

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

CODE: ODF-1

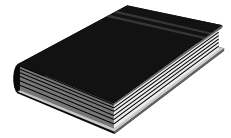
STRIP, CLEAN AND INSPECT A DIFFERENTIAL AND FINAL DRIVE

INDEX

The following elements are contained in this learning guide:

TOPIC	PAGE NUMBER
Index	2
Source reference	3
Objective	4 - 5
Hazard Identification and Control (HIAC) form	6 - 7
Condition report on differential and final drive	8 - 11
Introduction	12
Rear drive axle assembly	13 - 14
Hypoid and spiral bevel gears	14 - 15
Crown gear teeth nomenclature	16 - 17
Pre-load and backlash	18 - 19
Types of rear axle carriers	19 - 20
Operation	20 - 22
Self test 1	23 - 24
Final drive	25 - 27
Self test 2	28
Stripping the final drive	29 - 34
Practice	34
Dismantling the differential	35 - 42
Practice	43
Cleaning and inspection	44 - 51
Practice	52

SOURCE REFERENCES



Demonstration by a competent person, e.g. a Training Officer.

Makers' catalogues and service manuals.

Models in the training centre.

OBJECTIVE

You will be learning towards the outcome “Strip, clean and inspect a differential and final drive”. Whilst learning towards the outcome you will be required to achieve the following:

- Strip, clean and inspect the differential and final drive.

On completion of this module, the learner must be able to:

- Describe the operation of the differential and final drive.
- Strip the differential and final drive.
- Clean the differential and final drive.
- Inspect the differential and final drive.
- Complete the condition report

During this process you must adhere to certain specified requirements as listed in the Module.

ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you may achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- A practical test will be set at the end of the module and must be completed without using references.
- For the practical test, the learner will be given a rear axle with a differential and final drive and all the necessary tools and equipment.
- The following standards must be achieved:
 - a. The operation of the differential described correctly.
 - b. The operation of the final drive described correctly.
 - c. The differential stripped in the correct sequence.
 - d. The final drive stripped in the correct sequence.
 - e. All the component parts were thoroughly cleaned.
 - f. The condition report correctly completed.
 - g. There must not be any damage to any fasteners.
 - h. There must not be any damage to tools and equipment.

- i. All safety procedures must be adhered to.

HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM**ODF-1****STRIP, CLEAN AND INSPECT A DIFFERENTIAL AND FINAL DRIVE**

STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Use hand tools.	<ul style="list-style-type: none"> Using damaged tools or wrong tools for the job can cause injury and damage to equipment. 	<ul style="list-style-type: none"> Always use the correct tool for the job. Ensure tools are in good condition. Use tools correctly. Wear appropriate PPE where necessary. Always take good care of tools. Maintain, clean and store it properly.
2. Work on machinery.	<ul style="list-style-type: none"> Injury to person if working on moving machinery. 	<ul style="list-style-type: none"> Ensure that power to the machine is switched off, and if possible, physically locked out. Place a warning sign stating: "Men at work. Do not switch on" in a prominent position. Ensure that machinery is stationary before commencing work. Replace machine guards after completing the task and before starting the machine.

NOTE: Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner: _____

Signature of Training Officer:

Date:

CONDITION REPORT ON DIFFERENTIAL AND FINAL DRIVE		
1.PINION GEAR SHAFT	ACCEPTABLE	NOT ACCEPTABLE
Gear Teeth		
Bearing Surfaces		
Seal Surface		
Bearings		
Seals		
Retaining Nut		
Threads on Shaft		
Pinion Shaft Splines		
Remarks:		
2. CROWNWHEEL	ACCEPTABLE	NOT ACCEPTABLE
Gear teeth		
Bearings		
Thrust nut (if applicable)		
Remarks:		

3. SPIDER GEAR ASSEMBLY	ACCEPTABLE	NOT ACCEPTABLE
Spider Gear Teeth No.1		
No.2		
No.3		
No.4		
Side Gear Teeth No.1		
No.2		
Clearance Spider Gear Shaft No.1		
No.2		
No.3		
No.4		
Roller Bearings		
Bearing Surfaces		
Thrust Washers		
Splines on Side Gear No. 1		
No. 2		
Remarks:		

3. FINAL DRIVE ASSEMBLY	ACCEPTABLE	NOT ACCEPTABLE
Gear Teeth on Sun Gear		
Gear Teeth on Ring Gear		
Gear Teeth on Planet Gears No. 1		
No. 2		
No. 3		
No. 4		
Clearance Planet Gear/Shaft No. 1		
No. 2		
No. 3		
No. 4		
Planet Gear Thrust Washer No. 1		
No. 2		
No. 3		
No. 4		
Remarks:		

5. SIDE SHAFT	ACCEPTABLE	NOT ACCEPTABLE
Splines		
Bearing Surface		
Seal Surface		
Bearing		
Shaft (bent/broken)		
Remarks:		
6. Carrier housing cracked	Yes	No
7. Threaded holes in housing stripped	Yes	No
Remarks:		

INTRODUCTION

ITEM / TASK: Introduction

DESCRIPTION:

In Modules OMT and CLU it was explained that the clutch in a power train is used to disconnect the engine from the power train, allowing the engine to run while the machine is standing still. The clutch also engages the power train to move the machine. See Fig. 1.

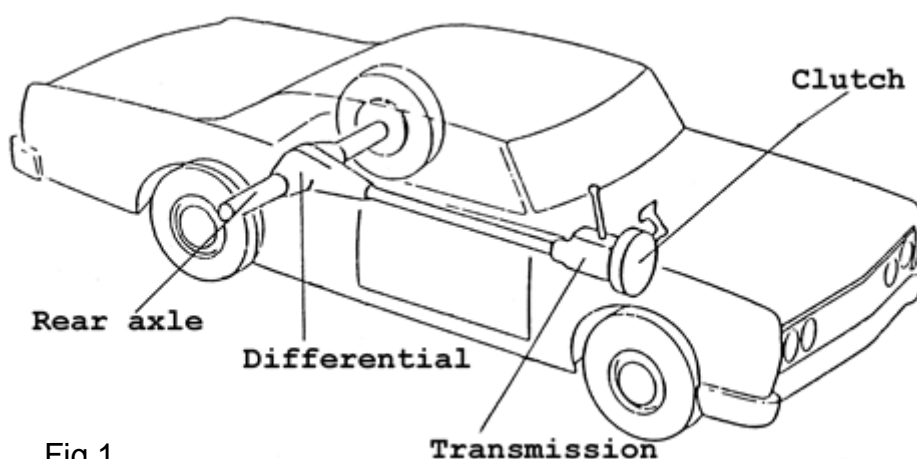


Fig 1

A transmission enables changes in the speed of the drive wheels in relation to the engine power. This allows slower speeds when starting to move the machine and faster speeds to match various loads and conditions. In this module we will cover the transmission up to the drive wheels by explaining the function of the differential and final drive.

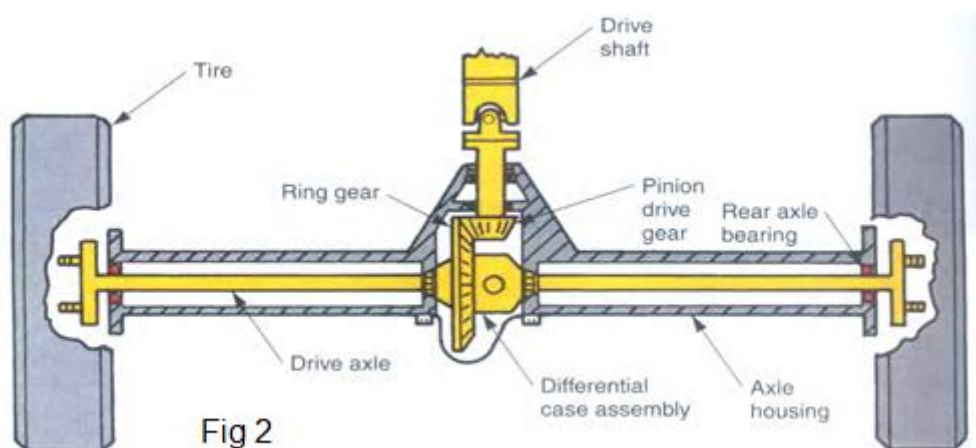
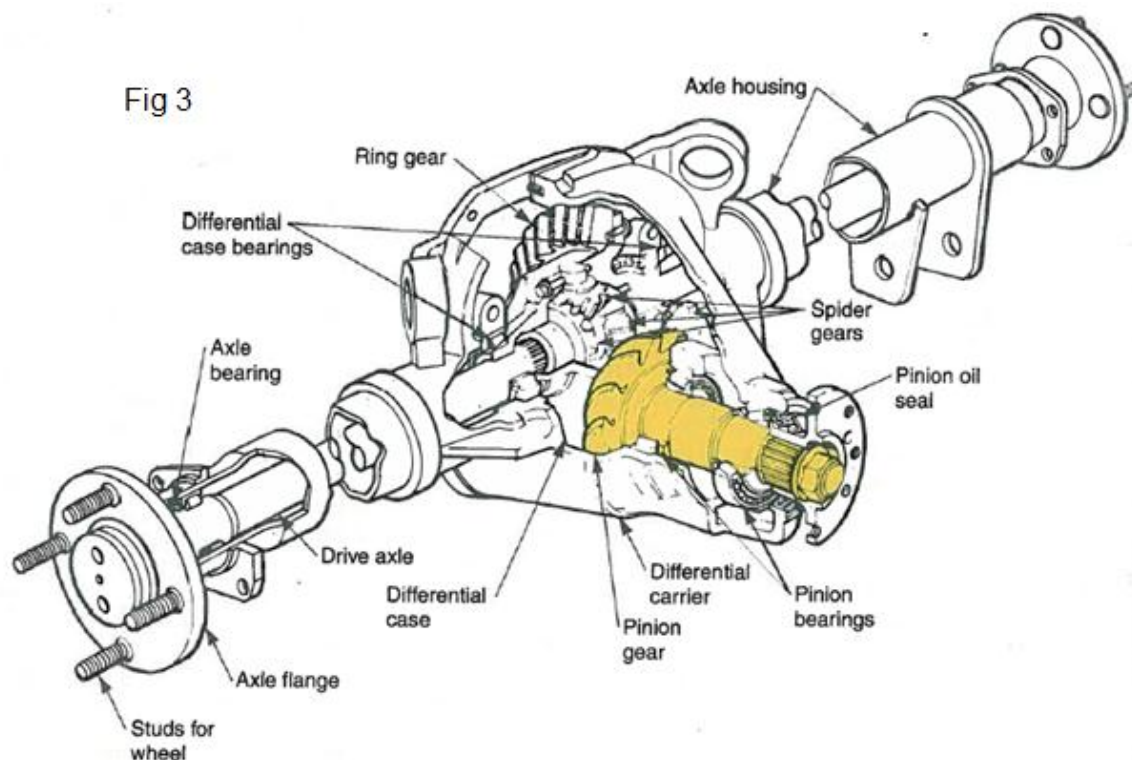


Fig 2

Fig 3



1. Sending power from the drive shaft to the rear wheels.
2. Providing a final gear reduction.
3. Transferring torque through a 90° angle.
4. Splitting the amount of torque going to each wheel.
5. Allowing the wheels to rotate at different speeds in turns.
6. Supporting the rear axles, brake assemblies, suspension components, and chassis.

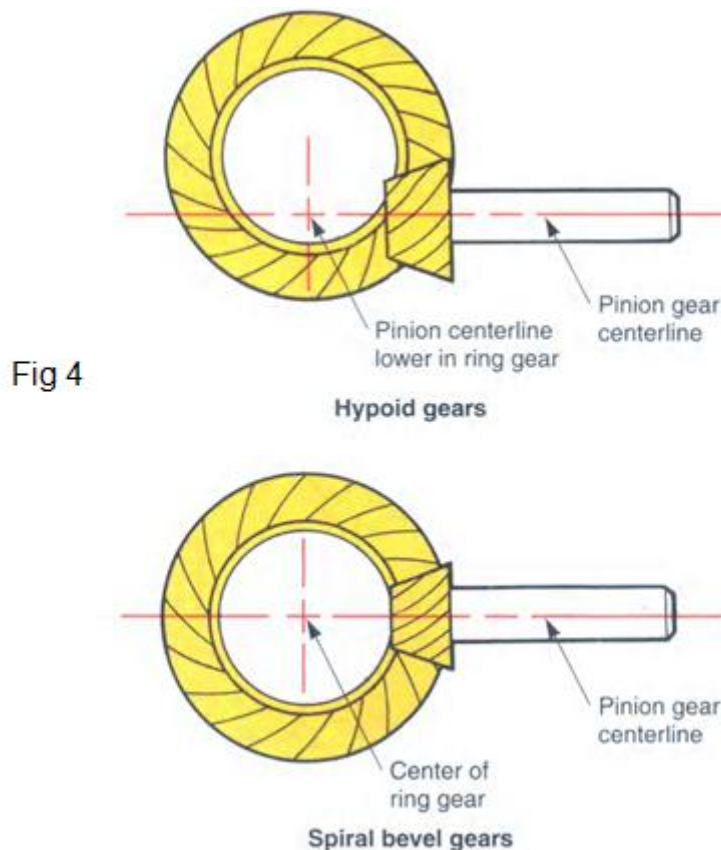
Hypoid and Spiral Bevel Gears

Hypoid gears have the driving pinion centreline offset, or lowered, from the centreline of the ring gear. Modern differential ring and pinion gears are hypoid type. Refer to Figure 4.

Spiral bevel gears have curved gear teeth with the pinion and ring gears on the same centreline. This type gear setup is no longer used.

Hypoid gears have replaced spiral bevel gears because they allow for a lower hump in the vehicle floor and improve gear meshing action.

Hypoid gears have a larger gear tooth contact area than spiral bevel gears. This helps increase gear life and reduces gear noise.

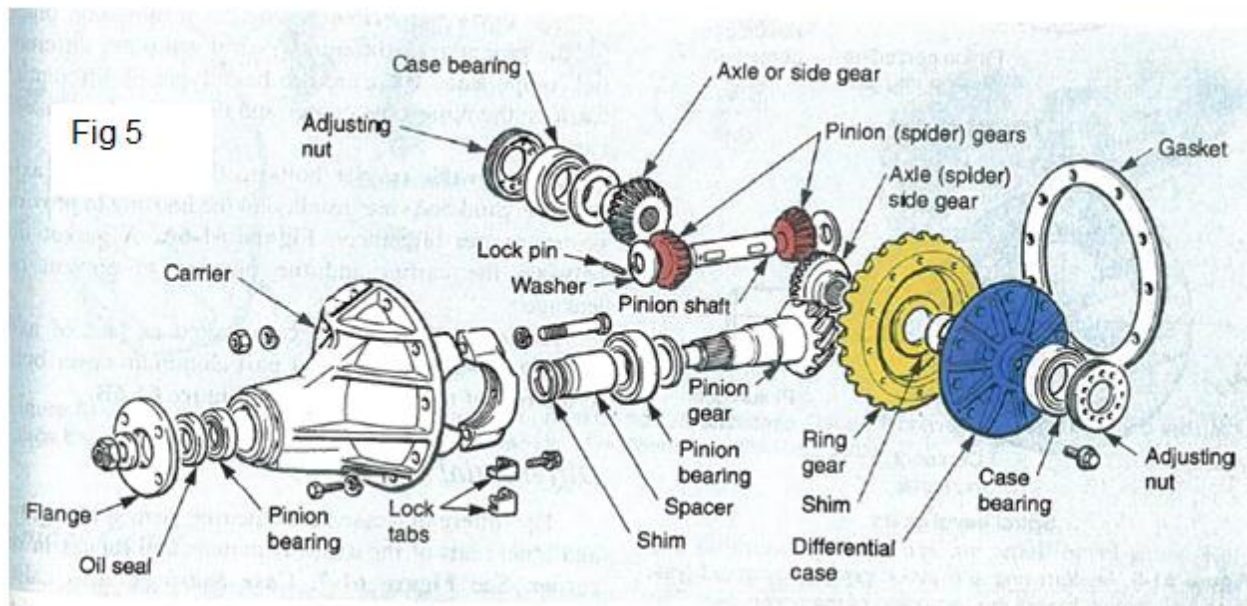


The exploded view shows all the major parts of a differential assembly.

The Crown / Ring gear bolts to the differential case.

The carrier bearings are adjusted using large nuts.

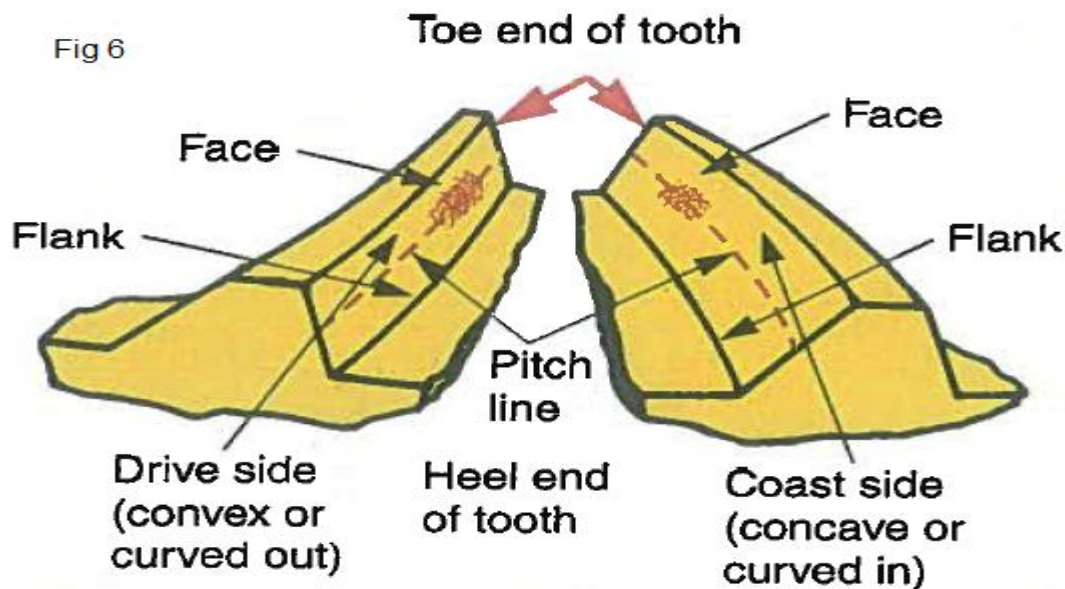
Study the part names and how they fit together.



- The differential case with ring-gear, and the drive pinion are mounted in opposed taper roller bearings in the one piece rear axle carrier.
- The rear axle drive pinion receives its power from the engine through the transmission and drive shaft.
- The drive pinion rotates the differential case through engagement with the ring gear, which is bolted to the differential case flange.
- Inside the differential case are two differential pinions (planetary gears) mounted on the differential pinion (Planetary)shaft, which is pinned to the housing.
- These gears are engaged with the side (sun) gears, to which axle shafts are splined. Therefore, as the differential housing turns, it rotates the axle shafts and rear wheels.

Crown gear teeth nomenclature.

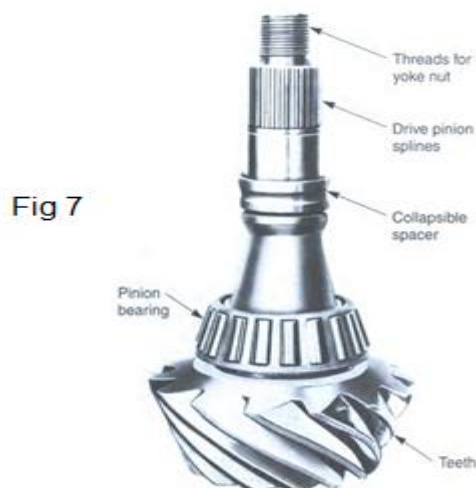
Study the names, they are needed when reading or interpreting gear contact

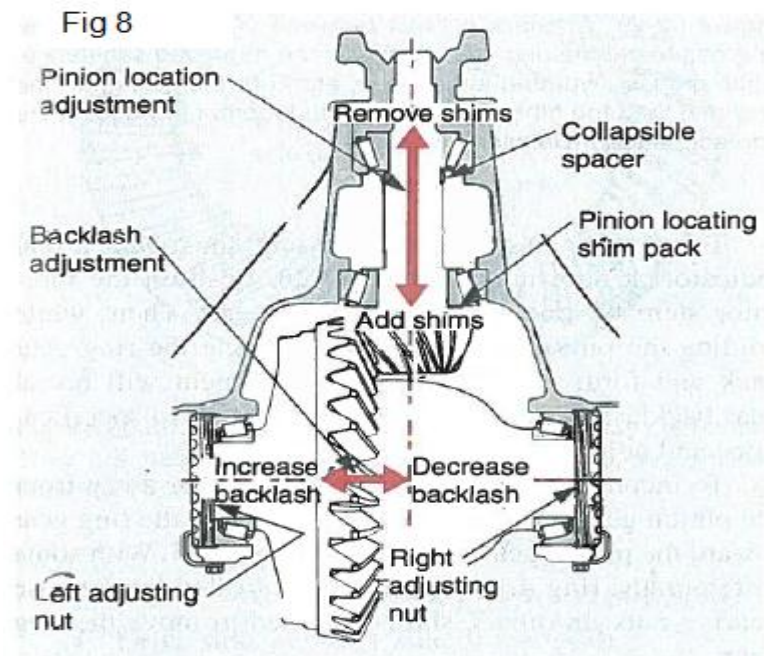


Pinion gear depth refers to the distance the pinion tends into the carrier. Pinion gear depth affects where the pinion gear teeth mesh with the ring gear teeth. Pinion gear depth is commonly adjusted by varying shim thickness on the pinion gear and bearing assembly.

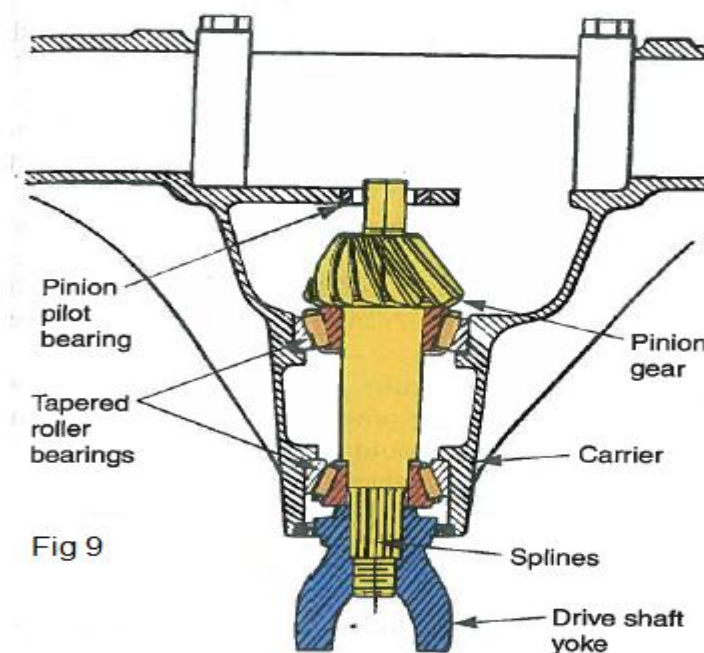
Fig.7 illustrates how shims affect pinion gear both removable and integral carriers.

Pinion bearing preload is frequently adjusted by torquing the pinion nut to compress a collapsible spacer. The more the pinion nut is torque, the more the spacer will compress to increase the preload (tightness) of the pinion bearings.





The outer end of the pinion drive gear is splined to the rear universal joint companion flange or yoke. The inner end of the pinion gear meshes with the teeth on the ring gear. The pinion gear is normally mounted on tapered roller bearings. They allow the pinion gear to revolve freely in the carrier. Either a crushable sleeve or shims are used to preload the pinion gear bearings. Gear preload is a small amount of pressure applied to the bearings to remove play and excess clearance.



With some differentials, the extreme inner end of the pinion gear is supported by a pinion pilot bearing. This is a straight roller bearing. The pinion pilot bearing helps the two tapered roller bearings support the pinion gear during periods of heavy load. See Figure 9 on previous page.

The ring gear is driven by the pinion gear and transfers rotating power through an angle change of 90°. The ring gear has more teeth than the pinion gear. Bolts hold the ring gear securely to the differential case.

The ring gear and pinion gear are commonly a matched set. They are lapped (meshed and spun together with abrasive compound on their teeth) at the factory. Then, one tooth on each gear is marked to show the correct tooth engagement.

When a solid spacer is used, pinion gear shims commonly control pinion bearing preload. The pinion nut is usually torqued to a specific value; decreasing the shims thickness will increase the bearing preload.

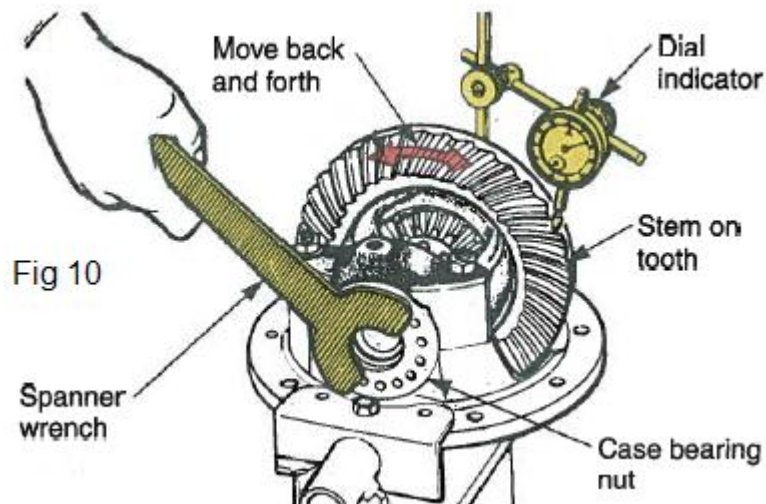
Carrier bearing preload is the amount of force pushing the differential case bearings together. As with pinion bearing preload, it is critical.

If Carrier bearing preload is too low (bearings too loose), differential case movement and ring and pinion gear noise can result. If preload is too high (bearings too tight), bearing overheating and failure can result.

When adjusting nuts are used to set case bearing preload, the nuts are typically tightened until all the play is out of the bearings. Then, each nut is tightened a specific portion of a turn to preload the bearings. This is done when adjusting backlash (covered shortly)

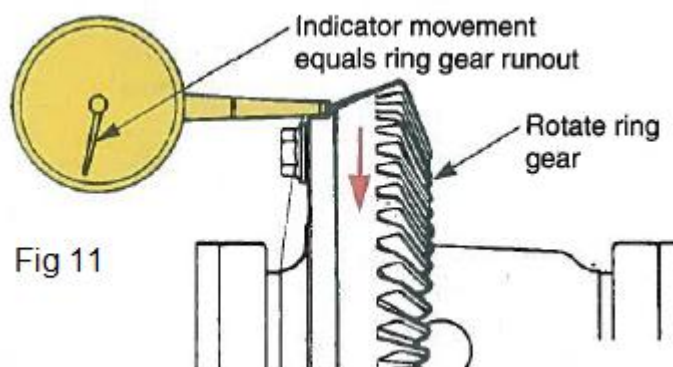
Ring gear and pinion backlash refers to the amount of space between the meshing teeth of the gears. Backlash is needed to allow for heat expansion and lubrication.

As the gears operate, they produce friction and heat. This makes the gears expand, reducing the clearance between meshing teeth. Without sufficient backlash, the ring and pinion teeth could jam into each other as they reach operating temperature. The gears could fail in a short time. Too much ring and pinion backlash could cause gear noise (whirring, roaring, or clunking).



Ring gear run-out is the amount of wobble (side-to-side movement) produced when the ring gear is rotated. Ring gear run-out must be within specifications.

To measure ring gear run-out, mount a dial indicator against the back of the ring gear. The indicator stem should be perpendicular to the ring gear surface. Then, turn the ring gear and note the indicator reading. See Figure 11.



Two basic types of rear axle carriers.

A removable carrier is handy because it can be serviced at a workbench.

Integral or unitized carrier is formed as part of the axle housing. (Local Differential)

See Fig 12 on the next page.

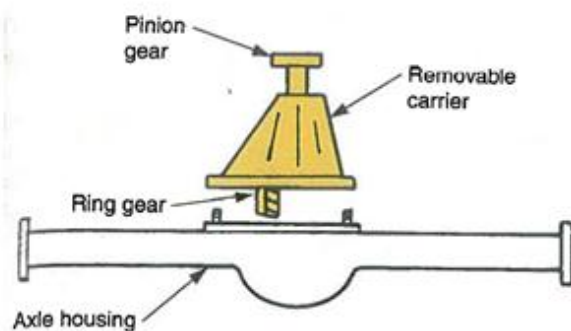
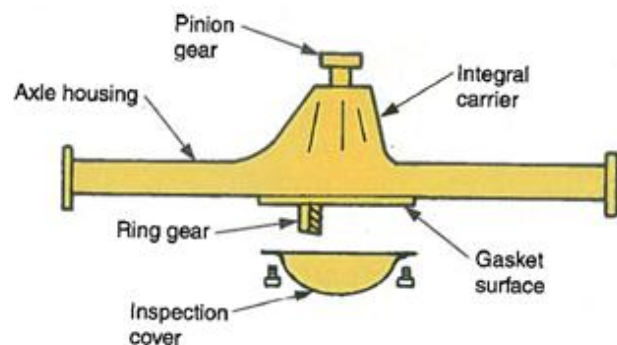
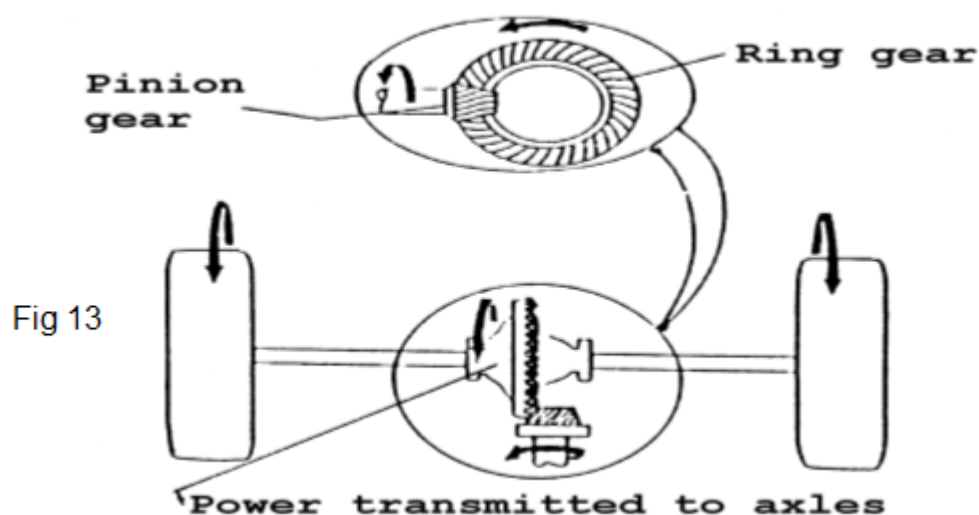


Fig 12

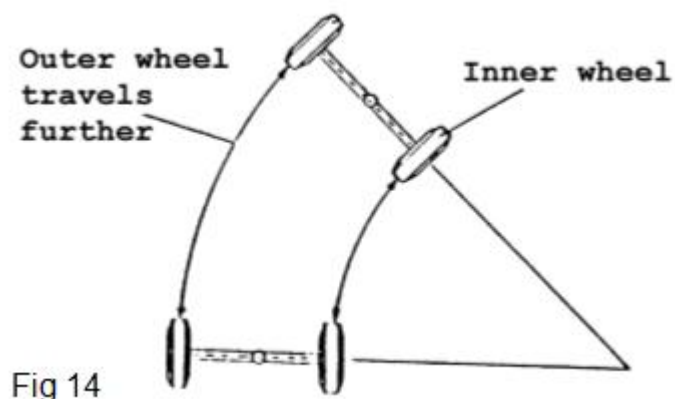


OPERATION

In the rear axle the ring gear and pinion transmits the power "around the corner" to the axles as shown in Fig. 13.

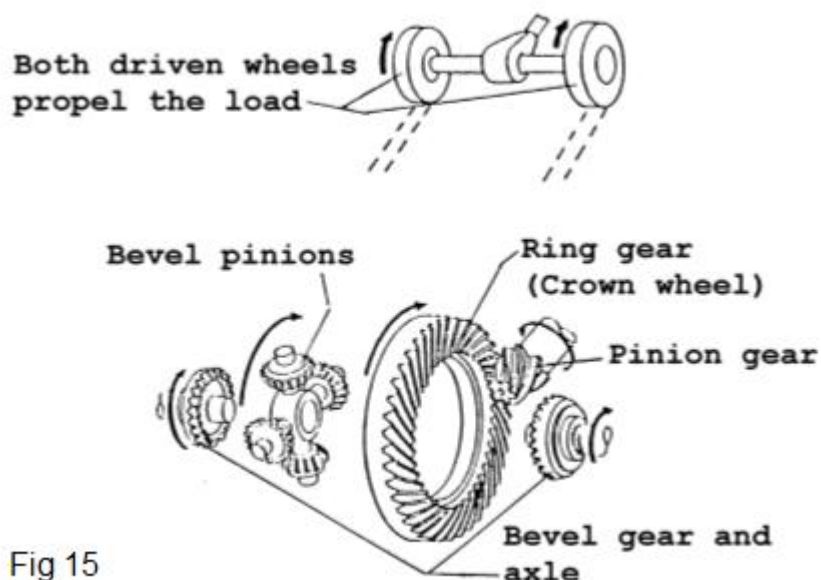


If it was only necessary to travel in a straight line, that is all the gearing would be needed at the rear axle, but when a corner is turned, the outside wheel has to travel a greater distance than the inside wheel in the same time. (Fig.14).



Driving straight ahead:

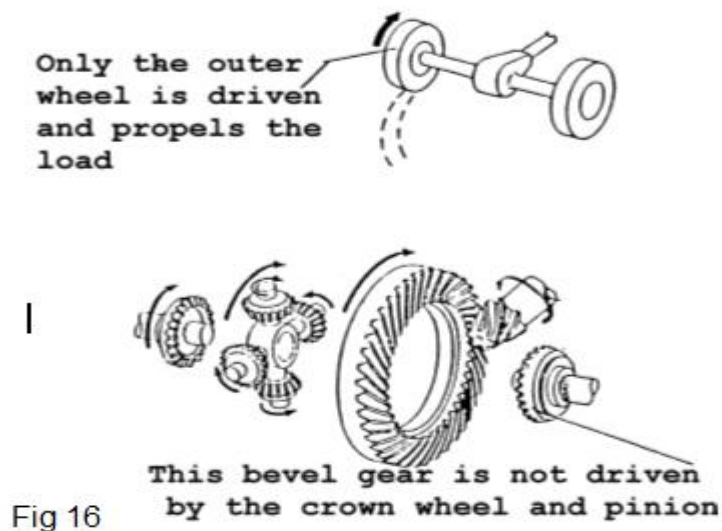
The differential will transmit power to both wheels, to propel the load when the machine or vehicle is moving straight ahead, or taking a gradual bend when the wheels are turning at different speeds. See Fig. 15.



Engine power comes in on the pinion gear and rotates the ring gear. The four bevel pinions and the two bevel gears are carried around by the ring gear and all the gears rotate as one unit. Each axle receives the same torque and so each wheel turns at the same speed.

Turning corners:

When the vehicle turns a sharp corner, only one wheel is free to rotate as shown in Fig. 16.



Again, engine power comes in on the pinion gear and rotates the ring gear, carrying the bevel pinions around with it. However, the right-hand axle is held stationary and so the bevel pinions are forced to rotate on their own axis and "walk around" the right-hand bevel gear.

Since the bevel pinions are in constant mesh with both bevel gears, the left-hand bevel gear is forced to rotate because it is subjected to the turning force of the ring gear, which is transmitted through the bevel pinions (Fig.16) through the sun gear to the outer wheel.

During one revolution of the ring gear, the left-hand bevel gear makes two revolutions - one with the ring gear and another as the bevel pinions "walk around" the other bevel gear. Therefore the speed of the outer wheel will increase with the same amount that the speed of the inner wheel had decreased.



SELF TEST 1

Answer the questions below without referring to your notes:

1. Name the parts of a rear drive axle assembly

2. What is the function of the differential?

3. Describe the operation of the differential when:

a) The vehicle is moving straight ahead.

b) The vehicle turns a sharp corner.

4. Define backlash

5. Define bearing pre-load

6. Describe how the Ring Gear run-out is measured

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

FINAL DRIVE

Some machines like Trucks, Tractors and earthmoving equipment have final drives on the axles to further reduce speed and increase torque to move bigger loads. Refer to Fig. 17. The main types of gearing used are planetary gears.

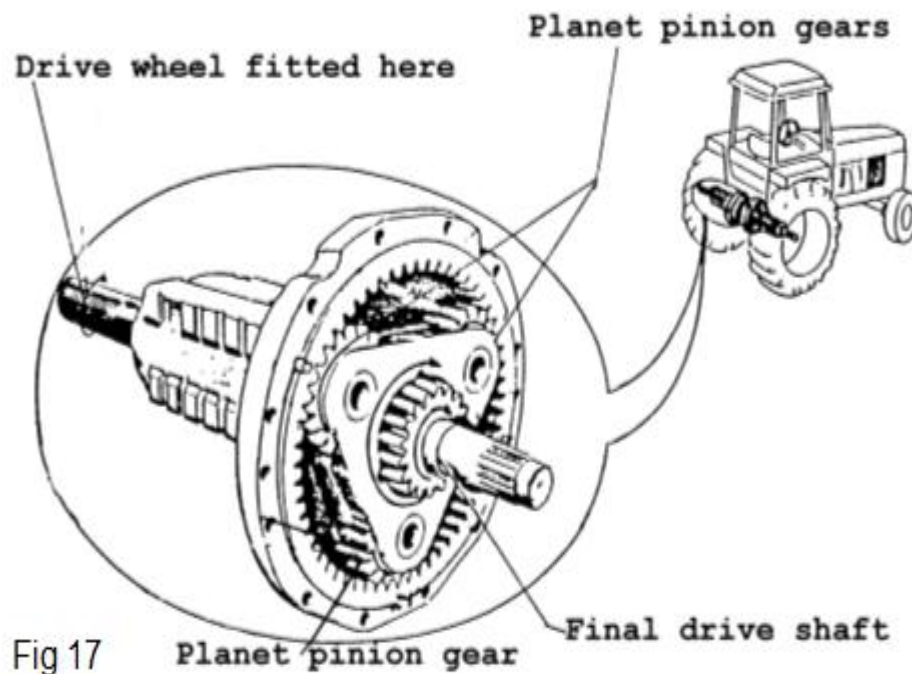


Fig 17

Planetary gears are simple in design, but their operation is not always understood. Planetary gears are similar to the solar system (Fig.18).

Each planet pinion gear turns on its own axis while rotating around the sun gear. This is much like the earth and other planets rotating around the sun. The pinion gears in turn mesh with the inside of the ring gear.

When power is applied to drive the sun gear or the planet pinion carrier, the entire system will rotate as a unit unless a restraining force is applied to hold one of the other two members of the system stationary.

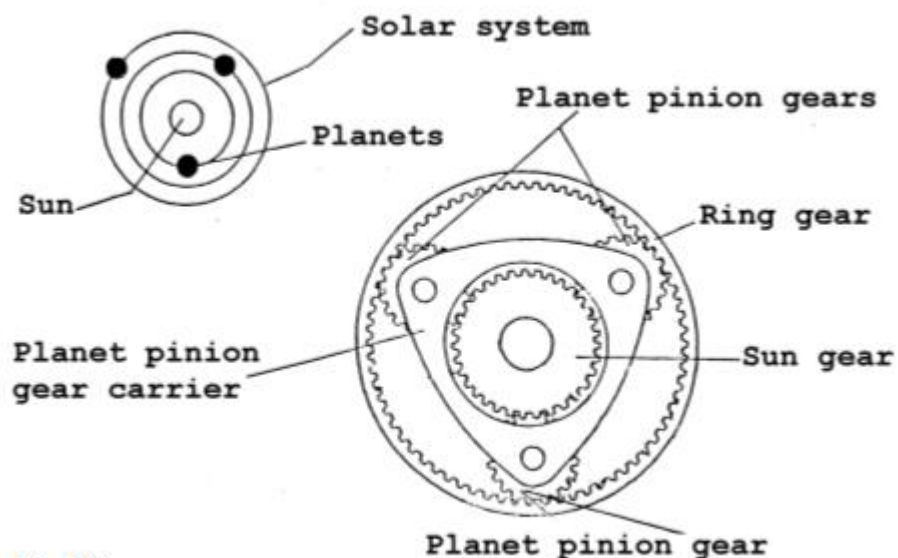


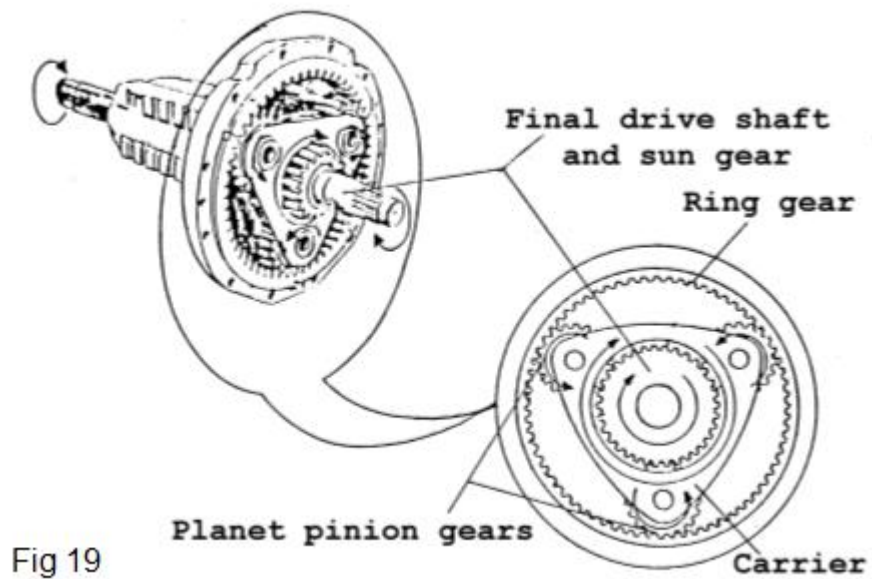
Fig 18

When power is applied to one member of the planetary system, and a brake is applied to restrain a second member from turning, the remaining part will become a power output source.

Operation of a final drive

The planetary gear reduction system receives engine power from the differential through the final drive shaft and sun gear. The sun gear is an integral part of the final drive shaft and this turns with the shaft (Fig. 19). The sun gear meshes with the planet pinions which are mounted in the planet pinion carrier.

As the sun gear turns, it forces the planet pinions to "walk around" the inside of the ring gear as shown by the arrows in Fig. 19. The planet pinion carrier is forced to rotate in the same direction as the sun gear, thus delivering engine power to the drive wheels, but at reduced speed and at increased torque to move bigger loads.



Go on to the next page to do the self test.



SELF TEST 2

1. What is the function of a final drive?

2. Describe the operation of the final drive.

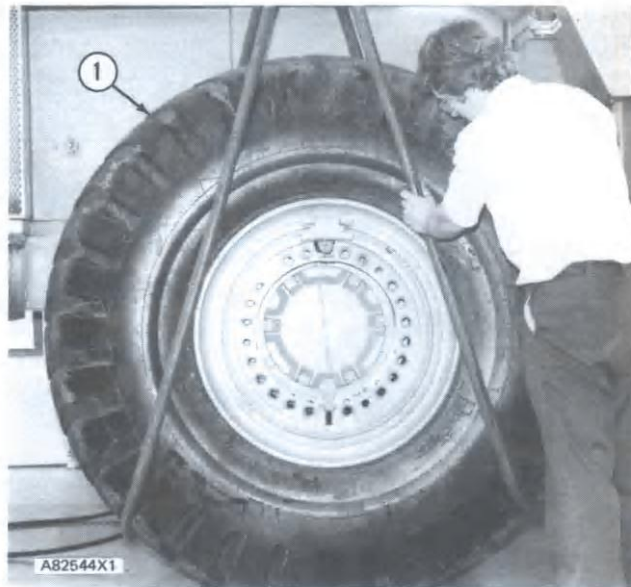
Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

STRIPPING THE FINAL DRIVE:

1. Fasten a hoist to the tyre and rim.
2. Remove the tyre and wheel assembly.

Fig 20



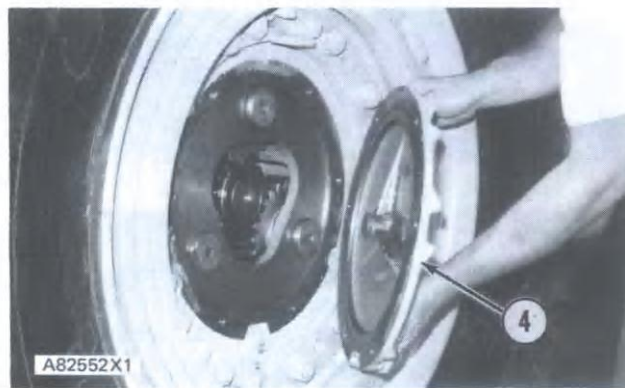
3. Turn the hub assembly forward or to the rear until drain plug (3) is in the downward position
4. Drain the oil from the final drive.
5. Remove bolts

Fig 21



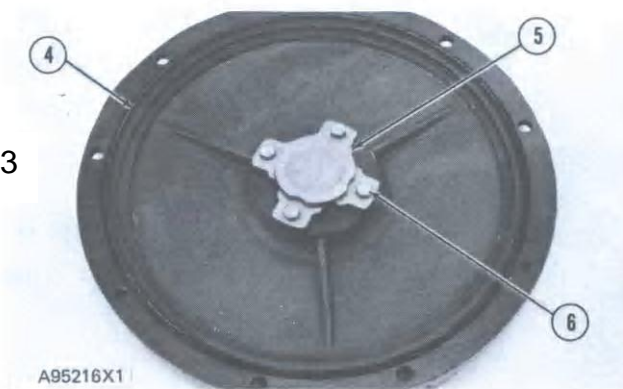
6. Remove cover assembly
7. Check the O-ring seal in the cover for wear or damage. If necessary, make a replacement

Fig 22



8. Remove 0-ring seal (4) from the cover assembly. Remove four bolts (6) then remove plate (5) from the cover.

Fig 23



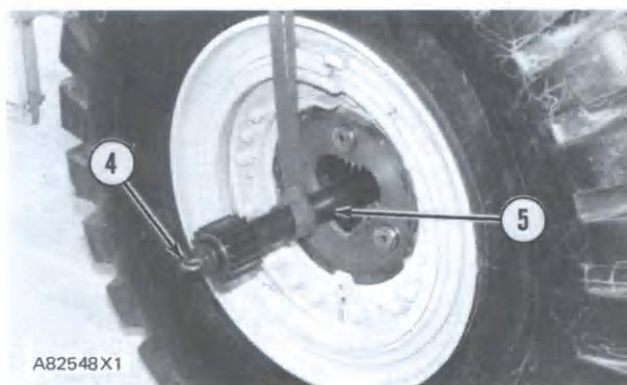
9. Install a 7/16"-14 NC forged eyebolt (4) in the end of the drive axle as shown.

Fig 24



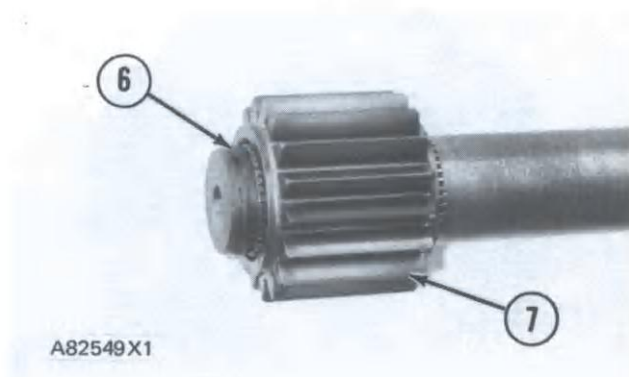
10. Pull drive axle out of the final drive approximately 38.1 cm. Fasten a hoist to the drive axle. Remove drive axle (5). The weight of the drive axle is 34 kg.

Fig 25



11. Remove retainer ring (6) from the axle shaft. Remove gear (7).

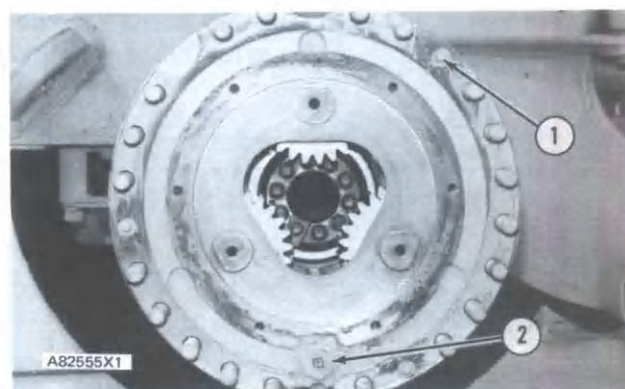
Fig 26



12. Remove three bolts (1) that hold the final drive planet carrier to the wheel assembly.

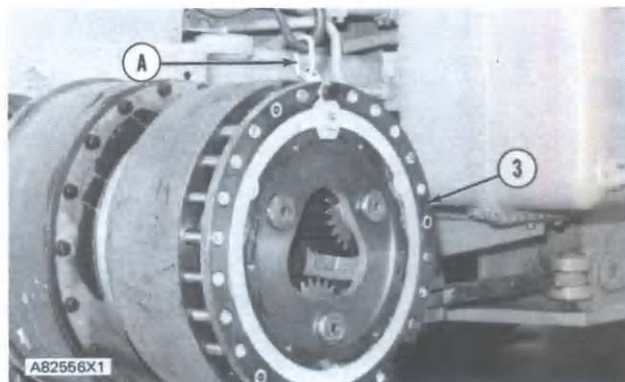
13. Turn the wheel assembly so drain plug (2) is at the top of the wheel assembly

Fig 27



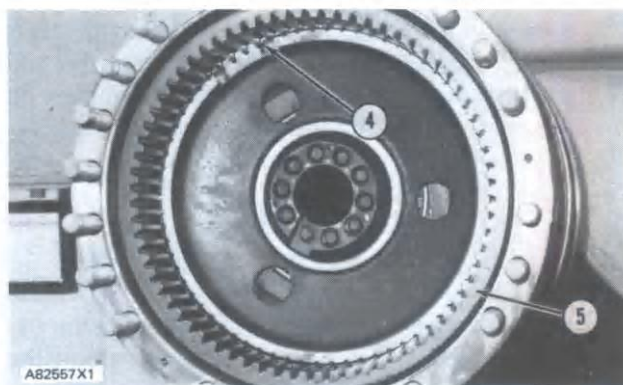
14. Pull the final drive planet carrier forward on the studs approximately 38 mm.
15. Install tooling (A) on the planet carrier as shown.
16. Fasten a hoist to the planet carrier.
17. Remove final drive planet carrier (3). The weight of the final drive planet carrier is 79 kg.

Fig 28



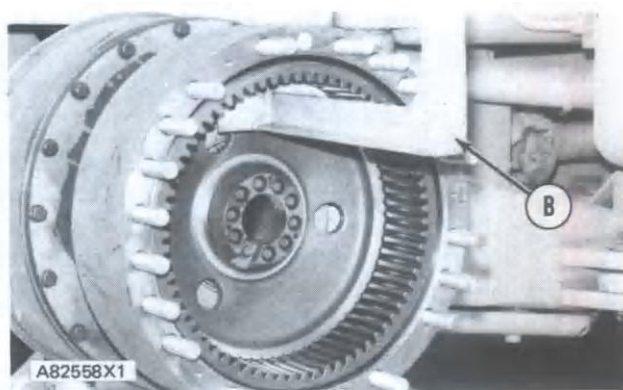
18. Check the O-ring seal on the planet carrier for wear or damage. If necessary, make a replacement

Fig 29



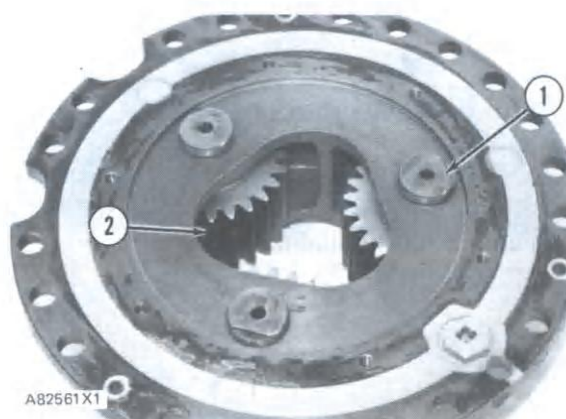
19. Put retainer ring (4) under compression. Slide ring gear (5) forward so that the retainer ring can not go back into the groove in the ring gear.
20. Put tool (B) in position in the groove of the ring gear as shown. Fasten a hoist to tool (B). Remove the ring gear. The weight of the ring gear is 24 kg.

Fig 30



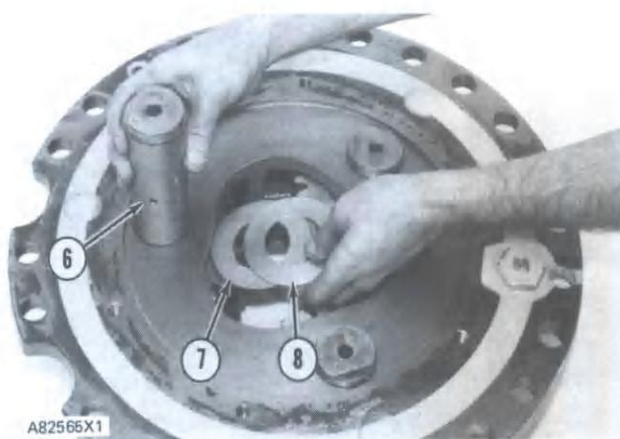
21. Lift three shafts (1) out of the carrier.

Fig 31



22. Remove the shafts (6) from the carrier. Also the thrust washers and gears

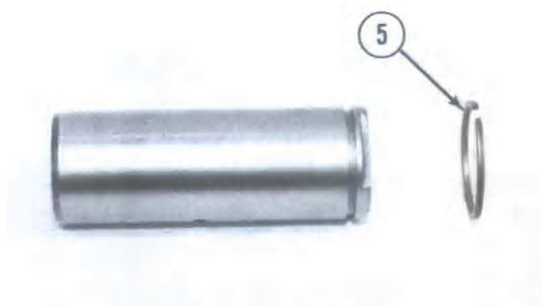
Fig 32



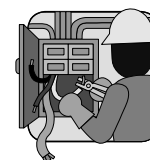
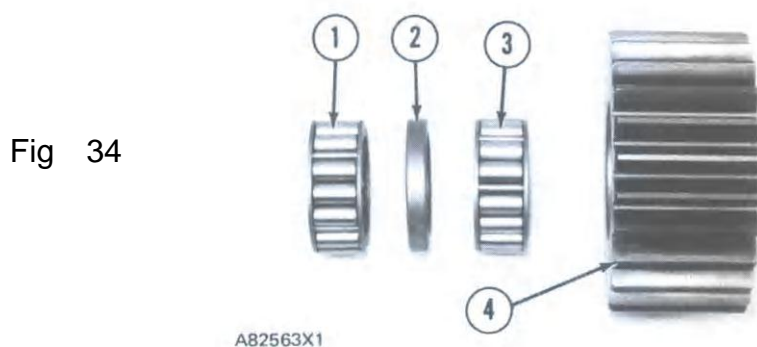
23. Inspect and measure the planetary shafts and compare to specifications

24. Check the condition of retainer rings (5), replace the parts if necessary

Fig 33



25. Check the condition of gears (4). bearings (1) and (3) and spacers (2), replace the parts if necessary



PRACTICE

Referring to these notes and the workshop manual, practice stripping the final drive.

Ask your Training Officer to check your work and if it is correct, to sign below and then go to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

Dismantling the Differential

- * Use a centre punch to match mark the differential carrier caps to carrier assembly.
This is to ensure correct match in reassembly (Fig. 35).

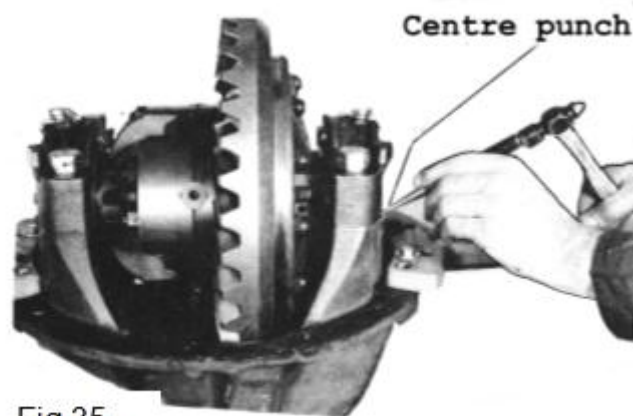


Fig 35

- * Remove the lock wire and the differential adjusting nut lock.
- * Remove the bearing cap bolts and bearing caps (Fig. 36).

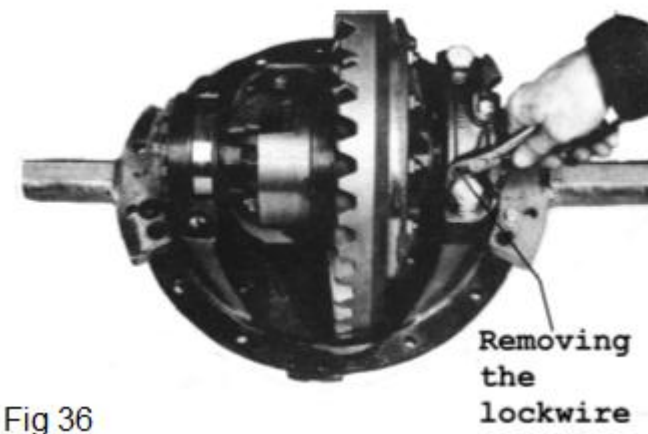
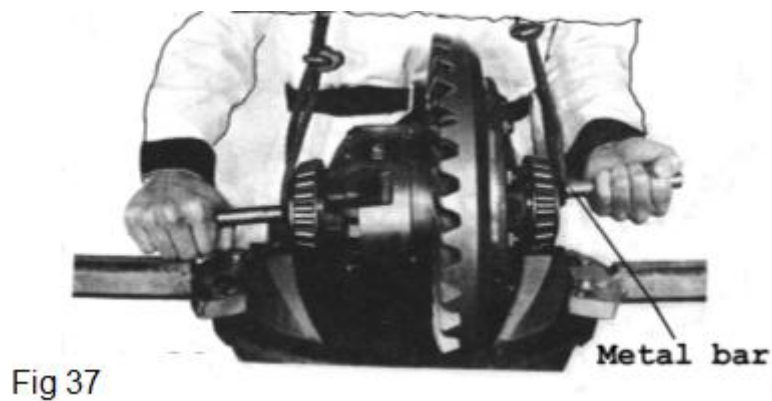
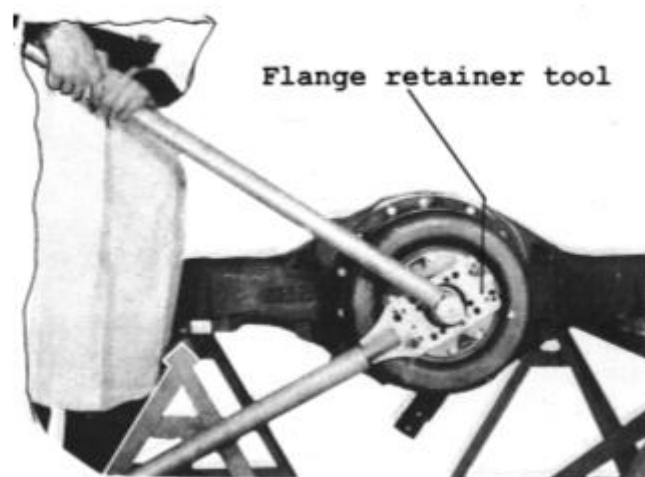


Fig 36

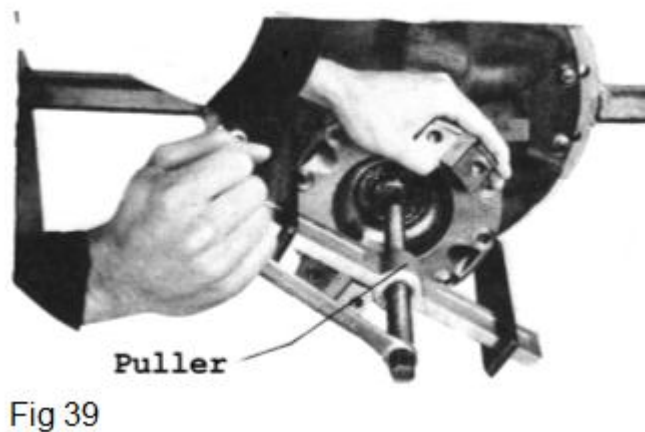
- * Insert a metal bar through the differential and raise it from the carrier assembly (Fig. 37 on the next page).



- * Remove the locking device securing the pinion shaft nut to the pinion shaft.
- * Position the socket on the pinion shaft nut.
- * Install the flange retainer tool on the flange (Fig. 38).



- * Remove the shaft nut and washer.
- * Remove the companion flange from the pinion shaft with a puller (Fig. 39).



- * Remove the bolts securing the seal retainer to the carrier and remove the retainer (Fig. 40).

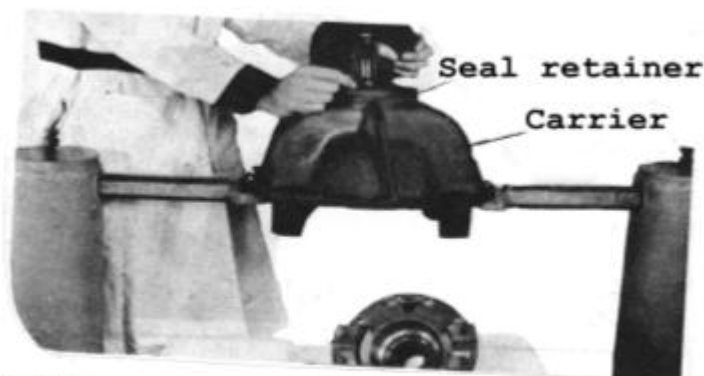


Fig 40

- * If necessary, tap with a soft mallet to break the seal between the parts.
- * Drive the seal from the pinion oil seal retainer. If required, screw two "jack" bolts in the holes provided and pull the bearing cage from the carrier assembly (Fig. 41). This pulls the outer pinion bearing cone from the shaft.

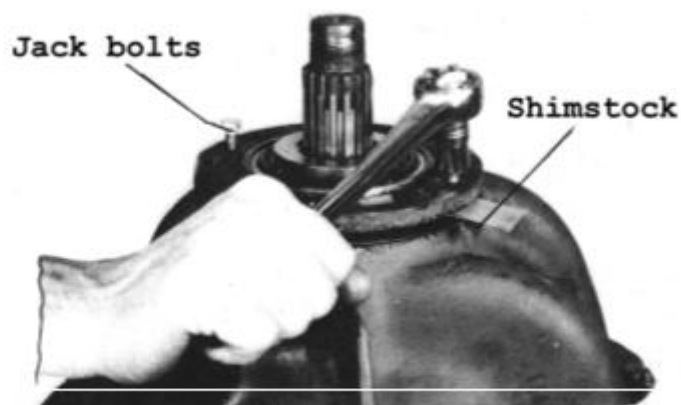


Fig 41

- * Turn each bolt equally to prevent damage to the carrier, shaft or bearing.
- * After the bearing cage is pulled out a short distance, back off the puller screws and insert shim-stock or plate under the puller screws before pulling is continued. This is to reduce possible damage to the shim-pack under the flange of the bearing cage (Fig. 41).
- * Remove the pinion shaft assembly from the carrier (Fig. 42) on the next page..

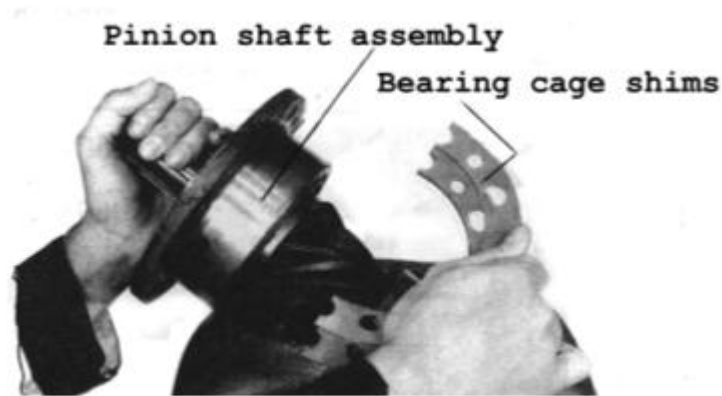


Fig 42

- * Remove the bearing cage shims.
- * Retain the bearing cage shim-pack intact for possible re-use in reassembly.

Disassembling the differential case and ring Gear

- * Match mark the case halves to ensure correct reassembly as shown in Fig. 43.

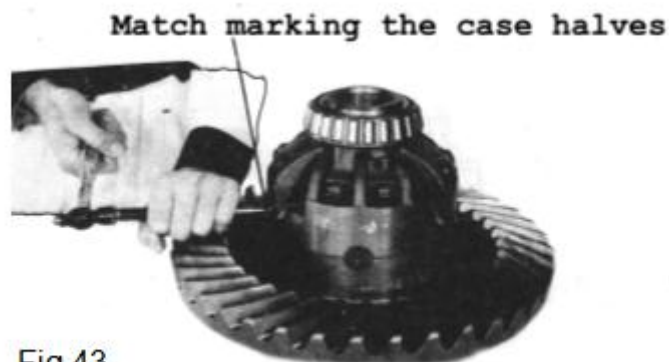


Fig 43

- * Remove the differential bolts securing the case halves together.
- * Lift off the plain case half (Fig. 44) on the next page.

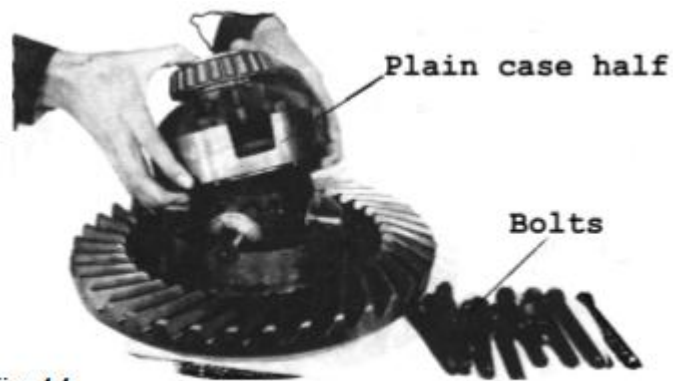


Fig 44

- * Remove the spider, pinions and thrust washer (Fig. 45).



Fig 45

- * Remove the nuts and bolts and remove the ring gear (Fig. 46).

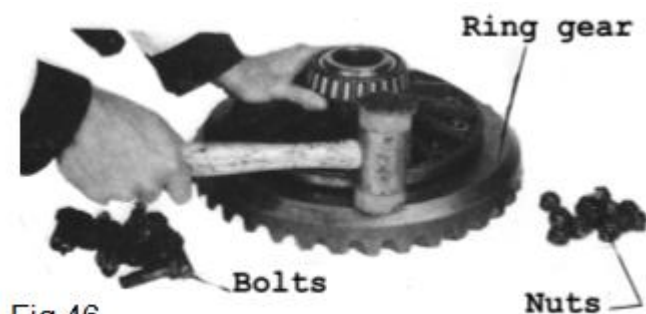


Fig 46

In some configurations the ring gear is rivetted to the ring gear mounting surfaces.

- * Remove the differential bearing cones (Fig. 47).

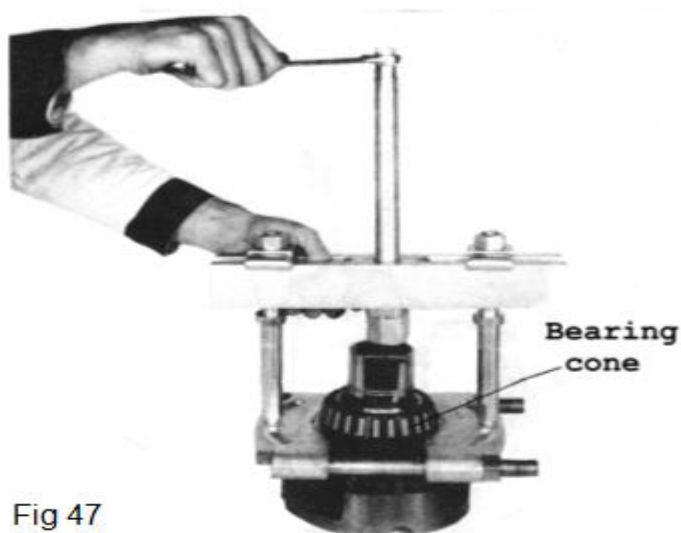


Fig 47

- * Press the pinion shaft from the pinion bearing cage assembly (Fig. 48).

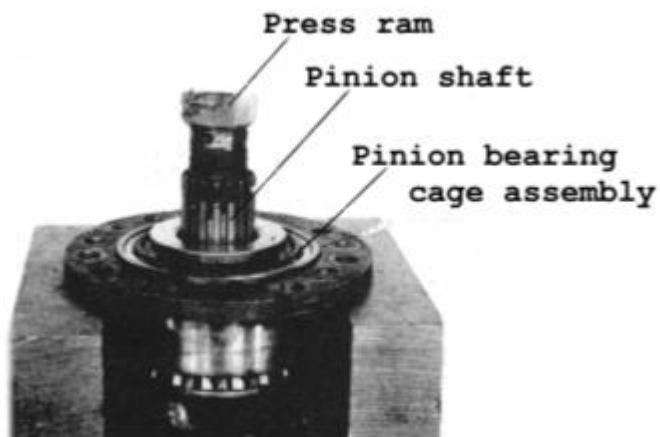


Fig 48

- * Press the centre pinion bearing cone from the pinion assembly (Fig. 49).

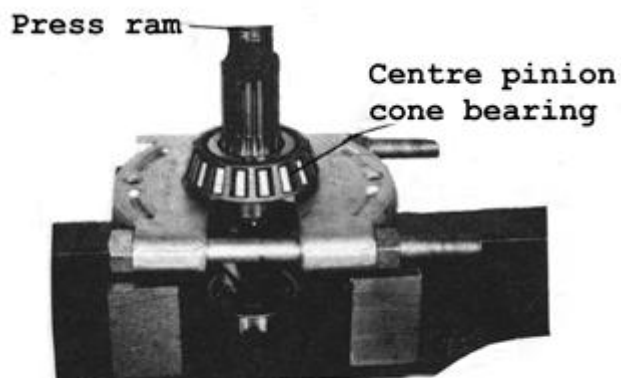


Fig 49

- * Remove the inner pinion bearing snap ring if applicable.

NB: Some pinion shafts have the inner pinion bearing staked to the pinion shaft, thus replacing the retaining ring feature.

Staking is a form of nicking a shaft or sleeve to lock it in position (Fig. 50).

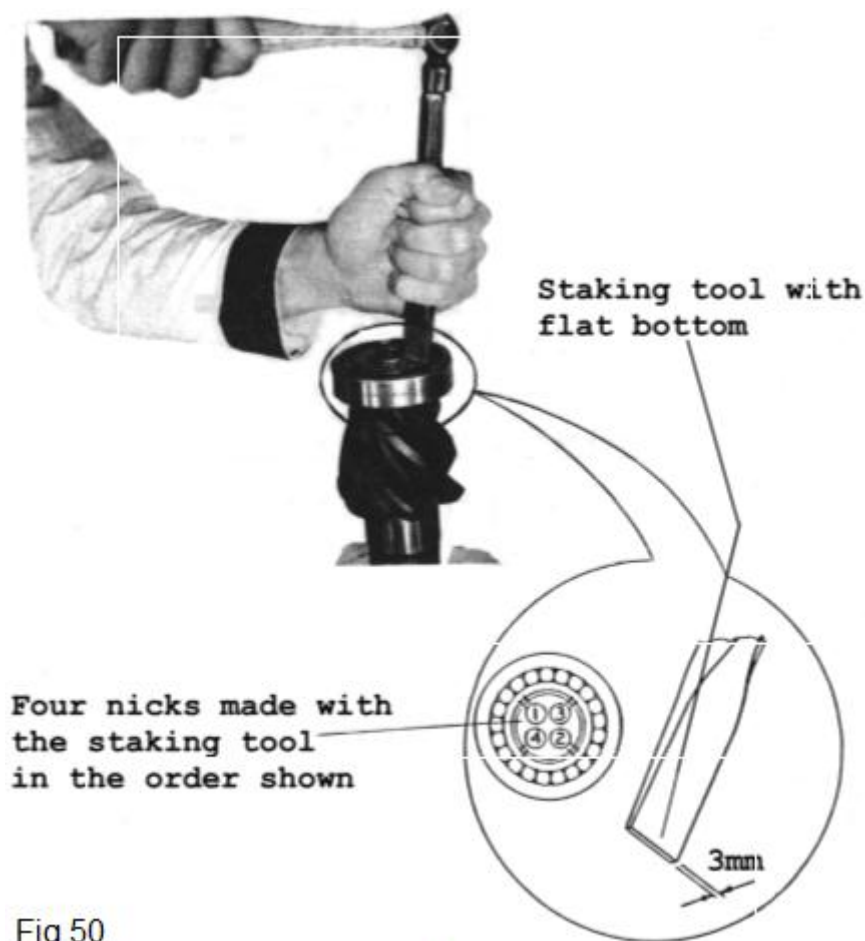


Fig 50

- * Remove the staking before pressing the bearing from the pinion assembly, using a suitable small file.
- * Press the inner bearing from the pinion assembly (Fig. 51) on the next page.

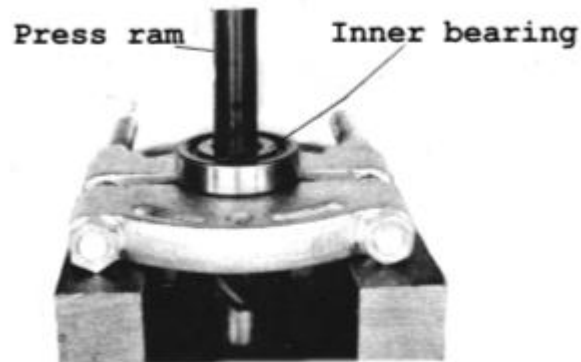


Fig 51

- * If worn or damaged, drive the bearing cups from the pinion bearing cage (Fig. 52).

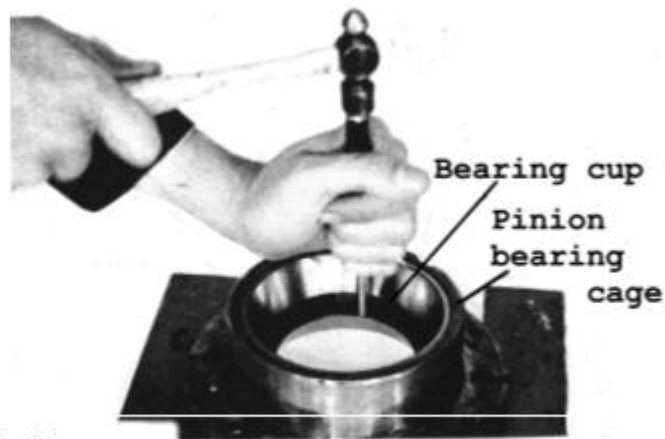
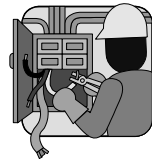


Fig 52

Go on to the next page for the practice.

PRACTICE



Referring to these notes and the workshop manual, practice stripping the final drive.

Ask your Training Officer to check your work and if it is correct, to sign below and then go to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

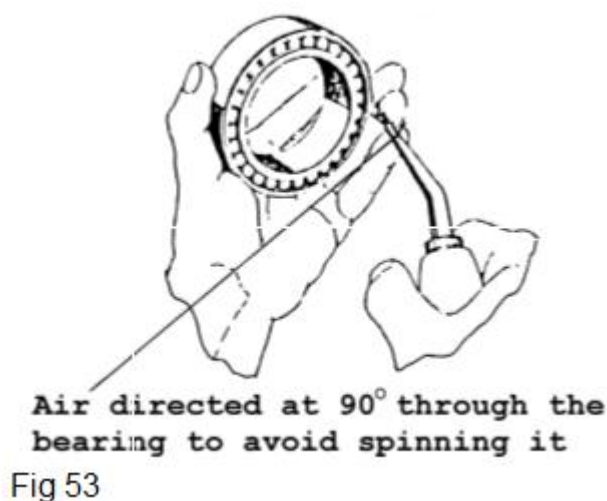
Cleaning and Inspection

Clean all parts thoroughly using solvent type cleaning fluid.

a) Bearings

- * Remove the bearing from the cleaning fluid.
- * Strike larger side of the cone flat against a block of wood to dislodge solidified particles of lubricant.
- * Immerse the bearings in cleaning fluid again to flush out the particles.
- * Dry the bearing using compressed air.

NB: Be careful to direct the air stream at 90° through the bearing to avoid spinning it (Fig. 53).



- * Oil the bearings immediately after cleaning and wrap in a lintless cloth to prevent rusting. (Refer to Module BRR-1).

b) Bearing cups

- * Check the bearing cups for rings, scores, chipping, nicks, or erratic wear patterns. The pinion cups must be solidly seated.

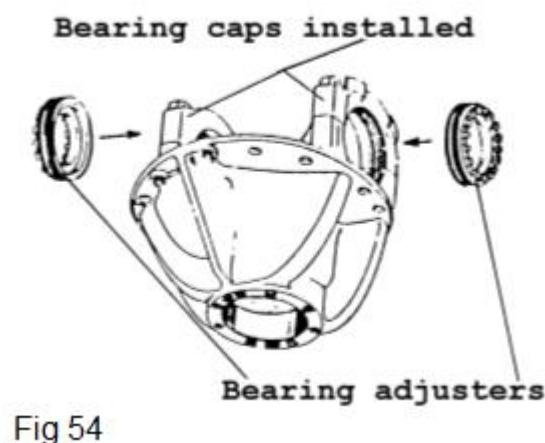
- * Check by attempting to insert a 0,04mm feeler gauge between the cups and the bottom of their bores.

c) Cone and roller assemblies

- * When rotated in the cups, the cone and roller assemblies must turn without any roughness.
- * Examine the roller ends for wear.
Step - wear on the roller ends indicate the bearings did not have enough pre-load or rollers were slightly cocked.

d) Differential bearing adjusters

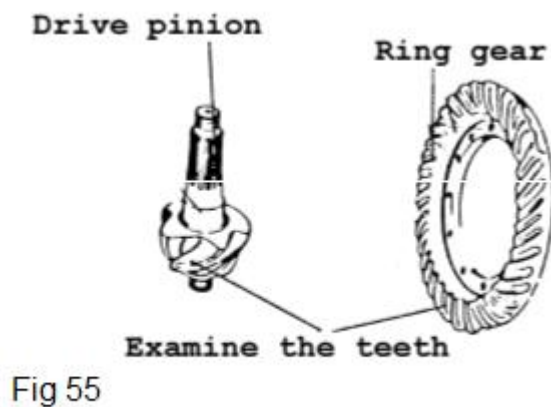
- * Test the fit of the bearing adjusters in their threads with the bearing caps installed
Fig 54.



- * The adjusters should turn easily when the caps are tightened to specifications. Refer to the workshop manual.
- * Check that the faces of the adjusters that contact the bearing cups are smooth and square.
- * Replace the adjusters or examine the threads in the carrier if they do not fit properly.

e) Gears

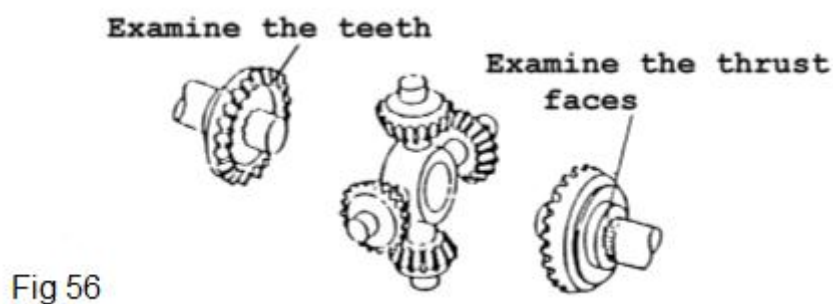
- * Examine the drive pinion and ring gear teeth for scoring, chips, nicks, or signs of excessive wear (Fig. 55) on the next page.



The pattern taken during disassembly should be helpful in judging if gears can be re-used.

NB: Worn gears cannot be rebuilt to correct a noisy condition. Gear scoring and flaking are the result of excessive shock loading, or the use of an incorrect lubricant - scored gears cannot be re-used.

- * Examine the teeth and thrust surfaces of the differential gears (Fig. 56).

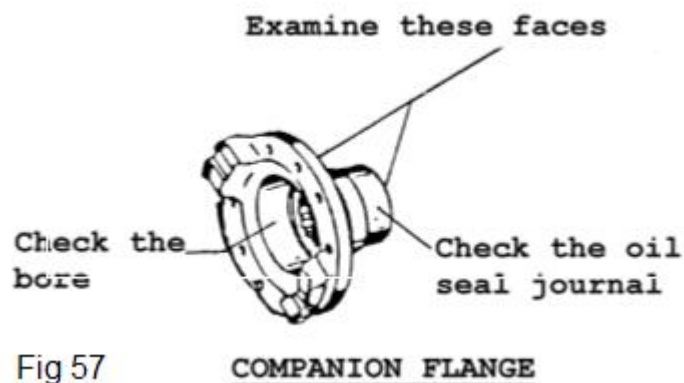


Wear on the hub of the differential side gears can cause a chuckling noise known as a chuckle, when the vehicle is operated at low speeds.

Wear of splines, thrust surfaces or thrust washers can contribute to excessive drive line back lash.

f) Companion flange

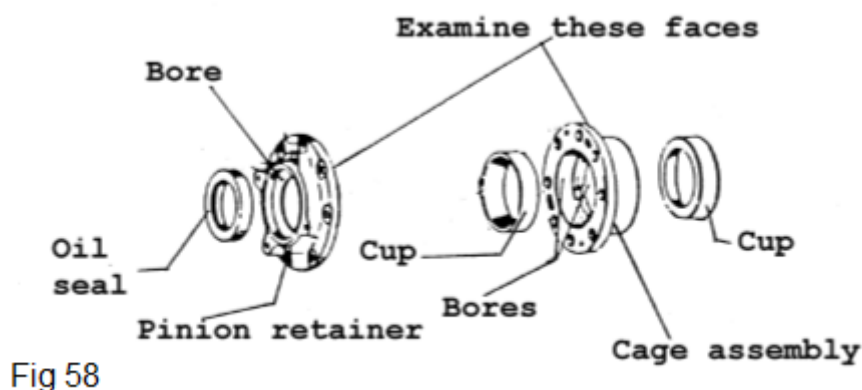
- * Ensure that the flat machined surfaces and the bearing cup sockets of the flange have not been damaged in removing the drive shaft or in removing the flange from the axle.
- * Check that the end of the flange that contacts the oil slinger or pinion front bearing of flange, is smooth. Refer to Fig. 57.



- * Polish this face if necessary.
Roughness aggravates backlash noise, and causes wear on the oil slinger with a resultant loss in drive pinion bearing pre-load.
- * Check that the seal surface is perfectly smooth or leakage will result.

g) Pinion Retainer and Cage Assembly

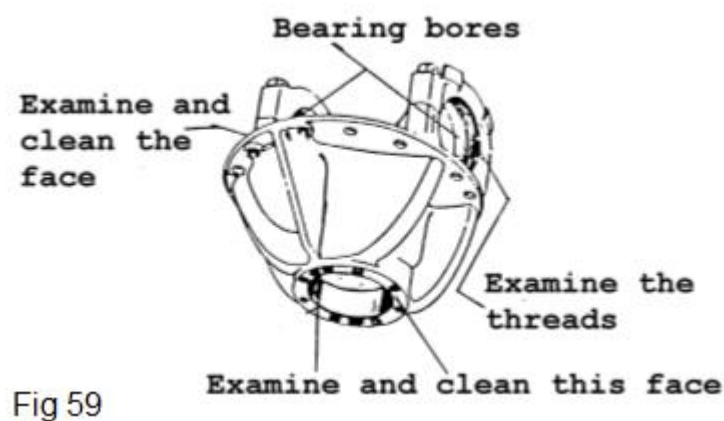
- * Inspect visually for damage.
- * Ensure that the bearing and oil seal bores are smooth and not damaged (Fig. 58).



- * Remove any nicks or burrs from the mounting surface.
- * Ensure that the pinion bearing cups are seated.
- * Examine the bores in the cage assembly carefully if the pinion bearing cups were removed.
- * Clean all lubricant passages.
- * Remove any nicks or burrs in these bores to permit proper seating of the cups.

h) Carrier housing

- * Inspect visually for damage.
- * Ensure that the differential bearing bores are smooth and the threads are not damaged (Fig. 59).

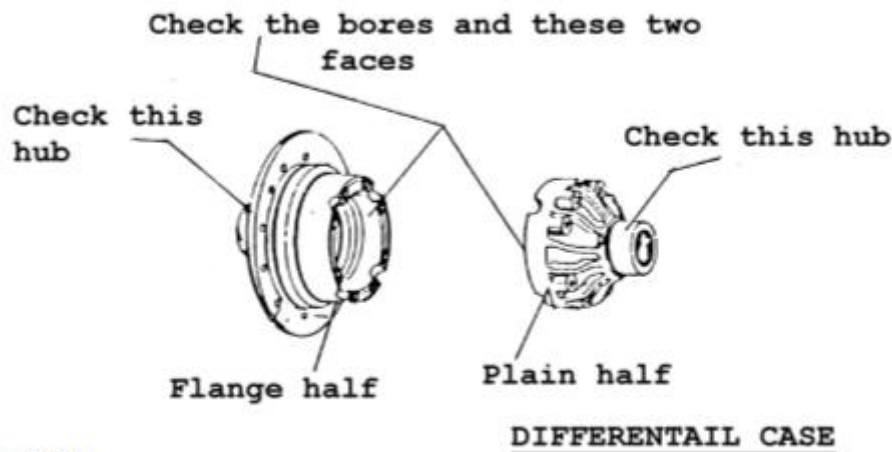


- * Remove any nicks or burrs from the mounting surfaces of the housing.

- * Inspect the housing for sand holes or cracks which could cause lubricant leakage.

i) Differential case

- * Ensure that the hubs where the bearings mount are smooth (Fig. 60).



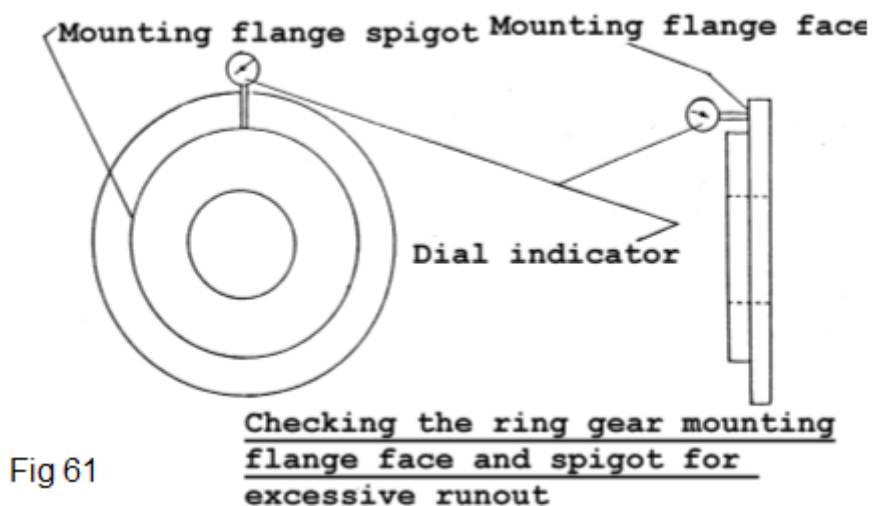
- * Check the fit of the differential gears in the counter bores.
- * Examine the thrust surfaces carefully.
They are sometimes damaged when the bearing assemblies do not seat firmly on the hubs, in which case, failure is certain.
- * Ensure that the mating surfaces of the two halves of the case and the face of the ring gear attaching flange are smooth and free from nicks or burrs.

j) Ring gear run out

If the ring gear run out check during disassembly exceed specifications, the condition could have been caused by warped gear, a distorted or damaged case, or by excessively worn differential bearings.

To determine the cause of the excessive run out, assemble the differential case **without the ring gear** and make the following checks:

- * Mount a dial indicator and then check the face and spigot (pilot) of the ring gear mounting flange for runout (Fig. 61).



If the runout does not now exceed specifications, install a new ring gear to the case. If the run out at tighter point is excessive and the gear is true, the condition is due to either the case of differential side bearings being defective.

- * Install new differential side bearings on the case hubs and install the case in the carrier.
- * Check the case run out. If the run out is still excessive, repair or replace the case.

NB: The ring gear and pinion are always matched. Never replace one without the other.

k) Vent system

- * Ensure that the breather hole in the top of the housing is clean, not blocked or damaged.

l) Thrust block

- * Check that the thrust screw is not bent and that the threads in the casing and lock nut are not damaged (Fig. 62).
- * Ensure that the thrust adjusting screw turns freely in the casing.

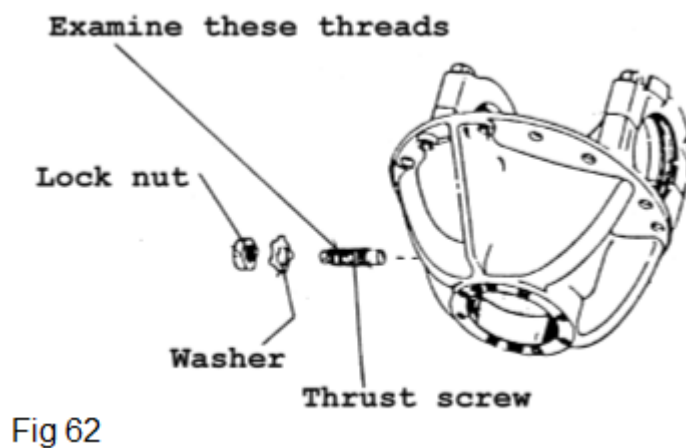
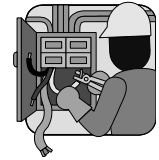


Fig 62

m) Planetary gears

- * Check the planetary pinion shafts and pinion rollers for scouring, chipping, nicks or uneven wear patterns.
- * Check the gear teeth for scouring, chips, nicks or signs of excessive wear.

Go on to the next page for the practice.



PRACTICE

Clean all the parts of the differential and final drives, inspect them and complete the condition report.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire self-tests and practices, you are now at liberty to request a Formative Assessment from your Assessor.