. Cover - 2. Planet gear carrier - 3. Seal case - 4. Axle shaft - 5. Toothed drum - 6. Final drive case - 7. Taper roller bearing - 8. Axle shaft front bushing - 9. Axle shaft rear bushing - 10. Planet gear - 11. Axle housing - 12. Lip seals - 13. Wheel hub.

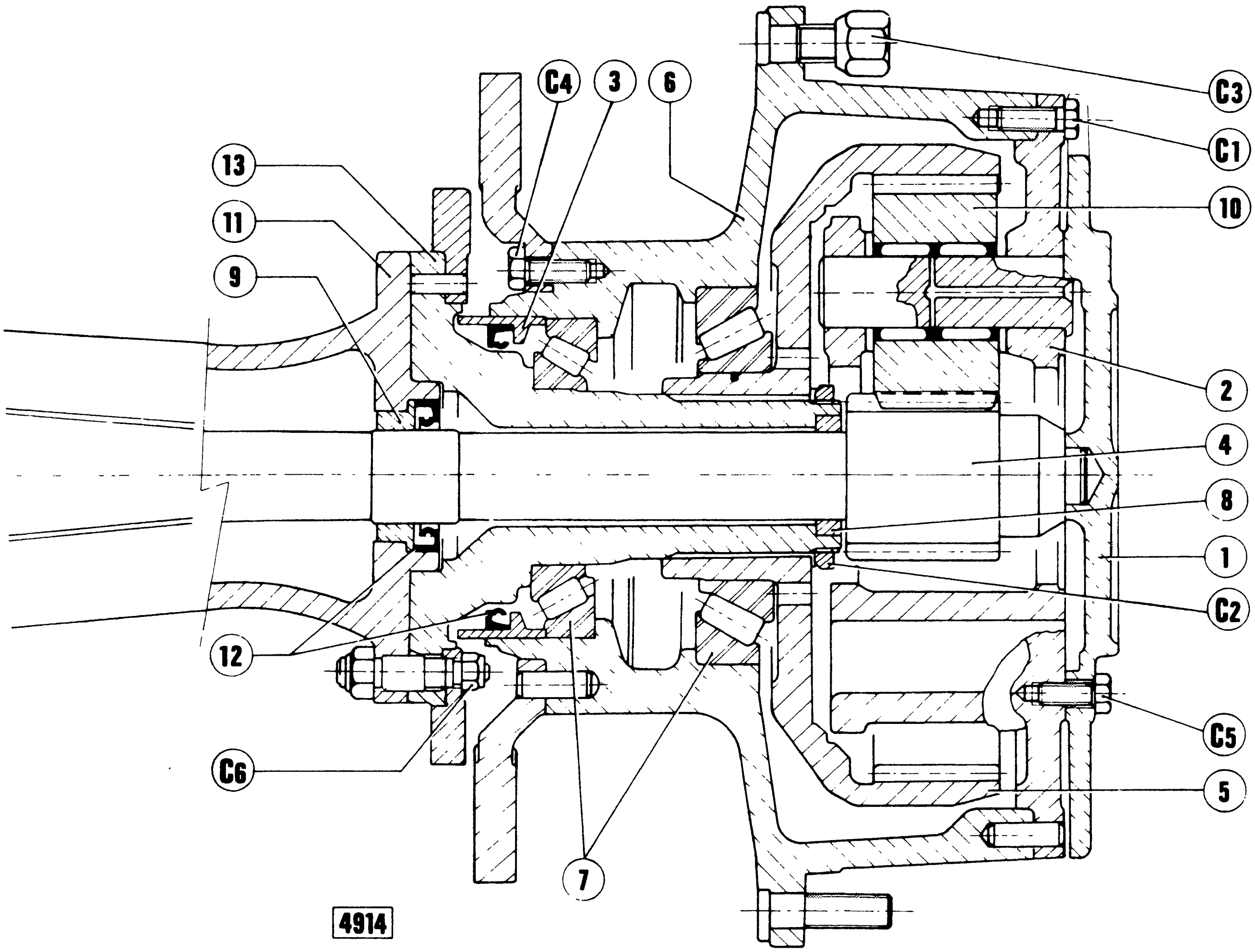

Fig. 8.2 - Section through a side final drive — FR9 Loader

C_1. Planet gear carrier mountig screws - C_2. Toothed drum hub ring nut - C_3. Wheel nuts - C_4. Brake disc screws - C_5. Cover (1), screws - C_6. Final drive case to axle housing screws - T_1. Oil filler/drain plug - 1. Cover - 2. Planet gear carrier - 3. Seal case - 4. Axle shaft - 5. Toothed drum - 6. Final drive case - 7. Taper roller bearing - 8. Axle shaft front bushing - 9. Axle shaft rear bushing - 10. Planet gear - 11. Axle housing - 12. Lip seals - 13. Wheel hub.

8.1 EPICYCLIC SIDE FINAL DRIVE DISASSEMBLY

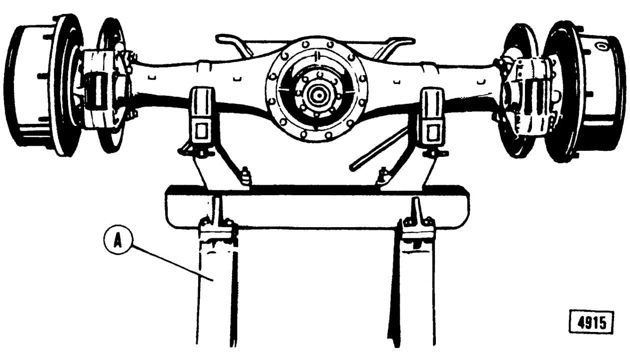

Fig. 8.3 - View of axle assembly on service stand 322215 (A)

WARNING

Guard against kinking chain or cables. Always wear heavy gloves when handling or cable.

WARNING

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cables or chain.

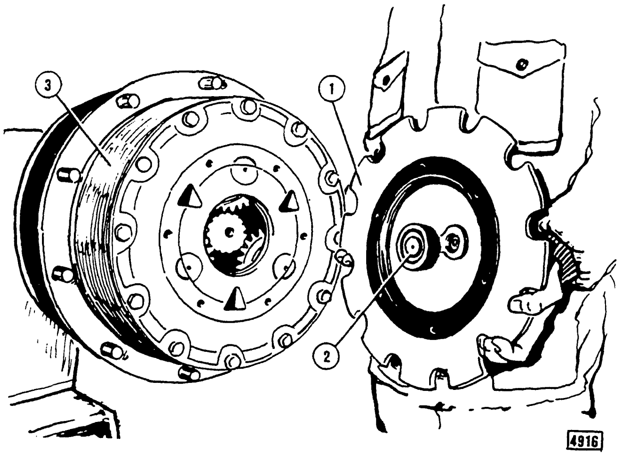

Fig. 8.4 - Final drive case cover removal

1. Cover - 2. Axle shaft thrust block - 3. Case.

WARNING

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

After installing axle housing on service stand 322215 proceed as follows:

– Drain oil by unscrewing the plugs provided.

– Remove the brake caliper.

– Back out cover screws (1) Fig. 8.4 and remove the cover.

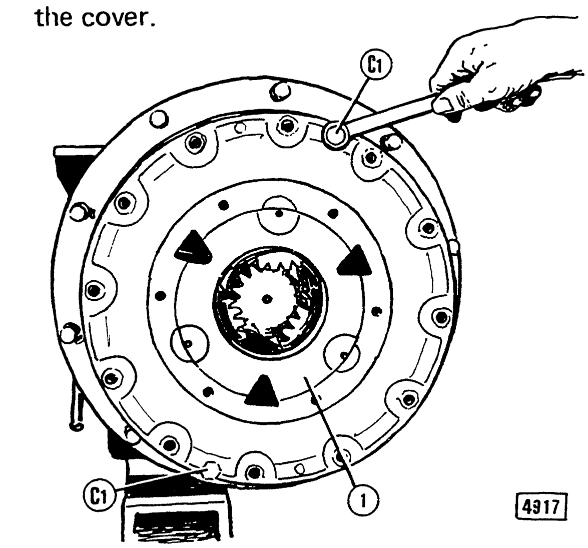

Fig. 8.5 - Planet gear carrier extraction

C_1. Puller screws (see text) - 1. Carrier.

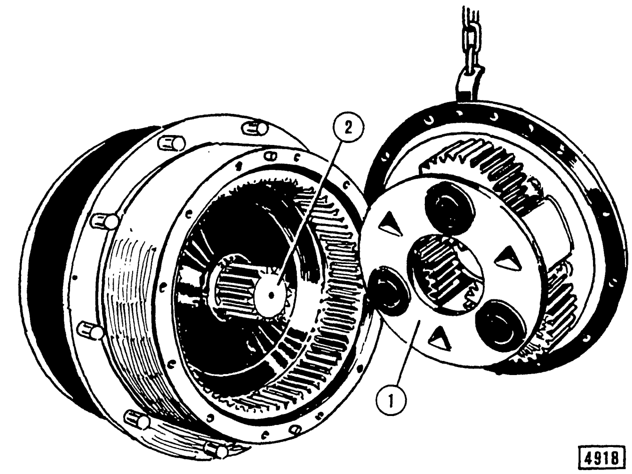

Fig. 8.6 - Planet gear carrier (1) removal

2. Axle shaft with integral sun gear.

– Extract the planet gear carrier using two specially provided 40 mm long puller screws (size 12 x 1.25) as shown in Fig. 8.5. Using a sling chain and hoist, separate the carrier from final drive case (Fig. 8.6).

– Pull out the axle shaft with integral sun gear.

NOTE – On FR7 machines, the sun gear is not integral, hence removable.

– Straighten the tab of the lock washer of ring nut (C_1) Fig. 8.7; next, using tool 75297500 remove the ring nut and washer.

– Remove the assembly complete with internally toothed drum and place on work bench.

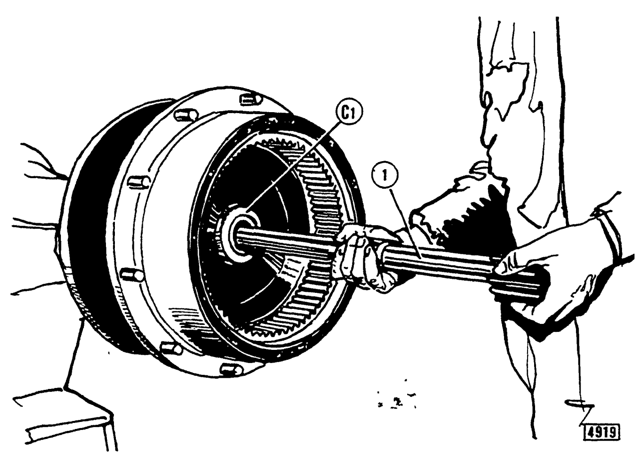

Fig. 8.7 - Removal of axle shaft (1) from housing

C_1. Toothed drum lock ring nut.

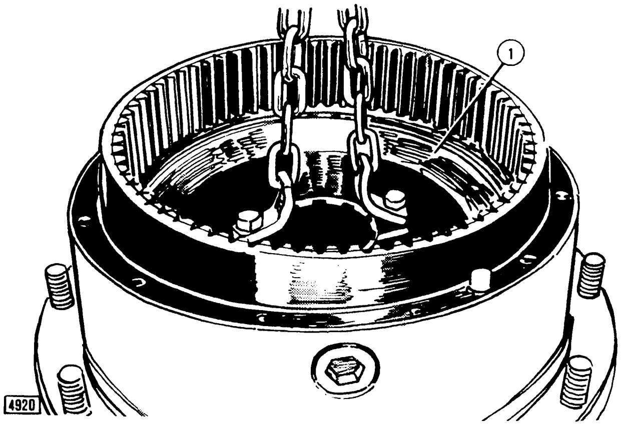

Fig. 8.8 - Lifting out internally toothed drum (1)

– Using a sling chain and screws (two off, size 12 x 1.25 mm) as shown in Fig. 8.8, lift out drum (1).

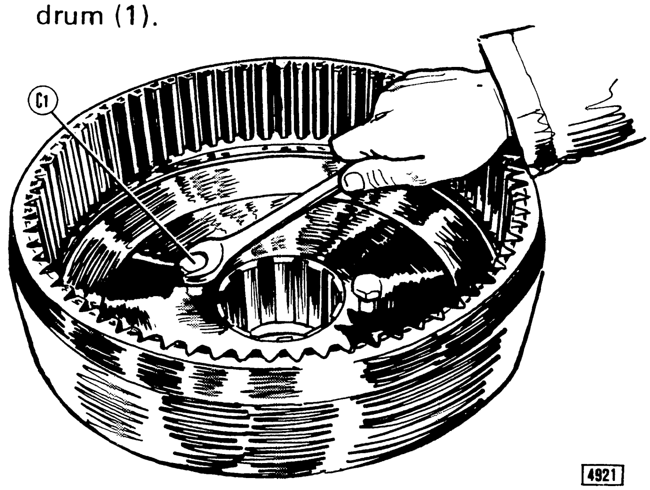

Fig. 8.9 - Wheel hub bearing inner ring removal

C_1. Puller screws.

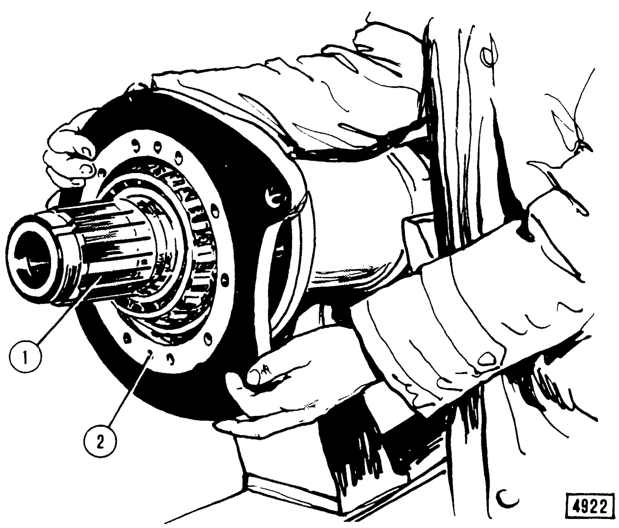

Fig. 8.10 - Removal of brake caliper holder plate (2) from wheel hub (1)

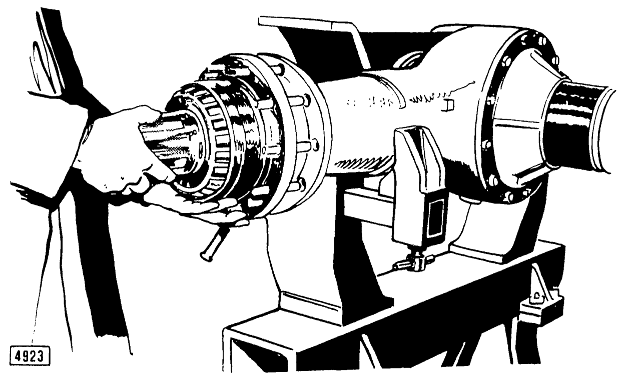

Fig. 8.11 - Removal of wheel hub from axle housing

– Undo the chain and using the same two screws pull out the inner ring of bearing (7) Fig. 8.2 as shown in Fig. 8.9.

– Unscrew the brake caliper holder plate nuts.

– Unscrew hub to axle housing nuts and remove hub.

Check axle shaft bushings for good condition. Bushings need replacement when found to be ovalized or excessively worn (New bushing specified I.D.: 50.20 to 50.25 mm).

When new bushings must be fitted, proceed as follows:

– Bushing press-fitted in axle housing: take off lip seal first then the bushing with the aid of a universal puller.

– Bushing press-fitted on wheel hub: remove bushing with a universal puller (1) Fig. 8.13.

To remove the seal case (1) Fig. 8.14 proceed as follows:

NOTE – This item is not present on FR7 Loader axles.

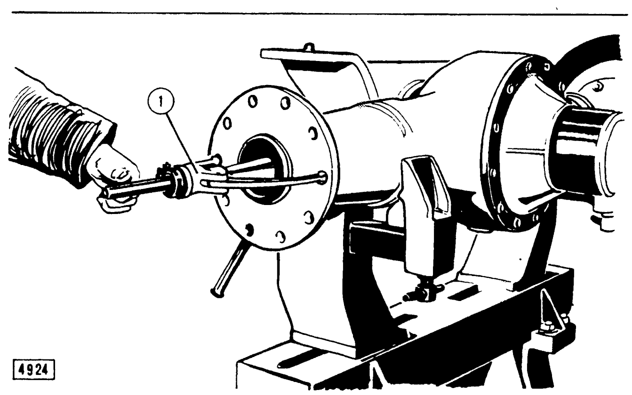

Fig. 8.12 - Removal of axle shaft bushing from axle housing

1. Universal puller.

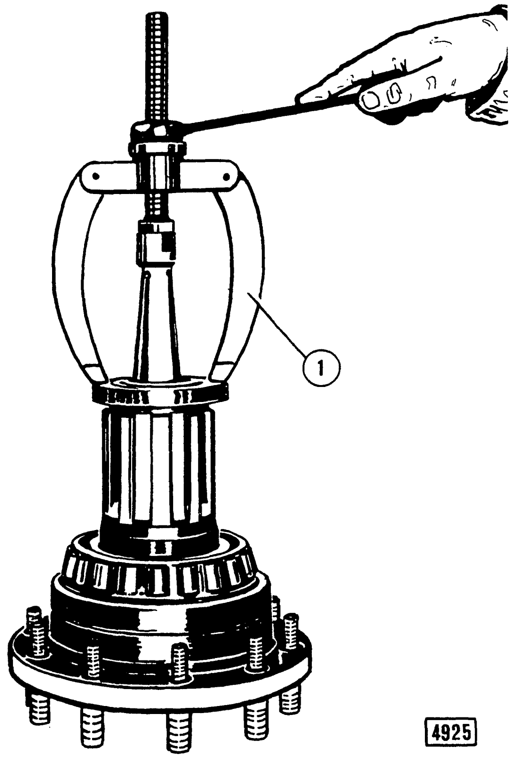

Fig. 8.13 - Removal of axle shaft bushing from wheel hub

1. Universal puller.

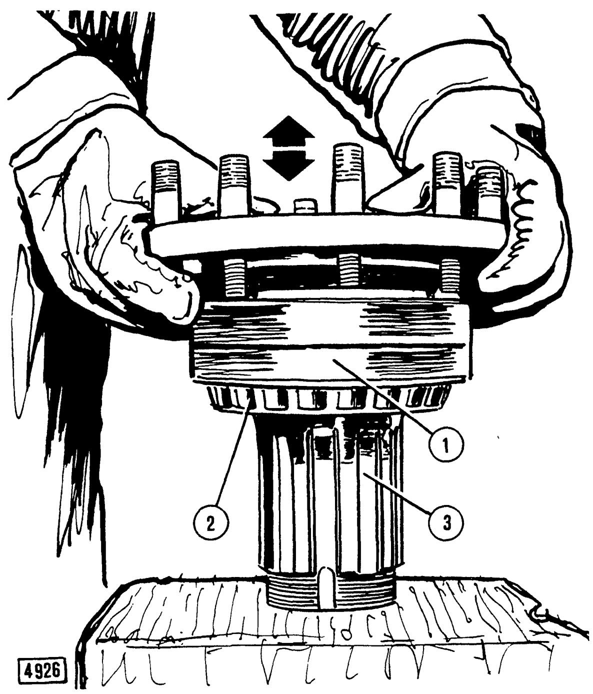

Fig. 8.14 - Removal of bearing inner ring (2) from hub (3)

1. Seal case.

– Provide a sufficiently strong wooden block to serve as support (see Fig. 8.14).

– Strike the hub repeatedly on the block until the bearing outer ring (2) Fig. 8.14 works loose completely together with seal case (1).

WARNING – Thick safety gloves must be used for this operation: hold the assembly as shown - see Fig. 8.14.

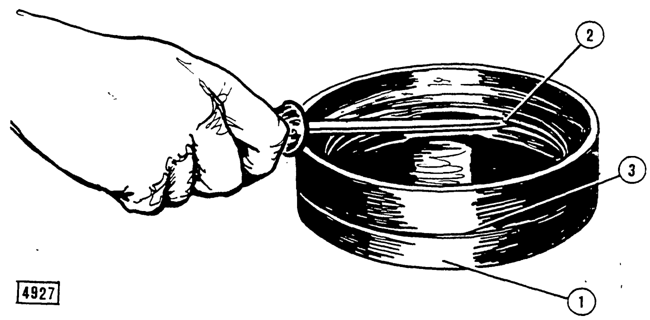

Fig. 8.15 - Removal of lip seal (2) from case (1)

3. O-ring.

– Take out the lip seal as shown in Fig. 8.15.

8.2 PLANET GEAR CARRIER DISASSEMBLY

When planet gears must be demounted, simply withdraw their pins (1) Fig. 8.16, then take out gear (2) complete with its needle roller bearing (3).
Pickup and hold aside the two gear thrust washers.

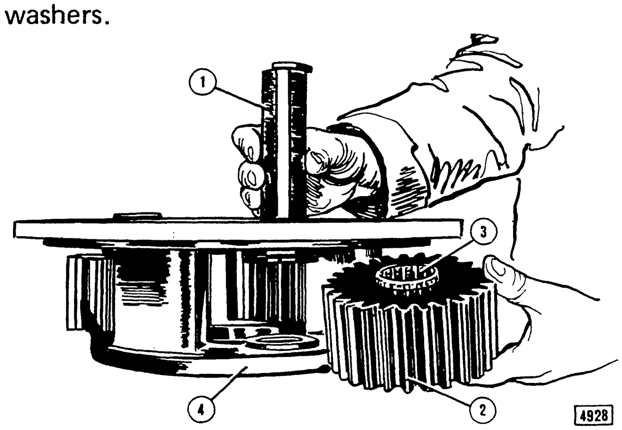

Fig. 8.16 - Removal of a planet gear (2)

1. Pin - 3. Needle roller bearing - 4. Carrier cage.

8.3 INSPECTION OF DISASSEMBLED COMPONENTS

WARNING

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2.1 bar (30 psi) according to local or national requirements.

WARNING

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Cleaning

All machine and smooth components such as gears, bearings and shafts should be cleaned using exclusively recommended non-flammable, non-toxic solvents. Never clean these components in alkaline water solutions such as caustic soda. Some as-cast components and machined parts, such as the planet gear carrier and a few brake components, may be cleaned in heated tanks containing weak alkaline baths, on condition that the parts involved do not have any ground or lapped surfaces. The parts must be kept in the liquid solution only for the time actually needed for cleaning and heating. Thorough rinsing is essential to remove any and all traces of alkali.

Inspection

An accurate inspection of all components, before assembly, is essential. A visual check for cracks or signs of wear, and possible replacement of components when found to be necessary, will prevent much more serious damages and avoid costly repairs.

Check all bushings and bearings, their outer and inner rings (excluding those that were not disassembled). Change the inner and outer rings that are found to be worn, pitted or otherwise damaged. For removal of parts to be replaced, use a suitable puller or press.

Check all gears for wear and damages: pitted or chipped gears must be replaced.

Make sure that the planetary gear carrier thrust washers are not pitted, scored or worn; check for worn or cracked planet gears and associated pins. Check axle shafts ensuring they show no sign of torsional fatigue or other indications of imminent failures. Make sure all studs are firmly rooted. Check all machined and ground surfaces for absence of cracks, indents, impressions and burrs.

When some parts that were washed, cleaned and dried must be shelved temporarily, coat them first with fluid oils as a rust preventive measure.

EPICYCLIC SIDE FINAL DRIVE REASSEMBLY

Proceed as follows:

WARNING

Always wear safety glasses with side shields when machining or grinding metal, or performing any task where particles might fly.

- Press-fit bushings (3), Fig. 8.17, and (9), Fig. 8.2, in their respective seats in hub and axle housing using the specially provided drift.
- Take lip seal (1) Fig. 8.17 pack with the recommended grade of grease and press fit in place.
- Fit seal (6) in case (8) provided with O-ring in the groove on its outer face. Next, mount case in hub (2).
- Heat inner ring of bearing (9) to 80 - 90° C then press fit on hub (2).
- Fit the hub/bearing/seal case assembly in axle housings: mating interfaces must first be coated with sealent.

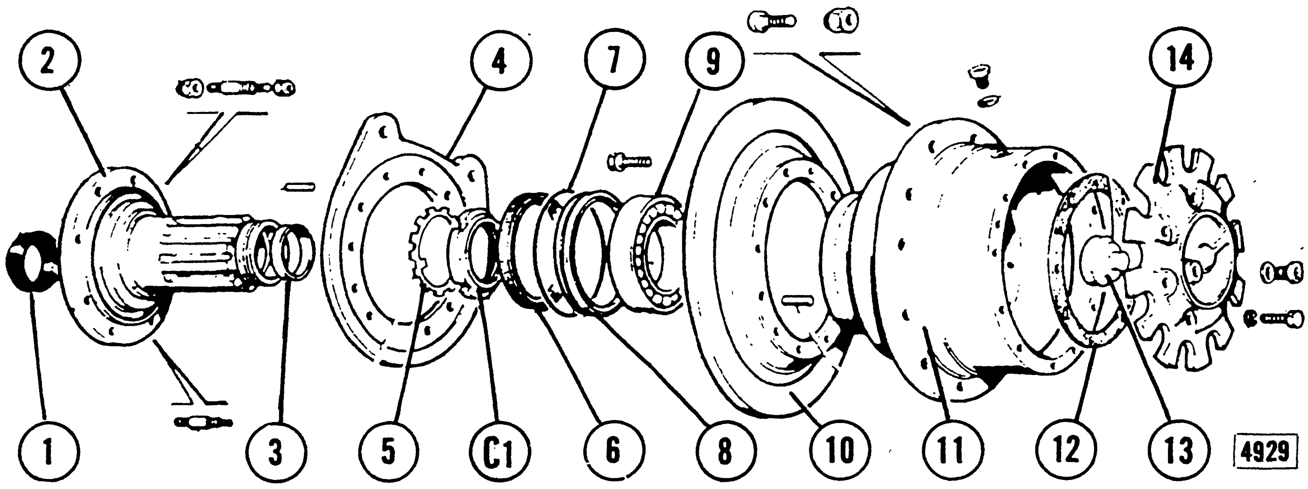

Fig. 8.17 - Wheel hub components (exploded view)

C_1. Ring nut - 1. Lip seal - 2. Hub - 3. Axle shaft bushing - 4. Brake caliper holder plate - 5. Ring nut (C_1) lock washer - 6. Lip seal - 7. O-ring - 8. Lip seal (6) case - 9. Bearing - 10. Brake disc - 11. Side final drive case - 12. Cover (14) gasket - 13. Axle shaft thrust block - 14. Cover.

- Insert brake caliper holder plate (4) Fig. 8.17 centering it properly with the aid of the location pins provided.
- Tighten lock nuts to the specified torques (See sect. 10).

WARNING

Always wear safety glasses with side shields when machining or grinding metal, or performing any task where particles might fly.

- Press fit the two outer rings of taper roller bearings (7) Fig,. 8.2 in the final drive case bore.
- Heat up bearing (1) Fig. 8.21 outer ring to 80 - 90° C and press fit on internally toothed drum (2).
- Fit the brake disc (10) Fig. 8.17, final drive case (11) and position the assembly on hub (2).

WARNING – As seal (8) is mounted in drive case (11) with a slight force (interference) the operation should be carried out following strictly the instructions given below to prevent damaging the seal case and associated O-ring.

- Coat with grease case (8) outer surface and O-ring; pack also all bearings.
- Insert drive case (11) on seal case taking care to center the assembly as accurately as possible in order not to load seal with drive case weight.
- Hammer case (11) slightly to make sure seal is properly assembled. Next, press fit the internally toothed drum (2) Fig. 8.21 onto the splines of hub (2) Fig. 8.17.
- Tighten ring nut (C_1) into hub to make sure seal (8) is force fitted completely in final drive case.

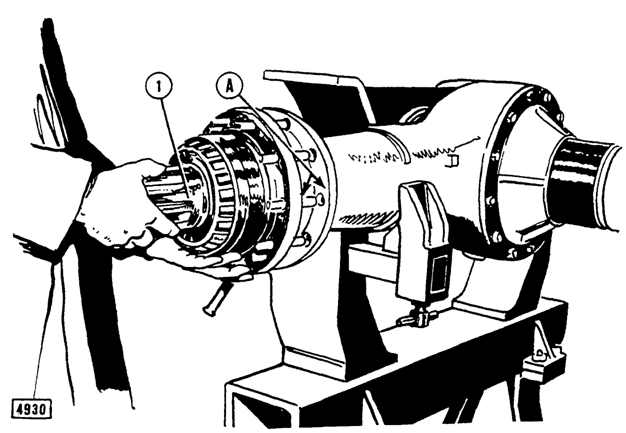

Fig. 8.18 - Installation of hub (1) in axle housing

A. Mating interfays to be coated with sealant.

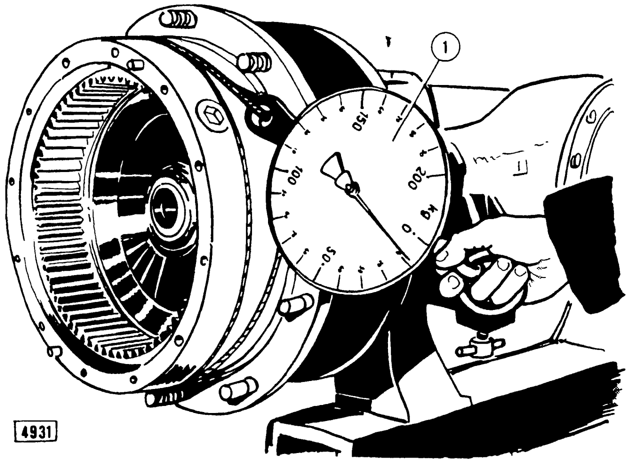

Fig. 8.19 - Checking the effort needed to rotate the internally toothed drum
1. Spring balance (dynamometer).

NOTE — Ring nut must be tightened gradually while turning the case to ensure proper seating of bearings.

- Complete the tightening of ring nut by attaining a torque of 45 to 50 daN.m.
- Check that the effort needed to rotate the case is 20 to 21 daN corresponding to the normal revolving torque.

NOTE — Should some slight displacement of the ring nut be needed to obtain proper locking with washer in place, such displacements should be done in a counterclockwise direction (i.e., unscrewing).

- Lubricate needle roller bearings (3) Fig. 8.16 liberally and install the planet gear in its carrier (6) Fig. 8.21 at the same time locating the thrust washer as shown in Fig. 8.20.
- Position the three planet gear pins with their lock ends oriented as shown in Fig. 8.22.

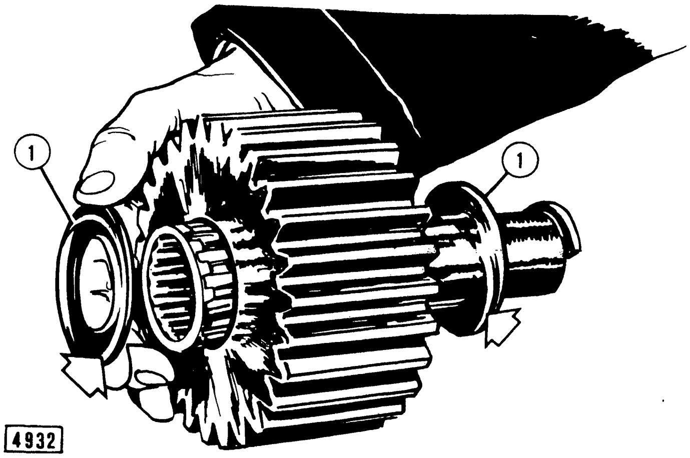

Fig. 8.20 - Correct installation of the two planet gear thrust washers (1)

NOTE — Arrows indicate the oil grooves which must be oriented as shown, at assembly.

WARNING

KEROSENE IS FLAMMABLE. Extinguish all smoking materials or open flames before flushing the implement hydraulic system.

- Coat the planet gear carrier-to-drum mating interfaces with a proper grade of sealant and secure the assembly with the screws provided.
- Install the axle shaft and interpose gasket (12) Fig. 8.17. Secure cover (14) complete with axle shaft thrust block (13).
- Fill with oil of the required grade and amount - See the Operation and Maintenance Instrction Manual.

8.4 BRAKE DISASSEMBLY, SERVICING AND REASSEMBLY

To take out the brake pads, simply pull off the retainment pins (1) Fig. 8.23 followed by the pads.

Pad lining minimum thickness wear limit is 3 mm.

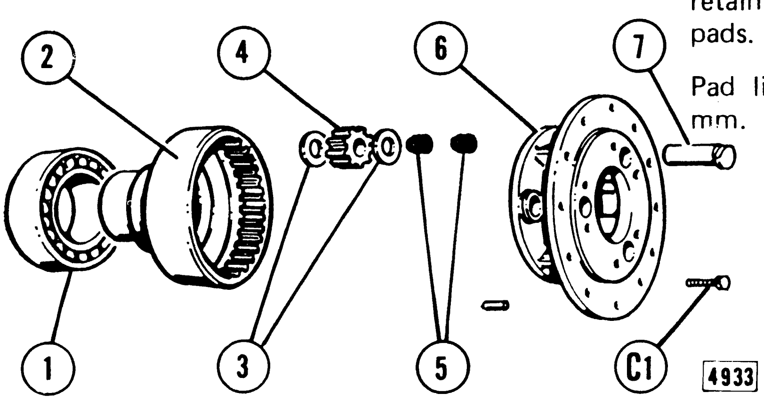

Fig. 8.21 - Epicyclic side final drive gear components

C_1. Carrier screws - 1. Drum (2) bearing - 2. Internally toothed drum - 3. Planet gear thrust washers - 4. Planet gear - 5. Needle roller bearing - 6. Planet gear carrier - 7. Planet gear pins.

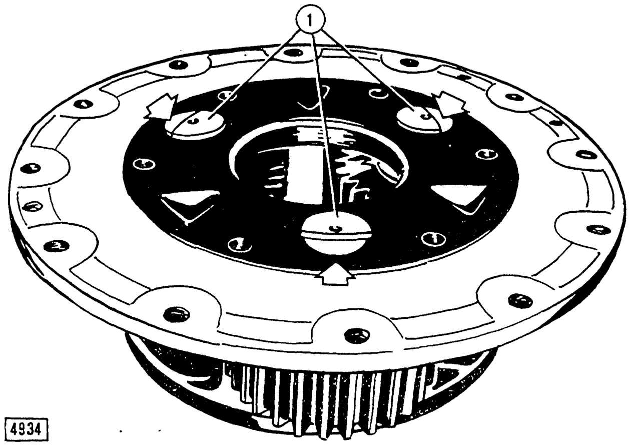

Fig. 8.22 - Correct orientation of planet gear pins at assembly

1. Pins.

NOTE – Should it be needed to simply disassemble the brakes without pad replacement it is suggested to mark off the position of pads (right or left) relative to brake disc.

For brake caliper removal, simply backout the two screws (C_1) Fig. 8.23 and pull off (Fig. 8.27).

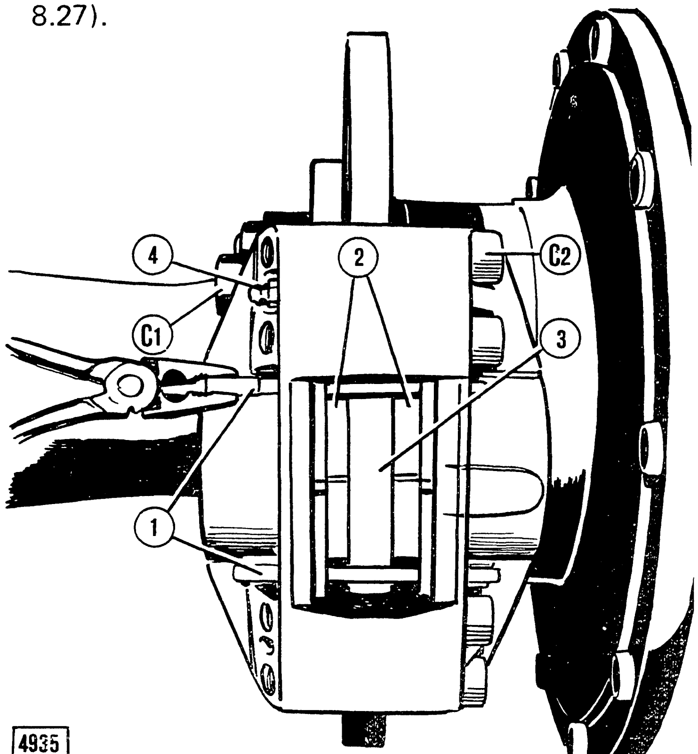

Fig. 8.23 - Removal of disc brake pads

C_1. Caliper to axle housing screws - C_2. Caliper assembly screws - 1. Brake pad retainment pins - 2. Brake pads - 3. Brake disc - 4. Bleeder screw.

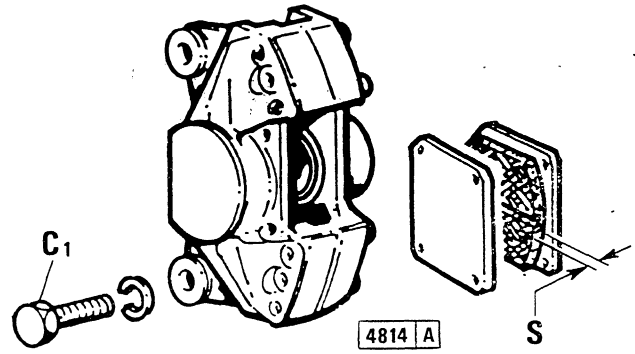

Fig. 8.24 - Brake pad lining thickness

C_1. Caliper-to-axle housing screw - S. Minimum allowable thickness = 3 mm.

Open out the two caliper halves by removing screws (C_2) Fig. 8.23 and then proceed as follows:

– Remove the rubber dust seal (2) Fig. 8.25.

– Using two screwdrivers, as shown in Fig. 8.26, lift the piston up and out of its cylinder bore.

8.5 INSPECTION AND CLEANING OF DISSASSEMBLED COMPONENTS

WARNING

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, nontoxic solvents.

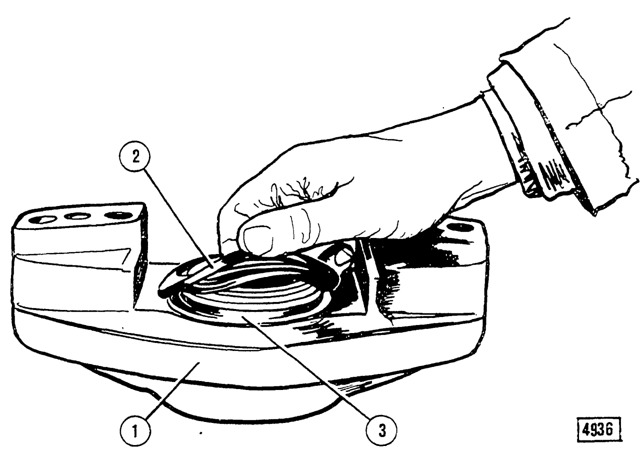

Fig. 8.25 - Removal of dust seal (2)

1. Brake caliper half - 3. Piston.

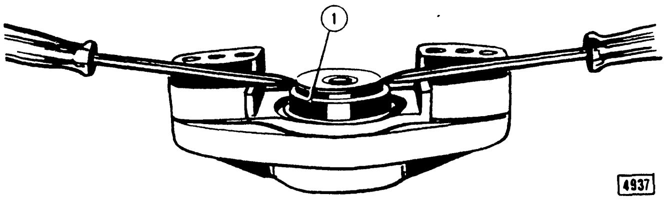

Fig. 8.26 - Removal of piston (1) from cylinder bore in caliper.

WARNING

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2.1 bar (30 psi) according to local or national requirements.

Wash the components in a hot water/FIAT LDC detergent solution and then blow dry with compressed air.

Check the piston and cylinder bore surface for abrasion or seizure marks: if any are found, replace the caliper assembly with piston.

Inspect the brake disc and check for proper thickness which must not be less than 16 mm.

Scoring and distortions, provided they are slight, may be remedied by grinding.

8.6 BRAKE REASSEMBLY

After the necessary inspections and replacements, proceed as follows:

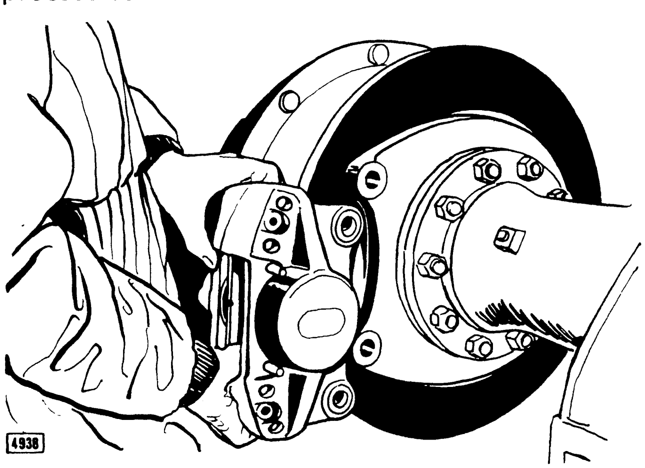

Fig. 8.27 - Disc brake caliper assembly removal and installation

- Introduce the piston (3) Fig. 8.25 into the cylinder bore in caliper half (1) to the end of its stroke.
- Install the rubber dust seal (2) Fig. 8.25 making sure its edge fits correctly in the groove on caliper body.
- Join the two caliper halves and fit the brake pads.
- Reinstall the calipers on their holder plates (4) Fig. 8.17: to facilitate the insertion of brake disc, if necessary, move pads slightly apart.
- Tighten the caliper mounting screws to the specified torque.
- Bleed the brake system as described in the Operation and Maintenance Manual.

8.7 DIFFERENTIAL DISASSEMBLY AND SERVICING

WARNING

Guard against kinking chain or cables. Always wear heavy gloves when handling or cable.

WARNING

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cables or chain.

WARNING

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

- Drain oil from differential case by removing the plug provided for this purpose.
- Take off the final drive side covers (14) Fig. 8.17, drain oil and pull out the two axle shafts partially.
- Take down the differential unit, using sling fixture 75297519 (A) Fig. 8.29.
- Install the complete differential unit on service stand 75290086/75290092 (A) Fig. 8.30 and secure by two screws (C_1).

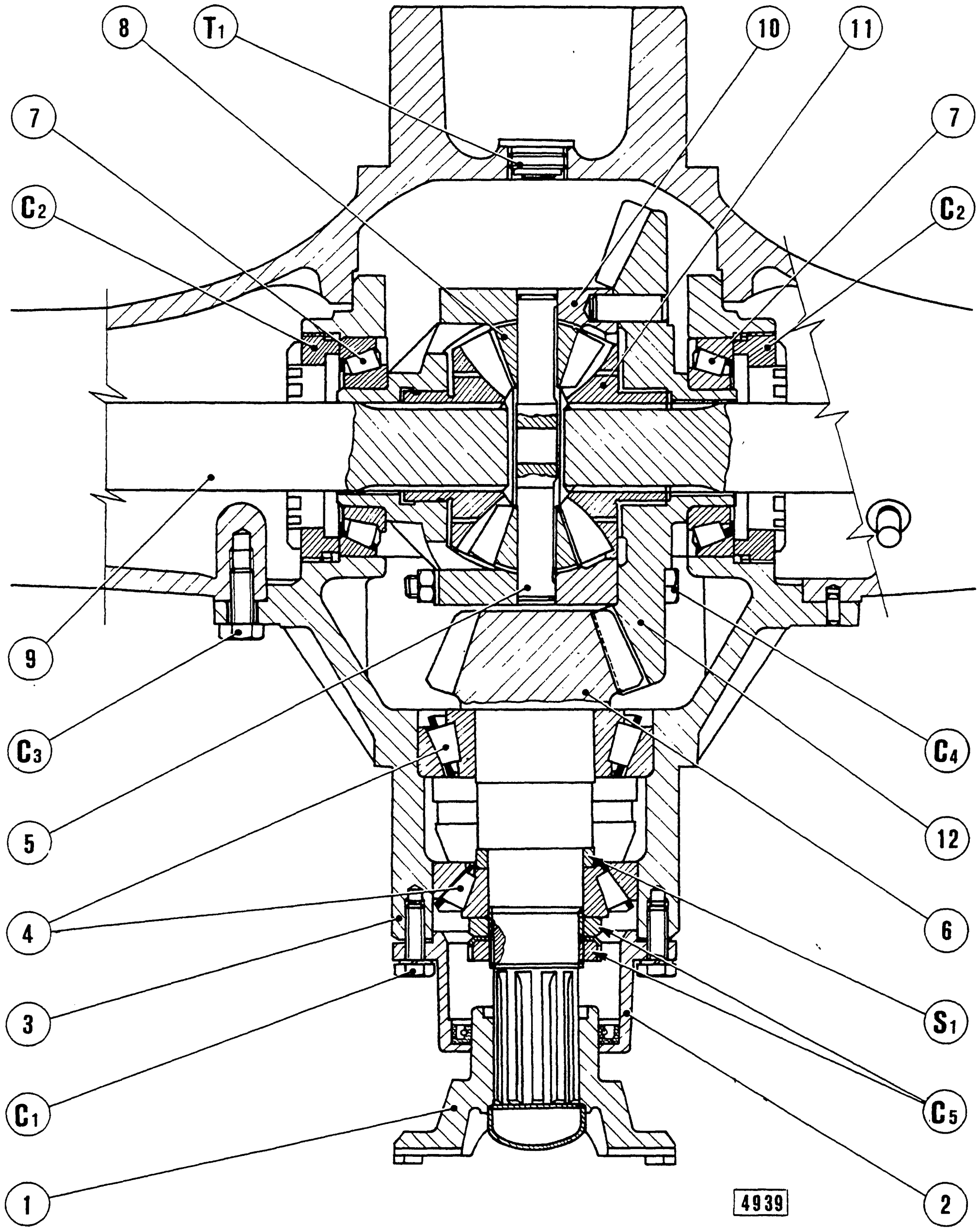

Fig. 8.28 -Section through differential unit

C_1. Cover (2) screws - C_2. Bearing (7) pre-load adjusters - C_3. Drive pinion bearing cage screws - C_4. Side gear cage screws - C_5. Drive pinion lock nut - S_1. Bearing (4) pre-load adjusting shim - T_1. Oil filler/level plug - 1. Companion flange - 2. Seal holder cover - 3. Drive pinion bearing cage - 4. Drive pinion bearings - 5. Idle pinion spider - 6. Bevel drive pinion - 7. Differential carrier bearings - 8. Idle pinions - 9. Axle shafts - 10. Differential cage - 11. Side gears - 12. Bevel drive ring gear.

– Remove differential bearing cap screws (C_2) Fig. 8.30.
– Remove the two caps complete with the two ring nut lock plates.

NOTE – The cap-to-carrier seat mating marks (1) Fig. 8.31 are punched in factory at first assembly.

– Insert a sufficiently long and strong steel bar through the differential (Fig. 8.32) sling to hoist as shown and lift out the unit; place in a workbench vise and clamp on ring gear (1) Fig. 8.32.

NOTE – Use lead liners on vise jaws to prevent damaging the ring gear.

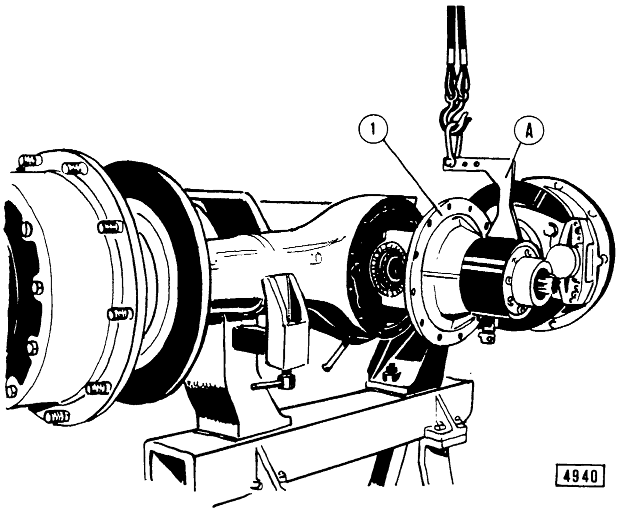

Fig. 8.29 - Removal of differential from axle housing

A. Sling fixture 75297519 - 1. Differential case.

- Straighten the lock plate tabs and undo the case half screws.
- Separate the case halves and disassemble all inner components (spider, thrust washers, idle pinions, side gears etc.).

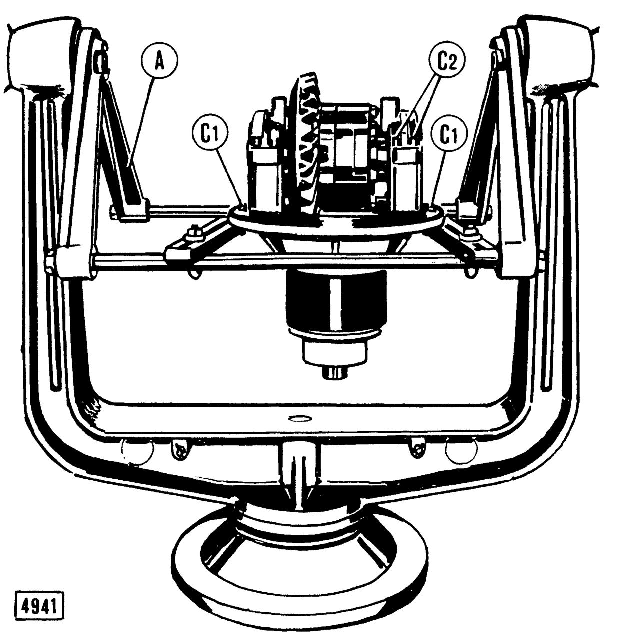

Fig. 8.30 - Differential unit installed on service stand

A. Service stand 75290086/75290092 - C_1. Differential mounting screws - C_2. Differential carrier bearing cap screws.

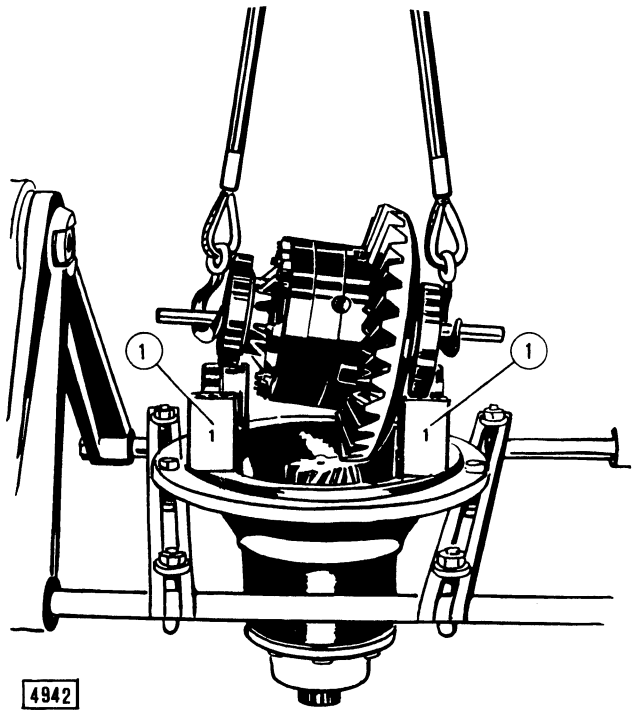

Fig. 8.31 - Removal of differential from carrier

1. Bearing cap mating marks.

- To remove the differential carrier bearing inner rings, use a universal puller as shown (Fig. 8.35).
- To remove the ring gear from case half, simply hammer its teeth with a plastic mallet until the parts involved work loose.

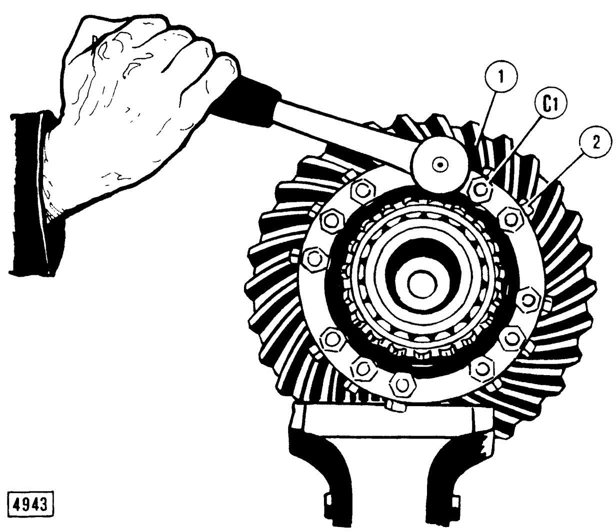

Fig. 8.32 - Disassembly of differential

C_1. Case half mounting nuts - 1. Bevel drive ring gear - 2. Lock plates for nuts (C_1).

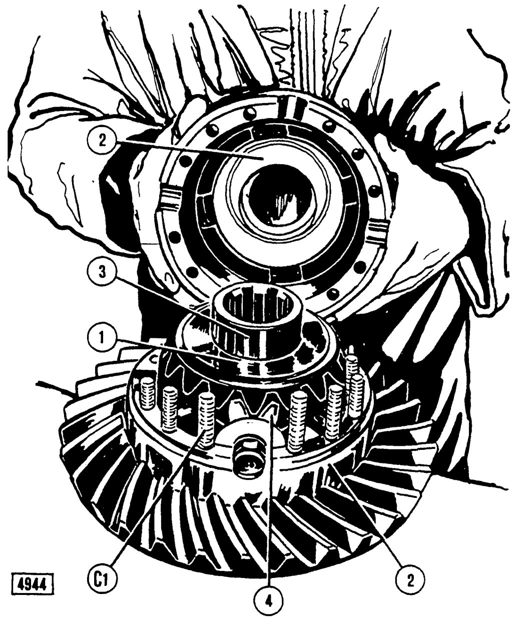

Fig. 8.33 - Differential case half (2) disassembly

C_1. Case half screws - 1. Side gear thrust washers - 3. Side gears - 4. Idle pinions.

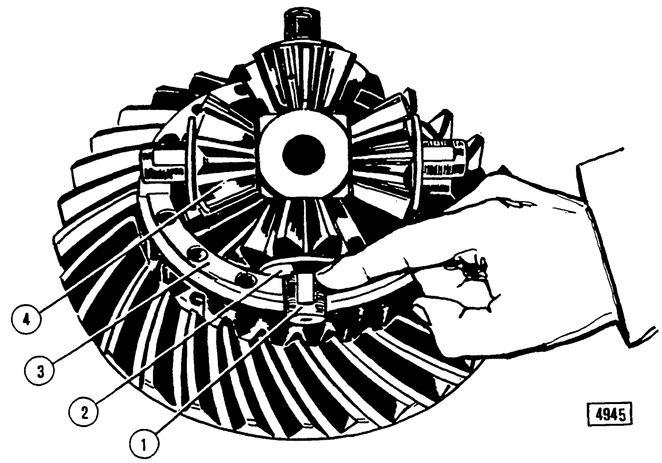

Fig. 8.34 - Differential inside components

1. Spider (trunnion) - 2. Idle pinion thrust washers - 3. Case half - 4. Idle pinions.

NOTE — Milled mark on spider to be oriented as shown.

- Using special wrench (A) Fig. 8.36 slacken the lock nut, remove the lockwasher and unscrew the drive pinion mounting ring nut.

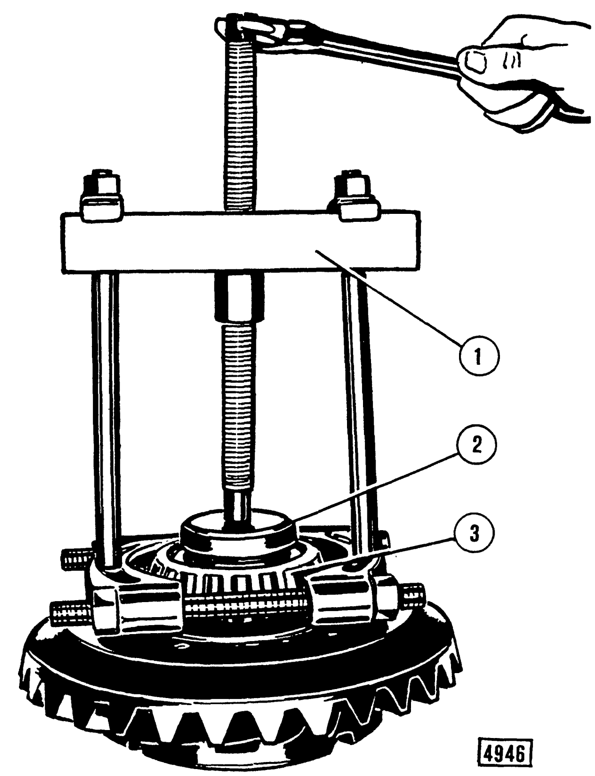

Fig. 8.35 - Bevel drive ring gear bearing inner ring removal

1. Universal puller - 2. Reaction block - 3. Bearing.

8.8 BEVEL DRIVE PINION DISASSEMBLY

Proceed as follows:

> **⚠ WARNING**
>
> Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

> **⚠ WARNING**
>
> Always wear safety glasses with side shields when machining or grinding metal, or performing any task where particles might fly.

- Remove the seal holder.
- Apply lock bar 75297520 (B) Fig. 8.36 on pinion head.

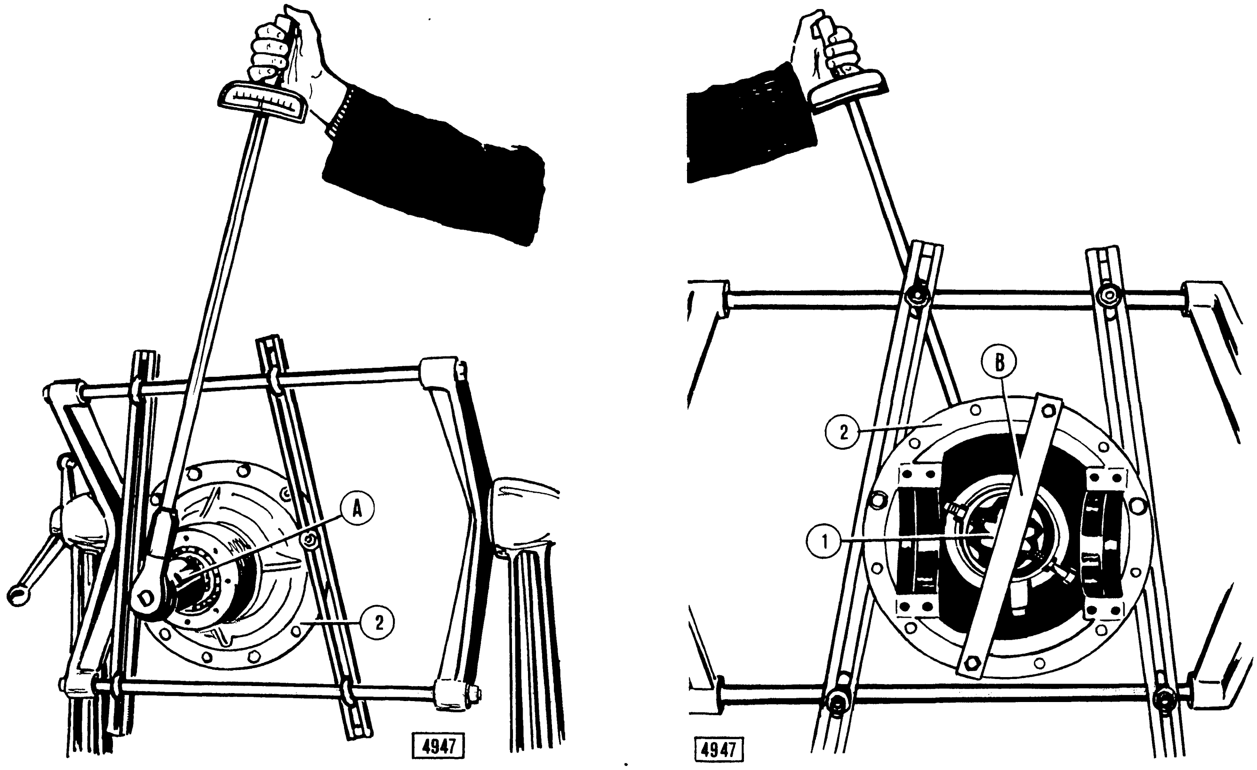

Fig. 8.36 - Bevel drive pinion disassembly

A. Special wrench 75297501 for ring nut removal - B. Drive pinion lock bar 75297520 - 1. Bevel drive pinion - 2. Bearing cage.

- Remove lock bar (B) Fig. 8.36 and pull out the drive pinion.
- Using a puller, remove the bearing inner ring (Fig. 8.37).
- From differential case, extract the bearing outer ring (1) Fig. 8.38 using a proper universal puller.

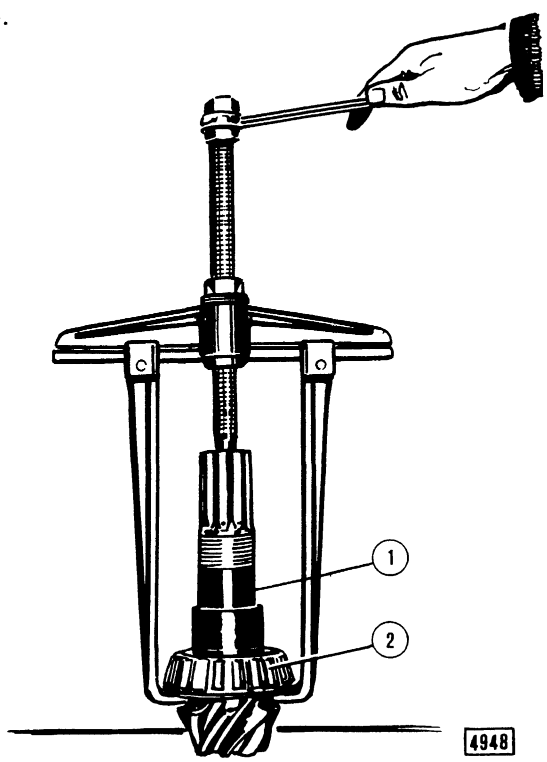

Fig. 8.37 - Removal of drive pinion bearing inner ring

1. Bevel drive pinion - 2. Bearing inner ring.

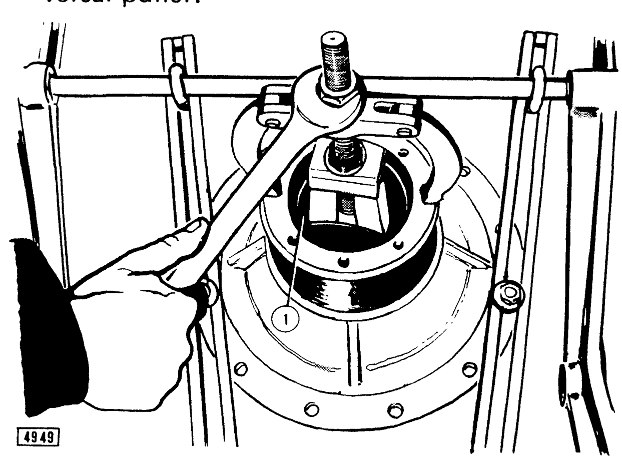

Fig. 8.38 - Removal of drive pinion bearing outer ring

1. Bearing outer ring.

8.9 INSPECTION AND CLEANING OF DIFFERENTIAL

Cleaning

Do not steam clean the differential and its components. When steam is used for this operation, water droplets may be retained in the various passages and spaces thus causing in time the corrosion of components.

As a consequence, rust particles are likely carried into circulation by the lubricant resulting in the rapid wear of bearings, gears and other parts.

All machined and smooth components such as gears, bearings and shafts should be cleaned using exclusively recommended non-flammable, non-toxic solvents.

NOTE — Never clean these components in alkaline water solutions such as caustic soda.
Differential cast parts may be cleaned in heated tanks containing weak alkaline baths: in this case, keep parts in the liquid solution only for the time actually needed for cleaning and heating.
Thorough rinsing is essential to remove any and all traces of alkali.

Checks

Inspect all bearings, their outer and inner rings (excluding those that were not disassembled) and change those that are found to have worn, pitted or otherwise damaged rollers, races and rings.

For the removal of components needing replacement, use suitable pullers or presses. Check the bevel drive pinion and ring gear for wear: if worn, pitted or chipped, replace the gears, **always as a set**, in any case.

Check also that the differential case halves, shims, idle pinion spider and gears show no evidence of pitting, chipping or excessive wear.

NOTE — Idle pinion shims must be replaced as a pack because the use of old and new shims combined can only shorten differential unit life.

Check that idle pinion and side gear teeth are neither scored nor worn. Never substitute gears singly but always as complete sets.

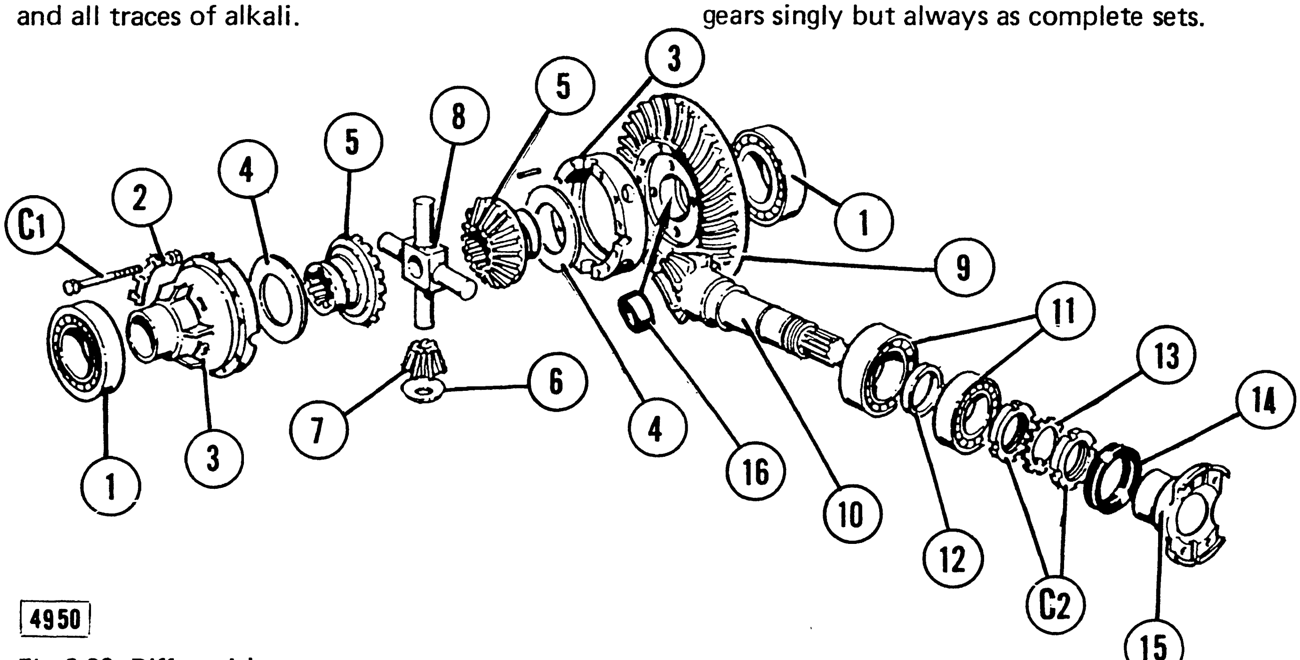

Fig. 8.39 - Differential components

C_1. Differential case half (3) mounting screws - C_2. Drive pinion mounting ring nut - 1. Differential carrier bearings - 2. Screws (C_1) lock plate - 3. Differential case halves - 4. Side gear thrust washers - 5. Side gears - 6. Idle pinion thrust washers - 7. Idle pinions - 8. Spider - 9. Bevel drive ring gear - 10. Bevel drive pinion - 11. Drive pinion bearings - 12. Spacer - 13. Ring nut (C_2) lock washer - 14. Lip seal - 15. Companion flange - 16. Bushing.

Make sure all studs are firmly rooted. Check all machined or ground surfaces for absence of indents, impressions or burrs. To obtain accurate adjustments and tightening torques all threads must be kept clean: use the specially provided file for cleaning.

At reassembly, fit only new oil slingers, seals and gaskets. Should bearing rings need replacement, fit complete bearings. When some parts must be shelved temporarily, coat them first with a reputable rust preventive product, then wrap in special paper or other rust barrier material.

8.10 DIFFERENTIAL REASSEMBLY AND ADJUSTMENTS

Bevel drive pinion

Reassemble the pinion as follows:

- Heat the pinion head end bearing (11) Fig. 8.39 in oil at 80 - 90° C and position in place.

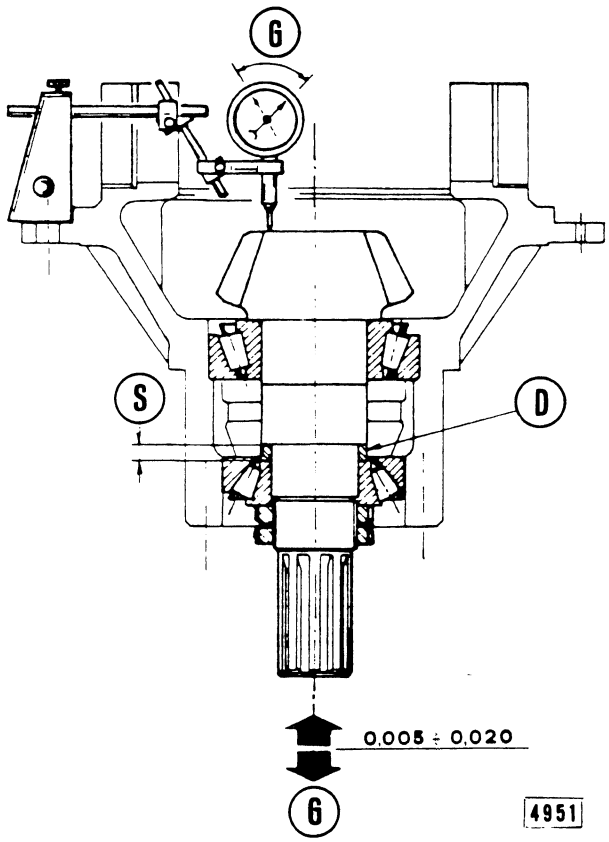

Fig. 8.40 - Bevel drive pinion bearing end play adjustment

D. Spacer - G. Normal operation end play (G = 0.005 to 0.020 mm) - S. Correct thickness of spacer (D).

- Force fit in position the outer rings of bearing (11).

NOTE – In case any single component of the drive pinion assembly was replaced, a new spacer (D) Fig. 8.40 must be fitted; before doing this, measure its thickness (Sn).

> **WARNING**
>
> Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

- Fit the drive pinion in place and, after mounting the other components (Fig. 8.39) secure the assembly obtained by the ring nut.

NOTE – Keep turning the pinion manually during the tightening operation.

- With the aid of a dial gauge fixed to differential carrier measure the pinion end play G.
- Correct thickness (S) Fig. 8.40 for spacer (D) is as follows:

  S = Sn minus G where Sn is the thickness of new spacers and G = 0.005 to 0.020 mm the specified end play.

Example:

Given S = 12 mm and G = 0.012 mm (average nominal end play) then –

S = 12 –0.012 mm = 11.988 mm approximated to 11.98 mm.

- Lap down both faces of the spacer to obtain the value found.
- Upon completion of the adjustment, fit the lockwasher and tighten the lock nut to the specified torque.

NOTE – Fit lock bar 75297520 (B, Fig. 8.36) to prevent the drive pinion from rotating during the tightening operation.

- Bend lockwasher tabs as required to secure the ring nut and make sure the drive pinion is free to rotate.

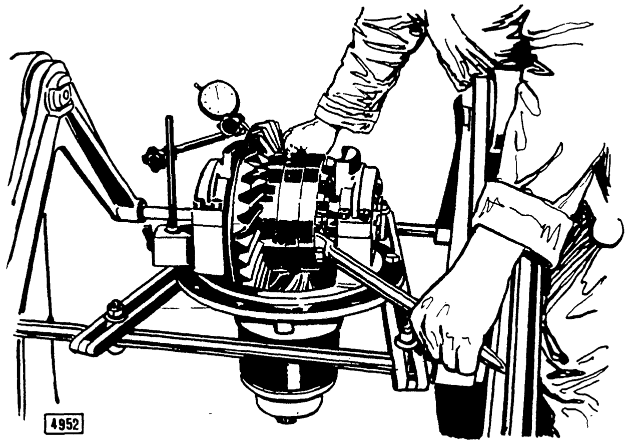

Fig. 8.41 - Measuring differential drive pinion end play

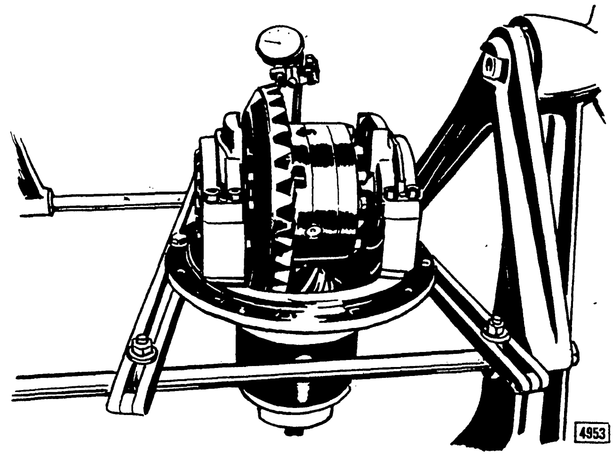

Fig. 8.42 - Measuring ring-gear-to-pinion backlash

Bevel drive ring gear and differential

Reassemble as follows:

WARNING

Handle all parts with extreme care. Keep hands and fingers from between parts.

- Fit the ring gear in case half, centering the two location pins properly.
- Fit all inside components (idle pinions, spider, side gears, etc) and position the spider with milled reference mark oriented as shown in (Fig. 8.34), relative to ring gear.
- Join the two case halves after having aligned their respective mating reference marks.
- Tighten screws (C_1) Fig. 8.39 to the specified torque and fix in place by bending the tabs of lockplate (2).
- Re-install the unit complete with grease-packed bearings.
- Fit bearing caps (Fig. 8.30) making sure the punch-marked references are in line; next, tighten the screws to a torque of 1.8 to 2 daN.m.
- Using wrench 75297506 tighten the two bearing adjusters (Fig. 8.28) taking up any clearance between bearings being careful, however, that the bevel ring gear does not force against the pinion.
- Check ring gear-to-pinion backlash by placing a centesimal dial gauge perpendicular to the outer face of one ring gear tooth ensuring that the point of contact be located at abt. 5 mm from ring gear outermost edge.
- Proceeding gradually, act simultaneously on the two adjusters (C_2) Fig. 8.28 until specified standard backlash value is obtained (min: 0.08 to 0.15 mm; max: 0.20 to 0.25 mm). Repeat the measurement in other three locations 90° apart making sure each time that the correct value checks.
- Tighten both adjusters (C_2) gradually, and of the same amount until the specified torque of 6.4 to 7.6 daN.m is obtained; then lock by the plate tabs.
- Check backlash again to ensure that no alterations have occurred during the earlier tightening operations.
- Tighten the bearing cap screws to the specified torque of 5.5 to 6.0 daN.m.
- Refit the seal cover (2) Fig. 8.28 after having coated liberally the mating interfays with sealant.
- Join the differential carrier to axle housing with interposed gasket.

NOTE – Joining the carrier and housing is a particularly difficult operation: it is suggested to use 3 location pins for proper centering of carrier and watch for the correct positioning of ring gear (to be located on the right in this case).

- Tighten the mounting screws to the specified torque setting.

9. SPECIFICATIONS AND DATA

		FR9	FR7
SIDE FINAL DRIVES			
No. of planet gears		3	
Drive ratio		4.875	3.706
Final drive gear backlash	mm	0.10 to 0.15	
Planet gear side shims	mm	3.9 to 4.0	2.95 to 3.05
Planet gear end play	mm	0.20 to 0.55	0.22 to 0.60
Planet gear pin O.D.	mm	37.975 to 37.991	29.991 to 30.000
Diameter of planet gear seats in carrier	mm	38.00 to 38.025	30.000 to 30.033
Fit clearance	mm	0.009 to 0.050	0 to 0.042
Sun gear shim		press-fitted in hub	
Proudness of shim to hub	mm	2	
Proudness at wear limit	mm	1.2	
Shim O.D.	mm	64.020 to 64.038	
Shim seat bore in hub	mm	63.938 to 63.958	
Interference fit at assembly	mm	0.062 to 0.10	
Hub to ring gear clearance		through splines	
Spline backlash	mm	0.066 to 0.127	
Hub bearings		Two, taper roller, axially loaded	
Preload adjustment		by adjusters on hub	
Wheel hub / drive case standard revolving torque specified for bearing pre-load adjustments (clean and grease packed new bearings)	daN.m	4.2 to 4.4	2.3 to 2.6
Effort required to turn hub / drive case assy at the specified revolving torque	daN	20 to 21	16 to 18

Specifications and Data (Cont'd)

DIFFERENTIAL		FR9	FR7
No. of idle pinions		4	
Spider trunnion diameter	mm	19.959 to 19.980	
Spider trunnion bore in idle pinions	mm	20.000 to 20.021	
Operation fit clearance	mm	0.020 to 0.062	
Spider trunnion seat bore in diff. case	mm	20.000 to 20.021	
Assembly fit clearance	mm	0.020 to 0.062	
I.D. after pressfitting bush (16) Fig. 8.39	mm	60.000 to 60.030	
Bushing pin I.D. in side gear	mm	59.94 to 59.97	
Bushing to pin clearance	mm	0.03 to 0.036	
Bushing O.D.	mm	64.041 to 64.071	
Bushing seat I.D. in ring gear	mm	64.00 to 64.030	
Interference fit	mm	0.011 to 0.071	
Side gear shim thickness (4, Fig. 8.39)	mm	1.95 to 2.05	
Wear limit	mm	1.75	
Idle pinion shim thickness (6, Fig. 8.39)	mm	1.95 to 2.05	
Wear limit	mm	1.75	
Idle pinion-to-side gear backlash	mm	0.1 to 0.15	
BEVEL GEAR SET		helical	
Reduction ratio		2.33 to 2.66	
Bevel drive pinion bearing		double row, taper roller	
Bevel drive pinion end play, after assembly	mm	0.005 to 0.020	
End play adjustment (see page 8-21)		by shims	
Shim thickness		to be calculated at assy	

SPECIFICATIONS AND DATA (CONT'D)

	FR9	FR7
Backlash between ring gear and pinion, measured at 5 mm from ring gear outermost edge. . . . . mm	min 0.08 to 0.15 max 0.20 to 0.25	
Backlash adjustment	by tightening differential carrier bearing adjusters	
Bearing adjuster torque . . . . daNm	6.4 to 7.6	
Bearing cap milled centering face (Fig. 8.31) to seat in axle housing fit clearance . . . . mm	0.02 to 0.04	
Axle shafts	Rigid, spline-coupled	
Axle shaft spline backlash . . . . mm	0.053 to 0.104	
Axle shaft-to-hub bushing I.D. . . . . mm	50.08 to 50.12	
Axle shaft bushing seat O.D. mm	49.95 to 50.00	
Bushing-to-axle shaft operation fit clearance. . . . . mm	0.08 to 0.17	
Bushing O.D. . . . . mm	70.043 to 70.062	
I.D. of bushing seat in axle housing. . . . . mm	69.90 to 69.93	
Interference fit . . . . mm	0.113 to 0.162	

10. TORQUE SPECIFICATIONS

Item	Thread size	Torque daN.m (*)
BEVEL GEAR SET – DIFFERENTIAL		
Differential carrier-to-axle housing screws	12x1.25	5.5
Oil slinger flange-to-case screw	10x1.5	3.5
Bearing cap mounting screws	12x1.75	6
Differential case half nuts	10x1.5	7
Bevel drive pinion lock nuts	50x1.5	28
EPICYCLIC SIDE FINAL DRIVES		
Final drive-to-axle housing nut	15x1.5	20
Disc brake caliper holder plate-to-hub nut	12x1.75	8.5
Disc brake-to-hub screws	12x1.25	5.5
Final drive cover screw	12x1.25	5.5
Wheel nut	20x1.5	37
Brake disc-to-hub screw (FR7)	12x1.25	9
Hub/caliper holder plate-to-axle housing screw (FR7)	18x1.5	29

(*) Lubricate with engine oil

11. SERVICE TOOLS

Catalog No.	Description
75297519	Differential sling fixture
75297520	Bevel drive pinion lock bar
75297501	Wrench for bevel drive pinion ring nut
75297506	Wrench for bevel gear set bearing adjusters
75297500	Tool for side final drive ring nuts