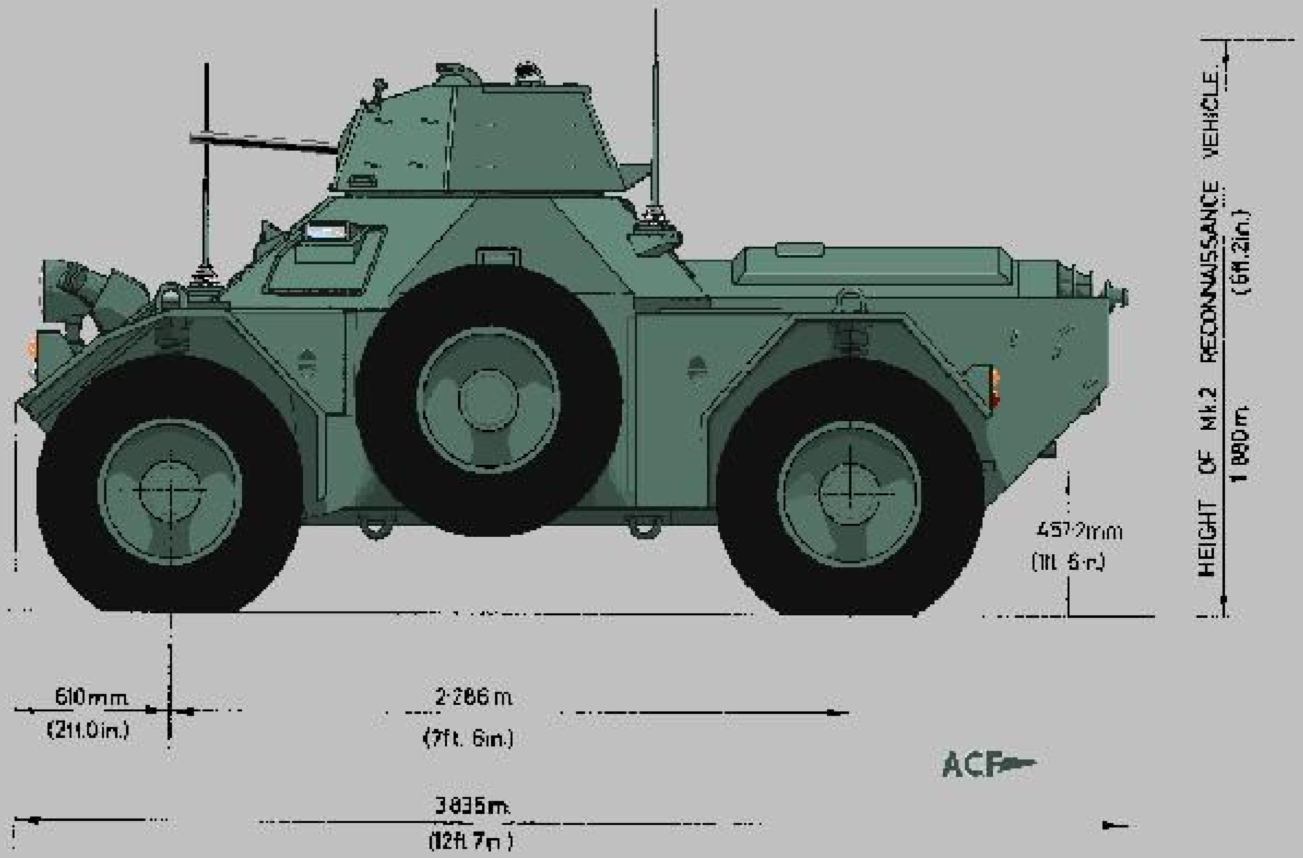
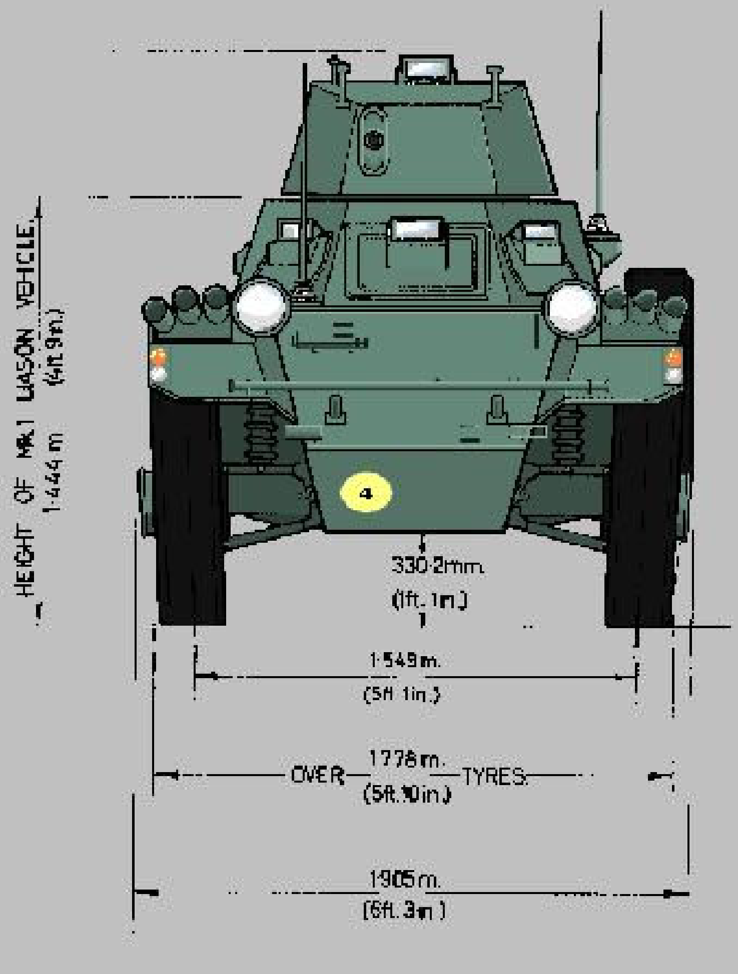
Daimler Ferret Scout Car Precis MK 1 & MK 2

www.ferret-fv701.co.uk





CHAPTER ONE

INTRODUCTION

Ferret is a four wheeled, four wheel drive, armoured, road and cross-country vehicle. Two versions are in use; one for reconnaissance and one for liason duties. The liason version has no turret.

The weight of the heaviest recconnaissance vehicle is 3.7 tons.

The weight of the heaviest liason vehicle is 3.5 tons.

Bridge classification for all versions is 4.

Fording. Prepared - 5 ft. Un-prepared - 3 ft.

Speed. On road - 58 mls/hr. Cross-country - 25 mls/hr.
For safety, road speed should be limited to 45 mls/hr.

Range. On road - 190 miles. Cross-country - 100 miles.

Fuel consumption. On road - 9 miles per gallon. Cross-country - 5 .

Engine. B60 Mk 6A.

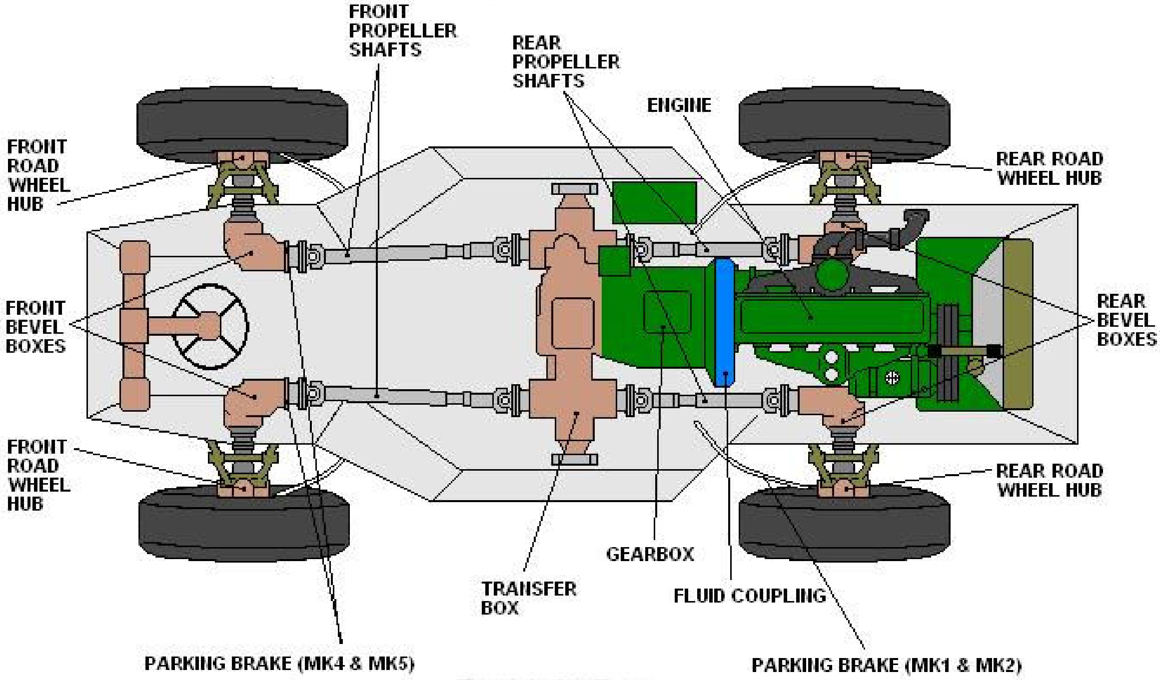
Transmission. 5 speed pre-selector gear box with a fluid flywheel.
Seperate Fwd/Rev is incorporated in the transfer box.
All four wheels are in permanent drive and the road wheel hubs incorporate a final drive reduction.

Brakes. Hydraulic operated, drum brakes, some vehicles having servo assistance. The parking brake operates on all four wheels through rods and cables.

Suspension. Fully independent on all wheels, with coil springs and shock absorbers.

Steering. Manual only, with re-circulating ball race and worm shaft.

Electrical. 24 volt (2 x 12 volt batteries) with voltage reduction to 12 volt for the ignition.



NOTES

CHAPTER TWO

ENGINE

Para		Fig	
2.1	Description.	2.1	Engine (valve gear).
2.2	Valve clearance setting.	2.2	Coolant circuit.
2.3	Cooling system.	2.3	Lubrication system.
2.4	Lubrication system.	2.4	Lubrication system.(diagramatic
2.5	Fuel system.	2.5	Lubrication PRV.
2.6	Ignition system.	2.6	Fuel system layout.
		2.7	Fuel pump.
		2.8	Carburettor layout.
		2.9	Contact breakers.

2.1 Description. The B60 engine is a 4.25 litre petrol engine having compression ratio of 6.4 : 1 giving 98 BHP at 3750 revs/min.
The "A" suffix shows that the engine is adapted for the fitting of the fluid fly-wheel. When the letter has been changed to "E", it indicates that the electrical system has been changed from DC to AC.

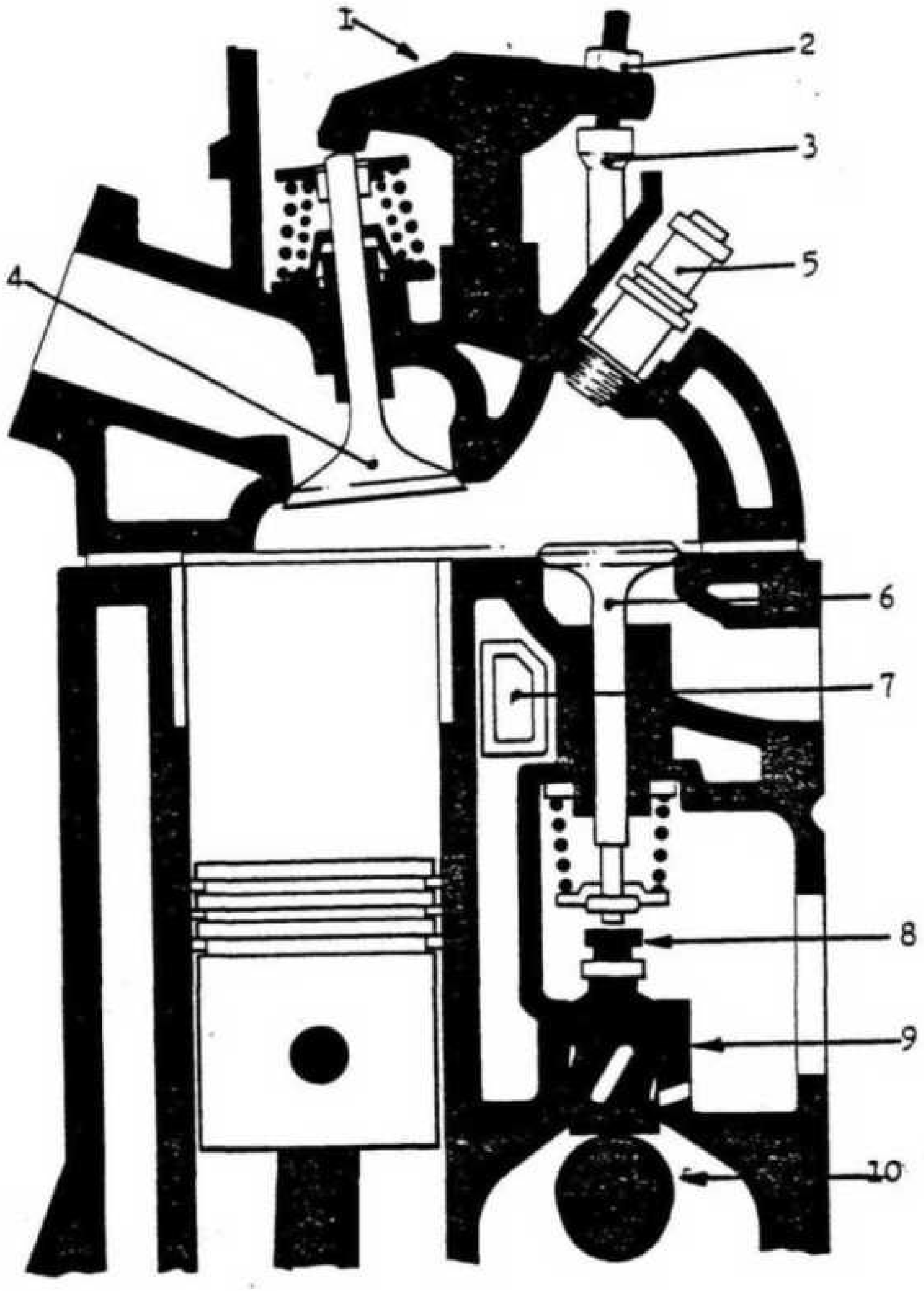
2.2 Valve clearance setting. The inlet valves are "over-head", with push-rods and rockers, and the exhaust are side valve. All are driven from the same cam-shaft.

Inlet valves.

Remove the rocker cover. Turn the engine in normal direction until the valve to be adjusted opens. Continue turning until the valve closes, then turn the engine a further half revolution. Using the special adjuster spanner, set the valve clearance to 0.010 inches.

Exhaust valves.

Remove the exhaust pipes for access and remove the tappet chest covers. Turn the engine until the valve opens, continue turning until the valve closes and then a further half revolution. Fit the locking plate between the valve to be adjusted and an adjacent one and set the valve tappet clearance to 0.015 inches.



1. Inlet valve rocker.
2. Inlet valve adjustment.
3. Inlet valve push rod.
4. Inlet valve.
5. Spark plug.
6. Exhaust valve.
7. Internal coolant rail.
8. Exhaust valve adjustment.
9. Cam follower.
10. Camshaft.

Fig 2.1 Engine (valve gear)

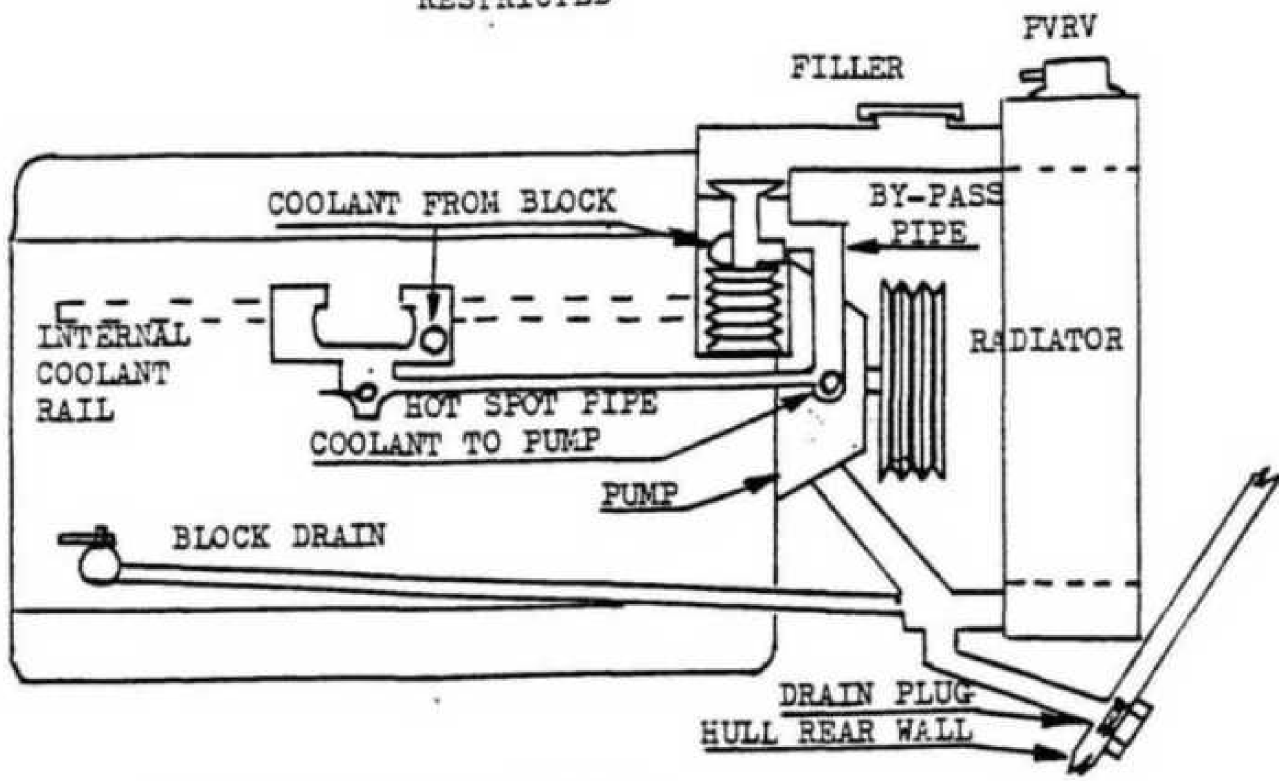


Fig 2.2 COOLANT CIRCUIT

2.3 Cooling system. Thermo-syphon, pressurised system with a coolant pum The pump delivers coolant direct to a coolant rail which runs the leng of the inside of the engine block. Drillings in the rail are positio to direct coolant to the areas around the exhaust valve seats and the coolant then circulates throughout the engine block. It is guided to the inlet manifold side of the engine where some passes to the manifold coolant jacket and the rest direct to the thermostat. The coolant passing through the manifold jacket heats the ingoing mixture and then passes through the external pipe to the pump, so that warm coolant is flowing whether the thermostat is open or closed. If the thermostat is closed the coolant passes along the by-pass to the pump for re-circulation to the engine. If it is open the coolant is directed to the top of the radiator, and the by-pass pipe is closed.

Thermostat. Either a bellows or wax element type. It should open between 75 and 80 degrees C and be fully open at 89 - 93 degrees C.

Pressurisation. The system is pressurised to 11 lbf/sq inch. The vaccuum valve should operate at 3 lbf/sq in below atmospheric pressure. To test the operation of the pressure relief valve:-

Solder a tyre valve to a spare filler cap and fit it to the filler neck.

With the engine stationary and the coolant cold, pressurise to 8 lbf/sq in and examine for leaks.

Increase the pressure to 11 lbf/sq in at which pressure the valve should have opened.

If it has not, replace the PVRV

Fan belts. When a DC generator is fitted, two belts are used. To replace them, the centre part of the fan drive coupling is removed, the generator tensioner rod nuts loosened and the generator pushed towards the engine, when the belts can be removed and passed through the gap between fan and pump. After re-fitting, tension the belts to give an overall deflection of 1 inch. The tension MUST be re-checked after 50 miles. When an AC generator is fitted, the removal and re-fitting procedure is the same except that there are three belts.
In both cases, belts must be fitted in sets, not replaced singly.

Lubrication system. The oil is contained in a tank below the fan cowl. The pressure and scavenge circuits are shown in illustrations 2.3 and 2.4. Within the engine the oil flow divides into a high pressure system and a low pressure one, the high pressure supplying mains, big-ends, connecting rods, cam-shaft and, where fitted, the gear box of the two speed DC generator. The low pressure is supplied to the overhead rocker gear and the timing gears.

The two circuits divide at the pressure relief valve.
The high pressure is limited to 35 lbf/sq in by the HP valve. The low pressure side by the LP valve to 3 - 5 lbf/sq in. Direct feed to the LP circuit takes place when the HP valve lifts but, to prevent lack of oil when the engine is idling, four slots cut on the HP valve seat permit sufficient oil to bleed to the LP gallery to maintain low pressure.
The filter is located on the hull wall in the rear right of the engine compartment. Should the element become blocked, a by-pass valve in the filter head opens when the pressure difference is 10 lbf/sq in.

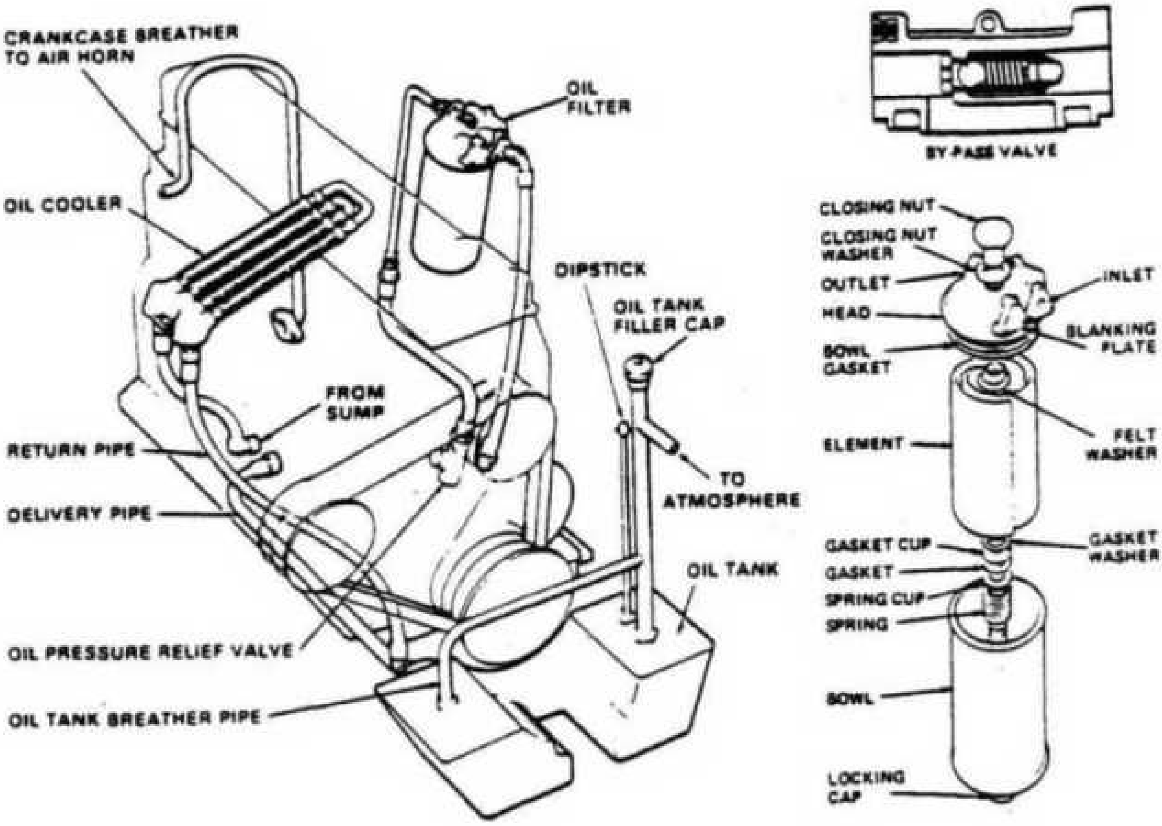


Fig 2.3 LUBRICATION SYSTEM

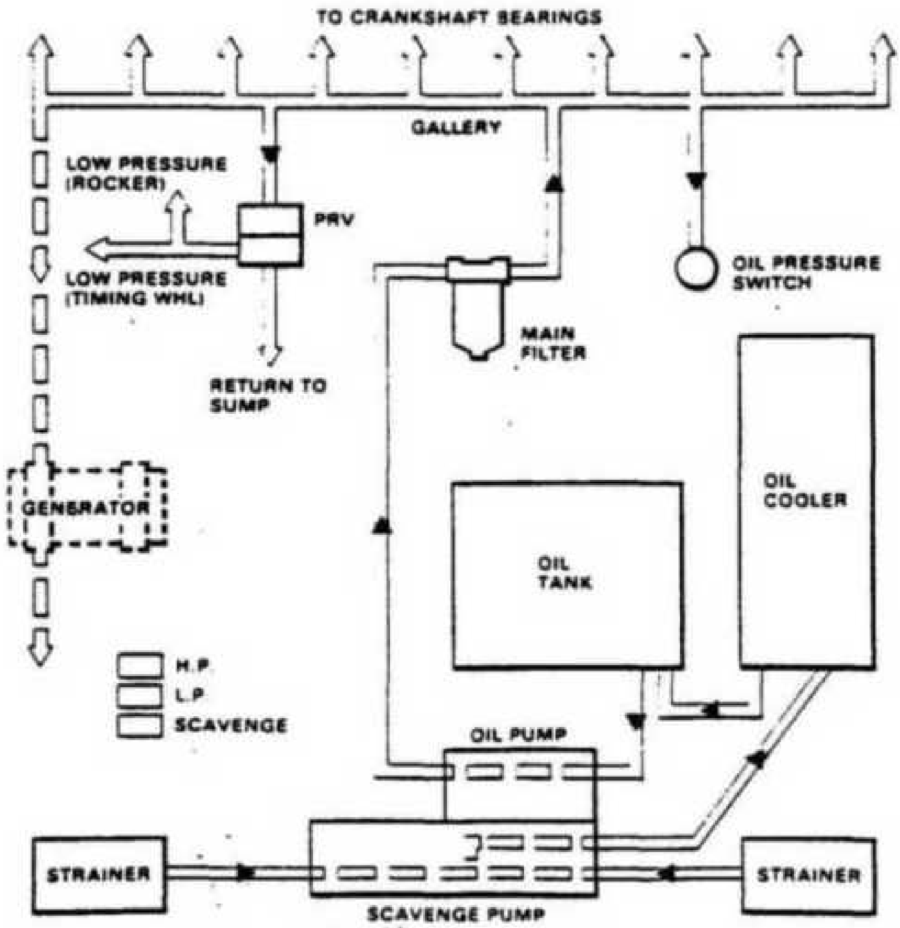


Fig 2.4 LUBRICATION SYSTEM (DIAGRAMATIC)

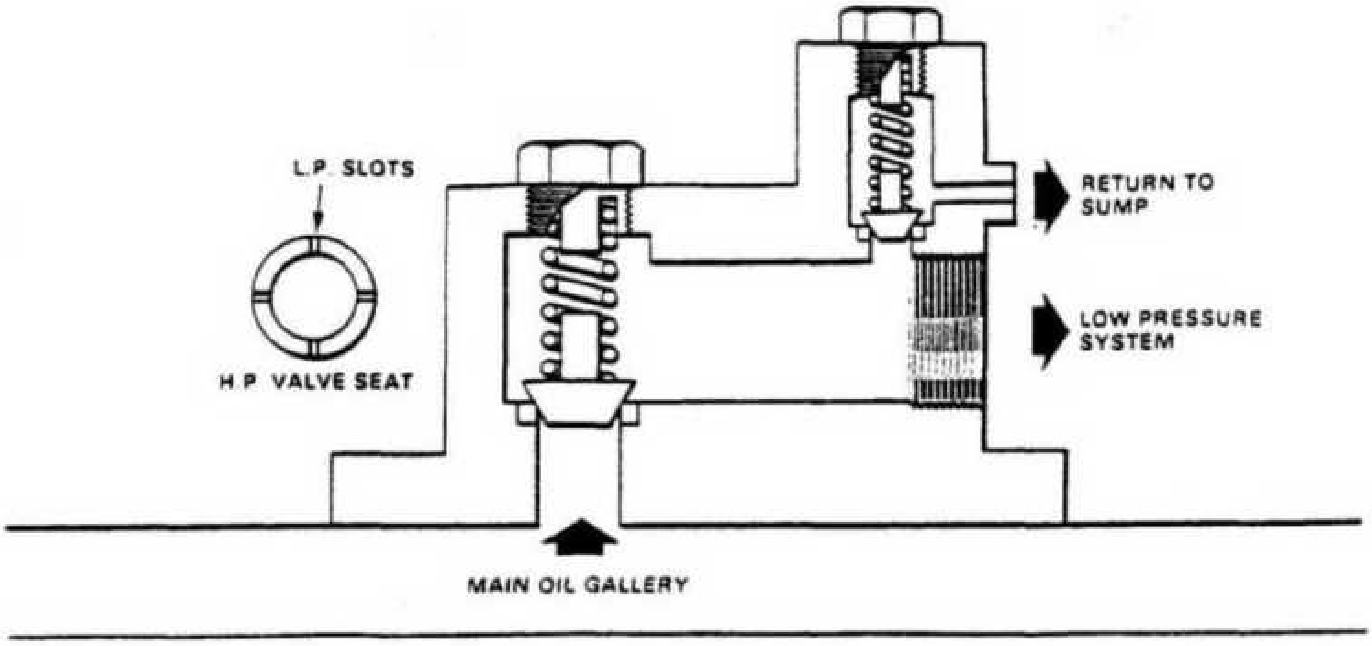


Fig 2.5 LUBRICATION PRV

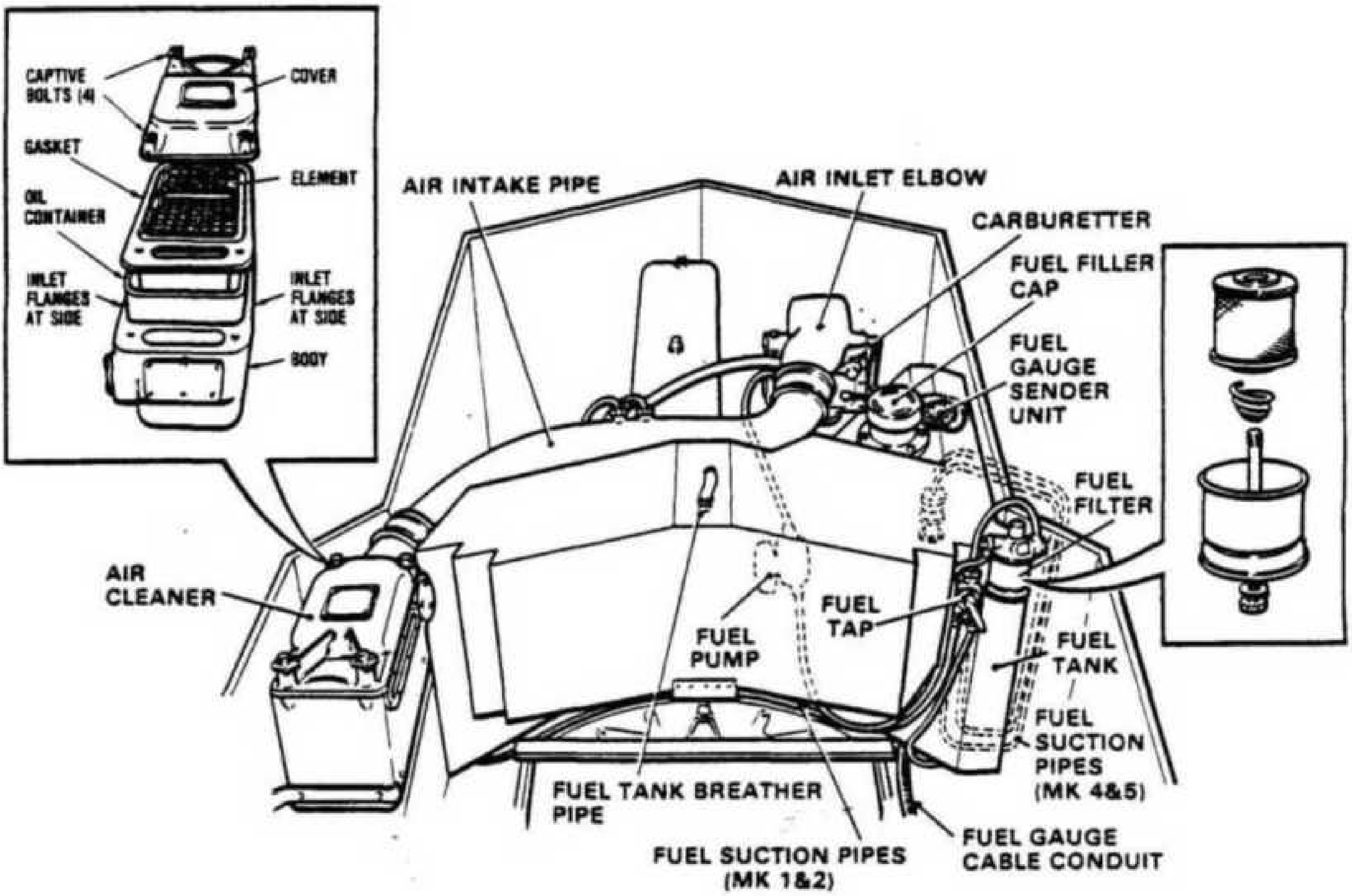


Fig 2.6 FUEL SYSTEM LAYOUT

2.5 Fuel system. The fuel tank is mounted, saddle-like, astride the fluid fly-wheel bell housing. Mounted on it, on a plate, is the tap and filter. The tap has "main", "reserve" and "off" positions. The reserve fuel is left in the part of the tank hanging down the right side of the bell housing when the main part of the fuel has been used. From the tap, the fuel flows to the filter and then to the fuel pump on the left side of the engine. The pump delivers fuel to the carburettor

Filter. Has a gauze covered felt element which is washable and has no provision for a by-pass. An air release plug is fitted to the inlet.

Pump. The "P" type fuel pump is fitted at the lower left front of the engine. A pulsometer diaphragm is fitted in the top cover above the outlet valve to damp out surging of the fuel in delivery to the carburettor. The pumping diaphragm is operated via its stem from the cam-shaft and the idling spring is contained within the main diaphragm stem.- There is a priming lever but it is difficult to reach when the engine is in the vehicle.

Carburettor. Solex 40 NNIP. For location of the jets and operating parts see illustration Fig 2.8.

Fault tracing.

Poor starting. Check:- The starter jet for cleanliness
The idling stop screw for correct speed
The throttle butterfly gap is correct

Poor slow-running Check:- Pilot jets for cleanliness
Correct idling speed - 375 revs/min

Poor acceleration. (Flat spots) Check:- The accelerator jets are clean
The accelerator pump circuit non-return valves are free

Engine lacks power Check:- That the throttle is opening fully
The main jets are clean
The economy jet is clean
The altitude correction device is set correctly for the local height above sea level

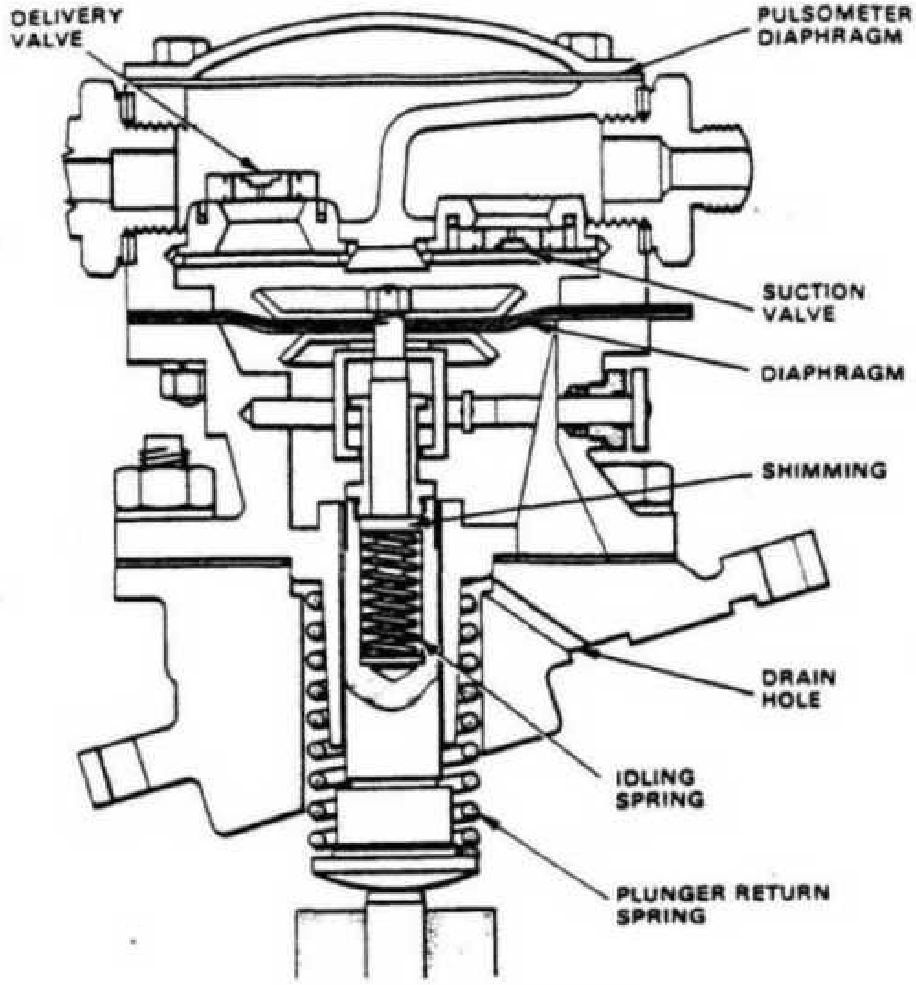
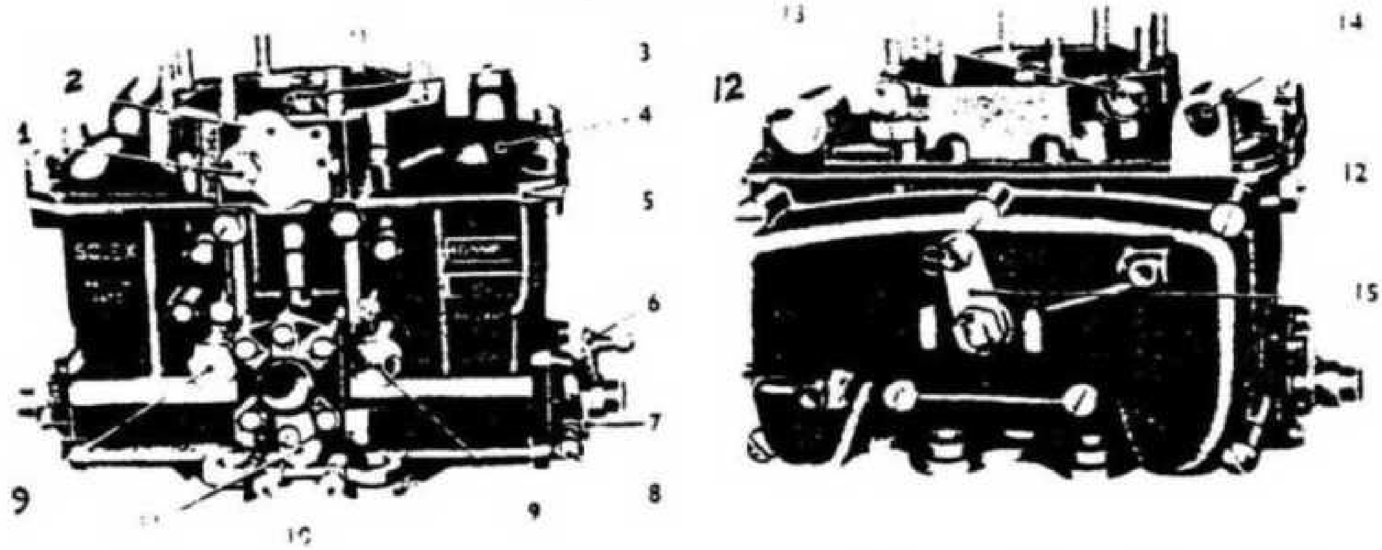


Fig 2.7 FUEL PUMP



1. Altitude control locking screw.
2. Altitude control.
3. Air balance pipe.
4. Top cover.
5. Top cover gasket.
6. Throttle lever.
7. Throttle stop.
8. Throttle stop screw.
9. Main jet and carrier.
10. Slow running screws.
11. Starter jet (normal)
12. Float spindle plug.
13. Accelerator pump nozzles.
14. Fuel inlet.
15. Starting device control lever.

Fig 2.8 CARBURETTOR LAYOUT

2.6 Ignition system. There are two sets of contact breaker points in the distributor. They are connected to the LT supply in parallel so both must be opened to collapse the coil primary field. Because each set opens last on alternate plug firings they have to be synchronised so that all plugs fire at exactly equal intervals. The method of setting the synchronisation on the bench was dealt with in the Electrical Section

Timing the distributor to the engine.

Set the CB points to 0.010 - 0.012 inches.

Remove No 1 spark plug, turn the engine in normal direction, with a finger over the plug hole, until the pressure indicates that No 1 piston is rising on the compression stroke.

Watch the flywheel, whilst continuing to turn the engine, and when the timing marks on the flywheel indicate 2 degrees AFTER TDC, stop turning.

Look in the distributor drive hole and check that the drive tongue is parallel to the engine block.

Position the rotor at 5 o' clock and install the distributor.

Connect a test lamp to the LT post and earth, switch on the ignitio

Turn the distributor body fully to the left, when the lamp should light.

Turn it to the right until the lamp just goes out and tighten the flange clamp nuts.

Checking the synchronisation on the vehicle.

With the test lamp connected, turn the engine until the flywheel marks are approaching TDC and the fixed CB points about to open. The lamp should be lit.

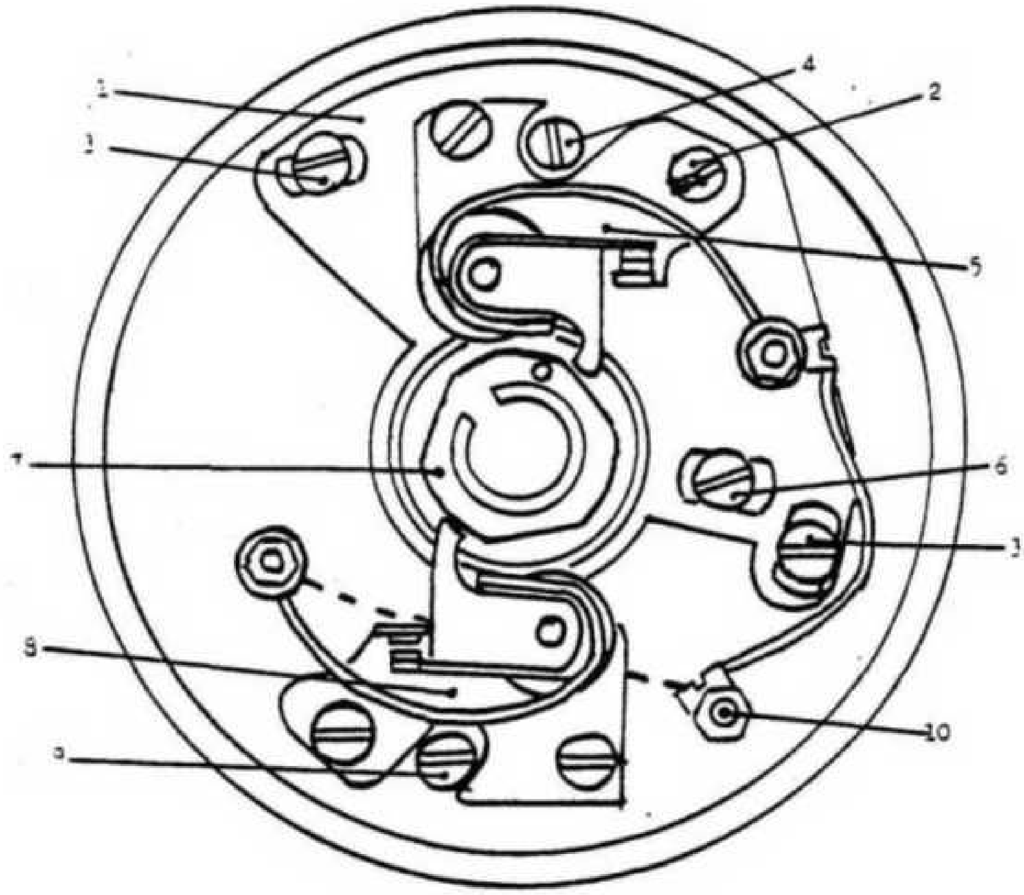
Turn the engine until the lamp just goes out.

Mark the flywheel accorately at the tip of the timing pointer.

Turn the engine nearly one revolution, then turn very slowly until the lamp just goes out again.

The mark on the flywheel should be exactly opposite the pointer.

If the synchronisation is not correct, do NOT attempt to adjust it with the distributor on the engine.



1. Moveable CB base plate.
2. Moveable CB lockscrew.
3. Base plate lockscrew.
4. Moveable CB adjuster screw.
5. Moveable CB points set.
6. Base plate adjuster screw.
7. Spindle and cam.
8. Fixed CB points set.
9. Fixed CB adjuster screw.
10. LT terminal post.

Fig 2.9 CONTACT BREAKERS

CHAPTER THREE

FLUID FLYWHEEL

Para		Fig	
3.1	Construction.	3.1	Fluid flywheel.
3.2	Filling.	3.2	Slip graph.
3.3	Operation.	3.3	Oil seal fitting.
3.4	Advantages and dis-advantages.		
3.5	Fitting the centre oil seal.		
3.6	Testing.		

3.1 Construction. (see fig 3.1) The front casing is bolted to the crankshaft flange. In the centre of the front casing is a bearing on a spigot. The rear casing (fluid flywheel "driving member") is bolted to the front casing, so always turns with the engine. In the centre of the rear casing is a bearing and a recess for an oil seal and its housing. The fluid flywheel runner (the driven member) is bolted to its runner hub and the runner and hub are supported on the bearings of the front and rear casings.

3.2 Filling. There are two filler plugs which balance each other.
Using the special box spanner, remove one plug when it is at 12 o' clock. Fill the flywheel with OM 13 to the bottom of the threads.
Fit a new washer to the plug, mark it, and re-fit the plug.
Spin the engine a few times and leave the flywheel with the un-marked plug at 12 o' clock.
Wait for two minutes to allow the oil to settle and remove the plug.
Check that the level is still correct, top up if necessary.
Using a new washer, re-fit the plug.

3.3 Operation. With a gear engaged and the parking brake 'on' the driven member is held stationary. When the engine starts the driving member turns with it. The fluid is thrown outwards by centrifugal force to the outside of the driving member but, because of the bowl like shape, when it leaves the driving member it is directed to the driven member. The shape of the driven member directs the fluid back to the centre of the driving member from where it is again thrown to the

(cont)

outside to be transferred again to the driven member. Because of the vanes in the driving member the fluid is thrown forward onto the driven member but, at low engine speed, the force with which it is thrown is not enough to turn the driven member. Thus, all the fluid passes back and forth between the two members and there is no drive to the transmission so there is 100% fluid transfer and 100% slip.
When the parking brake is released and the engine speed increased fluid is thrown from the driving member to the driven member at greater speed so with greater force. This makes the driven member start to turn and transmit drive to the gearbox and the vehicle begins to move slowly. As the engine speeds up the force with which the fluid is thrown at the driven member increases and the member speeds up, causing an increase in vehicle speed. The speed of the driven member increases as the rolling resistance of the vehicle lessens until, when the engine speed reaches 1500 revs/min, it is turning nearly as fast as the driving member. Under normal driving conditions the vehicle will begin to move at 600 revs/min so, between that and 1500 revs/min, there is slip between the two members. This range of speed is called the "Slip Range" and is when over-heating, due to excessive slip, is most likely to take place. Engine speed should be maintained above 1500 revs/min when driving.
Because of the inherent slip in the flywheel, the driven member speed is always about 2% less than that of the driving member when the engine is driving the transmission. Thus there is 2% slip and 98% efficiency during normal drive.
When the engine is used to slow the vehicle the forces on the two members is equal only for a moment at the point of over-run.

Advantages and dis-advantages.

Advantages:- Provides a smooth take-off without relying on driver skill.
Needs no routine adjustments.
Less wear for mechanical parts.
Silent and flexible operation.

Dis-advantages:- Slip, and over-heating at low speeds.
Not suitable for towing.
Can only be used with a semi or fully automotive gearbox.

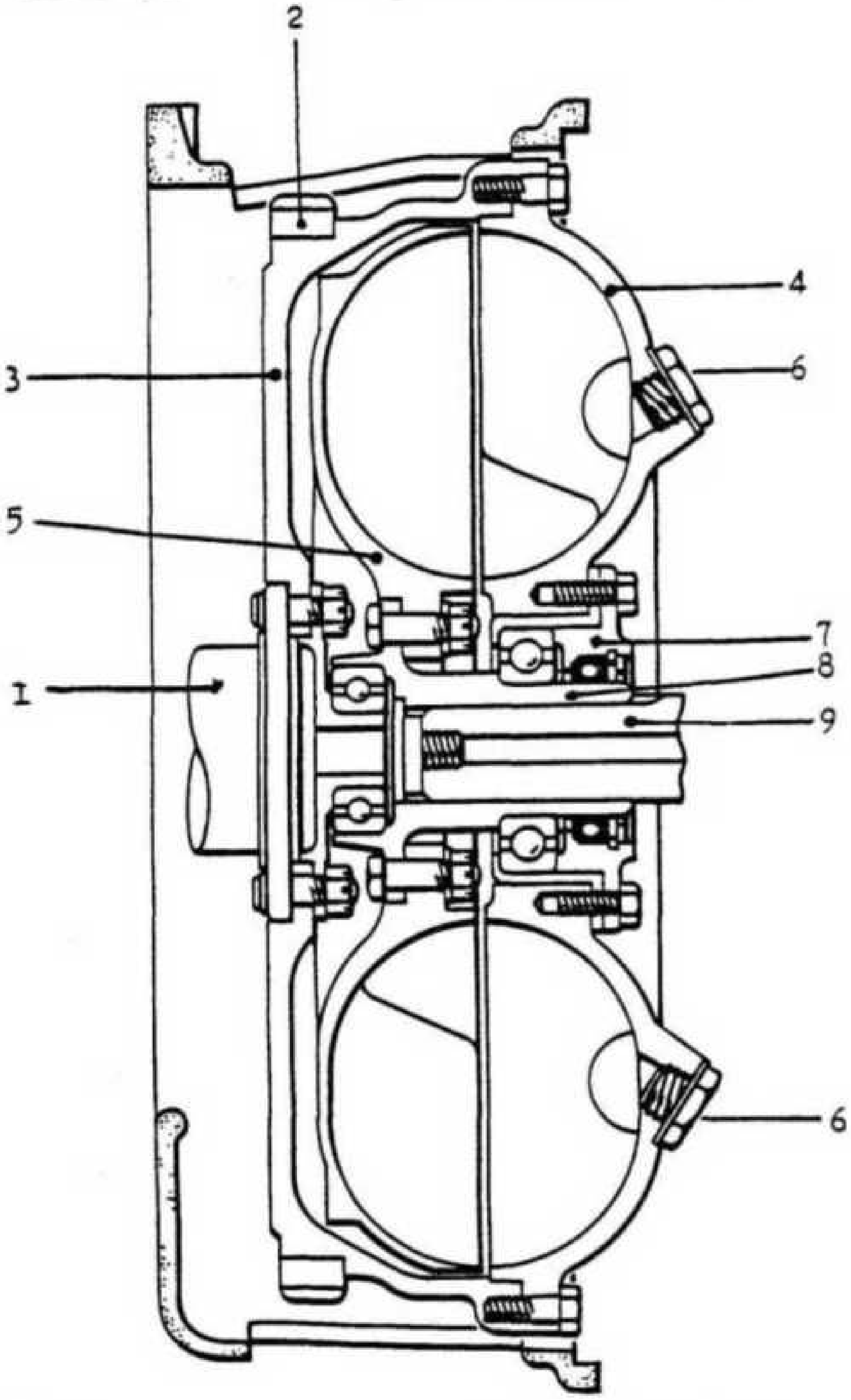
Causes of slip which can lead to over-heating:-

Vehicle "bogged down".

Brakes binding.

Towing another vehicle.

Excessive work at low engine speeds.



1. Crankshaft.
2. Starter ring.
3. Front casing.
4. Rear casing.
5. Runner.
6. Filler plug.
7. Oil seal unit.
8. Runner hub.
9. Gearbox input shaft.

Fig 3.1 FLUID FLYWHEEL

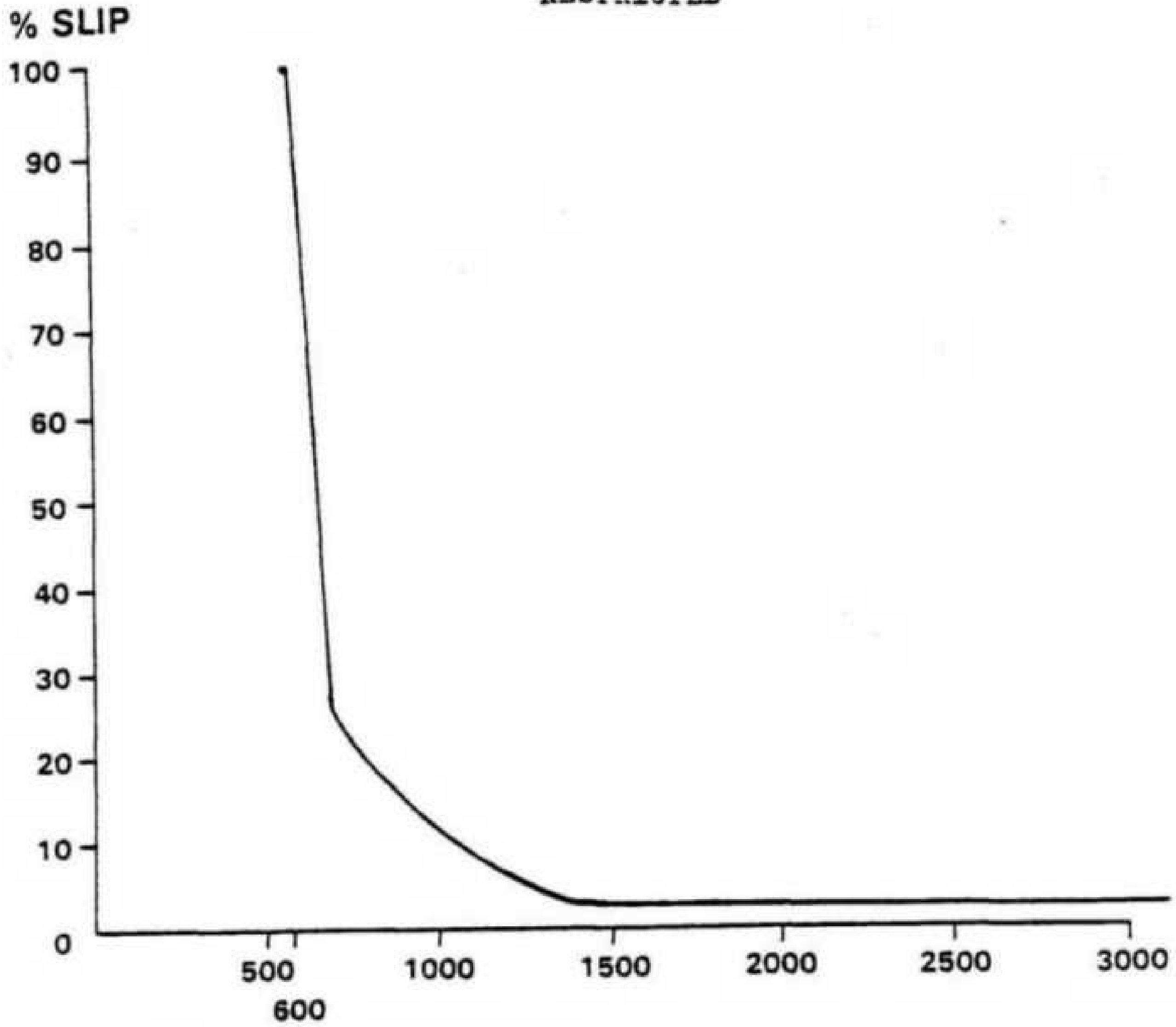


Fig 3.2 SLIP GRAPH

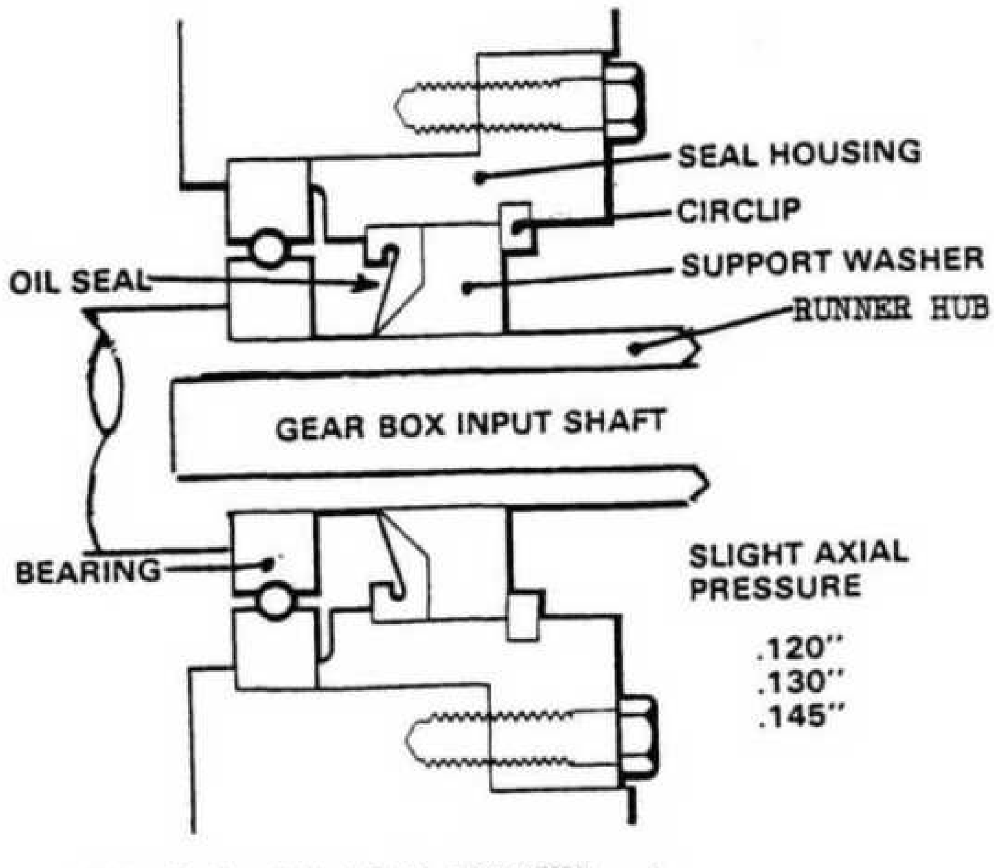


Fig 3.3 OIL SEAL FITTING

3.5 Fitting the centre oil seal. To ensure that the seal grips the runner hub tightly it is fitted in its carrier with a slight pre-load. After removing the old seal, soak the new one in OM 13 and place it in the seal housing. Use the seal press to push it fully home and keep i square. Remove the housing from the press. The seal is loaded with a special washer between the seal and retaining circlip. These washers come in three thicknesses measured at the flange. Select a washer such that the flange comes half-way up the circlip groove. The axial pressure now needed to push the circlip into its groove provides the necessary pre-load.
Washer sizes:- 0.120, 0.130 and 0.145 inches.

3.6 Testing. Remove one of the filler plugs and, in its place, screw the pressure gauge. With a foot pump, pressurise the flywheel to 40 lbf/sq. inch. The pressure must hold for 15 minutes.

NOTES

CHAPTER FOUR

EPICYCLICS AND THE RUNNING GEAR

Para		Fig	
4.1	Construction.	4.1	Epicyclic gear.
4.2	Basic rules.	4.2	Running gear.
4.3	The Master train.		
4.4	2nd gear.		
4.5	3rd gear.		
4.6	4th gear.		
4.7	5th gear.		
4.8	1st gear.		

4.1 Construction. An epicyclic gear cluster comprises an annulus, su and planet carrier. The planet carrier has planet pinions mounted it. The number of pinions indicates the amount of load the epicycl is expected to carry. The advantages of using epicyclic gears is t they contain the three parts in a smaller space than a conventional gear train and there are more teeth in contact, giving it greater strength.

4.2 Basic rules. Only those basic rules needed to understand the Ferret gearbox are included.

1. Annulus held, sun driving, planet carrier driven.
   The planet carrier is driven in the same direction as the sun with a considerable reduction of speed compared with the sun.
2. Sun held, annulus driving, planet carrier driven.
   The planet carrier is driven in the same direction as the annul with only a small reduction in speed compared with the speed of the annulus.
3. Annulus and sun driving in the same direction at different spee
   The planet carrier is driven in the same direction as the annul and sun at the total sum of the speeds given it by the annulus by the sun. e.g. (ignoring the actual speeds of the annul and the sun)

If the annulus drives the planet carrier at	25 revs/min forward
the sun drives the planet carrier at	10 revs/min forward
Planet carrier speed(sum of the two)	35 revs/min forward

4. Annulus and sun driving in same direction at the same speed.
The planet carrier is locked between them, with no rotation of the pinions on their spindles, so the epicyclic will rotate as one. This straight through drive gives a ratio of 1:1. NOTE. In practice, it is usual for the two driving members to be joined and drive only one, rather than try to keep the two speeds matched.

5. Annulus and sun driving in opposite directions.
The planet carrier is driven in the direction of the principal driving member at the DIFFERENCE of the speeds given to it by the annulus and sun. e.g.

If the annulus drives the planet carrier at	25 revs/min FORWARD
the sun drives the planet carrier at	10 revs/min backwards
Planet carrier speed(DIFFERENCE of the two)	15 revs/min FORWARD

6. Planet carrier held, sun driving forward.
The sun spins the planet pinions BACKWARDS on their spindles.
The pinions drive the annulus BACKWARDS.

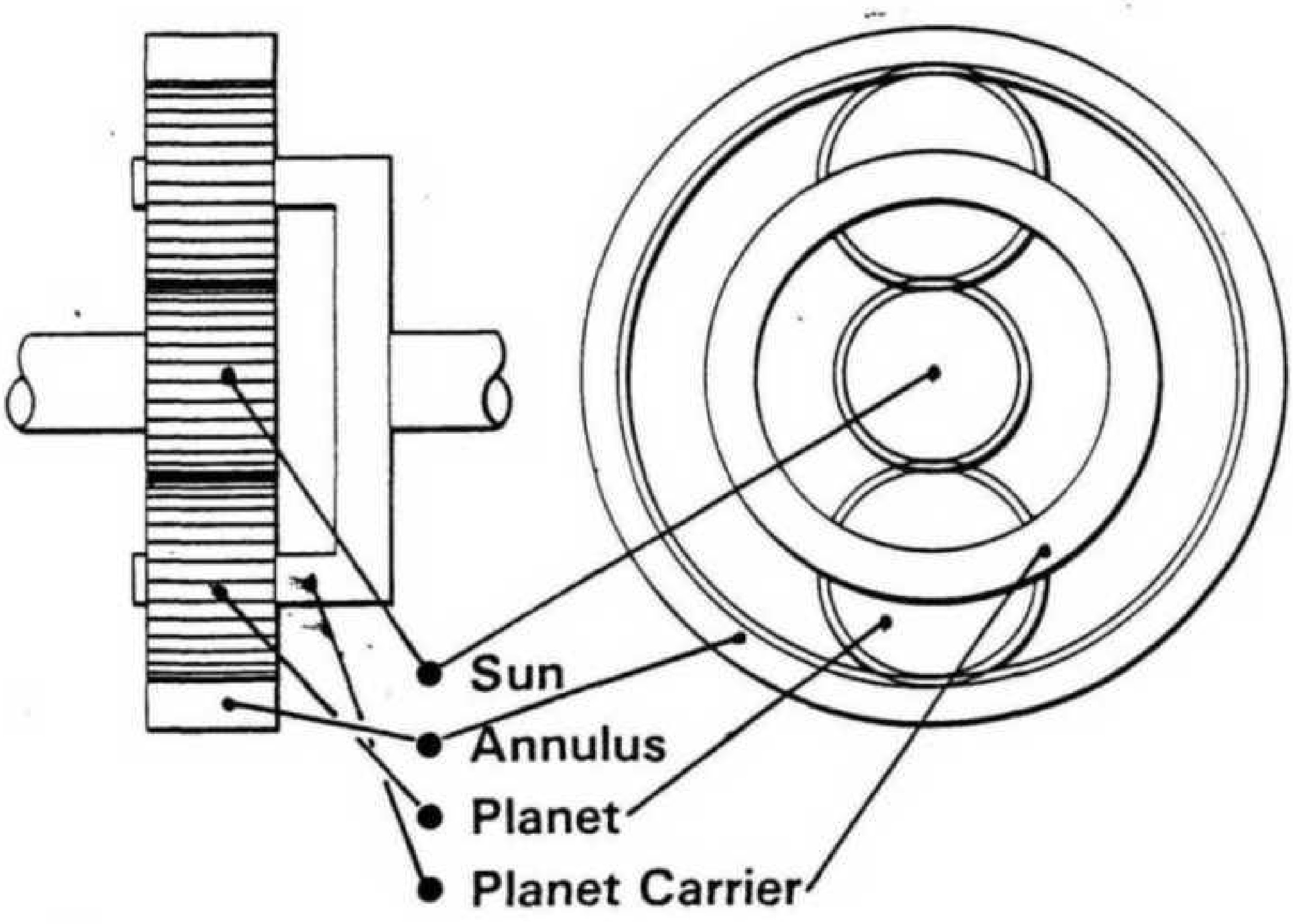


Fig 4.1 EPICYCLIC GEAR

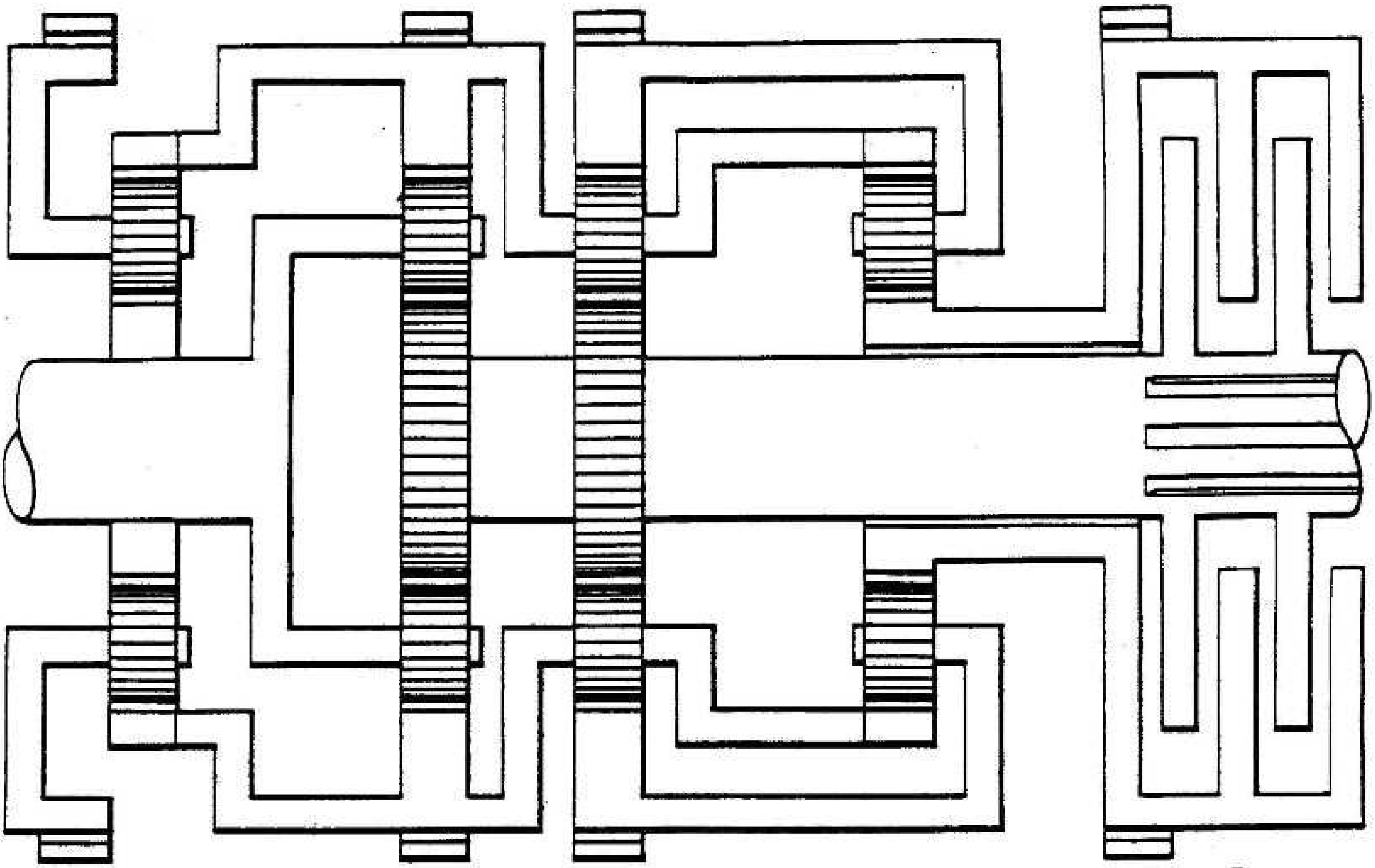


Fig 4.2 RUNNING GEAR

4.3 The Master train. Because the planet carrier of 2nd gear drives the gearbox output, and selecting a gear is designed to affect the speed of the output, 2nd gear is designated the "Master train".

4.4 2nd gear. A brake band is clamped round the annulus of the Master train. The sun, splined on the input shaft from the fluid flywheel, drives the 2nd planet carrier forward around the 2nd gear annulus.

4.5 3rd gear. 2nd gear brake is released and 3rd gear brake clamped on 3rd annulus. 3rd gear sun, splined on the input shaft, drives 3rd planet carrier forward. 3rd planet carrier, connected to the Master train annulus, drives that annulus forward. The Master train planet carrier is driven by its annulus and sun so speeds up compared with 2nd.

4th gear. 3rd gear brake released, 4th gear brake is clamped on a drum which is part of the 4th gear epicyclic sun. 3rd gear planet carrier drives the 4th gear annulus forward, which drives 4th gear planet carrier forward around the 4th sun. 4th planet carrier is connected to 3rd speed annulus so 3rd planet carrier is driven faster because annulus and sun are now driving it.

5th gear. In the 5th gear clutch are inter-leaved plates, some splined on the input shaft and the rest splined in the 4th gear drum. When the clutch is actuated the plates are clamped together so all suns are turning together. Thus, all the gear trains are locked together and the running gear rotates as one mass giving a ratio of 1:1.

1st gear. The brake is applied to the planet carrier. 1st gear sun, splined on the gearbox output shaft, is driving forward. It spins the planet pinions BACKWARDS on their spindles and the pinions drive the annulus BACKWARDS. 1st gear annulus is connected to the Master train annulus so the Master train annulus is driven backwards.
In the Master train the sun drives the planet carrier forward but the backward turning annulus slows the planet carrier to give a lower output speed than in 2nd.

CHAPTER FIVE

GEARBOX

Para

5.1 Description.

5.2 Mainspring and bucket.

5.3 Selector mechanism.

5.4 Pre-selection and gear engagement.

5.5 Operating sequence.

5.6 Automatic adjustment

5.7 Settings.

5.8 Faults and remedies.

5.9 Lubrication.

5.10 Control linkage adjustments.

Fig

5.1 Mainspring and bucket.

5.2 Selector, strut and brake.

5.3 Automatic adjuster.

5.1 Description. Pre-selection of a gear is made with the hand control at the drivers right hand. To engage a gear, the Gear Change Pedal (GCP) at the drivers left foot is smartly depressed and released. Inside the box, the pressing down of the GCP pushes a bus-bar down. When the GCP is released a strong spring(mainspring) raises the bus-bar to apply the brake bands/clutch. As described in Chapter 4 these control the gearbox output speed.

5.2 Mainspring and bucket. (Fig 5.1) The function of the mainspring is to keep the bus-bar up so that gears, once engaged, stay engaged. It is fitted round a telescoping rod to allow for compression and extension during operation. The inner end of the rod seats in a "bucket" which is pivoted on the bus-bar shoulders. The upper end has a socket resting on a pivot on the spring cover.

When the spring is placed in the gearbox the cover is pulled down with its fixing bolts and that compresses the spring. The spring then extends and raises the bus-bar. Thus the bus-bar will always be UP unless the GCP is used to push it down against the spring pressure. The bucket is a means of compensating for loss of effective pressure in the spring as the spring extends in raising the bus-bar. As the bus-bar rises the bucket swings away from the bus-bar pivoting edge to give a leverage to the spring rod (a torque) to multiply the force of the spring.

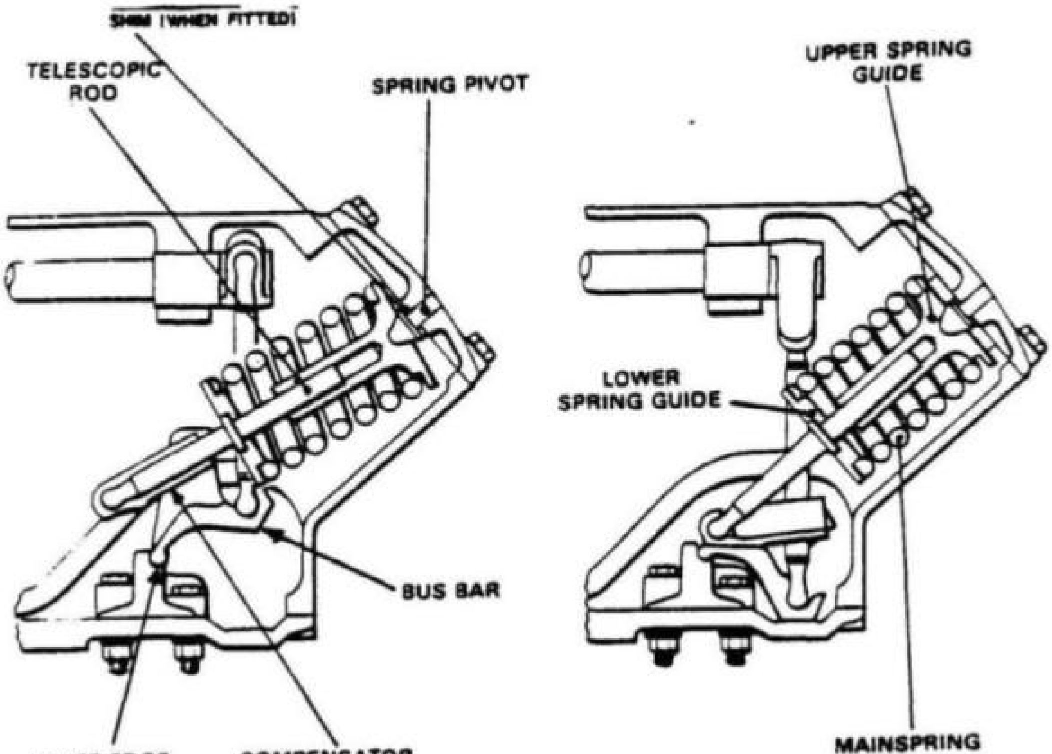


Fig 5.1 MAINSPRING AND BUCKET

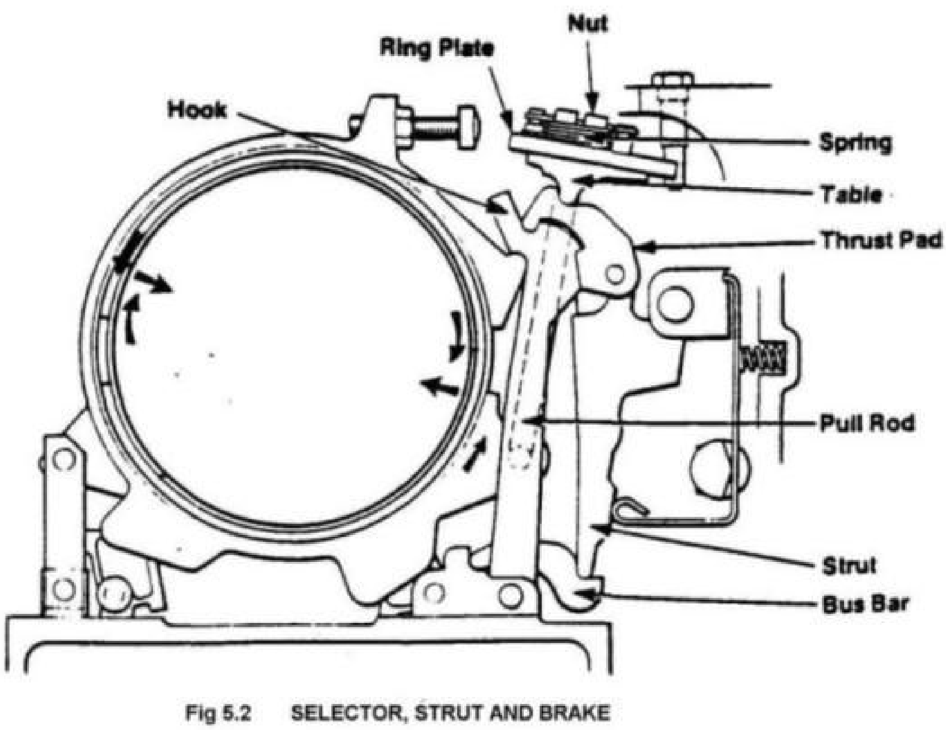


Fig 5.2 SELECTOR, STRUT AND BRAKE

5.3 <u>Selector mechanism</u>. (Fig 5.2) Selection of a gear at the hand control rotates the short lever on the outside of the selection cover which turns the quadrant gear on the inside of the cover. This is in mesh with the skew gear cut on the camshaft so causes the camshaft to turn. The camshaft is obverse-cut and when the full part at any gear position is against the strut guide the guide is pushed back against its spring. If the camshaft is turned to place the cut-away part to the strut guide the guide spring can push the guide and the strut forward. The quadrant and skew gears are punch marked for correct assembly. Across the top of the selector cover is an interlock block with slots to allow the strut ears to pass through. The floating plungers in the interlock cross drilling permit only one ear to pass so , if two struts attempt to rise, neither can pass the interlock.
A neutral strut is pivoted on the interlock block.

5.4 <u>Pre-selection and gear engagement</u>. (Fig 5.2) The amount of travel each strut guide is allowed is about ½ inch. With the gearbox assemb the strut return springs keep their struts pressed back against their guide. This leaves a gap of about 1/8th inch between strut and bus-bar. When a gear is selected the camshaft is turned so that the cut-away is presented to the guide, allowing the guide spring to push guide and strut forward until the strut is against the bus-bar, but the guide still has most of its allowable travel in hand.
If there is a gear already in use, the full part of the camshaft which is next to its strut guide is turned against the guide, pushing it fully back against its spring. The gear is now SELECTED.

To engage the selected gear, the GCP is pressed down, which pivots the bus-bar to its lowest position(against the gearbox floor).
The strut of the gear which was engaged is flicked out of the bus-bar and back against its guide. For the selected gear, the guide spring pushes the guide for the rest of its travel which pushes the toe of the strut over the bus-bar groove. When the GCP is released, the main spring raises the bus-bar which lifts the selected strut to engage the gear. The gear is now ENGAGED.

Operating sequence. (Fig 5.4) The bus-bar continues to push the strut upwards until the brake band is clamped on. This is achieved by the strut using the thrust pad as a lever which pivots in the recesses on the brake hooks. The brake pull rod is pinned to the free end of the "outer" brake band and the other end of the rod is threaded into the adjuster nut, resting on the thrust pad, so that, by levering the nut upwards the rod pulls the band around the running gear drum. The brake assembly contains two bands. The "inner" band is squeezed onto the running gear when the outer band is clamped on. Because its anchor point and free end are 180 degrees away from their matching points on the outer band brake application pressures are equal at diametrically opposite points around the drum.

The height to which the bus-bar rises is dependant on the gap between brake lining and drum. A large clearance permits the bus-bar to rise to near maximum and a small one allows the bus-bar to rise only a small distance before the band is applied.

To clamp the brake on with the correct pressure necessary to stop the drum turning there is a graduated system of leverages, called "Toggle action". As the strut rises to 'break' the thrust pad and lever up the pull rod, the rod is progressively moved closer to the thrust pad pivots. This increases the amount of leverage (toggle action) progressively as the bus-bar rises. The higher the bus-bar rises, the greater the toggle action which means that, if a large amount of toggle action is required, the brake band clearance must be large.

In 1st gear, which has a ratio of about 6:1, it is necessary to clamp the brake on hard so a large amount of toggle action will need a large brake band clearance. In 2nd (about 4:1) less toggle action is necessary so brake clearance is less, and progressively less up the other gears.

5.6 Automatic adjustment. When a gear is engaged its ring plate is just touching the auto adjuster screw head. When the brake lining wears, the clearance between it and the drum increases, so that, on gear engagement, the strut is raised higher than normal. In this case, the ring plate is deflected to the left which loosens the grip of the auto adjuster spring on the auto adjuster nut. As the gear is dis-engaged and the ring plate moves to its rear, the tail pin in the gearbox case deflects the ring plate to its right. This causes the spring to tighten again on the nut during the first half of the rearward travel and then turn the nut during the last half of travel so that the adjuste comes to rest with the spring gripped around the nut. The rotation of the nut causes the brake pull rod to be drawn up a small distance which decreases the brake band to drum clearance. If engagement and dis-engagement is carried out continuously the clearance is decreased a little each time until, when the clearance is correct again, the ring plate is only touching the screw on engagement and no more adjustment takes place.

Continuous operation of the GCP, with a gear engaged, is called "pedalli up". The driver must do this in each gear as part of the daily servicing, until free play is felt. If it is not obtained within a reasonable time it should be reported to REME.

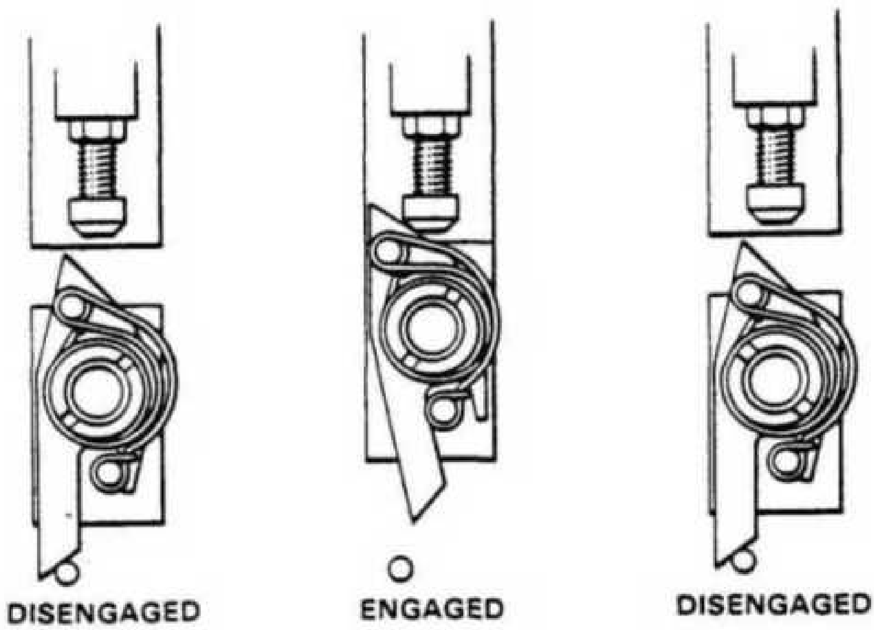


Fig 5.3 AUTOMATIC ADJUSTER

<u>Settings.</u> Removal of the top cover gives access to the adjusters.

1. Slacken the adjuster screws fully back.
2. Remove the auto adjuster springs.
3. Select and engage the gear to be set.
4. Set the bus-bar height setting gauge to the correct length.
5. Place the gauge into the gearbox with the bar resting on the edges of the opening and the rod between 4th and 5th gear, with the rod against the side of the box. Move the gauge toward the running gear until the point is in the bus-bar groove. It should rest firmly in the groove, with the bar resting on the box.
6. If the bus-bar is too high, turn the adjuster nut clockwise until the gauge sits correctly. If it is too low, turn the nut anti-clockwise.
7. When the bus-bar height is correct, leave the gear engaged and bring the adjuster screw out until it just rests firmly against the ring plate but without deflecting the plate.
8. Make a mark, as thin as possible, on the table fixed post and another, exactly aligned with it, on the adjuster nut.
9. Unscrew the nut ¼ turn, refit the spring and pedal up UNTIL THE NUT STOPS TURNING.
10. If the mark on the nut has passed the mark on the post, screw the adjuster screw IN a couple of flats, unscrew the nut to a ¼ turn before the fixed post again and repeat the test.
11. If the mark on the nut has not reached that on the post, screw the screw OUT a couple of flats and continue to pedal up.
12. Continue with the setting until the marks are exactly co-incident when the nut stops turning.

<u>Bus-bar height settings</u>

Gear	Inches	mm
1st	6.90	175
2nd	7.05	179
3rd	7.15	181
4th	7.20	183
5th	7.45	189

.8 Faults and remedies. These minor faults can be rectified on the vehicle by removal of the top cover or the selector cover.

1. Insufficient brake band clearance.

Symptom:- "Slip" in the affected gear only.

Cause:- The auto adjuster has operated too soon, closing the lining to drum gap and lessening the toggle action.

Remedy:- Set the bus-bar height and auto adjuster correctly

2. Excessive brake band clearance.

Symptom:- "Slip" in the affected gear, with

Cause:- The auto adjuster has failed to operate. Typical reasons:- failed adjuster spring, siezed adjuster nut, faulty tail pin.

Remedy:- Rectify the fault and set the bus-bar height and auto adjuster.

3. Faulty strut guide/guide spring.

Symptom:- The vehicle will not drive in the affected gear and any attempt to engage the gear produces heavy kick at the GCP.

Cause:- The strut is not pushed over the bus-bar groove when the bus-bar is lowered and the bus-bar rises to maximum height empty.

Remedy:- Remove the selector cover and replace/refit the defective part.

4. Failed strut return spring.

Symptom:- The vehicle will only drive in the affected gear.

Cause:- The affected strut stays in line with the bus-bar groove and is lifted together with any other gear strut selected when engagement is attempted. The interlock prevents double engagement so only the affected strut can be engaged.

Remedy:- Remove the top cover and replace the failed strut with a replacement.

Lubrication. Capacity 10 pints (5.7 ltrs) OMD 75.

A spur gear type pump is fixed to the bell housing and driven by the input shaft. It draws oil from the supply in the bottom of the box and directs it into the hollow shaft. Drillings are spaced along the shaft to provide lubrication the running gear bushes and inside the epicyclics. A PRV in the pump limits the delivery pressure to 15 lbf/sq. in.

All other parts of the box are lubricateted by "splash".

Control linkage adjustments.

GCP. With 1st gear engaged, adjust the rods to obtain ½ inch free play.

Gear selection linkage.

Remove the top cover.

Remove the clevis pin from the top yoke of the short rod on the side of the box.

Pull the lever on the outside of the selector cover fully UP.

Press and release the GCP and check that 1st gear is engaged.

Select 1st gear in the hand control gate.

Adjust the linkage until the clevis pin fits smoothly in the yoke.

With the clevis pin removed, push the gearbox lever fully DOWN.

Select 3rd gear in the hand control gate.

Check that the clevis pin fits cleanly in the yoke.

FWD/REV linkage.

Remove the transfer box top cover.

Remove the clamp bolt and push the transfer box shaft lower lever down off the shaft.

Turn the shaft until the sliding dog is exactly mid-way between the bevel wheels.

Check that the upper lever on the shaft is in line with the vehicle centre line.

Place the FWD/REV control in its mid-way position.

Fit the shaft lower lever on its splines such that it is at right angles to the upper lever

CHAPTER SIX

TRANSFER BOX AND WHEEL DRIVE

Para

6.1 Transfer box.
6.2 Propellor shafts and bevel boxes.
6.3 Constant velocity joints.
6.4 Hubs and final drives.
6.5 Hub bearing clearance.
6.6 Outer tracta joint clearance.

Fig

6.1 Transfer box.
6.2 Wheel station.
6.3 Hub assembly.
6.4 Tracta joint clearance.

6.1 Transfer box. (Fig 6.1) Two bevel wheels are supported on bearings in the upper part of the case; they are in constant mesh wit the gearbox output bevel pinion so, looking from the front of the vehicle, the left wheel is always turhing backwards and the right one always forward. Splined on the shaft passing through the middle of the wheels is a dog clutch so, if the dog is meshed with one of the bevel wheels, it drives the shaft in the direction of that wheel. The dog is engaged with the left one (looking from the front of the vehicle) for Forward.

The double helical gears carry the drive to the differential in the lower part of the case which drives the output shafts and their bevel wheels. Meshing bevel pinions carry the drive to the propellor shaft flanges.

Lubrication. 6 pints (3.41 ltrs) of OEP 220. There is no pump, all parts are splash fed. An oil seal between the gearbox and transfer box sections prevents transfer between the two.

6.2 Propellor shafts and bevel boxes. Conventional shafts, front ones longer than the rear, transmit drive from the transfer box to t bevel boxes. Left front and right rear bevel boxes are interchangeable and RF and LR. Inside each bevel box the drive is turn at right-angles onto a short shaft which is a forked shaft for the wheel station inner tracta joint. (Fig 6.2). A sliding seat allow the tracta joint to move in and out as the wheel station rises and falls with the suspension travel. The tracta joint output forked shaft is joined with a sleeve to the outer tracta joint input forke shaft.

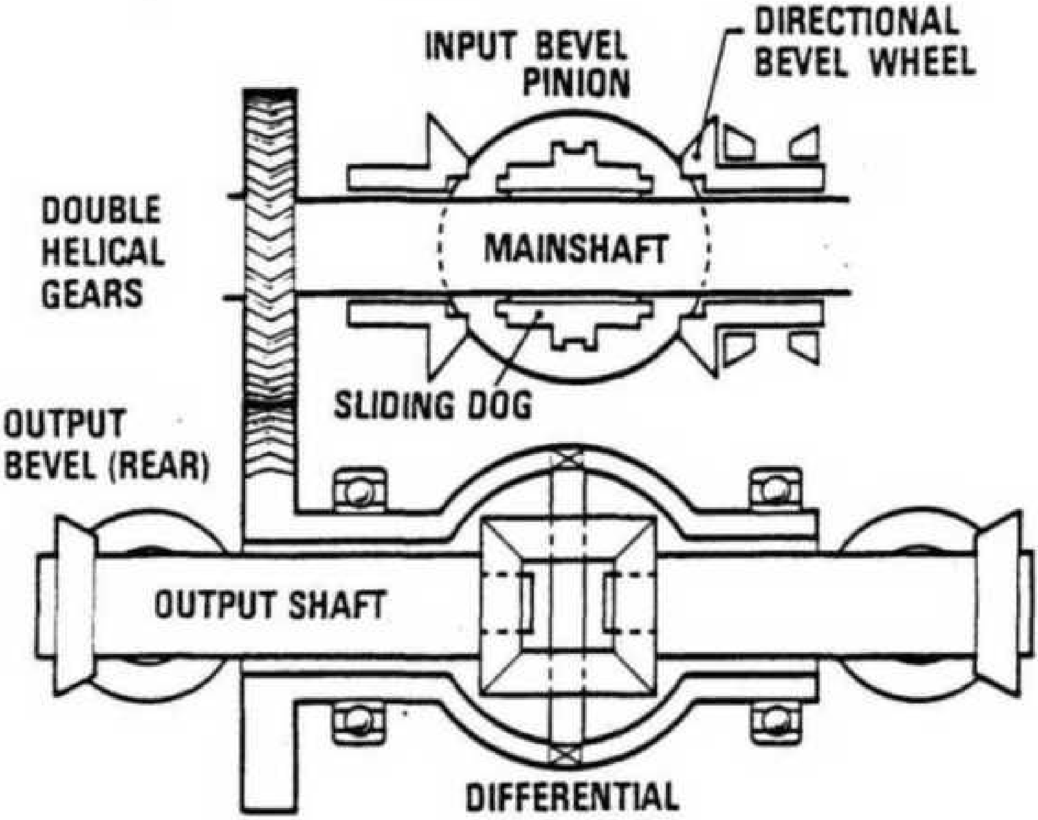
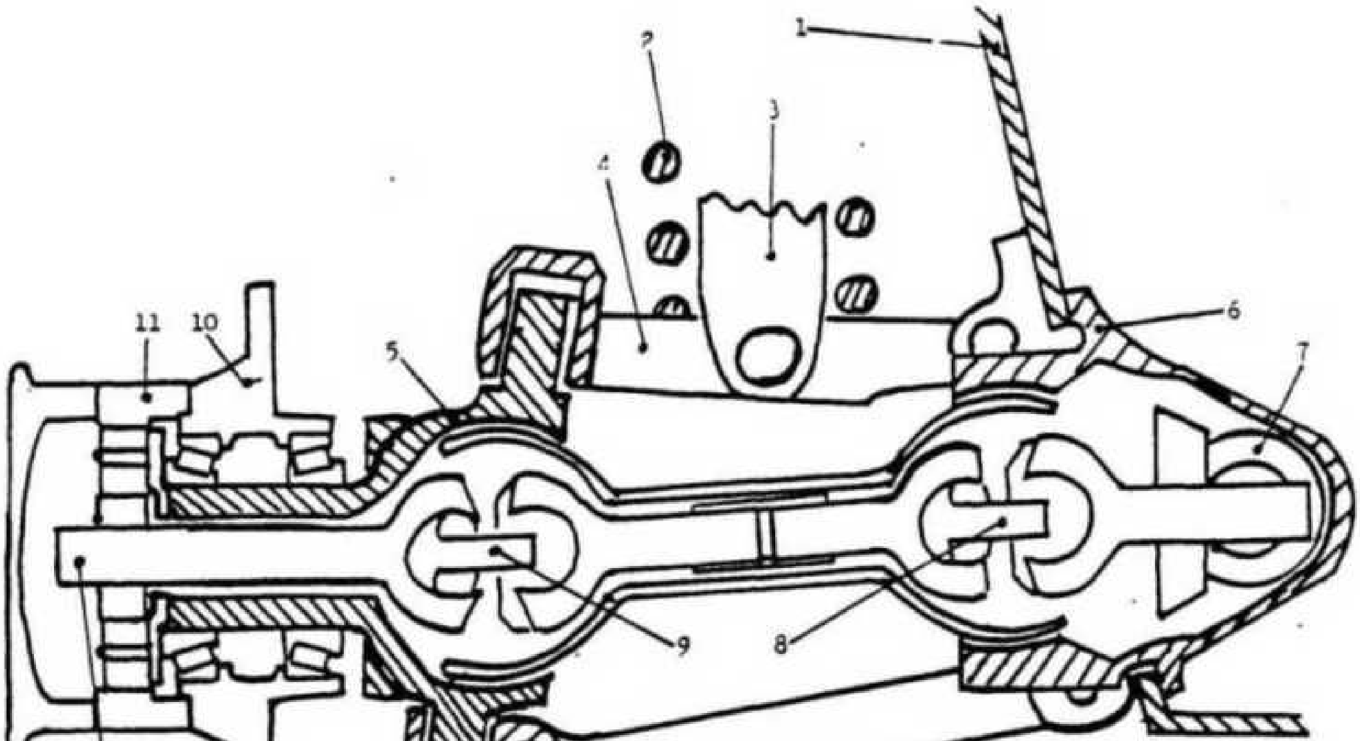


Fig 6.1 TRANSFER BOX



1. Hull.
2. Road spring.
3. Shock absorber.
4. Upper link.
5. Swivel assembly.
6. Bevel box.
7. Prop-shaft bevel.
8. Inner tracta joint.
9. Outer tracta joint.
10. Roadwheel hub.
11. Reduction gear annulus.
12. Outer tracta shaft.
13. Lower link.

Fig 6.2 WHEEL STATION

6.4 Hubs and final drives. The wheel station outer tracta joint is housed within the swivel assembly. (Fig 6.2) The joint output forked shaft extends through the swivel extension and has the final drive epicyclic sun splined to its outer end. Bolted to the end of the swivel extension is the hub reduction gear planet carrier. On machined journals on the swivel extension are the hub taper roller bearings on which the hub turns. The inner track of the outer hub bearing butts against the back of the planet carrier and bearing running clearance is adjusted by placing shims between the end of the swivel extension and the boss of the planet carrier. (Fig 6.3)
With the hub and planet carrier in place the reduction gear annulus is bolted to the hub so, when the vehicle is driven forward, the epicyclic sun must turn backwards to spin the pinions forward(because the planet carrier is stationary) and the pinions drive the annulus and hub and wheel forward.
To adjust the running clearance of the hub tracta joint spacers and shims are used to position the outer tracta shaft on the sun. The spacers are placed between the rear of the sun and the ends of the shaft splines and the shims between the front of the sun and the shaft outer support bearing. (Fig 6.3)
In the wheel hub reduction gear the planet carrier is bolted to the swivel extension. It is subject to leverage from the sun, driven by the engine and transmission, and resistance from the annulus and the weight of the vehicle. Any slackness of fixings, or excessive movement such as slack wheel bearings, will cause the planet carrier to quickly work loose and precipitate a hub collapse.
Correct, accurate, adjustment of the wheel bearings and care in assembling the hub and final drive is vitally important to prevent this happening. There are two methods of assembly in use at present. In the earlier method the planet carrier is held in place with bolts having thin heads together with coil spring washers. The later method, superseding the earlier, uses improved bolts and dowels, higher torque figures and fewer shims for bearing adjustment.

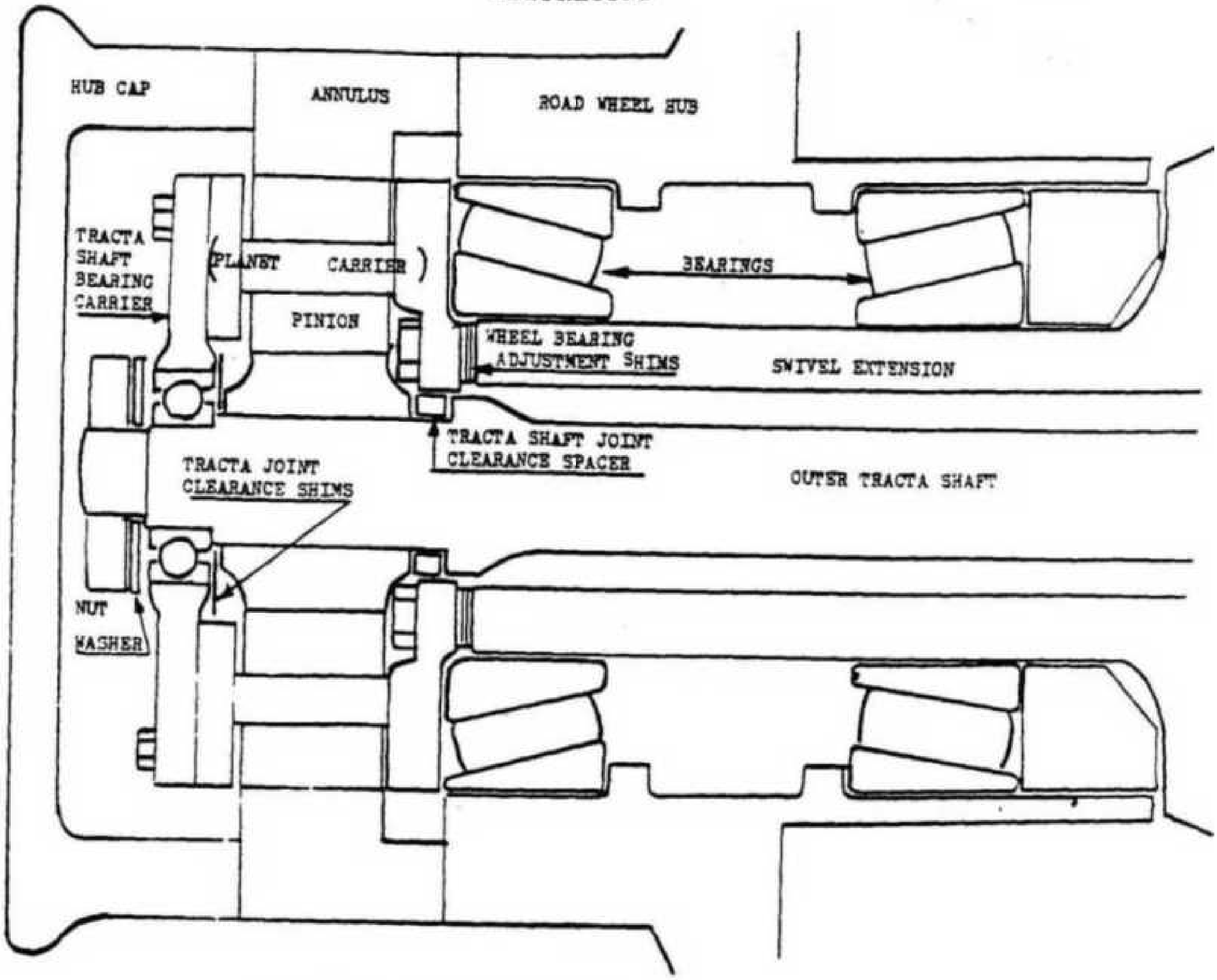


Fig 6.3 HUB ASSEMBLY

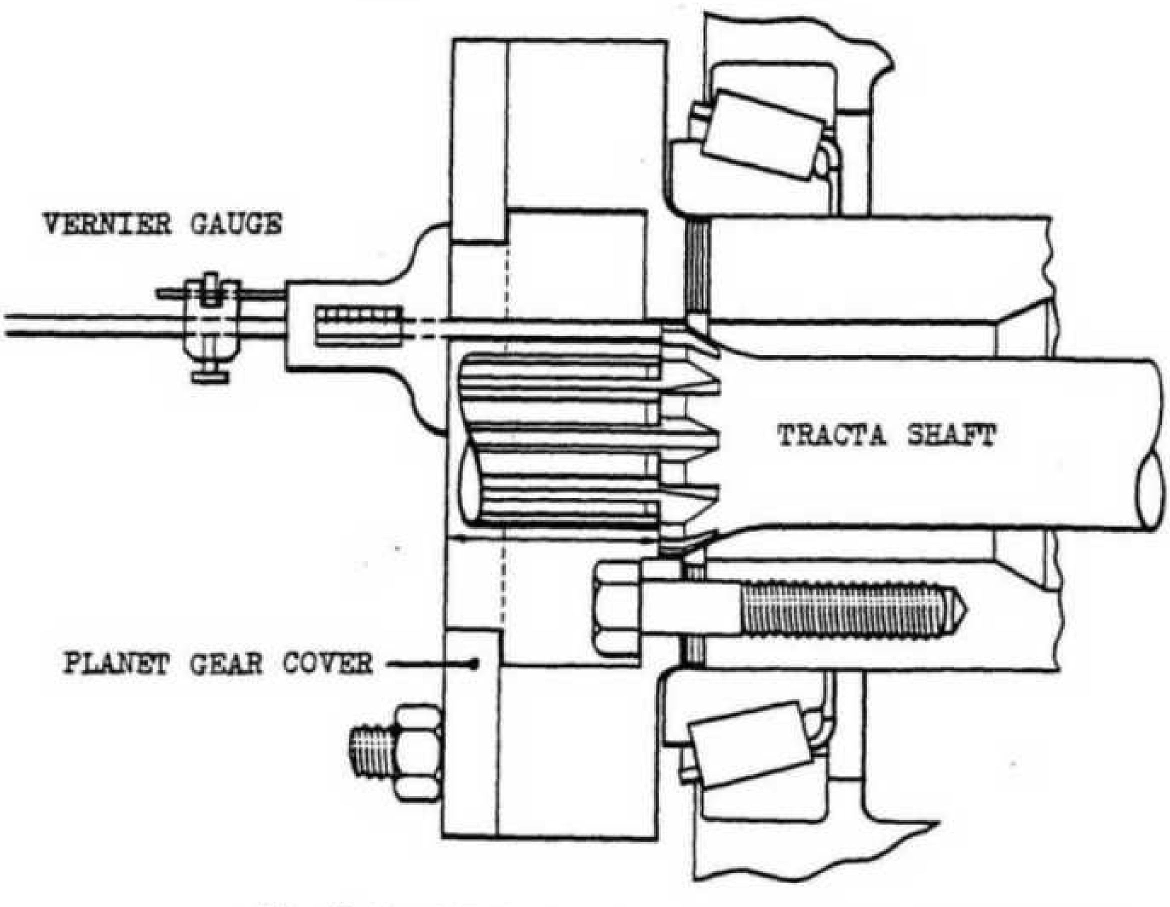


Fig 6.4 MEASURING FOR TRACTA JOINT CLEARANCE

5.5 Hub bearing clearance.

Earlier method. (Un-modified)

1. Fit the hub and bearings to the swivel extension.
2. Bolt the gauge plate, recess inwards, to the extension with bolts through the three smaller holes. Torque bolts to 10 lbf/ft.
3. Measure with a vernier through the three larger holes the distance to the extension. Find the average of the three.
4. Remove the gauge plate and subtract its thickness from the average found in para 3.
5. Measure the thickness of the boss on the back of the planet carrier. Subtract this from the figure left in para 4. The figure now remaining is the exact gap which would be left between the planet carrier boss and the swivel extension if the planet carrier were now bolted in place without giving any bearing running clearance. Bearing clearance must be 0.002 - 0.004 inches so, to the figure now remaining, must be added this clearance which gives the thickness of shims required.

EXAMPLE

Average of the three vernier readings	0.741 ins
Gauge plate thickness (subtract)	0.400 ins
Remaining	0.341 ins
Planet carrier boss thickness (subtract)	0.277 ins
Remaining	0.064 ins
Add, say, 0.002 ins for running clearance	0.002 ins
Total thickness of shims required	0.066 ins

That is: The shims can actually total 0.066-0.068 ins, given that the tolerance is 0.002 - 0.004 ins.

Shims are provided in sizes 0.003, 0.010 and 0.036 ins. thickness.

After placing the shims on the dowels, fit the planet carrier and tighten the bolts to 35 lbf/ft, using Loctite 290 on bolts and dowels.

Hub bearing clearance.
Later method. (Modified hub)

1. Fit the hub and bearings to the swivel extension.
2. Bolt the gauge plate, recess inwards, to the extension with bolts through the three smaller holes. Torque the bolts to 10 lbf/ft.
3. Measure with a vernier through the three larger holes the distance to the extension. Find the average of the three readings.
4. Remove the plate and subtract its thickness from the average found in para 3.
5. Measure the thickness of the boss on the back of the planet carrier. Subtract this from the figure left in para 4. The figure now remaining is the exact gap which would be left between the planet carrier boss and the swivel extension if the planet carrier were now bolted in place without giving any bearing running clearance. Bearing clearance must be 0.002 - 0.004 inches so, to the figure now remaining, this additional figure must be added to give the total thickness of shims to allow correct bearing clearance.

EXAMPLE

Average of the three vernier readings	0.741 ins
Gauge plate thickness (subtract)	0.400 ins
Remaining	0.341 ins
Planet carrier boss thickness (subtract)	0.277 ins
Remaining	0.064 ins
Add 0.002 - 0.004 ins for running clearance	
Thickness of shims required	0.066 - 0.068 ins

6. Shims are provided in sizes:- 0,003, 0.010, 0.015 and 0.036 ins. With these sizes it is possible to make up a "pack" of shims containing not more than three shims. NEVER USE MORE THAN THREE
7. Put the bolts through the planet carrier holes, fit the shims behind the carrier and on to the bolts, bolt the carrier in place and torque the bolts to 52 - 54 lbf/ft.
8. Push the dowels into their holes and peen over the ends.

5 Outer tracta joint clearance. This operation is sometimes referred to as "shimming the Sun".

1. After the planet carrier is in place fit the planet pinions and planet gear cover. Do not fit the sun.
2. Push the tracta shaft in as far as it will go.
3. With a vernier depth gauge, measure from the planet gear cover to the shoulder of the shaft splines. This measurement should be between 1.94 and 2.13 inches. If it is not, check that the shaft is fully in and that the vernier is not registering on the planet carrier.
4. From this figure subtract 1.8 inches. (1.8 inches is the thickness of the sun plus the maximum tracta joint clearance.)
5. Spacers to take up any extra clearance come in graduations of 0.050 ins. Select a spacer next below the remaining measurement when 1.8 ins has been subtracted from the measurement found at para 3. There will be a remainder of 0.050 ins or less.
6. Fit the spacer on the shaft, then fit the sun
7. Select shims to the value of the remainder left in para 5. fit them on the shaft in front of the sun.
8. Fit the bearing and housing and the shaft tab washer and nut. Tighten the nut until resistance shows that the shaft has been pulled out to trap the spacer behind the sun.
9. Before completing the assembly, remember that the hub filler is placed in the same relative position as the one on the other hub on that side of the vehicle. Among the holes for fixing the hub cap are two where the thread can be seen whereas the others have threads which start below the start of the hole. Turn the hub until one of these holes is in line with the filler plug on the other hub and fit the annulus and hub, with the filler plug in the same position as that on the other hub. If the dowels are not in line, they can be removed with pliers and replaced in the their holes as necessary.

NOTES

CHAPTER SEVEN

BRAKES

ara

.1 Layout.

.2 Brake assembly

.3 Brake operation.

.4 Hydraulics.

.5 Servo.

6 Parking brakes.

.7 Adjustments.

Fig

7.1 Brake assembly.

7.2 Expander operation.

7.3 Servo.

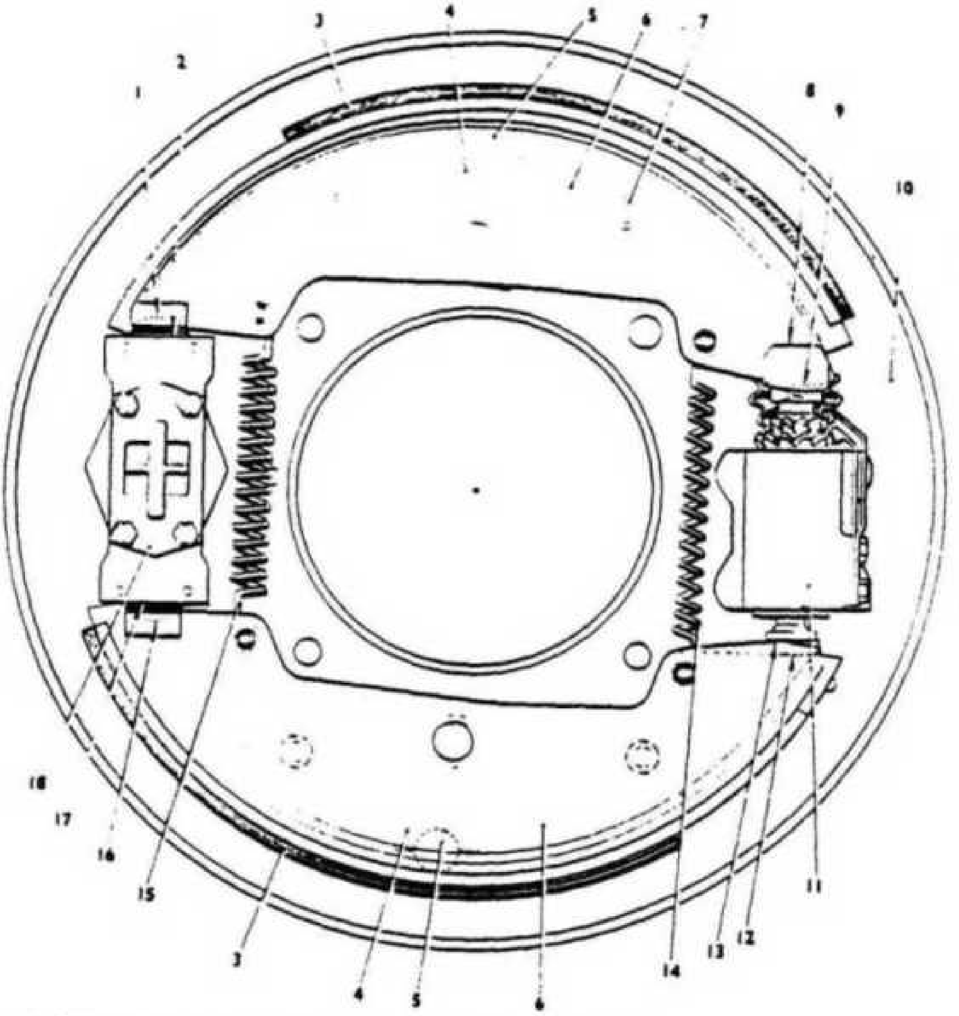
1 Layout. The master cylinder and reservoir are in the driving compartment on the right side hull wall. The servo, if fitted, is in the left rear corner of the engine compartment. The parking brake lever is in front of the driver, between his feet.

2 Brake assembly. (Fig 7.1) The backplate is bolted to the swivel housing. Fixed to the backplate is an expander unit and an adjuster unit. Bolted to the rear of the backplate is the "reverse scissors" which is the operating part for the expander. The adjuster has two actuating heads, one hexagon and one square section, so it can adjust each shoe independently.

The shoes are mounted in carriers which are assembled to the expander and adjuster first. The carriers can be fitted to top or bottom but the crescent shaped cut out at one end must be fitted to the expander. The heavier pull off spring is fitted nearest the expander and both springs are fitted behind the carriers.

The shoes can only be fitted one way. Each shoe has the lining left short at one end and the shoe is angled where the metal is not covered by the lining. This is the leading edge of the shoe when the vehicle is driving forward. To prevent the shoes being wrongly fitted, a pin, sticking out of the backplate, will not allow the "blunt" end of the shoe to be fitted where the angled end should go.

There are three holes in the brake shoe web. Two smaller ones for the friction, anti-rattle, springs and a larger, central one for the roller which seats in the recess at the top of the rocker link in the carrier.



1 Carrier abutment - forward direction
2 Shoe abutment - forward direction
3 Brake shoe
4 Link
5 Rocker pin
6 Brake shoe carrier
7 Brake shoe retaining spring
8 Shoe abutment - reverse direction
9 Carrier abutment - reverse direction
10 Back plate
11 Adjuster unit
12 Shoe abutment - forward direction
13 Carrier abutment - forward direction
14 Small pull-off spring
15 Large pull-off spring
16 Carrier abutment - reverse direction
17 Shoe abutment - reverse direction
18 Tappet unit

Fig 7.1 BRAKE ASSEMBLY

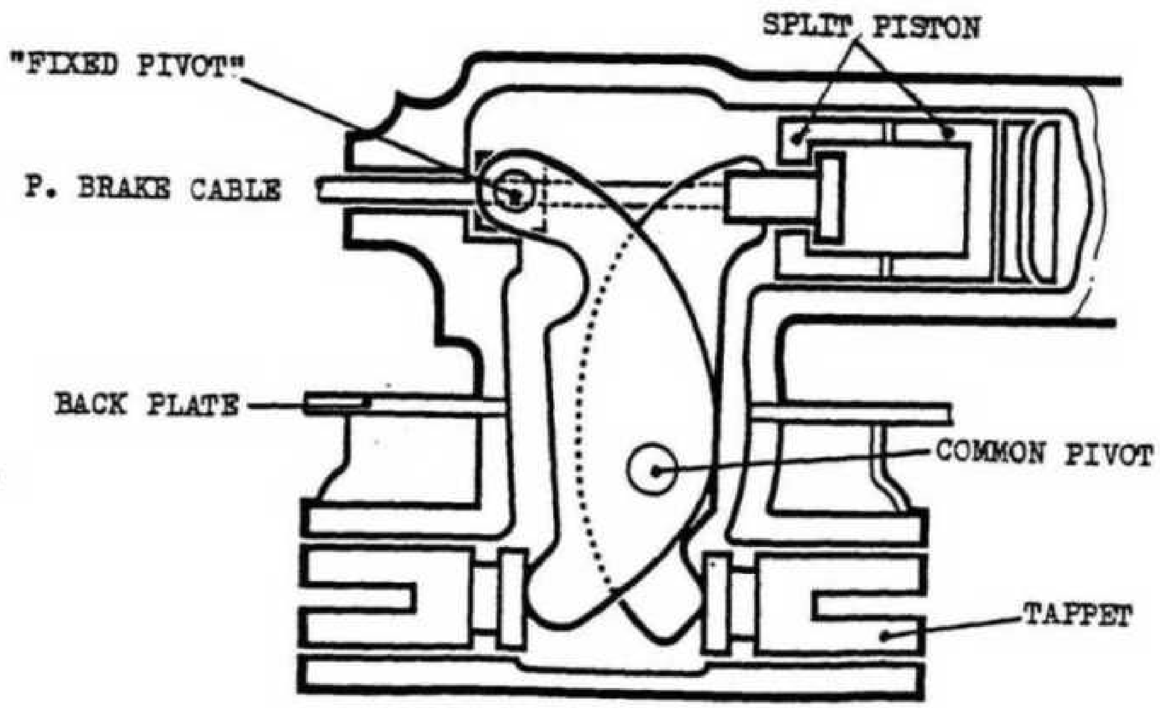


Fig 7.2 EXPANDER OPERATION

7.3 Brake operation. Because the Ferret can be driven as fast in reverse as in forward it is necessary to make the brake action "two leading shoe" in both directions. To achieve this, the shoes are mounted in carriers instead of carried directly on the expander tappets and adjuster screws. Because the rocker pin (the roller in the shoe larger hole) sits in the pivoting link the shoe can be rocked from end to end. The pivoting of the link causes the shoe to slide sideways, in either direction. It is the combination of these two movements which gives the two leading shoe action to the brakes.

Action.

With the brake centralised both ends of the carriers are pulled onto the tappets and adjuster screws, whilst the shoes have a clearance between their webs and the tappets and screws, sitting in their carriers with the rocker pin fully in the link recess.

If the vehicle is moving forward the drum, as shown in Fig 7.1, is turning clockwise. When the brake is applied the expander tappets push the rear ends of the carriers and shoes out to the drum until the rear edges of the linings touch the drum. On the upper (true leading) shoe, the pressure of the tappet pushes the carrier up and the shoe rocks on the rocker pin causing the forward end of the lining to contact the drum so that the full length of the lining is on the drum. Drum rotation tries to carry the shoe with it which only makes the drum wrap itself harder onto the lining. When this happens, the shoe can move to the right within the carrier for most effective self-wrapping action.

On the lower (true trailing) shoe, the trailing edge contacts the drum first and the front, leading edge, of the lining is pivoted to the drum as the shoe pivots on its rocker pin. When this happens, the drum wraps on and the shoe can slide in the carrier if necessary, to make this a leading shoe. The brake now has full two leading shoe application.

When the vehicle is driven in reverse, the operation is exactly the same except that the roles of the shoes is reversed.

When the brake is released, the pull-off springs pull the carriers inward. The friction springs are strong enough to keep the shoes tight in the carriers so the shoes move inward with the carriers for the linings to clear the drums.

Expander unit. The tappets are operated in the tappet block by a "reverse scissors" mechanism. The scissor legs are moved by a split piston, one half of which is moved by hydraulic pressure and the other half by the parking brake cable end. (Fig 7.2) The left side leg top (farthest from the piston) is resting against the inside of the expander case so is a "fixed" pivot. The top of the right side leg rests against the piston so will be moved to the left, whichever part of the piston is operated. About threequarters down the two legs are pinned with a common pivot and the lower ends rest against the tappets in the tappet block.

When the piston moves to the left, the right leg is pivoted on the common pivot to push the right tappet to the right. Because there is equal resistance on both brake shoes, some of the leverage is transferred to the common pivot, causing it to move to the left. This makes the lower end of the left leg bear against the left tappet to push it so that both tappets and their shoes move outwards using the combination of pivotal points. Should one shoe contact the brake drum before the other, the reverse scissors continues to act until the other shoe is on the drum. This is called "shoe to shoe compensation"

Hydraulics. The reservoir is integral with the master cylinder and should be kept topped up to prevent air entering the system. Use brake fluid OX 8. Bleed nipples are positioned on the expander unit at each wheel station and on the slave cylinder and relay valve on the servo, if fitted.

7.5 Servo. Operation (Fig 7.3). Brakes OFF - Engine running.

The atmospheric valve spring keeps the combined atmospheric/depression valve down so that the atmospheric valve is seated, sealing the servo off from atmosphere. The diaphragm spring keeps the diaphragm and relay valve down, keeping the depression valve throat away from the valve face so the depression valve is open. Drillings in the diaphragm cup connect the space above and below the diaphragm as long as the depression valve stays open.

Manifold depression, through the pipes and drillings, is thus felt on both sides of the servo piston at equal pressure so the servo spring keeps the piston pushed away from the slave cylinder.

In the slave cylinder, the piston spring keeps the piston fully back whilst the ball valve spring keeps the ball off its seat so transfer of fluid between the brake lines and master cylinder lines is possible to ensure there is no build up of pressure at the wheel expanders, above the residual pressure.

Brakes applied. (Engine running)

Pressure from the master cylinder begins to push the slave piston against its spring. The abutment washer, behind the ball valve forked rod, flexes and moves the forked rod to close the ball valve onto its seat, closing off the transfer port to make the slave piston "solid".

The fluid in the brake lines will now be forced to the wheels to operate the expander units.

In addition to operating the slave piston, master cylinder pressure acts on the relay valve and pushes it up to flex the diaphragm. The first part of the diaphragm travel closes the depression valve throat against the depression valve face to isolate the manifold depression below the depression valve. The spring side of the servo piston is still subject to manifold depression. The remaining movement of the diaphragm pushes up the combined atmosphere/depression valve, allowing atmospheric pressure to the non-spring side of the servo piston.

This pressure, acting against only the weak resistance of manifold depression and the relatively weak servo spring, pushes the servo piston hard onto the slave piston to pressurise the fluid in the pipes to the expander units much harder than could be achieved with foot pedal pressure alone.

Brakes held. (Engine running)

When the pedal is held steady, movement from the master cylinder stops. Under the atmospheric pressure, the servo piston travels a little farther after the pedal movement ends, giving a little more pressure to the brakes. This slight movement of the slave piston causes a small drop in pressure in the master cylinder delivery pipe. The atmosphere valve spring pushes the atmospheric/depression valve down onto the atmosphere valve seat to prevent any more pressure entering, but the atmospheric pressure already applying the servo piston is trapped to hold the piston and maintain its pressure.

The combined valve cannot go down far enough to push the diaphragm so far as to open the depression valve so the spring side of the servo piston is still subject to manifold depression and the brakes are held with a pressure proportionately equal to that of the drivers foot.

To increase the brake pressure, further movement of the master cylinder piston increases the pressure to slave cylinder and relay piston.

Relay piston moves up to open the atmosphere valve and more atmospheric pressure is felt at the servo piston to apply the brakes harder.

Brakes released. (Engine running)

As the brake pedal is released, the master cylinder piston moves back and the pressure in the pipe from master to slave cylinder falls.

The loss of pressure below the relay valve allows the depression valve spring to push the diaphragm down and open the clearance between the valve and throat. The atmospheric pressure air on the non-spring side of the servo piston is drawn into the manifold through the holes in the diaphragm cup so manifold depression is again felt on both sides of the piston. The servo spring pushes the piston away from the slave cylinder, brake shoe springs pull the shoes and carriers in to return the fluid to the slave cylinder and the slave piston is pushed back.

As the slave piston stops on its contact with the cylinder end, the abutment washer flexes to move the forked rod towards the servo rod to allow the ball to be pushed off its seat and open up the transfer port, allowing the fluid pressure to equalise throughout the system as the fluid returns through the master cylinder.

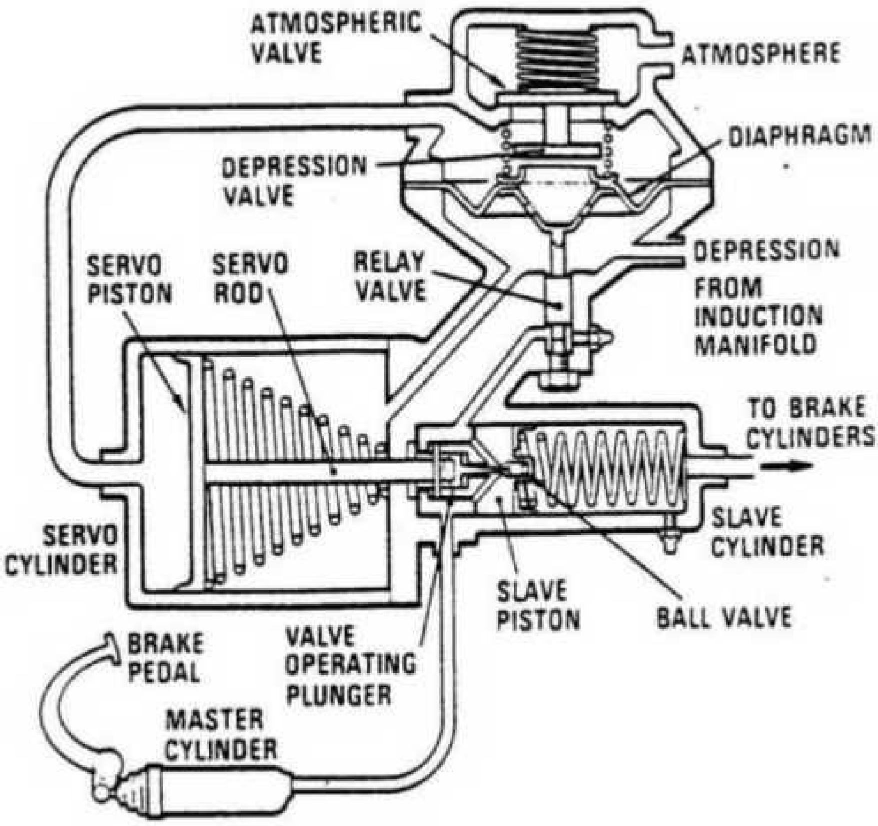


Fig 7.3 SERVO

To check the operation of the servo.

With the engine stopped, push the brake pedal down hard. Keeping the pedal down, start the engine. If the servo is working the pedal should move down appreciably.

Parking brake. The operating shaft is on the hull floor below the drivers feet. Pulling up of the lever rotates the shaft and draws the cables and rods which operate the brakes. Front brakes are operated by cables direct from the shaft and the rear ones by rods back to the abutment plate, which is below the propellor shafts, near the batteries, and then by cable. Adjusters are provided on the cables at the operating shaft for the front brakes. For the rear brakes, the adusters are between the ends of the rods and the cables. Each cable terminates in a nipple in the split piston in the expander unit.

7.7 Adjustments.

Road wheels.

Drain the hub, remove the hub cap and annulus.

Chock the wheels on the opposite side and release the parking brake.

Jack up the wheel.

Hold one of the adjuster heads and turn the other until its shoe is hard on the drum.

Release the adjuster until the drum is just "whispering" on the brake when the wheel is turned.

Repeat for the other shoe.

Carry out the same adjustment on the other wheels.

Parking brake.

Adjust all brakes at the road wheels.

Put the vehicle on stands with all wheels off the ground.

Pull the hand brake lever on three clicks.

Remove the batteries and battery boxes.

Adjust at each adjuster until its wheel is just beginning to bind.

Make sure the wheels bind equally.

Bleeding the brakes. (The engine must not be running)

Pump the brake pedal to clear the servo.

Bleed in the order:-

Servo slave nipple } If fitted
Servo relay nipple }

Expander unit nipples beginning with the one farthest from the master cylinder/servo.

CHAPTER EIGHT

SUSPENSION

Para

8.1 Description.

8.2 Operation.

8.3 Shock absorbers.

8.4 Roadwheels and tyres.

Fig

8.1 Suspension layout.

8.2 Shock absorber.

8.1 Description. (Fig 8.1) Idependent suspension units are fitted at each wheel station. Each comprises a link bracket, bolted to the hull, with the top and bottom links pivoting about pins in the bracket. The hub assemblies are mounted on pins at the outer ends of the links. A pivot pin, turning in eyes in the upper link, provides fitment for the spring seat and the shock absorber case eye. The top of the spring, and the shock absorber rod end, are fitted in the spring bracket bolted to the hull directly above each suspension unit. A "tail", part of each spring seat, is pinned to a control link which pivots on the rebound rubber bracket. The bump rubber is clamped between a shoulder on the shock absorber rod and the spring bracket.

8.2 Operation. As the suspension rises the spring is compressed and the shock absorber case pushed upward. The limit of upward travel is reached when the shock absorber case is stopped by the bump rubber. Controlled travel is about 6 inches. The spring seat tail is swung in an arc by the pivoting control link and keeps the spring seat in a horizontal plane during movement so as to prevent the spring from "bowing" and leaving the seat.
When the suspension travels down on rebound, the shock absorber controls the speed at which the spring extends and downward movement is limited by the underside of the upper link hitting the rebound rubber. Controlled travel is about 4 inches from the central position.

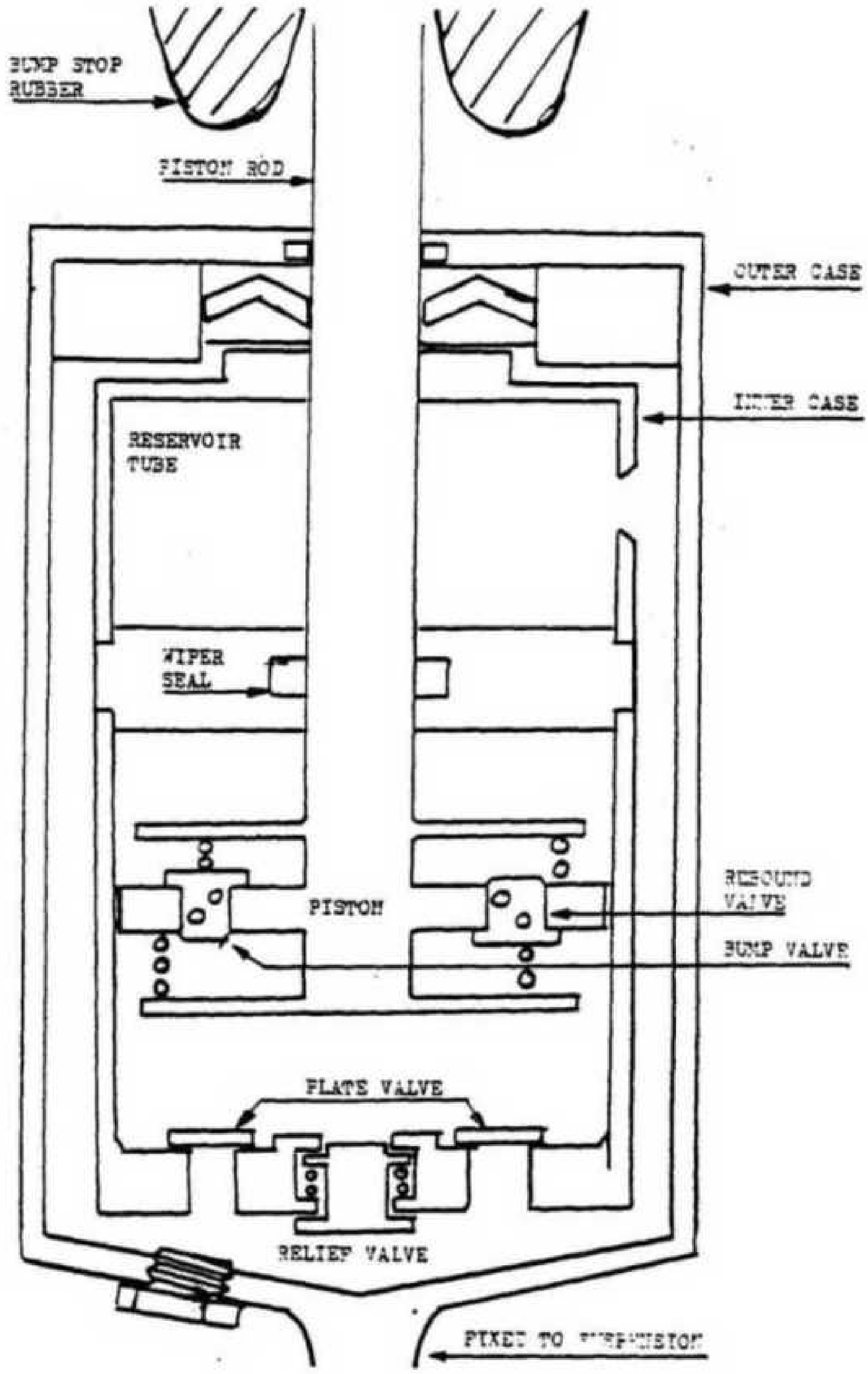


Fig 8.2 SHOCK ABSORBER

8.3 Shock absorber. These are hydraulic, telescopic, differential double acting. The outer and inner cases are in one piece and move up and down with suspension movement. The piston and its rod are fixed at the top to the upper bracket so can be considered to be stationary during operation. In the piston are six valves, spring loaded. Four permit fluid passage during "bump" movement and the other two during rebound only. The shock absorber is partly filled with hydraulic fluid and the upper part of the inner case forms a reservoir tube for storing displaced fluid during operation. In the lower end of the inner case are two valves. The heavier relief valve allows fluid movement from inner to outer case and the more lightly controlled plate valve allows fluid to return from outer to inner case.

Operation. (Fig 8.2)

As the suspension rises, the outer and inner cases move upward. The piston and rod remain stationary. The fluid below the piston is pressurised by the rising inner case and the increase of pressure opens the "bump" valves in the piston, allowing fluid to pass from beneath the piston to the increasing space above it. The space above the piston cannot accept the volume of fluid which is excess below it because the piston rod is filling part of the space. Increasing pressure on the fluid then forces open the relief valve and some of the fluid passes out into the outer case for storage in the reservoir tube. When the suspension moves down, the fluid above the piston is pressurised and that closes the bump valves and opens the rebound valves. There are only two rebound valves so the transfer of fluid is much slower than it was on bump. This slows the suspension and controls the expansion rate of the roadspring. Because the volume of fluid returning to the space below the piston is less than is required to fill the increasing space a depression occurs below the piston. This draws the plate valve open and the fluid from the reservoir tube is returned to the inner case below the piston.

8.4 Roadwheels and tyres. The twin disc type wheels have clamp nuts which are painted RED. Tyres must be fully deflated before these nuts are touched. Tyres are 9.00 x 16 Run-Flat or Cross-Country. All tyres must be of the same type.

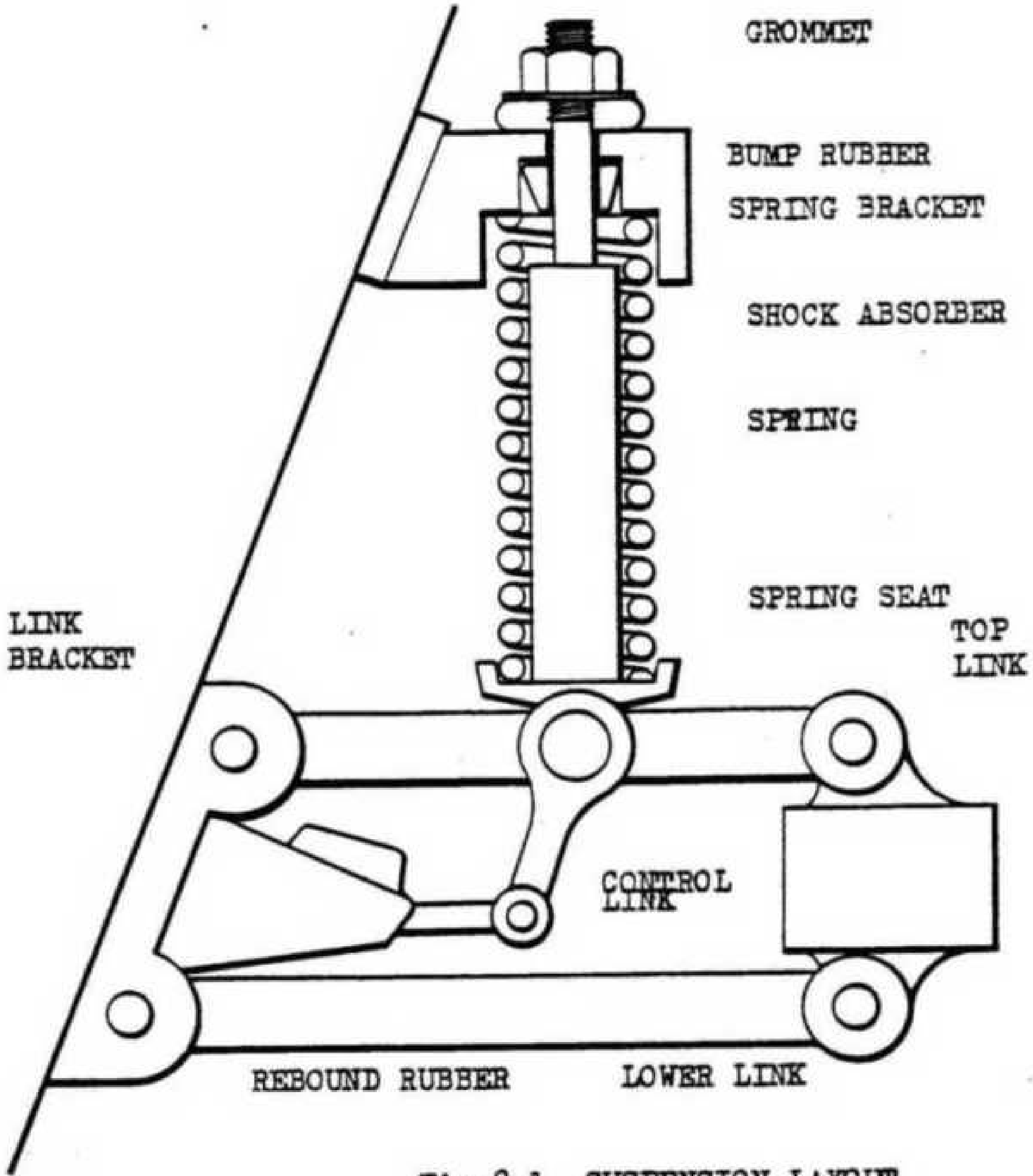


Fig 8.1 SUSPENSION LAYOUT

CHAPTER NINE

STEERING

Para

9.1 Layout.

9.2 Operation.

9.3 Adjustment.

9.4 Repairs.

Fig

9.1 Steering layout (front view)

9.2 Steering layout (projected)

9.1 Layout. (Fig 9.1) The steering gear assembly is bolted to inside of the hull front. The steering wheel shaft has a bevel pinion in mesh with a bevel on the steering column shaft in the upper steering box. The bevel on the lower end of the column shaft rotates a recirculating ball race sleeve. Within the sleeve is a cross shaft with a link attached to each end. Each link is attached to an inner steering lever which is splined onto its steering lever shaft, mounted in the steering lever case which is bolted on the outside of the hull. On the front end of the shaft, protruding from the lever case, is the outer steering lever(sometimes called the drop arm). Inner lever, shaft and outer lever are marked for correct assembly. A steering rod ball pin fits through a hole in the lower end of the outer lever and its other end ball pin fits in the steering arm on the hub.

9.2 Operation. When the steering wheel is turned to the right the column shaft turns the recirculating ball race backwards. Looking from Rear to FRONT of the vehicle, this draws the cross shaft from RIGHT to LEFT. The top end of the inner levers are pushed to the left, the shafts turn anti-clockwise, and the lower ends of the outer levers move to the right. Through the steering rods, the front of the right side front wheel is pushed to the right and the front of the left wheel is pulled to the right. On each outer lever a flat is machined on the inner face; the steering limit is reached when this contacts shims which are fixed on studs on the hull. The shims are fitted to set the angle through which the wheels can turn from lock to lock.

.3 Adjustment. Toe-in. Toe-in is 1/8th inch overall.

Method:-

1. Place the vehicle on level hard ground.
2. Place vehicle on sstands, spin the front wheels to check for running true. Replace suspect ones.
3. Centralise the steering after counting the steering wheel turns from lock to lock.
4. Hold the steering wheel firm and push the front of one wheel hard towards the hull. Measure from the wheel rim level with the wheel centre to the edge of the hull bottom plate. Record the measurement. Pull the front of the wheel hard away from the hull and measure again. Record the measurement.
These measurements difference represents the wheels free play.
5. Repeat para 4(above) for the other wheel.
6. Keeping the steering wheel firmly central, adjust the steering rods to produce "toe-out" on each wheel.
7. Lower the vehicle carefully to the ground.
8. Adjust each steering rod until the measurement from the wheel rim to the hull is half-way between the maximum and minimum found in para 4 and 5.
9. Mark the wheel rims and check the toe-in is 1/8th inch with a trammel gauge.
10. If the toe-in is not correct, adjust it by altering each steering rod by an equal anount.

4 Repairs.

If replacement of steering levers or shafts is necessary the method of removal and repair is contained in EMER Whld Vehs V 624 Chapter 5. Removal, replacement and repair of the complete steering assembly is also contained in the chapter.

When re-assembling the lower bevel box care must be taken to place the bearings in the recirculating ball race in the correct sequence and correct number and, also, that the bevel wheel on the ball race sleeve is at the right end in relation to the column shaft bevel, otherwise the steering operation will be reversed.

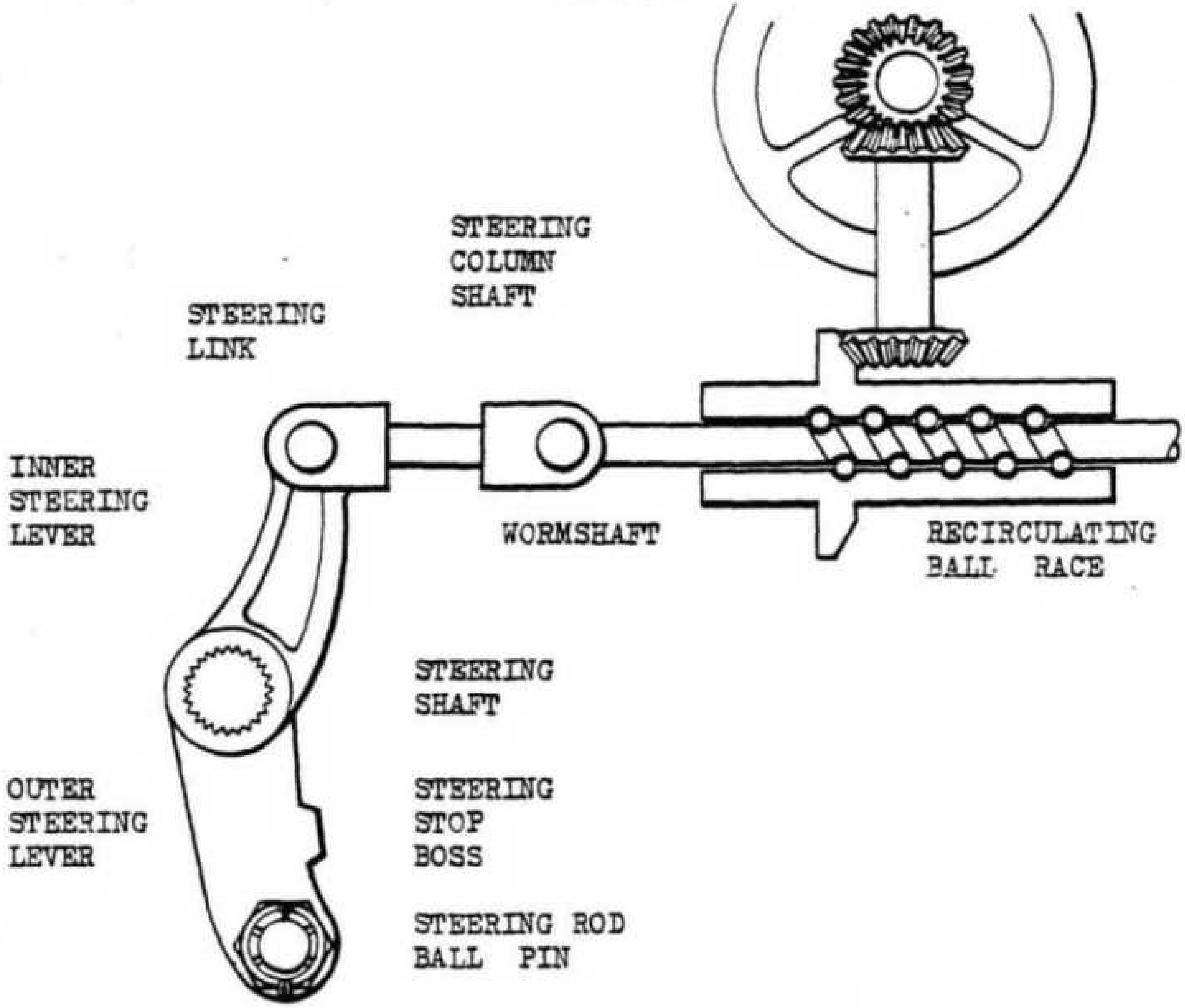


Fig 9.1 STEERING LAYOUT (FRONT VIEW)

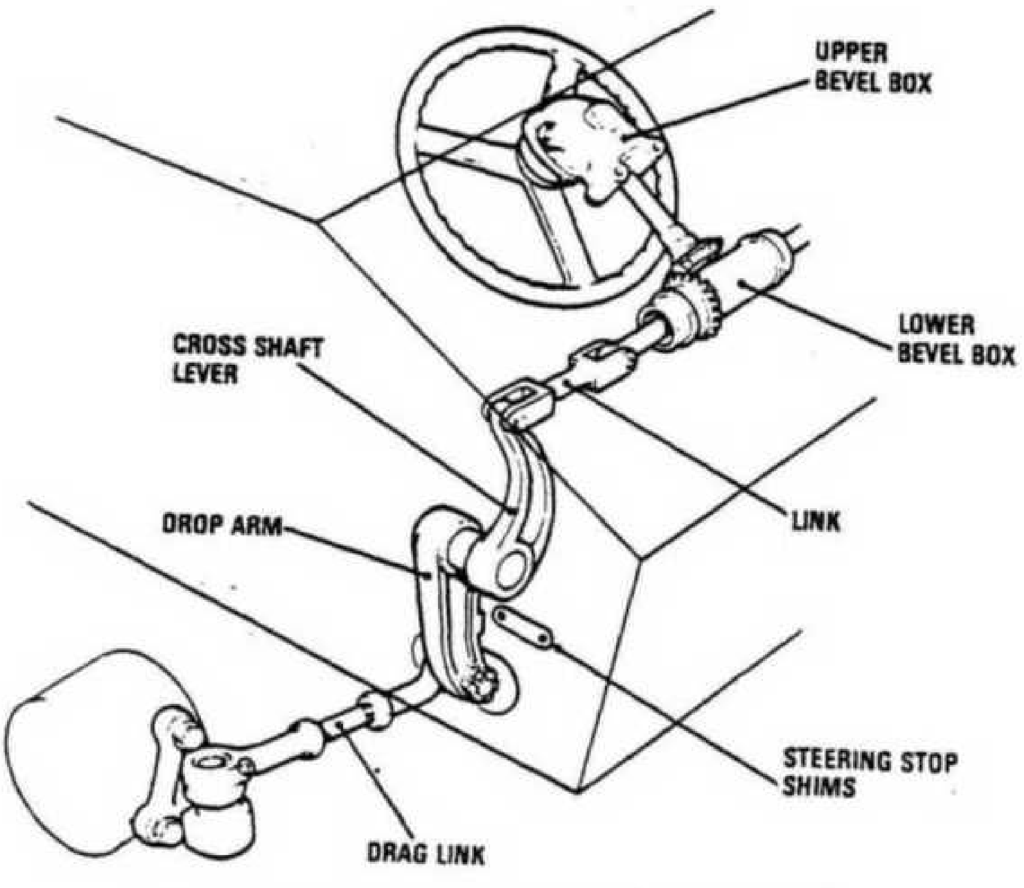


Fig 9.2 STEERING LAYOUT (PROJECTED)