Daimler

SERVICE MANUAL

for

THE 'FLEETLINE' CHASSIS

ISSUED BY

DAIMLER TRANSPORT VEHICLES LIMITED COVENTRY
ENGLAND

Telephone
COVENTRY 27626

Bus Service Department,
KINGFIELD ROAD, COVENTRY
TEL. COVENTRY 89423

Telegraphic Address
"DAIMLER PHONE COVENTRY"

Publication No E/1003/4

Published June 1969

INDEX TO SECTIONS

OPERATION AND MAINTENANCE

SECTION A

INDEX

The reversing light will automatically be illuminated when the reverse gear is selected

Stopping the Vehicle
Release the accelerator pedal and apply the footbrake. Select neutral and apply the handbrake. During traffic halts, it is possible because of the Daimler fluid Flywheel, to wait in a low gear rather than in neutral and applying the brake

Gear Change Speeds
It is recommended that gear changes are effected at the following speeds:-

1st to 2nd	6-8 M.P.H.	(9.6 – 14 K.P.H.)
2nd to 3rd	14 M.P.H.	(22.5 K.P.H.)
3rd to 4th	20-23 M.P.H.	(32-37 K.P.H.)

according to passenger load or gradient.

THE MAINTENANCE SCHEDULE
The maintenance Schedule has been compiled to show at a glance the essential service requirements of the CRG6 and SRG6 "FLEETLINE" chassis.
Methodical and efficient service to the details mentioned will maintain the vehicle in good condition and ensure economical and trouble free usage.
The Maintenance operations are detailed below together with the Section reference in which will be found the recommended sequence of the maintenance work to be effected.
For all Routine Maintenance on the engine refer to the manufacturers Service Manual.

DAILY	section
Check radiator coolant level	C
Check engine oil level	D
Check contents of fuel tank	E
Drain and refill Anti-freezer (when fitted)	K
Check build up of air pressure	K

WEEKLY

Check level of hydraulic fluid in accelerator reservoir	E
Check condition of flexible hydraulic reservoir hose	E
"Pump" gear box gears	E
Check condition of brake flexible hoses	K
Drain air pressure reservoir	K
Check all tyre pressures	–
Check security of road wheel nuts	–
Check electroliyte level in battery	R
Check specific gravity of battery electrolyte	R

FIRST 250 MILES (400 KM)

Check all chassis frame nuts and bolts	P

FIRST 500 MILES (800 KM)

Check centrifugal lock up clutch gland seal (when fitted	G

FIRST 1,000 MILES (1,600 KM)

Drain and refill gearbox and clean oil filter element	H
Drain and refill transfer box	H
Drain and refill rear axle	J

FIRST 2,500 MILES (4,000 KM)

Check the oil level in the fluid flywheel	G
Check end float of rear wheel hubs	J
Check condition of brake linings	K
Check end float of front wheel hubs	M

EVERY 2,500 MILES (4,000 KM)

Top up automatic chassis lubricator oil reservoir (if fitted)	B
Check tension of fan and compressor belts	C
Lubricate all engine controls	D
Check first and second fuel oil filters	E
Check the gearbox oil level	H
Check transfer box oil level	H
Lubricate cardan shaft universal joints	I
Check rear axle oil level	J
Check foot brake control valve for leaks	K
Lubricate single brake valve push rod pivot pin	K
Clean anti-freezer gauze filter (when fitted)	K
Check air pressure regulator for leaks	K
Lubricate brake pedal linkage	K
Lubricate handbrake linkage	K
Check unloader valve for leaks	K
Check brake chambers for leaks	K
Lubricate front wheel swivels (not if auto-lubrication system is fitted)	M
Lubricate steering ball joints (not if auto-lubrication is fitted)	N
Lubricate all road spring shackles (not if auto-lubrication system is fitted)	Q

FIRST 5,000 MILES (8,000 KM)

Check all spring/axle mountings	O

EVERY 5,000 MILES (8,000 KM)

Check automatic chassis lubricator pipe unions for leaks (when fitted)	B
Clean the engine air cleaner element	D
Drain oil from gearbox air cylinders	H
Clean transfer box air breather filter element	H
Drain oil from electro pneumatic valve block	H
Clean gearbox air breather filter element	H
Spray all road springs	O
Check the fluid level of the front dampers	O
Lubricate the electrical generator	R
Check air limiting valve for leaks	H
Check all chassis frame mountings	P

FIRST 10,000 MILES (16000 KM)

Check and tighten the lock-up flywheel gland seal securing nuts (when fitted)	

EVERY 10,000 MILES (16,000 KM)

Examine engine mountings for signs of deterioration and security of mounting bolts	D
Lubricate fan pulley bearings	C
Check the condition of all engine water hoses	D

Check the fluid flywheel oil level	G
Check the trailing link coupling setscrews	G
Clean oil filter element (replace if in bad condition)	H
Check cardan shaft flange nut and bolts	I
Check the rear axle mountings	J
Check the pressure setting — air regulator valve	K
Check footbrake linkage	K
Clean unloader valve inlet filterr	K
Check the front wheel alignment	M
Check steering lever and tie rods	N
Steering box oil level	N
Check all road spring shackles for end float	O

EVERY 20,000 MILES (32,000 KM)

Check rear hub bearings for end float and adjust as necessary.	J
Check front hub bearings for end float and adjust as necessary	M

EVERY 25,000 MILES (40,000 KM)

Drain sediment from fuel oil tank	E
Lubricate relay lever	N
Drain and refill transfer box	H
Drain and refill gearbox and replace oil filter element	H
Renew gearbox air breather filter element	H
Renew transfer box air breather filter element	H

EVERY 40,000 MILES (64,000 KM)

Drain and refill the rear axle unit	J
Remove, clean and re-lubricate rear wheel hubs	J
Remove, clean and re-lubricate front wheel hubs	M

EVERY 50,000 MILES (80,000 KM)

Check magnetic fan coupling units (when fitted)	C
Overhaul the air pressure regulator valve	K
Overhaul the footbrake control valve	K
Overhaul the unloader valve	K
Overhaul the brake chambers	K
Check all wiring connections	R

EVERY 75,000 MILES (120,000 KM)

Overhaul gear selector switch	H
Overhaul electro-pneumatic valve block	H

EVERY 250,000 MILES (400,000 KM)

Renew magnetic fan coupling unit (when fitted	C
Overhaul gearbox	H
Overhaul transfer box	H

LUBRICATION

SECTION B

INDEX

LUBRICATION

It is important that all oils and greases used in the maintenance of the vehicle should conform to those listed in the RECOMMENDED LUBRICANTS chart.
If it is desired to make any departure from those recommended, approval of the brand and viscosity should first be obtained from Daimler Transport Vehicles Ltd., to avoid affecting the guarantee.
In respect of the Gardner engine reference should be made direct to Messrs. Gardner Engine (Sales) Ltd.,
Since oil of different brands may not mix satisfactorily, draining and refilling is preferable to topping up if the brand of oil in the unit is unknown.

RECOMMENDED LUBRICANTS

	Engine Fluid Flywheel Oil Bath Cleaner	Rear Axle Transfer Box	Gear Box	Steering Box Automatic Lubrication	Hubs Cardan Shaft	Power Assisted Steering
B.P.	**Energol DS120W or Energol DS1 Multigrade**	**Gear Oil SAE 90 EP 90EP**	**Energol DS1-20W**	Gear Oil S.A.E. 140EP	Energrease L.2	Automatic Transmission Fluid Type A.
ESSO	**Esso Fleet HDX20**	**Esso Gear oil GP90/140**	**Esso Fleet HDX.20**	Esso Gear Oil GP90/140	Esso T.S.D.1186 or Esso Multi-Purpose Grease H	Esso Automatic Transmission Fluid
MOBIL	**Delvac Oil 920**	**Mobilube GX90**	**Delvac Oil 920**	Mobilube C.140	Mobil-grease MP	Mobil-fluid 200
REGENT Caltex/ Texaco	**Super RPM Delo Special SAE20**	**Multigrade Lubricant EP90**	**Super RPM Delo Special SAE20**	Multigear Lubricant EP.140	Marfax All-Purpose	Texa-Matic Fluid
SHELL	**Rotella T 20/20W or Rotella Multigrade**	Spirax 90EP	**Rotella T 20/20W**	Dentax 140	Retinax Grease A	Shell Donax T.6
CASTROL	**Castrol CR20**	**Castrol Hypoy**	Castrol CR.20	Castrol D	Castrolease L.M.	Castrol T.Q.
DUCKHAM	**HD.20/1 or Fleetol 10W 30/1**	**Hypoid**	H.D.20/1	C.G.140	L.B.10	Q-matic

LUBRICATION

AUTOMATIC CHASSIS LUBRICATION

The Clayton Dewandre R.P. Automatic chassis lubrication system is fitted as an alternative if required and replaces the grease gun and nipple system fitted as standard equipment.

SPECIFICATION AND DATA

Type	Clayton Dewandre R.P. Air pressure operated
No. of points lubricated	24
Capacity of Reservoir	1 gallon (4.546 litres)

DESCRIPTION

The air pressure operated lubricator automatically delivers a measured independant supply of oil to each selected bearing point irrespective of any variation in resistance, with each application of the foot brakes.

If excess resistance is encountered at any point pressure is accumulated in the individual feed line until the resistance is overcome without effecting any of the other feeds.

Should a feed line be broken or disconnected, only the one particular point is effected.

The supply tank is mounted on brackets attached to the right-hand side of the main frame. Access to the filler is provided for by the Coachbuilder.

The pump is mounted on an outrigger bracket on the right-hand side of the main frame beneath the driver's compartment.

The oil feed supply pipes are of heavy gauge nylon, grouped together in P.V.C. tubing and securely clipped to the frame and the various units. Twenty-three chassis points are lubricated, the twenty-fourth connection being for the lubrication of the actuating cylinder and piston.

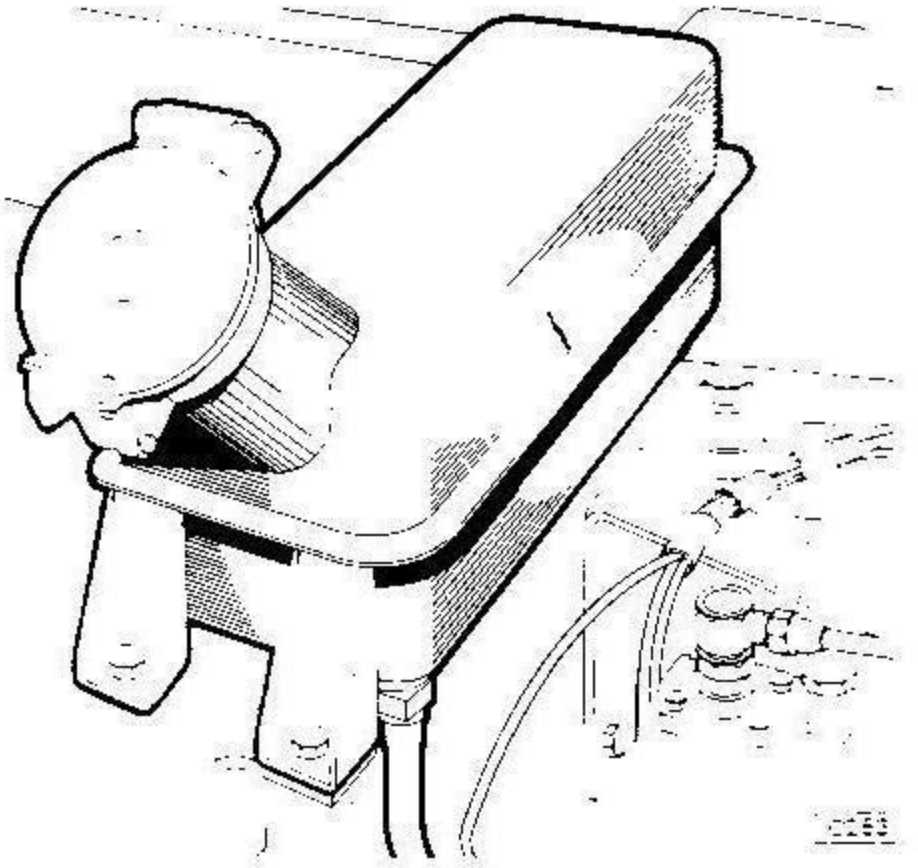


Fig. 1 Location of the chassis lubrication pump reservoir.

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 KM)

Top up the oil reservoir with the recommended lubricant.

EVERY 5,000 MILES (8,000 KM)

Inspect delivery pipe unions for any possible leaks and re-tighten if necessary.

LUBRICATOR

The lubricator can be expected to outlast the life of the vehicle without requiring any replacements but service units are available if required from the manufacturers.

Removal

1. Disconnect the main oil feed pipe by removing the banjo union bolt. Note the two sealing washers and drain the oil into a suitable clean container.
2. Disconnect the air pressure pipe from the lubricator cylinder.
3. Disconnect the lubricator pipe from cylinder junction.
4. Remove the six bolts, nuts and washers securing the delivery plate to the main body.
5. Remove the main body taking care to retain the joint.

Refitting

Refitting is the reverse of the removal procedure. Replace the joint between the delivery plate and body if damaged.

NOTE: Before refitting the unit the piping must be primed.

Priming

Since there is only a very small quantity of oil delivered to the feed pipes at each impulse of the lubricator unit, it would take some considerable time to initially fill all the feed pipes by this method. Priming is therefore necessary to charge the pipes to ensure that the oil reaches each of the lubrication points without delay at the commencement of service.

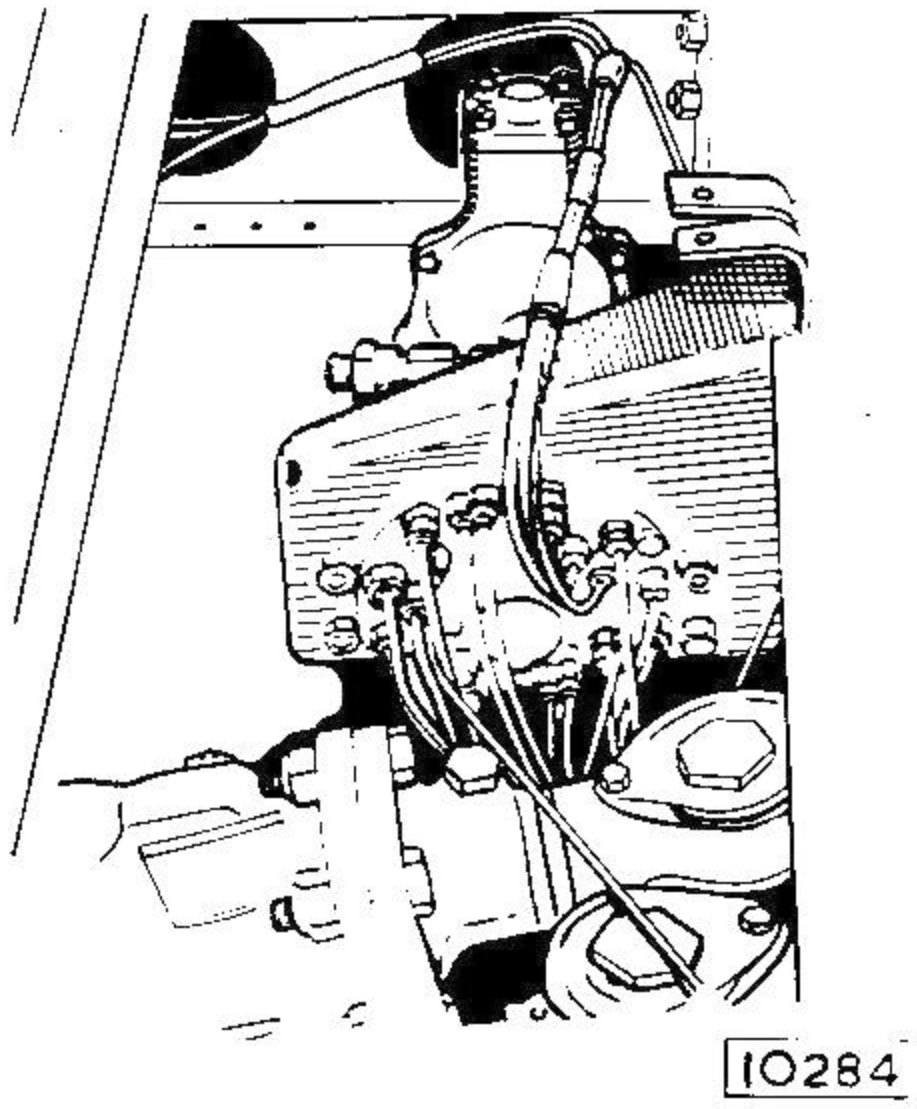


Fig. 2 Location of lubricator-pump

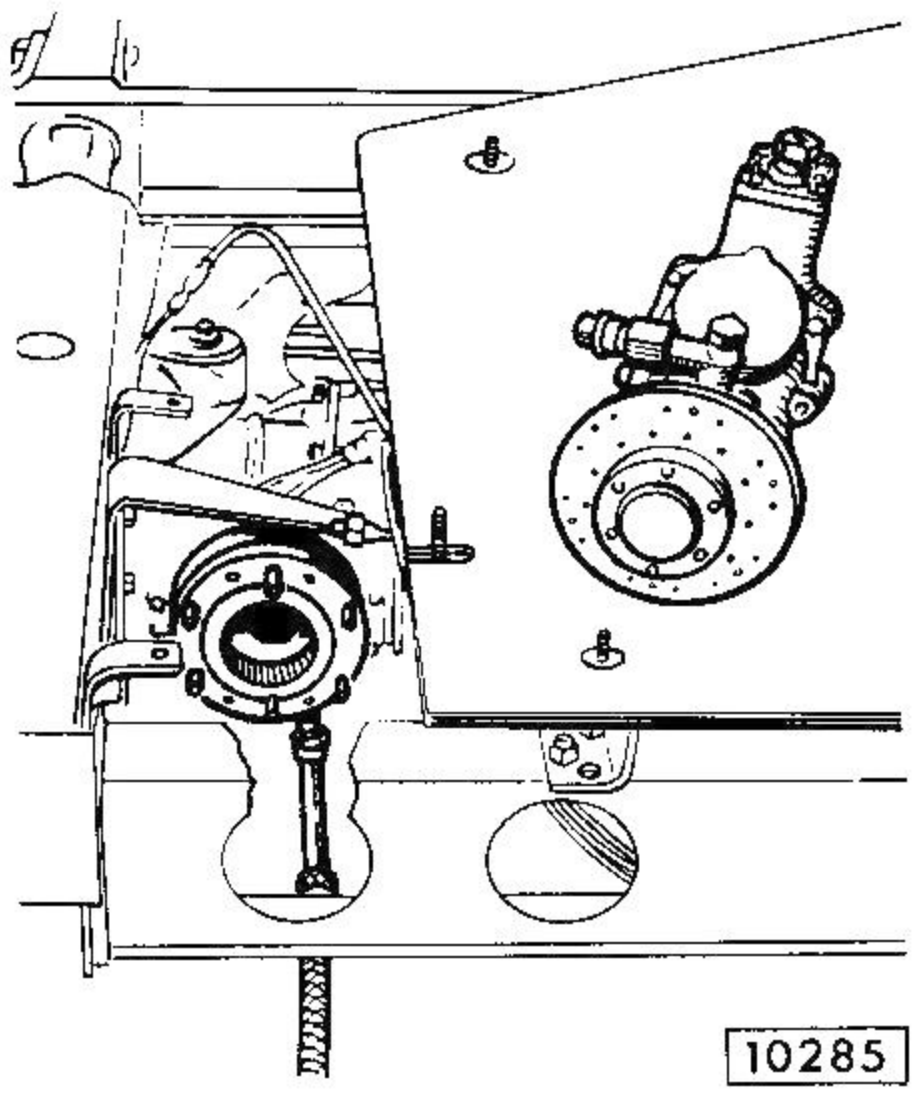


Fig. 3 Priming plate in position.

Priming can be effected by either of the two methods given below.

The special priming plate required by the first method has twenty-three nipples which coincide with the feed pipes. The feed line leading from the remaining distributor plate union is disconnected from the operating cylinder union and can be primed separately.

Priming – Plate Method

1. Remove the lubricator body after withdrawing the six bolts, nuts and washers securing the body to the delivery plate as described under "Removal". Disconnect the oil feed supply pipe and the lubricator pump connection (number 24 on the location chart) and blank off the unions.
2. Bolt the priming plate to the delivery plate.
3. Using an oil gun, pump oil into each of the priming plate nipples in turn until the corresponding pipe line is full, as determined by observation of the bearing point to which is is attached.
4. When the system is completely charged, remove the priming plate, remount the lubricator body onto the delivery plate. Refit the feed pipe to the operating cylinder and reconnect the pipes from the oil supply tank and air pressure system.
5. Fill the oil reservoir tank with the recommended grade of fluid.

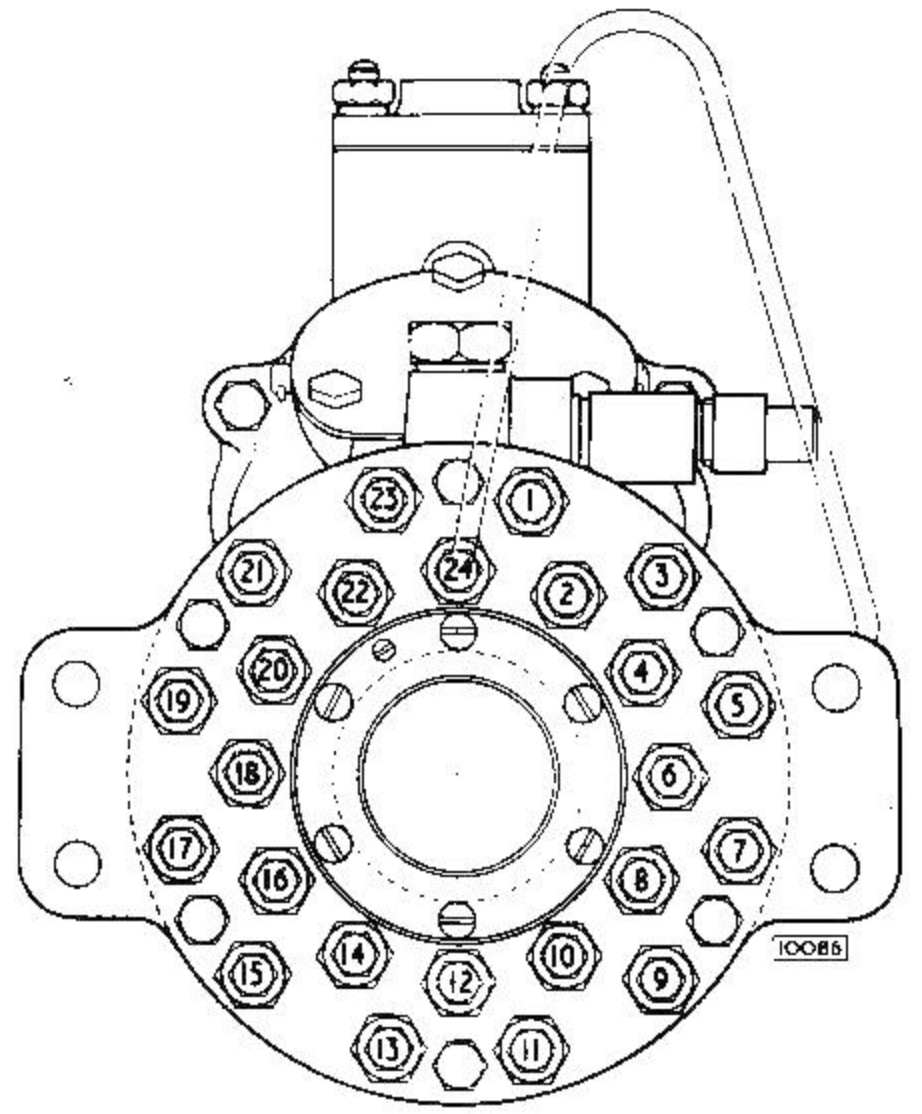


Fig. 4 *End view of lubricator pump showing connections numbering sequence.*

LUBRICATION

Priming – Delivery Union Method
The feed pipes from the 23 bearing points are connected to the distributor plate in accordance with the following table, Number 1 being the first union following the top centre fixing bolt in a clockwise direction. Odd numbers are arranged on the outer ring and even numbers on the inner ring.

CHASSIS POINT LOCATION

Distributor Point No:	Distributor Point No.
1. Steering Relay Lever	14. Rear Spring Rear Shackle – Bottom Pin Right-Hand Side
2. Front Steering Side Rod – Front Right-Hand Side	15. Rear Spring Rear Shackle – Bottom Pin Left-Hand Side
3. Front Steering Side Rod – Rear Right-Hand Side	16. Rear Spring Rear Shackle – Top Pin Left-Hand Side
4. Front Spring – Front Spring Pin Right-Hand Side	17. Rear Spring – Front Spring Pin Left-Hand Side
5. Rear Steering Side Rod – Front Right-Hand Side	18. Front Spring Rear Shackle – Bottom Pin Left-Hand Side
6. Rear Steering Side Rod – Rear Right-Hand Side	19. Front Spring Rear Shackle – Top Pin Left-Hand Side
7. Swivel Pin – Top Right-Hand Side	20. Track Rod – Left-Hand Side
8. Swivel Pin – Bottom Right-Hand Side	21. Swivel Pin – Bottom Left-Hand Side
9. Track Rod – Right-Hand Side	22. Swivel Pin – Top Left-Hand Side
10. Front Spring Rear Shackle – Top Pin Right-Hand Side	23. Front Spring – Front Spring Pin Left-Hand Side
11. Front Spring Rear Shackle – Bottom Pin Right-Hand Side	24. Lubricator Pump
12. Rear Spring – Front Spring Pin Right-Hand Side	
13. Rear Spring Rear Shackle – Top Pin Right-Hand Side	

1. Disconnect No. 1 union from the delivery plate.
2. Release the feed pipe union from the bearing point.
3. Using a pressure gun or other suitable means, charge the pipe with oil from the lubricator end until all air is expelled and oil seeps from the connection point.
4. Tighten the bearing point union and reconnect the delivery plate union.
5. Repeat the operation to the remaining 22 feed pipes.

Testing
1. Check all connections and ensure that they are secure.
2. Check that the oil reservoir is full and that the vent hole in the filler is clear.
3. Slacken off the inlet pipe banjo union until the oil is seen to flow from the joint and re-tighten.
4. Withdraw the three set bolts and remove the circular top cover plate to expose the operating lever chamber of the lubricator. Fill the chamber with oil of the specified grade, to the level of the gauze breather in the side of the chamber.
Release one pipe at the distributor plate and operate the brake pedal until oil is delivered at the disconnected union. Re-tighten the union. During this operation it will be necessary to maintain the air pressure in the braking system.
Test the vehicle on the road and apply the brakes frequently. Check all unions for leaks and tighten if necessary.

Adjustment
The lubricator is set initially to give the maximum quantity of lubricant per oil impulse at the maximum piston stroke; after a period of service oil should be showing at each lubrication point.
When service conditions are such that the chassis requires less lubrication adjustment should be made as follows: Release the locknut and screw in the stop screw, located at the bottom of the operating cylinder.

COOLING SYSTEM

SECTION C

INDEX

COOLING SYSTEM

COOLING SYSTEM

SPECIFICATION AND DATA

Type of cooling system	Pressurized, thermostatically controlled impeller pump assisted thermo-syphon
No. of fan blades	8
Type of drive	Vee belt and jack shaft
Speed of fan – GLX Engine	.94 times engine speed
GLXB Engine	
Cooling system capacity	6 gallons 6 pints (30.5 Litres)
Thermostat opens at	135°F (57°C)
fully open at	168°F (75°C)
Type of radiator	Vertical flow, fixed or removable tube type block
Normal running temperature	165° – 170°F (73.9° – 76.7°C)
Pressurized to	4 lbs per sq. in (0.28 kg/cm^2)
Drive belt tension – Fan	½" – (13 mm) at 4 lb. tension
Compressor	½" – (13 mm) at 6 lb. tension
Coolant level	To bottom edge of filler neck

GENERAL DESCRIPTION

The cooling system, pressurized and thermostatically controlled, consists of the following components.

(i) A vertical flow radiator unit resiliently mounted on steel and rubber bonded bushes at the right hand side of the engine compartment. A pressure relief valve incorporated in the overflow pipe connection and a hinged flap type radiator cap, the latter held closed by a spring catch pressurizes the system to 4 lbs per sq. inch. Radiators may also be fitted with an expansion chamber to suit operator's requirements and have a pressure release incorporated in the radiator cap. The pressure is released by turning the small knurled knob anti-clockwise before opening the radiator cap.

(ii) A 21.0" (533.4 mm) diameter eight bladed cooling fan runs in a special housing which is attached to the inside face of the radiator by its two vertical sides. Included in the fan housing assembly is a large diameter drive pulley which drives the cooling fan through three vee belts.

(iii) Two jack shafts which connect the cooling fan drive pulley to a pulley at the top of the timing chest situated on the left hand side of the engine unit.

(iv) An impellor type coolant pump situated at the rear bottom left hand corner of the engine unit.

(v) A thermostat mounted in a housing situated on the front top left hand side of the engine. Before the engine reaches its normal working temperature the coolant by-passes the radiator through an external pipe to the water pump.

(vi) A temperature warning device operating a warning light on the instrument panel and/or a buzzer in the switch panel is fitted as standard equipment. No routine maintenance or adjustment, with the exception of occasional contact adjustment of the buzzer, is necessary or provided for.

ROUTINE MAINTENANCE

DAILY

Checking the Radiator Coolant Level.

Check the level of the coolant in the radiator daily, and if necessary top up to the bottom of the filler neck.

Use water that is as soft as procurable, hard water produces scale which in time will impair the cooling efficiency of the system.

NOTE: It is dangerous to open the radiator cap while the engine is HOT as the escaping pressurised steam may cause scalding of the hands.

If the radiator cap is fitted with the pressure release control turn the small knurled knob anti-clockwise to release the steam pressure generated in the system before releasing the radiator cap spring catch. Fully close when refilling.

Rapid lowering of the water level should be investigated and the whole system checked for leaks.

EVERY 2,500 MILES (4,000 KM)

Checking the Fan Belt Tension

Check the fan and compressor drive belts. When correctly adjusted the deflection of the belts should be no more

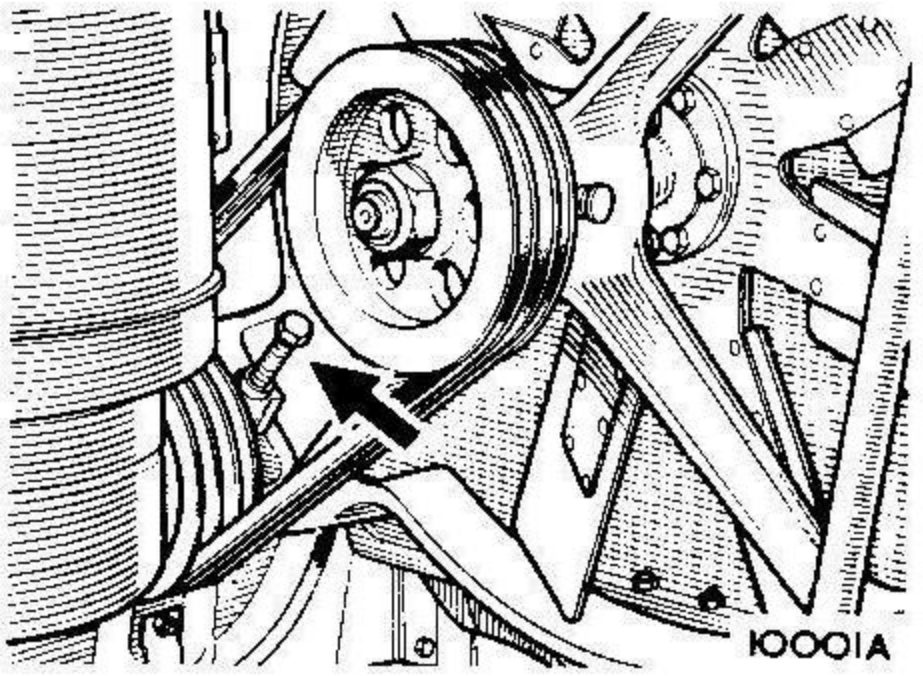


Fig. 1 Location of fan belt adjuster

than ½" (13 mm) with a pressure of 4.0 lbs (1.8 kg) applied between the pulleys.

Adjustment

Fan Belts

Release the two self-locking nuts securing the drive pulley bearing block to the mounting bracket.

Release the locknut locking the adjuster screw, and turn the screw in a clockwise direction to tighten the fan belts. Re-tighten the locknut and the two self-locking nuts.

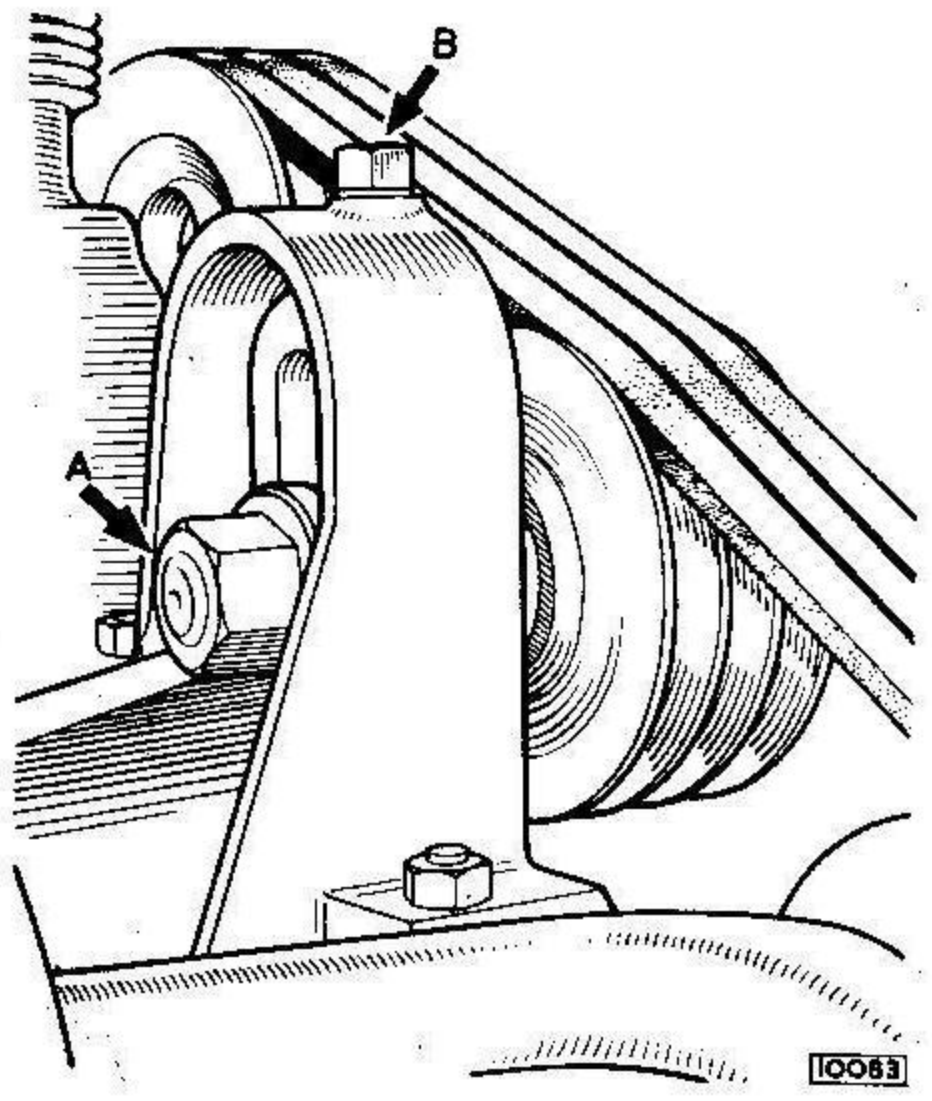


Fig. 2 Location of compressor belt adjuster

NOTE: Do not tighten the belts beyond the limits specified. Any undue load will create wear in the pulleys bearings.

Compressor Belts

Release the large nut securing the jockey pulley bearing block to the mounting bracket. Turn the adjuster screw located in the centre of the mounting bracket in a clockwise direction to tighten the belts. Re-tighten the large nut.

NOTE: Do not tighten the belt beyond the limits specified in "Fan Belt – Adjustment."

EVERY 10,000 MILES (16,000 KM)

Lubrication

Apply the grease gun to the grease nipples located in the fan pulley bearing and the drive pulley boss and inject a small quantity of grease.

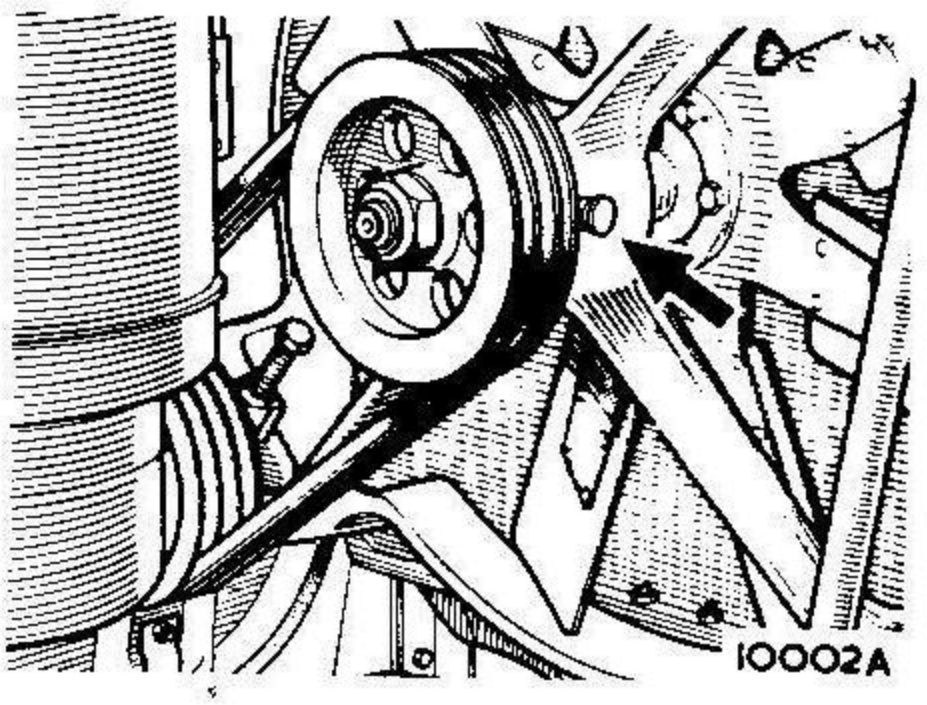


Fig. 3 Fan bearing grease nipple

Warning: Do not pack the bearing with lubricant. Any excess grease will be thrown out of the bearings by centrifugal action and may contaminate the fan belts.

PERIODICALLY

Care of the Cooling System

The entire cooling system should occasionally be flushed out to remove sediment. Remove the plug situated in the radiator bottom water pipe and open the taps in the cylinder inlet pipe and water pump. Insert a water hose in the radiator filler neck and allow the water to flow freely with the engine running at a fast idle speed (1,000 r.p.m.) to cause circulation until the water runs clear.

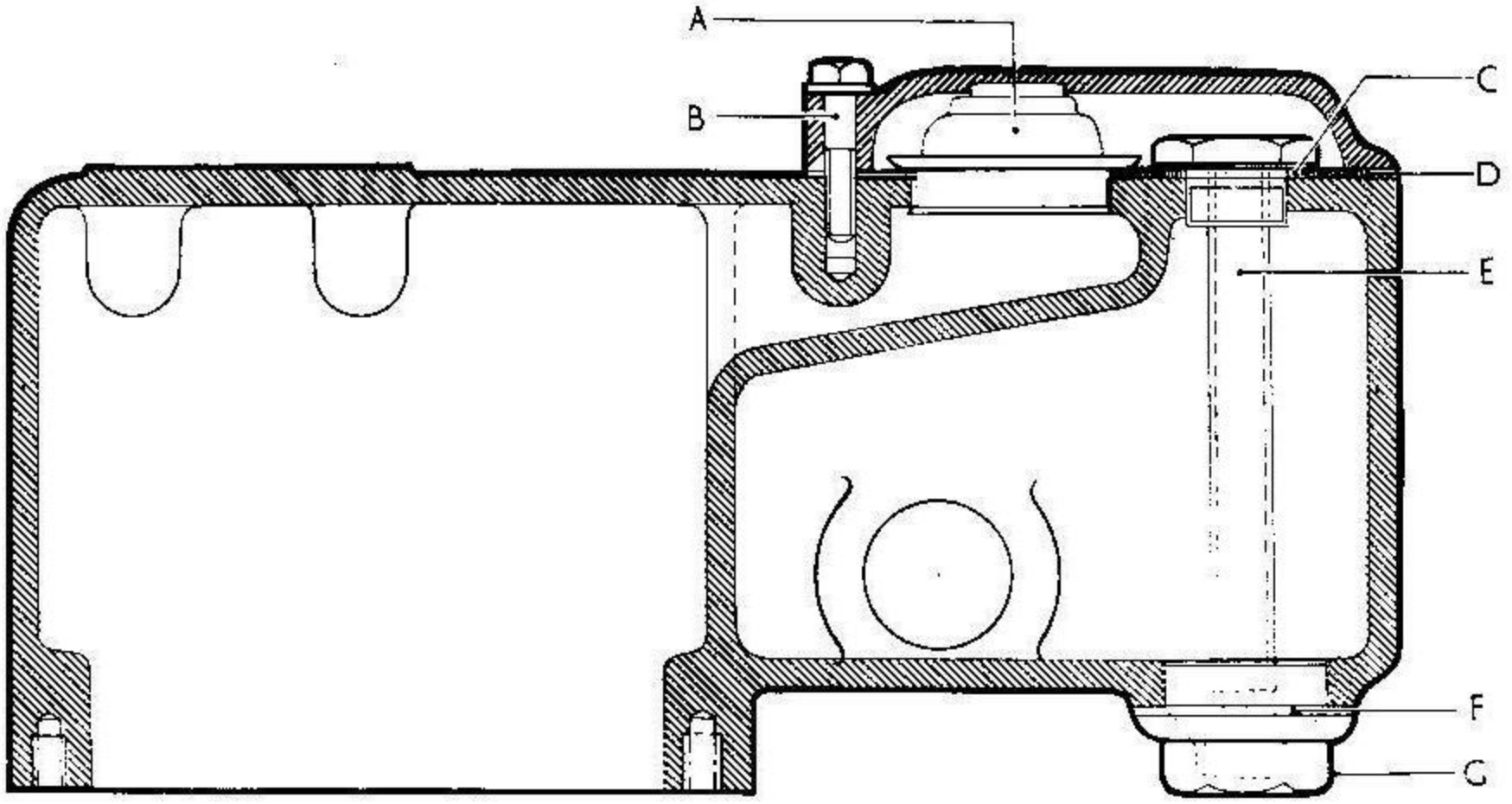


Fig. 4 Sectioned view of radiator expansion chamber

A Release valve
B Cover retaining screw
C Gasket
D Cover joint
E Expansion chamber tube
F Gasket
G Drain plug

Since deposits in the water will in time cause fouling of the surface of the cooling system with consequent impaired efficiency, it is desirable to retard this action as much as possible by using water as nearly soft as possible. If the cooling system incorporates an expansion chamber remove the large brass plug in addition to the items previously noted when flushing.

Water Pump – Lubrication
Refer to the Gardner Handbook for all details concerning the lubrication of the water pump.

Jack Shafts – Lubrication
The jack shaft assembly driving the fan drive pulley is comprised of two shafts connected by a flexible coupling. For the lubrication of the main shaft bearings refer to the Gardner Service Manual. The sliding joint on the coupling shaft should only require lubricating after a lengthy period of service.

FROST PRECAUTIONS

Anti-freeze – Important
During the winter months it is strongly recommended that an anti-freeze compound with an inhibited ethylene glycol base is used in the proportions laid down by the anti-freeze manufacturers. Before adding the anti-freeze solution the cooling system should be cleaned by flushing. The cylinder head gaskets must be in good conditions and the cylinder head nuts pulled down to the correct torque, refer to the Gardner Service Manual for correct torque figures. Check all water hoses and connections, water pump and manifold joints.
To ensure satisfactory mixing measure the recommended proportion of water and anti-freeze solution in a separate container and fill the system from this receptacle rather than add the anti-freeze direct to the system.

COOLING SYSTEM

FAN AND COMPRESSOR BELTS

Worn or damaged fan or compressor belts should always be replaced as soon as possible.

Fan Belts – Removal

Release the two self-locking nuts securing the drive pulley bearing block to the mounting bracket. Release the locknut locking the adjust screw and turn the screw in an anti-clockwise direction until the fan belts can be withdrawn clear of the pulley.

Remove the two screws securing the jack shaft flexible coupling to the fan drive pulley and slide back the sliding joint to allow the belts to be withdrawn.

Refitting

Refitting is the reverse of the removal procedure. Adjust the belts to the correct tension as detailed in the 2,500 miles maintenance service.

Compressor Belts

Removal

Release the large nut securing the jockey pulley bearing block to the mounting bracket. Turn the adjuster screw, located in the centre of the mounting bracket in an anti-clockwise direction until the jockey pulley is clear of the belts. Remove the belts.

Refitting

Refitting is the reverse of the removal procedure. Adjust the belts to the correct tension as detailed in the 2,500 miles maintenance service.

FAN

Removal

Remove the fan belts as detailed under "Fan Belt – Removal"

Remove the eight bolts securing the fan carrier bracket to the radiator. Withdraw the two bolts and nuts securing the radiator stays to the fan carrier. Remove the fan and carrier as a complete unit.

Dismantling

Remove the nut securing the fan to the fan spindle and extract the woodruff key. Remove the nut securing the pulley to the spindle and extract the key from the keyway.

Remove the four bolts and self-locking nuts securing the bearing and caps. Remove the caps taking care not to damage the oil seals. Extract the two bearing housings and withdraw the spindle.

To remove the fan blades from the centres boss extract the six bolts and nuts.

NOTE: The holes in the fan and centre boss are offset to facilitate correct re-assembly

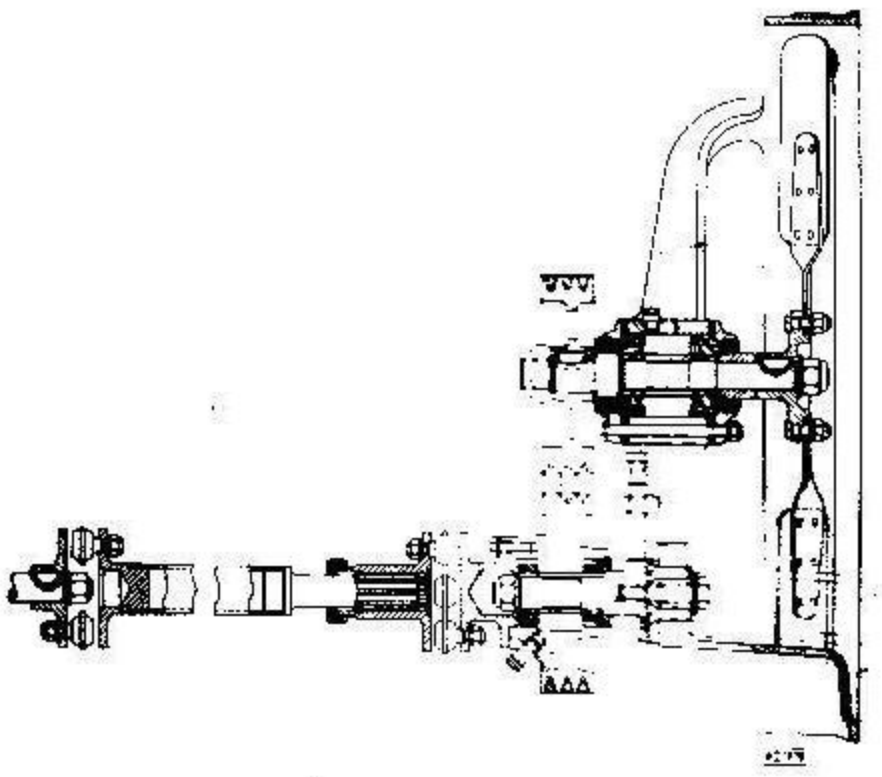


Fig. 5 Sectioned view of the fan assembly

Assembling

Assembling is the reverse of the dismantling procedure. Renew the two oil seals if worn or damaged.

Refitting

Refitting is the reverse of the removal procedure.

HIGH SPEED RADIATOR FAN.

High speed (gear driven) radiator fans are available as alternative equipment for "FLEETLINE" vehicles operating in countries with a normal high ambient temperature.

The fan is belt driven through a shaft and two bevel gears, the shafts being supported on ball bearings.

Routine Maintenance

Routine maintenance is confined to periodically checking the oil level in the unit and drive belt adjustment.

Removal

Remove the fan, drive belt and carrier as an assembly as detailed on this page.

Dismantling

Remove the plug and drain the oil from the unit.

Remove the self-locking nut and washer securing the fan to the spindle, withdraw the fan and extract the key.

Withdraw the sleeve from the shaft.

Remove the split pin, nut and washer securing the pulley to the drive shaft, withdraw the pulley and extract the key.

Withdraw four bolts and lockwashers and detach the fan spindle bearing housing from the drive shaft housing.

Remove four bolts and lockwashers and detach the bearing cap from the fan spindle housing.

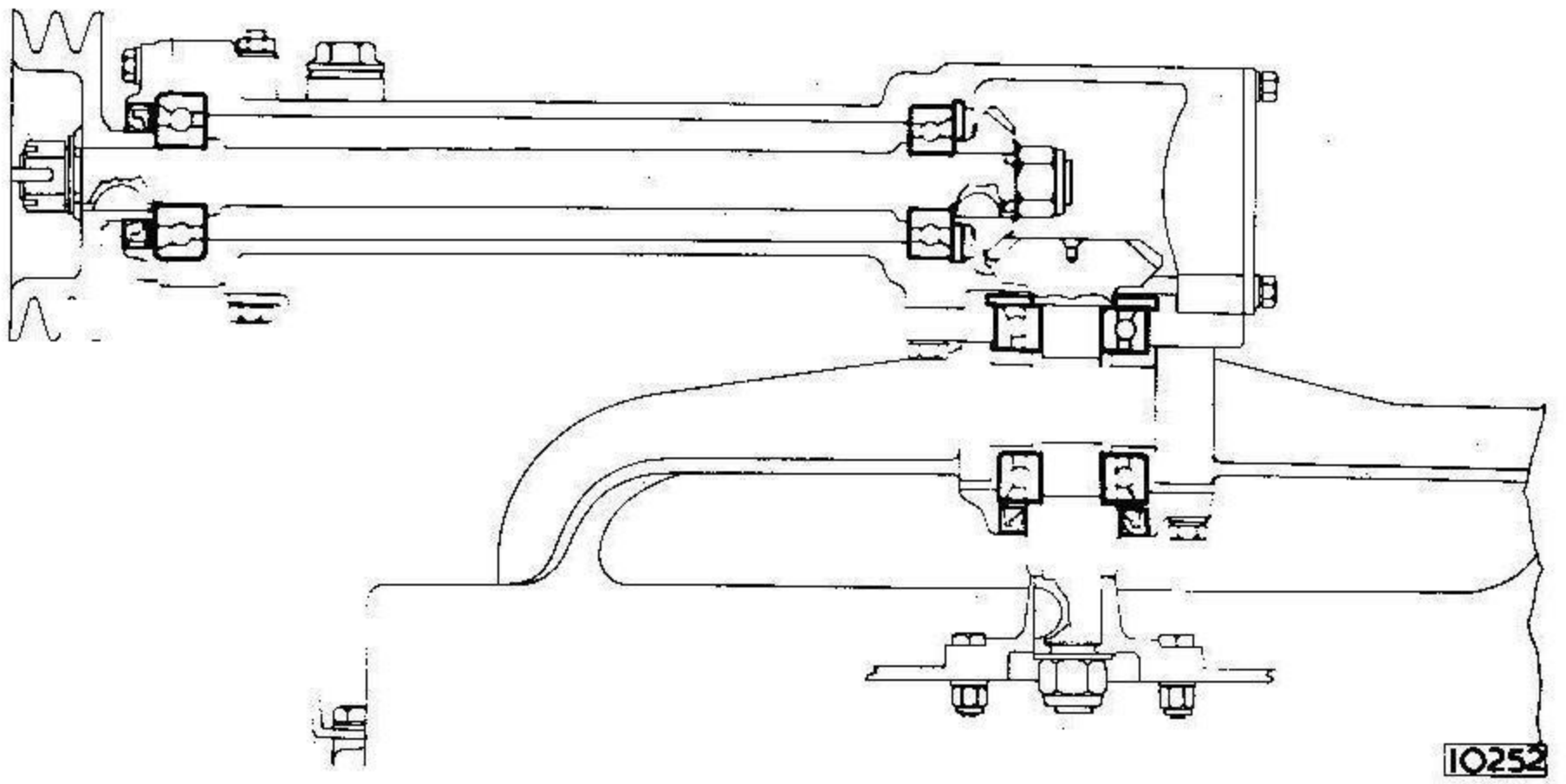


Fig. 6 Sectioned view of the high speed fan assembly

Withdraw the outer bearing and housing.
With a soft mallet drift the pinion shaft through the inner bearing and extract the inner bearing.
Remove the bearing cap from the drive shaft housing and withdraw the outer bearing.
Remove the end cover plate and drift the drive shaft through the inner bearing. Extract the inner bearing.
Note the location and number of shims fitted when removing the bearings for reference when reassembling.
Check the condition of the pinion teeth and renew the pinions if worn or damaged. The drive pinion may be removed from the shaft after removing the nut.
Renew the oil seals and gaskets.

Reassembling
Reassembling is the reverse of the dismantling procedure.
Add or subtract shims until all end float is removed from the bearings.
Refill the unit with the recommended grade of lubricant (S.A.E.140).
The capacity is approximately ¾ Imp: pints. (.42 Litres).

RADIATOR

Removal
Raise the engine cover to the open position. Remove the engine compartment right hand panel as detailed under Section Q "Engine Compartment Covers".
Drain away the coolant by removing the drain plug located in the bottom water pipe, conserving the coolant if an anti-freeze is in use.
Disconnect the bottom water tank hose and the air filter hose from the bracket attached to the top tank.
Remove the two bolts and nuts securing the radiator bottom mountings. Disconnect the jack shaft flexible coupling from the fan drive pulley by removing the two setscrews.
Remove the two bolts and nuts securing the radiator stays to the radiator top mounting and lift away the radiator complete with the fan assembly.
Note the two rubber pads fitted between radiator upper mountings and the two rubber pads and cup washers fitted between bottom mounting and bolt head.

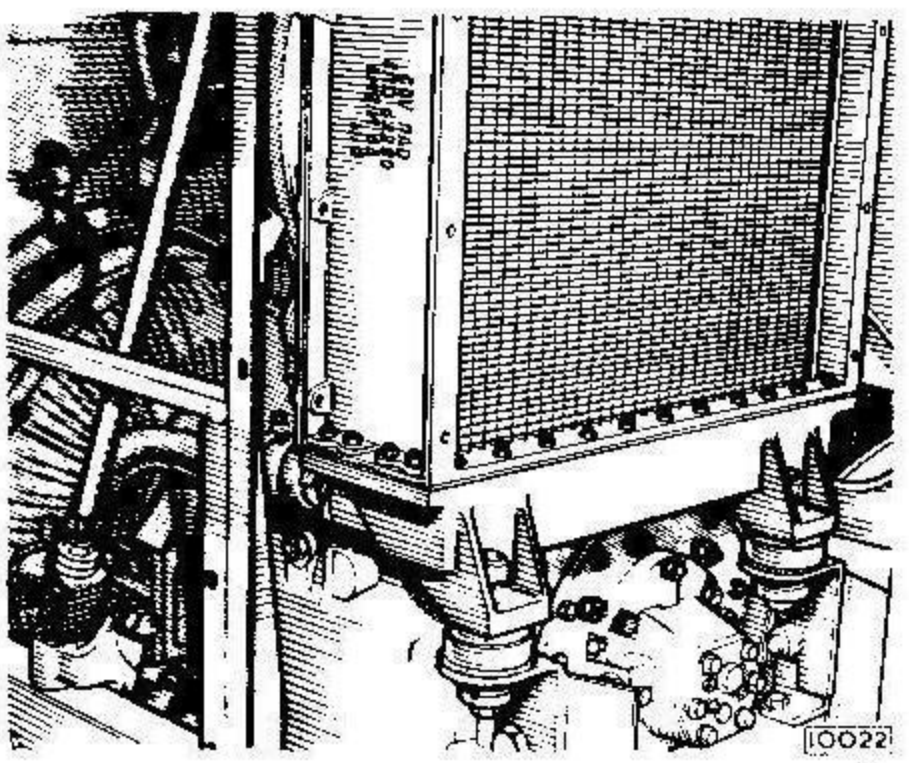


Fig. 7 Radiator lower mounting points

Refitting
Refitting is the reverse of the removal procedure.

THERMOSTAT
For all information and data concerning the thermostat refer to the Gardner Service Manual.

MAGNETIC FAN COUPLING

Vehicles may be equipped with a magnetic fan coupling to operator's requirements.
The following is a brief description of the operation and maintenance necessary to the coupling and associate parts.
For fuller details, parts list and guarantee details, operators are advised to apply to the components manufacturers (address below) for a copy of their Service Manual covering the Daimler "Fleetline" vehicle.

SMITHS MOTOR ACCESSORY DIVISION
Service Department,
55, Oxgate Lane,
London, N.W.2.

DATA

DESCRIPTION			OPERATION
Coupling Unit		Nominal voltage	24V – D.C.
		Coil resistance	19 ohms.
		Coil insulation	10 Meg ohms at 500V
		Torque	8 lbs/ft. (min:)
Relay		Nominal voltage	24V – D.C.
		Contact current rating (Max)	10A at 24V non-conductive
		Pull-in voltage	16V (max)
		Drop-out voltage	3.5V (min)
		Contact gap	.040"
Thermal Switch			
	Primary	Operating temperature	60°C – 70°C (140° – 158°F)
	Secondary	Operating temperature	70°C – 80°C (158° – 176°F)

DESCRIPTION

The Magnetic Fan Coupling provides a means of automatically regulating the operation of the cooling fan by accurately sensing the engine coolant temperature through a thermal switch as shown in the electrical control circuit diagram.
The switch contacts close and the fan coupling engages drive by being energised through the relay, only when operating conditions demand extra cooling beyond the thermal dissipation of the radiator under ram air conditions. As the thermal switch permits the fan coupling to remain disengaged until such additional cooling is necessary, the circuit is in-operative with a cool engine. The fan coupling installation has a safety control circuit incorporated as shown by the dotted line in the circuit diagram. The principle of operation is similar to that already described in that the primary thermal switch initiates control of the normal running circuit but in the event of failure of this circuit, control is taken over by the secondary switch and relay.
The two switches are set at slightly different operating temperatures to avoid simultaneous control; the safety switch (second), marked with a blue spot, being the higher.
Failure of the normal primary running circuit will be indicated by a warning lamp installed in the cab and if a failure is indicated the defective circuit must be serviced as soon as possible.

ROUTINE MAINTENANCE

The magnetic fan coupling components are sealed units, therefore no routine maintenance is necessary.

NOTE: It is advisable, when carrying out a major engine overhaul, or at 250,000 miles, to obtain a replacement fan coupling.

IMPORTANT

Although these couplings are sealed units it is important that they are not allowed to become excessively covered with grease or lubricating oil. If it is necessary to clean an external part of a unit only Trichlorethylene must be used and this sparingly to avoid leakage through the joints.

UNITS MUST NEVER BE UNPACKED FROM THEIR CARTONS UNTIL THEY ARE ACTUALLY REQUIRED FOR USE.

EVERY 50,000 MILES

Carry out operational tests on the units incorporated in the fan coupling installation as detailed under their respective headings.

Thermal Switch

Disconnect the battery supply.

Drain sufficient coolant from the system to enable the switch to be removed. Conserve the coolant if an anti-freeze is in use.

Loosen the clip and slide the rubber cover clear of the terminals. Disconnect the two cables.

With a spanner on the hexagon of the switch body unscrew (right-hand thread) the switch from the adaptor.

NOTE: If the thread is tight due to corrosion work the switch backwards and forwards to clear and so avoid unnecessary damage.

Connect the switch to a 2.5 volt battery with a 2.5 volt bulb wired in series.

Immerse the lower (threaded) portion of the switch in a pot of water. Raise the temperature of the water and note the exact point when the bulb lights up. Check temperature with an accurate thermometer.

Lower the temperature of the water and note the point at which the light goes out.

Check the switch operating temperatures with that given in the "DATA" section.

The switch cannot be adjusted and must be replaced if faulty.

Refit by reversing the removal procedure. Renew the joint washer.

Lightly coat the inside of the switch cover with a silicone grease to ensure water tight sealing before replacing.

Relay

Remove the plastic cover from the terminal block on the relay base and disconnect the wires from the terminals. Clearly mark the cables before removing to ensure correct reconnecting.

Remove the relay after unscrewing the two retaining screws.

To test for correct operation connect the coil terminals through a variable resistance across a 24 volt battery. At full voltage check with a 2.5 volt battery and battery and bulb wired in series between the relay contact terminals that the contacts are closed and the bulb lights up.

If satisfactory, check by means of the variable resistance that the contact pull-in and drop-out voltages are correct as stated under "DATA".

If it is necessary to remove the relay cover in order to check the contact gap ensure on refitting that it is seating correctly and seal by using air drying varnish.

If the relay fails these tests it must be replaced with a new or reconditioned unit.

Refit by reversing the removal procedure.

Fan Coupling

Before attempting to remove the coupling check that the wiring, relay and thermal switches are working satisfactorily.

Check the coupling for any signs of damage or extremely heavy deposits of oil or grease on the coupling. Any such contamination could adversely affect the coupling performance.

If the above is in order, then the coupling when energised from a 24 volt battery supply should engage with sufficient torque to drive the fan.

To establish the correct torque value proceed as follows:

NOTE: It is necessary before checking the torque value to ensure, by the following method, that the magnetic powder within the coupling is evenly distributed. Rotate the coupling and at the same time briefly energise and de-energise the coupling coil by shorting out the thermal switch.

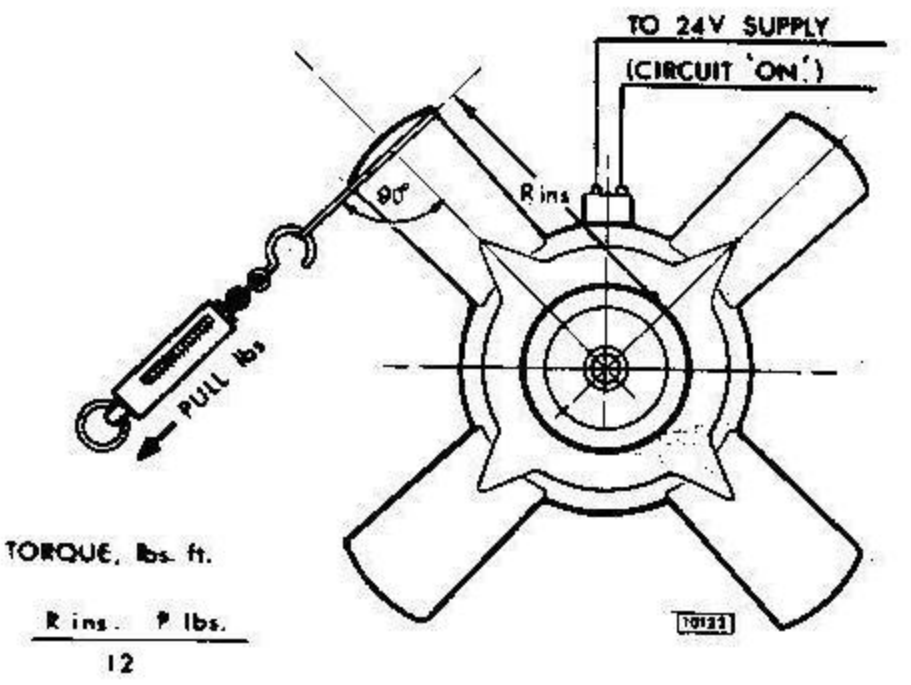


Fig. 8 Checking the torque of the fan coupling

Attach a spring balance to the tip of one of the blades and carry out the test as illustrated in Fig. 8. The resultant figure obtained should be – 8 ft/lbs (min).

Check the coil resistance by disconnecting the supply leads from the unit and connecting an ohmsmeter in circuit with the unit terminals. The resistance value obtained should be 10 ohms.

Check the coupling insulation by disconnecting the supply leads and connecting a MEGGA test instrument between either terminal and the case. Insulation value obtained should not exceed 10M.ohms at 500 volts.

In the event of failure in any of the above tests the coupling unit must be replaced.

COOLING SYSTEM

FAULT DIAGNOSIS

Before diagnosing faults, the engine must be cool (below 60°C), the control circuit should then be in the normal condition with the start switch "ON" as shown in Fig. 8. In this normal condition the thermal switch contacts are open, the relay is de-energised with its contacts open and the coupling is also de-energised with the fan free.

A visual examination of the installation, with the engine stationary, should first be carried out before investigating the symptoms in the following table.

Ensure that:—

(a) The belt drive to the fan coupling is in order.

(b) The fan will rotate freely by hand.

(c) There is electrical continuity to terminal No. 2 of the relay from the battery supply.

(d) The wiring is free from damage and correctly installed, the terminals are clean and tight and also there is electrical continuity between the coupling units.

Obvious faults must be rectified.

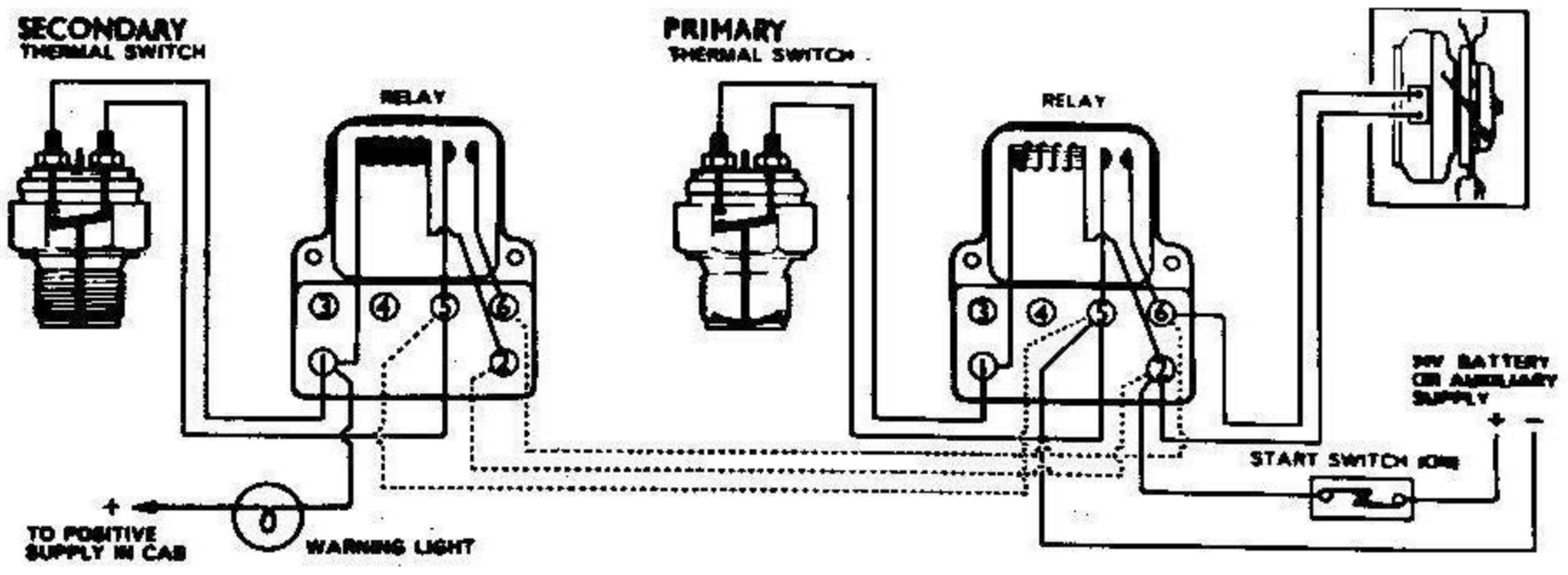


Fig. 9 Electrical control circuit

DIAGNOSIS CHART

	SYMPTOM	FAULT	ACTION
1.	Engine overheating. (i.e. the fan will not rotate when required).	Thermal Switch	With engine stationary, remove rubber cover from thermal switch and connect together the two terminals. If the fan engages with sufficient torque (see torque test, page C. 9) then a fault is indicated in the thermal switch and this must be replaced. To remove switch see under "THERMAL SWITCH".
		Relay	If the fan remains free when the switch terminals are connected then confirm that there is battery potential across the coupling terminals. No or low voltage assuming the wiring is satisfactory, indicates a faulty relay. To test relay see page C. 9 and to remove see under "RELAY". If a fault is indicated then the relay must be replaced.
		Coupling Unit	If battery potential is recorded at the coupling terminals then confirm the resistance and insulation of the coil within the coupling unit by using ohmeter and megga-tester. An incorrect recording indicates a faulty coil, correct recordings would at this stage mean a mechanical failure within the coupling. In both cases the coupling must be replaced. To remove coupling see Manufacturers Service Manual.

DIAGNOSIS CHART

NOTE: If the complete system appears to be satisfactory but "Engine Overheating" persists, then the thermal switch must be tested (see page C. 9) as it may be operating above its calibrated temperature.

	SYMPTON	FAULT	ACTION
2.	Engine Overcooling (i.e. fan rotates permanently).	Coupling Unit	With the engine cool, check with start switch "ON", that the fan will rotate freely by hand, if not disconnect the two wires from the coupling terminals. NOTE: – wires may be live. If fan does not then rotate freely a fault is present in the coupling and it must be replaced. To remove coupling see Manufacturer's Service Manual.
		Thermal Switch	If by removal of the coupling wires, the fan does rotate freely then reconnect the two wires and disconnect the two wires from the thermal switch. If this now frees the fan then a fault is indicated in the switch and must be replaced. To remove switch see under "THERMAL SWITCH".
		Relay	If fan remains engaged when thermal switch wires are disconnected a fault in the relay is indicated. To test relay see page C. 9 and to remove see under "RELAY". If a fault is indicated then the relay must be replaced.

NOTE: If the complete system appears to be satisfactory but "Engine Overcooling" persists, then the Thermal Switch must be tested (see page C. 9) as it may be operating below its calibrated temperature.

RADOLARM WATER LEVEL WARNING SYSTEM

DESCRIPTION

The "RADOLARM" water level warning system is available as optional equipment to Operator's requirements.

The complete unit consists of a probe inserted in the radiator top tank, a transistorised control unit, a warning buzzer or warning light and the necessary wiring cables.

The circuit diagram for the "Radolarm" system is shown on the main wiring diagram on page R.27.

DATA

Operating Voltage	24 volts
Operating current when dormant	0.5 m.A
Operating current when giving alarm	50 m.A–100 m.A

Operation

Lowering of the coolant level to below the base of the probe due to water vapour loss or damaged wiring or connections, will cause the warning light or buzzer or both (if fitted) to operate when remedial action should be taken immediately.

Routine Maintenance

No routine maintenance is necessary. Periodically check that all connections are clean and tight.

Test Procedure

Check that the operating voltage (24 Volts) is available at the transistor pack terminal.

Check that operating current 0.5 m.A. is available at the probe terminal.

Check that the buzzer is operating correctly.

Further tests to probe and transistor pack should be carried out by substition.

ENGINE UNIT

SPECIFICATION AND DATA

Type of Engine Unit	Gardner 6 LX
	Gardner 6 LXB (Alternative)
Bore	4.75" (120.6 mm)
Stroke	6.00" (152.4 mm)
No. of cylinders	6
Swept Volume	638 cu. ins (10.45 Litres)
B.H.P. – 6LX	150 at 1,700 r.p.m. (Max.)
	(Lower settings available to operators' requirements)
– 6LXB	180 at 1,850 r.p.m.
Firing order	1, 5, 3, 6, 2, 4
Governed speed – 6LX	1,760 r.p.m.
– 6LXB – 6LXB	1,980 r.p.m.
Idling Speed	420 r.p.m.
Oil Sump Capacity	4 gallons (18 Litres) approx.
Valve tip clearance	0.004" (0.1 mm) inlet, 0.011" (0.279 mm) exhaust cold
Mounting	4 point

GENERAL DESCRIPTION

The Gardner 6 LX or 6LXB, as fitted to the Daimler "Fleetline" chassis is resiliently mounted on four rubber and steel bonded pads, to a sub-frame attached to the chassis at the rear. For a full description of the engine and its components refer to the Operations Manual issued by the manufacturers, to which reference should also be made for all Routine Maintenance concerning the engine unit.

The accelerator control is hydraulically operated; the engine stop control being electrically operated through a solenoid relay and switch.

An oil bath air cleaner is fitted in the engine compartment attached to the right hand side of the bulkhead.

The 6LXB power unit is available as an alternative to the 6LX engine for the single deck coach chassis.

ROUTINE MAINTENANCE

For all routine maintenance and servicing details concerning the engine unit refer to the Operating Manual issued by the manufacturers.

DAILY

Oil Level – Checking

Check with the vehicle standing on level ground and with the engine stationary. Withdraw the engine dipstick, located on the rear side of the engine, wipe dry on a clean lintless wiper, re-insert and withdraw, note the level of the mark indicated on the dipstick. Top up with the recommended grade of lubricant to the correct level.

EVERY 2,500 MILES (4,000 KM)

Engine Controls – Lubrication

Lubricate with oil from an oil can, all the engine control rod joints. Clean the spindle of the engine stop solenoid and smear lightly with grease.

Engine Air Cleaner – Cleaning

Lower the air filter container body away from the filter head after removing the two brass cap nuts. Withdraw the filter element located on the underside of the filter. Wash the gauze filter element in clean petrol. Drain the oil away from the canister and the container, wash in petrol and dry with a clean cloth. Refit the canister to the filter element and fully tighten the thumb nut.

Replenish the canister body with clean oil to the level mark indicated by the arrow. Replace the filter element in the container body and refit to the filter head with two cap nuts and washers.

NOTE: Before replacing the filter unit examine the two rubber sealing rings located on the underside of the filter head. Replace if worn or damaged.

Important: If vehicles operating in very dusty conditions the air filter should be cleaned at more frequent intervals.

EVERY 10,000 MILES (16,000 KM)

Engine Mountings – Examination

Examine engine mountings for signs of deterioration and security of mounting bolts.

Water Hoses – Checking

Check the condition of all engine water hoses and replace if worn or damaged.

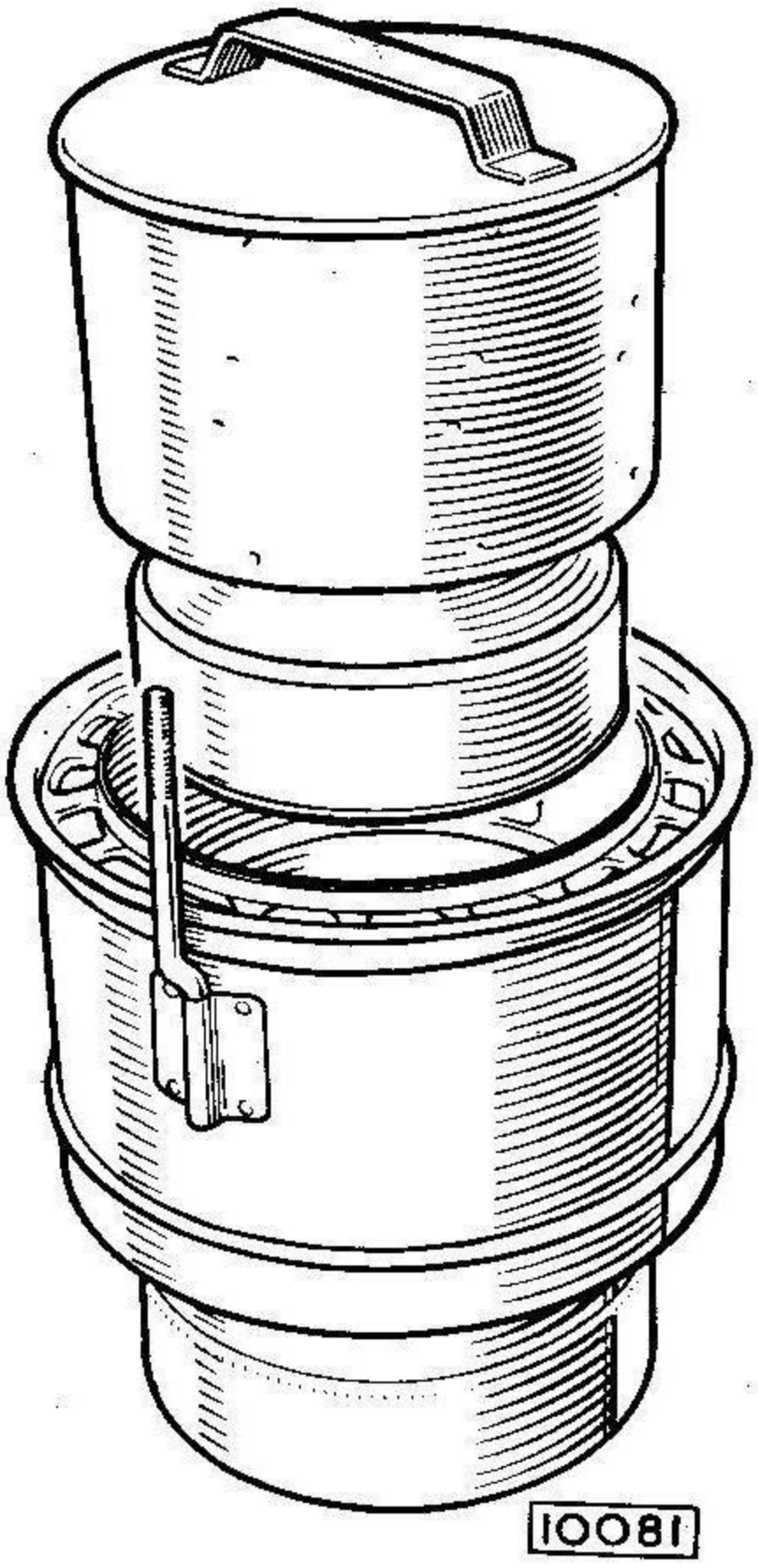


Fig. 1 Exploded view of the air cleaner

THE ENGINE UNIT (Double deck chassis)

Removal

1. Raise the engine cover to the fully open position.
2. Disconnect the battery system by rotating the master battery switch to the "OFF" position.
3. Drain the radiator, conserving the coolant if an anti-freeze is in use.
4. Remove the engine compartment covers, as detailed in Section Q "The Engine Compartment Covers".
5. Detach the air cleaner body by removing the two brass cap nuts and washers and lowering the container away from the head unit. Detach the air cleaner flexible ducts from the cleaner unit after releasing the clips.
6. Release the top water pipe hose clips and disconnect the hoses from the engine and radiator top tank.
7. Disconnect the fuel feed and fuel return pipes from the bulkhead and blank off the unions to prevent the ingress of dirt.
8. Release the two unions and detach the accelerator fluid pipes; remove the flexible pipe unions from the support bracket and blank off the unions.
9. Disconnect the electrical cables from the high and low pressure indicator switches, engine stop solenoid and relay.
   Disconnect the cables from the generator and starter motor. The latter is accessible after removing the central panel in the lower portion of the engine bulkhead.
10. Remove the left hand panel situated in the lower portion of the bulkhead.
11. Disconnect the bottom water pipe flange from the water pump; release the two clips securing the water pipe central hose and slide away hose until the joint between the two pipes is broken.
    Remove the two clamps securing the bottom pipe to the mounting brackets and remove the water pipe.
12. Remove the fan drive coupling shaft after removing the self-locking nuts securing the shaft to the fan drive pulley and jackshaft flanges.
13. Release the two clips securing the flexible portion of the exhaust pipe and slide the pipe clear of the exhaust manifold.
14. Remove the flywheel/gearbox coupling as follows:
    Tap back the locking plate and remove the four 5/16" bolts securing each bush housing to the respective yoke ends.
    Tap back the locking plates and remove the two 7/16" bolts securing each bush carrier to the centre piece.
    Remove the two halves of the coupling the centre piece can be withdrawn when the engine has been removed.

    NOTE: Before dismantling, note the assembly of the coupling links and yokes. When refitting, the trailing end of the link must always be connected to the gearbox yoke.
15. Disconnect the air compressor output at the flexible joint, located adjacent to the water pump.
16. Disconnect the engine left hand mountings by withdrawing the four bolts, nuts and washers securing the mounting brackets to the rubber/steel bonded pads.
    Disconnect the right hand mountings by withdrawing the two bolts and self-locking nuts securing the mounting brackets; the nuts are accessible from underneath the vehicle.
17. Remove the two valve cover right hand centre securing bolts, identified by the large washers fitted

under the bolt head and replace with the two eye-bolts supplied as part of the engine kit.
When lifting the engine the eye nuts must be screwed home finger tight only and NOT TIGHTENED BY MEANS OF A BAR OR LEVER. Overtightening the nuts in this manner may cause the cylinder head studs to become loosened or partially withdrawn when the eye nuts are removed. Should the nuts require turning in order to engage the slings unscrew the nuts slightly in preference to tightening further.
Pass the sling through the eyebolts, raise the engine to clear the sub-frame and withdraw.

NOTE: If lifting with a single hook hoist, fit a spacing bar between the two eye bolts to prevent a bending movement being applied to the cylinder head studs.

Refitting
Refitting is the reverse of the removal procedure. Care must be taken to ensure that the flywheel/gearbox coupling is assembled correctly; that is, with the trailing end of the links connected to the gearbox yoke.
Bleed the accelerator control slave cylinder and pipe line as detailed in The Fuel System Section E.
Before attempting to start the engine the fuel system must be primed as detailed in the Operation Manual issued by the engine Manufacturers. Check that the radiator has been refilled and the engine sump has been filled to the correct level with the recommended grade of lubricant. Run the engine and check the operation of the instruments and ancillary equipment.
Check for leaks at all joints and tighten as necessary.

Removal – Single Deck Chassis
The engine installed in the 36' 0" (single deck) chassis cannot be removed as detailed on Page 4 for the double deck vehicle due to the overhang of the body preventing the use of a lifting crane.
A wheeled trolley, with blocks to support the engine, must be available before removal of the unit can be attempted.
Disconnect the battery.
Remove the engine coverpanels after disconnecting any rear lamps which may be mounted on the panels.
NOTE: On some vehicles the panels may open fully to allow complete access to the engine without removal.
Disconnect all electrical cables, oil fuel and air pressure pipes after exhausting the pressure from the brake system.
Drain the coolant, conserve if anti-freeze is in use, and remove the radiator as detailed in Section C.
Remove the air cleaner and anti-freeze unit (if fitted).
Jack up the chassis on both sides at a point forward of the rear sub-frame and place the wheeled trolley with suitable blocks under the engine sump. Place blocks also under the gearbox/transfer box unit if this is not to be removed.
Lower the jacks until the engine and gearbox are supported firmly on the blocks.
Disconnect the flywheel/gearbox coupling as detailed in Section G.
Remove the engine mountings.
Detach and remove the sub-frame from the main chassis and withdraw the engine.

Refitting
Refitting is the reverse of the removal procedure.
Reference should be made to the points detailed under 'Refitting' for the double deck chassis.

FUEL SYSTEM

SECTION E

INDEX

FUEL SYSTEM

SPECIFICATION AND DATA

Fuel tank capacity	35 Imp. gallons (159 Litres)
Level of fluid in accelerator pedal reservoir	½" (13 mm) below bottom of filler orifice
Accelerator fluid	"LOCKHEED Super Heavy Duty brake fluid (S.A.E. 70 R3)"
Free travel of accelerator pedal	3/8" (9.5 mm) (1/8" (3 mm) at slave cylinder)
Fuel injection equipment	C.A.V./GARDNER

GENERAL DESCRIPTION

The 35 gallon (159 Litres) fuel tank is fitted to the right hand side of the chassis frame and is supported between two outrigger brackets mounted direct to the frame, by two hinged straps.

Nylon piping is used for both feed and return lines to and from the fuel tank and the engine compartment.

A C.A.V./GARDNER fuel injection pump is mounted on the rear face of the engine and is driven by a jack shaft from the timing chest.

The fuel pump is fitted with a centrifugal weight governor and full control of the engine speed is maintained from an idling speed of 420 r.p.m. to a maximum speed of approximately 1.760 r.p.m. (6LX) or 1.580 r.p.m. (6LXB) at no load through a hydraulically operated accelerator control.

Governor spring load at maximum r.p.m. (6LX) – 1072lb. (48.5 kg) and (6LXB) – 130 lb (58.9kg).

Fuel oil is drawn from the fuel tank by an AMAL diaphragm type lift pump incorporated in the fuel pump, and reaches the latter after passing through two replaceable paper element filters and a fuel SHUT OFF cock.

A solenoid actuated engine stop control, mounted on a bracket attached to the engine is connected by means of a fork joint and clevis pin to the stop lever on the fuel pump.

A stop button is mounted on the drivers switch panel with a second button mounted externally in the rear of the vehicle above the left hand top corner of the engine compartment.

The accelerator control is hydraulically operated, the fluid reservoir being mounted in the driver's cabin.

ROUTINE MAINTENANCE

DAILY

Fuel Oil Tank

Check the contents of the fuel oil tank before taking the vehicle into service.

WEEKLY

Accelerator Control

Check the level of the fluid in the accelerator control reservoir and top up to the specified level if necessary with fluid of the recommended grade.

Check the condition of the flexible hydraulic reservoir hose.

EVERY 2,500 MILES (4,000 KM)

Fuel Oil Filters

Check the condition of the first and second fuel oil filters and renew if necessary.

EVERY 25,000 MILES (40,000 KM)

Drain sediment away from the fuel tank by opening the drain tap and allowing a quantity of fuel oil to drain away into a suitable container. Under dusty conditions or where good fuel storage or filling conditions cannot be arranged, carry out this service every 20,000 miles (32,000 km). For all "ROUTINE MAINTENANCE" service on the fuel injector pump and equipment refer to the GARDNER Service Manual.

THE FUEL TANK

Removal

Drain away all fuel oil into a suitable container by opening the drain tap. Release the filler cap when draining. Fully close the drain tap on completion.

Release the nuts securing the fuel feed and return pipes to the tank and remove the unions.

Position wooden blocks to support the weight of the tank and release the two support straps by removing the two nuts and upper packing pieces. Withdraw the strap studs and collect the lower packing pieces. The nuts are accessible from the top of the outrigger support brackets. Lower the straps away from the tank. Remove the support blocks and lower the tank to the floor and withdraw clear of the vehicle.

FUEL SYSTEM

Note: On certain bodies it may be necessary to jack up the vehicle before the tank can be withdrawn.

Refitting
Refitting is the reverse of the removal procedure.

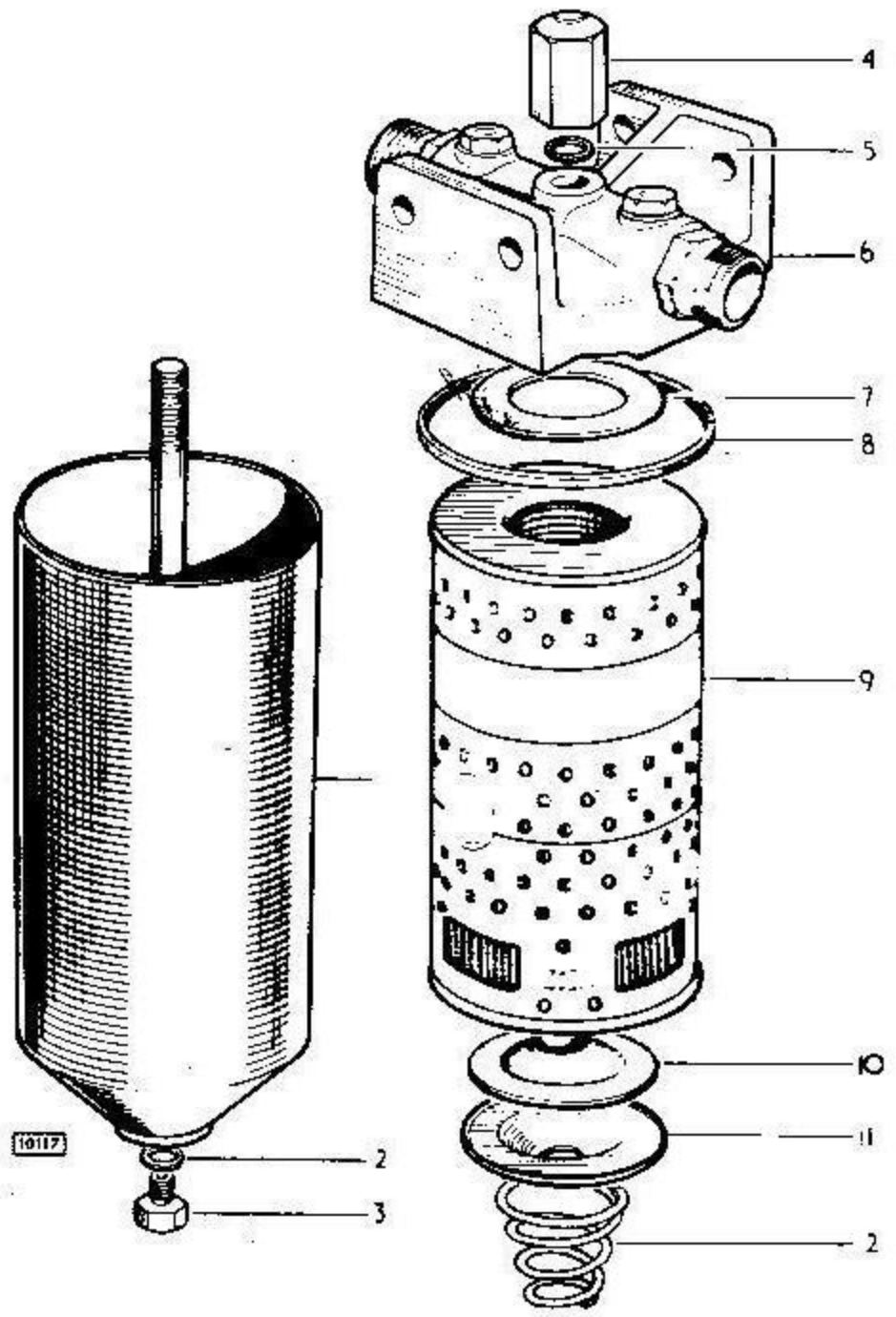


Fig. 1 Exploded view of the first fuel oil filter

1 Element canister
2 Washer
3 Drain plug
4 Retaining nut
5 Washer
6 Filter head
7 Clamping plate
8 Sealing ring
9 Filter element
10 Pressure plate
11 Spring plate

THE FUEL OIL FILTERS

The First Filter
The first fuel oil filter is located in the left-hand bottom corner of the engine compartment below the air compressor. To remove the element from the filter unit, release the top centre nut fixing and detach the filter body. Empty out any fuel oil and discard the element. Wash out the filter body. Renew the rubber seal and re-assemble the unit with a new element. It will be necessary to prime the fuel system after refitting as detailed in the Gardner Service Manual.

The Second Filter
The second fuel oil filter is attached to No. 1 cylinder block. To remove the element from the unit, remove the drain plug and drain the fuel oil into a suitable container. Release the cover centre fixing nut and remove cover, spring and filter element. Renew the rubber seal and re-assemble unit with a new element. Prime the fuel system after refitting as detailed in the GARDNER Service Manual. See Section A Fig. 1.

THE FUEL SHUT OFF COCK

A fuel shut off cock is incorporated in the fuel line system and is mounted adjacent to the second fuel filter.

Operation
Rotate clockwise to turn the fuel oil "OFF" and anti clockwise to turn "ON".
Access to the fuel cock is gained by opening the engine compartment.

THE HYDRAULIC ACCELERATOR CONTROL

Checking
Check that full movement of the fuel injection pump rack lever is obtained when the accelerator pedal is operated. To adjust, release the fork and locknut on the master cylinder operating rod, remove the clevis pin and adjust the fork end as required, refit the clevis pin and split pin and tighten the locknut. Adjust to give .030" (.76 mm) free travel measured on the operating rod between the master cylinder and the operating lever under the accelerator pedal attachment.

TO BLEED THE SYSTEM

Bleeding the system will only become necessary if the fluid container has been allowed to become empty or, if any of the pipes or units have been removed.
To ensure complete exclusion of air from the system it is advisable to utilize an external pressure pump when bleeding.
Suitable pressure bleeding equipment for carrying out the operation is available from various manufacturers, or, if desired can be fabricated utilizing a Lockheed hydraulic

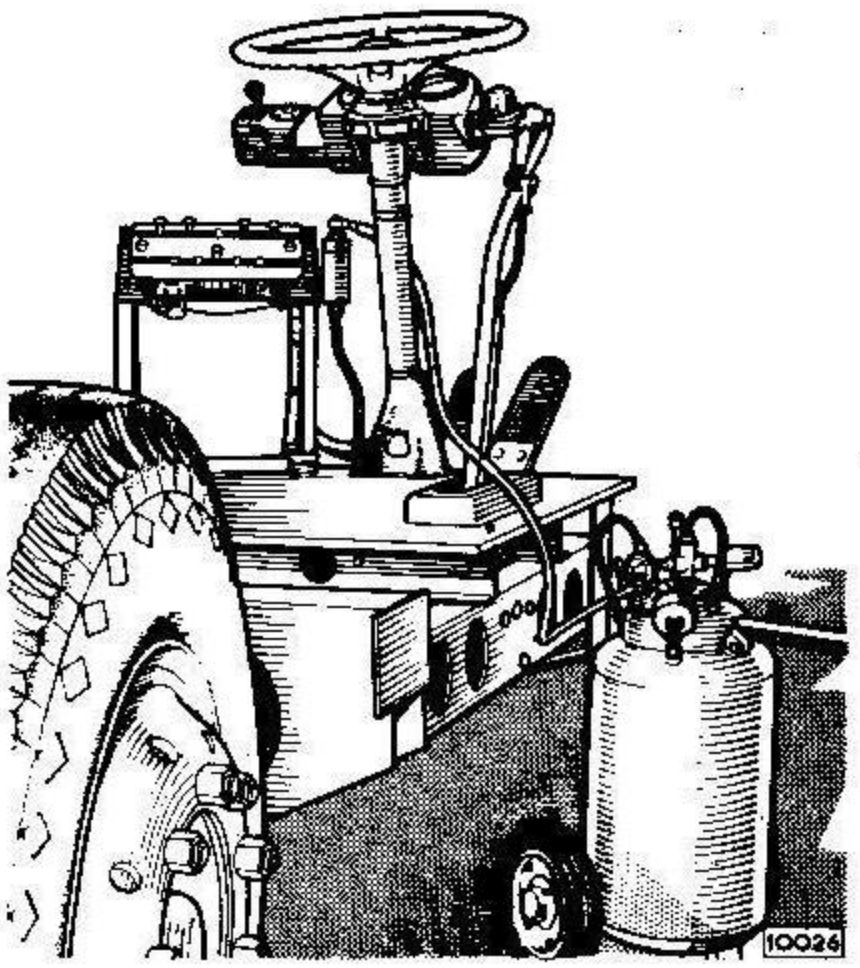


Fig. 2 Utilizing pressure operated equipment when bleeding the accelerator control line

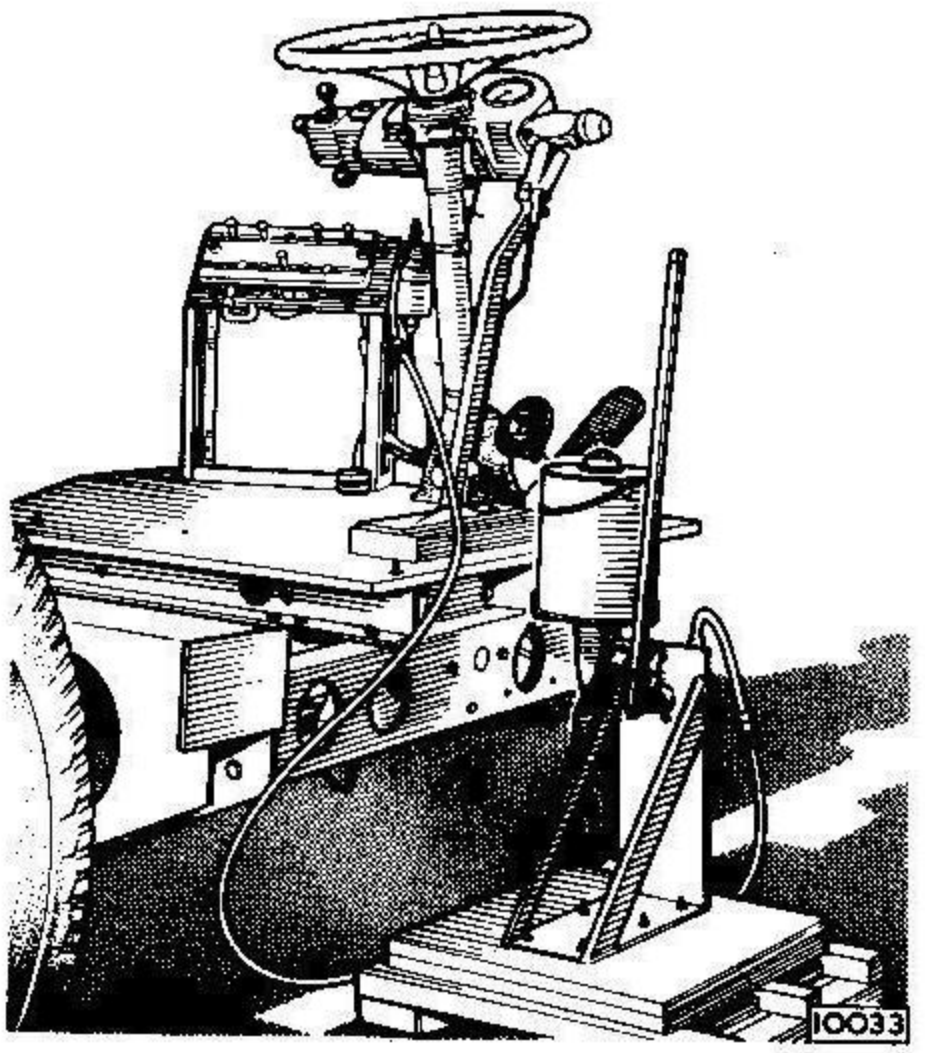


Fig. 3 Utilizing hand operated equipment when bleeding the accelerator control line

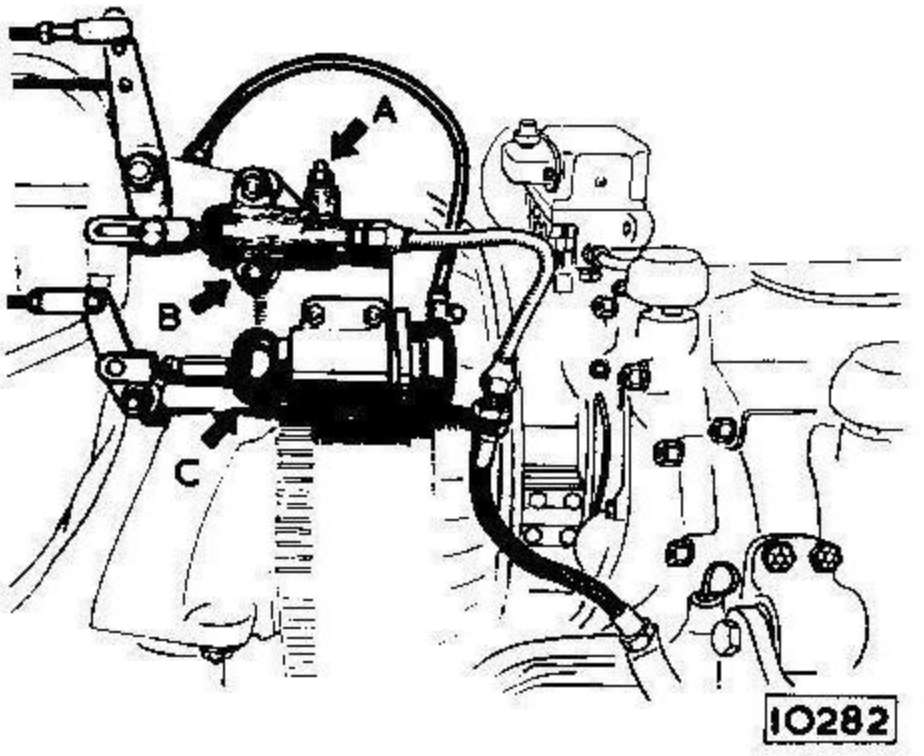


Fig. 4 Location of slave cylinder and stop solenoid

A Bleed nipple
B Slave cylinder
C Engine stop solenoid

master cylinder in conjunction with a supply tank of 1½ pints (.75 litres) minimum capacity and a pivotted lever connected to the master cylinder operating rod.

To bleed the system remove the cap from the fluid container on the vehicle and replace with the adaptor attached to the pump assembly outlet tubing.

Ensure that both containers (vehicle and pump) are filled with the correct fluid as specified under "DATA".

Clean the nipple on the slave cylinder, located in the engine compartment, attach a length of rubber tubing to the nipple and submerge the opposite end of the tubing in a small quantity of hydraulic fluid contained in a glass jar and open the nipple one full turn.

Operate the pump apparatus while observing the fluid

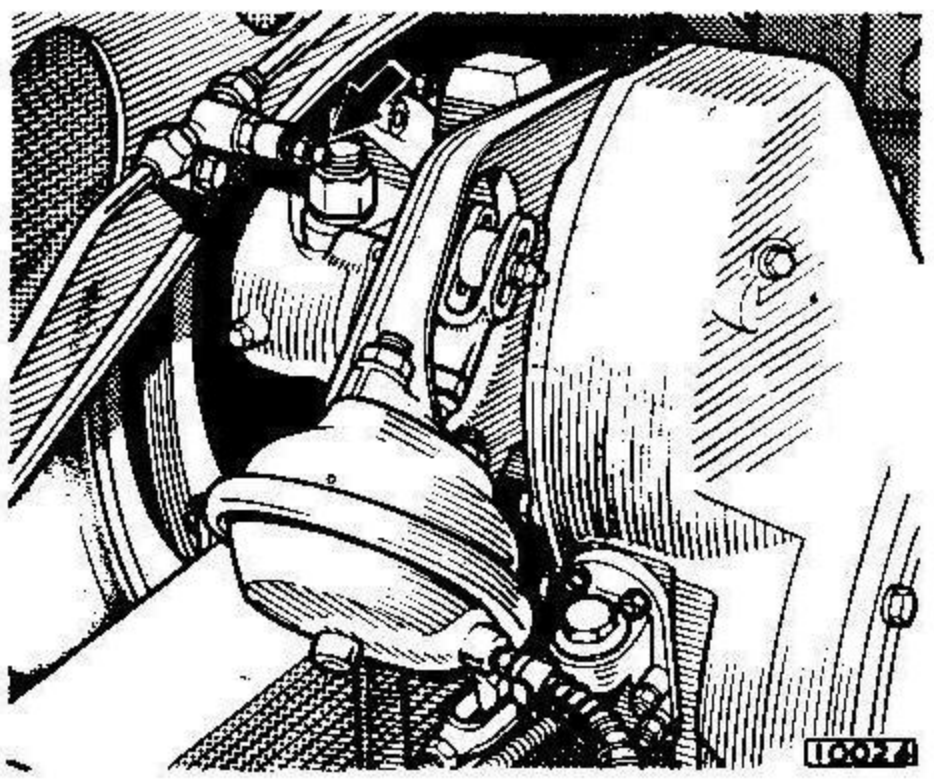


Fig. 5 Location of pipe line bleed nipple

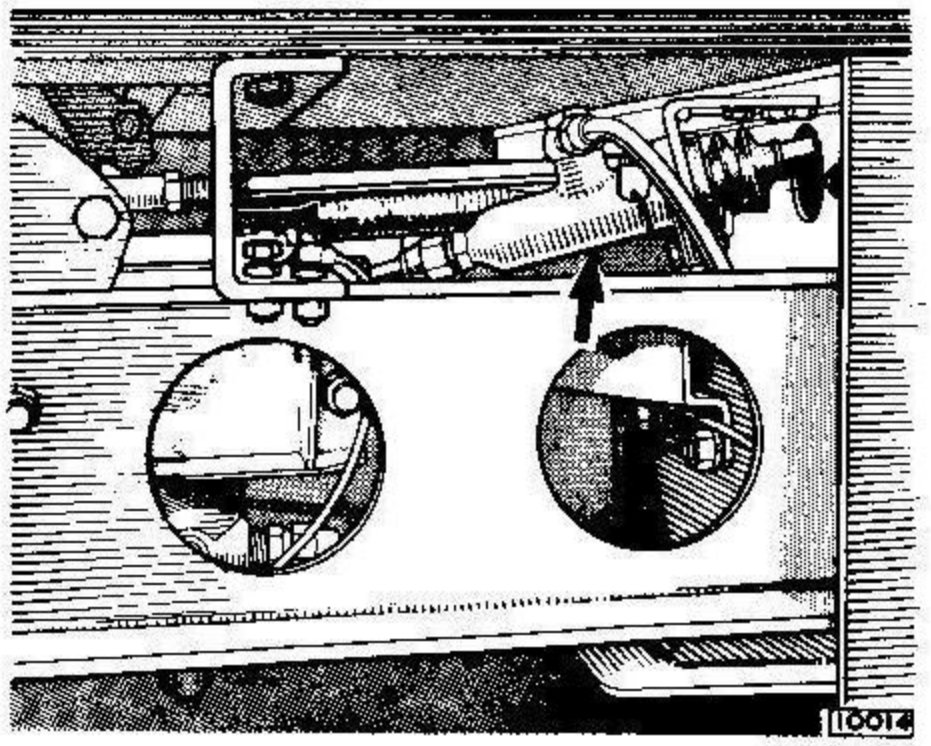


Fig. 6 Location of accelerator control master cylinder

issuing from the tube submerged in the glass jar.
Continue the operation until the fluid is free of air bubbles, close the nipple and remove the rubber tube.
Repeat the operation to the nipple located in the pipe line above the right-hand wheel arch until all air trapped in the junction is expelled and tighten the nipple.
Remove the pump apparatus and top up the vehicle fluid container to the correct level and replace the cap.

NOTE: It is essential that the accelerator pedal control remains closed during the operation.

THE ENGINE STOP SOLENOID

For all servicing details concerning the engine stop solenoid, see Section R "The Electrical Equipment".

EXHAUST SYSTEM

SECTION F

INDEX

EXHAUST SYSTEM

The exhaust system consists of a branched manifold, a flanged down pipe, flexible pipe, lower extension pipe, an elbow, silencer and tail pipe extension. The silencer is suspended from a bracket attached to the chassis frame and is flexibly mounted by means of rubber suspension blocks.

At frequent intervals check all flange nuts and pipe clips and tighten if necessary. Renew all blown gaskets at the first opportunity. Check rubber mountings and renew if worn or damaged.

Access to the exhaust manifold and flexible connections is gained by removing the centre and right hand inspection panels in the engine bulkhead; while access to the elbow, silencer and tail pipe is obtained from beneath the vehicle.

The inspection panels are accessible from inside the vehicle.

FLUID FLYWHEEL AND TRAILING LINK COUPLING

SECTION G

INDEX

FLUID FLYWHEEL AND TRAILING LINK COUPLING

SPECIFICATION AND DATA

Type	Open Circuit
Diameter	19.0" (48.2 cm)
Oil Capacity	3.18 Imp. Gallons (14.2 Litres)
Trailing Link Coupling	METALASTIK

GENERAL DESCRIPTION

The Fluid Flywheel
The fluid flywheel is of the open circuit type which gives decreasing slip over the entire speed range and also reduces the oil content temperature thus increasing the overall efficiency of the flywheel.
The rear casing and runner are manufactured from aluminium alloy castings, the front casing from steel. Oil sealing is effected by a metal bellows type seal in which a ground bronze ring on the end of the bellows mates with the polished face of a steel disc fitted on the runner output shaft.

The Trailing Link Coupling
The trailing link coupling incorporates metal and rubber bonded bushes in its construction and is fitted between the flywheel and the gearbox coupling yokes.

ROUTINE MAINTENANCE

FIRST 2,500 MILES (4,000 KM)

The Fluid Flywheel – Checking the Oil Level
To check the oil level raise the engine compartment cover and proceed as follows.
Rotate the flywheel so that one of the two plugs is in the 12 o'clock position. Clean and remove the plug and sealing washer and top up with oil of the recommended grade to the bottom of the orifice.
Refit the plug with a new sealing washer.

EVERY 10,000 MILES (16,000 KM)

The Fluid Flywheel
Check the oil level as detailed under the first 2,500 miles maintenance service.

The Trailing Link Coupling
Check the trailing link setscrews and tighten if necessary. Tighten to a torque of 38-42 lb.ft. (5.2 – 5.8 kg.m).

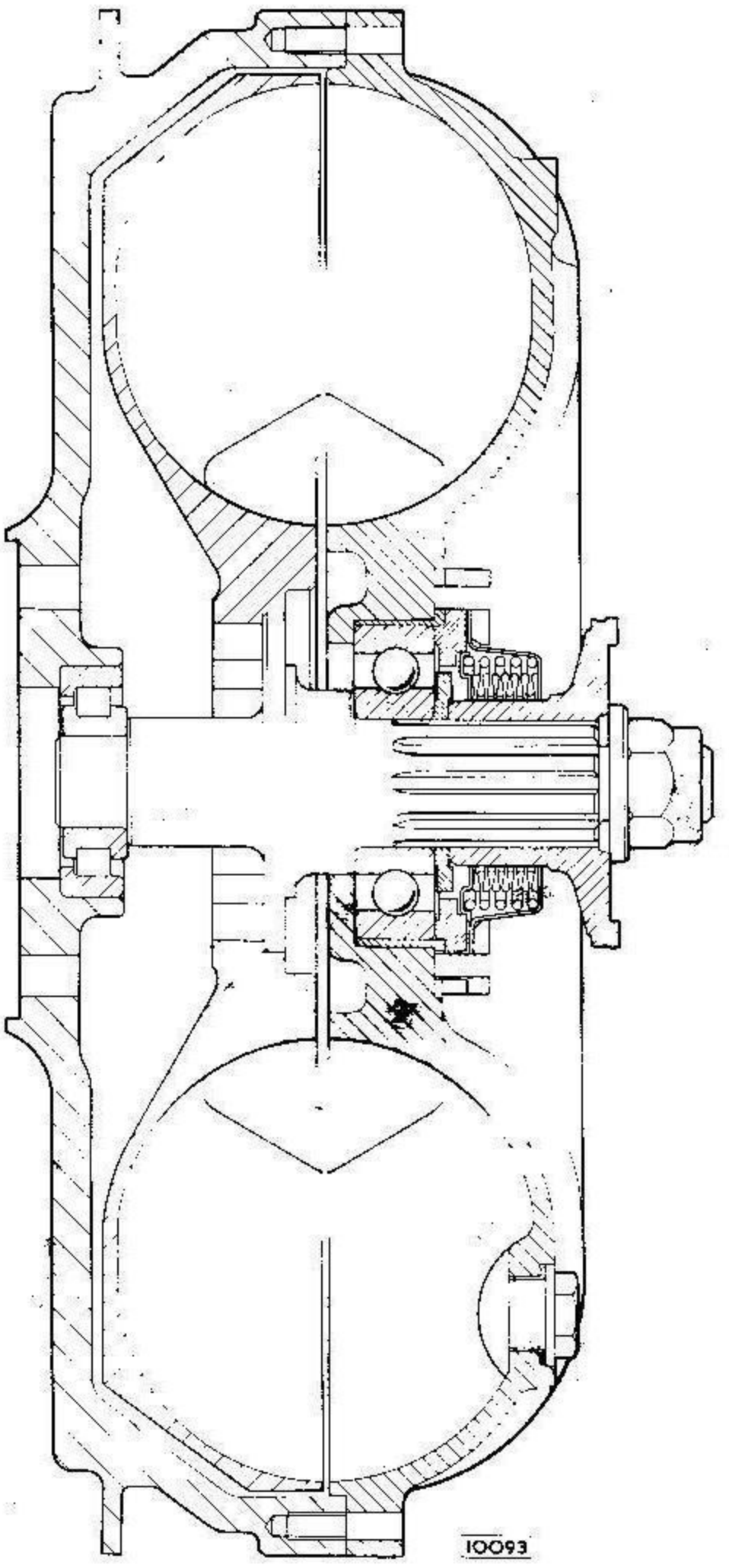


Fig. 1 Sectioned view of the fluid flywheel showing the gland seal

THE FLUID FLYWHEEL

Removal
Remove the gear-box unit as detailed in Section H "The Gear-Box and Transfer Box".

FLUID FLYWHEEL & TRAILING LINK COUPLING

To remove the flywheel from the engine proceed as follows:
Rotate the flywheel until the plugs are on the 12. o' clock and 6. o' clock positions. Place a clean container under the lower plug and drain away all oil by removing both plugs.
Remove the trailing link yoke by removing the self-locking nut and withdrawing from the splined shaft.
Remove the gland seal from the centre of the flywheel by withdrawing the gland seal flange securing screws.
Remove all the setscrews from the periphery of the flywheel, insert two 5/16" U.N.C. extractor screws in the tapped holes provided. Turn to remove the flywheel rear casing with the runner. Withdraw the runner from the casing.

Refitting
Assemble the rear casing as a unit with the runner and refit the gland seal. If the gland seal is damaged, it should be replaced with the necessary new parts.
Front and rear cases are marked with serial numbers which should coincide when refitting the rear casing.
Clean all surface faces and coat lightly with "Hylomar" jointing compound before assembly. Refit all setscrews and tighten down evenly to ensure a perfect joint.
Refit the trailing link yoke and refill the flywheel with oil of the recommended grade to the level of the filler plug.

THE CENTRIFUGAL (LOCK-UP) FLUID FLYWHEEL/ CLUTCH UNIT

DESCRIPTION

Vehicles may be equipped with a centrifugal clutch, incorporated in the fluid flywheel, to operator's requirements The complete assembly is also referred to as the lock-up" flywheel.
Basically the clutch consists of four brake shoes, with friction material facings, pivotted at one end to a dished plate. This plate is attached to the output shaft and the complete is housed in the flywheel casing.
In action, acceleration of the engine produces automatic take up through the fluid coupling with maximum smoothness. As the output shaft speed rises the friction clutch shoes are thrown outwards so making contact with the flywheel drum.
The centrifugal clutch then provides a positive drive between the engine and the gearbox and so eliminating the inherent slip (1-2%) present in all fluid couplings when the engine is operating in the higher speed range.
Due to the necessity of restricting the overall dimensions of the unit, the fluid coupling is reduced in section, leaving a space between the runner and the inside of the flywheel proper.
This reduces the volume of the fluid present in the flywheel with the result that the transfer of kinetic energy is less for any given speed and consequently the idling drag is therefore less.

ROUTINE MAINTENANCE

FIRST 500 MILES (800 KM)

Flywheel Gland Seal-Checking
Check and tighten the six self-locking nuts securing the flywheel gland seal.

FIRST 2,500 MILES (4,000 KM)

Checking the Oil Level

Rotate the flywheel until one of the four plugs is in the 12 o'clock position. Clean and remove the filler plug and sealing ring and top up with oil of the recommended grade to the bottom of the orifice.

FIRST 10,000 MILES (16,000 KM)

Check and tighten the flywheel gland seal securing nuts.

EVERY 10,000 MILES (16,000 KM)

Check the oil level as detailed under the first 2,500 miles maintenance service.

THE CLUTCH UNIT

Removal
Remove the gearbox unit as detailed in Section H "The Gearbox and Transfer Box".
Remove the flywheel unit as follows:–
Rotate the flywheel until two of the plugs are in the 12 o'clock and 6 o'clock positions respectively.
Place a clean container under the lower plug and drain away all oil after removing both plugs.
Remove all setscrews (6) and washers (5) from the periphery of the flywheel, insert extractor screws in the holes provided and withdraw the rear casing (7) complete with associate parts.
Withdraw the securing bolts and remove the front casing from the crankshaft.

Refitting
Refitting is the reverse of the removal procedure.
Assemble the rear casing as a unit with the runner and associate parts. Clean all the surfaces, coat lightly with jointing compound and renew the gasket between the front and rear casings.
The front and rear cases are marked with serial numbers which must coincide when refitting.
Refit all setscrews and lockwashers and tighten down evenly to ensure a perfect joint.
Refit the trailing link yoke and refill the flywheel with oil of the recommended grade to the level of the top filler plug.

Dismantling

To dismantle the rear casing and shaft assembly proceed as follows:-

Remove the nut (15) and washer (17) and remove the coupling (18).

Remove the nuts (21), stiffener ring (12) and withdraw the gland seal (13) followed by the joint (11), spacing ring (22), joint (10) and rubbing washer (19).

Press out the shaft and runner assembly and withdraw bearing (32) and bearing housing (23).

Dismantle the shaft and runner assembly.

Remove the nuts (35) from the bolts (33) and withdraw the shaft.

Remove the nuts (39), washers (40) from the bolts (41) and withdraw the runner (27) and baffle plate (25) from the reaction member (4).

The clutch shoe assembly (42) can now be removed from the reaction member (4) by withdrawing the garter spring (31).

Re-assembling

Re-assembling is the reverse of the removal procedure.

Check that all components are clean and suitable for further service. Particular attention must be paid to the condition of the gland seal (13) and rubbing washer (19).

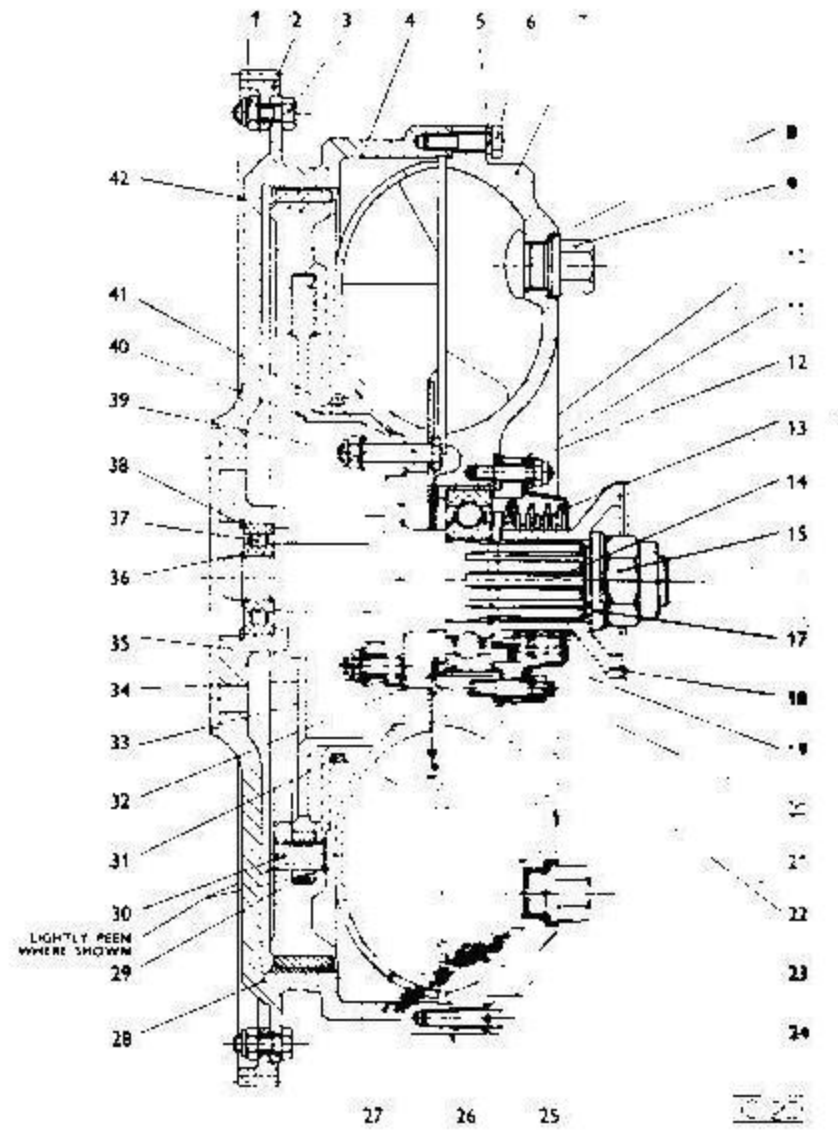


Fig. 2 Sectioned view of the centrifugal (lock-up) fluid flywheel/clutch unit

1 Nut
2 Starter ring
3 Bolt
4 Reaction member
5 Spring washer
6 Bolt
7 Rear casing
8 Washer
9 Plug
10 Joint
11 Joint
12 Stiffener ring
13 Gland seal
14 Shaft
15 Slotted nut
16
17 Washer
18 Coupling
19 Rubber washer
20 Joint
21 Nut
22 Spacing ring
23 Bearing housing
24 Stud
25 Baffle plate
26 Gasket
27 Runner
28 Front casing
29 Insert block
30 Pin
31 Garter spring
32 Bearing
33 Bolt
34 Ferrule
35 Nut
36 Circlip
37 Bearing
38 Circlip
39 Nut
40 Washer
41 Bolt
42 Clutch shoe assembly

GEARBOX AND TRANSFER BOX

SECTION H

INDEX

GEARBOX AND TRANSFER BOX

SPECIFICATION AND DATA

GEARBOX

Type		DAIMLER, Semi or fully automatic, direct air pressure operated.
No. of Speeds		Four forward and one reverse
Oil capacity		15 Imp. Pints (8.53 Litres)
Gear Ratios		D/D / S D
	Top	1.00 : 1 / 1.00 : 1
	3rd	1.64 : 1 / 1.64 : 1
	2nd	2.53 : 1 / 2.53 : 1
	1st	4.5 : 1 / 4.5 : 1
	Rev.	5.53 : 1 / 5.53 : 1
Final Drive		By attached transfer box through spur and bevel gear trains.
Suspension		Four detachable lugs, with pressed in "Metalastick" bushes No. 13/897.
Bearings		
Gearbox	— top gear clutch	HOFFMANN 380 AC — F088
	— driving shaft	HOFFMANN 555
	— Reverse brake drum	HOFFMANN LS21V3
Air Cylinder Bores		
1st and Rev. gears		3.00" — 2.99" (76.2 — 76.175 mm)
2nd, 3rd and top		2.00" — 1.99" (50.8 — 50.775 mm)
Piston Diameters		
1st and Rev. gears		2.997" — 2.996" (76.137 — 76.111 mm)
2nd, 3rd and top		1.997" — 1.996" (50.736 — 50.711 mm)
Piston Seals		
1st and Rev. gears		DOWTY PD 2850 — 488
2nd, 3rd and top		DOWTY PD 2850 — 962
Air Cylinder Base Seals		
1st and Rev. gears		BURTONWOOD 6 — 312
2nd, 3rd and top	2nd, 3rd and top	BURTONWOOD 6 — 212

GEARBOX AND TRANSFER BOX

Top Gear Clutch Springs	
Free length	2.50" (63.5 mm)
Thickness of	
Clutch bearing thrust ring	.350" – .340" (8.89 – 8.64 mm)
3rd speed sun wheel bush flange	.125" – .120" (3.19 – 3.02 mm)
Steel thrust washer	.180" – .170" (4.57 – 4.318 mm)
Bronze thrust washer	.104" – .102" (2.64 – 2.59 mm)
Sun wheel thrust washer	.155" – .150" (3.97 – 3.8 mm)
2nd gear drum bush	.100" – .098" (2.5 – 2.49 mm)
3rd speed annulus washer	.100" – .098" (2.5 – 2.49 mm)
1st & 2nd speed distance piece	.100" – .098" (2.5 – 2.49 mm)
1st & 2nd speed sun wheel thrust washer	.076" – .074" (1.93 – 1.86 mm)
1st gear drum bushes	.100" – .098" (2.5 – 2.49 mm)
Reverse gear drum bushes	.100" – .098" (2.5 – 2.49 mm)
Brake drum clearances	
Reverse and 1st gear	.012" – .008" (.305 – .202 mm)
1st and 2nd gear	.015" – .012" (.381 – .305 mm)
2nd and 3rd gear	.015" – .012" (.381 – .305 mm)
Running Gear end float	0.040" (1 mm)
Adjusting Washers (alternatives)	
1.	.128" (3.22 mm)
2.	.064" (1.626 mm)
3.	.048" (1.219 mm)
4.	.036" (0.911 mm)
5.	.020" (0.508 mm)
Tail pin setting	.50" (12.7 mm)
Brake Band Adjuster Stop Bolt Setting	
Reverse gear	.75" (19.50 mm)
1st gear	.700" (17.780 mm)
2nd gear	.700" (17.780 mm)
3rd gear	.800" (20.30 mm)
4th gear	.550" (12.970 mm)
Internal dia. of Oil Pump Body	1.13" – 1.285" (28.7 – 28.664 mm)
Diameter of Oil Pump Gears	1.1265" – 1.1240" (28.613 – 28.575 mm)
Depth of **Oil Pump** Body	0.5006" – 0.4994" (12.715 – 12.684 mm)
Thickness of **Oil Pump Gears**	.4984" – .4979" (12.659 – 12.646 mm)
Backlash between **Oil Pump** Driver and driven gears	0.012" – 0.008" (0.305 – 0.203 mm)
Diameter of Oil Pump **Driven Gear** Spindle	0.4993" – 0.4983" (12.682 – 12.657 mm)
Internal Diameter of Driven **Gear Bush**	0.5004" – 0.4996" (12.710 – 12.690 mm)

Oil Pressure at 1,500 engine RPM	15–18 lbs per sq.in. (1.05kg/cm^2) (1.26kg/cm^2)
Oil Filter Element	PUROLATOR No. M.F.26

TRANSFER BOX

Oil Capacity	7 Imp. pints (3.9 Litres)
Bearings	
Pinion (small)	TIMKEN 462 – 453 X
Pinion (large)	TIMKEN 55G – 552 A
Outshaft (small)	TIMKEN 3780 – 3720
Output shaft (large)	TIMKEN 559 – 552 A
Output sleeve (G/Box)	HOFFMANN 2L19LV3
Trailing Link coupling	HOFFMANN RL16E
Oil Seals	
Transfer Box – Speedo Drive	GACO G350350 or BURTONWOOD 250 – 350
Output Sleeve (Gearbox)	GACO MIS 32 or BURTONWOOD 312 – 412
Driving Shaft (Gearbox)	GACO MIS 114 or BURTONWOOD 187–262–12
Trailing Link	GACO G40C300 or BURTONWOOD T8/300–400
Spur Gear Ratios (Alternatives)	1.026 : 1
	0.925 : 1
	0.883 : 1
Bevel Gear Ratio	1.043 : 1
Overall Ratio (Transfer box – rear axle)	5.68 : 1
	5.12 : 1
	4.61 : 1

AIR PRESSURE EQUIPMENT

Auxiliary reservoir air pressure	105 lbs/sq.ins (7.4 kg/cm^2)
Working pressure taken at outlet of air pressure limiting valve	80 lbs/sq.ins (5.624 kg/cm^2)

GEAR ENGAGING EQUIPMENT (ELECTRICAL)

Make	C.A.V.
Gear selector switch contact gap	0.070" (1.778 mm)
Relay contact gap	0.059" (1.270 mm)
Relay armature back spring angle	11½° approx.

pull in current	1.2 to 1.25 amperes
Contact unit terminal location	R : Reverse A : 1st gear B : 2nd gear C : 3rd gear D : 4th gear
Selector switch terminal location	R : Reverse A : 1st gear B : 2nd gear C : 3rd gear D : 4th gear
Electro-pneumatic valve unit air valve clearance	0.010" (0.254 mm)

GEARBOX UNIT

GENERAL DESCRIPTION

The DAIMATIC gearbox is of the epicyclic direct air operated type providing a reverse and four forward speeds.

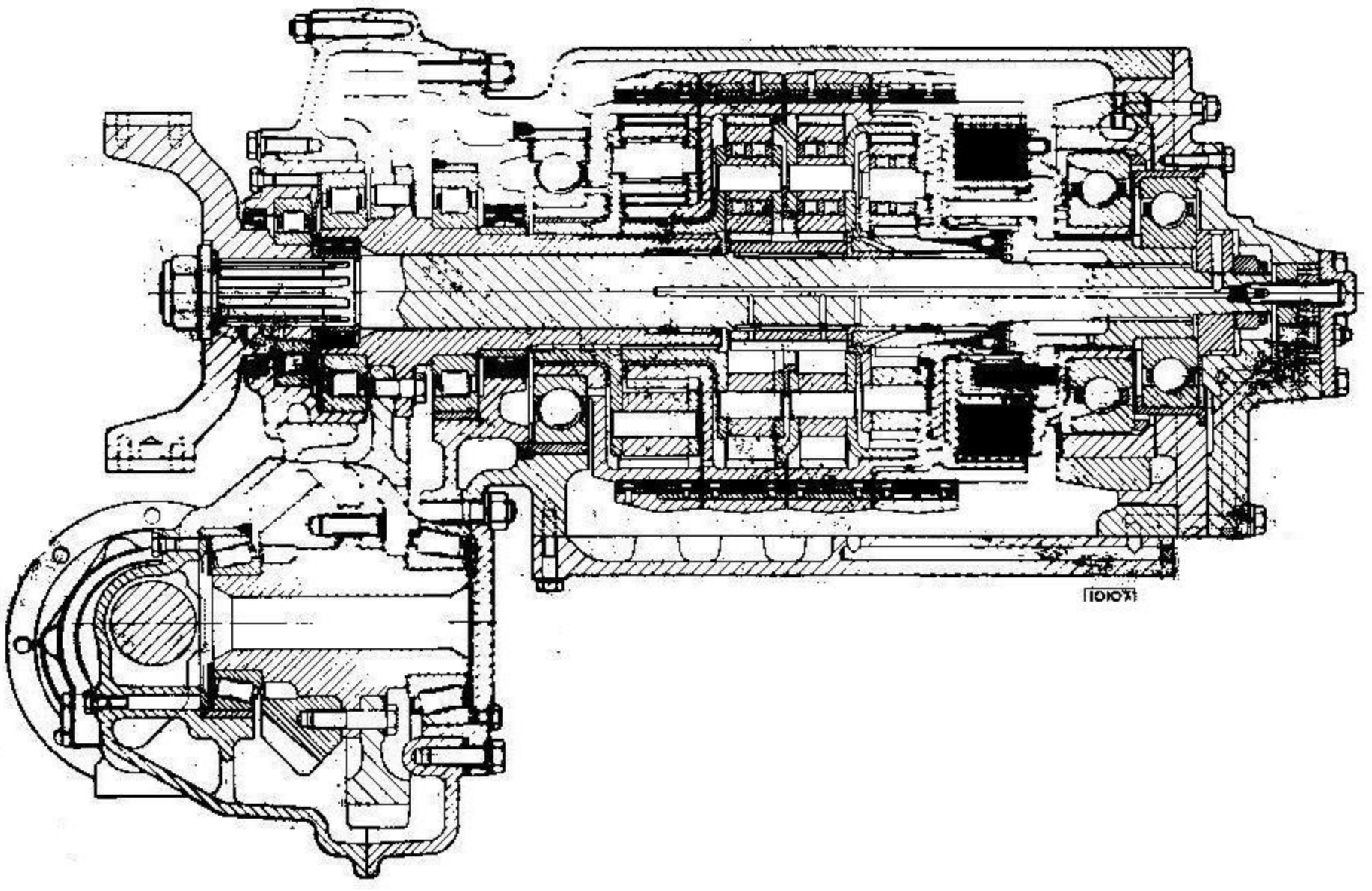


Fig. 1 Sectioned views of the "Daimatic" gearbox and transfer box

Semi or fully automatic gear engagement is controlled by a C.A.V. electro-pneumatic control system.
The first gear is obtained by applying a brake to the annulus of a simple epicyclic gear train, the planet carrier being attached to the driven shaft. The second and third gears are obtained by compounding further gear trains to that of the first gear. Application of a brake to any specific gear train result in the first gear revolving at a controlled speed in the same direction as the driving shaft so reducing the original ratio. Apart from the first gear there are no individual gear sets as in a sliding type gearbox.
The reverse gear is obtained by compounding a further gear train to that of the first gear in its freely revolving condition. In this condition the first gear annulus is revolving slowly in the opposite direction to the driving shaft and by connecting the sunwheel of the reverse gear train to this annulus the change of direction and part of the gear reduction is obtained.
The top gear is obtained by closing a multi-plate clutch which effects the locking of the driving and driven shafts together.
The running gear, comprising the gear trains, oil pump assembly and the gearbox front cover is mounted on three large capacity ball races. It is built up as an assembly and fitted into the gearbox casing and bottom cover assembly with the specified amount of end float.
The brake gear and actuating mechanism is built up on the bottom cover which is then fitted to the underside of the gearbox casing before the running gear assembly is fitted. Replacement brake band assemblies cannot be fitted without removing the gearbox from the chassis and the withdrawal of the running gear and bottom cover assemblies from the gearbox casing.
Continuously filtered lubrication is provided for the running gear and other working parts by a gear type oil pump driven from the mainshaft. Before the oil enters the running gear it passes through a full flow replaceable filter accessible from beneath the vehicle. The filter can be renewed without draining the gearbox oil.
The air operating cylinders, which are cast integrally in the top face of the bottom cover have pressed in pre-finished steel liners.
The pistons are of aluminium alloy and are fitted with two Dowty heat resisting synthetic rubber seals. The bottom extremities of the air cylinders are sealed with rubber 'O' rings and individual cover plates which incorporate the air restrictor valves, the air nozzles and cylinder drain plugs.
Gear selection is made with a C.A.V. electro-pneumatic system whether for a fully or semi-automatic installation. The C.A.V. equipment used with the semi-automatic application is a finger tip gear selector switch situated adjacent to the steering wheel and an electro-pneumatic valve unit attached to the gearbox. A warning light is incorporated in the gear selector switch to indicate that the electrical power is switched on and neutral gear is selected. To engage any gear, the selector switch lever is moved to the appropriate position and the accelerator depressed; there is no gear engaging or clutch pedal.
The output drive of the transverse mounted gearbox is by means of a spur and bevel geared transfer box incorporated in the gearbox and cover.
An air limiting valve is installed between the auxiliary air pressure tank and the gearbox electro-pneumatic valve unit mounted on a bracket attached to the gearbox. The valve, as its name implies, limited the amount of air available to the gearbox and auxiliary components on the body. Air pressure setting 80 lbs. per sq.in. (5.6 kg/cm^2).

Operation

The Gearbox

In the following paragraphs reference is made to the top gear clutch and the various epicyclic gear trains of the running gear assembly. It must be realised that the individual gear trains are not used independently as in a sliding type gearbox. It is by compounding the reverse or second epicyclic gear train to that of the first gear train that reverse or second gear is obtained and by further compounding the third gear train to that of the second and first trains that the third gear is obtained.

First Gear

The first speed gear is obtained by using a basic epicyclic gear train. The sunwheel mounted on the driving shaft. The outer periphery of the annulus acts as a brake drum to which the gear brake is applied. The planet gears, between the sunwheel and the annulus are attached to the planet carrier which is splined to the output shaft.
The gear brake is applied holding the annulus stationary, and the sunwheel rotates the planet gears inside the annulus thus turning the planet carrier in the same direction as the sunwheel at a reduced speed.

Second Gear

The second gear is obtained by allowing the first gear annulus to revolve at a controlled speed while its planet gears are still being driven by the sunwheel thus reducing the original ratio.
This is effected by introducing a second gear train, the planet of which is connected to the annulus of the first gear. Hence the rotation of the second gear planet carrier, which the brake is applied, is imparted to the annulus of the first gear train.

Third Gear

The third gear is obtained by speeding up the annulus of the first gear again thereby reducing the original ratio still further.
This is effected by connecting the third gear planet carrier to the annulus of the second gear and the third gear annulus to the second gear planet carrier and constructing the third gear sunwheel so that the brake can be applied.

GEARBOX AND TRANSFER BOX

It will be realised that as the second gear planet carrier is connected to the first gear annulus, any rotation of the third speed annulus will be imparted to the first gear annulus because of their connection with the second gear planet carrier. The sizes of the various gears are designed to effect an increase of speed to the first annulus above that of the second gear.

Top Gear

The top gear is obtained by closing the multi-plate clutch between the third gear sunwheel and the driving shaft, locking the third gear sunwheel to the first and second gear sunwheel on the driving shaft together. The running gear will then rotate as a solid unit as the driving shaft has become locked to the first gear planet carrier which is splined to the driven shaft.

Reverse Gear

The drive is taken through the reverse gear train and as the first gear annulus is free to rotate it will revolve slowly in the opposite direction to that of its sunwheel. The first gear annulus connects with the reverse gear sunwheel and so this change of direction and speed reduction is transferred to the latter. The gear brake being applied to the reverse gear annulus holds it stationary. The sunwheel causes the planet gears to rotate around the now stationary annulus thus turning the planet carrier and the driven shaft to which it is splined in the same direction as the contra-rotating reverse gear sunwheel but again at a slower speed.

The Transfer Box

The transfer or right angle drive box is mounted integral with the gearbox, its function being to convert the gearbox transverse drive into a longitudinal drive to the rear axle. The lubrication system is separate from that of the gearbox and an individual dipstick is provided for oil level checking purposes.

The initial stage of the output drive is by spur gears, the second stage being by bevel gears. Three alternative ratios are available and reference must always be made to the component list number plate attached to the engine bulkhead top rail, located in the engine compartment, when ordering replacement parts.

Also included in the transfer box is the drive for the electrical speedometer generator.

The Limiting Valve

Westinghouse System

High air pressure enters the valve via the inlet port and passes the valve disc to the outlet port and the by-pass passage to the underside of the diaphragm.

As the air pressure rises sufficiently to overcome the spring setting the diaphragm moves upwards allowing the valve disc to seat and so shutting off a further supply of air

When air is used from the low pressure side, the resultant drop in pressure allows the main spring to re-assert itself and unseat the valve disc thus repeating the cycle.

Should the low pressure build up beyond the operative setting the increased deflection of the diaphragm will allow the hollow stem to move away from the valve disc letting the air through the cover to bleed away to atmosphere.

Clayton-Dewandre System

High air pressure enters the valve via the inlet port and passes through the open inlet valve to the outlet port chamber and outlet port.

A metered hole is provided in the guide plate and as air pressure builds up in the chamber is passes through this hole and acts on the diaphragm. When the pressure reaches the pre-determined spring setting limit the diaphragm overcomes the action of the spring and the inlet valve seats cutting off further supply from the reservoir.

Should the pressure rise above that of the valve setting, increase diaphragm movement opens the release valve and excess pressure is released through the centre of the diaphragm assembly and the holes in the top cover to atmosphere. This continues until the correct pressure setting is reached.

ROUTINE MAINTENANCE

IMPORTANT It is essential that the oil and filter change services are carried out as detailed under "Routine Maintenance".

Any deviation may result in sludge formation in the gearbox which can in extreme cases be forced under exhausting pressure into the electro-pneumatic gear change valve unit causing faulty gear selection and extensive consequential damage to the gearbox.

WEEKLY

Pumping the Gears

To ensure that the automatic adjusters in the gearbox are working correctly the gears should be 'pumped' weekly as follows:

(1) Start the engine to recharge the air pressure system
(2) Stop the engine
(3) With the "START" switch "ON" move the gear selector lever in and out of each gear position about twelve times.

FIRST 1,000 MILES (1,600 KM)

The Gearbox — Changing the Oil

Drain and refill with the recommended grade of lubricant. The draining of the gearbox is best effected when the oil is at its thinnest, when the vehicle has just returned from

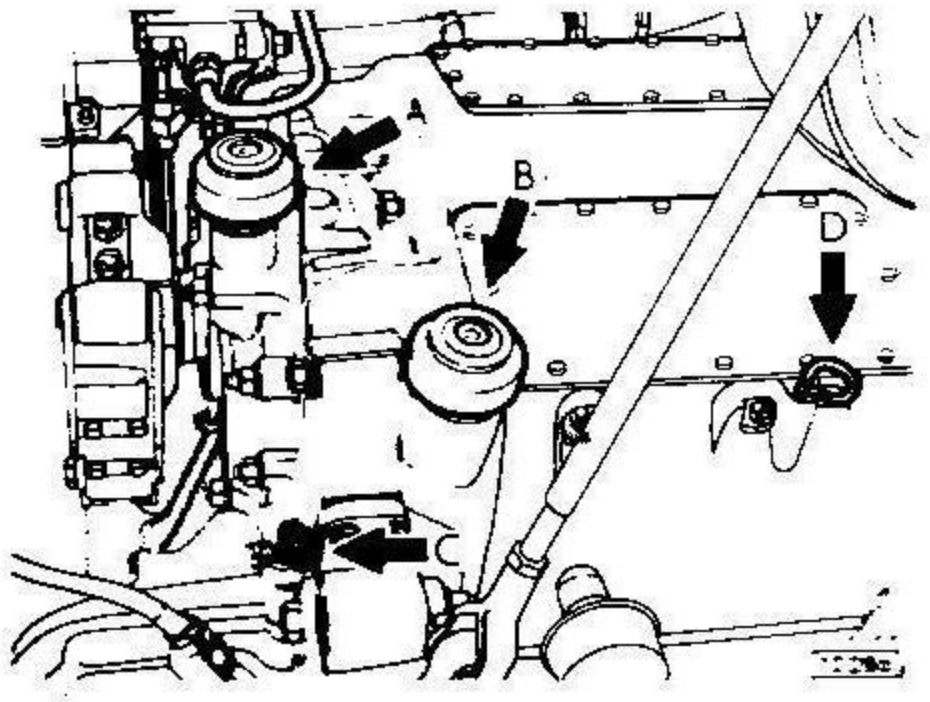


Fig. 2 Location of transfer box and gearbox filler plugs and dip sticks.

A Transfer box filler plug.
B Gearbox filler plug.
C Transfer box dip stick.
D Gearbox dip stick.

service. It will then have much of the impurities in suspension and so will assist in flushing out the unit. The drain plug is located in the bottom cover. Clean the area around the plug before removing.
Remove the gearbox filler plug, located in the rear left hand top corner of the gearbox case and refill with the recommended grade of lubricant.
Check the level by withdrawing the dipstick, wiping clean, re-inserting and withdrawing a second time. Fill up to the level mark on the dipstick. Clean the area around the filler plug and the dipstick before removal.
NOTE: An air breather is incorporated in the gearbox filler plug.

Cleaning the Oil Filter Element
Clean the road dirt from around the filter cover on the underside of the gearbox and position a drip tray beneath to catch any escaping oil.
Remove the filter cover by withdrawing four setscrews. Remove the filter element from the outer tube, wash element and all metal parts in flushing oil. Clean the interior of the oil filter housing. Refit the spring to the centre tube, fit the spigotted rubber washer to the top of the filter element, and the rubber washer and spigotted metal washer to the bottom of the element. Position the element assembly on the centre tube and feed the element and cover into the housing secure with the four setscrews and washers.

The Transfer Box — Changing the Oil
Drain and refill with the recommended grade of lubricant. The draining of the transfer box is best effected when the oil is at its thinnest; when the vehicle has just returned from service.

The drain plug is located in the bottom of the casing. Clean the area around the plug before removing.
Remove the filler plug, located in the top of the casing and refill with the recommended grade of lubricant.
Check the level by withdrawing the dipstick, wiping clean, re-inserting and withdrawing a second time. Fill up to the level mark on the dipstick. Clean the area around the filler plug and dipstick before removal.
NOTE: An air breather is incorporated in the transfer box filler plug.

EVERY 2,500 MILES (4,000 KM)

Checking the Oil Level
Check the level of the oil in the gearbox when the vehicle is standing on level ground. Top up to the level mark on the dipstick, if necessary with the recommended grade of lubricant.

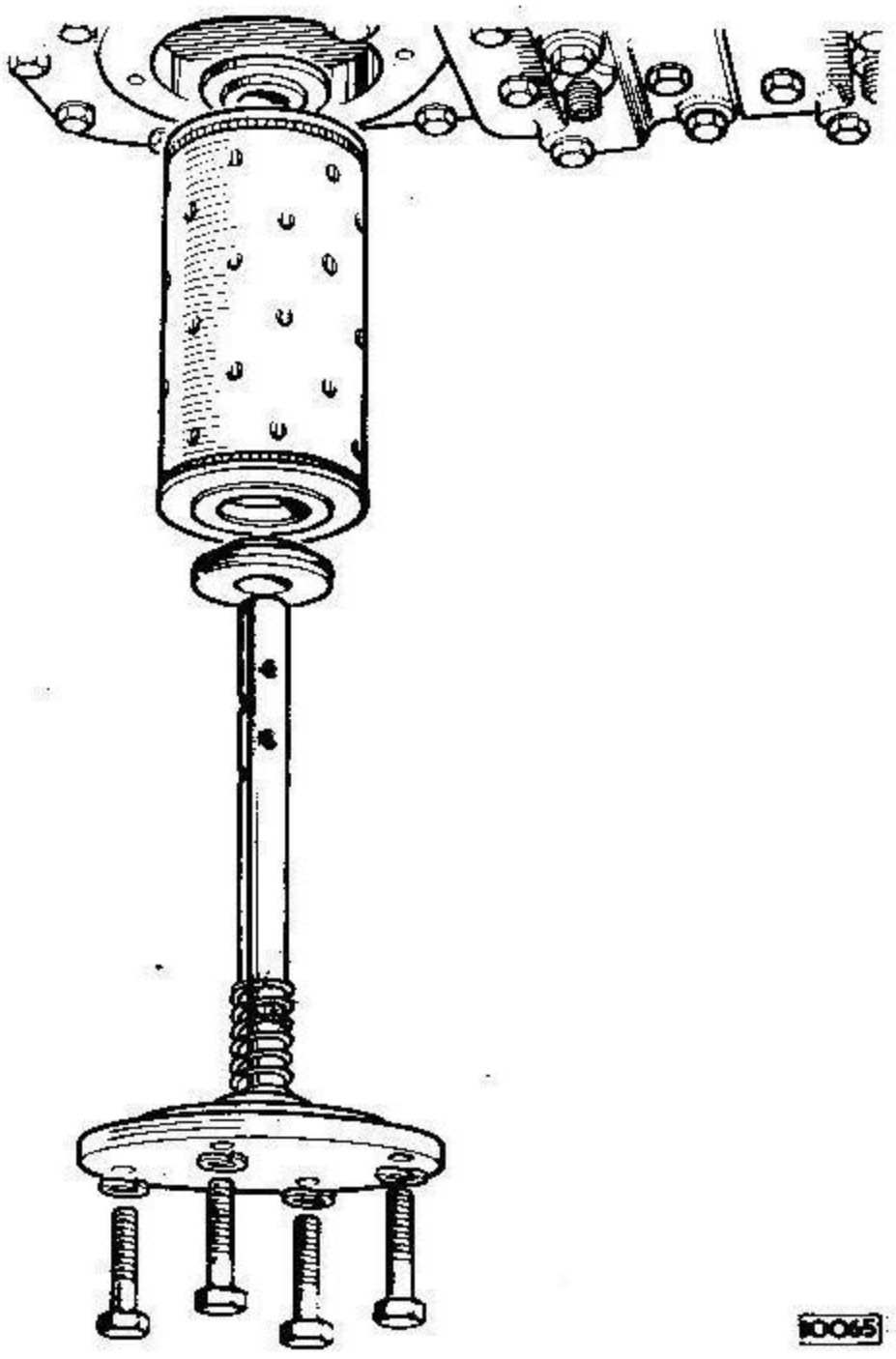


Fig. 3 Exploded view of the oil filter

GEARBOX AND TRANSFER BOX

The Transfer Box—Checking the Oil Level
Check the level of the oil in the transfer box when the vehicle is standing on level ground. Top up to the level mark on the dipstick if necessary with the recommended grade of lubricant.

EVERY 5,000 MILES (8,000 KM)

Gearbox
Cleaning the Air Breather Filter Element
Wash the air filter element in the gearbox filler plug in petrol and dry in clean air. Carry out this service more frequently if the vehicle is operating in dusty territories.

Air Cylinder — Oil Draining
Remove the five air cylinder drain plugs from the base of the gearbox and drain away any oil sediment which may have collected in the piston cavities.
The draining of the oil is best effected when the oil is at its thinnest, when the vehicle has just returned from service.
Apply air pressure to each cylinder by selecting each gear in turn whilst the corresponding drain plug is removed.

Electro-pneumatic Valve Unit—Draining
Remove the drain plugs in the base of the E.P. unit and drain away any contaminated oil and moisture which may have accumulated in the high pressure gallery.
To ensure maximum discharge from the E.P. unit when the drain plugs are removed air pressure should be applied by selecting any position on the gear control switch.
Perform this routine maintenance service more frequently if the vehicle is operating under very humid climatic conditions.

Transfer Box
Cleaning the Air Breather Filter Element
Wash the air filter element in the transfer box filler plug in petrol and dry in clean air. Carry out this service more frequently if the vehicle is operating in dusty territories.

Limiting Valve — Checking
Apply a soap solution to the cover joint and unions and check for leaks.
Check that the breather hole in the cover is not restricted.

EVERY 10,000 MILES (16,000 KM)

Gearbox — Cleaning the Oil Filter Element
Remove, clean and refit the oil filter element as detailed under "First 1,000 miles (1,600 km) Service".
Renew if in bad condition.

EVERY 25,000 MILES (40,000 KM)

Gearbox
Changing the Oil
Drain and refill with the recommended grade of lubricant as detailed in the "First 1,000 miles (1,600 km) Service".

Changing the Air Breather Filter Element
Renew the air filter element in the gearbox filler plug.

Transfer Box
Changing the Oil
Drain and refill with the recommended grade of lubricant as detailed in the "First 1,000 miles (1,600 km) Service".

Changing the Air Breather Filter Element
Renew the air filter element in the transfer filler plug.

EVERY 50,000 MILES (80,000 KM)

Limiting Valve — Overhaul
Westinghouse System
Exhaust all air pressure and remove the valve unit.
Remove the setscrews and washers and detach the main spring cover and lift out the diaphragm assembly.
Extract the securing screw and ease away the end cover.
Withdraw the valve disc now exposed.
Clean all metal parts in cleansing solvent and wash the diaphragm assembly, O ring and valve disc in soap and water. Dry all parts in a clean air jet and inspect the diaphragm and O ring for signs of hardening or cracking.
Check the valve disc for pitting, renew as necessary.
Check the condition of the valve spring for sufficient tension to seat the valve disc.
Lightly smear the stem of the diaphragm assembly with a good grade grease such as John Etherington's Paragon Artic.
Re-assemble the valve and install in the vehicle. Pressurize the system and test the cover joint and unions for leaks with a soap solution.
Insert a pressure gauge in the delivery line and check for correct delivery pressure, 80 lbs. per sq.in. (5.6 kg/cm^2).
Adjust by releasing the locknut and turning the adjuster clockwise to increase and anti-clockwise to decrease the pressure.

Clayton-Dewandre System
Exhaust all air pressure and remove the valve unit.
Remove the four setscrews and washers and detach the main spring cover.
NOTE: When removing, the cover will be under the pressure of the spring.
Withdraw the top spring guide and spring.
Carefully lift off the diaphragm assembly.
Remove the circlip and withdraw the guide plate.
Unscrew the plug from the base of the valve and remove the grommet from the plug.

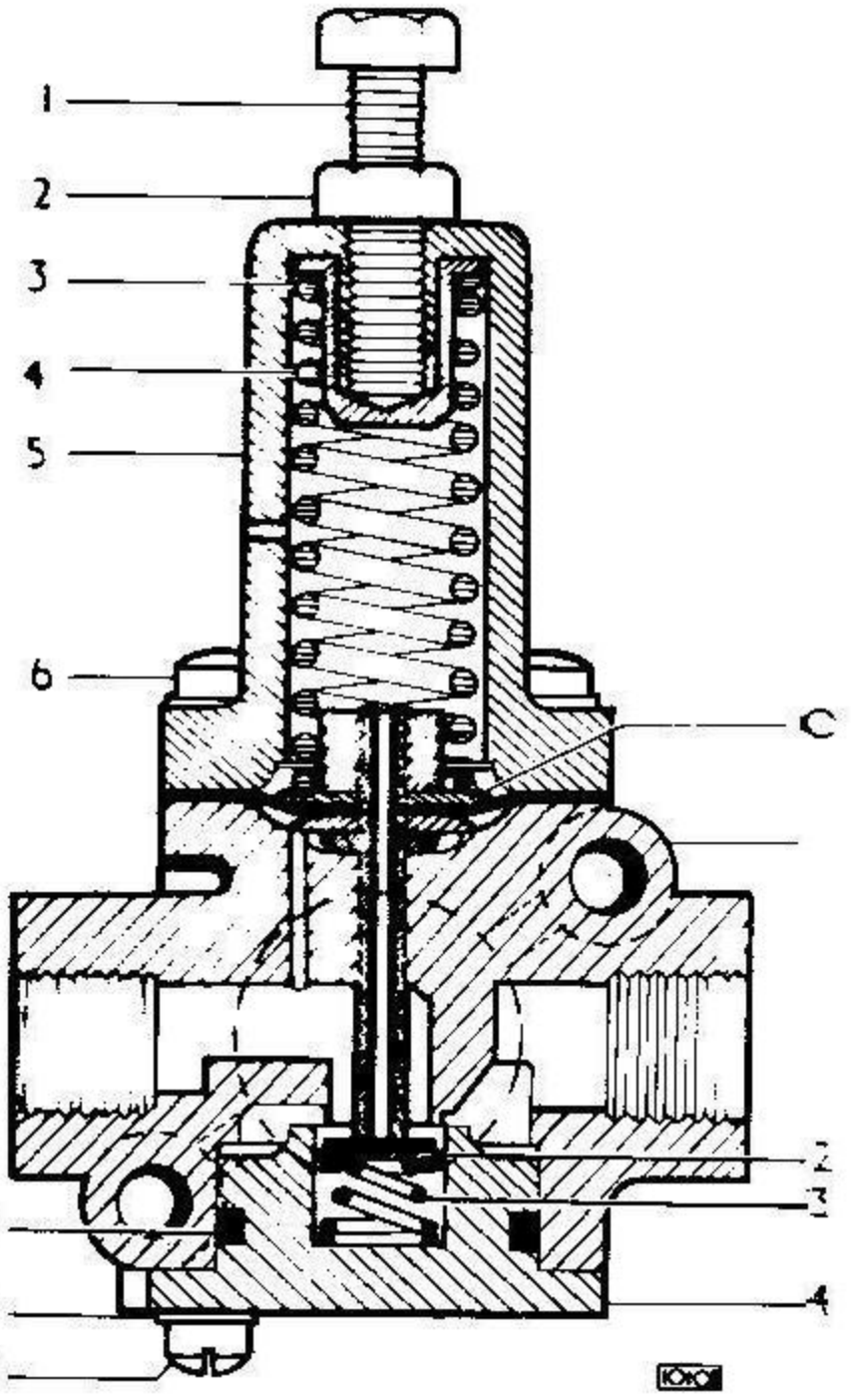


Fig. 4 Sectioned view of the Westinghouse limiting valve

1 Adjuster screw
2 Locknut
3 Mainspring
4 Spring seat
5 Spring Cover
6 Cover screw
7 End cap 'O' ring
8 Lockwasher
9 End cap screw
10 Diaphragm assembly
11 Valve body
12 Valve disc
13 Valve spring
14 End cap

Unscrew the retaining nut and lift off the release valve.
NOTE: The joint beneath the valve must be retained.
Withdraw the valve guide and vlave return spring.
Remove the inlet valve and stem.
Clean all metal parts in cleansing solvent and wipe clean the rubber faces of the valves. Renew the valves if damaged or indented.
Examine the diaphragm assembly for damage, or, deterioration, renewing as necessary.
Check that the base plug and guide plate grommets are in perfect condition, renew as necessary.

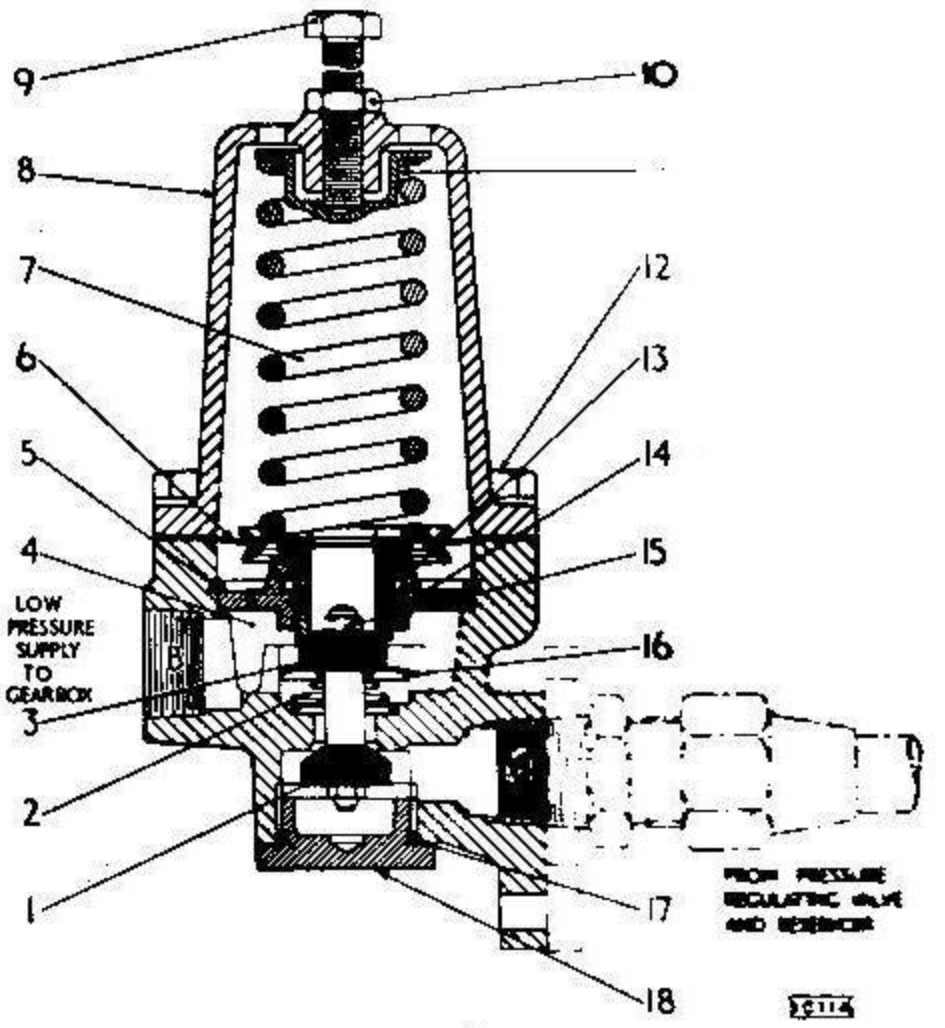


Fig. 5 Sectioned view of the Clayton—Dewandre reducer (limiting) valve

1 Inlet valve
2 Return spring
3 Release valve
4 Outer chamber
5 Circlip
6 Diaphragm assembly
7 Main spring
8 Cover
9 Adjuster screw
10 Locknut
11 Spring guide
12 Cover setscrew
13 Grommet
14 Guide plate
15 Valve locknut
16 Valve guide
17 Grommet
18 Plug

Ensure that the metered hole in the guide plate is unobstructed.
Check the bearing surfaces of the diaphragm assembly and guide plate for wear.
Re-assemble the valve and install in the vehicle.
Pressurize the system and test the cover joint and unions for leaks with a soap solution.
Insert a pressure gauge in the delivery line and check for correct delivery pressure, 80 lbs. per sq.in. (5.6 kg/cm^2).
Adjust by releasing the locknut and turning the adjuster screw clockwise to increase and anti-clockwise to decrease the pressure.

EVERY 75,000 MILES (120,000 KM)

Gear Change Selector Switch — Overhaul
Remove, overhaul and refit as detailed on page H.24

GEARBOX AND TRANSFER BOX

Electro-pneumatic Valve Unit – Overhaul
Remove, overhaul and refit as detailed on page H .

EVERY 250,000 MILES (400,000 KM)—Overhauling

Remove and overhaul or fit re-conditioned gear/transfer box unit.

GEARBOX

Removal
The gearbox – transfer unit can be removed without disturbing the engine as follows.
Remove the engine compartment front panel and cover surround as detailed in Section Q (Supplementary)—"Engine Compartment Covers"
Remove the radiator as detailed under Section C "The Cooling System". Remove the fan drive pulley back shaft completely after removing the radiator.

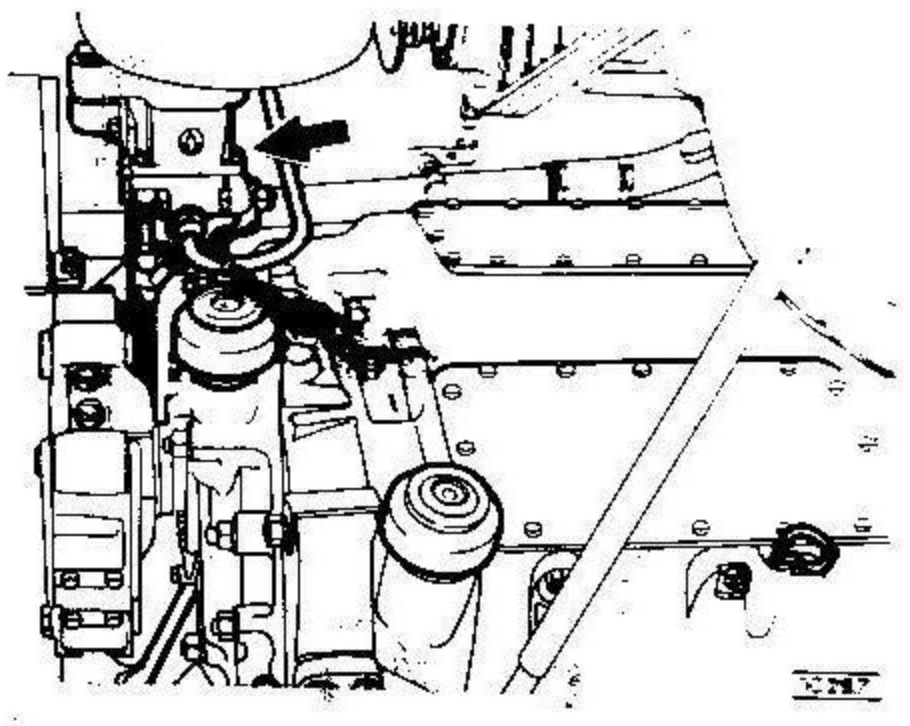


Fig. 6 Location of the electro-pneumatic valve control unit

Detach the electro-pneumatic control unit air pressure pipe at the flexible pipe junction. Remove the electrical connections from the control unit by extracting the four screws retaining the contact plate to the unit body and withdrawing the contact plate complete with cables.
Remove the two radiator stays after withdrawing the two nuts and rubber mounting pads located on the underside of the mounting brackets.
Remove the bottom water pipe after releasing the hose clips and removing the clamp fixing.
Release the top water pipe hose clips retaining the pipe to the engine connection.
Remove the two ¾" diameter bolts retaining the radiator stay mounting brackets to the rear sub-frame by removing the nuts and spring washers and drifting out the bolts. The nuts are accessible from underneath the vehicle.
Remove the radiator stay brackets.
Place a jack, with a wooden block inter-posed between, under the engine sump adjacent to the flywheel and disconnect the engine gearbox coupling. Release the engine rear mounting bolts and jack up the engine to give clearance to the transfer box on removal.
WARNING Check that the engine does not foul any body components when being raised and do not raise beyond the flexibility of the exhaust pipe junction.
Disconnect the propeller shaft from the gearbox drive flange by withdrawing the eight bolts and nuts.
Position wire slings around the gearbox and attach to hoist.
NOTE: The use of rope slings may prevent the gearbox from clearing the frame.
Complete the lifting and removal of the unit.

Refitting
Refitting is the reverse of the removal procedure.

Dismantling
The Rear Cover and Running Gear
Remove the transfer box as detailed under "The Transfer Box". Collect the shims from the brake drum bearing.
Identify and remove the five air pipes between the C.A.V. Electro-pneumatic valve unit and the restrictor valves by detaching the pipe union nuts and pipe clips.
Detach the valve unit after withdrawing the three bolts.
Remove the four setscrews retaining the oil filter cover, remove the cover and extract the filter element. Detach the two inspection covers and joints from the top of the gearbox after withdrawing the sixteen setscrews and washers from each cover.
Check and note on each individual brake band adjuster the dimension between the abutment face of the brake adjuster stop bolt locknut and the inner face of the stop bolts 'A' and also the abutment face of the nuts and the inner face of the adjuster table 'B'.

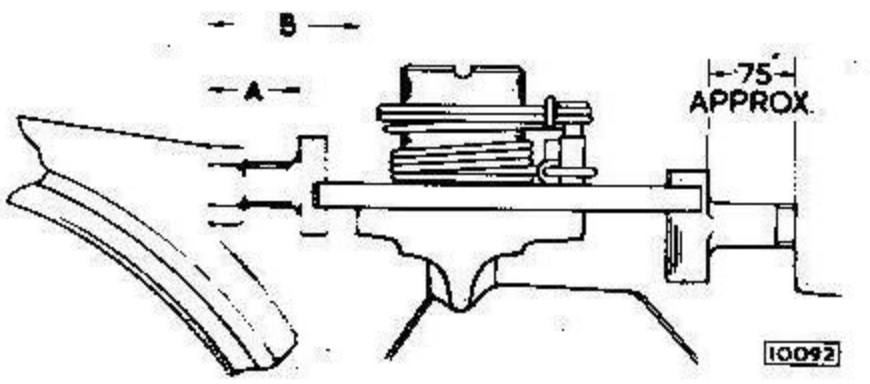


Fig. 7 The toggle settings for 'Daimatic' gearbox

Gear	Dimension 'A'.	Dimension 'B'.
1st	0.70" –17.8mm).	1.31" (33.27mm).
2nd	0.625" (15.9mm).	1.25" (31.73mm).
3rd	0.75" (19.0mm).	1.40" (35.5mm).
4th	0.5" (12.7mm).	1.12" (28.4mm).
Rev.	0.5" (12.7mm).	1.16" (29.4mm).

Detach the brake adjuster spring loops from the anchoring pegs. Remove the adjuster rings, pull rod nuts and adjuster tables.

Remove one nut and thirteen setscrews and washers from the gearbox rear cover.

Fit a plain washer 4.00" (10.16 cm) outside diameter and 1.13/16" (46.0 mm) internal diameter over the gearbox mainshaft. Ensure that the washer abuts against the reverse drum race.

Fit a steel distance tube 1.13/16" (46.0 mm) internal diameter and 7¼" (18.42 cm) long to shaft and secure with the self-locking nut and plain washer.

The distance tube and washer retain the running gear as an assembly during removal.

Tap the end of the main shaft with a soft mallet to break the end cover joint.

Remove the gearbox from the bench fixture and stand the unit on the transfer box mounting face. It will be necessary to support the box on wooden blocks 7" (17.78 cm) high to raise the driving shaft clear of the work bench or table. Remove the oil pump cover retaining setscrews and detach the cover complete with the oil pump assembly.

Make up a plate with an attached eyebolt and secure to the oil pump aperture.

To ensure that the running gear is withdrawn centrally check that the eyebolt is secured above the centre line of the main shaft when fitted in position for lifting.

Attach the lifting tackle to the eyebolt and withdraw the running gear by raising the hoist exercising care not to trap the top gear operating pin.

Lower the running gear to the bench and remove the eyebolt attachment plate.

Stand the running gear vertically on the end cover on wooden blocks to raise the oil pump cover aperture clear of the work bench or table.

Remove the nut, distance tube and plain washer from the mainshaft.

Check the gap widths between the brake drums and compare with those specified under "Specification and Data". Any variations from these dimensions will indicate worn busnes and washers which will require renewing when re-assembling the running gear.

Remove the reverse and first gear trains from the driving shaft and collect the various bushes. Remove the running gear assembly from the blocks and grip the mainshaft in a vice, using soft jawed vice clamps to avoid damage to the shaft bearing surface.

Remove the setscrews and withdraw the rear bearing housing cover.

Remove the self locking nut and oil pump muff from the mainshaft, and withdraw the top gear outer actuating ring assembly taking care to control the eight top gear actuating balls or rollers.

Detach the top, third and second gear assemblies from the mainshaft and collect the various bushes.

Wash all parts and examine for wear. If the wear on the bushes is excessive as indicated in the brake drum clearance check, replacements should be fitted.

Gear Brake Assemblies

Detach the top gear brake hooks by removing the nut and

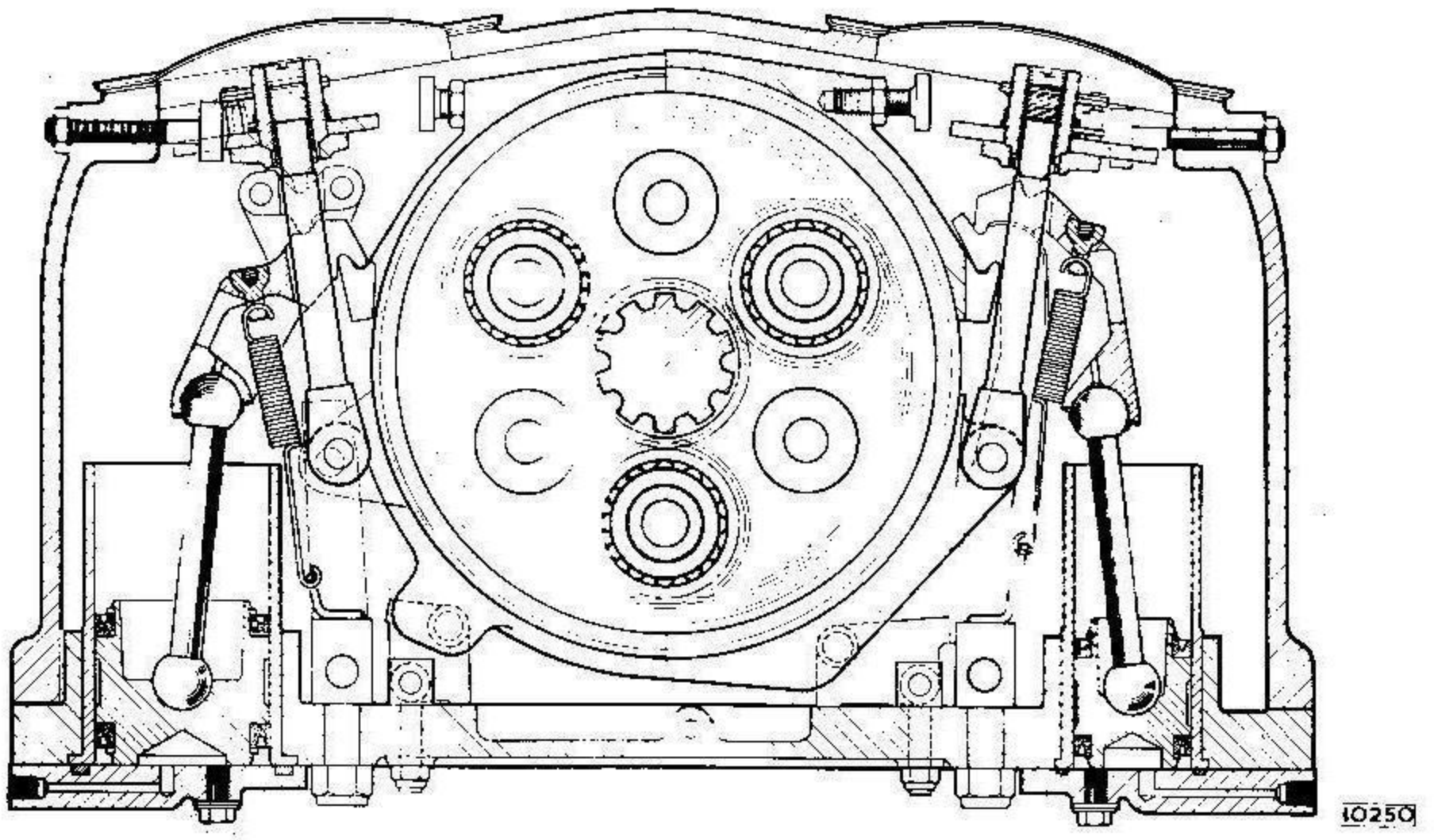


Fig. 8 Cross section of the gearbox showing the brake assembly

countersunk bolt securing the hooks to the gear case. Note the distance piece between the hooks.
Remove the thirty-five setscrews and washers from the bottom cover and lift the gear case away. Screw the special tool (Fig. No. 9) into the spherical spring retainer in the thrust blocks.
Lift the retainers against the spring tension from the location in the blocks and detach the spring and push rods.

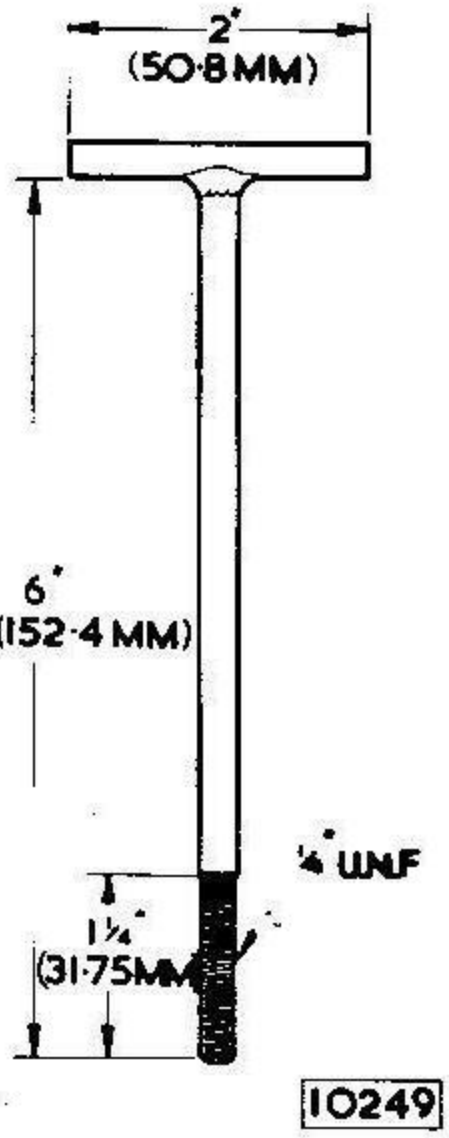


Fig. 9 ***The special tool necessary when refitting the gear band hooks***

Apply pressure to the top of each brake band and prise the hooks away from their location on the bands.
Remove the split pins from the two hooks and the two centralizer fulcrum rods.
Withdraw the four fulcrum rods, detaching and identifying the brake band assemblies, brake band hooks, distance pieces and washers as they become free.
Detach the link pins from the protruding lugs of the internal brake bands. Note the position of the link pin head in relation to the bands. Lift the bands away from the centralizers taking care not to lose the springs.
Remove the securing nuts and withdraw the centralizers from the bottom cover.
Remove the brake pull rods from the lugs of the outer brake bands by ejecting the pins. Wash all parts, examine and renew as necessary.
Withdraw the pistons from the cylinders, remove the retaining rings and piston seals.
Replace if worn or damaged.

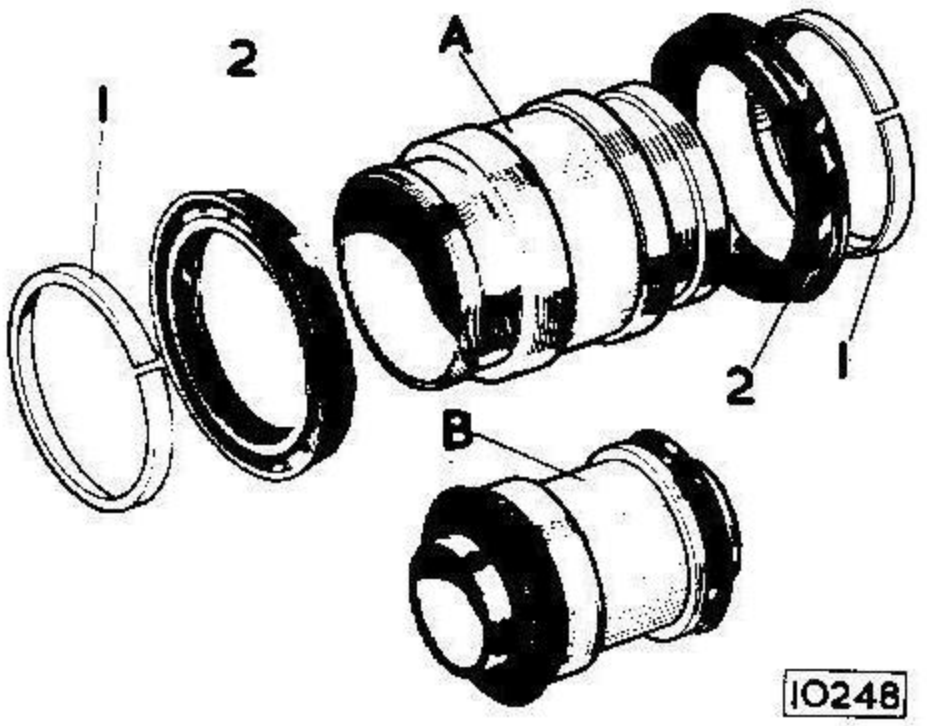


Fig. 10 *The gearbox piston and seal assemblies*
A 1st and reverse gear pistons
B 2nd, 3rd, 4th gear pistons
1 Retainer
2 Seal

Check the cylinder liners. Remove the bottom covers and press out the liners if worn or scored.
NOTE: When it becomes necessary to reline the brake bands it is recommended that the bands are returned to the works for this work to be carried out. Special jigs are necessary to hold the band while trueing up the liner in a lathe.

The Oil Pump
The oil pump can be removed as a unit for servicing as follows.
Remove the oil pump cover plate complete with gears and body after withdrawing the six setscrews and washers.
Remove the four ¼" self-locking nuts and detach the oil pump body and gears.
Check the mainshaft and driving spindle coupling for excessive backlash and wear. Examine all spindle bearing bushes and renew as necessary.

The Oil Pump Relief Valve
A non-adjustable oil relief valve is incorporated in the oil pump system and is located underneath the right hand gearbox suspension bracket.
Withdraw the four setscrews and detach the suspension bracket to gain access to the valve plug.
Remove the plug and sealing washer and withdraw the spring and valve. Examine the valve for wear and check the spring for free length against the dimension given below.
Refitting is the reverse of the removal procedure. Renew the plug sealing washer.
Free length of spring 1.8" (45.7 mm).

Re-assembly
Rear Cover and Running Gear
Press the driving shaft ball race into the housing in the

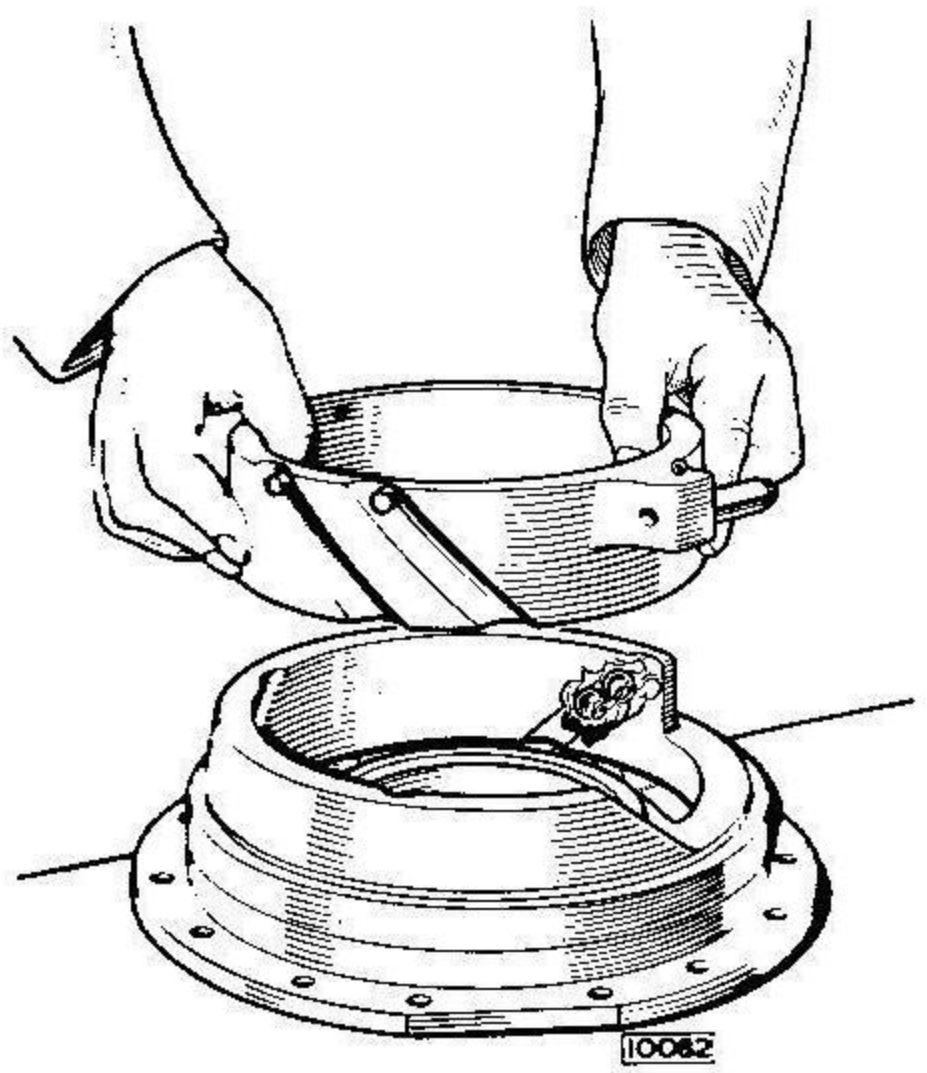


Fig. 11 Fitting the top gear thrust ring to the inner actuating ring

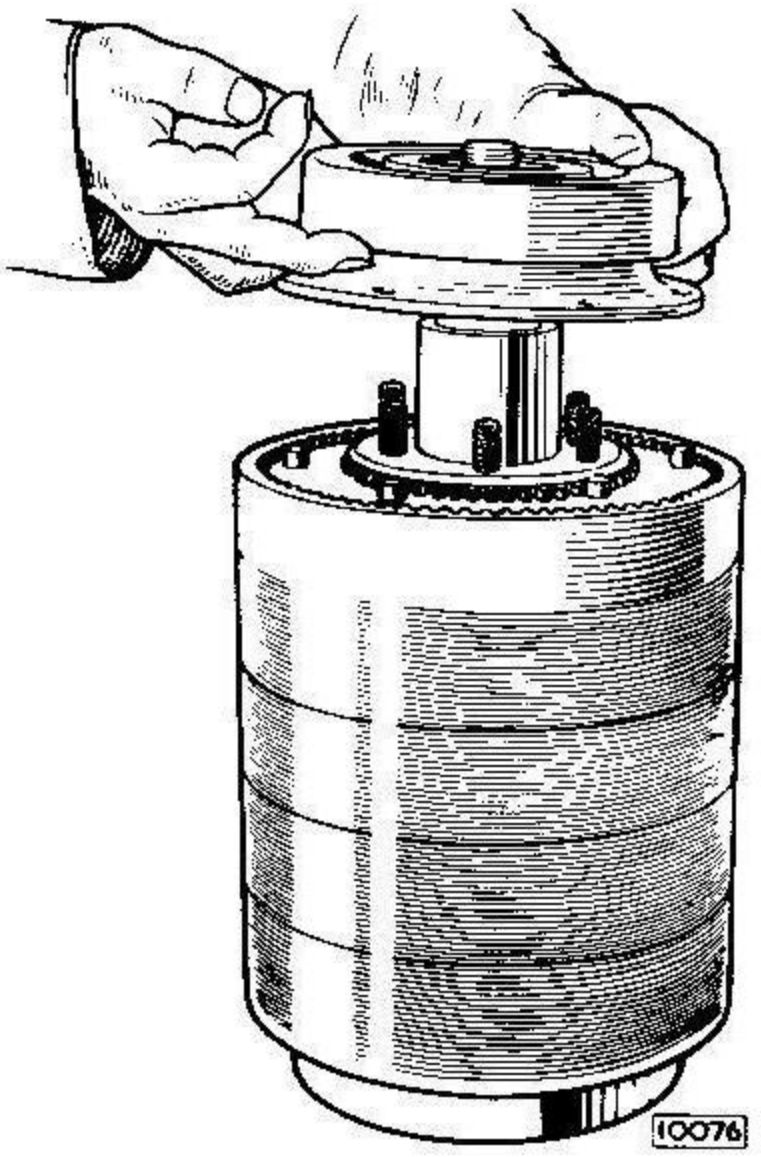


Fig. 12 Fitting the clutch sliding member. Note the springs in position and the locating pegs.

rear cover if removed during the dismantling procedure.
Position the top gear thrust ring inside the inner actuating ring, chamfered side first, followed by the outer race of the top gear thrust bearing.
Apply a smear of grease to each of the tracks in the inner actuating ring and fit two balls or rollers to each track.
Support the rear cover with attached outer actuating ring uppermost between two blocks.
Feed the inner ring into position in the outer ring taking care that the balls or rollers remain in position.
Place the driving shaft vertically in a soft jawed vice with the oil pump juction at the top.
Refit the 1st and 2nd speed sunwheel with the internal splines abutting the shoulder on the shaft. Fit the 3rd gear dowelled thrust plate to the 3rd sunwheel and brake drum assembly. Feed the sunwheel into the front end of the sunwheel and fit the assembled unit to the shaft. Check that the flange of the bush abuts to the 2nd speed sunwheel. Fit the steel and bronze thrust washer to the shaft.
Refit the top gear clutch assembly lining up each clutch plate as necessary. DO NOT USE FORCE when entering the plates into the brake drum. Refit the top gear thrust bearing inner race to the sliding member if previously removed during the dismantling procedure.
Renew the sliding member bush if worn excessively.
It will be noted that the sliding member bush is rolled over at both ends in order to retain the bush in the member as the unit moves forward to close the top gear clutch plates.

This roll must be broken at one end before the worn bush can be removed.
Re-roll after fitting a new bush.
Position the clutch springs in the clutch assembly and fit the sliding member to the clutch spigot bearing ensuring that the locating pegs enter their respective holes and slide freely.
Replace the thrust washer on the spigot and lift the rear cover assembly over the top of the shaft at the same time holding the inner actuating ring in position.
Tap the driving shaft bearing home with a soft mallet if necessary.
Refit the oil pump muff checking that the oilways in he muff align with the oil passage drilled in the driving shaft.
Refit and tighten the self-locking nut.
Refit the rear cover, lightly coating the joint faces with jointing compound and tighten the setscrews down evenly.
Remove the assembly from the vice, reverse and support the rear cover vertically on two wooden blocks to raise the oil pump cover aperture clear of the work bench or table.
Place the rear support washer in position and fit the 2nd gear drum and 3rd planet carrier assembly followed by the double flanged bush. Fit the 3rd gear annulus and 2nd gear planet carrier to the sunwheel followed by the front support washer.

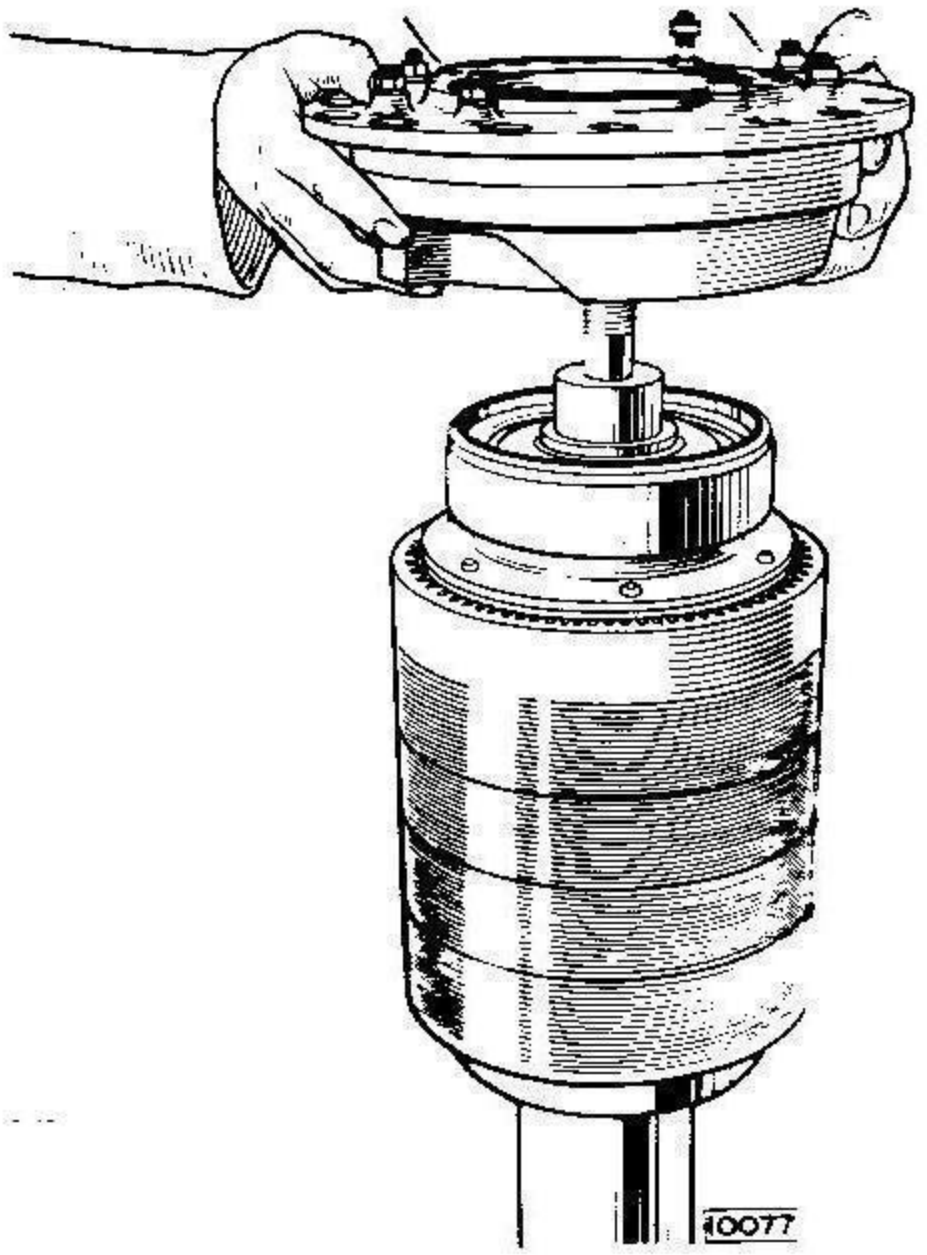


Fig. 13 Fitting the rear cover. The inner actuating ring must be held in position

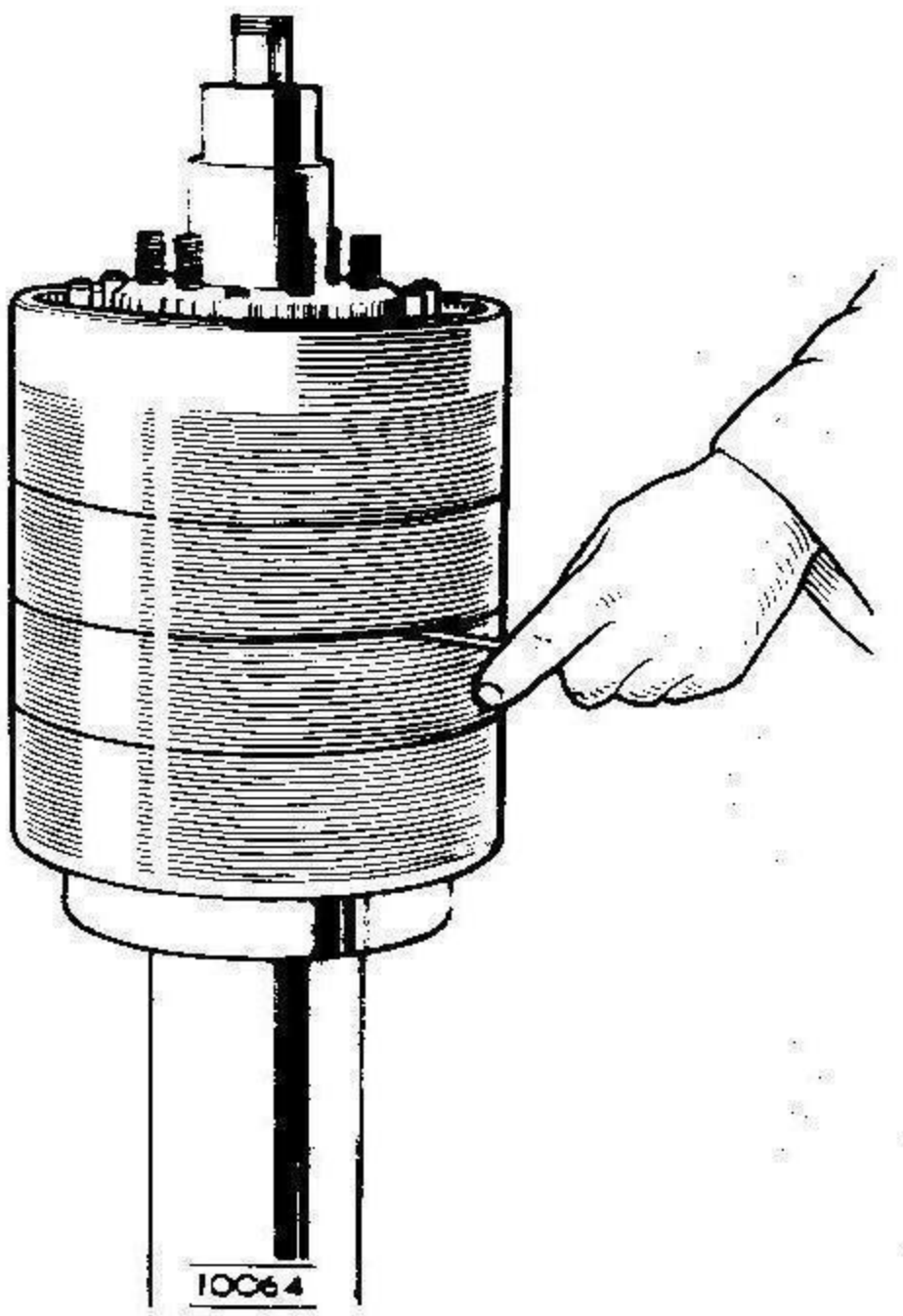


Fig. 14 Checking the brake drum clearances.

Feed the 1st gear planet assembly on to the sunwheel and Follow with the 1st gear drum rear bush. Fit the 1st gear drum and front bush.

Fit the reverse gear planet assembly and reverse gear drum bush.

Follow with the reverse gear drum and bearing Asembly.

Check the brake drum clearances and compare with those Started in "Specification and Data". When the gaps differ from those quoted the running gear must again be dismantled and the thickness of the bush flanges and washers checked.

When the drum clearances have been finalized refit the large plain washer, tube, nut, and washer and tighten the nut.

Gear Brake Assemblies

Renew the air cylinder liners if badly scored.

Remove the bottom covers to enable the cylinders to be extracted.

Renew the top and bottom piston seals if worn or Damaged

Renew The Seals fitted to the air cylinder bottom covers and refit the covers.

Insert the piston and seal assemblies into the cylinders with the spherical face for the thrust block push rod uppermost.

Place the centralizer springs in the centralizers; compress each spring with large pliers or tongs and press the brake bands on to the centralizers so that the springs are trapped between the lugs on the bands. Refit the links and pins to the internal brake bands.

Position the centralizers on the bottom cover and feed through the fulcrum pin.

Fit and tighten the centralizer securing nuts and insert the split pins in the fulcrum pin.

Insert the brake hook fulcrum pins into the fulcrum brackets and refit the brake hooks and link pins. Refit washers and distance pieces noted on removal of the assembly.

Apply pressure to the top of each brake band and position the lugs between the brake hooks. Refit the reverse band operating strut and secure with adjuster nut.

Locate the brake band pull rods between the brake hooks, fit the thrust blocks and push rods and secure with the adjuster nuts.

The nuts should only be screwed on far enough to hold the strut in position.

Attach the thrust block springs to the wire loops and the

spring retainers. Screw the special tool (Fig. 9) into the retainer. Lift against the spring tension and locate in the recess in the thrust block.
Renew the oil filter element, refit the assembly into the housing and secure with four setscrews and washers. Coat the face of the cover lightly with jointing compound before assembly.
Apply a thin coating of jointing compound to the face of the bottom cover and lower the gear case into position.
Replace the setscrews securing the bottom cover, tightening down evenly.
Refit the distance piece between the top gear hooks and secure to the gear case with the countersunk headed bolt and nut and split pin.

Refitting the Running Gear
Refitting the running gear is the reverse of the removal procedure.
Check that the top gear pull rod lies between the two top gear hooks with the cup towards the centre line of the gearbox. THIS IS IMPORTANT since the pull rod cannot be placed in position after the running gear has been inserted. Lower the running gear into the gear case and secure the rear end cover with the thirteen setscrews, nut and washers. Coat the rear end cover face with jointing compound before re-fitting. Remove the hoist and lower the gear case on to the bottom cover.

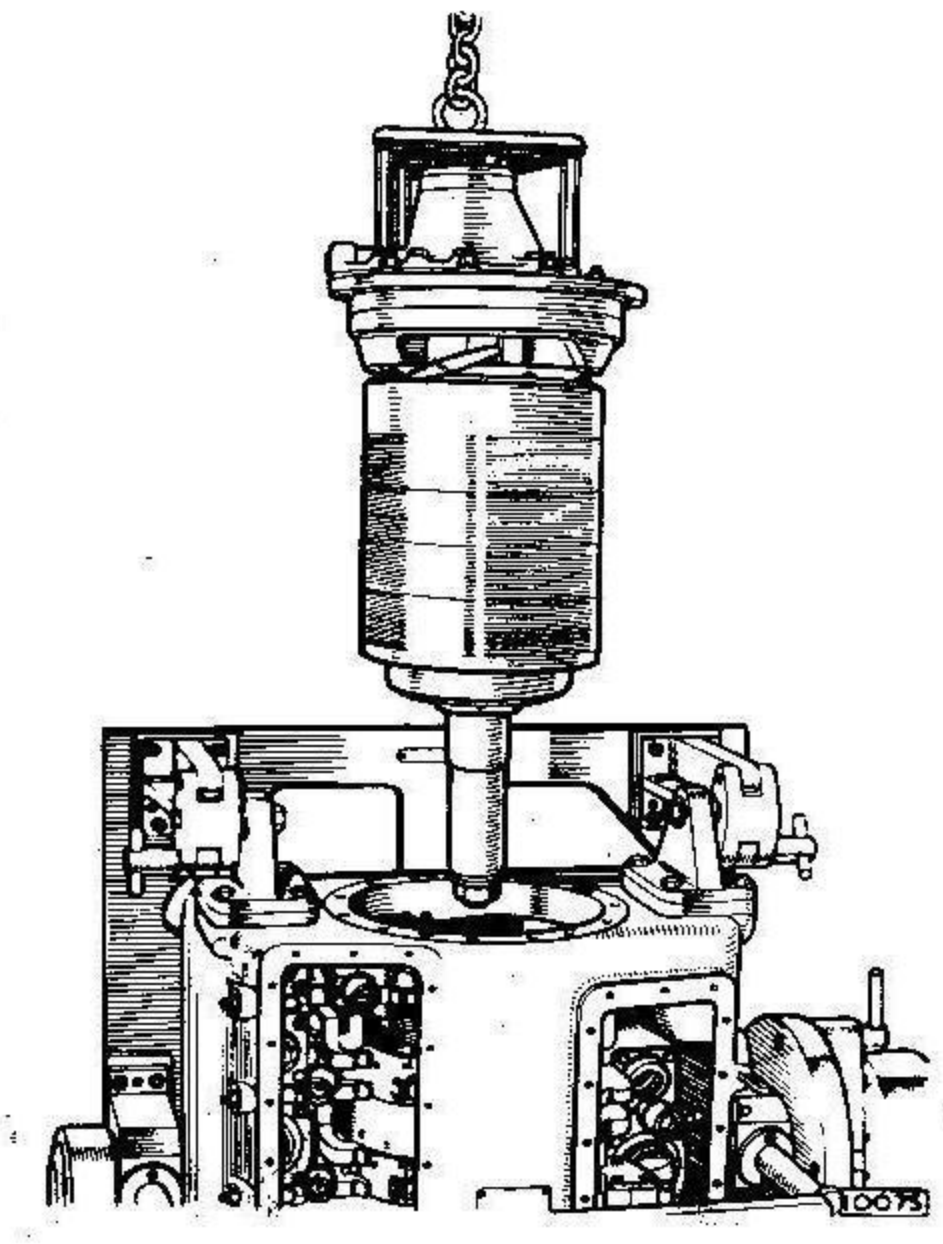


Fig. 15 Lowering the running gear into the case

Remove the nut, tube and plain washer from the driving shaft.
Refit the pump assembly. Check that the pump spindle registers correctly with the driving pin in the mainshaft. Coat the face of the cover with jointing compound before refitting. Adjust the running brake bands as under "Automatic Brake Adjuster"

Automatic Brake Adjuster
Refitting and Adjusting
Check that the top gear operating pin is located in the spherical seat of the top gear pull rod and trap the latter between the gear hook with the blade of a screwdriver.
Remove the nut from the pull rod, feed the top gear thrust pad push rod into the air cylinder and locate the thrust block in the grooves of the hooks. Fit the adjuster table over the pull rod and follow with the adjuster ring and nut.
Remove the screwdriver.
Replace the remaining push rod and thrust block assemblies.
The adjuster nuts should only be screwed on far enough to hold the struts in position.
Fit the adjuster springs to the nuts, small coil first and position the right hand loop on the adjuster table peg and the centre and two left hand loops on the adjuster ring peg.
Remove the restrictor valve bodies from the 1st, 2nd, 3rd and reverse gear air cylinder bottom covers and withdraw the restrictor valves. Refit the bodies. Connect an air supply of 80 lbs. sq.in. (5.624 kg/cm^2) through a single way ON/OFF tap and two way ON/OFF tap venting to atmosphere in one position to the top gear restrictor valve body.
Mark the top of the nut with a pencil line.
Adjust the brake adjuster stop bolt to the dimension A

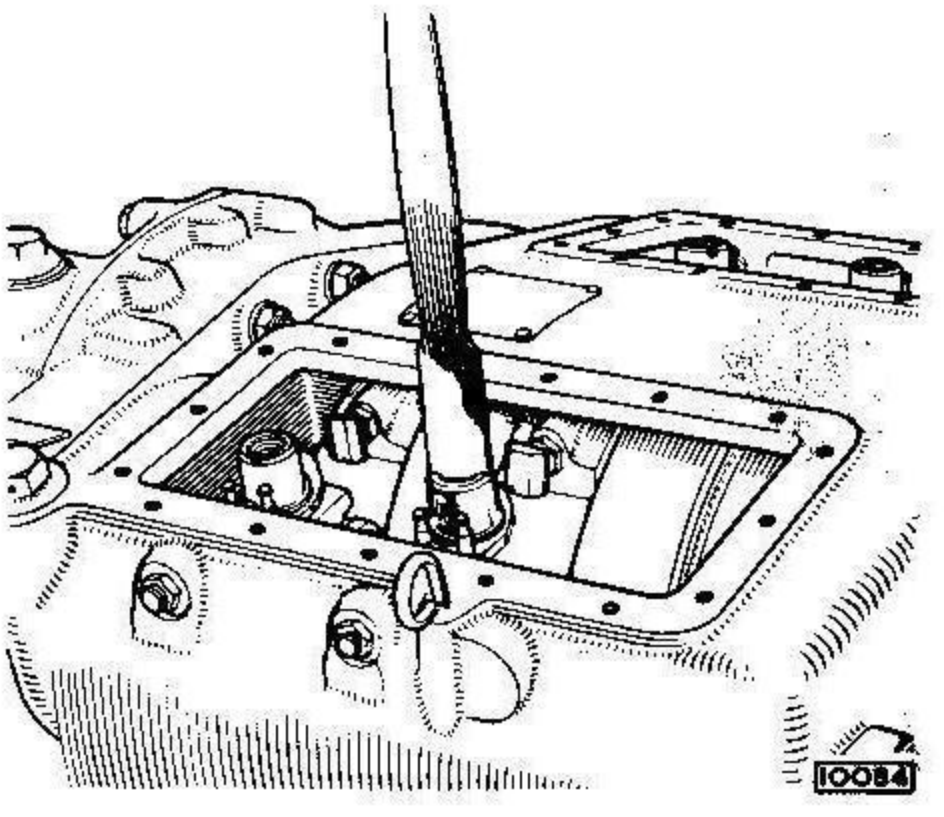


Fig. 16 Turning the adjuster nut. Note the spring is removed before turning.

in table given below as noted during the removal procedure.
Close the atmosphere venting tap and open the first ON/OFF tap and so engage the gear. Leave the tap open to allow the piston and connected thrust pad to rise to the full extent.
Close the ON/OFF tap and open the venting tap, so disengaging the gear.
Repeat the cycle of operations until it is observed by noting the pencil mark that the nut ceases to turn as the gear is disengaged.
Check that the distance between the abutment face of the locknut and the inner face of the adjuster table corresponds to dimension "B" in the table given below. If the distance is greater than "B" select neutral. Release the locknut on the brake adjuster stop bolt and screw the stop in half a turn, re-tighten the locknut. Release the spring eyes from their pegs and unscrew the adjuster nut one turn. Replace the spring eyes. Repeat the pumping operation until the nut ceases to turn.
When the dimension "B" in the table below has been obtained the gear is correctly adjusted.
If the dimension "B" is less than the one required unscrew the stop half a turn but do not adjust the nut.
Repeat the pumping operation and recheck.
Disconnect the air connection from the top gear valve body and connect to the remaining gear valves in turn and repeat the operation.
When completed, withdraw the restrictor valve bodies and washers from the 1st, 2nd, 3rd and reverse gear air cylinder bottom cover.
Insert the restrictor valves into the bodies and refit the new joint washers.
There being no restrictor valves in the top gear it is not necessary to remove the valve body.
Refit the top covers and joints.
Refit the electro-pneumatic valve unit and air pipes.
Ensure that the unions are perfectly clean before Connecting.

Gear	Dimension 'A'	Dimension 'B'
1st	0.70" (17.8 mm)	1.31" (33.27 mm)
2nd	0.625" (15.9 mm)	1.25" (31.73 mm)
3rd	0.75" (19.0 mm)	1.40" (35.5 mm)
4th	0.50" (12.7 mm)	1.12" (28.4 mm)
Rev.	0.50" (12.7 mm)	1.16" (29.4 mm)

RUNNING GEAR END FLOAT

Checking

Check the running gear end float as detailed under "The Transfer Box — Refitting" and refit the transfer box.

THE TRANSFER BOX

Due to the weight (approx. 6½ cwts) of the combined transfer/gearbox unit it is essential that a suitable support fixture and adequate lifting tackle is available before attempting to dismantle the unit.
Mount the gearbox vertically on the rear end with the transfer box uppermost on a rigid table or platform by means of suitable brackets. Remove the gearbox suspension brackets from the gearbox and attach the fixture supports to the bracket mounting points.
The support fixture should be positioned beneath a running lifting gear.

Removing from Gearbox

Remove the drain plugs and drain all the oil away from the gearbox and the transfer box.
Attach a rope sling to the transfer box and raise the unit with the transfer box uppermost. Lower to the support fixture and bolt securely into position. Retain the sling in position. Withdraw the flywheel coupling yoke after removing the securing nut, plain and felt washers from the transfer box output shaft and withdraw the cardan shaft coupling.
Remove the nuts and spring washers securing the transfer box to the gearbox. The lower fixing nuts cannot be completely removed from the studs until the transfer box has been lifted approximately ¼". Lift the transfer box clear and remove the gearbox.
Collect the shims from the reverse drum ball race outer. These shims control the end float in the running gear.
Collect the driven shaft bush from the main shaft.

Dismantling

Remove the setscrews and bolts securing the speedometer generator bush and withdraw the bush and spindle. Tap back the spindle thrust button tab washer and unscrew the plug. Collect and note the shims attached to the plug.
Extract the setscrews and remove the output shaft end cover and withdraw the tapered roller race and speedometer drive gear. Access to the gear can be obtained through the pinion bush housing aperture.
Remove the eight setscrews and washers securing the bevel pinion race housing, withdraw the housing and output shaft with attached pinion.
If required, remove the bevel pinion from the shaft by tapping back the tab washers and removing the setscrews.
Withdraw the six setscrews and washers from the input shaft bearing housing and remove the housing from the main cover.
Remove the 16 nuts and washers from the transfer box front casing studs and separate front and rear casings.
Withdraw the driven spur gear coupling with the attached spur and bevel gears.
Remove the gearbox driven shaft with the attached spur gear.
Wash all parts in cleaning solvent.
Check condition of spur and bevel gears, ball and roller races, mainshaft bush bearing and all oil seals.
Renew all worn or damaged parts.

Re-assembly

IMPORTANT: If replacement spur gears are to be fitted it should be noted that the three alternative final drive ratios are obtained by varying sets of these two gears. It is therefore ESSENTIAL that the correct replacement gears are obtained.

(1) Check the depth between the driving bevel pinion faces with a micrometer and note reading obtained.

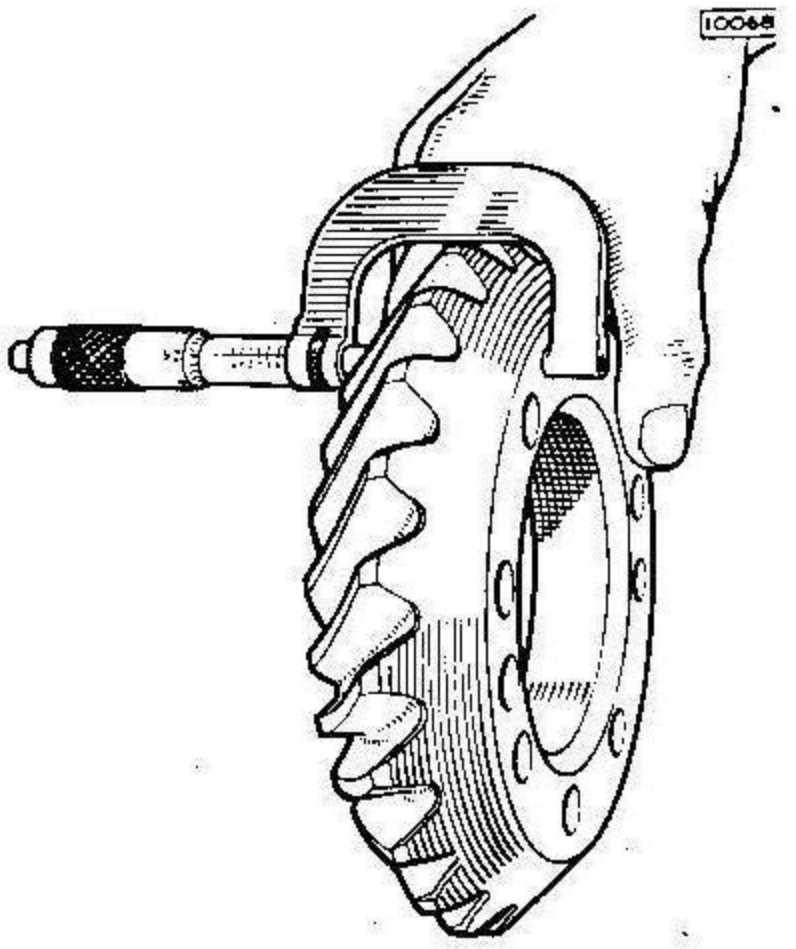


Fig. 17 Checking the depth of the bevel pinion faces

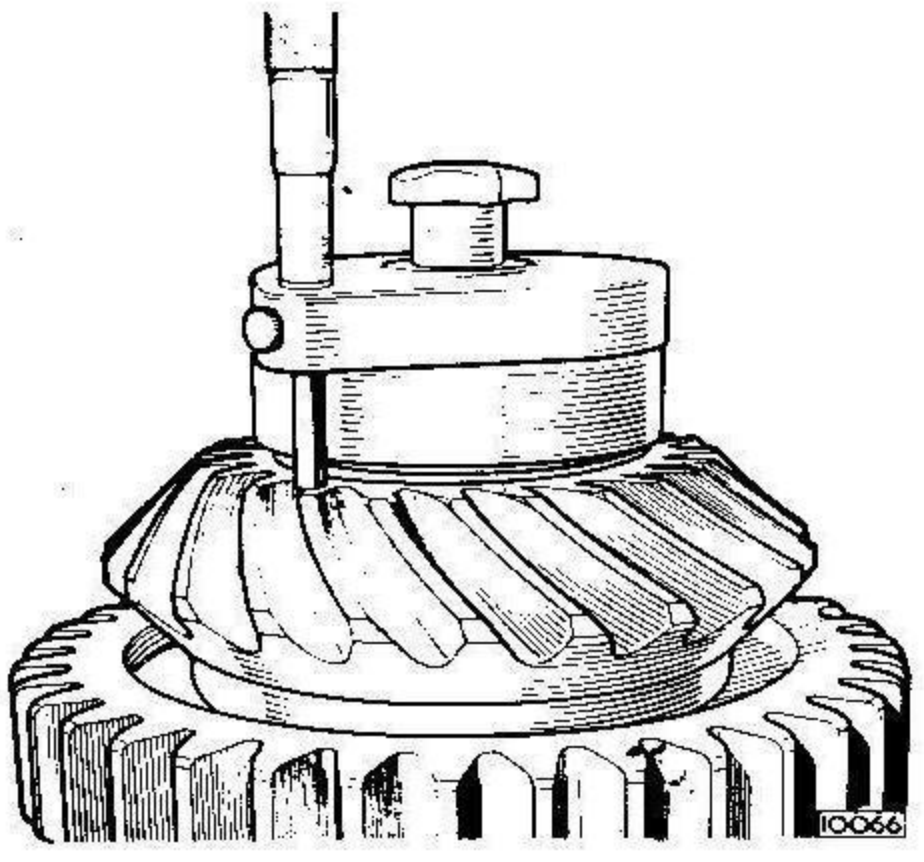


Fig. 18 Checking the depth between the bevel face and inner bearing with a micrometer depth gauge

(2) Assemble the bevel pinion and driven spur gear to the coupling locating on the dowel pins in the spur gear and refit the eight setscrews and four lock plates. Tighten the setscrews fully and secure with the lock plate tabs. Refit the roller race inner bearings to the coupling.

(3) Check the depth between the bevel pinion face and the face of the adjacent inner bearing with a micrometer depth gauge.

(4) Add measurement (1) and (3) together to give the total depth of pinion and race and note reading obtained.

(5) Machine a disc approximately .75" (19.1 mm) in depth to a diameter of 7.623" (192.63 mm) and drill a hole ½" (12.7 mm) in the centre. Machine a ½" (nominal) diameter bar 6" (152.4 mm) in length to fit into the hole drilled in the disc. Insert the bar in the disc maintaining a true 90° angle to the face of the disc. Insert the check gauge into the output shaft bevel pinion bearing housing. The centre of the pointer will indicate the centre of the pinion housing.

(6) Remove the bevel pinion bearing outer race from the front case by extracting the two 5/16" diameter setscrews with copper sealing washers, inserting two rods ¼" (6.4 mm) in the holes and drifting out the outer race, shims and bevelled ring. Refit the setscrews with washers and re-insert the ring.
Bolt the front and rear cases together with three setscrews.

(7) Check the distance between the bottom face of the driving pinion housing (with the bevel ring inserted) to the centre of the output shaft bearing housing, that is, to the centre of the rod, by means of a micrometer depth gauge.

(8) Add measurement (4) and (7) together. Subtract the total from the figures etched on the bevel pinion.
The result will give the thickness of shims required to give the correct setting of the pinion in relation to the centre of the output shaft. Remove the

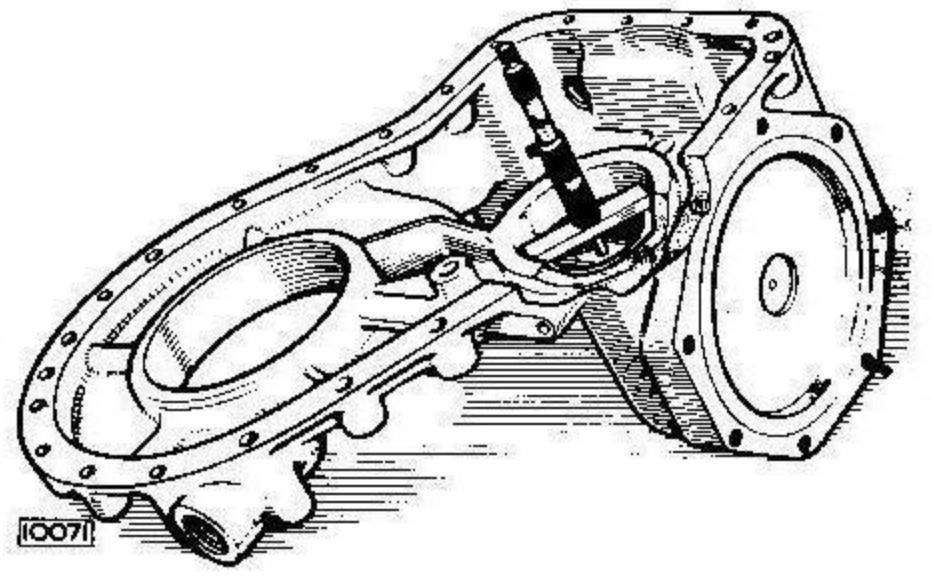


Fig. 19 Checking the distance between the bottom face of the driving pinion housing and the centre of the output shaft bearing housing

temporary fixing bolts and detach the front from the rear casing.

Renew oil seals and roller bearing in front case if worn or damaged.

NOTE: Two single oil seals are fitted as a pair. Seals must always be fitted with the plain surface of the seals together.

Fit the gearbox driven shaft with attached spur gear to the front case. Care must be taken that the oil seal lips are not distorted when refitting shaft.

Remove the end cover from the driving pinion rear bearing housing and collect the shims located under the cover.

Check that the bevel ring is fitted in the pinion front bearing housing and fit the required thickness of shims as calculated in paragraph (8).

Place the spur/bevel pinion assembly in position in the front casing.

Renew the twin oil seals and bearing in the rear case if worn or damaged.

Fit the rear case to the front casing taking care that the gearbox driven shaft does not damage the oil seals during the fitting procedure.

As extended sleeve of pen or shim steel fitted to the shaft will ensure that the seal lips are not distorted. Secure with sixteen nuts and washers, tightening the nuts down evenly. Refit the rear bearing cover and shims and tighten bolts down evenly.

Check the rotation of the gear assembly, add or remove shims under the cover until the gears are free to rotate with a slight nip on the bearings.

Insert the output shaft with attached bevel gear, tapered roller race and speedometer gear key. Note figure etched on bevel gear for later reference. This figure (e.g. .008") denotes the permissible backlash between the two bevel pinions. Refit the bearing housing, coat the faces with jointing compound, tightening down the eight setscrews and washers evenly.

Refit the bearing end cover without the shims, tightening the setscrews finger tight only. Do not apply jointing compound to the surfaces. Insert the speedometer drive gear, geared end first. Ensure that the gear registers correctly with the key.

Fit the inner race to shaft ensuring that it is driven fully home and refit the outer race.

Refit the bearing end cover without shims tightening the bolts finger tight only to take up end float in the two bearings.

Check the backlash in the bevel pinions as follows.

Remove the small side cover in the transfer box, six setscrews and washers and erect a clock gauge with the pointer fed through the side cover aperture in contact with the top side face of the uppermost tooth of the driven bevel gear. Rotate the output shaft clockwise until all backlash in the bevel gears is taken up. Set the dial gauge to zero and rotate the shaft in the opposite direction. Note the reading on the clock which will denote the total backlash between the gears.

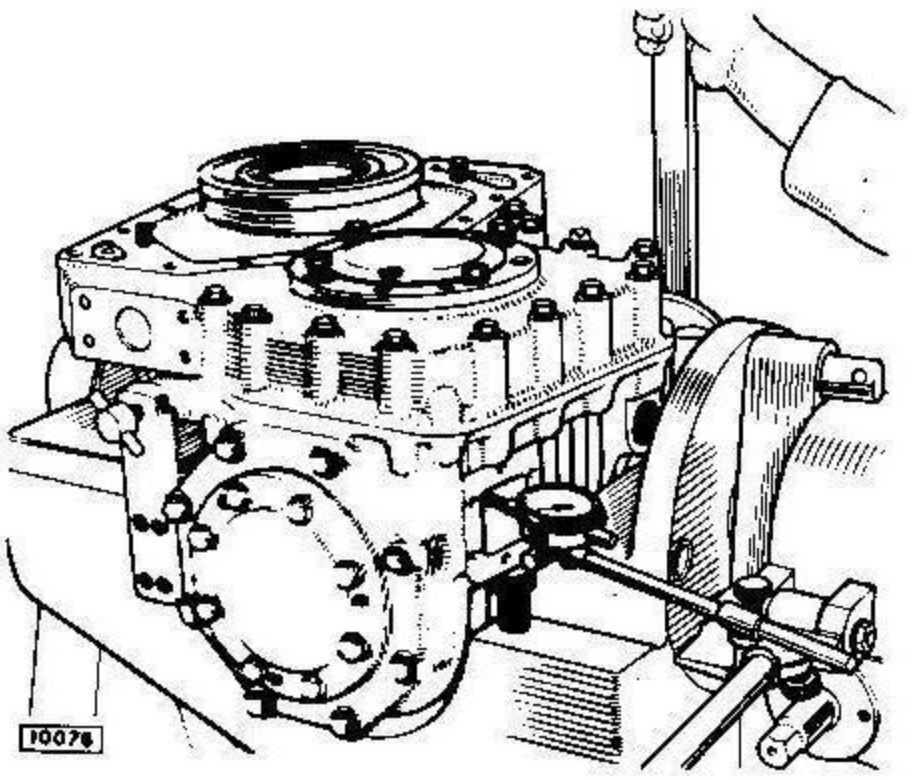


Fig. 20 Checking the backlash in the bevel pinions

Tighten the bevel gears and cover setscrews evenly until the backlash figure etched on the gear is obtained. Check the gap between the end cover and bearing housing with feeler gauges.

Remove the end cover and refit with the calculated amount of shims. Coat the faces with jointing compound and tighten the setscrews evenly.

Check the preload in the output shaft bearing as follows.

Remove the sixteen nuts and washers and separate the front and rear transfer box cases.

Remove the spur and bevel pinion gear assembly. Remove the output shaft coupling end cover and withdraw the oil seal.

Tap the bevel pinion and output shaft assembly towards the centre of the case to the full extent of travel using a soft drift.

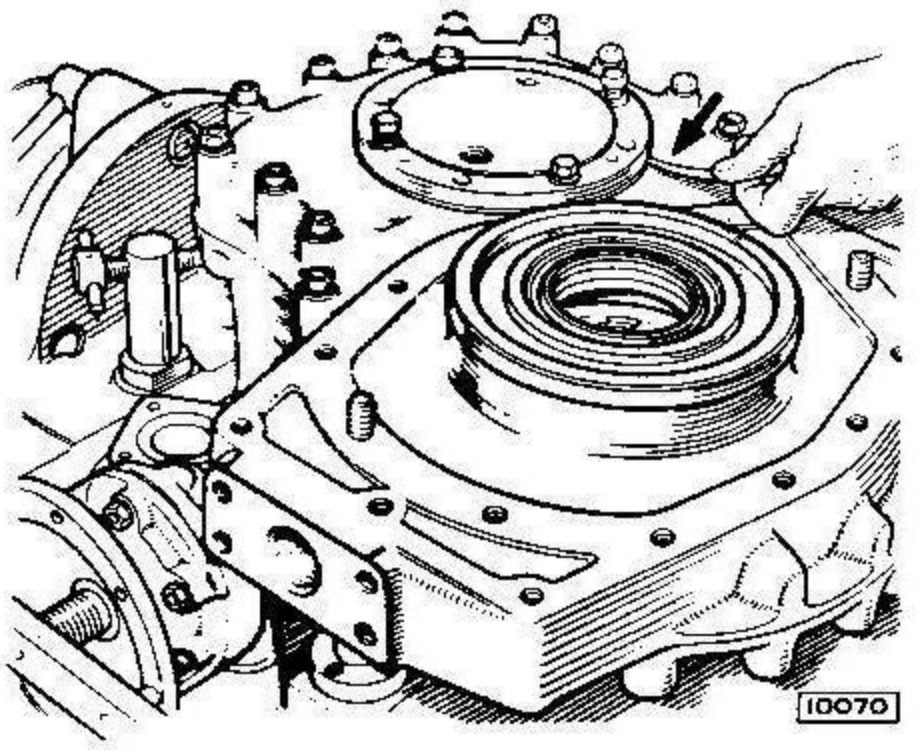


Fig. 21 Checking the gap with feeler gauges

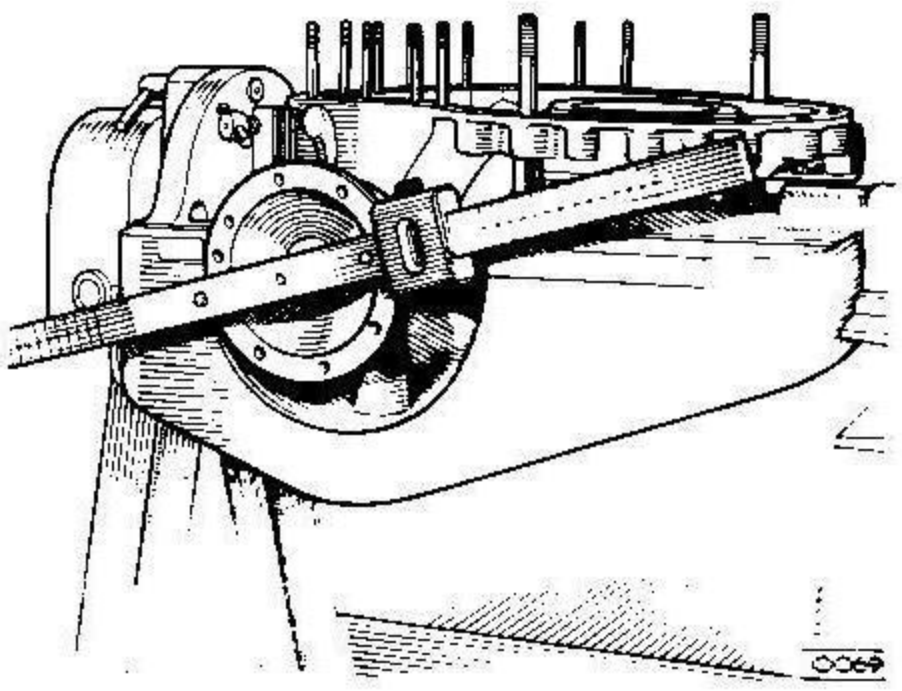


Fig. 22 Checking the bearing pre-load

This is important. Omitting this procedure will result in a false pre-load setting.
Refit the end cover without shims and tighten the setscrews down finger tight only.
Insert the cardan shaft coupling but do not fit the securing nut and washers.
Attach a bar measuring 12" (30.48 cm) either side of a centre line to the coupling with two bolts and nuts, the centre of the bar to coincide with the centre of the coupling shaft.
Attach a 2 lb (.89 kg) weight to the bar 6" (15.24 cm) from the centre line.
Tighten the end cover setscrews evenly until the lever with attached weight will fall under its own load with a slight initial pressure applied to the weighted end of the lever.
Check the gap between the end cover and bearing housing with a feeler gauge and select shims to this dimension.
Remove the coupling and end cover.
Refit the end cover with the calculated shim pack. Coat the joint faces with jointing compound and tighten the setscrews down evenly.
Refit the coupling with the felt and plain washers and tighten the nut.
Refit all gears and shims into the main case coat the faces with jointing compound and re-assemble the front and rear cases. Tighten the sixteen setscrews down evenly.
Refit the side cover; coat the faces with jointing compound before assembly.

Refit the Speedometer Drive
Replace the pinion bush 'O' ring. Extract the oil seal and insert the bush in the case together with the pinion and shaft. Coat the face of the bush flange with jointing compound and secure with the bolts, nuts, washers and setscrews. Fit the thrust button plug with locking plate and shims. Check the end float of the shaft with a clock

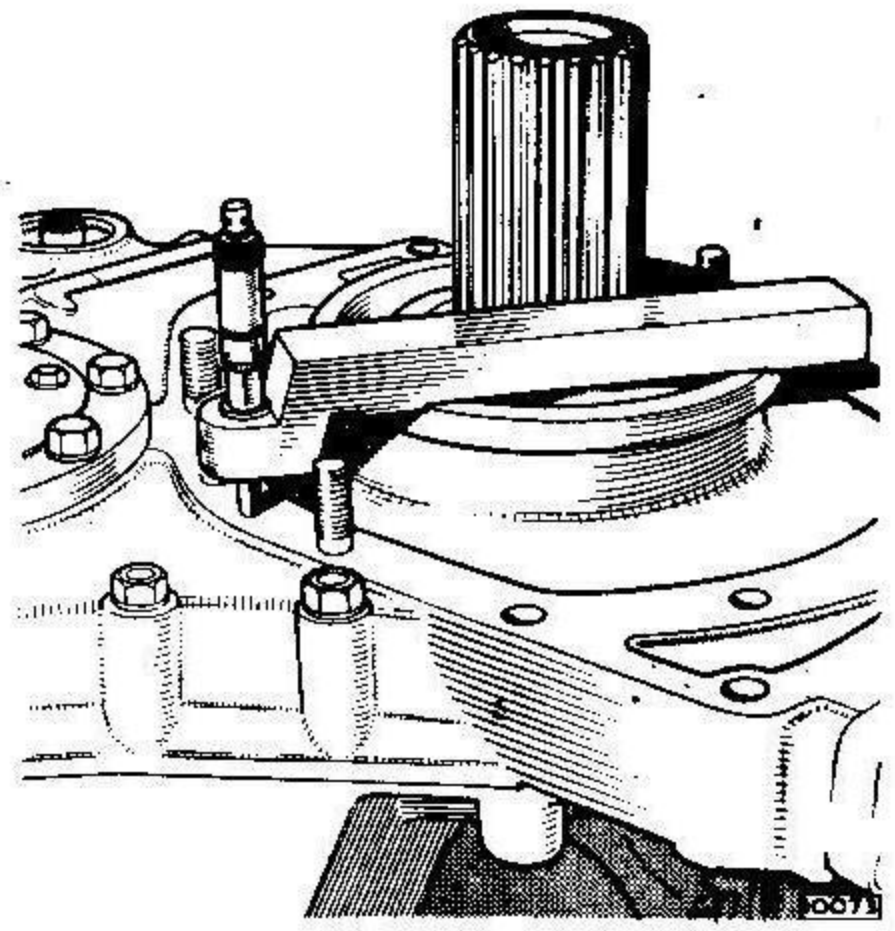


Fig. 23 Checking the distance between the gearbox flange face and the outer race of the brake drum bearing

gauge and adjust to a total of .020" by adding or removing shims from the thrust button plug.
Secure the locking plate on completion.
Refit the bearing bush to the transfer box input shaft ensuring that the bush is free to rotate in the shaft bore. Renew the bush if worn or damaged.

Refitting to Gearbox
Checking Gearbox Main Shaft End Float
Ensure that reverse drum ball race in the gearbox is fully home.

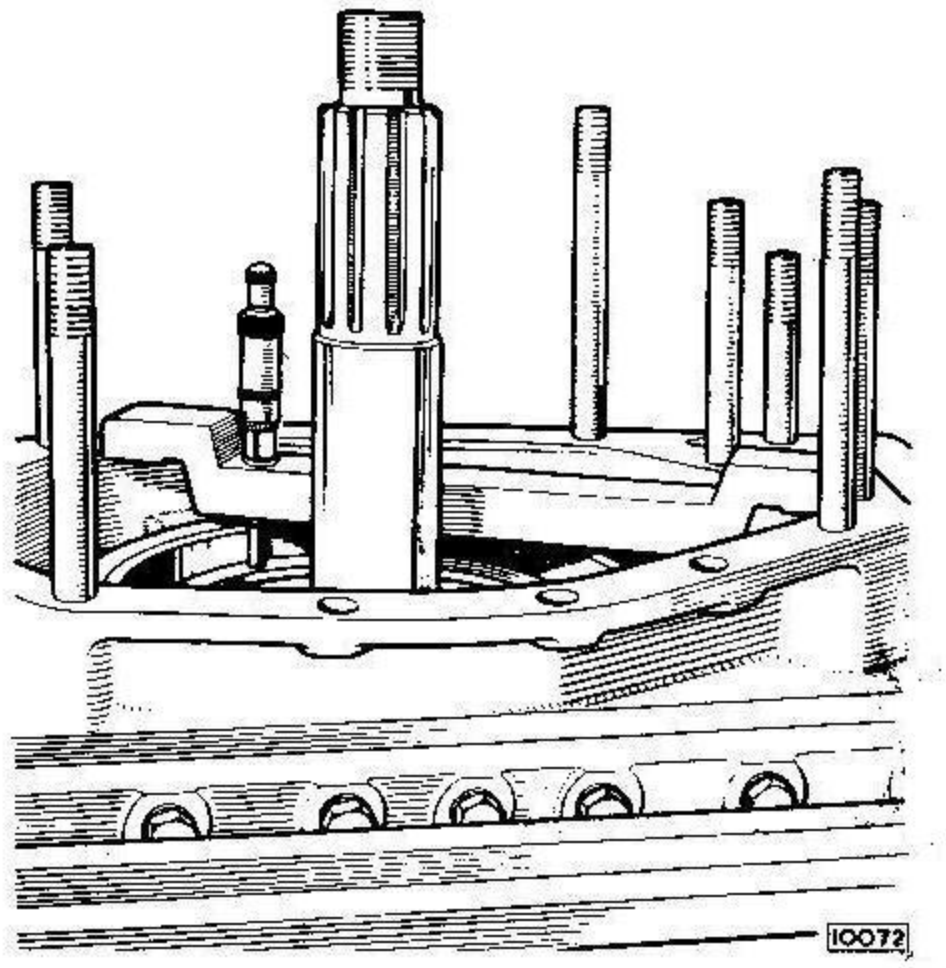


Fig. 24 Checking the distance between transfer box face and input shaft bearing face

GEARBOX AND TRANSFER BOX

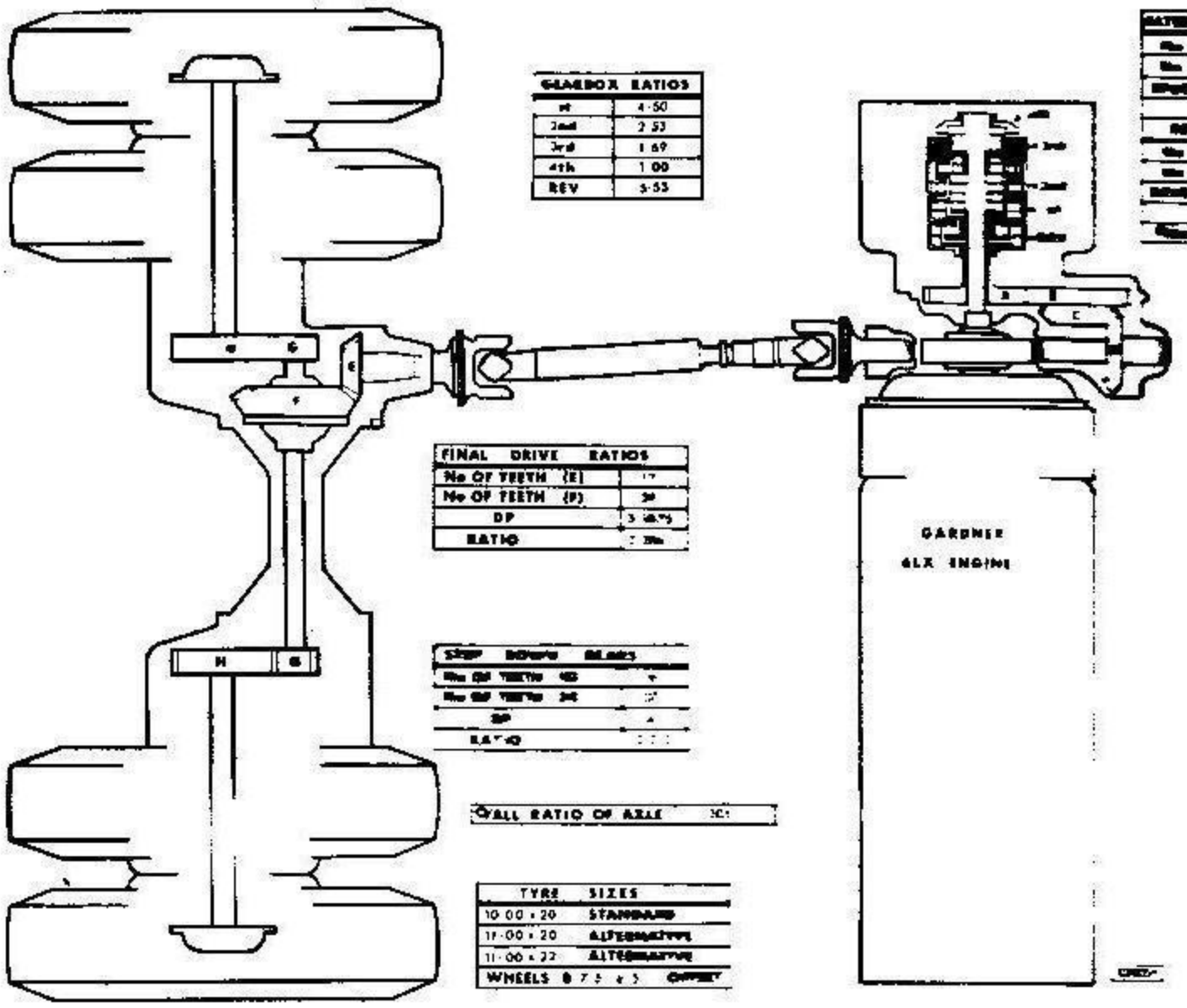


Fig. 25 Table of gear ratios

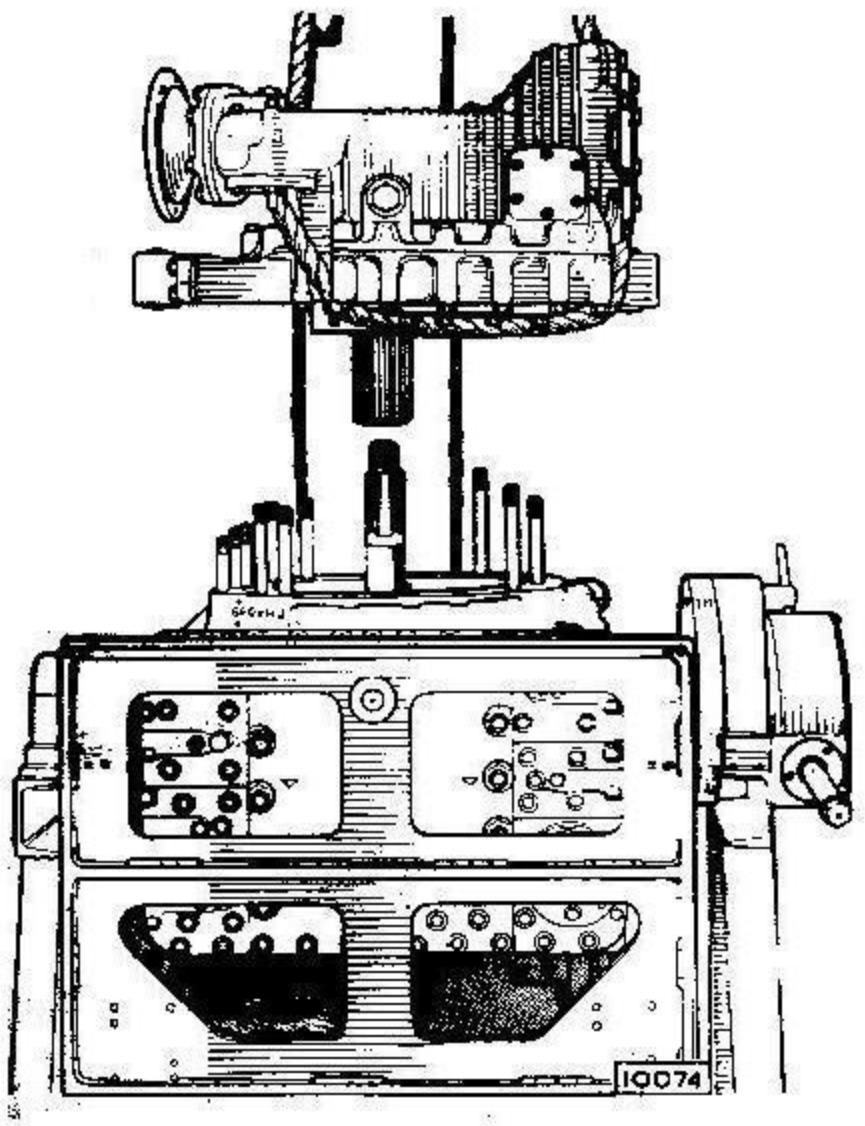


Fig. 26 Refitting the transfer box to the gearbox

1. Check distance between gearbox flange face and the outer face of brake drum bearing with a micrometer depth gauge.
2. Check distance between transfer box face and input shaft bearing housing face.
   Subtract (2) from dimension (1) to ascertain total end float. Select shims to give .040" (1.0 mm) mainshaft end float. Fit the shims to the gearbox race.

Line up the planet gears in the gear case. Insert the flywheel yoke coupling through the transfer box end bearing cover, care being taken that the oil seal is not damaged.

Check that bearing bush is located in the transfer box input shaft and retain with a slight smear of grease.

Coat the face of the gearbox with jointing compound and lower the transfer box onto the gear case.

Fit the flange securing nuts and washer as the gearbox studs appear through the transfer box flange. The lower nuts cannot be fitted if the two face flanges are joined together before the nuts are started on the stud threads. Follow through with the flywheel coupling yoke as the transfer box is lowered.

The inner bearing must not be allowed to rise and clear the double oil seals, otherwise damage may result to the oil seal lips when refitting the yoke. Fully tighten all securing nuts. Refit coupling flange nut, plain and felt washers.

Refit the drain plugs.

GEAR CHANGE CONTROL EQUIPMENT (Steering Column Mounted)

GENERAL DESCRIPTION

The C.A.V. electrical gear change control equipment consists of a gear selector switch mounted on the steering column and an electro-pneumatic valve block unit mounted on a bracket attached to the gearbox.

Air pressure pipes connect the valve block unit to the valve unions in the gearbox.

Operation

The gear selector switch consists, basically, of a set of five pairs of contacts. These contacts are mounted on leaf springs and are opened and closed by the action of a cam mounted on a sliding spindle.

This cam is operated by a gear lever connected to one end of the spindle and protruding through a gate in the top of the switch housing.

Movement of the gear lever into any slot of the gate causes a similar movement of the cam; this in turn closes a corresponding pair of contacts and so energises the appropriate solenoid in the electro-pneumatic valve block.

A further pair of contacts on the gear selector switch can be provided for door lock control if required.

The lower end of the gear lever is fitted with a spring loaded indexing ball catch to provide both positive location at the gear positions and the necessary amount of "feel" in the system.

Accidental engagement of the reverse gear is prevented by a spring loaded locking plunger and a mechanical latch prevents movement of the gear lever from fourth to first gear without using second and third gears.

A safety relay is built into the switch to prevent simultaneous engagement of two gears in the event of an electrical fault. This relay has a series winding and high resistance shunt winding; the latter being normally short-circuited by the relay contacts. The high current created by the simultaneous operation of two solenoids energises the series coil. This opens the contacts and inserts the high resistance shunt coil into circuit.

The ensuing reduction of current allows the valve solenoids to close and the gearbox reverts to the neutral position. The combined flux of series and shunt coils ensures that the relay contacts remain open until the current is broken.

The electro-pneumatic valve block consists of a bank of five electrically operated double-acting valves. Each valve is held in the "normally closed" position by the action of a coil spring.

When a valve solenoid is energised the solenoid plunger opens the valve and admits compressed air from a common inlet gallery to an individual outlet. This outlet is connected to the operating cylinder of a particular gear in the gearbox.

Release of the solenoid plunger allows the valve to return to its normally closed position under the pressure of its return spring. This seals off the inlet gallery and at the same time exhausts the compressed air from the selected gear into a common outlet gallery.

Electrical connections to the valve solenoids are made through a terminal board protected by a small cover. The connections are completed by means of spring loaded silver contacts, which automatically isolate the solenoids when the protective cover is removed.

The gear selector switch requires no lubrication as the operating spindle is carried in oil-less bearings, but the index ball (14 must be greased during overhaul).

The warning light bulb is accessible for inspection or renewal by unscrewing the bezel (7).

Checking

The L17 relay can be checked with the selector switch

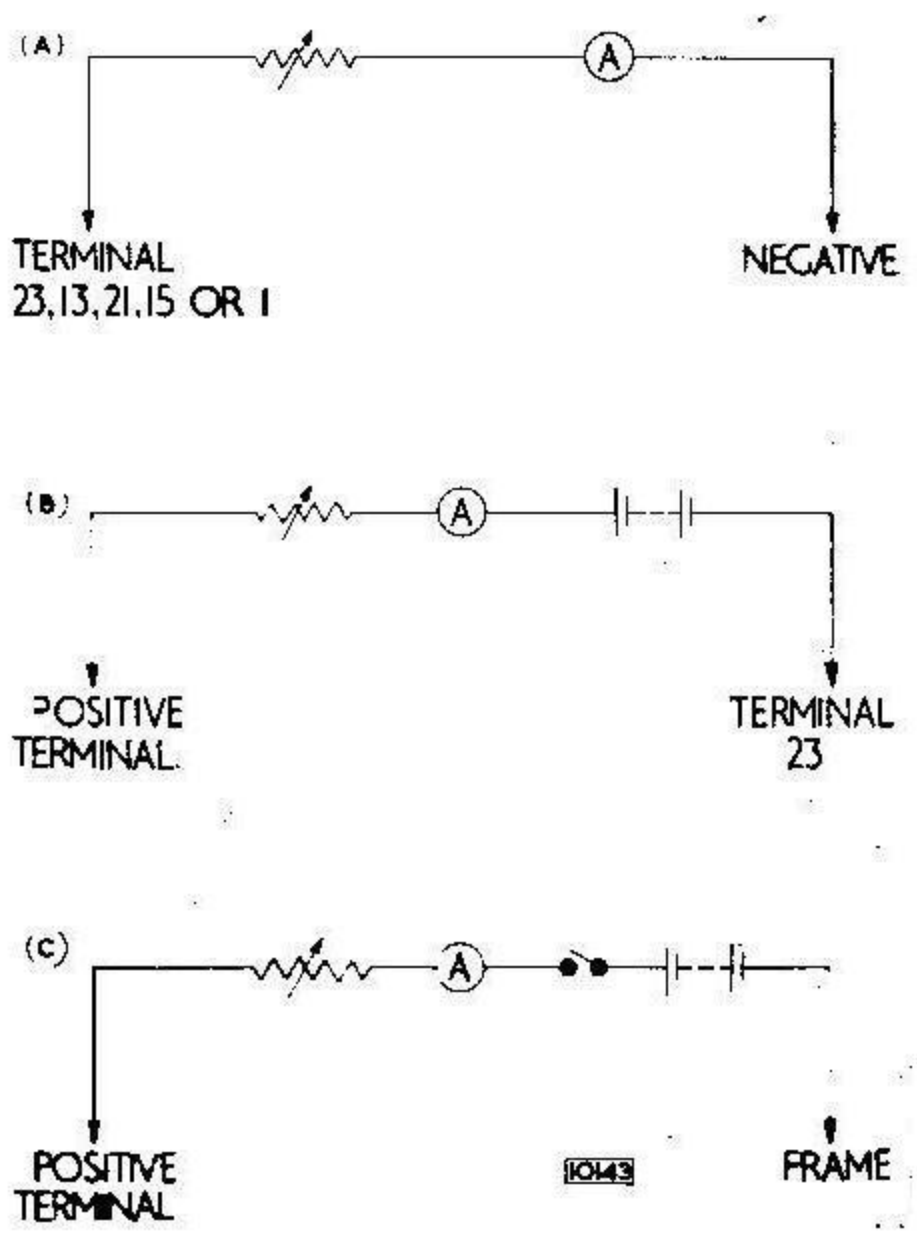


Fig. 27 Test circuit for L.17 relay

fitted to the vehicle or removed as detailed below.
The current required to operate the relay is known as the pull-in valve and should be in the range of 1.20A to 1.25A. This figure can be checked by means of a moving coil ammeter of 0 to 2 amperes reading and a 35ohm 2 ampere variable resistance. Check the pull-in value in the following manner.

With Switch fitted to Vehicle

(1) Open the battery cut-off switch.
(2) Detach the selector switch from the mounting and remove the base cover.
(3) Remove one lead (1, 13, 15, 21 or 23) from the selector switch terminals.
(4) Connect the variable resistance and the ammeter between the free terminal and the negative terminal as shown in Fig. 27(A).
(5) Set the resistance at maximum and select in the normal manner the gear corresponcing to 1, 13, 15, 21 or 23 as in para: 3 above.
(6) Close the battery cut-off switch.
(7) Reduce the resistance gradually, watching the ammeter, until the relay operates. The current value at the instant before the relay operates is the pull-in valve, and this must be within 1.20 to 1.25 amperes. After the relay has operated the current will fall to a lower value owing to the high resistance of the shunt coil.
(8) If the correct pull-in value is not obtainec the relay must be adjusted with the setting procedure as detailed on Page H.26.

With Switch removed from Vehicle

(1) Remove the base cover from the switch.
(2) Connect a switched 24 volt supply with an ammeter and resistance to terminal 23 and positive terminal on the selector switch as shown in Fig. 27(B).
(3) Set the resistance at maximum and select the gear corresponding to terminal 23.
(4) Switch on the current and gradually reduce the resistance until the relay operates. The current value at the instant before the replay operates is the pull-in value and must be within 1.20 to 1.25 amperes.
(5) If the correct pull-in value is not obtained the relay must be adjusted in accordance with the setting procedure as detailed on Page H.26.

Removal

Remove the two nuts and bolts securing the selector switch to the mounting bracket and detach the switch.
Remove the terminal cover and disconnect the cables. Note the cable colours and location for reference when refiting

NOTE When pulling the wires through the rubber guides ensure that they do not foul the relay and disturb the setting.

Refitting

Refitting is the reverse of the removal procedure.

Dismantling (Fig. 28).

Switch off the current supply to the selector switch.
Unscrew the two securing bolts and release the switch from the mounting.
Remove the terminal cover plates (11, 12) and disconnect all cables. Note the cable colours and location for reference when refitting. When pulling the cables through the rubber guides (15, 20) ensure that they do not foul the relay (19) and disturb the setting.
Release four screws (21) and ease out the contact unit (22) until it is possible to reach the inner terminals. Disconnect the two wires leading to the warning light and withdraw the complete contact unit, being careful not to disturb the relay setting.
Slacken the locknut (5) on the gear lever, remove the knob (4) and the locknut (5).
Detach the lower housing (24) by removing the two securing nuts. Remove the indexing ball (14) and spring (1).
Remove the top cover by easing out the two remaining bolts. These bolts are a push fit in reamed holes. Detach the latch (28) and its two steel balls.

NOTE: do not lose the steel balls: they are essential to the proper functioning of the latch.
Remove nut (25) lockwasher, and plain washer.
Ease lever (3) from the operating spindle and remove the key (2).
Remove the two screws (16) and withdraw the end bearing (17) complete with operating spindle (8).
Unscrew the warning light bezel and withdraw the bulb.
Unscrew the two lampholder securing screws and remove the lampholder.
Remove reverse stop (26) by unscrewing the glandnut (30).
Detach the end cap (18) and extract the operating spindle (8) from the end bearing (17) being careful not to lose the thrust washer (31).
Unscrew the nut (10) and withdraw the small spring loaded spindle from the operating spindle (8).

Servicing

Examine all switch and relay contacts and clean the contact faces with a brush dipped in petrol or white spirit. If the contacts are blackened or pitted, clean them with fine glass paper and afterwards wipe the contact surfaces clean with a rag moistened in petrol or white spirit.
CAUTION: DO NOT USE EMERY CLOTH TO CLEAN THE CONTACTS.
After cleaning all contact surfaces, set the open contact gap of the switches to 0.050" – 0.070" (1.27 – 1.78 mm) by bending the respective fixed contact arm. Check the relay gap as detailed on page H.26.

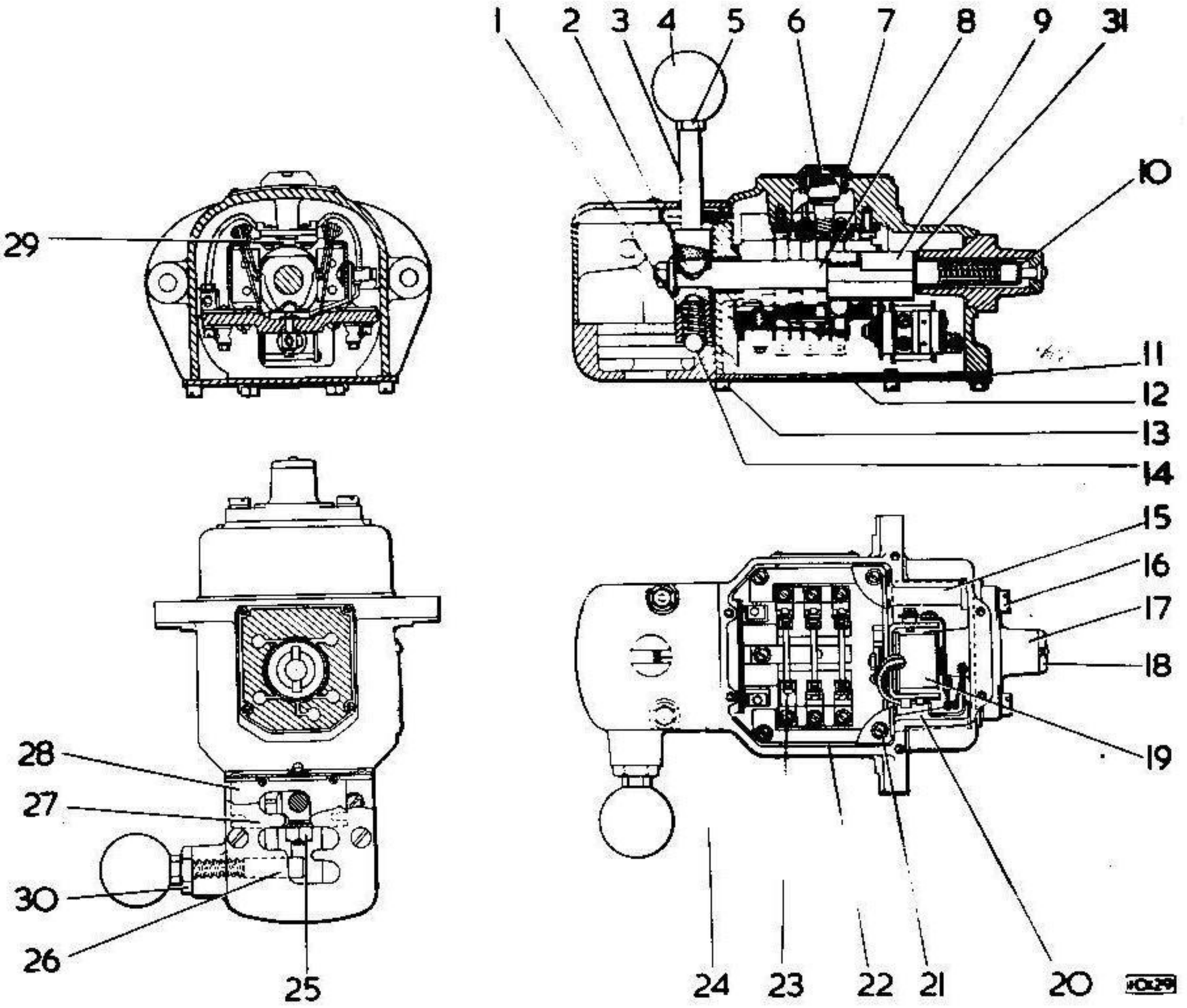


Fig. 28 The gear selector switch

1 Indexing ball spring
2 Key
3 Lever
4 Knob
5 Locknut
6 Warning light
7 Bezel
8 Operating spindle
9 Spindle
10 Nut
11 Terminal cover plate
12 Terminal cover plate
13 Cover plate screws
14 Indexing ball
15 Rubber guide
16 End bearing screws
17 End bearing
18 End cap
19 Relay
20 Rubber guide
21 Cover screws
22 Contact unit
23 Contact
24 Lower housing
25 Nut
26 Reverse stop
27 Plate
28 Latch
29 Warning light unit
30 Gland nut
31 Thrust washer

Clean the indexing ball tracks of the lower housing.
Pack the pressure spring of the indexing ball with SHELL ALVANIA No. 3 grease (or equivalent) before assembling.

Assembling

Assemble the small spring-loaded spindle to the operating spindle (8) and screw in the nut (10).
Assemble the operating spindle to the end bearing (17), inserting the thrust washer (31) and secure in place with the end cap (18).
Offer up the reverse stop (26) and secure in place with the gland nut.
Insert the lampholder (29) and secure the two retaining screws (16).
Fit the key (2) to the operating spindle and ease the lever (3) into position on the spindle.
Screw on the nut (25), lockwasher and plain washer to secure the gear lever in position.
Insert latch (28) and fix in position with the retaining screws.
Replace the top cover and press in the two retaining bolts.
Fit the pressure spring (1) and indexing ball (14) into the case of the gear lever. Offer up the lower housing (24)

and secure in position with the two nuts on the through bolts.

Check that the gear change lever does not touch the switch body casting in the region of the cam spindle bearing when in neutral position and that the lever enters the gate without fouling either side.

To adjust if necessary check that the thrust washer (31) has been fitted and fit shims as required between the switch body and the end bearing (17).

Withdraw the end bearing securing screws (16), select third or fourth gear position and measure the gap between the body and the bearing with feeler gauges and select suitable shims.

Remove the end bearing, fit shim and complete assembly.

Check that the gear lever does not foul the gate.

Shims are available from the manufacturers of the switch

C.A.V. LIMITED,
ACTON,
LONDON, W.3.

in three sizes 0.010" (0.254 mm), 0.015" (0.381 mm), 0.035" (0.889 mm).

Connect the two warning light wires to the contact unit (22) and insert the contact unit into the body of the switch. The slack of the connecting wires should be folded towards the gear lever end.

DO NOT DAMAGE THE RELAY OR BEND THE RELAY CONTACT ARMS DURING ASSEMBLY.

Screw in the four retaining screws (21) and angle brackets securing the contact unit in place.

Connect the external wires to correct terminals. When pulling the wires through the rubber guides (15,20) care must be taken to ensure that they do not foul the relay and disturb the setting.

Place terminal cover plates (11, 12) in position and secure with the retaining screws.

Screw the locknut (5) on to the gear lever (3) and screw on the knob (4). Tighten the locknut to secure the knob.

Carry out a final check of the relay setting with the switch assembled to ensure that the relay setting has not been disturbed during assembly of the switch. Assemble the switch to the mounting and secure in position with the two bolts.

Type L17 Relay — Setting Procedure

The relay must be detached from the body of the selector switch as detailed in the switch dismantling procedure (page H.24) before attempting any adjustments.

Remove the relay armature fixing screws (1) Fig. 29 and packing pieces (2).

Set the contact gap to 0.059" (1.5mm) by holding the relay armature (3) down on the relay core and bending the top contact carrier (5).

Remove the armature from the relay and set the angle of the backspring (4)

For initial setting an angle of 11.5° as shown in Fig.31 will provide a setting of approximately the correct order.

Replace the armature (3), packing pieces (4) and fixing

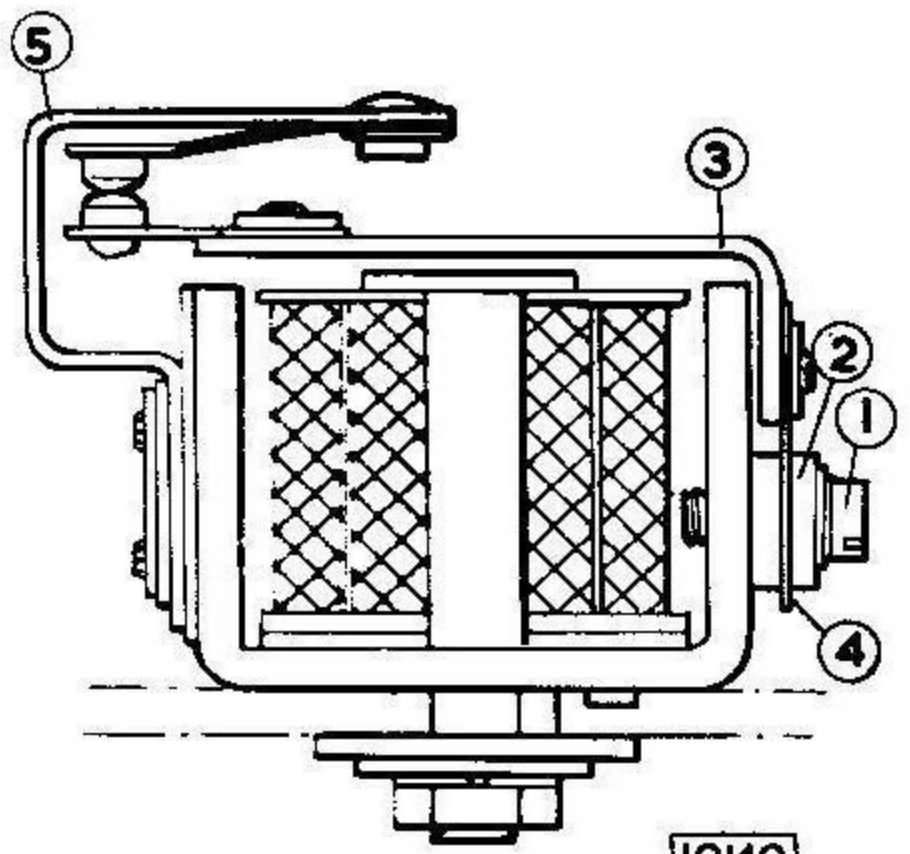


Fig. 29 The L.17 relay

1 Armature fixing screws
2 Packing piece
3 Relay armature
4 Back spring
5 Top contact carrier

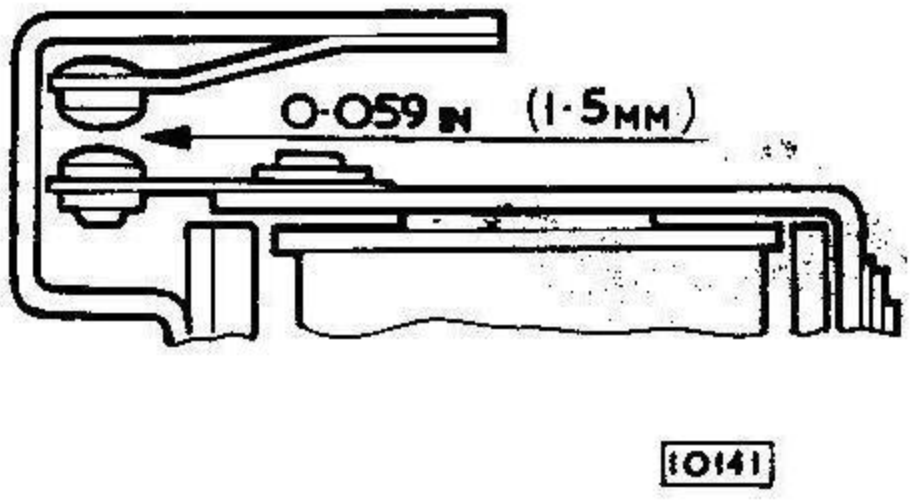


Fig. 30 Setting the control gap

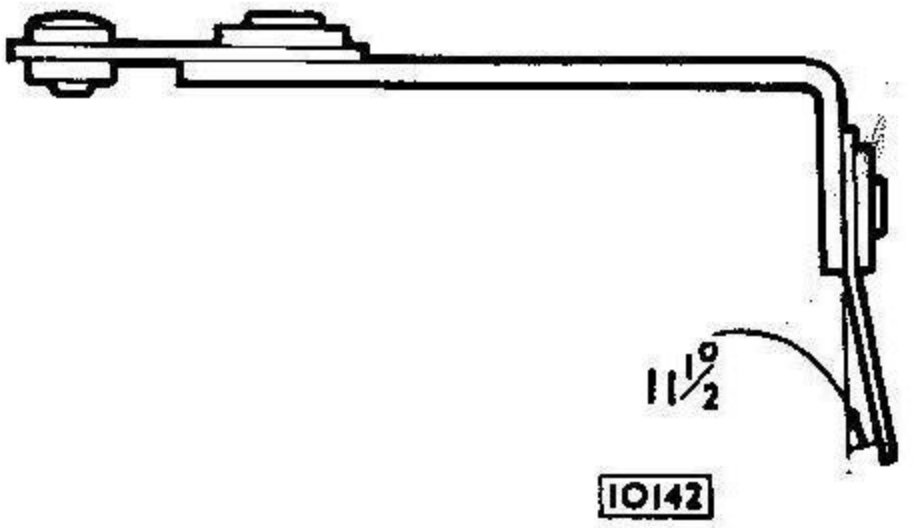
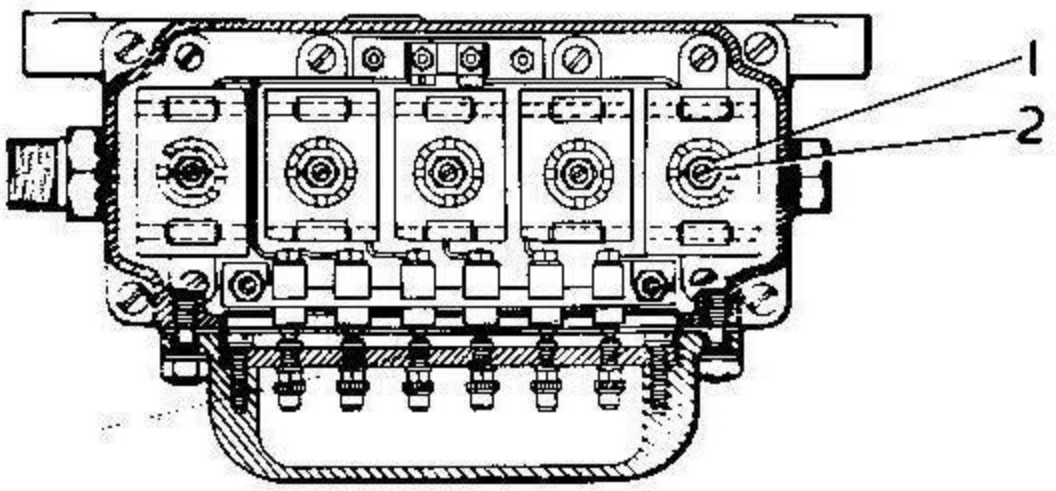
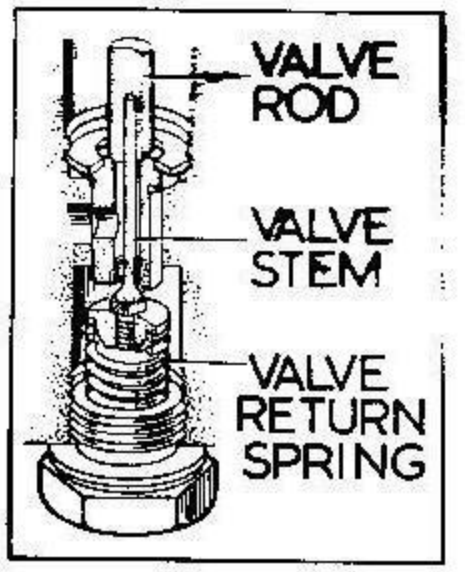


Fig. 31 Adjustment of back spring angle





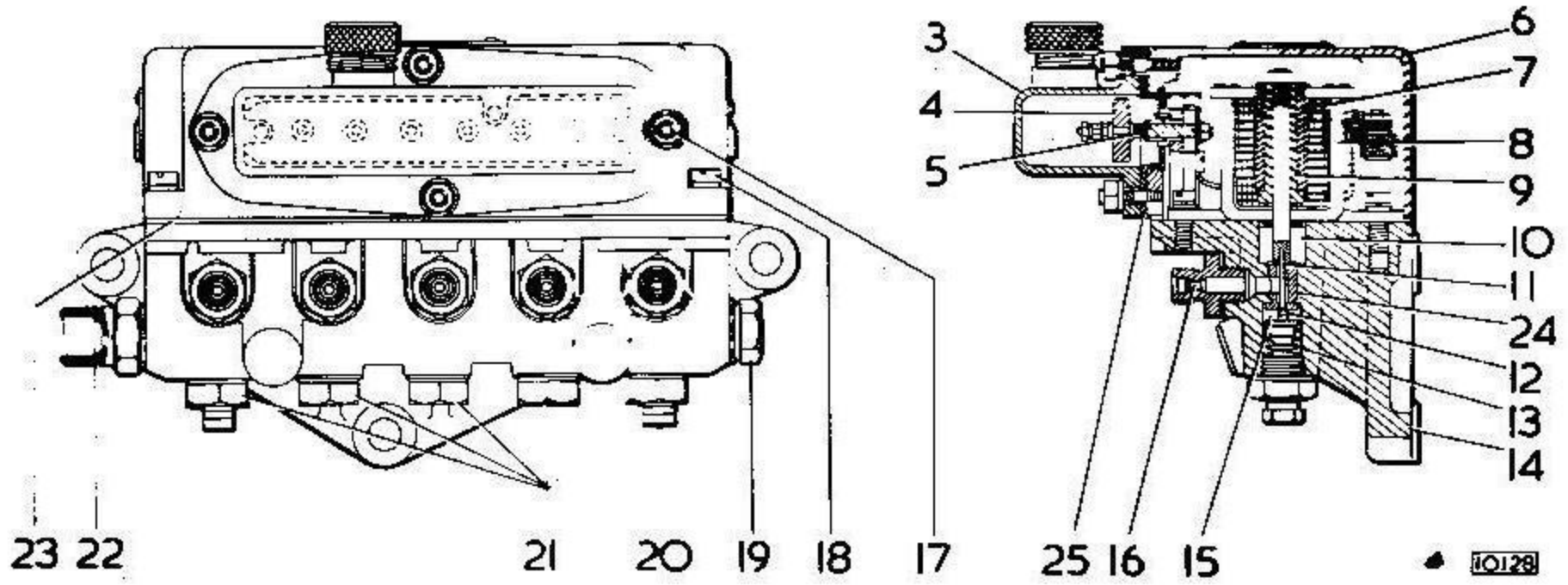


Fig. 32 The electro-pneumatic valve block

1 Locknut
2 Grubscrew
3 Plug body
4 Connector plug
5 Spring contact bank
6 Main cover
7 Solenoid
8 Solenoid case
9 Plunger
10 Valve chamber
11 Valve rod
12 Valve stem
13 Valve spring
14 Valve block
15 Spring seat
16 Air pipe unit
17 Plug body nut
18 Main cover screws
19 Plug
20 Drain plug
21 Valve spring plug
22 Union
23 Gasket
24 Valve block
25 Rubber gasket

screws (5), screwing them down lightly.
Hold the armature firmly down on the relay core, ensuring that the zero core gap is obtained over the full width of the core. Tighten the armature fixing screws.
Check the pull-in value of the relay in the following manner.
A moving coil ammeter reading 0A-2A and a 35 ohm 2A variable resistance are required to check the setting.
Connect a switched 24 volt D.C. supply with ammeter and resistances between the frame of the contact assembly and the positive terminal (See Fig. 27(C)).
Set the resistance at maximum, switch on the supply and gradually reduce the resistance until the relay operates. The current value at the instant before the relay operates is the pull-in value. This pull-in value should be 1.20A–1.25A.

Increase the back spring angle if the relay operates at a lower value than 1.20A.
Decrease the back spring angle if the relay operates at a higher value than 1.25A.

THE ELECTRO-PNEUMATIC VALVE BLOCK

The drain plug (20) Fig. 32 must be removed at 8,000 Miles (12,000 km) intervals in order to drain off any water which may have accumulated in the high pressure gallery. The length of these intervals varies with climatic conditions and the moisture content of the air. No lubrication is required in the valve unit and because of the risk of dirt penetrating to the solenoids and valve assemblies, it is recommended that no adjustments be carried out while the unit is on the vehicle.

Removal
Disconnect the air pressure pipes after exhausting all air pressure from the system. Identify the air pipes when removing for reference when refitting.
Disconnect the air feed flexible pipe from the valve block junction.
Remove the electrical connections from the unit by removing the four screws retaining the contact plate to the unit body and withdrawing the contact plate complete with cables.
Remove the unit from the support bracket after removing the two bolts and nuts.

Refitting
The refitting of the Electro-pneumatic Valve Block is the reverse of the removal procedure. Care must be taken when refitting the air pressure pipes to the valve block to ensure that the unions are perfectly clean.
Any dirt present may enter the gearbox when under pressure and cause damage to the restrictor valves

Dismantling (Fig. 32)
Remove the valve block as detailed under "Dismantling".
NOTE: The following operations must be carried out in a clean dust free atmosphere.
Remove the rubber gasket (25).
Unscrew the four screws (18) and detach the main cover (6) and gasket (23).
Unscrew the two nuts securing the spring contacts assembly (5) and lift the assembly clear of the retaining studs to expose the solenoid retaining screws.
Remove the solenoid retaining screws and detach the solenoids (7) one at a time. Each solenoid must be carefully lifted vertically clear of the valve blocks (14) to avoid damaging the valve rod (11) and the valve stem (12).
Lift out the valve rod (11) and inspect the valve seat.
Remove the valve plug (21) and valve spring (13) and withdraw the valve stem (12).
NOTE: After prolonged use the valve parts bed together. If old components are used again, they must be fitted in their original positions.

Servicing
Inspect the spring loaded contacts for damage and clean the contact faces with a brush moistened in petrol or white spirit. If the contacts are blackened or pitted, clean them with fine carborundum paper and afterwards wipe the contacts clean with a rag moistened in petrol or white spirit.
Inspect the valve seats on both sides of the monel block. If the seats are worn or scored a replacement casting complete with valve seats must be fitted. Any valve that is worn or scored must be discarded and new replacements fitted.

Assembling
Insert the valve (12) in position on the block (24). Secure in place with the spring (13) and plug (21). Repeat until all five valves are fitted.
Place each valve rod (11) in position.
Carefully fit each solenoid (7) and plunger (9) over each valve rod (11) and lightly screw in the securing screws.
Supply the block with air compressed to 60 lb per sq.in. (4.2 kg/cm^2), and locate each solenoid individually. The solenoid is located in the correct position and the valves accurately aligned when the air ceases to leak past the valve. Tighten the solenoid securing screws when the solenoid is correctly positioned.
Each valve assembly must be adjusted individually to obtain the correct amount of valve travel. This is carried out in the following manner.
With the solenoid de-energised, slacken the locknut (1) and screw in the grub screw (2) until the valve (12) is leaking slightly (that is the valve is just opening). Gradually unscrew the grub screw until the valve stops leaking. Unscrew a further 1/3 of a turn to provide the working clearance of 0.010" (.254 mm) and tighten the locknut.
Operate the valve manually by pressing down and releasing the grub screw. Repeat this operation a number of times to check the air flow and then re-check the setting.
Re-adjust if necessary, tighten the locknut and secure it in position by dabbing a small quantity of Shellac Varnish on the threads of the top of the grub screw.
Disconnect the air supply.
Secure the spring contact bank (5) in position over the retaining studs by means of the two retaining nuts.
Replace the gasket (23) and the main cover (6) and secure firmly in position with the four screws (18) and place the rubber gasket (25) in position and refit the unit to the vehicle as detailed above.

GEAR CHANGE CONTROL VALVE (Floor Mounted)

DESCRIPTION

Vehicles may be equipped with a floor mounted gear change control valve as optional equipment to operators requirements.

The valve unit replaces the standard steering column mounted gear selector switch and also the E.P. valve unit attached to the gearbox.

Air line tubing conveys the air pressure to the gearbox valves.

The gear lever is supported on a trunnion block and operates through a gate.

Four forward gears and a reverse are provided for in the gate, reverse gear can only be engaged after lifting a spring loaded collar on the lever.

A neutral lock is provided on the lever and should always be engaged when the vehicle is stationary, whether or not the engine is running. This position is obtained by lifting the control knob and turning it through 90° so that the gear cannot be accidently engaged.

A sixth position may also be incorporated in the control unit to give door operation and is available as optional equipment to operators requirements.

OPERATION

When the gear lever assembly is moved in the gate (1) Fig. 34, between the second and third gears, the lever rotates the pivot block (18) about the pin (16), the roller (21) then rides over the cam face of the central rocker (23) and depresses the appropriate piston (28).

As the piston is pushed downwards, its lower face abuts on the common inlet and exhaust valve disc (31) thus sealing off the exhaust passage through the centre of the piston, further downward movement forces the disc off the inlet seat (A) Fig.33. The air supply, which is connected to the underside of all the valves via the gallery (B), can pass to the appropriate delivery port (C) which is in turn connected via the pedestal block to the pipe feeding the appropriate control cylinder in the gearbox.

When the gear lever is returned to the neutral position, the spring (30) Fig. 34 will push the piston upwards until it is balanced by the spring under the opposite piston at the same time, the lower spring (32) will force the valve disc on to its seat, thus the air supply is cut off and the pressure in the operating cylinder can pass from the passage (C) to the central in the piston.from the passage (C) Fig. 33 to the central port in the piston and thence by the holes in the piston stem and port (D) to the control cavity in the lower valve body, which is connected to the exhaust.

If the control lever is moved across the gate in the neutral position, the lever rotates about the pin (19) Fig. 34 and the roller (21) will be moved from one rocker to the other, so that any other gear can be selected. when the sequence explained previously will be repeated.

The cam profiles of the rockers are designed with indents to enable the neutral position to be felt when moving across the gate.

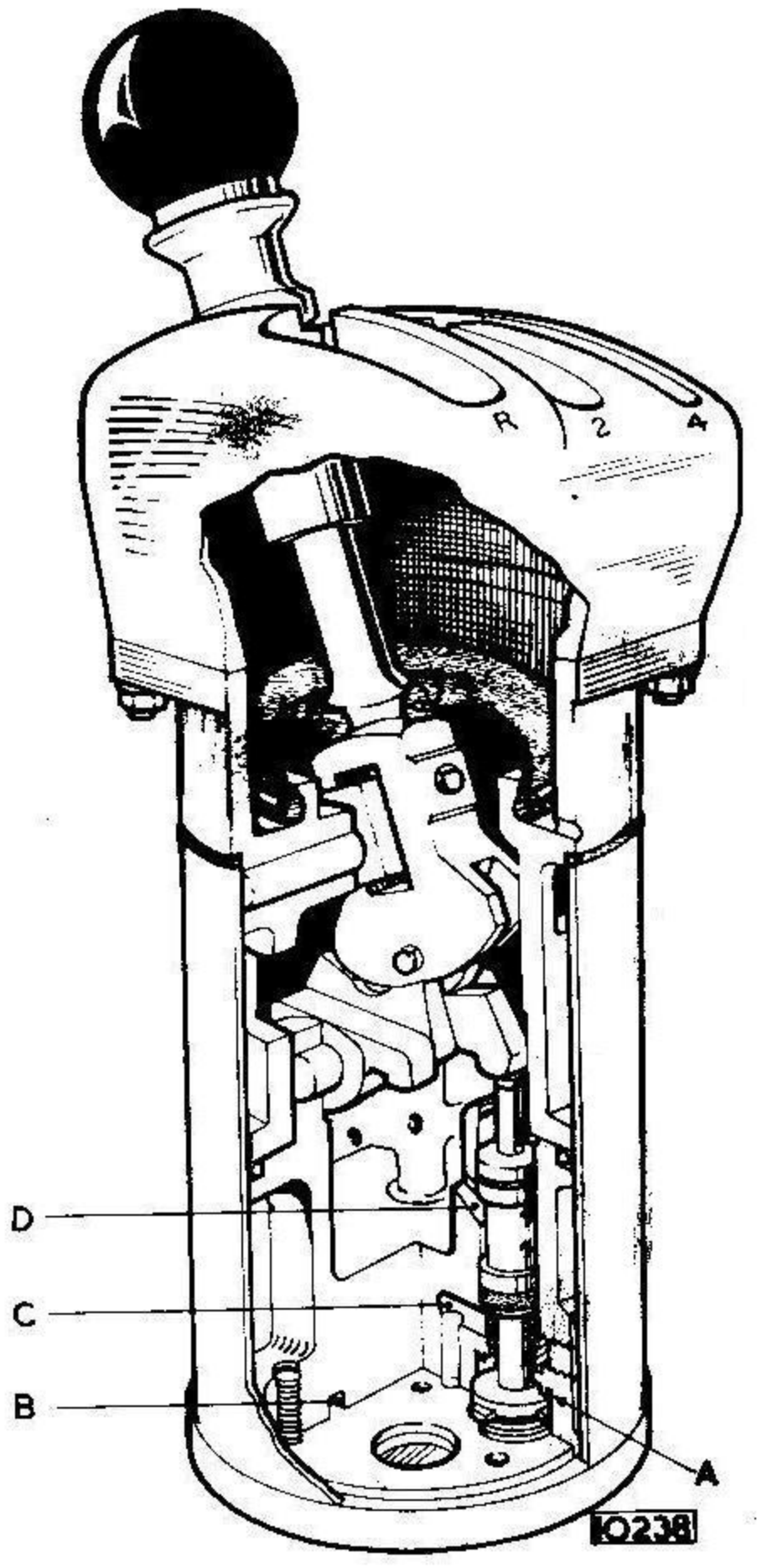


Fig. 33 The floor mounted gear change control unit

GEARBOX AND TRANSFER BOX

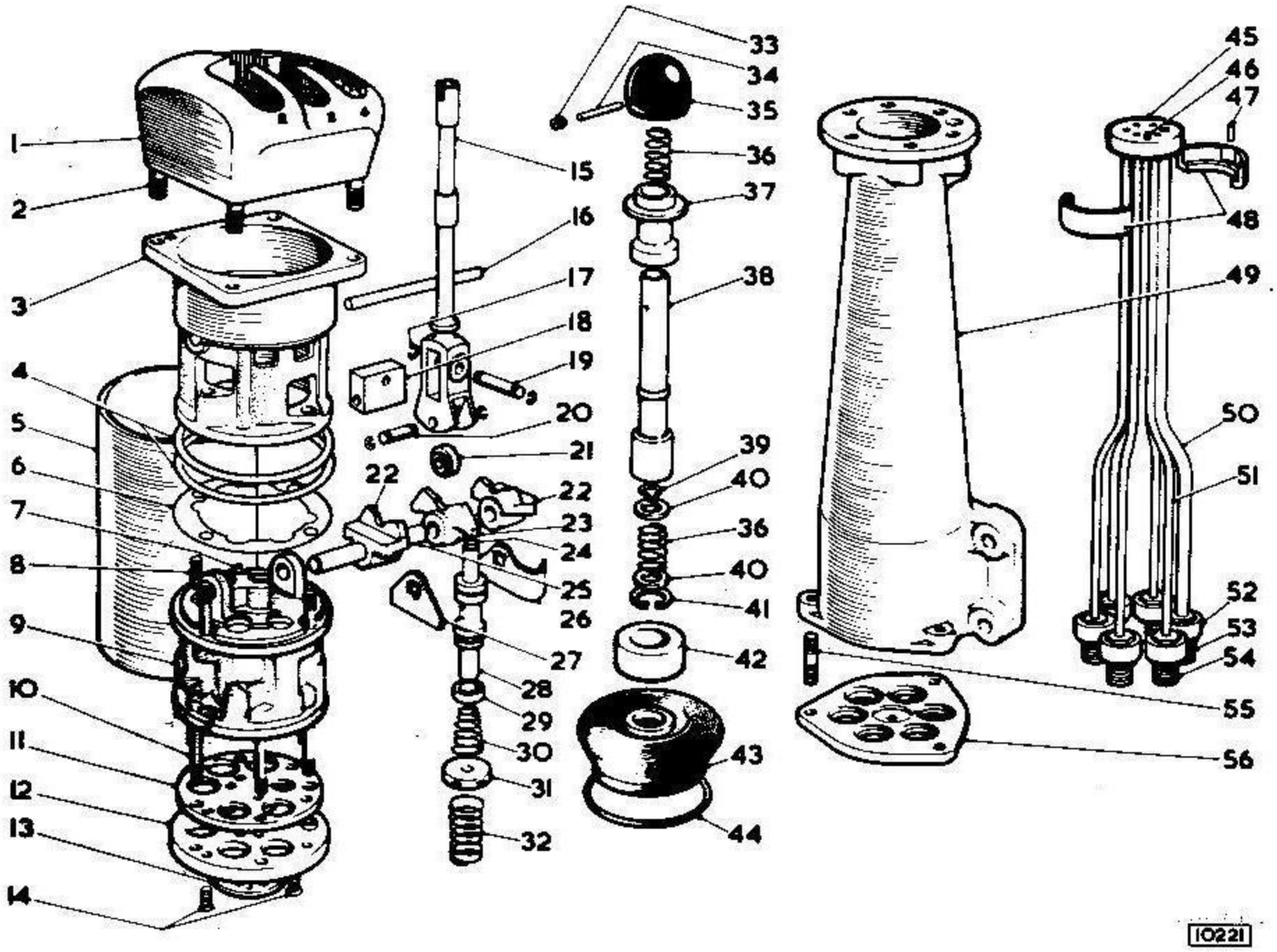


Fig. 34 Exploded view of the gear change control unit

LUBRICATION

No lubrication is required except at unit overhaul periods.

MAINTENANCE

The valve should not normally require attention except at complete vehicle overhaul periods, when the valve should be completely dismantled and examined. It is, however recommended that the following periodic checks be made.

Operational Tests

1. With no air in the system, move the lever to all gear positions and check that the effort required in each case is approximately the same and that when crossing the gate the effect of the roller entering the cam is apparent, thus providing a check to further movement, if the lever is unduly free in any position a collapsed spring (30) Fig. 34 is indicated. If difficulty is experienced in moving the lever into a gear position this may indicate a faulty piston (28) or packing (29).
2. With air pressure in the system check with soap suds for leakage at the exhaust port, moving the lever to all positions, but allowing time for the air to exhaust from the cylinder previously engaged.
   Leakage in the neutral position indicates a faulty inlet valve or seat, if this stops when a particular gear is engaged the valve disc or seat concerned should be suspected.
   If the leak only occurs when a gear is engaged this

indicates a faulty valve or disc or exhaust seat on the piston concerned.

If the leak persists in all positions more than one valve or seat should be inspected.

In any of the previously mentioned tests if a leak is suspected or found, the complete valve should be dismantled and examined.

NOTE: When the lever is moved across the gate in the neutral position, the rocker engaged will be on the opposite side of the valve to the side on which the control knob is placed, similarly when the lever is moved into the gear position, the piston which is depressed will be on the opposite side of the valve to the position of the control knob.

To Dismantle the Valve

1. Ensure that there is no air pressure in the system, and remove the six nuts holding the valve to the pedestal. The valve can now be removed from the vehicle for overhaul.
2. Remove two countersunk-head screws (14) from the base of the valve and carefully remove the base plate (12) and gasket (13) as the inlet valve springs (32) and the disc valves (31) are now free to fall out. Remove the outer casing (5).
3. Remove the four nuts holding the lower body (9) to the upper body (3).
4. To remove the components from the lower body, place one hand across the rockers and push out the pin (25), the rockers (22 and 23) and the spacing washers (26) can then be removed.
5. Remove the pistons (28) and return springs (30).
6. To remove the components from the upper portion of the valve, remove the grub screw (33) from the control knob (35), remove the pin (34) using the small hole provided on the opposite side of the knob, and remove the knob (35), spring (36) and reverse catch (37).
7. Remove the four nuts holding the gate (1) to the upper body (3), remove the gate, remove the circlip (41) and withdraw the sleeve (38). Remove the circlip (39) and take off the two washers (40) and spring (36).
8. Remove the pin (16) from the upper body and remove the control lever (15) downwards through the upper body, it is not necessary to remove the dust cover (43) unless this has deteriorated, similarly the pivot block (18) and roller (21) need not be removed unless wear is evident.

   All parts should be cleaned, examined for wear and replaced as necessary.

Examine the valve seats on the pistons and in the lower body for pitting. If necessary these can be lightly refaced with a suitable cutter, the valve discs (31) should also be examined and renewed if wear is evident.

The pistons and bores should be free from scoring, and it is advisable to fit new piston packings (29).

When rebuilding the valve, lightly smear the pistons and bores with Paragon Artic Grease. The rockers, rollers and pivot block mechanism should be liberally smeared with similar grease.

Ensure that the various sections of the valve are correctly re-assembled with the dowels engaged in the holes provided.

Before replacing the base plate and the outer casing, check that with the control lever in the neutral position, there is between .0012/.0075" (.0635/.1905 mm) clearance between the roller and rockers. This clearance can be adjusted by adding or decreasing the number of shims (6) required between the upper and lower bodies.

When replacing the base plate fit a new gasket (11), and when refitting the valve to the pedestal fit a new gasket (13). Ensure that these gaskets are correctly located and that there is a clear passage through the ports.

Refit the valve and test as given under Operation Tests.

SPECIAL SERVICE TOOLS

Special service tools are available for use with the DAIMLER "FLEETLINE" C.R.G. 6LX. chassis from:-

Messrs. V.L. Churchill and Company Ltd.
P.O. Box No. 3.
London Road
Daventry
Northants
England.

The use of these tools is strongly recommended when overhauling the Gearbox Transfer Box unit and their application will be found to be invaluable to all Operators when servicing these components.

Tool No:	Application	Page Ref.	Remarks
D.706	Transfer box assembly jig.	H.18	See Fig. 15.
D.707-3	Transfer box output sleeve roller bearing removal adaptors		
D.707	Bearing cone remover (Main Tool).		For use with tools No. D707-1-2-3
D707-1	Transfer box Bevel pinion shaft L.H bearing removal adaptors.		
D707-2	Transfer box bevel pinion R/H bearing removal adaptors.		

INSTRUCTIONS FOR USING TOOL D 706 (TRANSFER BOX)

Checking the depth between the bevel face and the inner bearing (page H.19) Fig. 18.

component parts required Pad D 706/3
Anvil D 706/1
Micrometer with short rod
Setting block.

Insert the micrometer in the Pad D 706/3, set to zero using the setting block supplied and tighten the locking screw. This will give a rod protrusion of exactly 1" (25.39 mm).

Assemble the gear train on the anvil D 706/1 and attach the pad. Adjust the micrometer to the bevel pinion and read off the dimension obtained.

Add the 1" (25.39 mm) given by the setting block to obtain the total depth of the bevel and the race.

Continue as directed on Page H25.

INSTRUCTION FOR USING TOOLS NO's D 707-1-2-3

These tools are used in conjunction with Tool D707.

Place the two halves of the split extractor over the bearing to be removed.

Insert the bearing cone remover D707 with the appropriate thrust button.

Fit the locking ring and turn the screw to remove the bearing.

CARDAN SHAFT

SECTION I

INDEX

CARDAN SHAFT

SPECIFICATION AND DATA

Type	Open
Length	38.5" (97.8 cm)
Diameter of tube	3.5" (89 mm)
Compression	1.75" (44.5 mm)
Angular movement of universal bearings	20° – 22°
Front universal bearing No. Hardy Spicer B.R.D.	KR 1608 – GB2 07/500112
Rear universal bearing No. Hardy Spicer B.R.D.	KR 1601 – 1 07/500112

GENERAL DESCRIPTION

The cardan shaft is of the open type with needle roller universal joints and having a sliding joint fitted to the gearbox end.

ROUTINE MAINTENANCE

EVERY 2,500 MILES(94,000 KM)

Universal Joint – Lubrication

Lubricate the needle roller bearings with the recommended grade of lubricant by applying a grease gun and injecting the lubricant until it exudes from the relief valve in the centre of the spider journal.

Lubricate the sliding spline in a similar manner with the recommended lubricant.

Access to the cardan shaft is gained from beneath the vehicle and it may be necessary to move the vehicle forward in order to gain access to each nipple.

EVERY 10,000 MILES (16,000 KM)

Cardan Shaft (Checking flange bolts)

Check all cardan shaft flange securing nuts and bolts. Tighten if necessary.

THE UNIVERSAL JOINTS

Examine and Check for Wear

The parts most likely to show signs of wear after long usage, are the bearing races and spider journals. Should any undue looseness in these parts be observed they should be renewed as a complete unit. Other parts likely to show signs of wear are the sliding splines. A total of .004" (.1 mm) circumferential movement should not be exceeded. If wear has taken place above this limit, the complete cardan shaft should be replaced.

To Remove

Remove eight bolts and spring washers and detach the shield from the rear axle end of the cardan shaft.

Remove the eight self-locking nuts and bolts from the front and rear coupling flanges. Accessibility is gained from underneath the vehicle, and it will be necessary to jack up one rear wheel clear of the ground in order to enable the cardan shaft to be turned. Place blocks on either side of the other road wheel. Withdraw cardan shaft from beneath.

Refitting

Refitting is the reverse of the removal procedure.

To Dismantle

To remove the sliding joint from the splined shaft, unscrew the dust cap and pull back the cork washer. Detach the bearing cap plates from the sleeve and coupling flange yokes by lifting the locking tabs and extracting the two setscrews securing each plate.

Hold the joint and tap the yoke lug with a soft nosed mallet. The top bearing will gradually emerge when it can be removed with the fingers. Repeat this operation for the opposite bearing. The splined sleeve yoke or flange yoke can now be removed.

Rest the two exposed trunnions or lead blocks, and tap yoke with a soft nosed mallet to remove the remaining bearing races. Wash all parts in petrol, renew the seals if damaged.

To Assemble

The assembling of the cardan shaft is the reverse of the removal procedure, but particular attention must be given that the keyway in each bearing assembly is fitted in line with the cover plate setscrew holes. This will ensure that the bearing cover plate will locate in the keyway and prevent the needle bearing assembly from turning.

CARDAN SHAFT

When replacing the sliding joint, it must be fitted with the fixed yoke in line with the fixed yoke at the end of the cardan shaft tube. Arrows are stamped on the splined sleeve and tubular shaft to facilitate alignment.

Should any difficulty be encountered when assembling the needle rollers in the housing, smear the wall of the race with vaseline. It is advisable to fit new gaskets on the spider assembly when renewing bearing races.

REAR AXLE AND HUB ASSEMBLIES

SECTION J

INDEX

REAR AXLE AND HUB ASSEMBLIES

SPECIFICATION AND DATA

Type	Fully floating, hypoid, two stage drop down reduction axle. First stage spiral pinion and second stage spur gears.
Axle Ratio	5.3 : 1
Overall ratio with gearbox and right angle drive	5.68 (top gear)
Alternatives	5.12
	4.61
Oil capacity	22 pints (12.5 Litres)
Roadwheel end float	0.008" – 0.010" (0.203 – 0.254 mm).

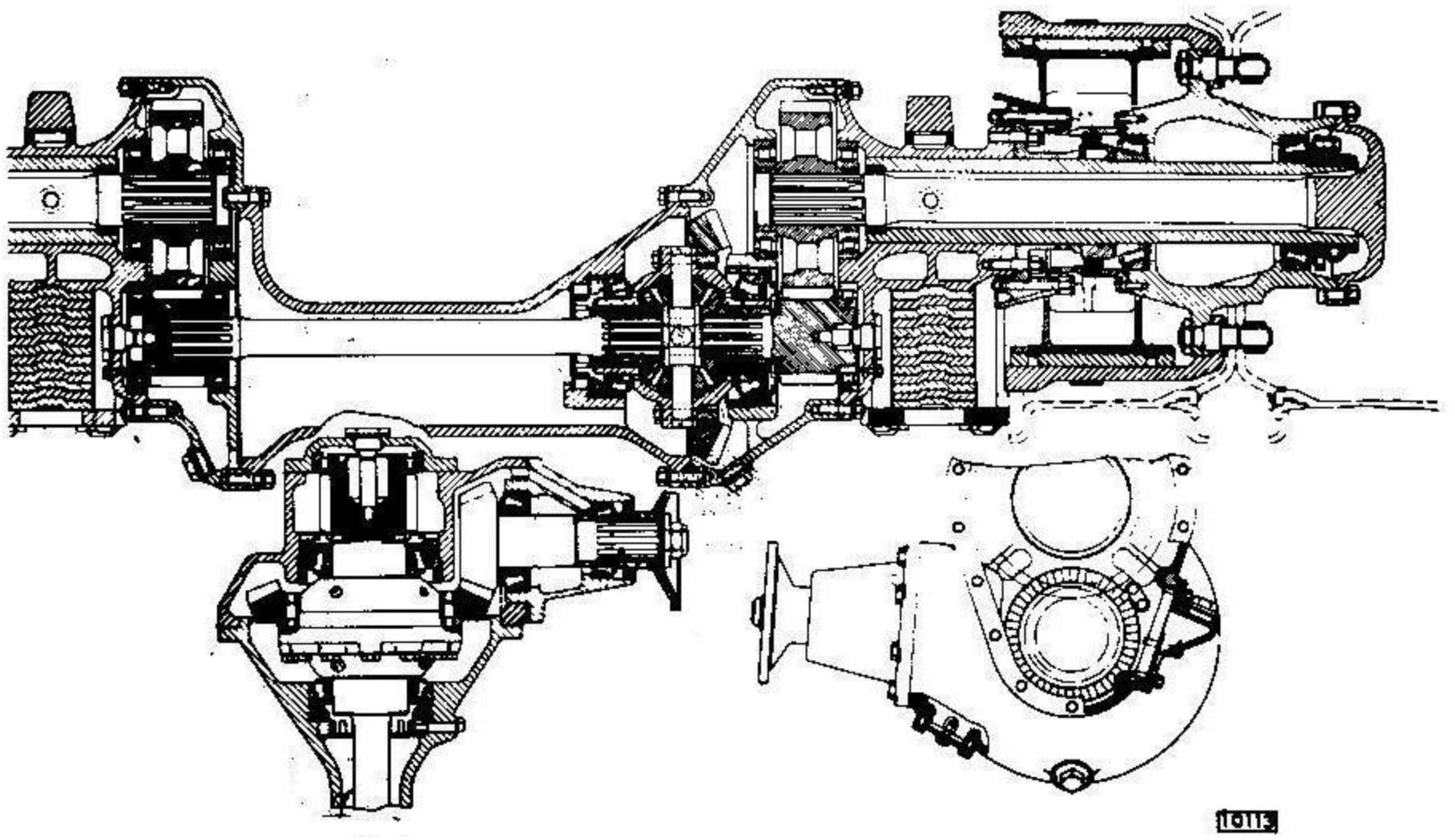


Fig. 1 Sectioned view of the rear axle centre section

GENERAL DESCRIPTION

The fully floating two stage, drop down reduction axle is constructed from steel castings which also incorporate the road spring seatins and attachment points for the rear brake carriers.

The axle tubes are pressed into the outer reduction gear housings with a forced fit and located with screwed dowels.

Mounted on these tubes are the hubs which are supported on opposed taper roller bearings. Provision is made for a vernier adjustment of the road-wheel hub end float. Renewable seals prevent the hub lubricant contaminating the brake shoe assemblies.

The first stage of the axle unit is by spiral bevel pinion and wheel housed in a casing on the right hand side of the axle and drives through a large four planet pinion differential unit. Both bevel pinion and wheel are mounted on opposed taper roller bearings with the bevel

pinion carried in the nose end of the right hand casting. The planet gears of the differential unit have pressed steel backed bronze precision bearings and rotate on a hardened "star" member with spherical bronze washers controlling the thrust. The second stage is by straight cut spur gears, the pinion of which being connected to the differential unit; the right hand pinion having an integral shaft, while the left hand pinion is connected to the differential unit by a splined shaft passing through the axle tube centre. The end float of the two pinion shafts is controlled by screwed buttons fitted into the outside faces of the two reduction gear cases. The road wheel driving flanges and half shafts are an integral unit with splines at the inner ends to engage the splines within the large spur gears of the second stage reductions, and all spur gears are mounted on roller bearing races. Oil sealing is by lip type seals which are fitted on the bevel pinion in the nose end of the right hand gear casing and also on the inboard ends of the road-wheel driving shaft.

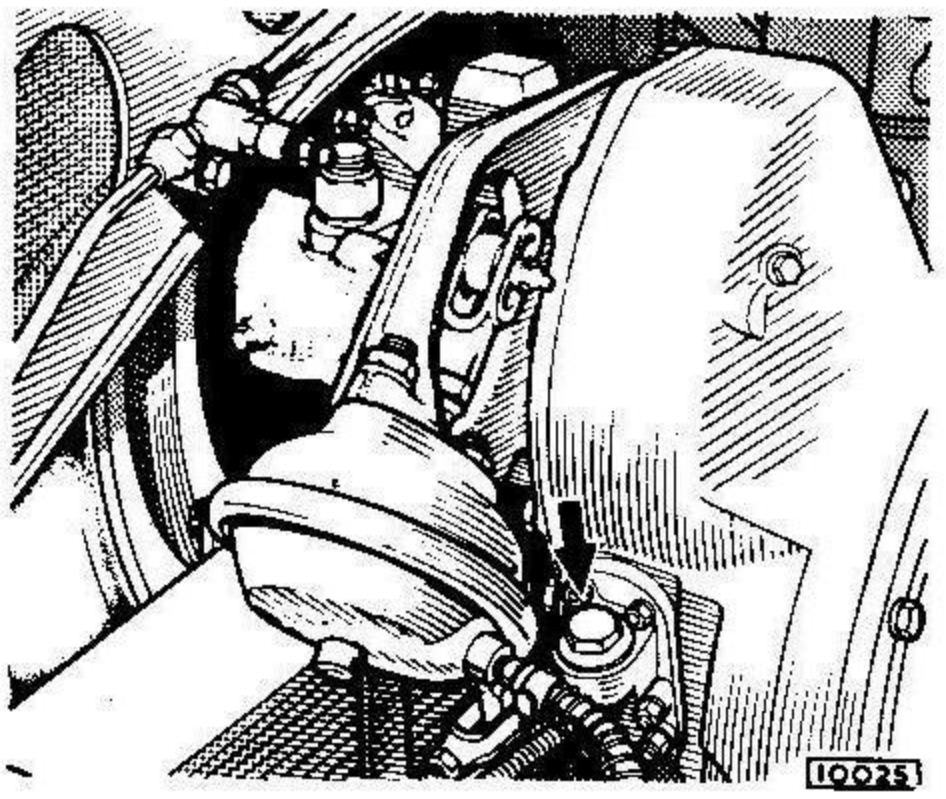


Fig. 2 The rear axle oil filler

ROUTINE MAINTENANCE

FIRST 1,000 MILES (1,600 KM)

Changing the Oil
The draining of the rear axle should be carried out at the end of a run when the oil is hot and therefore will flow more freely. The drain plugs are situated in the bottom of the two axle reduction gear casings.
After all the oil has drained away, replace the plugs and refill with the recommended grade of lubricant through the combined filler and level plug hole situated in the front face of the right hand reduction gear casing. Fill slowly allowing time for the lubricant to transfer to the left hand reduction casing. The correct level is to the bottom of the filler plug hole.
Clean off any road dirt from around the plugs before removing.

FIRST 2,500 MILES (4,000 KM)

Rear Wheel Hubs
Check the end float as detailed under "Rear Wheel Hubs — Checking the End Float".

EVERY 2,500 MILES (4,000 KM)

Check the Oil Level
Check the level of the oil in the rear axle with the vehicle standing on level ground. The combined level-filler plug is situated on the front face of the right hand gear casing. Clean off any road dirt from around the plug before removing.
Fill slowly with the recommended grade of lubricant allowing time for the lubricant to transfer to the left hand reduction gear casing. The correct level is to the bottom of the filler plug hole.

EVERY 10,000 MILES (16,000 KM)

Checking the Axle Mountings
Check the axle mountings for tightness and tighten as necessary.

EVERY 40,000 MILES (64,000 KM)

Rear Hubs
Repack the rear hubs as detailed under "Rear Wheel Hubs — Repacking".

Rear Axle
Drain and refill axle unit as detailed under "First 1,000 miles (1,600 km) Service".

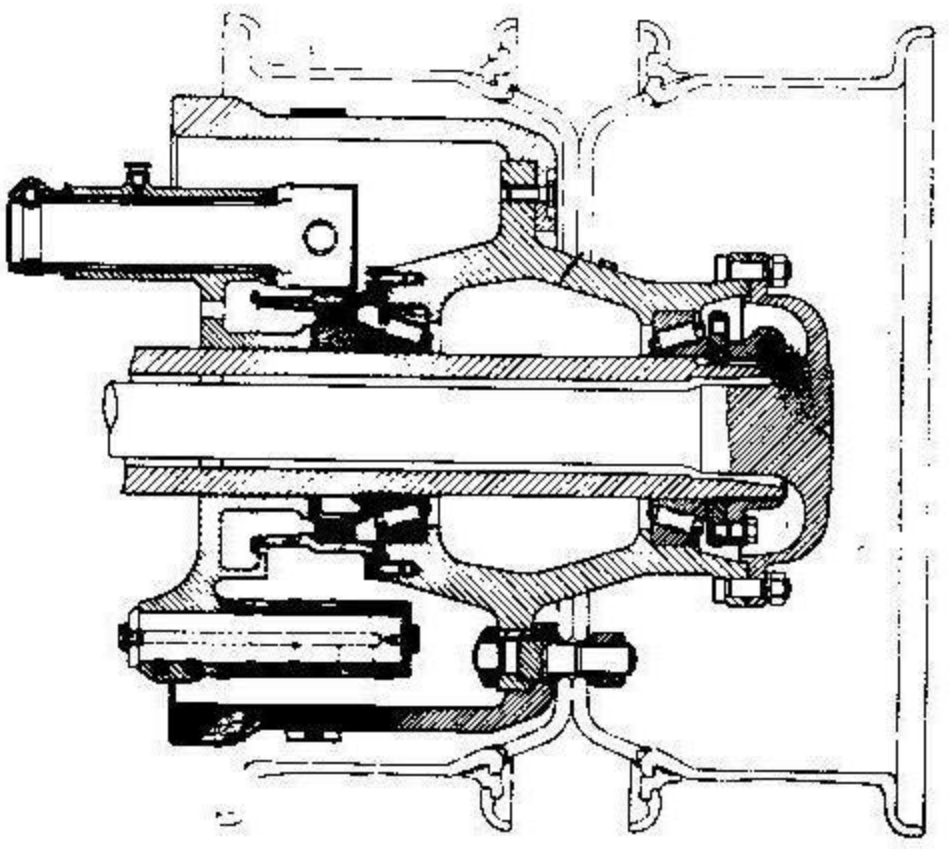


Fig. 3 Sectioned view of the rear hub arrangement

THE REAR WHEEL HUBS

Checking the End Float

Securely chock the front wheels, release the handbrake, jack up the rear of the vehicle and remove one set of road wheels.

Clean the dirt from the hub and axle half shaft and remove the latter by removing the eight bolts and utilizing the three jack tappings provided. Erect a Dial Test Indicator so that the plunger contacts the hub or brake drum in a horizontal position.

Utilizing a suitable lever move the hub and brake drum to the full limit of its travel towards the indicator and set the indicator dial to zero. Lever the hub in the opposite direction when the reading on the dial will indicate the total end float. The permissible end float is 0.008"–0.010" (0.203–0.254 mm). To adjust the end float if required, remove the hub nut pinch bolt and nut. Remove the hub nut locking screw.

Rotate the nut by means of a tommy bar placed in the pinch bolt hole clockwise to decrease the end float and anti-clockwise to increase. Movement of the original setscrew hole to the next tapping in the lock plate gives .006" (0.152 mm) end ways movement of the hub nut while movement of the alternate setscrew hole to the original tapping gives .003" (0.076 mm) end ways travel. Refit the pinch bolt and setscrew when the correct clearance is obtained. Recheck clearance after tightening pinch bolt. Refit all components by reversal of the removal procedure.

Repeat the operation to the opposite hub.

Repacking

Securely chock the front wheels and release the handbrake. Jack up the rear of the vehicle and remove one set of road wheels. The hub nut is similar to that shown in Fig. 3. Section M.

Withdraw the axle shaft by removing the eight bolts from the hub and utilizing the three jack tappings provided. Slacken off the brake shoes as described in Section K "The Braking System". Remove the brake drum squarely after removing the nine sunken headed setscrews and utilizing the jack tappings provided.

Remove the locknut followed by the locking plate from the end of the axle casing by withdrawing the hub nut pinch bolt and locking setscrew and utilizing a tommy bar inserted through the pinch bolt hole, turn the nut anti-clockwise.

Withdraw the hub shell complete with bearing and seals and clean any grease from within the grease catcher.

Clean the used grease from within the hub shell taking care not to damage the oil seals and repack with fresh grease of the recommended grade. Liberally coat the bearings and add a small amount to the hubs only.

Refit the hub shell with the cone assembly of the inner bearing to the axle casing followed by the outer bearing, the hub locking plate, hub nut and brake drum. Adjust the hub end float as detailed under "Rear Hubs—Checking the End Float".

Balance the brake shoes as described under Section K "The Braking System".

Refit the road wheels and all other components. Repeat operation to opposite side.

THE REAR AXLE

Removal

The rear axle is best removed as a unit complete with the road springs but less wheels. Jack up the vehicle and insert stands under the frame forward of the road springs.

Remove the drain plugs from the two axle reduction gear cases, and drain away all the oil.

Remove the locknut, nut, washer and top rubber mounting from the top and bottom of the shock absorbers.

Telescope the shock absorbers to disengage the stems from the mounting brackets and lift the units away from the chassis.

Disconnect the brake pull-off springs, leaving the brake spring anchorage blocks in position on the rods.

Disconnect the pull rods from the brake levers by extracting the clevis pins.

Release the axle locating bolts but do not remove.

Disconnect the cardan shaft as detailed in Section 'I' and remove the road wheels.

Place a jack under each end of the springs.

Remove the automatic lubrication pipes from the spring shackles (if fitted).

Remove the road spring shackle and eyebolt nuts and drift out the shackle pins after extracting the pinch bolts. Care must be taken not to lose the distance washers.

Lower the axle on to a wheeled flat platform or truck, remove the four jacks and withdraw the unit from the vehicle.

Pass two wire slings under the axle hubs and attach to a hoist. Remove the nuts and lock washers from the spring retaining bolts, drift out the bolts and raise the axle until the springs are clear.

Swing away and lower on to a table or trestle for further dismantling.

Refitting

Sling the axle, complete with road springs and lower to the wheeled platform or truck.

Reposition under the chassis ready for refitting.

Raise the axle by means of jacks, until the spring mountings are in line refit the steel washers between the springs and spring mountings.

Insert tapered locating bars and follow through with the shackle pins and eyebolts. Adjust the shackle pins for end float as detailed in the 10,000 miles (16,000 km) Service Section 0 "The Front and Rear Suspension".

Refit the cardan shaft and brake connections. Reconnect the automatic lubrication pipes to the pins if the system

is installed on the vehicle. Prime the oil pipes as detailed in Section B "Lubrication" before reconnecting.
Check the two drain plugs and refill with the recommended grade of lubricant to the specified level.
Refit the road wheels and lower the vehicle to the ground.

Dismantling
Remove the eight bolts and nuts from each hub cover and withdraw the right and left hand half shafts utilizing the three jack tappings provided.
Release the brakes by slackening off the brake adjusters as detailed in Section K "The Braking System". Remove the brake drums by withdrawing the retaining setscrews and utilizing the three jack tappings.
Remove the locknut followed by the locking plate from each end of the axle casing by withdrawing the hub nut pinch bolt and locking setscrew and utilizing a tommy bar inserted through the pinch bolt hole, turning the nut anti-clockwise.
Withdraw both hub shells complete with bearings, seals and grease catcher.
Remove the ten self locking nuts and washers and withdraw both brake assemblies.
Remove the right hand spur gear and the left hand intermediate shaft thrust button locking plates and setscrews. Unscrew the thrust buttons noting the shims located under the heads.
Identify the individual thrust buttons and shims to the individual outer casing for re-assembly procedure.

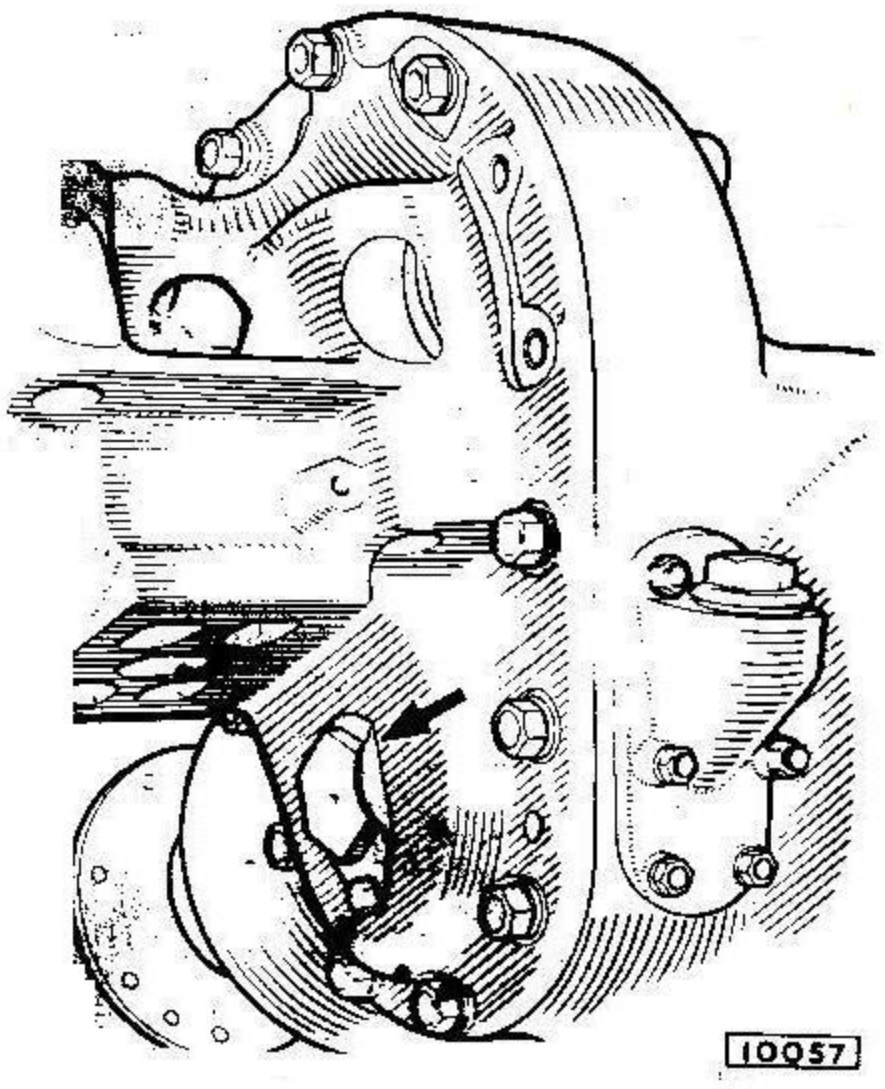


Fig. 4 The thrust button locking plates

Remove the fifteen nuts and lock washers and detatch the left and right hand outer casings. Remove the spur gears Note the left hand gear is splined to the intermediate shaft, which can now be withdrawn from the differential assembly. Remove the five setscrews and seven nuts securing the left hand spur gear case to the centre casing and detach the case.
Remove eight setscrews and withdraw the axle nose piece utilizing the three jack tappings provided. Collect the shims located between the nose piece flange and axle casings.
Stand the axle on the right hand spur gear case face, remove the five setscrews and seven nuts securing the case to the centre casing and detatch the axle centre.

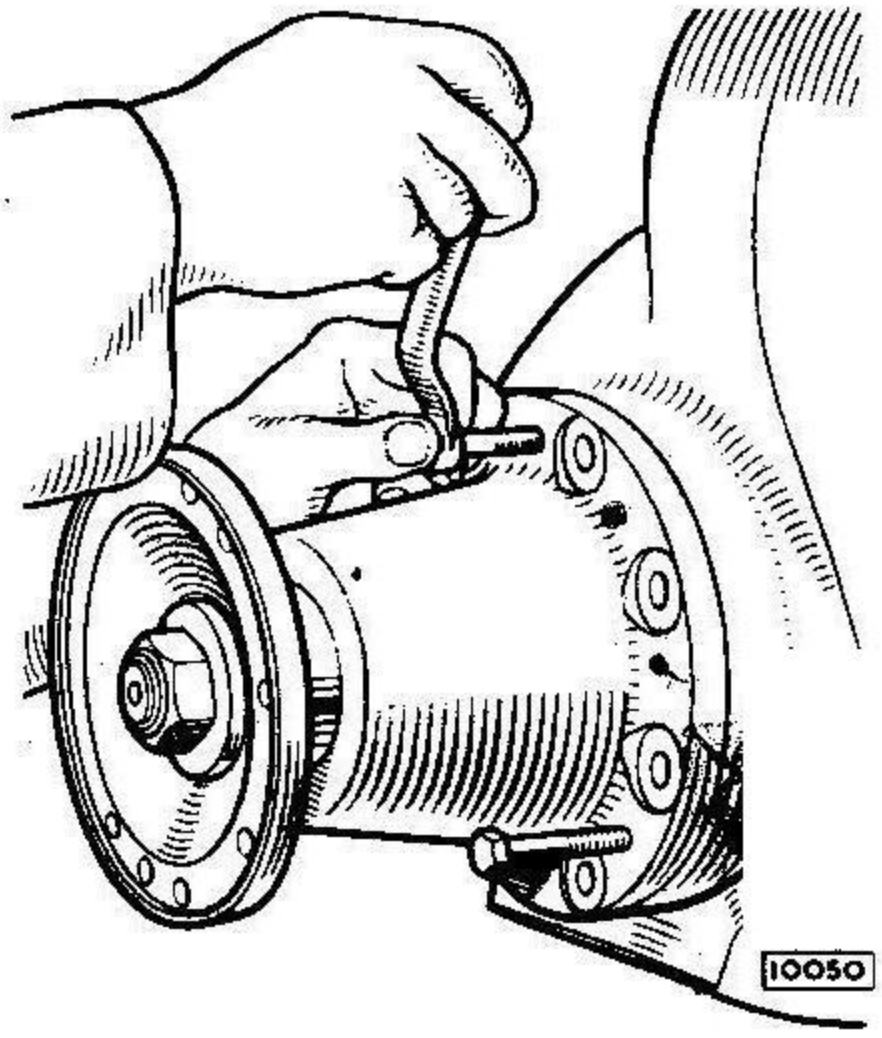


Fig. 5 Withdrawing the nose piece

Lift out the crown wheel and differential assembly.
Remove the two setscrews and copper sealing washers from the centre casing. Note one of the setscrews functions as a differential left hand bearing adjuster locking pin and may be fitted to either side varying with the position of the slots in the adjuster ring. Remove the bearing outer and the adjuster ring by rotating the ring clockwise.
Tap back the tab washer, extract the two setscrews and remove the differential right hand bearing adjuster locking plate. Remove the adjuster ring.
To dismantle the nose piece assembly remove the cardan shaft coupling nut and washer and withdraw the coupling complete with shield.
● Press out the pinion shaft complete with the inner race. Note the number of Distance pieces fitted.

Remove the oil seal if it is required to renew the outer bearing race.
To obtain access to the differential pinions tap back the tab washers and remove the twelve setscrews securing the crown wheel.
Separate the two halves of the differential case and extract the pinions bushes and thrust rings. Wash all parts in cleaning solvent and examine for wear.
Particular attention should be paid to the condition of the oil seals, renewing if worn or damaged. Check all gears and bearings.
Check the brake assemblies as detailed in Section K "Braking System" replacing with new units as necessary
NOTE: IMPORTANT The crown wheel and pinion are a matched pair. It is not permissible to renew one item only. If wear necessitates renewal of the crown wheel or pinion a matched pair must be obtained from the Daimler Co. Limited.

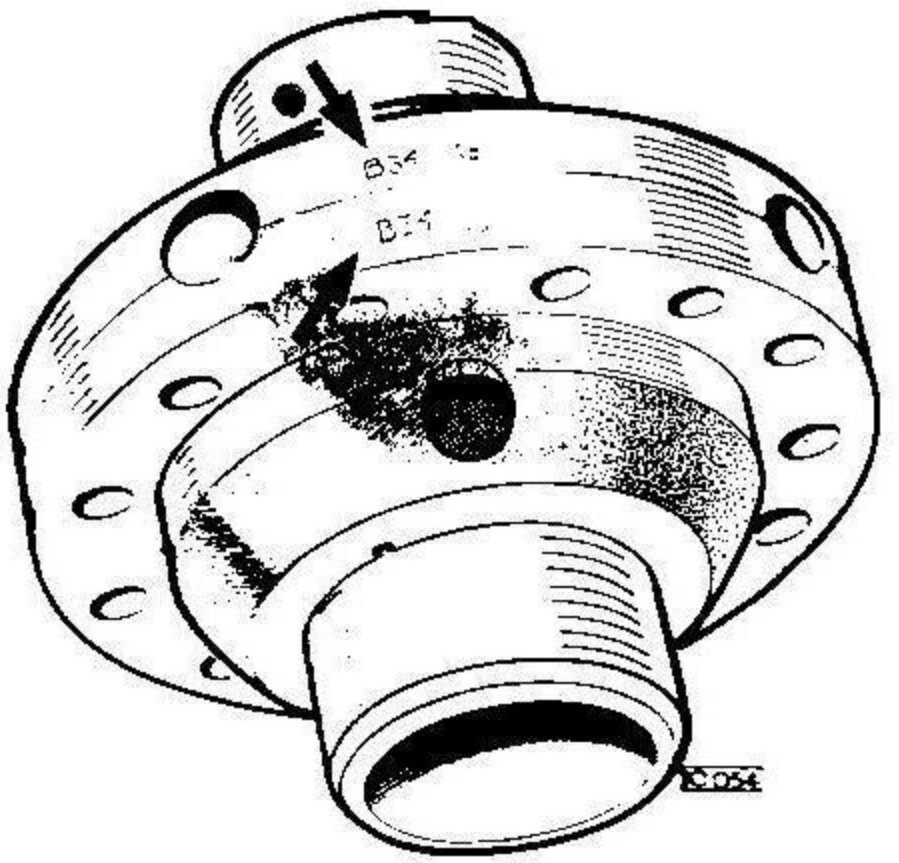


Fig. 7 Illustrating the corresponding marks on the differential case halves

Reassembly

Differential Unit

Check the condition of the bushes and thrust rings and renew if worn or damaged.
Check for wear in bevel pinions and pinion carrier.
Check the depth of the crown wheel mounting flange with a depth gauge and note for reference when re-building the rear axle assembly.

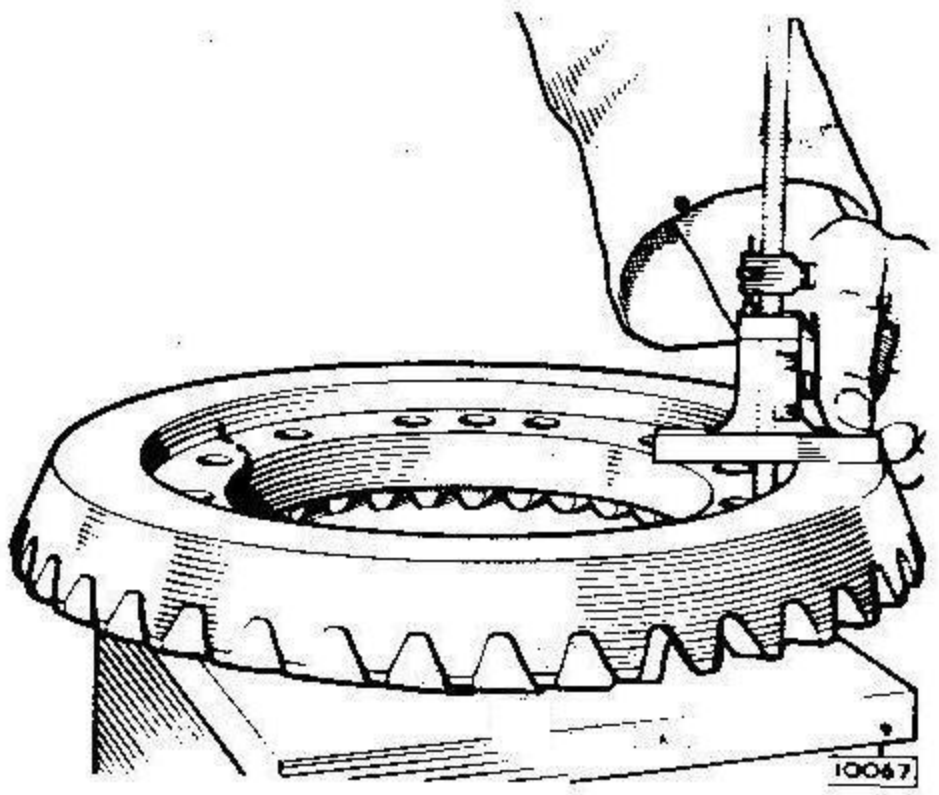


Fig. 6 Checking the depth of crown wheel mounting flange

Re-assemble the differential unit by reversing the dismantling procedure.
NOTE: The two halves of the differential case are marked and these must correspond when connecting the two halves together.

Pinion Nose Piece

Check the depth of the bevel pinion with a depth and note for reference when re-building the axle assembly

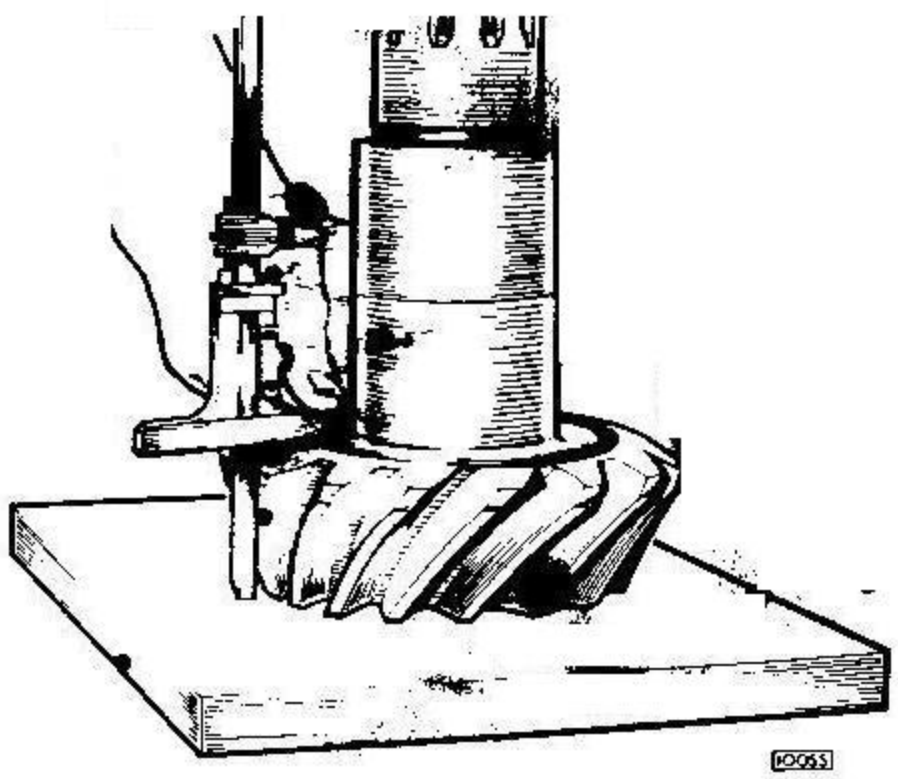


Fig. 8 Checking the depth of the bevel pinion

Re-assemble the nose piece and pininon assembly by reversing the dismantling procedure Refit the cardan shaft coupling and fully tighten the nut.
Adjust the distance piece pack until all end float removed between the two taper bearings.
Reduce the total value of the pack by selecting distance pieces to give the correct bearing nip of .002" (.050 mm).

REAR AXLE AND HUB ASSEMBLIES

Distance Pieces are available in the following sizes:-

0.50" – (12.70 mm)
0.51" – (12.90 mm)
0.52" – (13.20 mm)
0.53" – (13.46 mm)
0.30" – (7.62 mm)
0.302" – (7.67 mm)
0.304" – (7.72 mm)
0.306" – (7.77 mm)
0.308" – (7.80 mm)

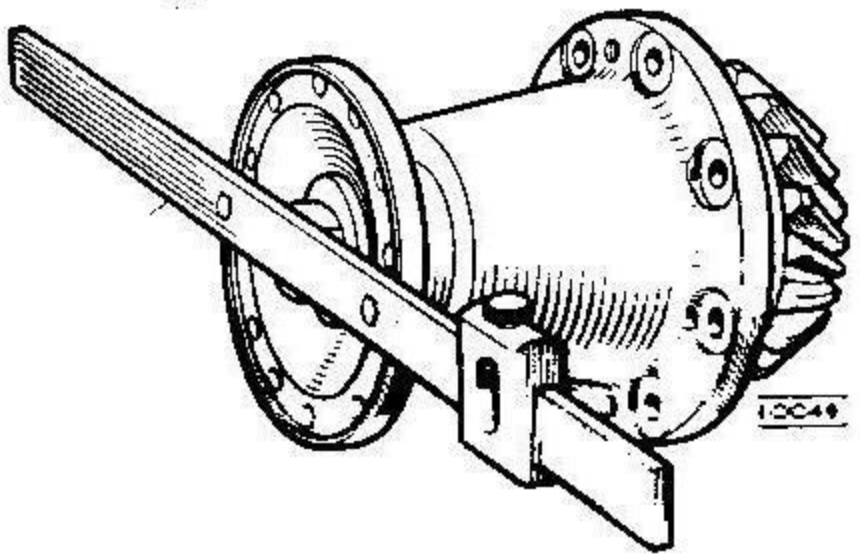


Fig. 9 Checking the nose piece bearing preload by the steel-yard method

Checking by Steelyard Method

Attach a bar measuring 12" (30.48 cm) either side of a centre line to the coupling with two bolts and nuts, the centre of the bar to coincide with the centre of the coupling.

Attach a 2 lb. (.89 kg) weight to the bar – 8.5" (21.6 cm) from the centre line.

Adjust the distance piece pack until the bar with attached weight will fall under its own load with a slight initial pressure applied to the weighted end of the bar.

The Rear Axle Unit

Note the dimension figures etched on the crown wheel and pinion. these figures denote the apex of the two gears

Machine a disc approximately .75" (19.1 mm) in depth to a diameter of 6" (152.4 mm) and drill a hole ½" (12.7 mm) diameter in the centre.

Machine a ½" (nominal) diameter bar 6" (152.4 mm) in length to fit into the hole drilled in the disc.

Insert the bar into the disc maintaining a true 90° angle.

Insert the check gauge in the differential outer bearing race housing located in the bevel gear casing. Remove the race before inserting the gauge.

(1) Measure the distance from the nose piece case mounting face to the centre of the check gauge with micrometer depth gauge.

(2) Measure the distance between the nose piece mounting face and the back face of the bevel pinion.

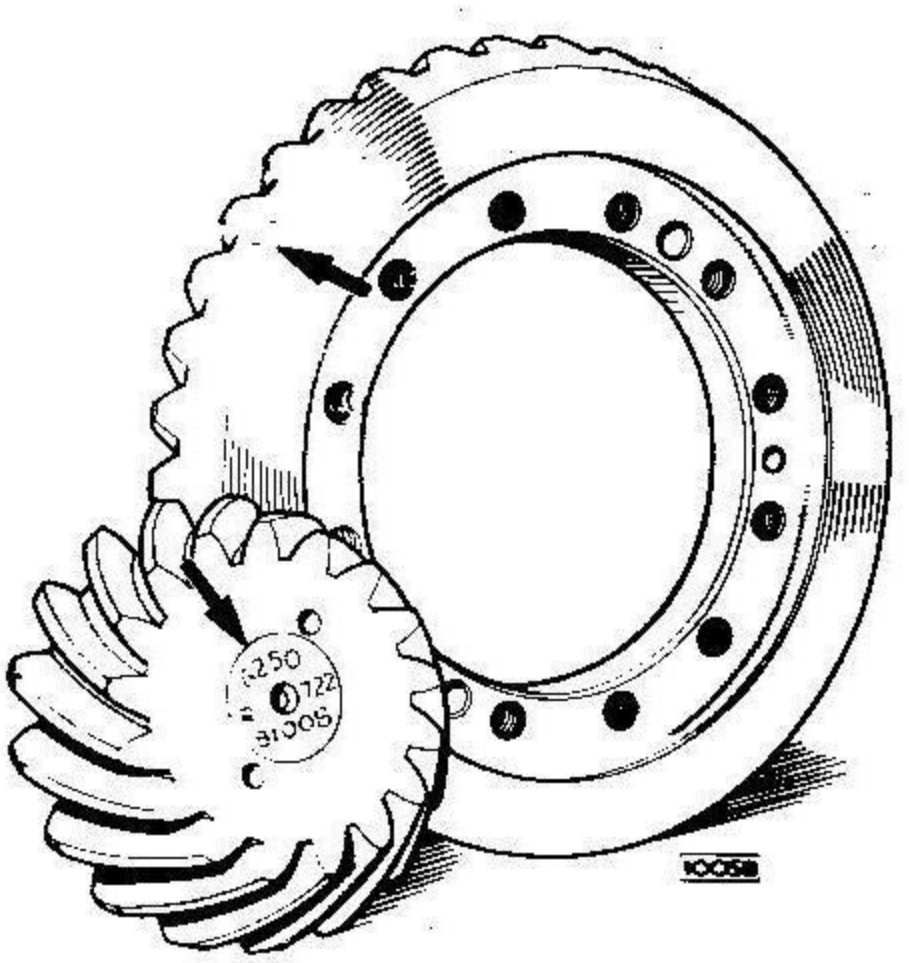


Fig. 10 Showing the dimension figure etched on crown wheel and pinion

(3) Subtract the depth of the bevel pinion, noted before re-assembling the nose piece and pinion assembly, from dimension (2).

(4) Add dimension (3) to the figure etched on the bevel pinion.

Subtract dimension (1) from (4). The result will give the thickness of shims required to be inserted between the nose piece and case mounting faces to give the correct setting of the pinion in relation to the centre of the

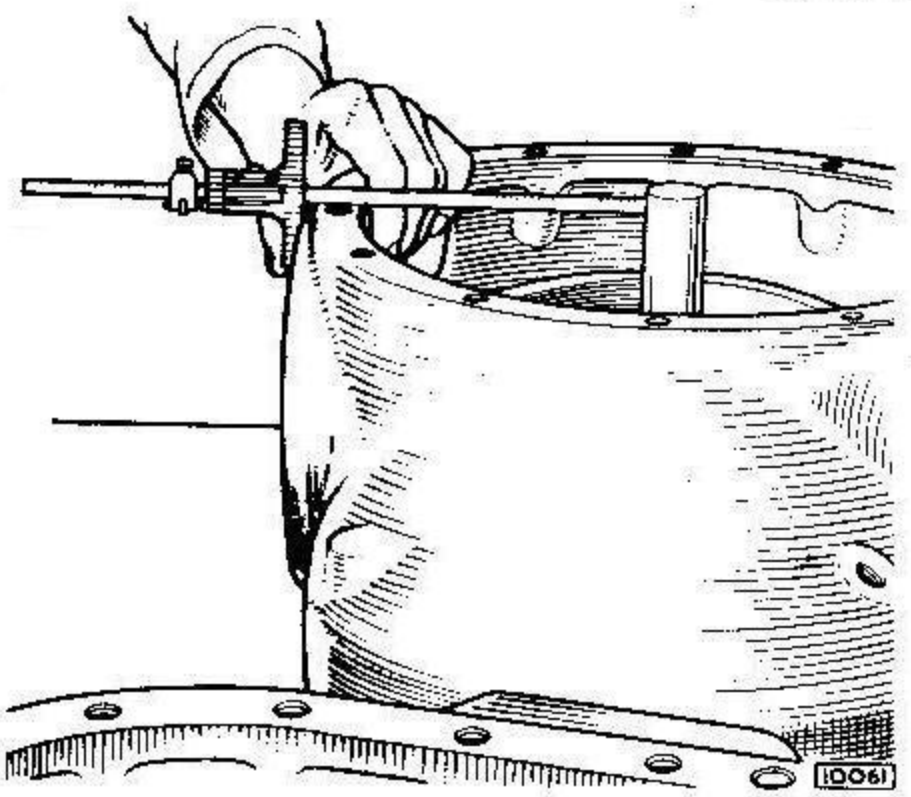


Fig. 11 Checking the dimension from the nose piece mounting face to the centre of the differential outer bearing race housing

crown wheel. Shims are available in .002" (.64 mm), .003" (.076 mm), .005" (.127 mm) and .008" (.203 mm) sizes.

Remove the check gauge and refit the bearing race.

Refit the outer bearing adjuster ring and screw down until it contacts the bearing race.

Stand the differential case on the outer case mounting face and lower the differential assembly into the outer bearing.

(1) Check the dimension from the back face of the crown wheel to the centre case mounting face.

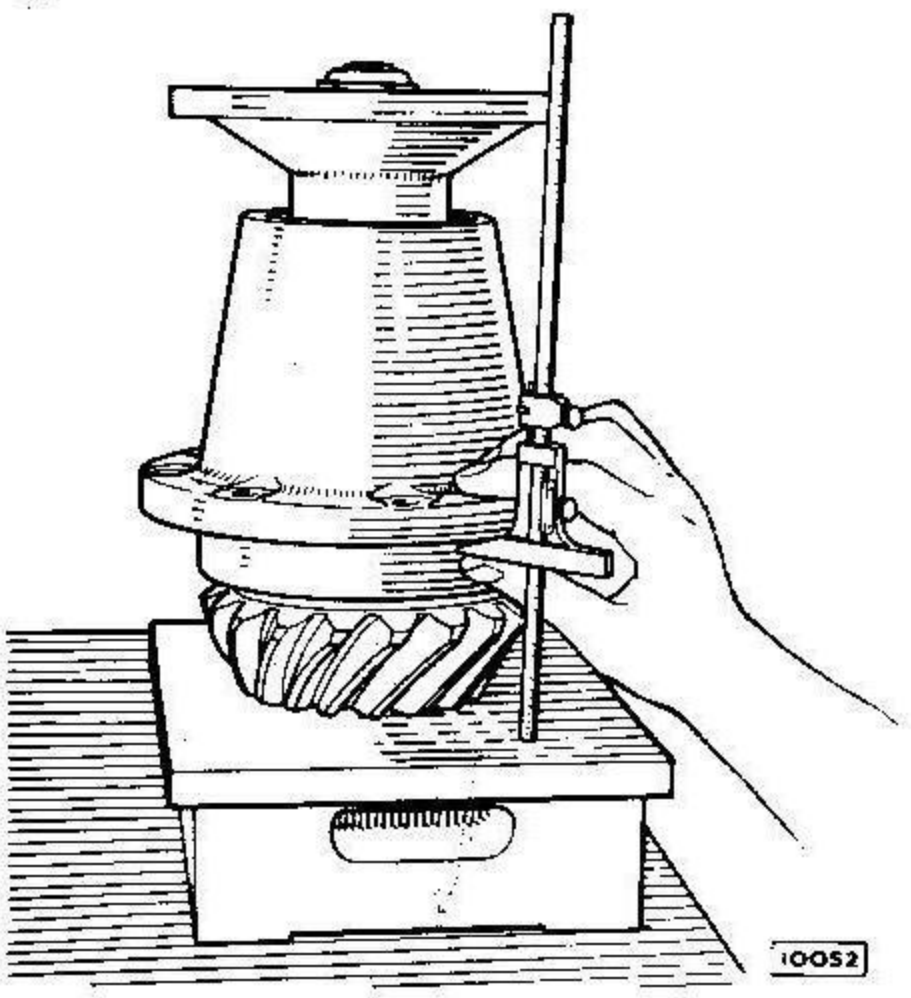


Fig. 12 Checking the dimension from the nose piece mounting face to the back face of the bevel pinion

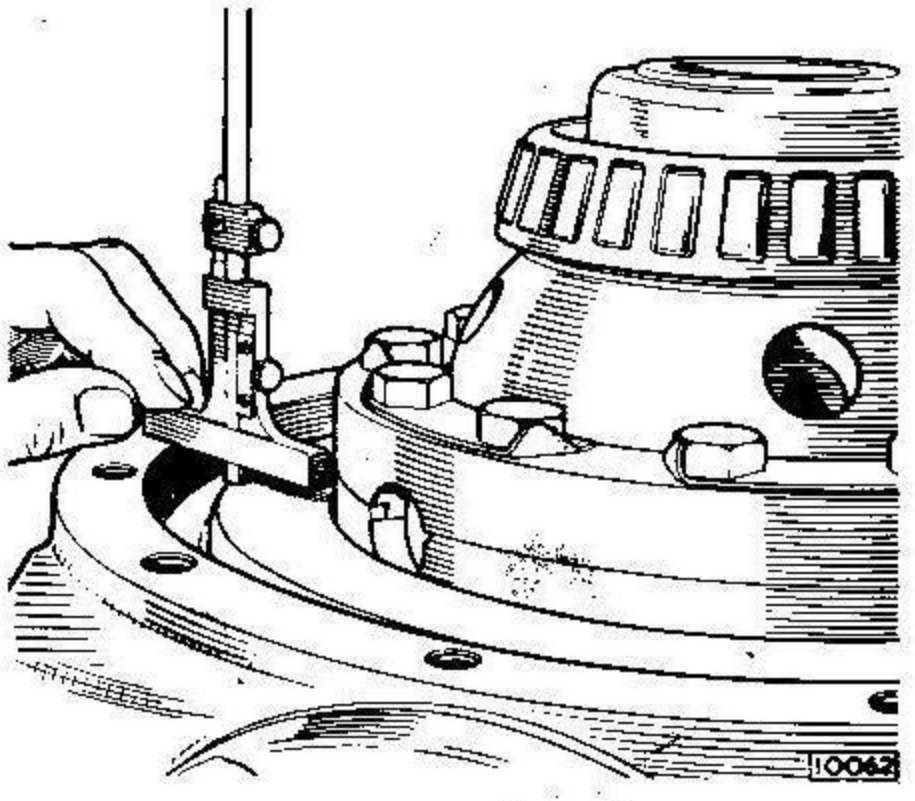


Fig. 13 Checking the dimension from the back face of the crown wheel to the centre case mounting face

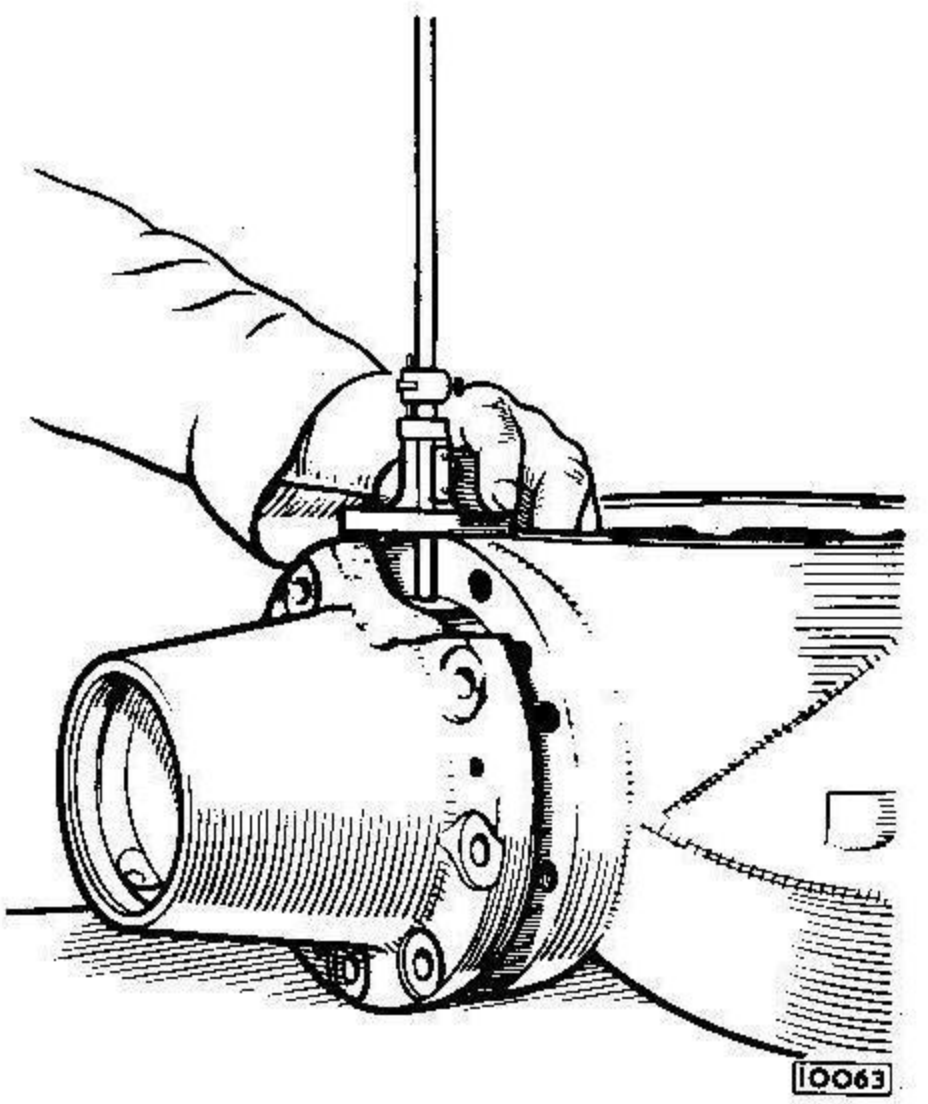


Fig. 14 Checking the dimension from centre mounting face to the centre of the nose piece housing bore. To the dimension obtained as illustrated, add 3.00"

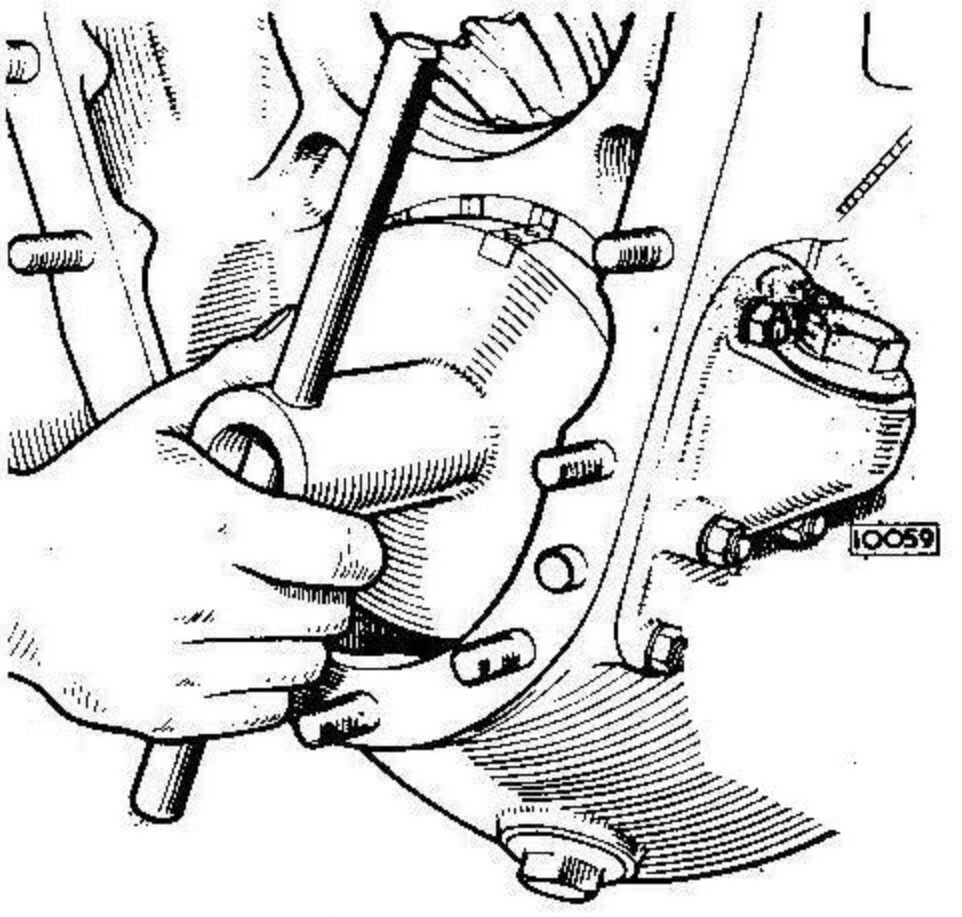


Fig. 15 Adjusting the outer bearing ring

(2) Add this dimension (1) to the figure etched on the crown wheel and the thickness of the crown wheel flange obtained during the differential assembly.

(3) Check the dimension from the centre case mounting face to the centre of the nose piece housing bore.

(4) Result (2) should equal (3). Adjust the bearing adjuster ring by unscrewing or screwing in the ring until this condition is obtained.

Lock the ring in position by refitting the ring locking piece. Do NOT bend the tab washers.

NOTE: The ring nut can be adjusted to within half a castellation by reversing the locking piece.

Refit the inner adjusting ring followed by the inner bearing outer race to the right hand side of the centre case.

Mount the centre case to the differential case and secure with two nuts and two opposite bolts. Coat the faces with jointing compound before mounting and pull down evenly. Turn the adjuster nut until all end float is taken out of the bearings.

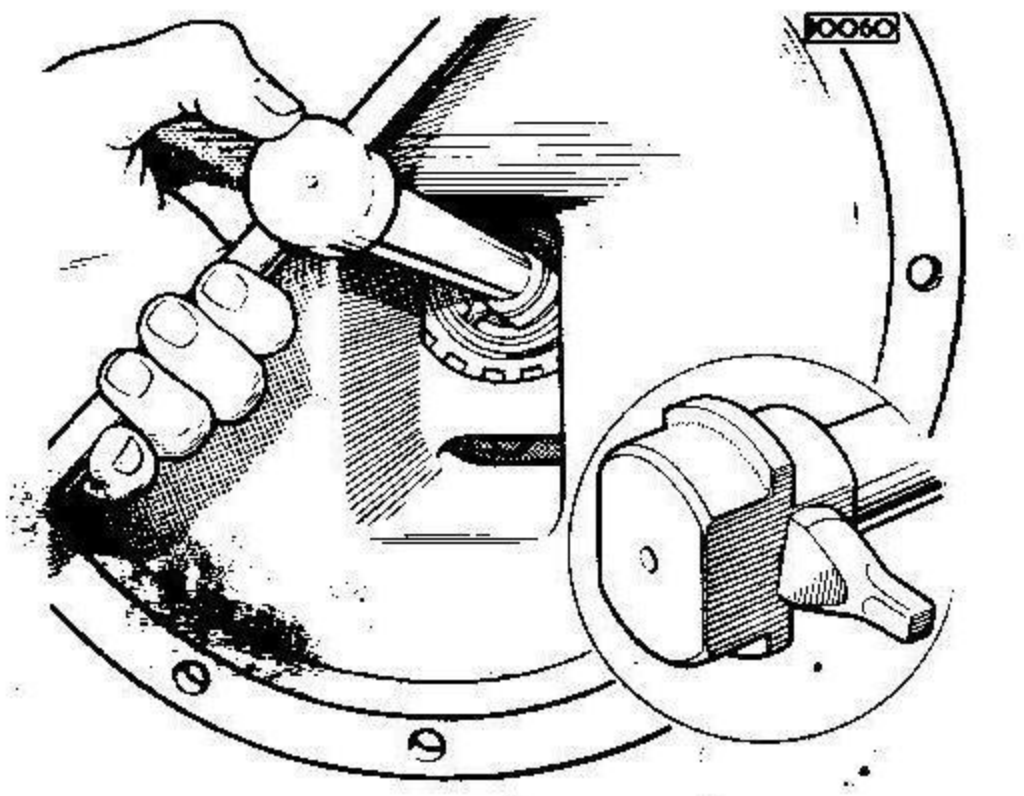


Fig. 16 Adjusting the inner bearing ring. The inset shows the form of the special tool

The adjuster nut is only accessible through the centre of the axle case It will therefore be necessary to fabricate a special tool approximately 18" (45.72 cm) long with welded straight cut claws to register with the nut castellations before any adjustment can be made.

Insert a check rod 3/8" (9.5 mm) dia. through either of the two holes in the side of the centre case and screw in the nut until the rod will enter the first castellation available the difference between one hole and the opposite one being half a castellation.

Remove the check rod, slacken off the two nuts and two bolts and screw the adjuster nut in one complete castellation to give .005" (.127 mm) final nip on the bearings.

Refit all nuts and bolts to the centre case and tighten down evenly. Refit the adjuster nut locking pin and the opposite sealing plug, renew the copper joint washers and tighten down fully.

Refit the axle nose piece to the axle centre with the calculated shim pack. Coat the faces with jointing compound before assembling and tighten down fully.

Lower the axle to the bench and support the centre case.

Refit the left hand spur gear case to the centre case. Coat the faces with jointing compound before mounting and pull down evenly.

Check the backlash between the crown wheel and pinion by means of a clock gauge as illustrated.

Permissible total backlash .008" (.203 mm).

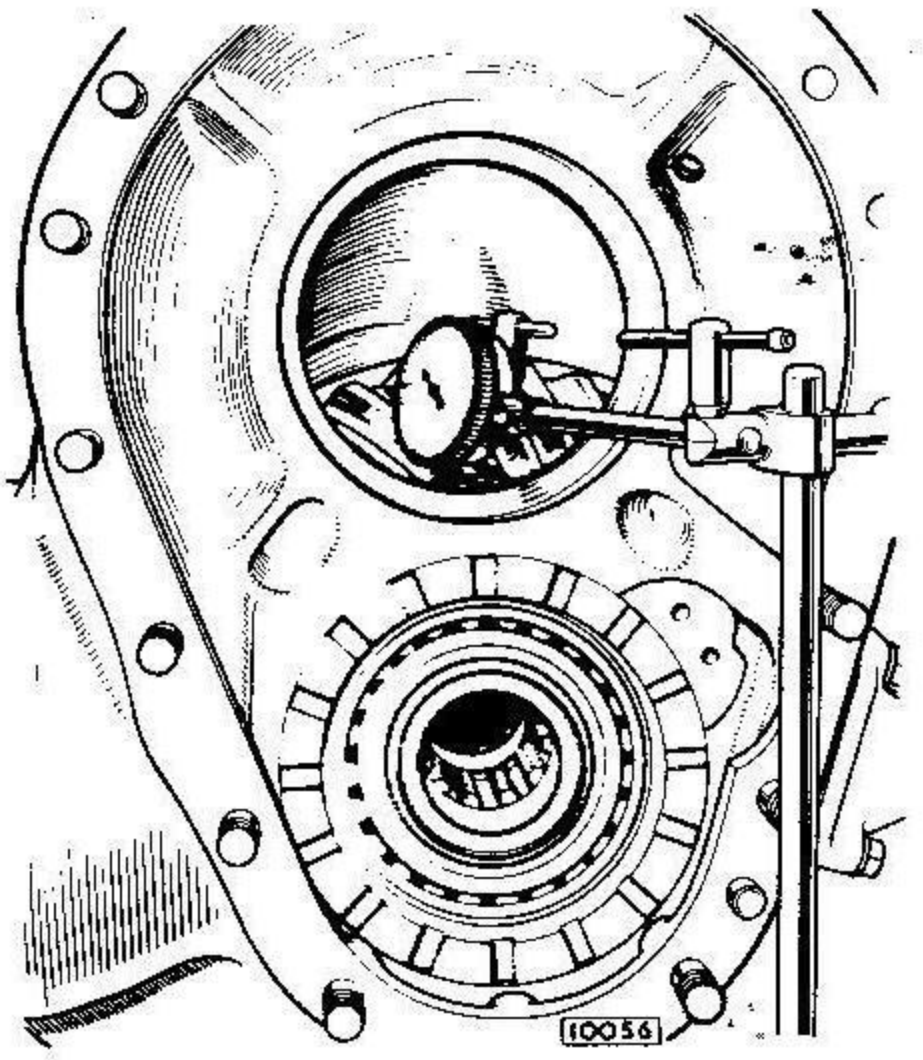


Fig. 17 Checking the backlash between the crown wheel and pinion with a clock gauge

Adjust as necessary by rotating the outer bearing nut in the required direction after removing the locking piece. Refit the locking piece on completion and bend the two tab washers to secure the two setscrews.

Paint the crown wheel lightly with yellow ochre or similar marking compound, rotate the cardan shaft coupling flange and check for gear marking.

Adjust if necessary by increasing or decreasing the shim pack between the nose piece and the case.

Refit the intermediate drive shaft and re-assemble the spur gear train. If the bearing races have been removed from the driving gear ensure that the chip rings are replaced before the bearings are refitted.

Reassemble the spur gear train to the right hand case.

Refit the right and left hand outer cases. Coat the faces with jointing compound before mounting and pull down evenly.

Check the intermediate axle shaft end float as follows. Total permissible end float .120" (3.05 mm).

(a) Insert a soft drift in the left hand side of the axle case and tap the axle shaft towards the right hand side to the full extent.

(b) Measure the depth of the axle shaft from the right hand case thrust button face.

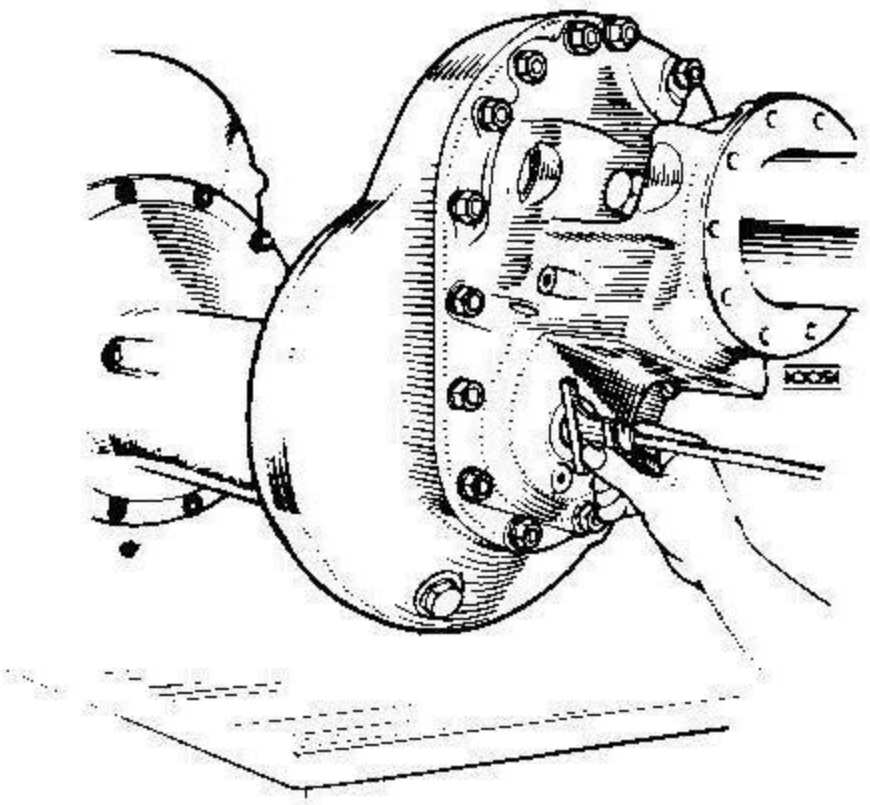


Fig. 18 Measuring the depth of the axle shaft from the right-hand thrust button face

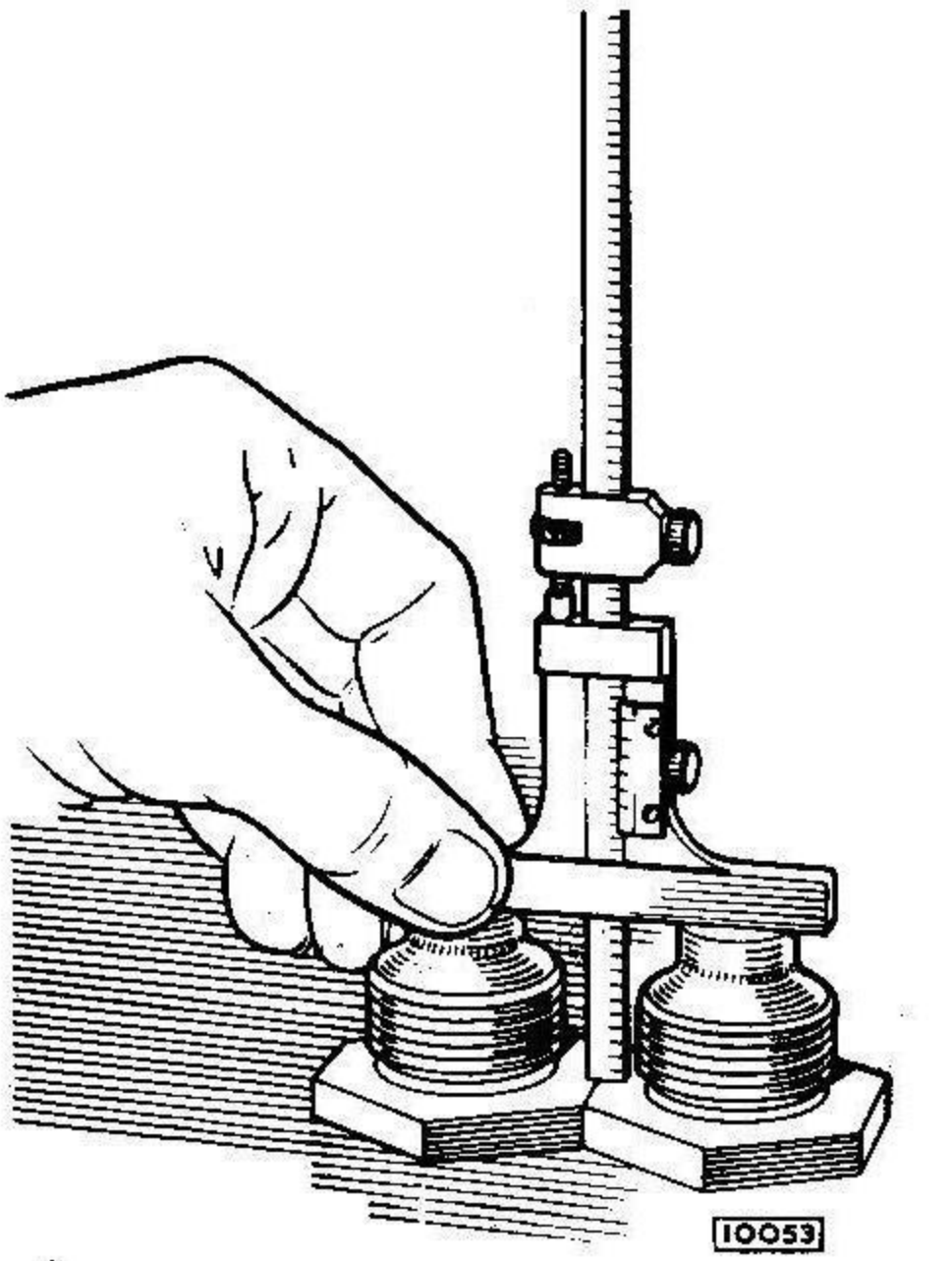


Fig. 19 Measuring the depth of the thrust button

(c) Measure the depth of the thrust button plug from the underside of the hexagon to the button face.

(d) Add .040" (1.01 mm) to (b) and subtract from (c) c - (b + .040").

(e) The resultant figure obtained from (d) will indicate the shims required.

(f) Add .040" (1.01 mm) to (b) and subtract from (c) c - (b + .040").

(g) The resultant figure obtained from (d) will indicate the shims required, for the right hand thrust button. Include the thickness of the locking plate when selecting shims.

(h) Insert the left hand plug less shims and lock plate and tap the shafts to the left hand side to the full extent.

(i) Measure the depth of the shaft again from the right hand case thrust button face.

(j) Add .120" (3.05 mm) to (e) and subtract (g). (e + .120") - g.

(k) Subtract (d) from (h) to give the shims required for the left hand thrust button.

Include the thickness of the locking plate when selecting shims.

Fit both thrust buttons with calculated shim packs and locking plates. Insert locating screws in the locking plates, fully tighten the thrust buttons and lock into position by bending the locking plate tabs.

Refit the brake assemblies.

Check the condition of the hub shell oil seals and renew if damaged or worn

NOTE: These oil seals are fitted in pairs with the lip pointing towards the outer ends of the axle.

Repack the hub shells and adjust for end float as detailed under "The Rear Wheel Hubs".

Refit the brake Drums and fully tighten the setscrews retaining the drums in position.

Refit both axle half shafts and hub covers. Renew the hub cover joints when refitting.

Refit the road spring by reversal of the removal procedure.

Adjust and balance the brakes as detailed in Section "The Braking System".

BRAKING SYSTEM

SECTION K

INDEX

BRAKING SYSTEM

SPECIFICATION AND DATA

Type		Westinghouse or Clayton Dewandre Air Pressure
Diameter of Brake Drums		16.00" (40.64 cm)
Lining Width	– front	4.75" (120.7 mm)
	– rear	8.00" (203.2 mm)
Effective Lining Area	– Front	273 sq.ins. (1761 sq. cm)
	– Rear	460 sq.ins. (2967 sq. cm)
	– Total	733 sq.ins. (4729 sq. cm)
	– Handbrake	460 sq.ins. (2967 sq. cm)
Brake Drum/Lining clearance		0.015" (0.381 mm)
Unloader Valve "cut in" Setting		91 lbs. per sq.in. (6.37 kg cm^2)
Unloader Valve "cut out" Setting		105 - 115 lbs. per sq.in. (7.382 - 8.085 kg/cm^2)
Length of Brake Chamber push rod protrusion from brake chamber mounting face when brake is in the "OFF" position.		Rear 7.5" (19.05 cm) frame mounted chambers Rear 3.0" (7.6 cm) axle mounted chambers. Front 4.5" (11.43 cm)

GENERAL DESCRIPTION

Westinghouse or Clayton Dewandre air pressure brakes are fitted as alternatives to suit customers requirements, both fully automatic or manual brake shoe adjustment being available.

Brakes are equipped with dual brake valve systems.

The linkage of the handbrake is set during the initial assembly of the chassis and apart from lubrication and checking for wear in the joint pins no further attention will be necessary.

On vehicles fitted with the fully automatic system the position of the handbrake lever will remain constant when "ON" and in vehicles fitted with the manually adjusted system adjustment of the rear brake shoe clearance will restore the handbrake movement.

Both systems also supply the air pressure for the C.A.V. electro-pneumatic gear engagement equipment and body accessories.

The brake and gear air pressure systems have a common engine driven air compressor, but have separate air storage reservoirs.

These are both positioned on the right hand chassis side member, the main reservoir being the outer one of the two.

Individual air pressure gauges mounted on the instrument panel indicate the air pressure in each system.

The front portion of the dual reservoir (595 cu.in. capacity) supplies air pressure to the front brakes, the rear portion (960 cu.in. capacity) functioning in the rear brake system.

With the dual brake installation check valves are incorporated in both circuits as a safety factor preventing complete brake failure following a breakdown in either front or rear systems.

Air pressure is conveyed by flexible and rigid pipes from the air compressor through the unloader valve to the air reservoir and then to the brake control valve and the auxiliary reservoir for the gear operation.

Rigid steel pipes convey the pressure released by the brake control valve to the front road wheel brake chambers mounted adjacent to the brake assemblies through an outlet port and to the rear brake chambers mounted on the rear axle.

An anti-freezer unit or alcohol evaporator can be fitted into the system if necessary due to climatic conditions. Air is drawn by the air compressor through the anti-freeze unit which is connected to the head of the oil bath engine air cleaner, thus ensuring that only filtered air passes into the system.

ROUTINE MAINTENANCE

DAILY

Anti-Freezer (When fitted)

Drainage and filling

The container of the anti-freezer should be drained daily before filling the container with Methanol by withdrawing the plug in the base. Failure to observe this will result in a misleading indication on the dipstick as condensation in the form of water sinks to the bottom of the container.

To fill the anti-freezer, withdraw the combined filler/dipstick plug from the side of the container and top up with Methanol until the level is just below the filler neck. Refit the plug.

NOTE: The anti-freezer should only be filled with Methanol when freezing conditions are expected. The level of the Methanol can be readily discerned on the gauge of the dipstick which is attached to the filler can. Should the movement of the vehicle cause a film of Methanol to cover the entire gauze, it should be blown off and redipped, when the level will be easily

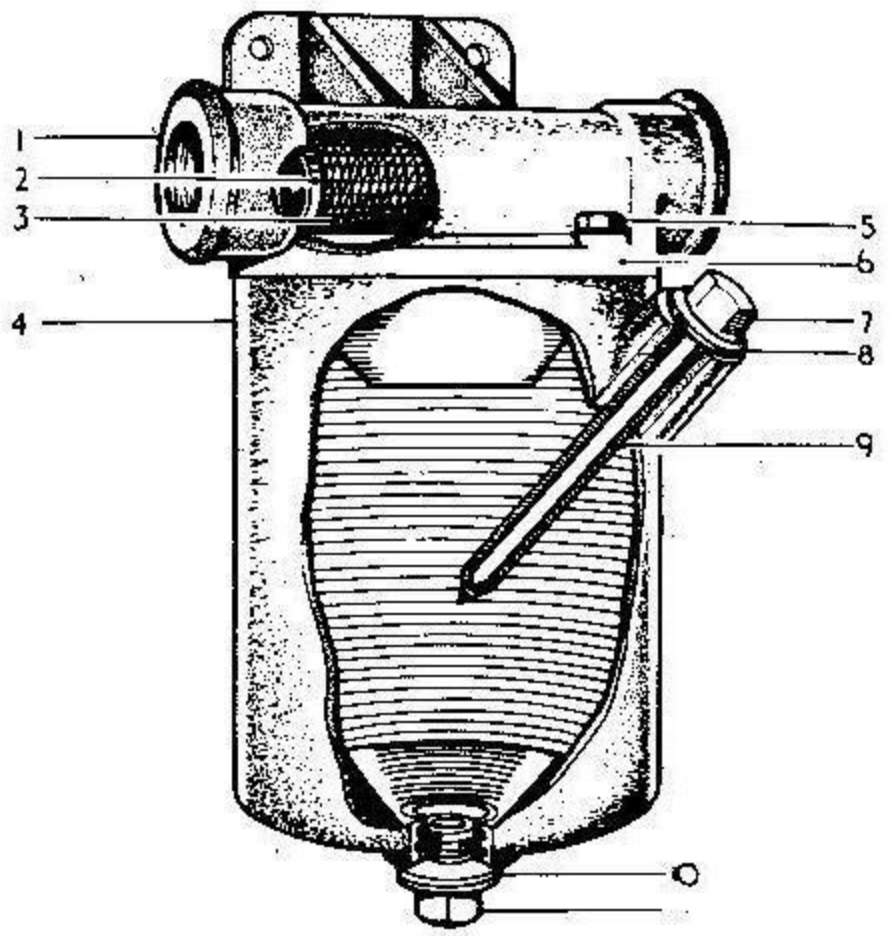


Fig. 1 Sectioned view of the anti-freezer

1 Body
2 Circlip
3 Strainer
4 Container
5 Container setscrew
6 Gasket
7 Filler cap
8 Gasket
9 Dipstick
10 Washer
11 Drain plug

discernable. The gauze strainer should be removed periodically for inspection and cleaning.

Alcohol Evaporator (when fitted)

Check the level of the methyl alcohol in the container before taking the vehicle into service if freezing conditions are expected.

Remove the filler plug and top up the container to within two thirds full with commercially pure methyl alcohol (188 proof). The alcohol should be free of any inhibitor. The level of the methyl alcohol can readily be seen through the wall of the plastic container.

NOTE: The alcohol evaporator should only be used when freezing conditions are expected.

Air Pressure

Checking Build-up

Check the air pressure recorded on the two gauges in the instrument panel daily when the vehicle is in service by running the engine and noting the pressure. The pressure recorded should not fall below 70 lbs/per sq. in. (4.9 kg/cm^2) for the brakes (right hand gauge) and 65 lbs. per sq.in. (4.57 kg/cm^2) for the ancillary equipment.

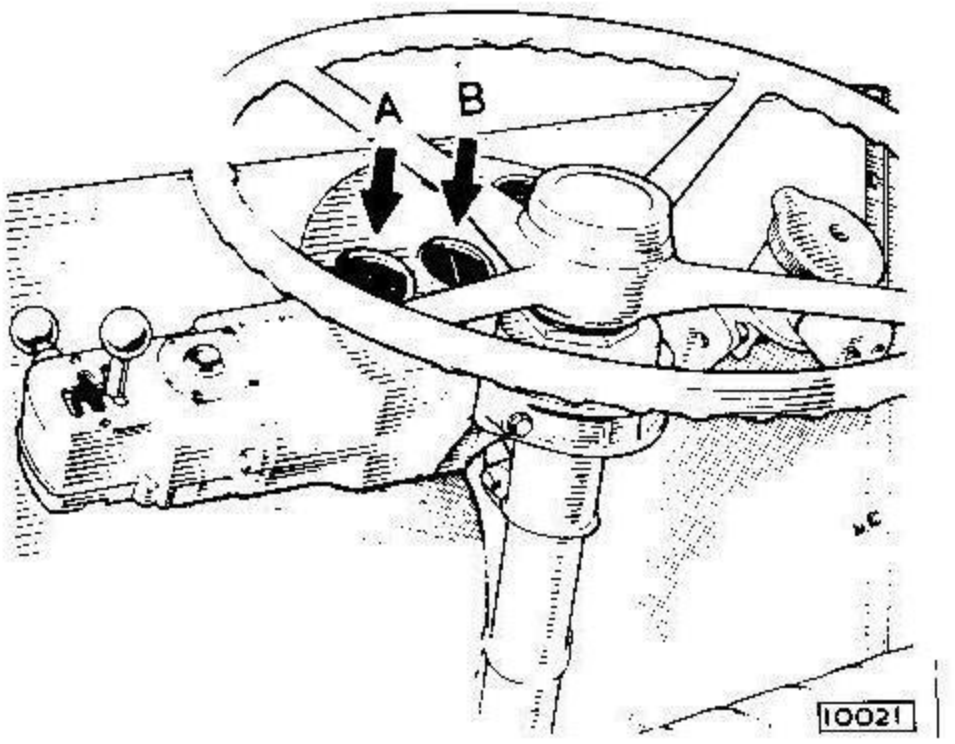


Fig. 2 The air pressure gauges

A Ancillary equipment
B Brakes

When the vehicle is in use the air pressured recorded should be 100 – 110 lbs/per sq.in. (7.03 – 7.73 kg/cm^2). If the air pressure gauges read "ZERO" it should take no more than one minute for the air reservoirs to be charged to the pressure specified above.

NOTE: The brake pressure will record 65 lbs/per sq.in. (4.4 kg/cm^2) before the ancillary gauge begins to move. As the vehicle stands stationary overnight, the pressure should not fall below 50 lbs/per sq.in. (3.5 kg/cm^2).

WEEKLY

Flexible Hoses – Checking

Check the condition of all flexible hoses in the system and renew if worn or damaged. Check all hose clips and tighten if necessary.

Six flexible hoses are included in the pipe layout and are situated as follows:-

i. Inside the engine compartment between the air intake and the compressor.
ii. Inside the engine compartment between the air compressor and the chassis frame pipes.
iii. One to each brake chamber.

Air Pressure Reservoirs – Draining

Drain all fluid due to condensation or compressor oil leakage from the reservoirs weekly.

To drain the reservoirs, open the drain tap after exhausting all air pressure from the system by operating the brake pedal. When it is desired to analyse the condensation, a glass vessel should be positioned under each drain tap to collect the fluid.

After draining, allow the fluid to stand for sufficient time to allow the contents to separate, any oil content can be

readily observed indicating that oil is passing the piston rings of the compressor.

FIRST 2,500 MILES (4.000 KM)

Brake Shoe Linings — Checking
Check the brake shoe linings for any signs of undue rapid wear.

New Linings 3/8" (16 mm)
Worn Linings 3/16" (5 mm)

EVERY 2,500 MILES (4,000 KM)

Alcohol Evaporator Filter — Cleaning.
(when fitted).
Remove the filter element, wash in cleaning solvent, and refit.

Power Assisted Handbrake (When fitted).
Check the brake chamber for leaks with the air pressure system fully charged, as detailed on Page K00.
Check the air control valve for leaks as detailed on Page K00.

Anti-Freezer Gauge Filter — Cleaning
(When fitted)
Open the engine compartment. Detach the outlet and inlet pipes from the anti-freezer unit. Remove the unit from the engine bulkhead by withdrawing the attachment bolts. Remove the adaptor from the outlet port. Extract the circlip located inside the outlet port and withdraw the filter gauze. Wash in petrol, dry and refit gauze. Refitting of the unit is the reverse of the removal procedure.

Air Pressure Regulator Valve
Checking for leaks
The procedure is identical for both Westinghouse and Clayton—Dewandre systems. With the air pressure system fully pressurised, apply a soap solution to the pipe unions and vent hole in the cover of the regulator. When air leaks are observed at the unions they must be tightened and retested. If the air leaks persist, exhaust the air system, disconnect the unions and examine for possible cause of fault. Refit unions, re-charge the system and re-check.
Check that the vent hole is not blocked with dirt or paint.
Air leaks at the vent hole indicates a perforated diaphragm. Disconnect, remove and fit a new unit.

Brake Pedal Linkage
Lubrication
The lubrication of the brake pedal linkage is confined to (1) the brake pedal pivot situated beneath the floor of the driver's compartment (2) the two control rod fork ends connecting the brake pedal to the brake operating valve, (3) the four brake chamber fork ends, (4) the front and rear brake cam levers and (5) the front and rear brake pivot shafts.
Numbers (1) and (4) are lubricated by means of a grease gun applied to the nipples provided. Numbers (2) and (3) by oil can and Number (5) by oil gun after removal of the plugs located in the end of each pivot shaft.
NOTE: When the vehicle is fitted with the automatic chassis lubrication system no grease nipple is fitted to point Number (1) and no routine maintenance will be required at this point.

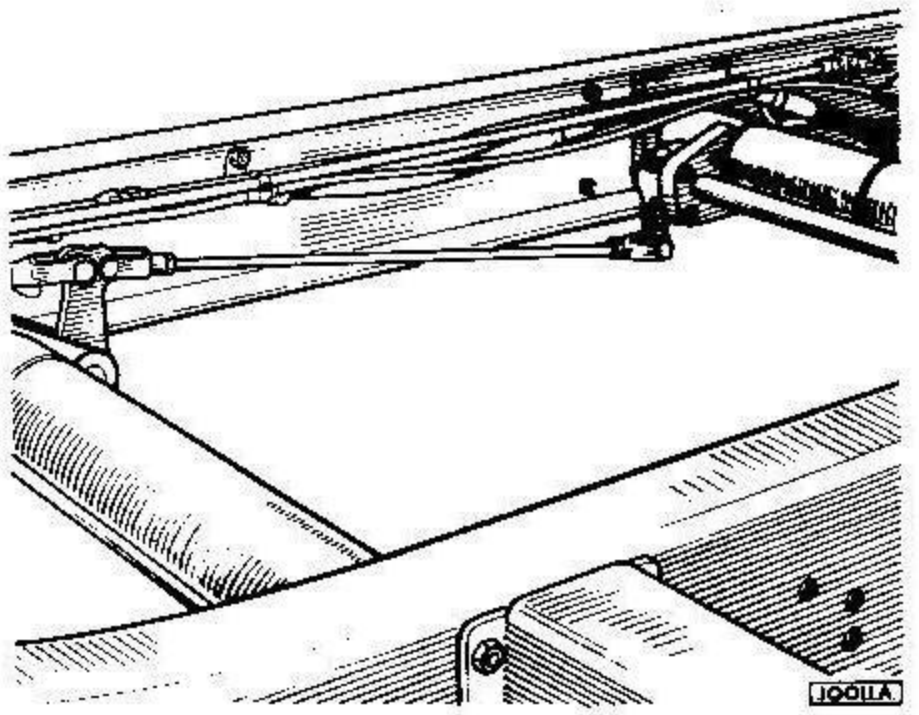


Fig. 3 The handbrake relay pivot points

Handbrake Linkage
Lubrication
Lubrication of the handbrake linkage consists of (1) four fulcrum pins and (2) the ratchet quadrant on the lever assembly, (3) the lever pivot shaft (4) the six control rod fork ends and (5) the forward relay lever (6) and the rear brake lever way shaft.
Numbers (1) and (4) are lubricated by means of an oil can.
Number (2) by the application of a small quantity of grease.
Numbers (3), (5) and (6) by means of a grease gun.
The intermediate relay lever shaft bearings are pre-packed during assembly.
NOTE: When the vehicle is fitted with the automatic lubrication system no grease nipples are fitted to points (3), (5) and (6) and no routine maintenance will be required.

Foot Brake Control Valve
Checking for Leaks
The checking procedure is identical for both Westinghouse and Clayton Dewandre systems. Remove the automatic lubricator pressure pipe from the three-way rear brake chamber pipe junction and connect in an accurate air pressure gauge.
On vehicles not fitted with the automatic lubricator

system, remove the blanking plug from the three-way junction. Fully charge the pressure system, depress the brake pedal to various positions and read the pressures indicated on the check gauge.
These should increase progressively as the pedal is depressed. If any undue fall off in pressure is indicated check the pipe 1 in. unions connected to the brake valve by applying a soap solution and noting any air bubbles which will indicate a faulty joint. Tighten all such joints and re-check. Check that when the pedal is fully released the gauge immediately falls to zero and when the pedal is fully depressed the air pressure on the check gauge agrees with the pressure recorded on the instrument panel gauge. Check that the exhaust port on the valve is clear and unobstructed. Coat the exhaust port with a soap solution to check for any leakage in the valve unit.
Check with the pedal released and fully depressed. Leakage in excess of a one inch soap bubble is not permissible in either of these tests. If any excess is observed this will indicate that the valve seats on the inlet and exhaust valve assemblies require attention. Remove and repair or replace valve with a re-conditioned unit.

Unloader Valve
Pressure Setting — Checking
Start the engine, charge up the main reservoir and check the cut-out pressure as indicated on the panel gauge. "Cut-out" pressure setting 105 - 115 lbs/per sq. in. (7.382 - 8.085 kg/cm^2)

To Adjust (Westinghouse System)
Remove the rubber cap from the unloader valve and turn the screwed bush now exposed clockwise to increase and anti-clockwise to decrease the cut-out pressure.

To Adjust (Clayton—Dewandre System)
Release the locknut and turn the screwed sleeve clockwise to increase and anti-clockwise to decrease the pressure. Tighten the locknut when the adjustment is completed.
With the engine still running, reduce the pressure in the reservoir and note the "cut-in" pressure reading.
"Cut-in" pressure setting 91 lbs. per sq.in. (6.37 kg/cm^2). When the unloader valve cuts out again stop the compressor. Apply a soap solution to the exhaust port to test for leakage from the reservoir via the check valve on the relay piston seal, also apply a soap solution to the opening at the end of the control spring housing for leakage past the left hand pilot valve seat.
Reduce the pressure in the reservoir and re-start the compressor; apply a soap solution to the exhaust port to test for leakage past the exhaust valve. Also apply a soap solution to the opening at the end of the control spring housing for leakage past the relay piston seal, or the right hand valve seat. In either test if leakage is evident dismantle the unloader valve and examine for faulty parts.

Brake Chambers
Checking for Leaks
With the brakes fully applied, coat the brake chamber flange holding the diaphragm in place with a soap solution to check for leakage. No leakage is permissible. If leakage is detected, tighten the two setscrews and nuts retaining the clamping ring until leakage stops, Tighten each bolt and nut only sufficiently to eliminate leakage. Over tightening may cause distortion of the diaphragm and promote premature failure. Check for leakage through the diaphragm by coating the clearance hole around the push-rod and the drain hole in the non-pressure plate with the soap solution. No leakage is permissible with the air system pressurized and the brakes applied. If leakage is detected the brake chamber must be dismantled and the diaphragm renewed. Check all pipe unions by applying the soap solution and applying the brakes. Tighten all faulty joints.

EVERY 10,000 MILES (16,000 KM)

Air Pressure Regulator Valve —
Checking Pressure Setting
Connect an air pressure test gauge in the air supply line and observe at what pressure the regulator valve opens. If the setting varies more than 5 lbs/per sq.in. (.35 kg/cm^2) from that specified, adjust the setting by releasing the locknut and turning the adjuster screw clockwise to increase and anti-clockwise to decrease the pressure. Always tighten the locknut after adjustment. Pressure setting 65 lbs/per sq.in. (4.57 kg/cm^2).

Footbrake Linkage and Handbrake — Checking
Check all foot brake control rod fork ends and clevis pins and renew any that are worn. Check handbrake ratchet and pawl. Renew when worn.

Unloader Valve — Cleaning Inlet Filter
Exhaust all air pressure from the system by applications of the brake pedal. Detach the air compressor pipe from the inlet union of the unloader valve and remove the adaptor from the valve body. Withdraw the filter, filter guide and spring. Clean the filter in petrol, dry thoroughly and refit by reversing the removal procedure. NOTE: Clayton—Dewandre valves will not have the spring or spring guide.

Condenser and Drain Valve (If fitted)
Remove, clean and refit the filter element.

EVERY 50,000 MILES (80,000 KM)

Air Pressure Regulator Valve — Overhaul
Remove regulator valve, overhaul and refit, for details of procedure see "AIR PRESSURE REGULATOR VALVE".

Condenser and Drain Valve (If fitted)
Remove the condenser and drain valve, overhaul and refit. For details of procedure see "CONDENSER AND DRAIN VALVE".

Foot Brake Control Valve – Overhaul
Remove control valve, overhaul and refit. For details of procedure see "FOOT BRAKE CONTROL VALVE".

Unloader Valve – Overhaul
Remove unloader valve, overhaul and refit. For details of procedure see "UNLOADER VALVE".

Brake Chambers – Overhaul
Remove all brake chambers, overhaul and refit. For details of procedure see "BRAKE CHAMBERS".

Alcohol Evaporator (When fitted).
Cleaning
Remove and dismantle the alcohol evaporator. Thoroughly clean all parts and inspect for wear and damage. Renew all gaskets. Re-assemble and refill with methyl alcohol if freezing conditions are expected.

Power Assisted Handbrake (When fitted).
Brake Chamber – Overhaul
Remove the brake chamber, overhaul and refit. For method of procedure see "BRAKE CHAMBER" Page K.14.

Air control valve – Overhaul
Remove the air control valve, overhaul and refit. For method of procedure see "AIR CONTROL VALVE" Page K.28

THE PRESSURE REGULATOR VALVE

The function of the Pressure Regulator Valve is to ensure that an adequate air pressure is available in the brake system reservoir before pressure is permitted to build up in the auxiliary system. The valve is set to open at 70 lbs/per sq.in. (4.92 kg/cm^2) thus ensuring that this pressure is provided for in the brake system before the auxiliary system becomes pressurized.
Air pressure from the main tank operates against a spring load diaphragm and valve. When the pressure from the main reservoir is greater than the effort of the spring the diaphragm is forced upward and the delivery valve is lifted off its seat allowing the excess air to pass to the auxiliary tank.

Removal
Exhaust the air system and disconnect the air lines to the regulator valve.
Remove the two mounting bolts, nuts and washers and detach the valve unit.

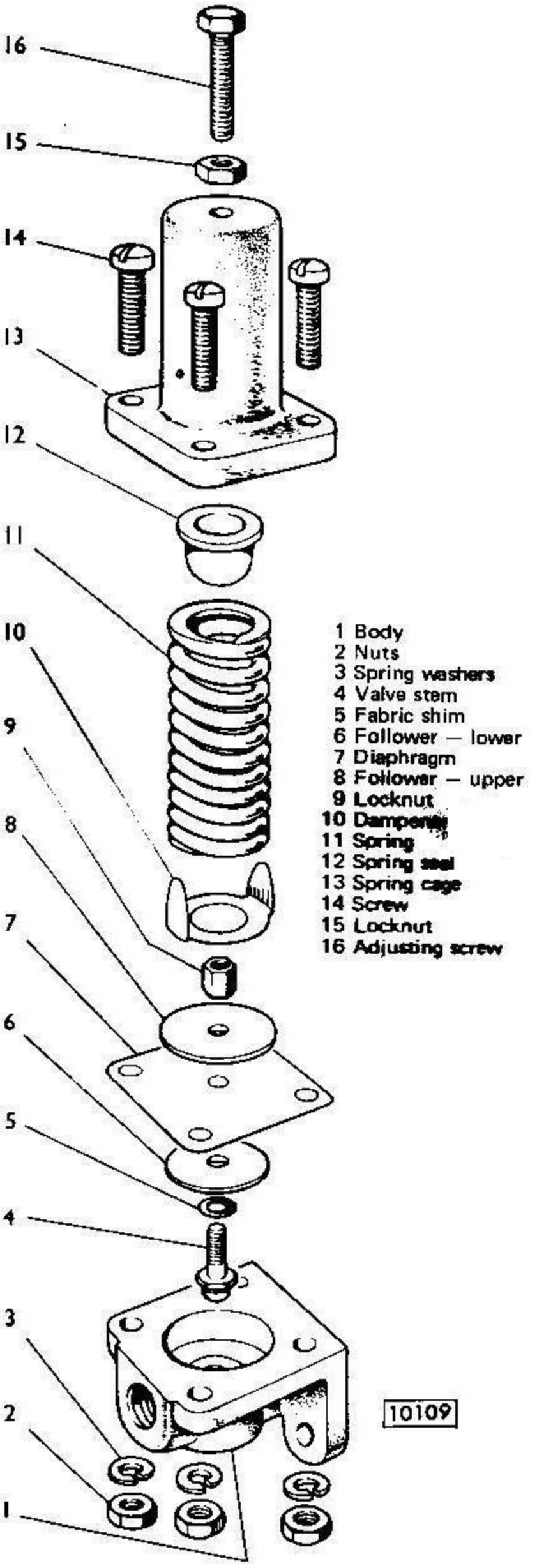


Fig. 4 Exploded view of the pressure regulator valve

Refitting
Refitting is the reverse of the removal procedure. Care must be taken when refitting to ensure that all pipe connections are clean and free from paint.

Dismantling
Remove the four bolts, nuts and washers attaching the cover to the body. Remove the spring dampener, spring and upper spring seat from the cover.
Remove the diaphragm assembly from the body. Wash all parts in cleansing solvent and examine for wear.
Replace the diaphragm if worn, cracked or damaged.
Inspect the valve and valve seat for wear or damage. If the valve is excessively grooved or pitted it should be replaced and if the valve seat shows signs of being pitted, scratched or damaged it should also be renewed.
Check the condition of the dampener; replace if it is cracked or broken.

Re-assembly
Position the diaphragm assembly to the body.
Place the dampener on one end of the spring with the ears of the dampener along the side of the spring.
Place the upper spring seat on the other end of the spring with the well of the seat down into the spring.
Install the spring assembly into the cover. Position and attach the cover to the body with the four bolts, nuts and washers.

Re-checking
Check the pressure setting as given in the 10,000 miles (16,000 km) service.
Check for air leaks as given in the 2,500 miles (4,000 km) service.

THE UNLOADER VALVE

The function of the unloader valve mounted in the pipe line between the air compressor and the main reservoir controls the pressure of air in the reservoir. With a cut-out pressure of 105 lbs/per sq.in. (7.4 kg/cm^2) the unloader relieves the compressor of its load by diverting the air delivered to the atmosphere and sealing the pressure in the reservoir by means of a non-return valve.

Removal
To remove the valve exhaust all air pressure from the system, disconnect all pipe connections and remove from the mounting.

Refitting
Refitting is the reverse of the removal procedure. Care must be taken to ensure that the pipe connections are clean and free from paint.

Dismantling – Westinghouse System
Remove all dirt and grease from the exterior of the unloader valve and inspect for damage. Unscrew the control spring housing and withdraw the control spring, push rod, pilot valve seats, pilot valve, pilot valve bush and filter.
Remove the two screws retaining the exhaust silencer to the base of the unit and detach the silencer, remove the circlip below the exhaust valve and withdraw the perforated plates, spring, sleeve and the exhaust valve and relay piston assembly.
Remove the circlip retaining the check valve spring guide and withdraw the spring guide, spring and check valve.
Unscrew the inlet adaptor and withdraw the strainer, strainer guide and spring.
Remove the rubber boot covering the end of the control spring housing on Westinghouse valves. Wash all metal parts in cleansing solvent and examine for wear.
If any parts of the relay piston and exhaust valve assembly are faulty the complete assembly must be replaced. If the check valve seat in the body is worn or damaged, replace with a new body or valve unit complete.
The pilot valve filter, inlet strainer and exhaust silencer felt pads should be cleaned or replaced as necessary.

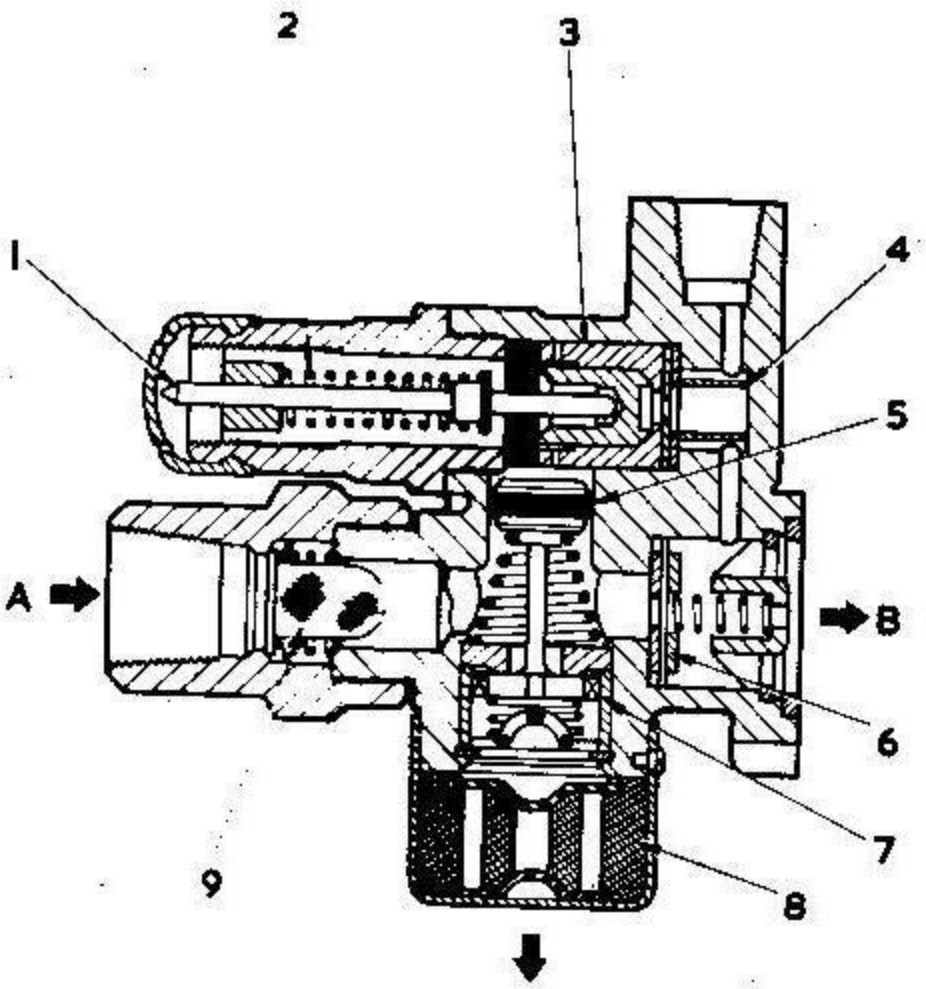


Fig. 5 The Westinghouse unloader valve

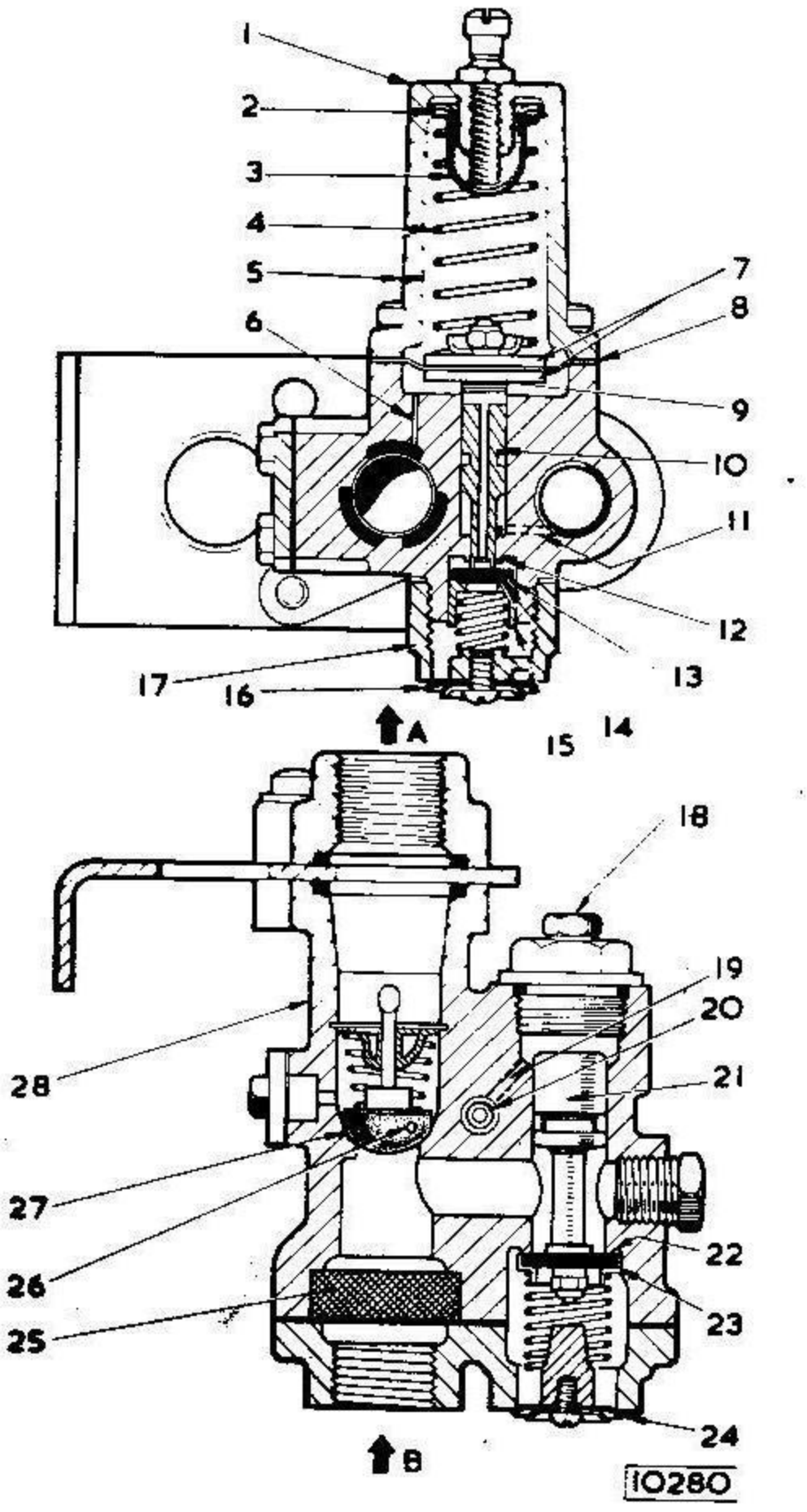
1 Push rod
2 Control spring
3 Pilot valve piston
4 Filter
5 Relay piston
6 Cheek valve
7 Exhaust valve
8 Exhaust silencer
9 Inlet strainer
A from compressor
B to reservoir
C exhaust

Re-assembly
Lightly grease all moving parts with "Arctic Paragon" grease and assemble all parts in the reverse order to that for dismantling.
When replacing the pilot valve bush, ensure that the holes in the bush are towards the relay piston and that the relay valve piston is a free sliding fit in the bush.

Re-checking
Check the pressure setting as detailed in the 2,500 miles (4,000 km) service.
Check the valve for air pressure leaks.

Dismantling — Clayton–Dewandre System
Remove grease and dirt from the exterior of the valve.
Before dismantling the unit, carefully measure the exposed length of the adjusting screw so that the unit can be re-assembled to the same valve setting.
Mark the top cover, and mounting bracket where fitted, relative to the body to ensure correct re-assembly.
Loosen the adjusting screw locknut and remove the screw, and sealing ring if fitted.
Progressively remove the four screws attaching the top cover to the body and remove the spring washers, identification tag, cover, pressure setting spring, spring seat, and washer if fitted.
Withdraw the diaphragm assembly from the body and remove the plunger sealing ring. Dismantle the diaphragm assembly by holding the plunger with a length of 1/8" rod inserted in the cross hole and unscrewing the nut. Separate the nut, spring guide, followers, diaphragm, fabric shim and plunger.
Where applicable, unscrew the unloader exhaust check valve retaining screw and remove the diaphragm washer and diaphragm.
Progressively unscrew the unloader cover screws and remove the spring washers, cover, joint, spring, spring guide, and filter element if fitted. Where applicable, withdraw the spring guide and valve stop from the cover.
Unscrew the large hexagonal plug and remove the sealing ring. Unscrew the nut from the unloader plunger and remove the washer and valve. Withdraw the unloader plunger and remove the sealing ring.
Unscrew the governor exhaust check valve retaining screw and remove the diaphragm washer and diaphragm.
Unscrew the exhaust nut and remove the washer, spring, spring retainer or valve guide and inlet-exhaust valve.
Unscrew the two nuts or screws and remove the spring washers, cover and joint or sealing ring. Where applicable, remove the bracket and sealing ring.
Unclip and withdraw the circlip and withdraw the non-return valve parts.
Where applicable, unscrew the two nuts securing the low pressure switch. Remove the cover and withdraw the parts of the switch, taking care not to mislay the shim(s), if fitted. Remove the gasket.
Clean all non-metallic parts with a clean cloth.
Wash all other parts in cleaning solvent and blow dry with compressed air. Ensure that the vent in the top cover, if present, and all other air passages are clear and clean.
Examine the body and covers, and the exhaust nut and non-return valve housing where applicable, for cracks and other damage. Check all threads for damage.
Examine all rubber parts for wear and deterioration. The sealing faces of the inlet-exhaust and unloader valves should be flat and smooth.
Check that the valve seats in the body, and non-return valve housing where applicable, are free from wear and nicks.
Check that the fabric shim is in good condition.
Inspect the plungers and the plunger bores in the body for wear and scores. Inspect the valve seat at the end of the governor plunger for damage.
Check all springs for corrosion and distortion.
Ensure that the circlip is in good condition.
Referring to the unit shown in Fig. 5, check that the governor check valve seat is in good condition.
Where applicable, examine the low pressure switch contact points for signs of pitting. If pitting is not too severe, the contacts may be reconditioned by filing them with a fine file such as is used for distributor points. If they cannot be reconditioned, replace the contact disc and contact plate assemblies.

Re-assembly
Renew all parts found to be defective during 'Inspection'.
Lubricate the valve parts, where necessary, with 'Valvoline X-5 Regular', or equivalent, grease.
Before re-assembling the diaphragm assembly parts, note that the chamfered sides of diaphragm followers must be placed against the diaphragm and that where only one follower has a chamfered side, this follower must be fitted next to the fabric shim. Fit the diaphragm so that the outer edge is in line with the upper follower, as shown in the section views. Assemble the parts on the plunger in the following order: fabric shim, follower, diaphragm, follower, spring guide, nut. Securely tighten the nut.
Lightly smear the plunger sealing ring with grease and fit it into the plunger groove. Lightly smear the plunger and plunger bore in the body with grease and carefully insert the plunger into the bore.
Position the pressure setting spring seat in the top cover. Where applicable, fit the washer. Place the spring in cover and position the cover on the body ensuring that the spring is correctly seated. Align the positioning marks made before dismantling and replace the identification tag, four spring washers and screws. Tighten the screws progressively.
Insert the non-return valve assembly into the valve body and fit the circlip; check that the circlip is correctly located in its groove. If the parts are loose items, fit the non-return half-ball valve on the spring and insert the assembly into the body. Insert the spring guide and valve



The Clayton—Dewandre unloader valve

1 Top cover
2 Washer
3 Spring seat
4 Pressure setting spring
5 Vent
6 Air passage to governor
7 Follower
8 Diaphragm
9 Fabric shim
10 Governor plunger
11 Air passage to unloader
12 Exhaust valve seat
13 Inlet valve seat
14 Inlet-exhaust valve
15 Valve guide
16 Unloader exhaust diaphragm
17 Exhaust nut
18 Connection to automatic drain valve
19 Air passage to unloader
20 Governor plunger
21 Unloader plunger
22 Valve seat
23 Unloader valve
24 Unloader exhaust diaphragm
25 Filter element
26 Air passage
27 Non-return valve
28 Body

stop and fit the circlip. Check that the circlip is correctly located in its groove.

Lightly smear the sealing ring(s) for the delivery cover or mounting bracket with grease. If the unit has a mounting bracket, fit the sealing ring and then position the bracket, aligning the marks made before dismantling. Position the other sealing ring, or a new joint if a new joint was previously fitted, and then fit the delivery cover. If the unit does not have a mounting bracket, fit one sealing ring and then the delivery cover. Replace the spring washers and screws or nuts and tighten securely.

Smear the unloader plunger sealing ring with grease and fit it into the unloader plunger groove. Lightly smear the sliding surfaces of the plunger and plunger bore in the body with grease, and insert the plunger into the body, taking care not to damage the sealing ring. Correctly position the unloader valve on the plunger with the smooth face towards the seat in the body. Fit washer and nut and tighten.

Insert the filter element into its recess in the body. Place the unloader spring guide on the valve and the spring on the guide.

Position the spring guide and valve stop in the cover. Position a new joint on the body and fit the cover, spring washers and screws. Securely tighten the screws. Position the onloader exhaust diaphragm and diaphragm washer on cover, with the rounded surface of the washer against the diaphragm. Replace and tighten the screw. Lightly smear the plug sealing ring with grease. Screw the plug complete with sealing ring into the body and tighten securely.

Position the inlet-exhaust valve spring, spring retainer or valve guide, and inlet-exhaust valve in the exhaust nut as shown in the appropriate sectional illustration. Screw the nut, complete with washer, on to the body and tighten securely.

Position the governor exhaust diaphragm and diaphragm washer on the exhaust nut with the rounded surface of the washer against the diaphragm. Replace and tighten the screw.

Screw the locknut on to the adjusting screw. Where applicable, lightly smear the adjusting screw sealing ring with grease and position it against the locknut. Replace the screw in the top of the cover and set the screw to the original length measured before dismantling. Securely tighten the locknut.

If the unit has a low pressure switch, lightly smear the bore in the cover and sliding surfaces of the cavity in the body with grease. Insert the 'O' ring diaphragm, plain side uppermost, into the cavity in the body and then re-lubricate the sliding surface.

Position a new gasket on the body. Place this piston on the 'O' ring diaphragm and position the contact plate assembly over the projections on the piston. Fit the cover, contact disc assembly, spring and shim(s). If no replacement parts have been fitted, the original shims, if any, must be placed on the top of the spring to maintain the correct pressure setting. Position the contact plate and top cover. Fit the nuts and tighten securely.

THE FOOT BRAKE CONTROL VALVE

The function of the brake valve is to control the air pressure released to the brake chambers. Operation of the brake pedal governs the movement of an inlet and exhaust valve assembly which in turn regulates the air pressures to the brakes.

When the pedal is depressed, air passes through the valve and pressure is developed in the chambers. The valve automatically adjusts the pressure in proportion to the degree of pedal movement so that the further the pedal is depressed the greater the pressure is applied to the brake chambers until the full reservoir pressure is delivered to apply the brakes.

Removal

Exhaust all air pressure from the system and disconnect all pipe connections. Detach the pedal rod linkage by removing the split pin and extracting the joint pin.

Disconnect the two cables from the stop light switch.

Remove the three mounting bolts and withdraw the valve unit. Seal the open ends of the pipes to prevent ingress of dirt.

The valve unit is accessible from underneath the vehicle and is located under the drivers foot plate.

Refitting

Refitting is the reverse of the removal procedure. Care must be taken when refitting to ensure that all pipe connections are clean and free from paint.

Check all unions and exhaust port, with a soap solution, for possible leaks. Check with pedal fully depressed and released.

Dismantling – Westinghouse System

Remove the three bolts, nuts and washers and detach the mounting bracket from the valve body.

Withdraw the plunger and link assembly.

Remove the two valve plungers and extract the valve and piston assemblies.

Remove the circlips and graduating spring retainers and dismantle both valve units.

Remove the retaining circlips and withdraw the inlet valve guides from the base of the body.

Wash all metal parts in cleansing solvent and check for wear or damage. Replace all faulty parts.

Renew all 'O' rings and rubber seals.

Re-assembling

Re-assembly is the reverse of the dismantling procedure. During assembly smear the link, linkpin, valve plungers and pistons with a light engine oil. Lubricate 'O' ring bores with Molydenum Disulphide based grease.

Testing

When assembled, connect the unit to an air supply, or refit to the vehicle and charge the air pressure system. Coat the exterior of the valve with a soap solution and inspect for air leakage.

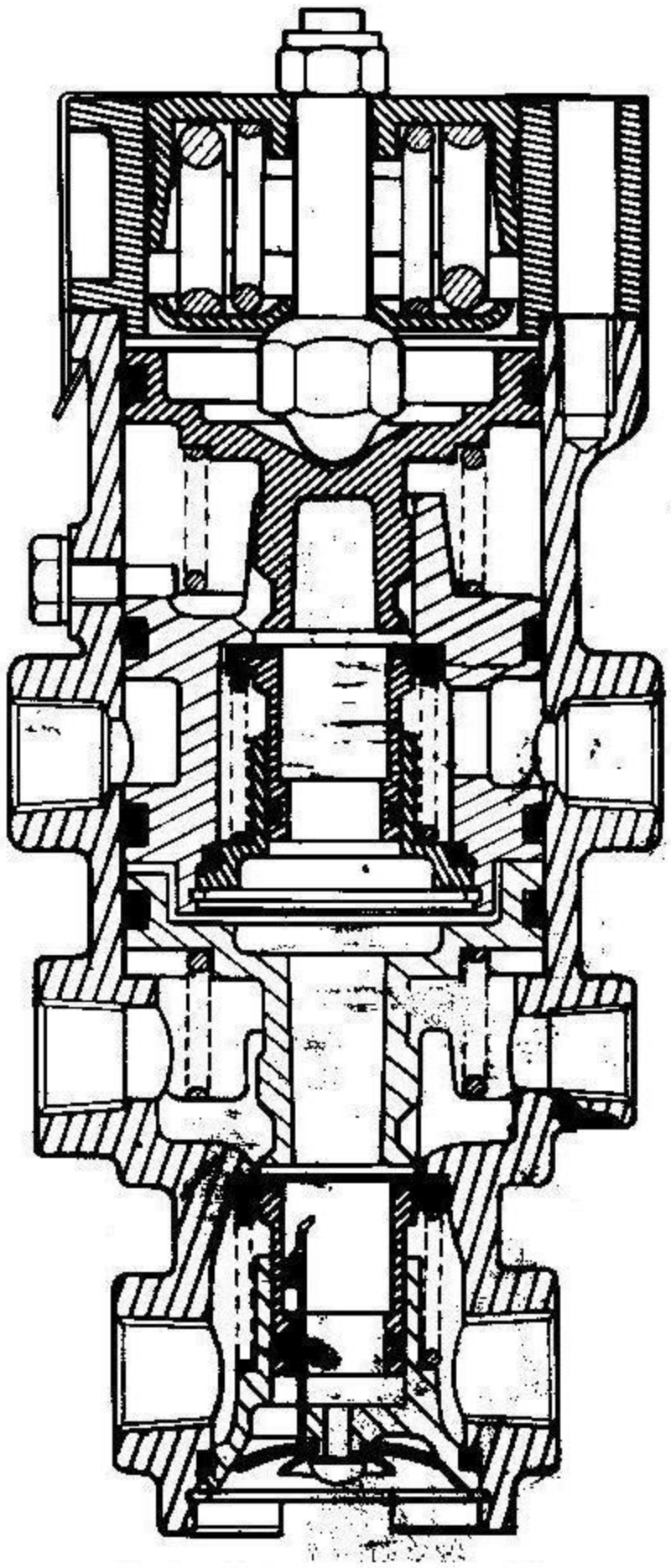
Insert air pressure gauges in the two delivery lines and check that the recordings do not differ by more than 5 lb /per sq.in. (.37 kg/cm^2). Graduation should be available between 7 - 75 lbs/per sq.in. (.49 - 5.28 kg/cm^2) after which an emergency type application will occur.

NOTE: During this test there will be a momentary escape of air at the exhaust filter each time the valves "lap off" during the various stages of build up in line pressure.

Air will also be expelled through the exhaust filter whilst the air line pressure is being reduced.

Dismantling – Clayton Dewandre System

Remove the three nuts and washers and detach the



mounting bracket with plunger from the valve body.
Release the spring clips and detach the upper plunger chamber.
NOTE: Care must be taken when removing the chamber due to the piston being under spring pressure.
Withdraw the upper piston and spring.
Remove the hexagon headed dowel screw from the side of the valve body.
Withdraw the remaining pistons and lower spring.
Remove the circlip from the underside of the centre piston assembly and extract the spring seat, spring and valve.
Invert the valve body, remove the retaining circlip and withdraw the exhaust valve assembly.
Press down the small lever in the bore of the exhaust valve and remove the plunger slide.
Wash all metal parts in cleansing solvent and inspect for wear or damage. Replace all faulty parts.
Renew all 'O' rings and rubber seals.

Re-assembly
Re-assembly is the reverse of the dismantling procedure. During assembly lubricate the plunger and plunger chamber and all other sliding surfaces with "Valvoline X 5 Regular" grease.

Testing
When assembled connect the unit to an air supply, or, refit to the vehicle and charge the air pressure system. Coat the exterior of the valve with a soap solution and inspect for air leakage.
Insert air pressure gauges in the two delivery lines and check that the recordings do not differ by more than 5 lbs/per sq.in. (.37 kg/cm^2).

THE CHECK VALVES
The function of the check valves, installed in the front and rear end faces of the main reservoir is to isolate the front or rear brake systems in the event of air brake failure in either line.
Air flow in the normal direction moves the valve from its seat and air flow is unobstructed. Flow in the reverse direction is prevented by the action of the valve return spring assisted by the air pressure flowing in the reverse direction.

Removal
Exhaust all air pressure from the system, disconnect the air line and detach the check valve from the individual reservoir.

Refitting
Refitting is the reverse of the removal procedure. Ensure that the union and tank joint are clean when refitting.

DISMANTLING
Unscrew the cap and nut and remove the valve and valve

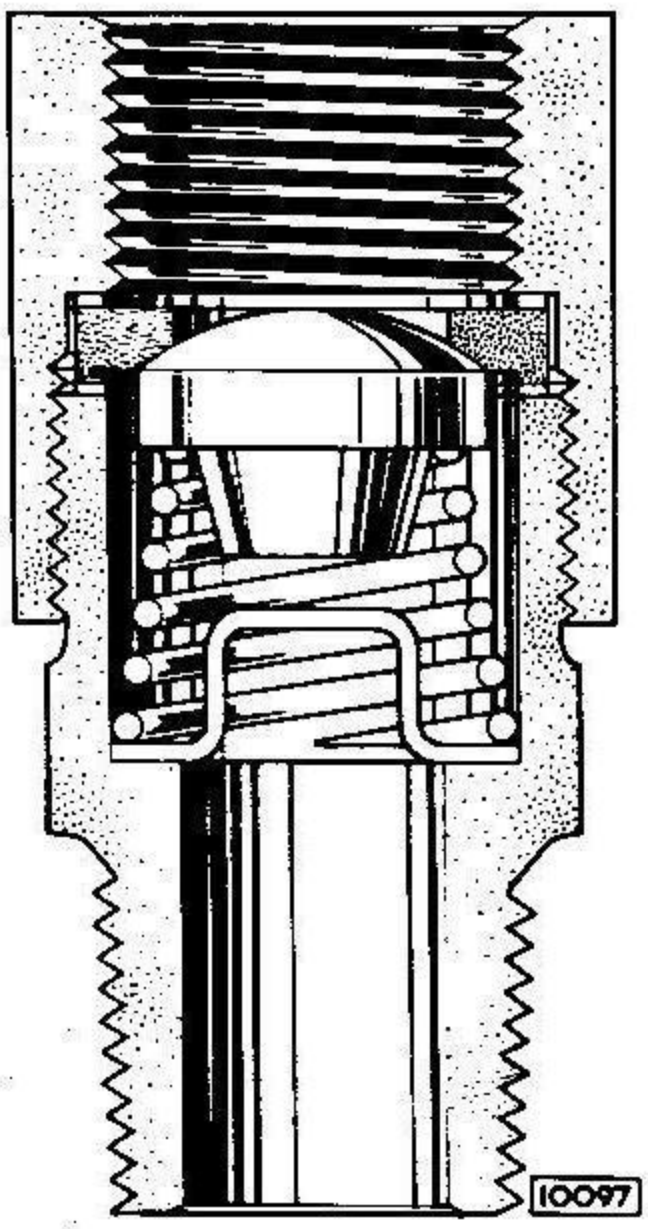


Fig. 8 Sectioned view of the Clayton–Dewandre check valve

spring. Extract the valve seat and joints. Examine the valve and valve seat and renew if pitted or worn. Renew the valve seat joints.

Re-assembly
Position the valve and spring in the valve body. Place the valve seat and joints in the cap nut.
Screw the cap nut on to the body and tighten fully. Attach the valve unit to the reservoir and connect the feed pipe.

Checking
Pressurise the system and check for leaks.

THE BRAKE CHAMBERS
The function of the brake chambers is to convert the energy of the compressed air released by the brake valve into mechanical force and motion necessary to operate the brakes. As air enters the brake chamber, the diaphragm forces the push rod outwards. Thus rotating the automatic adjuster (when fitted) the brake camshaft and brake cam, so applying the brakes. The higher the air pressure admitted to the brake chamber the greater the force pushing the brake lining against the drum, and the greater the retarding force.

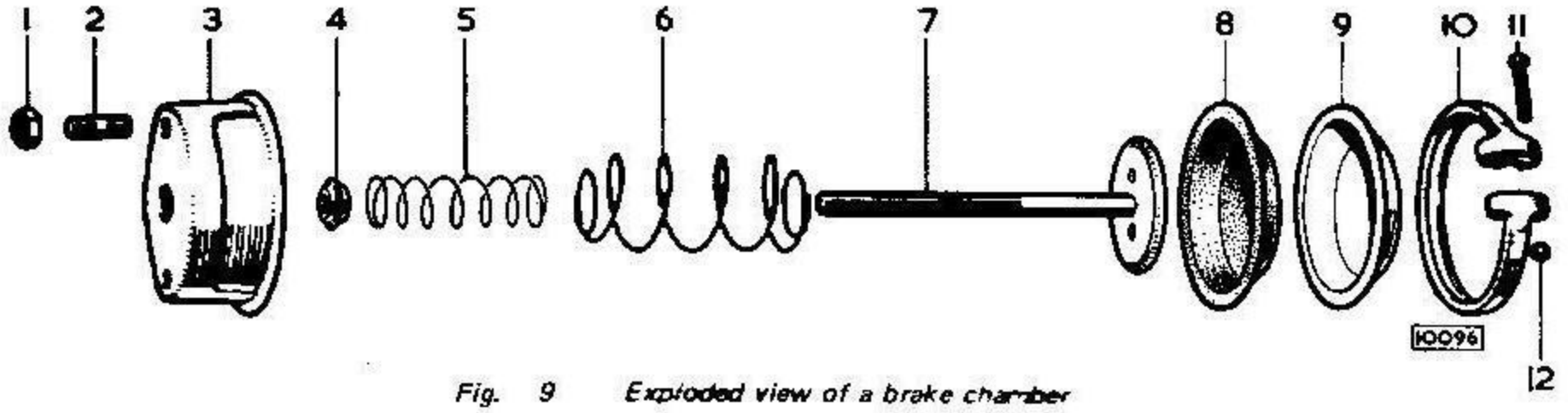


Fig. 9 Exploded view of a brake chamber

1 Nut
2 Stud
3 Non-pressure plate
4 Seal assembly
5 Seal spring
6 Main spring
7 Push rod assembly
8 Diaphragm
9 Pressure plate
10 Clamping ring
11 Bolt
12 Nut

If all air pressure is released from the brake chamber, the brake shoe release springs and the brake chamber release springs return the brakes shoes, the brake cam, brake chamber push rod and diaphragm to the release position, so releasing the brakes.

Removal

Exhaust all air pressure from the system. Disconnect the air line pipe union. Disconnect the push rod yoke by removing the split pin and nut from the clevis pin and withdrawing the pin. Remove the two nuts and spring washers from the mounting studs and withdraw the brake chamber unit.

Refitting

Refitting is the reverse of the removal procedure. Check before assembly that the push rod protrudes from the chamber mounting face by 4.5" (11.43 cm) on the front brake chambers and by 7.5" (19.05 cm) on the rear brake chambers. 3.0" (7.6 cm) on rear axle mounted chambers. Fit the brake chamber to the mounting plate and secure with the nuts and spring washers. Screw the locknut and fork end on to the push rod.

Adjust the position of the fork end on the front brake chambers until the clevis pin will pass through the fork end and brake lever. Refit plain washer, nut and split pin. Tighten locknut to the fork end.

Adjust the position of the fork end on the rear brakes chamber until the clevis pin will pass through the fork end and the rear portion of the slot in the way shaft levers. Ensure that the handbrake is "OFF" before connecting the rear brake chamber push rods. Refit plain washer, nut and split pin. Tighten the locknut to the fork end.

Dismantling

Before dismantling the brake chambers, mark both the non-pressure and pressure plate in relation to the clamping ring so that the bolts of the clamp ring will be in the same position when re-assembled. This will eliminate the possibility of any installation interference when the brake chamber is installed on the vehicle.

Pull out the push rod to the full extent and clamp it at the non-pressure plate by using a vice or vice grip pliers. This will relieve the tension of the spring on the diaphragm and clamp ring.

Remove the two clamping nuts and bolts. Spring the ring slightly and push the clamp ring on to the pressure plate leaving the non-pressure plate clear. Remove the pressure plate and the diaphragm. Remove the fork end lock nut from the push rod. Release the clamp from the push rod and withdraw the push rod assembly, spring, seal and seal spring from the non-pressure plate. Clean all parts thoroughly using cleansing solvent and inspect for wear or damage. Replace all worn parts. Inspect the diaphragm for signs of wear or cracking.

IMPORTANT: If a new diaphragm is to be fitted to one brake chamber, a replacement should also be fitted to the corresponding brake chamber on the opposite side of the vehicle. Failure to do this may result in uneven braking.

If a replacement release spring is to be fitted, it is essential to ensure that the correct type is installed, also ensure that the release spring on the opposite brake chamber is of the same type. Failure to carry out this check will also result in uneven braking.

Renew seal assembly if worn.

Re-assembling

Rest the push rod assembly upright on a flat surface and assemble the seal spring, seal, return spring and non-pressure plate to the push rod. Force down the non-pressure plate until it rests on the flat surface. Holding the plate in this position, against the tension of the return spring, clamp the push rod at the non-pressure plate with vice grip pliers or similar tool.

Place the clamp ring over the clamping surface of the non-pressure plate. Position the diaphragm to the pressure plate and join with the open end of the non-pressure plate, working the clamp ring over the clamping surface

of the pressure plate. With the two halves in position, align the marks made before dismantling. With the two halves and the clamp ring in this position, using vice grip pliers, clamp one set of lugs together. Fit a bolt and nut in the other lug and secure. Remove the pliers and install the remaining bolt and nut.
Tighten the clamp ring bolts evenly and only sufficient to eliminate leakage at the clamp ring surface. Over-tightening may cause diaphragm distortion.

Checking
Check that maximum push rod movement is obtained.
Check for leaks as detailed in the 2,500 miles (4,000 km) service.

THE STOP LIGHT SWITCH
The stop light switch, an electro-pneumatic unit, operates in conjunction with the brake valve and stop lights by completing the electrical circuit when the brakes are applied.
The switch consists of a die-cast body, rubber diaphragm and an insulated cover on which are mounted the electrical contacts. Inside the switch, above the diaphragm, a plunger fitted with a contact point connects with the upper contact when air pressure enters the switch below the diaphragm. The return spring connects the contact plunger with the remaining terminal. The stop light switch is located in the rear brake pipe line attached to the right hand chassis frame.

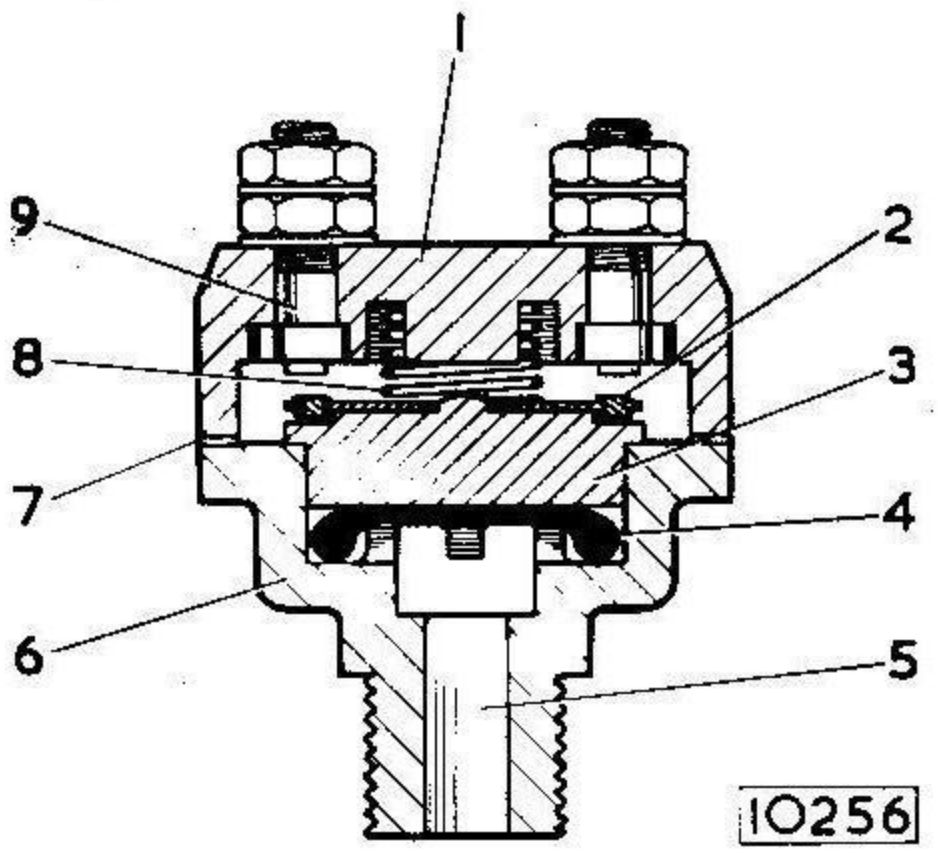


Fig. 10 Sectioned view of the stop light switch

1 Cover
2 Contact strip
3 Piston
4 Diaphragm
5 Inlet port
6 Body
7 Gasket
8 Spring
9 Terminal

Removal
Exhaust all air pressure from the system. Note the respective positions of the electrical connections to ensure correct replacement. Disconnect cables and air line union, and detach the switch.

Refitting
Refitting is the reverse of the removal procedure.

Dismantling
Withdraw two screws and remove the cover. Lift out the spring, contact, piston, and diaphragm. Clean all metal parts in cleansing solvent.
Inspect contact points for pitting. Contacts may be refaced with a fine file or oil stone if pitting is not too severe. Check the return spring, renew if weak. Examine the diaphragm and replace if worn or cracked.

Reassembly
Place the diaphragm on the body. Position the contact and piston on the diaphragm and fit the return spring. Position the cover on the body and replace and tighten the two screws. Refit the switch to the chassis and reconnect the cables and air line.

Checking
Re-charge the air pressure system. Coat the switch with a soap solution and check for air leaks with the brakes applied. No air leaks are permissible at the switch joint or the air pipe union.
The switch should operate with an air pressure of not more than 5 lbs/per sq.in. (.35 kg/cm^2).

THE LOW PRESSURE INDICATOR SWITCH
The low pressure switch is designed to work in conjunction with a warning light incorporated in the instrument panel to give an indication to the driver that the air pressure in the brake system is below a safe working limit. The switch is attached to the front chassis cross member beneath the driver's foot plate.

Removal
Exhaust all air pressure from the brake system. Disconnect the cables and detach the switch.

Dismantling
Withdraw two setscrews and detach the body of the switch from the adaptor.
Remove the spring, contact disc and contact plate.
Check the disc and plate for wear and pitting.
The disc and contact terminal plate may be turned over to extend the life of the contacts.
Note the number of shims fitted above the spring.

Re-assembly
Re-assembling is the reverse of the dismantling procedure.
Renew the piston at main vehicle overhaul periods.

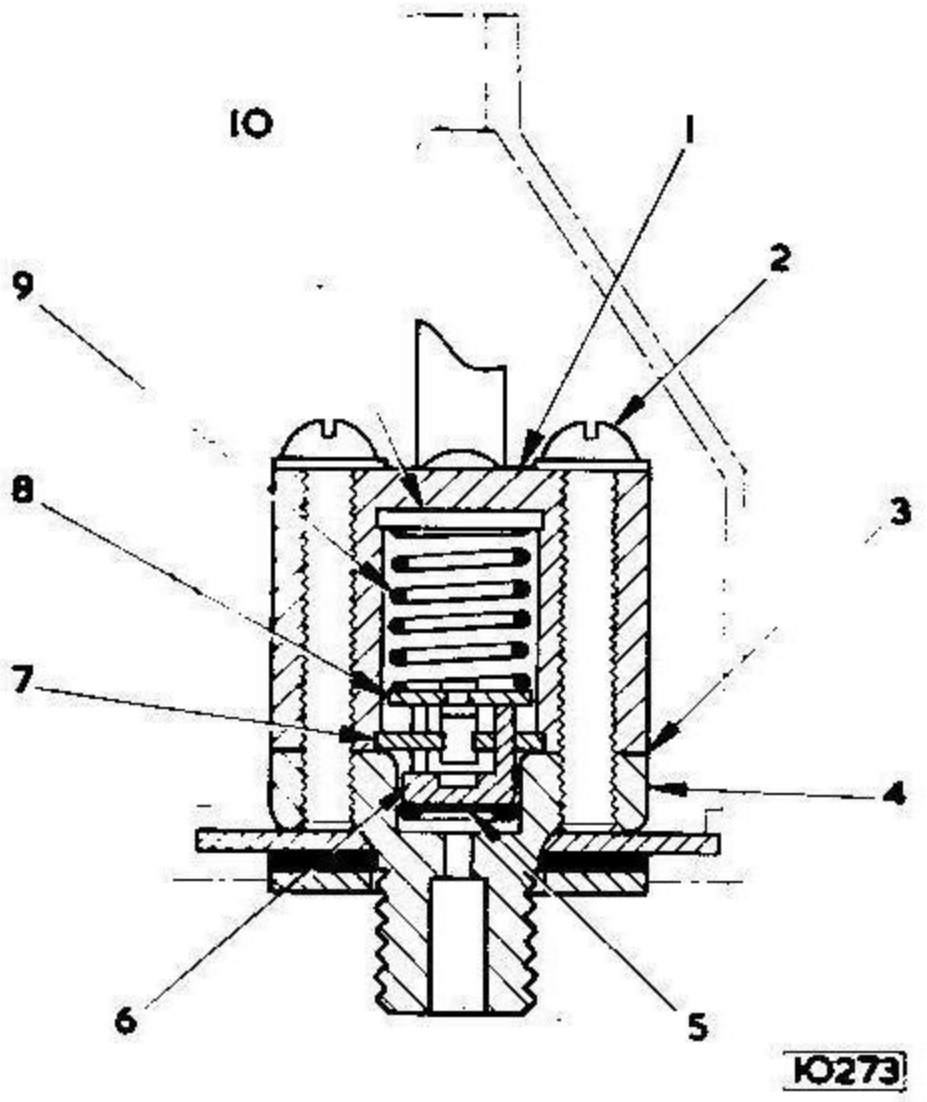


Fig. 11 Sectioned view of low pressure indicator switch

1 Body
2 Clamp screw
3 Gasket
4 Adaptor
5 'O' ring diaphragm
6 Piston
7 Contact terminal plate
8 Contact disc
9 Control spring
10 Shim

Refit the unit to the chassis and connect the cables and air pipe line.

Checking

Re-charge the air pressure system. Coat the switch with a soap solution and check for air leaks through the vent hole in the cover. Any leaks will indicate a faulty diaphragm assembly. Check that the contacts close, that is, when the warning light or buzzer operates, when the air pressure falls below 60 lbs/per sq.in. (4.22 kg/cm^2). Adjust by removing or adding shims above the spring. Adding shims will raise the cut-out point.

THE AIR COMPRESSOR — Westinghouse System

The air compressor is a twin cylinder single stage air cooled unit of 2¼" (57.15 mm) bore and 1.31/32" (50.01 mm) stroke having a piston displacement of 9 cu. ft. per min. at 1,000 compressor r.p.m.

Removal

If it is required to remove the compressor with the engine in the chassis it will be necessary to detach the engine left hand side cover as detailed in Section Q "Engine Compartment Covers". Exhaust all air pressure from the braking system and disconnect the two air pipes from the cylinder head. Disconnect the oil feed pipe from the crank bearing cap.

Release the drive belt jockey pulley adjuster nut and slide the pulley to the bottom of its adjustment.

Remove the three drive belts. Remove the split pin and nut retaining the pulley to the crankshaft and, using a suitable extractor, withdraw the pulley.

Remove the four nuts and washers securing the compressor base flange to the mounting plate and lift away the compressor.

Refitting

Refitting is the reverse of the removal procedure, but care must be taken to ensure that the air pressure pipes are clean and tight.

Renew the base gasket after scraping the two faces clean. If standard gaskets are not available, brown paper .005" - .006" (.13 - .15 mm) thick may be used with a suitable jointing compound. Re-adjust the drive belt tension to the specified limits.

Dismantling

Remove the safety valve from the cylinder head. Unscrew the eight setscrews and washers and remove the cylinder head.

Invert the compressor and after removing the nuts remove the connecting rod caps.

Note the markings on the connecting rods and caps to facilitate refitting; it being essential that the rods and caps are replaced as marked during manufacture.

Withdraw the piston and connecting rods through the top of the cylinder bores.

Remove the six nuts and washers retaining the crankshaft end cover and drive out the crankshaft from the driving end until it is free of the crankcase.

Remove the valve caps from the cylinder head and lift out the delivery valve springs and valve discs.

From the underside of the head, remove the suction valve inserts and extract the springs and discs.

Wash all parts in cleansing solvent and examine for wear or damage. Remove all carbon deposit from the cylinder head and piston crown.

Check the valve springs and replace with new if they are in a bad condition or have collapsed. The valve discs can be refaced by running on a fine grinding paste diluted with oil; all traces of paste must be removed before re-assembly. If the faces of the discs are too badly pitted to permit grinding they must be renewed.

The valve seats can be refaced with a cutter, details of which can be obtained from the compressor manufacturers. If it is found impossible to recut the valve seat due to excessive wear a replacement head should be fitted and the original one returned to the manufacturers for re-conditioning.

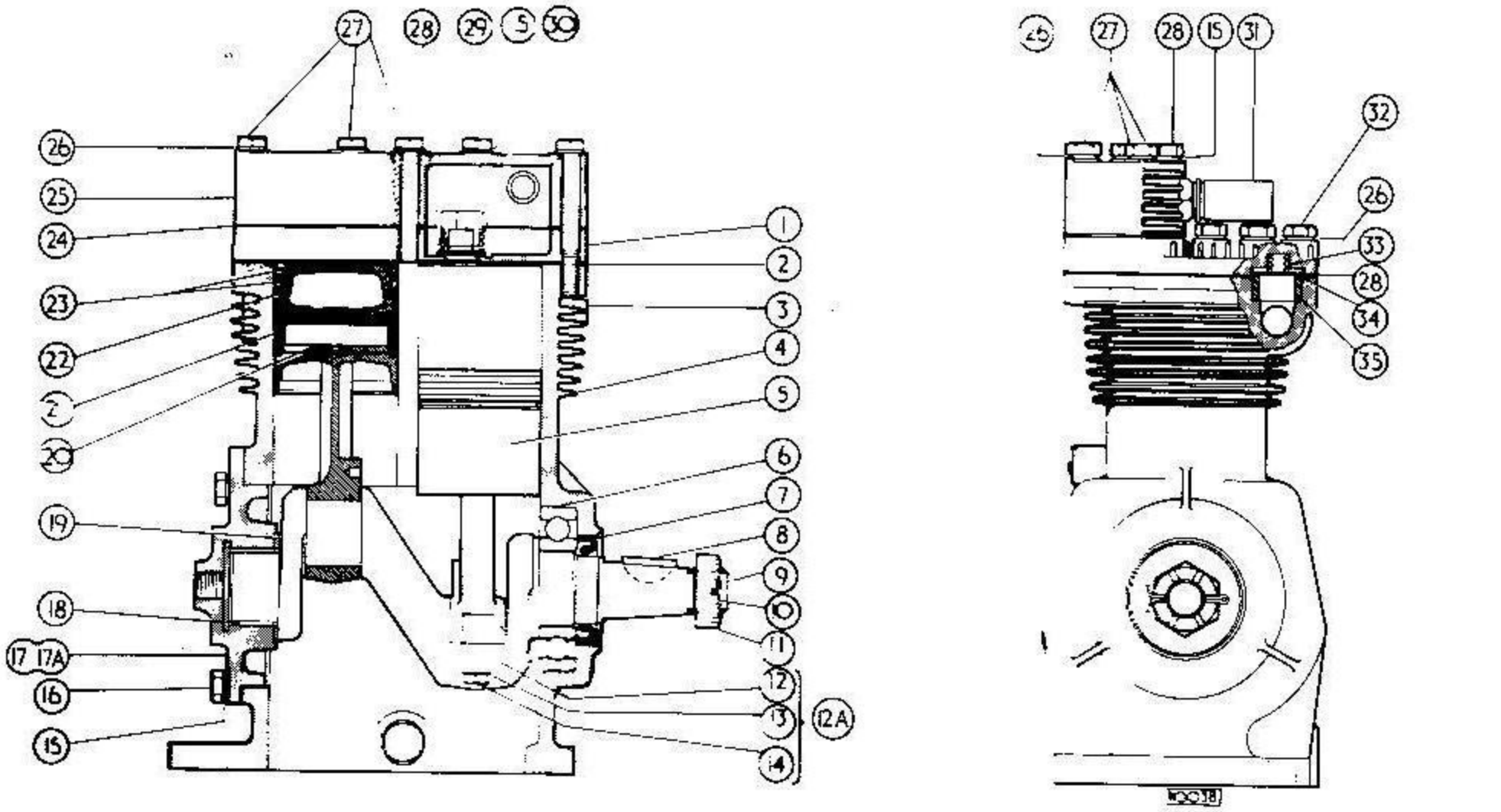


Fig. 12 The air compressor (typical)

1 Cylinder head
2 Gasket
3 Plug
4 Cylinder and crankcase assembly
5 Piston
6 Main bearing, drive end
7 Oil seal
8 Woodruff key
9 Crankshaft
10 Split pin
11 Nut
12a Connecting rod assembly
12 Connecting rod and cap
13 Tab washer
14 Connecting rod bolt
15 Spring washer
16 Bolt
17a Bearing cover assembly
17 Bearing cover
18 Bearing bush, non-drive end
19 Thrust washer
20 Gudgeon Pin
21 Circlip
22 Piston ring (oil)
23 Piston ring (compression)
24 Gasket
25 Delivery manifold
26 Spring washer
27 Bolt
28 Valve disc – suction and delivery
29 Bolt
30 Valve spring – delivery
31 Safety valve
32 Bolt
33 Valve spring – suction
34 Valve guide
35 Valve seat – suction valve
36 Bolt

Check the piston side play and if in excess of .01" (.26 mm) the piston should be renewed.

The pistons are provided with two internally steoped compression rings and one scraper ring.

Check the ring gap and renew if the gap is greater than .01" (.26 mm); minimum gap .003" (.08 mm) with .001" - .002" (.026 - .052 mm) side play. These limits apply to both scraper and pressure rings.

NOTE: When replacing the compression rings CHECK THAT THE INTERNAL STEP IS AT THE TOP.

Check the cylinder bore wear for ovality and if in excess of .005" (.127 mm) the cylinder should be rebored and oversize pistons fitted.

Original bore diameter 2.5" (6.35 mm).

Details of oversize pistons can be obtained from the manufacturers.

Check the gudgeon pins. If any play is felt renew the pin, piston or small end bush, whichever may be worn.

Remove the gudgeon pins by extracting the gudgeon pin circlips and drifting out the pin with a soft drift.

Should a new small end bush be required, these are supplied by the manufacturers slightly undersize on the internal diameter. Ensure that the oil hole in the bush is in line with the hole in the connecting rod when refitting and ream the bush to .6255" - .626" (15.8 - 15.9 mm) parallel to the big end bearing.

Check the conditions of the big end bearings and renew if any play is felt. The bearing shells are white metal lined, steel backed half shells and no scraping is permissible. Care must be taken to ensure that the nicks provided in each half bearing are correctly located in the connecting rod or cap.

Check the plain bearing at the non-driving end of the crankshaft. It is important that no wear exists as any such wear will result in loss of oil pressure to the big end bearings.

NOTE: When replacing the bearing it is important that it is fitted with the oil groove nearest to the cylinder bore.

Assembling

Assembling is the reverse of the dismantling procedure but care should be taken to ensure that absolute

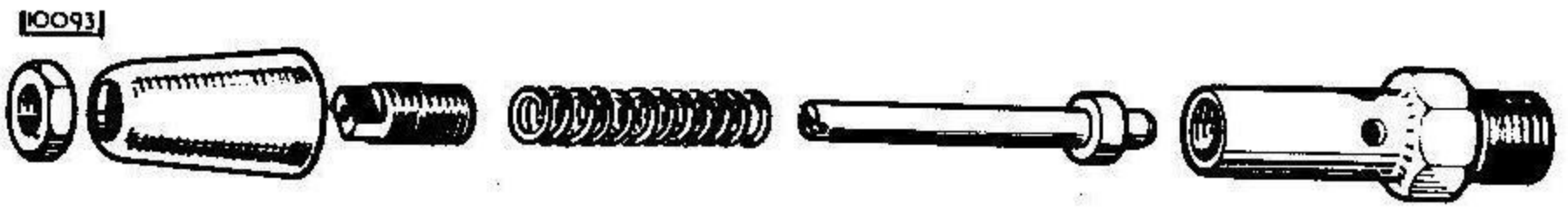


Fig. 13 Exploded view of Clayton—Dewandre safety valve

cleanliness is maintained during the assembly of the components.
Any gaskets that are removed should be renewed and may be made from brown paper .005" - .006" thick if the standard gaskets are not available. The cylinder head gasket should be made from "Oaken-strong" jointing 1/64" thick. No jointing compound should be used on the cylinder head joint.
When replacing the cylinder head it should be drawn down evenly, tightening down the centre setscrews first. It is recommended that the pumping up times for given engine speeds are taken when the compressor is first replaced in service; these figures will provide a useful check on the efficiency of the machine at any future date. Coat the thread of the safety valve lightly with jointing compound before inserting into the valve cap. Care must be taken to ensure that no jointing compound enters the valve chamber.
The safety valve should be overhauled before refitting to the compressor.

The Clayton—Dewandre Safety Valve
Dismantling
Release the locknut and remove the adjusting screw. Lift out the valve stem, spring and valve.
Wash all parts in cleaning fluid.
Examine the valve for pitting and scratches. Renew if necessary. Clean the valve seat.

Re-assembling
Re-assembling is the reverse of the dismantling procedure.
Insert an accurate pressure gauge in the pressure line and set the valve to "blow off" at 150 lbs/per sq.in. (10.55 kg/cm^2).
Adjust by releasing the locknut and turning the adjusting screw clockwise to raise and anti-clockwise to lower the setting. Tighten the locknut screw after adjustment.

The Westinghouse Safety Valve
Dismantling
Unscrew the spring cage from the body of the valve. Lift the ball valve from the body and remove the spring seat, spring and release pin from the spring cage.
Wash all parts in cleaning solvent.
Examine the ball for signs of pitting or scratches. Renew if necessary. Clean the ball valve seat thoroughly.

Re-assembling
Place the ball valve in the body of the safety valve. Place the spring release pin and spring in the spring cage with the adjusting screw assembly. Position the spring seat over the ball valve and screw the cage to the body.
Insert an accurate pressure gauge in the air pressure line and set the safety valve to "blow off" at 150 lbs./per sq.in. (10.55 kg/cm^2).
Adjust by releasing the locknut and turning the adjusting screw clockwise to raise the setting and anti-clockwise to lower. Tighten the locknut after adjustment.

THE BRAKE SHOE ASSEMBLIES

Removal
Automatic Brake Shoe Adjusters
Firmly apply the handbrake when the front brake assemblies are to be changed and securely chock the front wheels when the rear brakes are to be changed. Jack up the front or rear of the vehicle and remove the road wheels.
Slacken off the brake adjuster by depressing the pawl release lever and rotating the squared end of the ratchet wheel shaft anti-clockwise.
Remove the brake drum from the hub by withdrawing the nine setscrews and utilizing the jack tappings provided.
Detach the ratchet lever link from the brake cam lever by discarding the split pin, and withdrawing the clevis pin.
Insert a suitable lever through the aperature between the thrust plate and the nose of the brake shoe assembly and allow it to contact the projection of the pull off spring lever, take the tension of the pull off spring with the lever and withdraw the brake shoe release pin from the brake shoe thrust plate; repeat the sequence with the second brake shoe assembly. Remove the brake shoe adjuster assemblies from the brake camshaft by moving them vertically up and down to clear the internal connecting piece.
Remove the brake shoe anchor pivot washer from the outer end of each anchor pin by tapping back the tab washer and extracting the two bolts. Remove the clamp bolt from the inner end of the pin and withdraw the pin. When withdrawing the pin note the location of the five

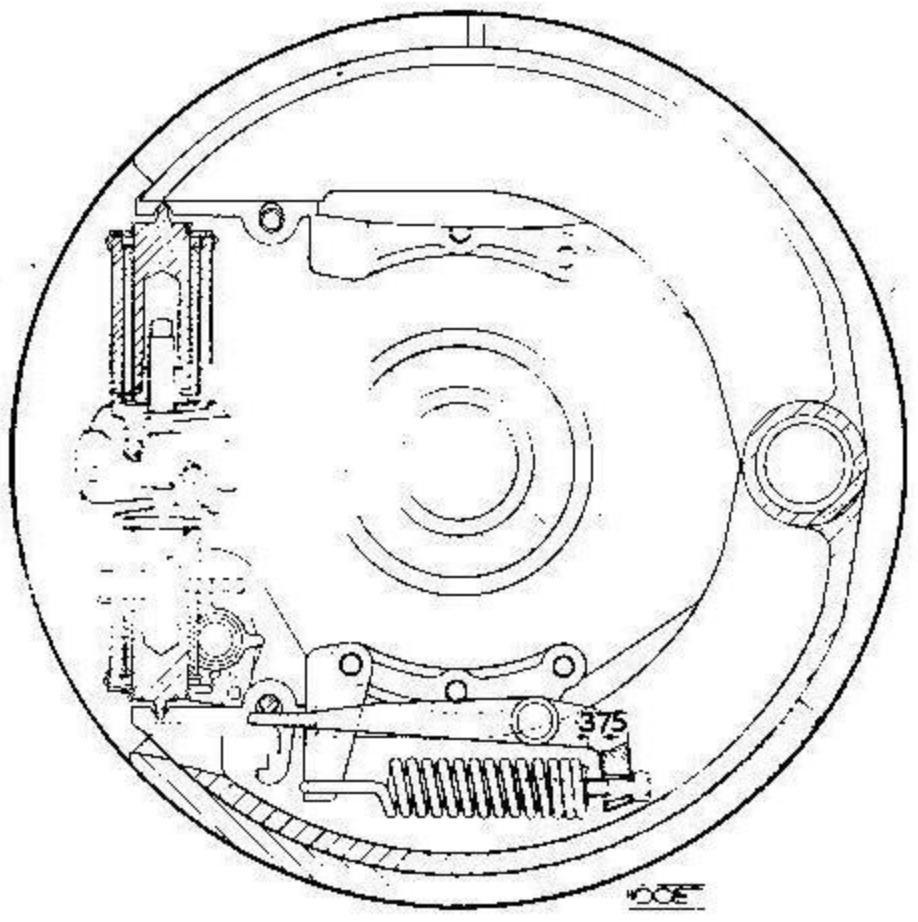


Fig. 14 Diagrammatic view of the strut brake

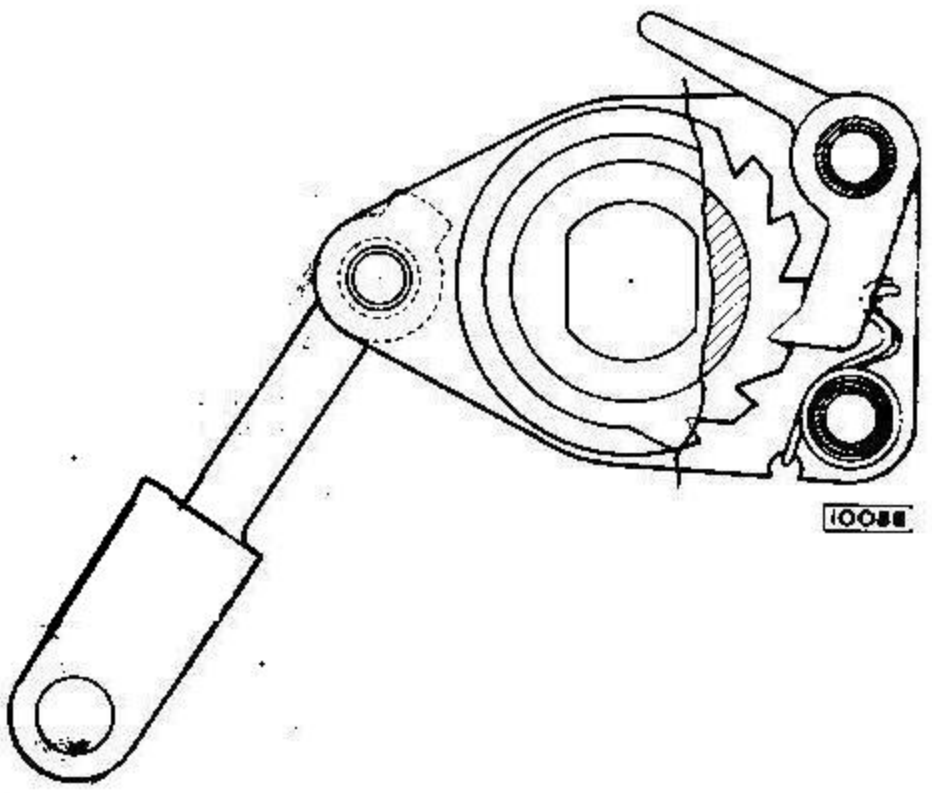


Fig. 15 Section through pawl ratchet assembly

O ring seals fitted to each pin. Remove the thrust plates from the nose of each brake shoe assembly by withdrawing four countersunk screws. Extract the two dowel pins

Manual Brake Shoe Adjusters

Proceed as given for the automatic adjusters with the exception of the method employed to slacken off the brake shoe assemblies.

There being no ratchet, pawl and link assembly it will only be necessary to rotate the squared end of the worm shaft anti-clockwise to slacken off the brakes.

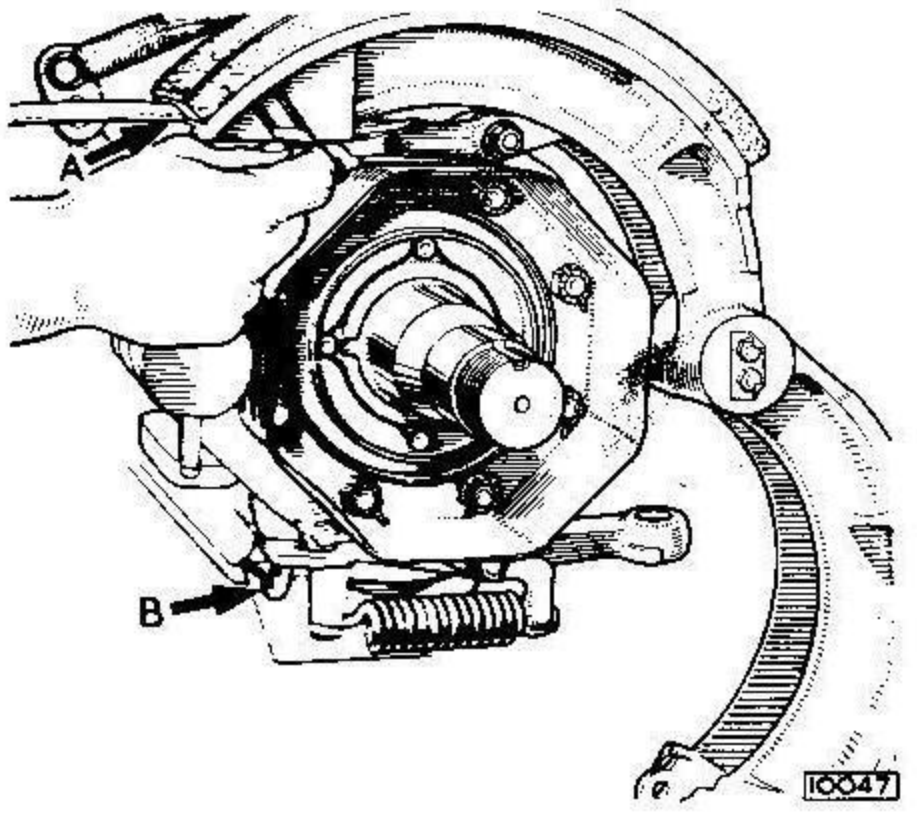


Fig. 16 Method of releasing the tension on the pull-off spring and withdrawing the release pin

A Shows the lever inserted
B Shows projection of pull-off spring lever

Refitting

Refitting is the reverse of the removal procedure for both manual and automatic adjusting systems.

Overhaul the automatic adjusters on the latter system before assembly as detailed in "The Automatic Adjusters". Care must be taken when assembling the brake shoe pivots that the 'O' ring oil seals and the distance piece are fitted in the same order as removed.

Renew the oil seals if worn or damaged.

After refitting the brake shoe, clearance must be checked and balanced as detailed in "Brake Drum Lining Clearance — Balancing".

THE AUTOMATIC ADJUSTER

Dismantling

For the convenience of these instructions, details of the brake shoe adjuster having the ratchet assembly attached is referred to as the adjuster (left-hand thread) and the body as the driving body, and their counter parts in the opposite brake shoe adjuster as the adjuster (right-hand thread) and the driven body respectively.

Detach the spring cap from the squared end of the ratchet wheel shaft by depressing the cap and withdrawing the split pin and washer.

Note the side of the driving body to which the ratchet wheel is attached. Withdraw the ratchet wheel assembly and backlash spring from the ratchet wheel shaft and detach the worm shaft spring from the ratchet assembly.

Eject the worm shaft by pushing the squared end of the shaft through the body.

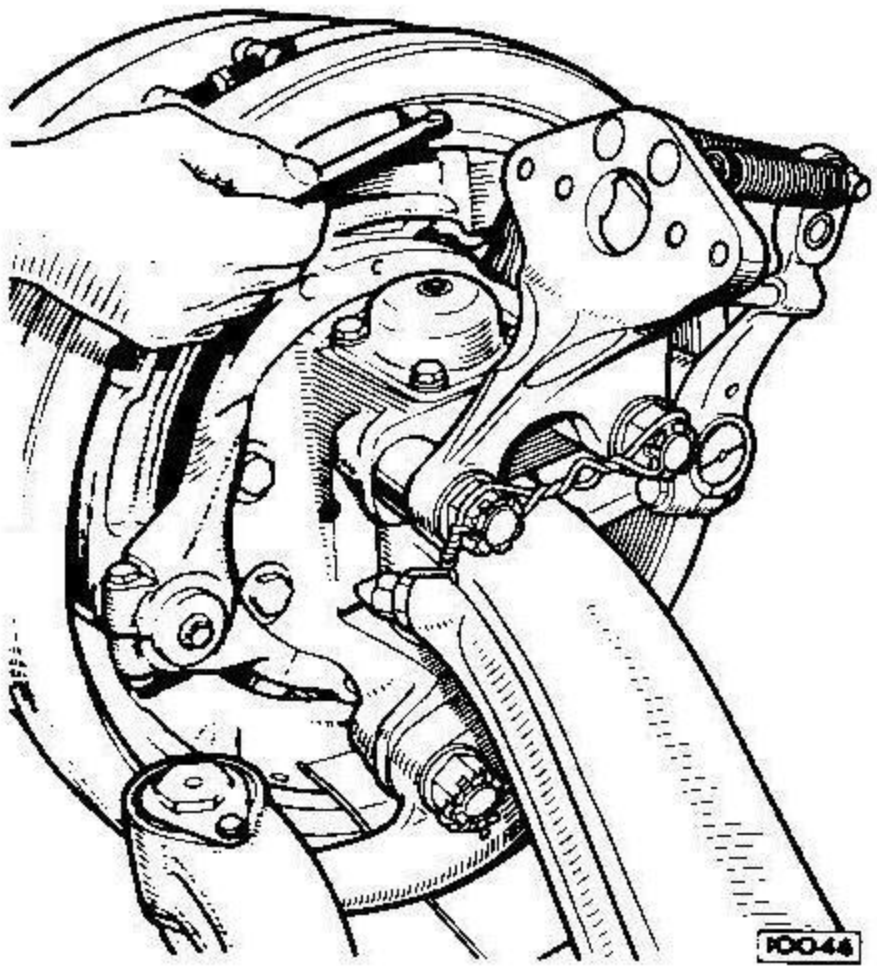


Fig. 17 Checking the brake drum — lining clearance

Detach the rubber boot from the end of the driving body and remove the circlip now exposed.
Withdraw the adjuster screw, adjuster sleeve and flexible connector. Unscrew the adjuster screw (left-hand thread) from the adjuster sleeve by rotating in an anti-clockwise direction. The dismantling of the second brake shoe adjuster assembly is effected in a similar manner but in this instance the flexible connector is replaced by a driving piece and the adjuster screws have right-hand threads.
Wash all components in cleaning solvent and examine for wear. Particular attention should be paid to the condition of the ratchet wheel teeth and the pawl. If worn, both or either should be replaced.
NOTE: In order to facilitate the servicing of the ratchet assemblies, the two side carrier plates are secured together with small sleeved bolts and nuts.
IMPORTANT: Brake shoe adjusters should always be removed, stripped, and examined when the brake shoes are relined.

Assembling
The assembly of the adjuster is the reverse of the dismantling procedure. Care should be taken to ensure that the adjuster screw (left-hand thread) is fitted with the correct adjuster sleeve to the driving body and the ratchet assembly is fitted to the side noted on removal. Coat all parts with a silicone-based grease when re-assembling.

BRAKE DRUM – LINING CLEARANCE

Balancing – Automatic Adjusters
Apply the brakes by depressing the brake pedal, or, turn the squared end of the ratchet shaft until the ratchet wheel and pawl cease to operate. Check the brake drum lining clearance by inserting a feeler gauge between the brake drum and each brake shoe at a point approximately mid-way along their surface. The correct clearance with the brakes fully adjusted should be 0.015" (0.381 mm). Record the difference between the two readings obtained.
NOTE: If the brakes are checked with the weight of the vehicle off the road wheels, the clearance of the bottom shoe will normally be greater than the upper shoe by .005" (.127 mm). This is due to the float in the hub bearings. Remove the brake drum and detach the driven brake shoe adjuster as described under "Brake Assembly – Removal". Care should be taken that the adjuster struts are not rotated during removal.
Grip the brake shoe strut in a vice and while holding the body steady, rotate by means of a square ended tool, the driven piece located in the adjuster body 1/4 turn (one flat of the square).
1/4 turn will increase or decrease the clearance by .010" (.254 mm). Rotate clockwise to increase or anti-clockwise to decrease the clearance.
Refit components and brake drums and re-check. Repeat adjustment if necessary until a correct even clearance is obtained.

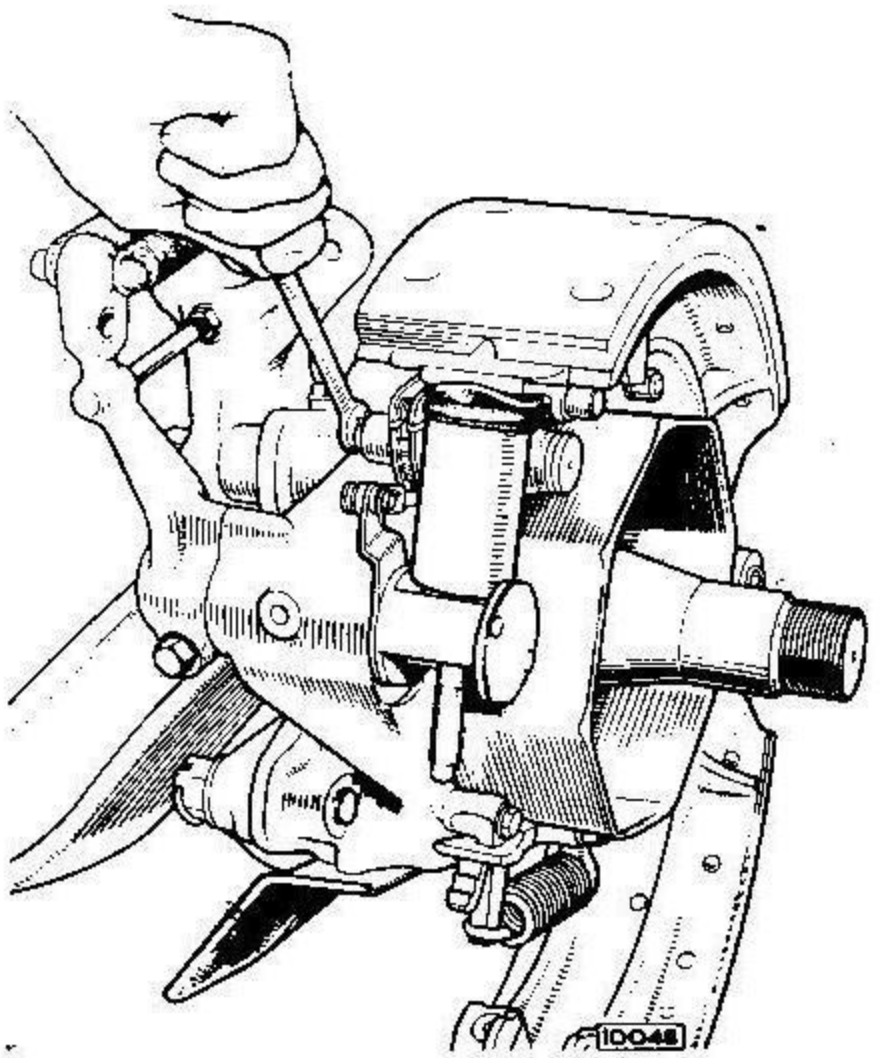


Fig. 18 Method of adjusting for balance (the brake drum is removed for clarity)

THE ALCOHOL EVAPORATOR

DESCRIPTION

The purpose of the alcohol evaporator is to permit vaporized alcohol to be drawn into the air brake system and so guard against any possible interruption of braking service when a vehicle is operating in below freezing temperatures.

The device consists of a casting attached to a bracket mounted on the engine and forming a support for a plastic container for ordinary methyl alcohol, which in a vaporized state, is drawn into the brake system.

Operation

When the compressor is operating, a partial vacuum is present in the compressor intake manifold.

The evaporator is connected by a small bore pipe to the same manifold, therefore, a partial vacuum is also created above the liquid in the container.

Atmosphere passes through the air strainer, through the cored passage in the cover, down the tube leading to the bottom of the jar, and then bubbles up through the alcohol and out via the pipe line to the compressor intake manifold.

The passing of the air bubbles through the alcohol causes some of the liquid in the form of vapour to be carried along with the air stream through the compressor and into the brake system.

The alcohol thus introduced into the system acts as an anti-freeze.

Removal

Disconnect the pipe line union, remove the mounting bolts and detach the evaporator.

Refitting

refiting is the reverse of the removal procedure.

Fill the container about two-thirds full of commercially pure methyl 188 proof alcohol. The alcohol should be free from any ibhibiter.

Dismantling

Unscrew the container from the cover body.

Detach the strainer from the cover; unscrew the filler plug and remove the filler plug and container gaskets.

Withdraw the evaporator tube and connector from the body.

Cleaning and Inspection

Wash all metal parts in cleansing solvent.

Check that the evaporator tube and connector are not plugged or restricted with foreign matter.

Check that the container is not damaged.

Renew all gaskets and all damaged parts.

Re-assembly

Re-assembly is the reverse of the dismantling procedure.

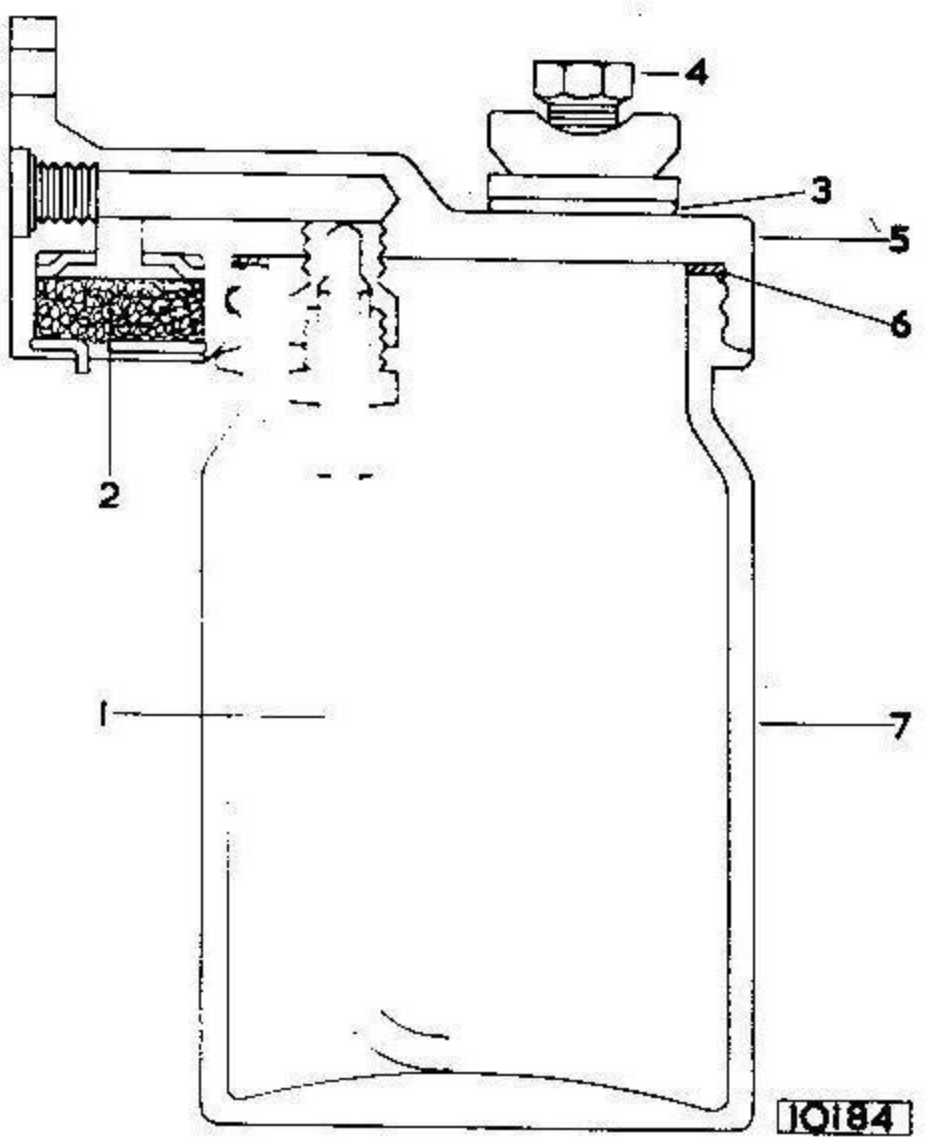


Fig. 19 The alcohol evaporator

1 Tube
2 Strainer
3 Filler plug gasket
4 Compressor connection
5 Cover body
6 Cover gasket
7 Container

THE LOW PRESSURE SIGNAL UNIT

The WESTINGHOUSE low pressure signal unit is fitted to Daimler vehicles as an optional extra to Operator's requirements and indicates visually to the driver when the air pressure in the reservoir falls below a safe value.

The unit can be used in conjunction with, or, can replace the brake air pressure gauge fitted as standard equipment.

The low pressure signal consists of a cast body with a slot in the top for the signal arm, a removable cover on the lower side for inspection and maintenance and is open-ended at one end.

Bolted to the open end is a combined air connection and cylinder head and at the opposite end the signal arm is pivoted. A spring loaded piston assembly is connected to the signal arm at one end by a pin through the piston rod, the piston at the other end of the assembly operates in the cylinder head.

A section of the piston rod is threaded and carries the spring adjusting nut and spring seat.

Operation

Air from the brake reservoir enters the cylinder head and provided the pressure is above the pre-determined

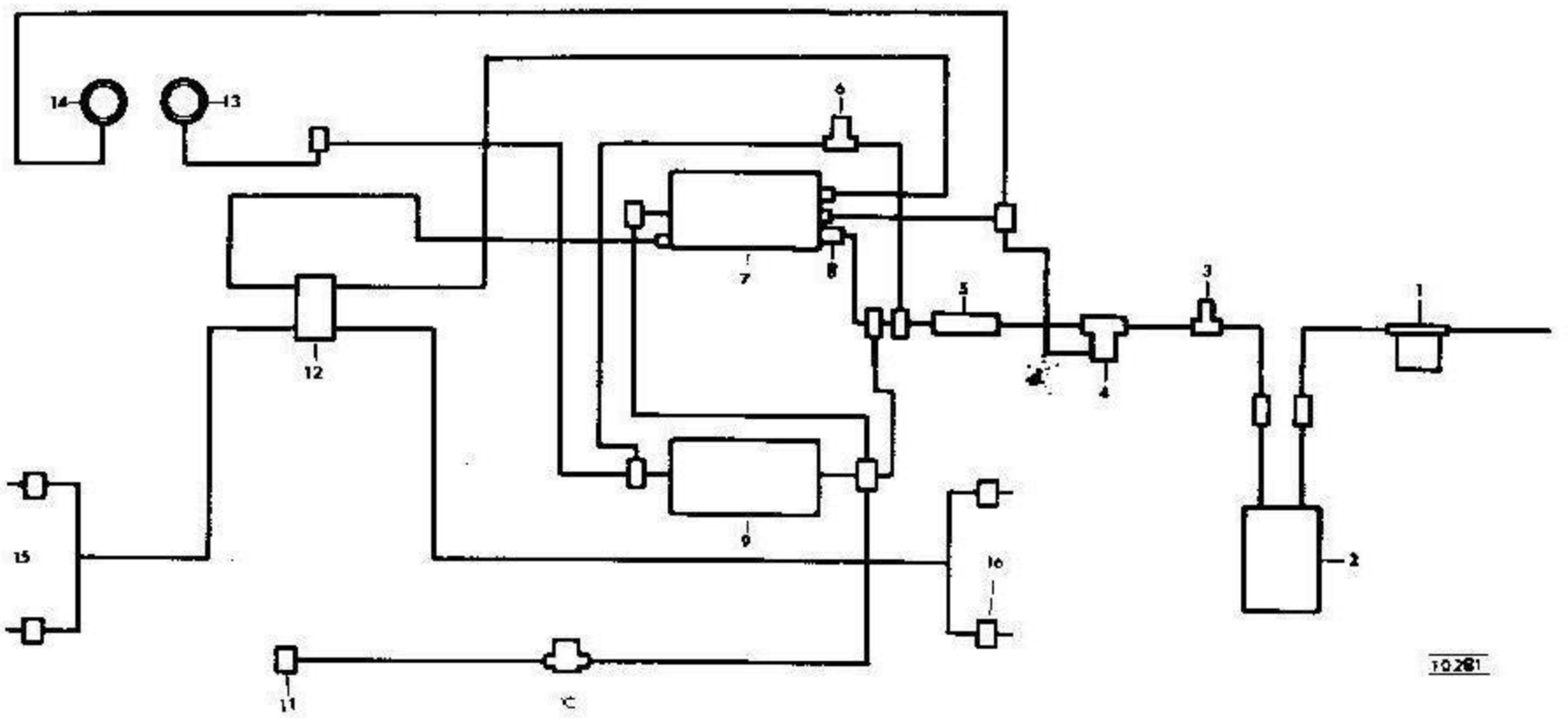


Fig. 20 Layout or air pressure equipment

1 Anti-freezer unit
2 Compressor
3 Safety valve
4 Automatic drain valve
5 Unloader valve
6 Limiting valve
7 Outer reservoir
8 Non-return valve
9 Inner reservoir
10 Power-assisted handbrake valve
11 Power-assisted handbrake chamber
12 Foot valve
13 Auxiliary pressure gauge
14 Main pressure gauge
15 Front brake chambers
16 Rear brake chambers

minimum value the movement of the piston to the right will compress the spring, and the signal arm will be held horizontally within the body.
If the reservoir pressure falls below the minimum value the spring overcomes the decreased load and the signal arm is raised.
If the signal arm is in any other position than the horizontal, that is completely within the body, then it must be assumed that the main reservoir pressure has fallen below its safe minimum value, and the fault must be rectified. The unit normally requires attention only at vehicle overhaul periods when it should be completely dismantled, cleaned and inspected.

Dismantling
Remove the set screws and washers and detach the bottom cover and the cylinder head.
Turn the adjuster nut towards the piston until the spring tension is relieved.
Remove the signal arm split pin and move the signal arm until the pin linking the piston rod to the signal arm is in line with the hole in the body. Push out the pin and remove the piston assembly from the body.
Remove the nut, spring washer and pivot pin and withdraw the signal arm.

Inspection
Wash the piston packing cup in soap and water and dry with a low pressure air jet, examine for signs of wear or damage and renew if necessary.

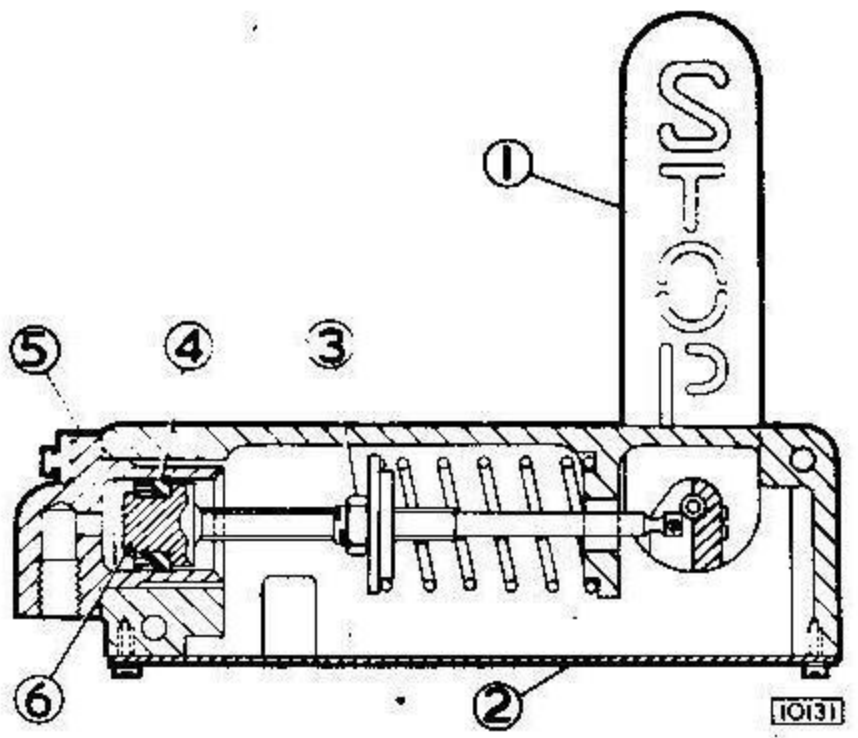


Fig. 21 The Westinghouse low pressure signal unit

Wash all metal parts in cleansing solvent and dry with an air jet.
Examine the cylinder bore for signs of scoring and renew if badly damaged.
Check the pins for wear, and the spring for sufficient tension.

Reassembly
Re-assembly is the reverse of the removal procedure. Lightly smear the cylinder bore, packing cup and pivot

pins with a good grade grease such as John Etherington's Paragon "Artic".
Do not fit the bottom cover until the signal has been correctly adjusted as detailed under "Testing".

Testing
Testing should be carried out as follows on a test lay out as shown below.
Open cock (1) and charge to main reservoir pressure of 55 lb/sq.in. (3.8 kg/cm^2).
Close cock (1) and slightly open cock (2) reducing the pressure to the signal.
Note the pressure recorded on the gauge at which the signal arm moves towards the vertical position; this should not be less than the minimum effective working pressure of 40 lb/sq.in. (2.8 kg/cm^2).
If the correct pressure setting is not obtained alter the spring setting by means of the adjusting nut and repeat the test.
Refit the bottom cover when the test is completed.

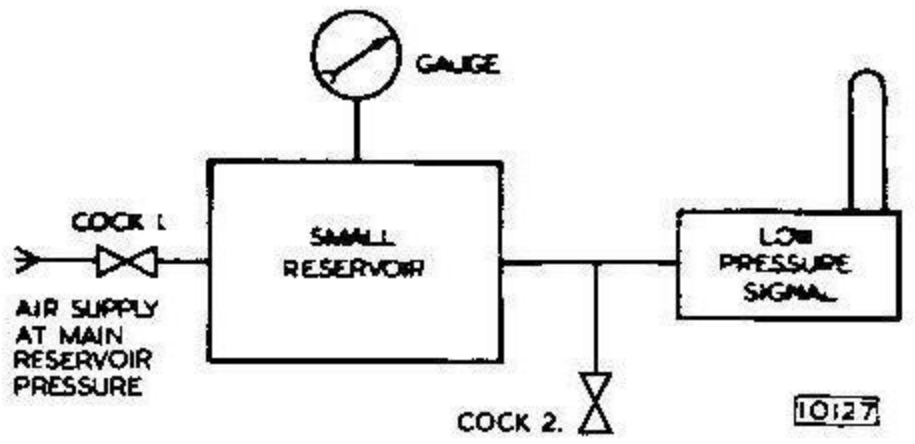


Fig. 22 The low pressure signal test lay-out

THE CONDENSER AND DRAIN VALVE

The Clayton–Dewandre condenser drain valve unit is fitted as optional equipment to CRG6 (Fleetline) chassis to suit Operator's requirements.

DESCRIPTION

The Condenser and Drain Valve combined unit is used in the vehicle air pressure system to filter and dry the air delivered by the compressor, the drain valve automatically draining the condensate which collects at the bottom of the condenser cylinder.
The assembly is mounted in the air line between the compressor and the main reservoir and is connected by a control air line to the governor valve.
The unit consists of a cylinder, a spring loaded filter assembly, and an automatic drain valve which is secured to the cylinder base plate.
The air filter assembly comprises a paper ribbon type filter element and a filter retainer. During normal operation, the assembly is held upwards by the spring located between the retainer and the base plate.
The retainer is fitted with a sealing ring to prevent unfiltered air from escaping into the delivery port.

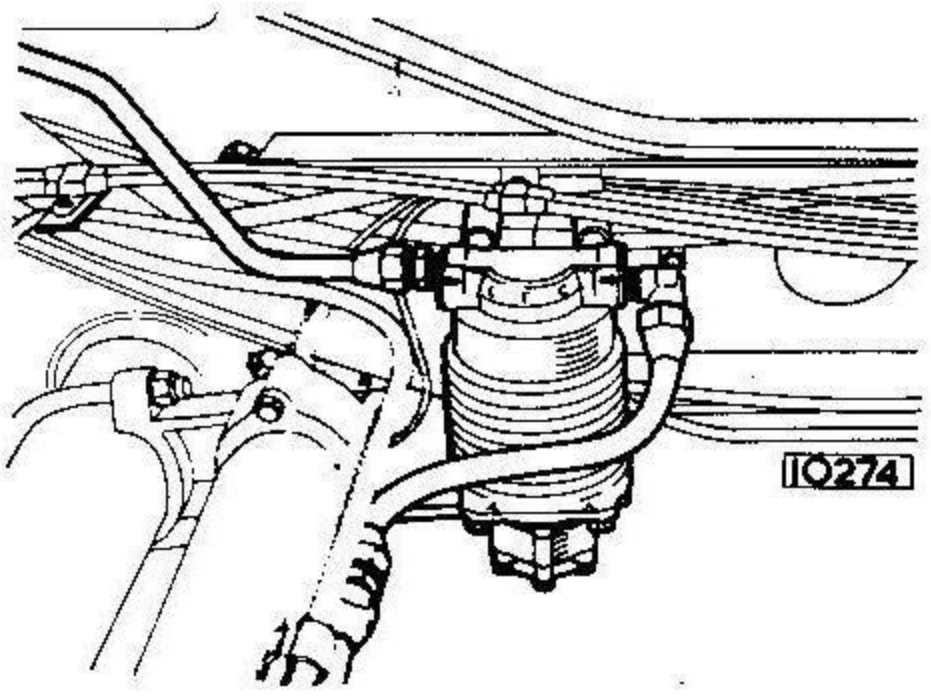


Fig. 23 Location of condenser/drain valve

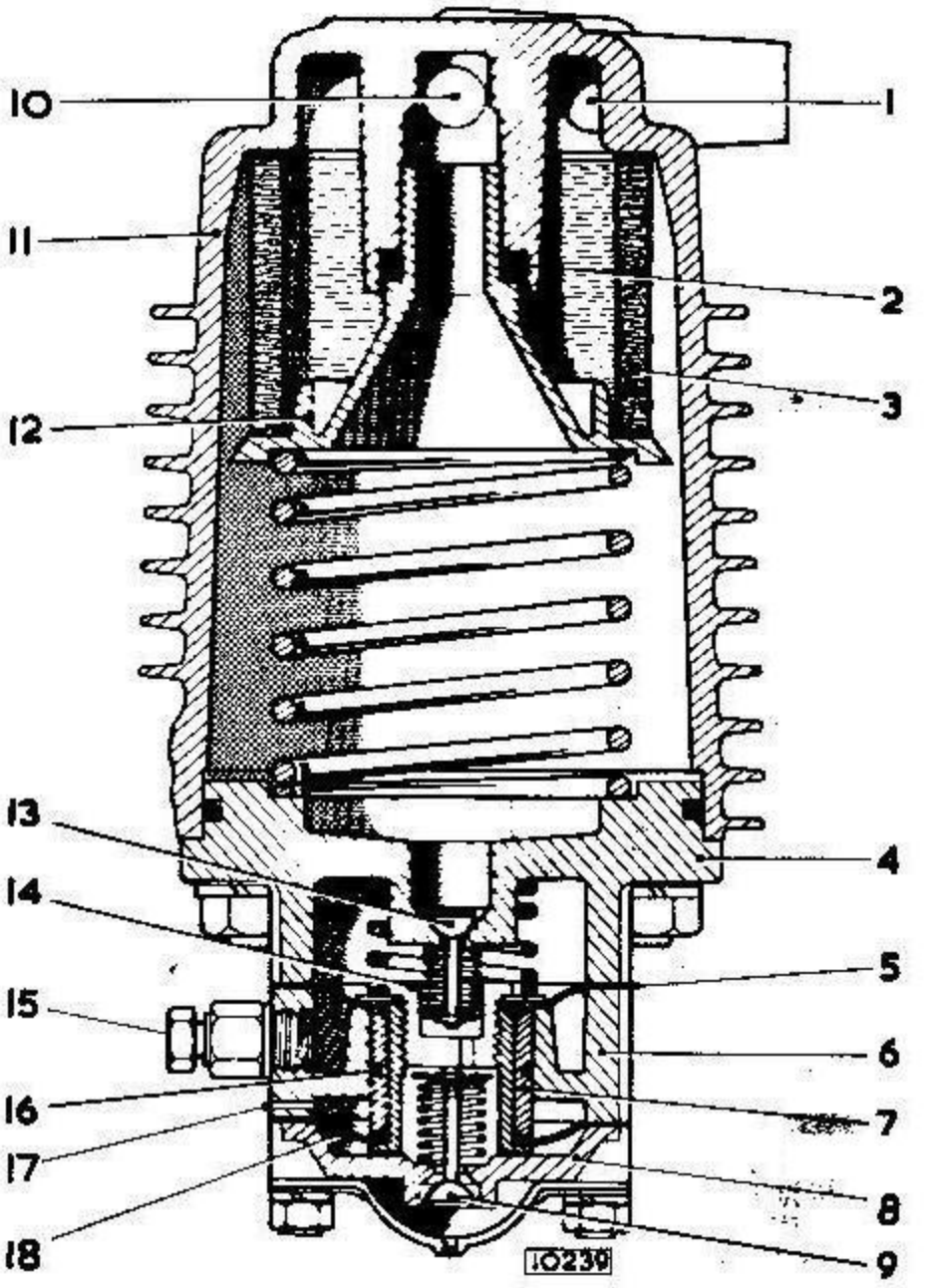


Fig. 24 The condenser/drain valve

1 Air inlet port
2 Sealing ring
3 Filter element
4 Cylinder base plate
5 Diaphragm
6 Valve body
7 Piston
8 Bottom cover
9 Lower valve
10 Air delivery port
11 Cylinder
12 Filter retainer
13 Upper valve
14 Valve centre guide
15 Control air line connection
16 Sealing ring
17 Breather vent
18 Diaphragm
19 Drain valve

The drain valve assembly comprises two valve assemblies and a valve operating assembly contained in a body, bottom cover and cylinder base plate. The valves are spring loaded against conical seats in the base plate and bottom cover.
The valve operating assembly consists of two diaphragms clamped between the base plate, body and bottom cover, and fitted one at each end of a piston which operates in a bore in the body.
The assembly is biased towards the bottom of the valve by a return spring.

OPERATION

Air delivered by the compressor enters the condenser and drain valve unit via the inlet port and passes through the filter element. The element prevents any dirt which may be present in the air, from passing through the unit to the air pressure system.
On emerging from the filter element, the air impinges on the cold wall of the unit and the moisture in the air condenses and drains to the bottom of the cylinder.
The dry air passes through the narrow gap between the filter retainer and the cylinder, and then passes upwards through the passage in the filter retainer and out of the delivery port to the air pressure system.
In the event of the filter becoming blocked, the consequent increase in air pressure above the retainer would cause the retainer to move downwards against the resistance of the spring and the air would by-pass the filter and pass through the unit as previously described. Moisture would continue to condense in the unit and the supply of dry air would not be interrupted.
The automatic drain valve removes the condensate which collects at the bottom of the cylinder. When the drain valve control line is open to atmosphere through the control unit, the upper valve in the unit is seated and prevents compressed air from escaping from the cylinder via the drain valve orifice.
When compressed air from the controlling unit passes through the line to the drain valve body, the air pressure build up under the upper diaphragm causes the valve operating assembly to move upwards. The lower valve is lifted by its spring and closes the passage through the bottom cover.
Further upward movement of the operating assembly then lifts the upper valve off its seat, and condensate and air pass from the cylinder to the chamber above the upper diaphragm and through a hole in the valve centre guide to the chamber below the lower diaphragm. The lower valve is held seated by its spring which is strong enough to hold the valve seated against full reservoir pressure during operation.
When the control unit releases the air pressure from the control line to the atmosphere, the valve operating assembly is moved downwards by the return spring. When this occurs, the upper valve is reseated by its spring and the lower valve opens, allowing the condensate and air to exhaust through the drain port.

Filter Element – Cleaning.
Remove the filter element for cleaning and inspection.
Apply the handbrake or block the roadwheels.
Remove grease and dirt from the cylinder base plate and lower part of the cylinder.
Brush away dirt from the control line connection, disconnect the air line from the valve and seal the unions to prevent the ingress of dirt.
Remove the filter element as detailed under "DISMANTLING".
Clean the element by directing air pressure through the wall from the outside. If the element is very dirty, wash in petrol or paraffin and dry in clean air.
Renew the element if worn or damaged.
Check that the sealing rings on the filter retainer and the cylinder base plate are in good condition.
Place the filter retainer on the spring. Fit the spring on the cylinder base plate and check that the spring is correctly located in the recesses in the base plate and retainer.
With the drain valve air line connection facing towards the control air line, insert the assembly into the cylinder.
Fit the spring washers and nuts and tighten evenly to a torque of 200 lb/in. (2.26 kgm).
Reconnect the control air line.
Check that the unit is securely mounted.
Check air connections.

OPERATING TESTS

Charge the air pressure system to the normal maximum pressure and stop the engine.
Decrease the air pressure by applying and releasing the brakes, and check that the drain valve exhausts a small volume of air and/or water when the air pressure in the system has been reduced to the compressor cut-in pressure.
If the valve does not function correctly, check the controlling unit for satisfactory operation and the control line connections for security. If these are satisfactory, the fault is attributable to the drain valve.

AIR LEAKAGE TESTS

NOTE: The unit should be drained of any condensate by causing the drain valve to operate before testing the unit for air leakage.
Charge the system to the normal operating pressure and stop the engine.
Coat the condenser/drain valve unit and air line connections with a soap solution.
Leakage from the drain port in excess of a 1/2" (12.0 mm) soap bubble in five seconds is not permissible. Air leakage indicates that the lower valve and/or seat is defective.
Excessive leakage indicates that the upper diaphragm has ruptured.

Leakage from any other part of the unit or from the air line connections is not permissible.
Leakage from the breather vent indicates that the piston sealing ring or lower diaphragm is defective.
Reduce the pressure in the reservoir by applying and releasing the brakes until the drain valve operates and exhausts a small volume of air, then coat the drain port with soap solution. Leakage from the port in excess of 1/4" (6.00 mm) soap bubble in five seconds is not permissible. Leakage indicates that the upper valve and/or seat is defective.
If the tests indicate defective parts or loose connections, these must be rectified.

Removal
Apply the handbrake or chock the wheels and release all air pressure from the system by applying and releasing the brakes.
Brush away dirt from the unit, disconnect the air lines and take precautions to prevent dirt from entering the air lines and the unit.
Remove the mounting blocks and detach the unit from the chassis frame.

Refitting
Refitting is the reverse of the removal procedure.
Carry out the operating and air leakage tests as detailed previously.

Dismantling
Remove the grease and dirt from the exterior of the unit.
Mark the cylinder, cylinder base plate and drain valve body prior to dismantling to show their correct relationship.
Progressively, unscrew the four nuts securing the base plate to the cylinder.
Remove the plate and withdraw the spring, filter retainer and element. Remove the sealing rings from the retainer and base plate.
Slacken the nuts and rest the drain valve on a flat surface, drain cap uppermost. Press the drain cap downwards against the force of the valve operating mechanism return spring and complete the removal of the nuts and washers.
Taking care not to damage the lower diaphragm against the studs, withdraw the body, cover, drain cap and drain cap disc.
Carefully unscrew the nuts from the valve stems and remove the valves, springs and spring retainers.
Unscrew the valve centre guide from the diaphragm retainer; remove the diaphragm plate and diaphragm.
Withdraw the piston from the body and separate the diaphragm retainer, diaphragm and piston. Remove the piston sealing ring.

Cleaning and Inspection
Wipe the rubber parts with a clean cloth.

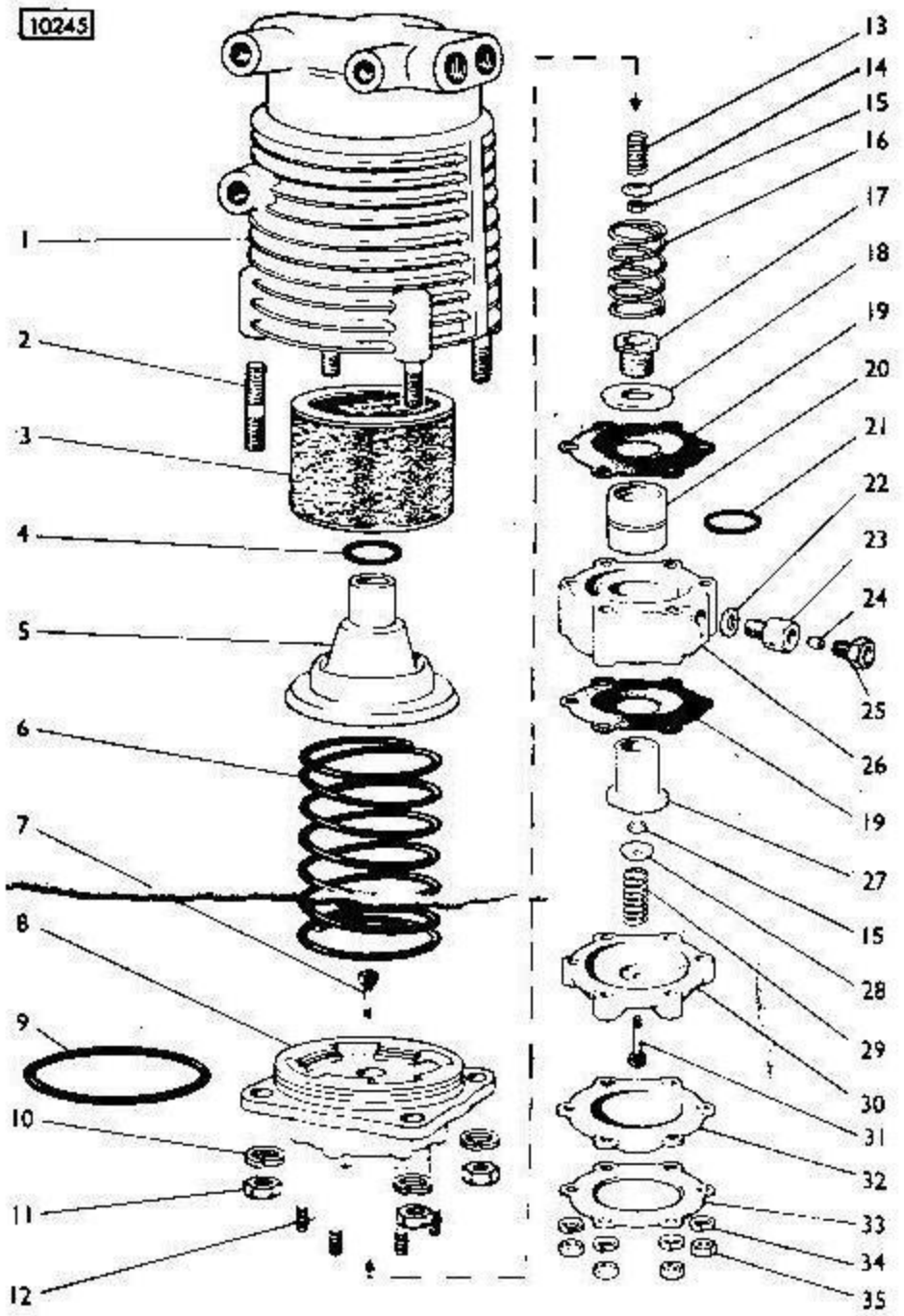


Fig. 25 Exploded view of the condenser/drain valve

1 Cylinder
2 Stud
3 Filter element
4 Sealing ring
5 Filter retainer
6 Spring
7 Upper valve
8 Cylinder base plate
9 Sealing ring
10 Spring washer
11 Nut
12 Stud
13 Spring for upper valve
14 Spring retainer
15 Nut
16 Spring
17 Valve centre guide
18 Diaphragm plate
19 Diaphragm
20 Piston
21 Sealing ring
22 Washer
23 Adaptor
24 Olive
25 Nut
26 Valve body
27 Diaphragm retainer
28 Spring retainer
29 Lower valve spring
30 Bottom cover
31 Lower valve
32 Drain cap
33 Drain cap disc
34 Spring washer
35 Nut

Clean the filter element as detailed under the 10,000 miles (16,000 km) Service. Renew if necessary.
Wash all other parts in cleaning solvent and dry with compressed air. Check that the breather vent in the valve body and the hole in the valve centre guide are unobstructed.
Examine the cylinder, base plate, drain valve body and bottom cover for cracks or damage.
Check the threads for damage, and the bore in the drain valve body for excessive scoring.
Examine the filter retainer for damage and check that the retainer moves freely in the bore in the cylinder.
Examine the valves for wear and deterioration of the rubber and the seats in the bottom cover and base plate for wear and damage.
Check the springs for distortion. Check that the polythene coating of the filter retainer spring is not damaged.
Examine the diaphragms, sealing rings and pistons for wear and deterioration, and the drain cap for damage.

Re-assembly
Renew all parts found to be defective.
Position one of the diaphragms on the diaphragm retainer with the flat side against the retainer flange. Fit the sealing ring on the piston and slide the piston onto the retainer. Check that the rubber beading on the diaphragm is seated correctly in the recess in the piston.
Smear the piston and the bore in the valve body with 'Valvoline X-5 Regular' or equivalent grease, and insert the piston into the breather end of the body, taking care not to damage the sealing ring.
Position the other diaphragm on the piston and insert the rubber beading in the recess in the piston.
It is IMPORTANT that the diaphragm is fitted correctly. Fit the diaphragm plate with the radius on the outer edge facing towards the diaphragm.
Screw the valve centre guide into the retainer and tighten to a torque of 120 lb./in. (1.35 kg/m).
The threaded parts of the valve stems and the nuts should be free of oil or grease before assembling; if the valve nuts are of different sizes the smaller nut should be fitted to the upper valve.
Insert the short valve assembly into the base plate and fit the small diameter spring and spring retainer.
Smear the threads with "Grade AA LOCTITE", or equivalent, sealing compound. Screw the nuts on to the stem so that the threads protrudes 1/32" (.08 mm) through the nut.
Assemble the other valve, spring and spring retainer into the bottom cover. Smear the threads with "Grade AA LOCTITE" and adjust as detailed above.
Check that both valve springs are correctly located on their seats.
Position the spring in the base plate, check the mating marks and fit the body. Check that the spring has correctly located on the diaphragm plate.
Assemble the bottom cover, drain cap, disc, spring washers and nuts. Tighten the nuts to a torque of 60 lb/in. (.678 kg/m).
Insert the filter element into the cylinder with a sealing ring at each end.
NOTE: If one ring is smaller than the other, fit the smaller of the two in the recess in the cylinder.
Fit the retainer into the cylinder, ensuring that the element is located correctly on the locating ring.
Lightly smear the base plate sealing ring with "Valvoline X-5 Regular" grease and fit into the recess in the base plate.
Place the spring on the retainer and position the base plate on the spring.
Note the positioning marks made on the base plate and cylinder during dismantling and check that the spring is located correctly in the recesses in the retainer and base plate.
Depress the drain valve assembly and fit the spring washers and nuts. Tighten the nuts to 200 lb/in. (2.26 kg/m).

POWER ASSISTED HANDBRAKE

DESCRIPTION
Power (air pressure) assisted handbrakes are available as optional equipment, supplementing the normal manually operated handbrake system, to operator's requirements.
Movement of the handbrake lever causes a cam on the lever to open an air valve, which in turn allows air pressure to pass from the reservoir to a brake chamber lined to the handbrake linkage on the rear way-shaft.
Releasing the pressure on the lever will allow the air control valve to return to the "OFF" position and air will be exhausted from the brake chamber.
The brakes will be held applied by the pawl and rachet.

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 KM)

Brake Chambers — Checking for Leaks
Check for leaks with the air pressure system fully charged and the handbrake applied as detailed on Page K.8.
The lever must be held "ON" during the test.

Air Control Valve — Checking for Leaks
Check that the exhaust check valve is clean and unobstructed.
Check the valve mounting and the security of the air line connections.
Examine the rubber gaiter for splits or deterioration and replace if necessary.

BRAKING SYSTEM

EVERY 50,000 MILES (80,000 KM)

Brake Chamber — Overhaul
Remove the brake chamber, overhaul and refit. For details of procedure see "BRAKE CHAMBER" page K.14.

Brake Valve — Overhaul
Remove the brake valve, overhaul and refit. For details of procedure see "AIR CONTROL VALVE", page K.28.

THE BRAKE CHAMBER

Removal
Disconnect the air pressure line from the brake chamber. Seal the union connections to prevent the ingress of dirt. Withdraw the clevis pin from the way-shaft linkage, remove two nuts and lockwashers and detached the chamber from the mounting bracket.
DO NOT operate the handbrake when the brake chamber has been removed.

Refitting
Refitting is the reverse of the removal procedure.
Release the locknut and adjust the position of the fork-end until the clevis pin will pass through the fork-end and the way-shaft lever. Fit the pin and tighten the locknut.
Ensure that the handbrake is OFF before the brake chamber push rod is connected.

Dismantling and Re-assembling
Refer to Page K.14 for the correct "Dismantling and Re-assembling" procedure.

Checking
Check for air leaks with the air pressure system fully charge; and the handbrake applied as detailed on Page K.16

AIR CONTROL VALVE

Description
The unit comprises a valve body (Fig. 29) and an end cover (5) containing a spring loaded inlet-exhaust valve assembly (12) and two operating plungers (7 and 14).
The end cover plunger (7) is fitted with a setscrew to enable the operating clearance in the handbrake mechanism to be maintained.
A gaiter (6) is fitted to the plunger and cover to protect the sliding surfaces.
The hollow plunger (14) which is contained in the valve body, forms an exhaust passage and is spring loaded away from the inlet-exhaust valve. The hollow end of the plunger forms the exhaust valve seat.
The inlet-exhaust valve assembly (12) and the spring (11) are retained in the body by a cap screw (10).

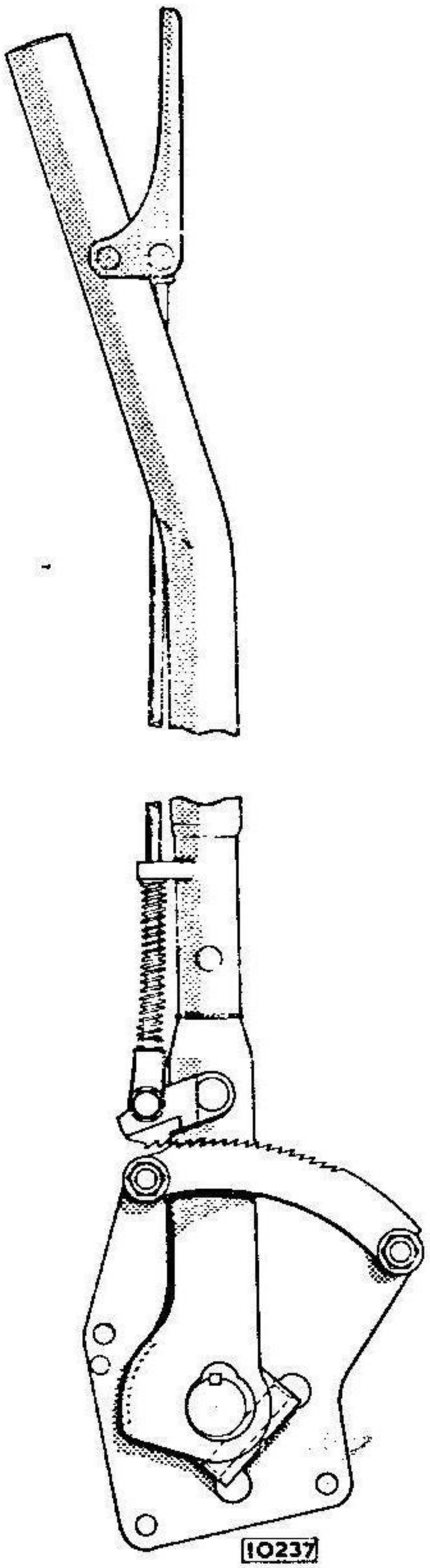
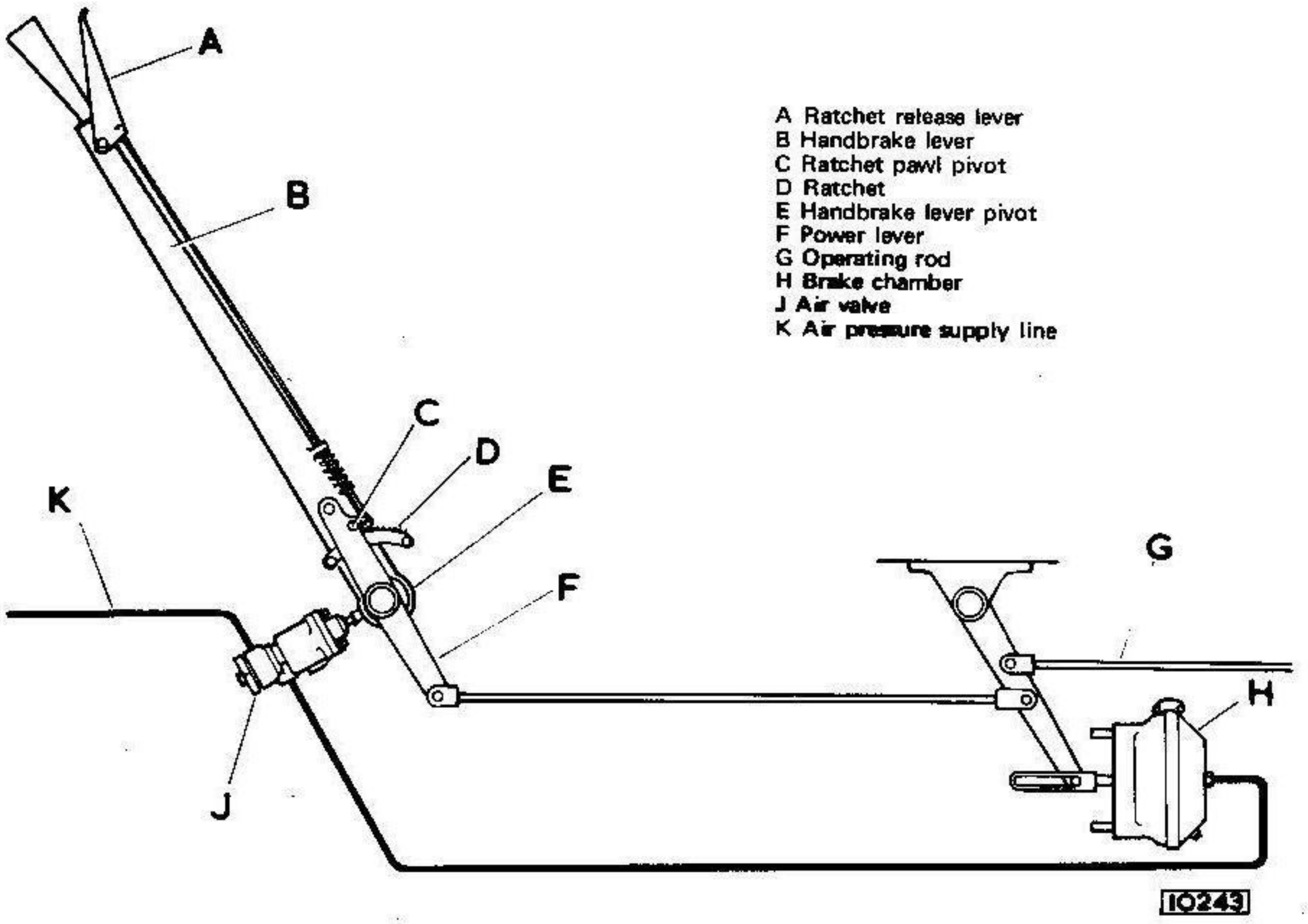


Fig. 26 The handbrake lever



A Ratchet release lever
B Handbrake lever
C Ratchet pawl pivot
D Ratchet
E Handbrake lever pivot
F Power lever
G Operating rod
H Brake chamber
J Air valve
K Air pressure supply line

Fig. 27 The power-assisted handbrake mechanism

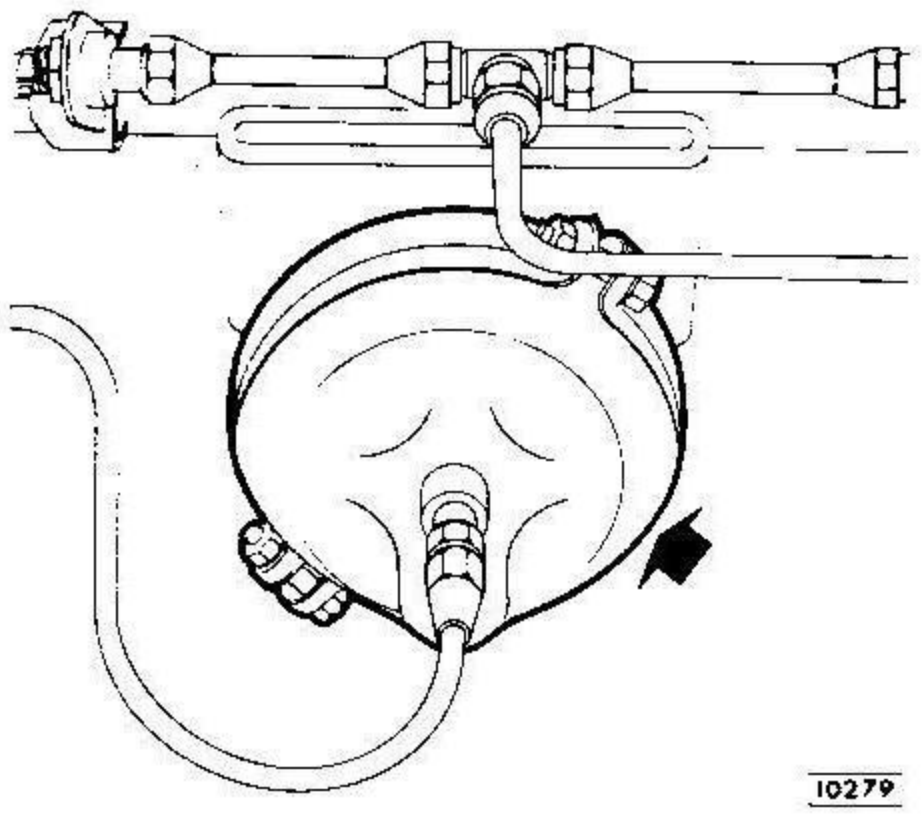


Fig. 28 Location of brake chamber

The diaphragm type check valve (2) is fitted in the exhaust port to prevent dirt from entering.

Operation

When the handbrake lever is moved towards the applied position, force is exterted on the adjusting screw (8) which moves the plungers against the resistance of the spring (15). The hollow plunger first seats on the inlet-exhaust valve, which closes the exhaust passage and then unseats the inlet valve, allowing the compressed air to pass through the valve to the brake chamber and so assisting the brake application.

Whilst the brakes are being applied the effort provided by the brake chamber tends to reduce the drivers effort on the plunger, so that, when no further effort is applied by the driver the spring loaded inlet-exhaust valve reseats and stops the air supply to the chamber. As soon as the brakes are held applied by the pawl and rachet the effort on the control valve plungers is relaxed and the plunger return spring moves the hollow plunger away from the inlet-exhaust valve allowing air pressure from the chamber to escape through the plunger and exhaust port to atmosphere.

When the driver pulls the brake lever to disengage the pawl prior to releasing the brake, force is again applied to the plungers in the body and the valve passes compressed

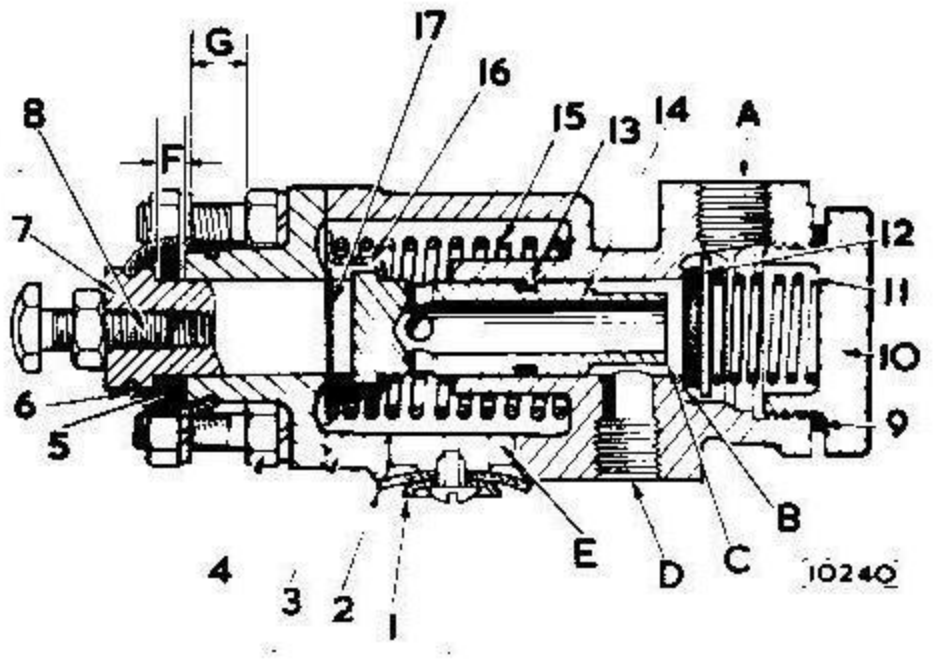


Fig. 29 The control valve

1 Plate
2 Exhaust diaphragm
3 Valve body
4 End cover studs
5 Cover
6 Gaiter
7 Plunger
8 Adjuster screw
9 Sealing ring
10 Screw cap
11 Spring
12 Inlet exhaust valve assembly
13 Sealing ring
14 Plunger
15 Spring
16 Spring retainer
17 Circlip
A From air pressure supply
B Inlet valve seat
C Exhaust valve seat
D To brake actuator
E Exhaust port
F Maximum stroke 3/16" (4.8 mm.)
G Maximum bracket dimension 3/8" (9.5 mm.)

air to the chamber so that the braking effort is transferred from the pawl to the chamber.
This enables the pawl to be disengaged and the brakes released. When the lever is moved to the "OFF" position, the valve releases the air pressure from the brake chamber.

Operating Tests
Charge the braking system to the normal operating pressure. Move the handbrake lever from the fully-released position to the fully applied position, to check that the brakes apply satisfactorily.
Check that air pressure is released from the brake chamber when the brakes are held applied by the rachet and pawl

Leakage Tests
Leakage tests should be carried out as follows.
Charge the braking system to the normal operating pressure, and apply the soap solution to the valve body screw cap (10) and the pipe connections, with the handbrake lever in the released position. Check at the exhaust port for air leakage. Leakage is not permissible. Any leakage indicates that the inlet valve or seat is defective.
Fully apply the handbrake and hold the lever towards the applied position by manual effort on the lever.
The appearance of bubbles at any part of the valve or pipe connections indicates that the air pressure is leaking. Leakage is not permissible. Leakage at the exhaust port indicates that the exhaust port valve, seat, or plunger sealing rings is defective.
If the tests indicate defective parts or loose connections, these must be rectified.

Removing
Brush away dirt from the unit.
Release all air pressure from the system and disconnect the air lines from the valve.
Seal the unions to prevent dirt from entering the valve, remove the mounting screws and detach the valve.

Refitting
Refitting is the reverse of the removal procedure.
Re-set the adjuster screw so that the head just touches the brake lever when the lever is held towards the released position.
Securely tighten the locknut after adjusting the valve screw.
After refitting carry out the leakage tests as detailed previously.

Dismantling
Remove the gaiter (6). Unscrew the end cover studs (4) and remove the spring washers and cover (5). Detach the circlip (17) and remove the plunger (7). The adjusting screw (8) need not be removed from the plunger unless the parts are damaged.
Withdraw the hollow plunger assembly and spring from the body.
Remove the sealing ring (13) and spring retainer (16).
Unscrew the screw cap (10) and remove the washer, spring and inlet-exhaust valve (12).
Unscrew the exhaust valve retaining screw and remove the plate (1) and diaphragm (2).

Cleaning and Inspection
Wash all metal parts in cleaning solvent and blow dry with compressed air.
Clean all rubber parts with a clean cloth.
Examine the body for cracks and other damage. Check the threads in the body for damage and the bore in the body for excessive wear and scoring. Examine the valve seat for damage.
Examine the inlet-exhaust valve for deterioration of the rubber faces, wear, damage and distortion.
Examine the gaiter (6) and the valve plunger sealing ring

(13) for wear and deterioration.
Check both springs for corrosion and distortion.
Examine the end cover (5) for damage and the bore for scoring. Examine the plunger (7) for scoring and check that it moves freely in the end cover.
Check the screw cap threads for damage.
Examine the exhaust valve check for wear and deterioration.

Re-assembly
Renew all parts found to be defective.
Insert the inlet-exhaust valve assembly (12) into the valve body with the flat rubber surface towards the seat and position the spring (11) on the valve. Screw the cap (10), together with a new aluminium washer into the body and tighten securely.
Fit the spring retainer (16) and sealing ring (13) on to the plunger. Lightly smear the sliding surfaces of the valve plunger and the plunger bore in the body with "Valvoline X-5 Regular", or equivalent grease. Position the spring in the body and insert the plunger, taking care not to damage the sealing ring.
Position the end cover on the body and screw the coarse-threaded ends of the studs, complete with spring washers, into the body and tighten securely.
Fit the gaiter and check when fitted that the gaiter grooves are located in the groove.
Screw the adjusting screw with locknut into the plunger.
Position the exhaust diaphragm (2) and plate (1) over the exhaust port and secure with the drive screw.

WHEELS AND TYRES

SECTION L

INDEX

WHEELS AND TYRES

SPECIFICATION AND DATA

Wheel size	
Width and Diameter	7.50" x 20.0" (19.05 cm x 50.8 cm)
Offset	6.30" (16.0 cm)
Tyre size	10.00 x 20 14 Ply Single front, twin rear
Tyre Pressures	
Max.	90 lbs per sq. in (6.3 kg/cm^2)
Running Pressure	Refer to tyre manufacturers; quote total front and rear axle weights.
Fixing	10 — 7/8" studs
Nut threads	Left hand wheel nuts have left-hand threads Right hand nuts have right-hand threads

GENERAL DESCRIPTION

The Ventilated disc type road wheels are of a welded construction with the closed valve slots in the flat rim base and consist of three pieces.

(i) Rim base, with an integral flange.
(ii) Detachable endless flange.
(iii) Lock ring retaining detachable flange to rim base.

The road wheels are attached by ten studs, the threads being handed as to the side of the vehicle.

ROUTINE MAINTENANCE

WEEKLY

Check all tyre pressures.
Check security of road wheel nuts.

THE ROAD WHEELS

There being considerable clearance between the road wheel stud and the countersunk disc hole, the entire weight of the front of the vehicle is supported by the conical face of the front wheel securing nuts. The weight of the rear end is taken by conical collars adjacent to the brake drums and the conical faces of the rear wheel securing nuts. It is therefore most important to ensure that the road wheels are centred correctly on the studs when refitting. Tighten all road wheel nuts evenly.

THE TYRES

Tyre Pressures

The tyre pressure should be checked weekly.

CHECK WHEN THE TYRES ARE COLD, FOR INSTANCE, BEFORE THE VEHICLE LEAVES THE DEPOT AND NOT WHEN THEY HAVE ATTAINED THEIR NORMAL RUNNING TEMPERATURE.

The valve caps must always be replaced after inflation. Renew the caps when the rubber seal is worn.
Inflate to the pressures recommended by the tyre manufacturers. Always quote united weight and front and rear axle weights when requesting information.
The maximum tyre pressures permissible is 90 lbs per sq.in. (6.3 kg/cm^2) with fully laden vehicle.

Checking Tyre Wear

Check the tyres periodically for nails or flints which may become embedded in the tread and remove with a blunt screwdriver or similar instrument.

WHEELS AND TYRES

Road Wheel Interchanging

In order to obtain maximum mileage from the tyres and to prevent irregular wear on the front tyres, it is advisable to interchange the wheels at regular intervals. It is suggested that the following sequence is adopted at changing intervals when not only the station is changed but also the direction of rotation.

Left hand front to	Right hand rear outer
Right hand rear outer to	Left hand rear outer
Left hand rear outer to	Right hand front
Right hand front to	Right hand rear inner
Right hand rear inner to	Left hand rear inner
Left hand rear inner to	Left hand front

All the wheels are interchangeable.

FRONT AXLE AND HUB ASSEMBLIES

SECTION M

INDEX

FRONT AXLE AND HUB ASSEMBLIES

SPECIFICATION AND DATA

Axle Type	'I' section steel stamping
Front Wheel Alignment	1/16" to 1/8" (1.6–3.2 mm) toe-in
King Pin Inclination	2½°
Camber	2°
Castor	1°
Wheel Hub Bearings	Opposed taper roller
Front Wheel End Float	0.006" – .008" (0.152 – 0.203mm)
Centre of Swivel Pin Boss above spring pad face	4.625" (11.7475 cm)
Swivel Axle to Swivel Pin boss clearance	0.003" – 0.006" (0.0762 – 0.1524 mm)

GENERAL DESCRIPTION

The front axle beam is a steel stamping with integral spring pads and swivel pin bosses.
From the spring pad outward to the swivel pin bosses the axle beam is polished, thus facilitating the inspection for flaws which may develop in service; these portions must be kept well greased at all times to prevent corrosion.
The swivel pins are taper mounted in the axle beam from below, to support the swivel axles which rotate on replaceable bushes. End thrust on the base of the swivel pin is accommodated by a hardened steel button, washer and pad, the former being pressed into the base of the swivel pin and adjusted by means of shims to give the required clearance between the swivel and the axle beam.
The road wheel hubs are mounted on two opposed taper roller bearings with a vernier adjustment to provide the necessary end float.
Grease sealing of the hubs is effected by lip type seals running on a replaceable ring with a grease catcher attached to the brake carrier. The grease catcher is fitted to protect the brake linings from grease contamination should any pass the seal due to excessive lubrication.
Ferodo lined bands are fitted to the exterior of the brake drums to reduce molecular vibration and thereby reducing brake squeal to a minimum.

ROUTINE MAINTENANCE

FIRST 2,500 MILES (4,000 KM)

Front Wheel Hubs
Check the front wheel hubs for end float as detailed under "Front Wheel Hubs Checking" and adjust as necessary.

EVERY 2,500 MILES (4,000 KM)

Wheel Swivels
Lubricate the nipples (four per vehicle) fitted to the top and bottom of the wheel swivels. The bottom nipples are accessible from underneath the vehicle.
Lack of lubrication at these points may cause stiff steering.
On vehicles fitted with the automatic lubrication this routine service is not necessary.

EVERY 10,000 MILES (16,000 KM)

Front Wheel Alignment
Check the alignment of the front wheels as detailed under "Front Wheel Alignment".

EVERY 20,000 MILES (32,000 KM)

Front Wheel Hubs
Check the front wheel hubs for end float as detailed under "Front Wheel Hubs – Checking" and adjust as necessary.

EVERY 40,000 MILES (64,000 KM)

Front Wheel Hubs
Dismantle, clean and repack front hubs with grease as detailed under "Front Wheel Hubs – Re-packing".

FRONT WHEEL HUBS

Checking
To check for end float firmly apply the handbrake, jack up the front of the vehicle and remove the road wheels
The right hand wheel nuts have right hand threads, the left wheel having left hand threads.
Clean the road dirt from the end of the hub and detach

FRONT AXLE AND HUB ASSEMBLIES

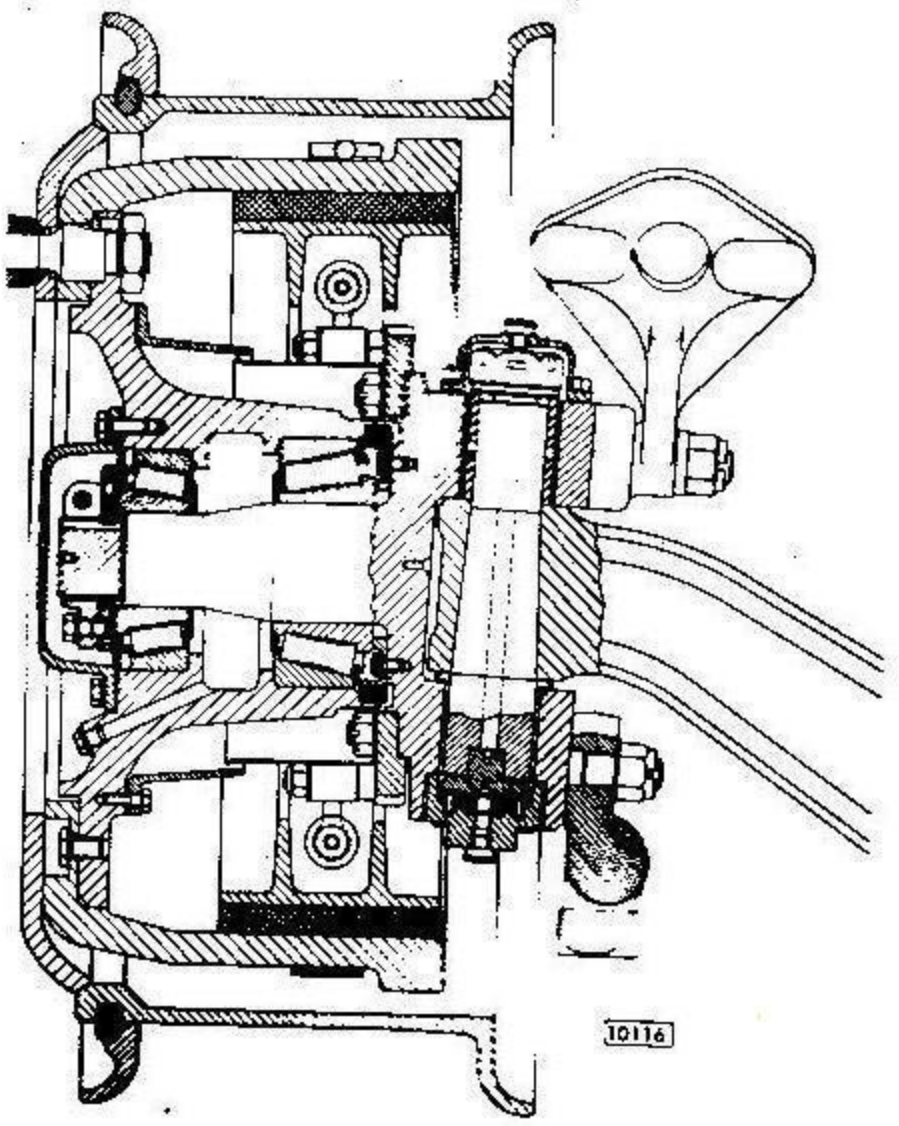


Fig. 1 Sectioned view of the front hub arrangement

the hub cap from the road wheel hub by withdrawing six bolts. Erect a dial test indicator so that the plunger contacts the hub or brake drum in a horizontal position. utilizing a suitable lever, move the hub to the full limit of its travel towards the indicator. Set the dial to zero. Lever the hub in the opposite direction when the reading on the dial will indicate the end float.

The permissible end float is .006" – .008" (.203 – .254 mm). To adjust the end float, if required, remove the hub nut pinch bolt and nut. Remove the hub nut locking setscrew. Rotate the hub nut by means of a tommy bar placed in the pinch bolt hole in a clockwise direction to decrease the end float and anti-clockwise to increase. movement of the original setscrew hole to the next tapping in the locking plate gives 0.005" (0.127 mm) endways movement of the hub nut while movement of the alternate setscrew hole to the original tapping gives a 0.0025" (0.0625 mm) endways travel.

Refit the pinch bolt and setscrew when the correct clearance is obtained. Refit the hub cap end cover and roadwheel.

Repeat the operation to the opposite hub.

Repacking

Remove the hubs for repacking by the following procedure

Turn the wheel disc cover turnbuckles through 90° and lift the cover away. Jack up the front of the vehicle and remove the road wheels. Detach the wheel finisher carrier and hub cap from the hub by withdrawing six setscrews. Slacken off the brake shoes as detailed in Section K "The Braking System".

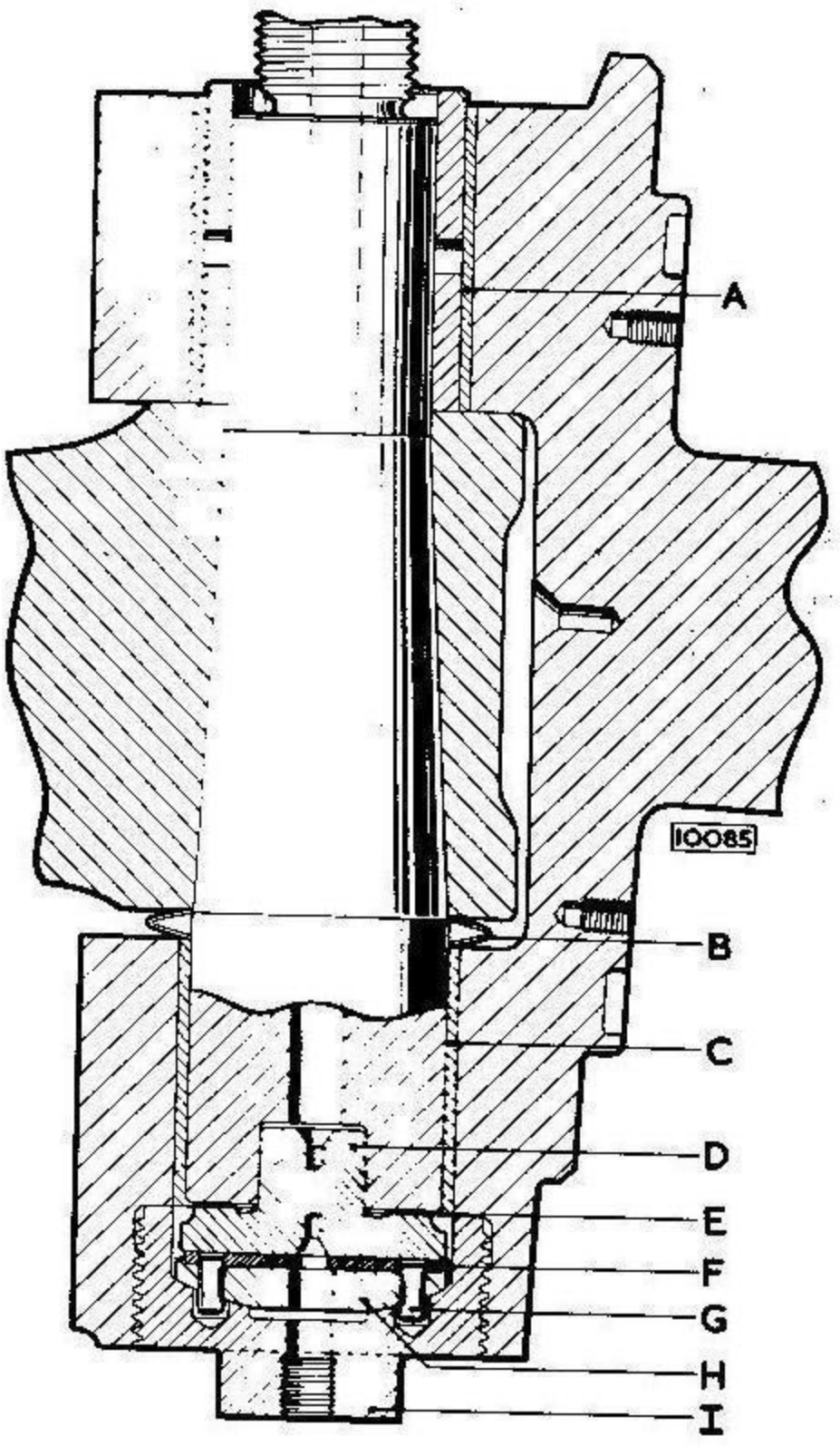


Fig. 2 Sectioned view of the swivel pin arrangement

A Swivel pin bush – upper
B Dust cover
C Swivel pin bush – lower
D Thrust button
E Thrust button shim
F Thrust washer
G Dowel
H Thrust washer pad
I Swivel pin cap – bottom

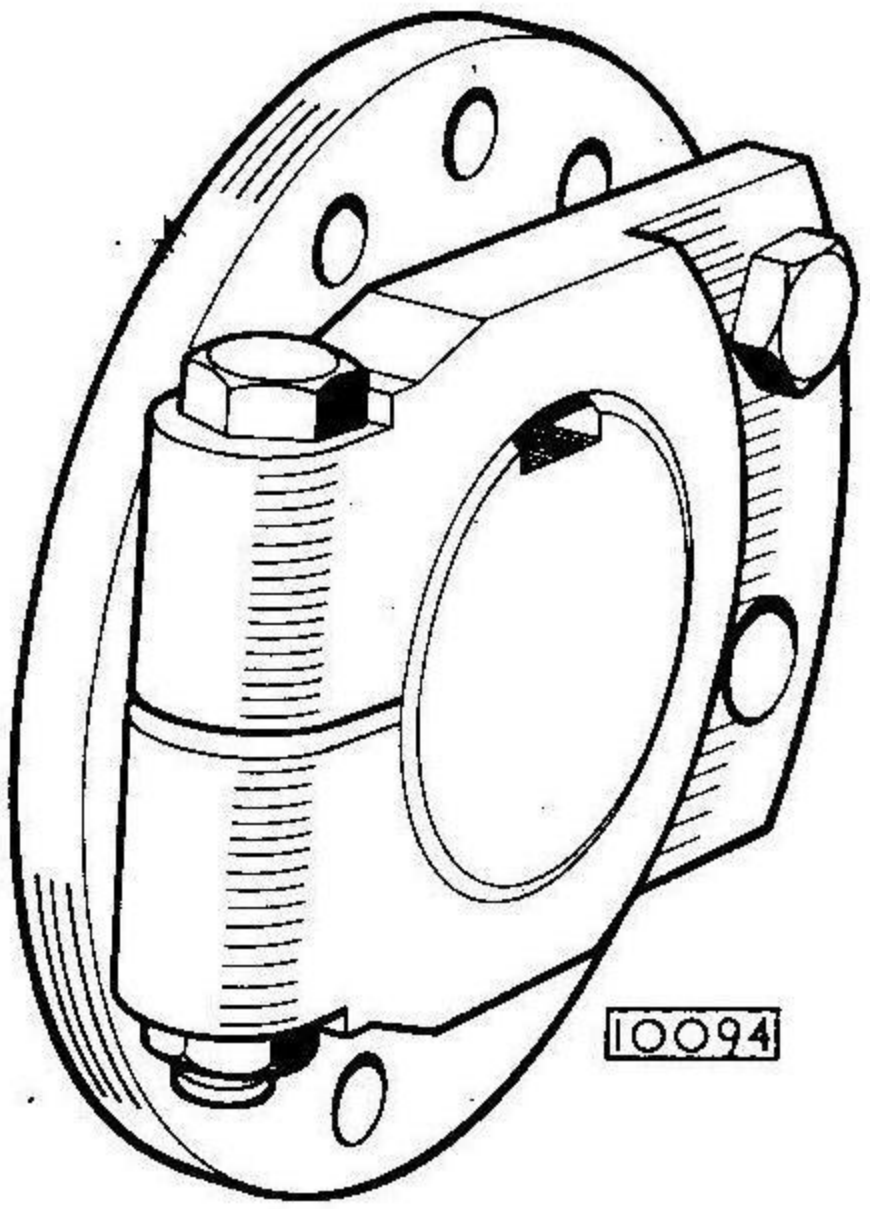


Fig. 3 The adjustable hub nut

Remove the brake drum by removing the nine sunker setscrews and utilizing the three jack tappings provided
Remove the hub nut followed by the locking plate from the end of the stub axle carrier by withdrawing the hub nut setscrew and pinch bolt and utilizing a tommy bar inserted through the pinch bolt hole and rotating the hub nut anti-clockwise. Withdraw the hub complete with bearings and clean away any grease from the grease catcher. Clean the grease from the hub exercising care not to damage the seal and repack with fresh grease of the recommended grade.
Do not overload the hubs with grease when re-packing. Each of the bearings should be liberally coated with grease on assembly, and only a small amount added to the hub.
Refit the hub with the cone assembly of the inner bearing followed by the cone assembly of the outer bearing. Refit the locking plate, hub nut and brake drum. Re-adjust the end float of the hub bearings as detailed in "Front Wheel Hubs Checking" and balance the brake shoes as detailed in Section K "The Braking System".
Refit road wheel and components.
Repeat the operation to the opposite wheel.

FRONT WHEEL ALIGNMENT — Checking
Check that all tyre pressures are correct and that the vehicle is standing on level ground.
With the wheels in the straight ahead position, check the alignment of the front wheels with an approved track setting gauge.
The front wheel alignment should be: 1/16" – 1/8" (1.6 – 3.2 mm) "toe-in". (measured at wheel rim)
Recheck the alignment after pushing the vehicle forward until the wheels have turned half a revolution (180°).
If adjustment is required, slacken the clamp bolt at each end of the track rod and rotate the rod in the required direction. The ball joint threads are handed L and R hand to facilitate this adjustment. When the specified measurement is obtained, ensure that the ball joints are situated on the top of their ball pins in the centre of their angular movement before tightening the clamp bolts. Recheck the alignment after tightening the clamp bolts.

THE FRONT AXLE

Removal
The front axle is best removed as a unit complete with road springs and wheels. Jack up the front of the vehicle and insert stands under the frame to the rear of the road springs. Disconnect brake air pipes from the brake air chambers and automatic lubrication pipes if fitted
Disconnect the steering drag link from the steering lever.
Remove road spring shackle and eye bolt nuts and drift out the shackle pins after extracting the pinch bolts
Disconnect the shock absorbers. Wheel the axle unit away from the vehicle.

Refitting
Refitting is the reverse of the removal procedure. Re-adjust the spring shackles for side play as detailed in Section O "The Front and Rear Suspension".
Do not tighten the shock absorber connections until the complete weight of the vehicle is on the road wheels.
Do not tighten the spring holding down bolts until the shackle pins have been fitted.

STEERING

SECTION N

INDEX

MANUAL

POWER ASSISTED

STEERING

STEERING (MANUAL)

SPECIFICATION AND DATA

Type	Daimler worm and nut
Ratio	40 : 1
Turns of steering wheel (lock to lock)	6.5 turns
Swept Turning Circle. (30'0" chassis)	69'0" (21.031m).
(33'0" chassis)	70'9" (21.565m).
(36'0" chassis)	71'0" (21.640m).
Oil capacity	6 pints (3.25 litres)
Steering wheel diameter	21" (533 mm)
End float of rocker shaft	.003" – .005" (.076 – .127 mm)
Pre-load on idler lever bearings	.003" (.076 mm)

GENERAL DESCRIPTION

The steering unit is of the Daimler worm and nut type incorporating a three start nut; the whole unit being rigidly mounted to the front cross member. The inner column is located at the top by a duplex type ball bearing which is supported between two large rubber buffers. This flexible mounting permits angular movement of the inner column as necessary to accommodate the radial movement of the nut held in the forked end of the rocker shaft.

The rocker shaft is supported in phosphor bronze bushes and end float is controlled by thrust washers available in five thicknesses .093" (2.36 mm), .0955" (2.42 mm), .098" (2.48 mm), .1005" (2.57 mm) and .105" (2.6 mm) to allow for adjustment of the shaft.

The worm nut is mounted on two trunnions which are retained in position by pinch bolts. An oil seal in the rocker shaft housing retains the oil in the steering box.

Movement of the steering wheel is transmitted from the rocker shaft drop arm by a drag link to a relay lever assembly mounted on the chassis outrigger racket where a similar link conveys the movement to the steering lever on the swivel axle assembly.

The track rod conveys the movement to the other road wheel.

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 KM)

Steering Ball joints

On vehicles not fitted with an automatic lubriction system lubricate all (6) steering ball joints at the specified intervals with the recommended grade of lubricant. On vehicles fitted with the automatic system, no lubrication service is necessary.

EVERY 10,000 MILES (16,000 KM)

Steering Tie Rods

Check steering lever, drag links and tie rod nuts and tighten as necessary.

Steering Box

Check the oil level in the steering box housing and top up to the level of the filler plug orifice with the recommended grade of lubricant.

Clean and withdraw the filler/level plug from the rear face of the steering box.

Fill up slowly with the recommended grade of lubricant until the level rises to the bottom of the filler plug extension.

The filler plug is located on the top of the steering box accessible from inside the driver's cab.

EVERY 25,000 MILES (32,000 KM)

Relay Lever

Lubricate the relay lever with the recommended grade of lubricant. The grease nipple is located in the side of the pivot bracket and is accessible from underneath the vehicle. Apply the grease gun and inject grease until it is seen to exude from the small breather hole situated at the top of the pivot bracket

Crack Detection

The steering unit drop arm, steering levers and steering relay levers are polished to facilitate the detection and location of any flaws which may develop in service these components must always be well coated with greese to prevent corrosion.

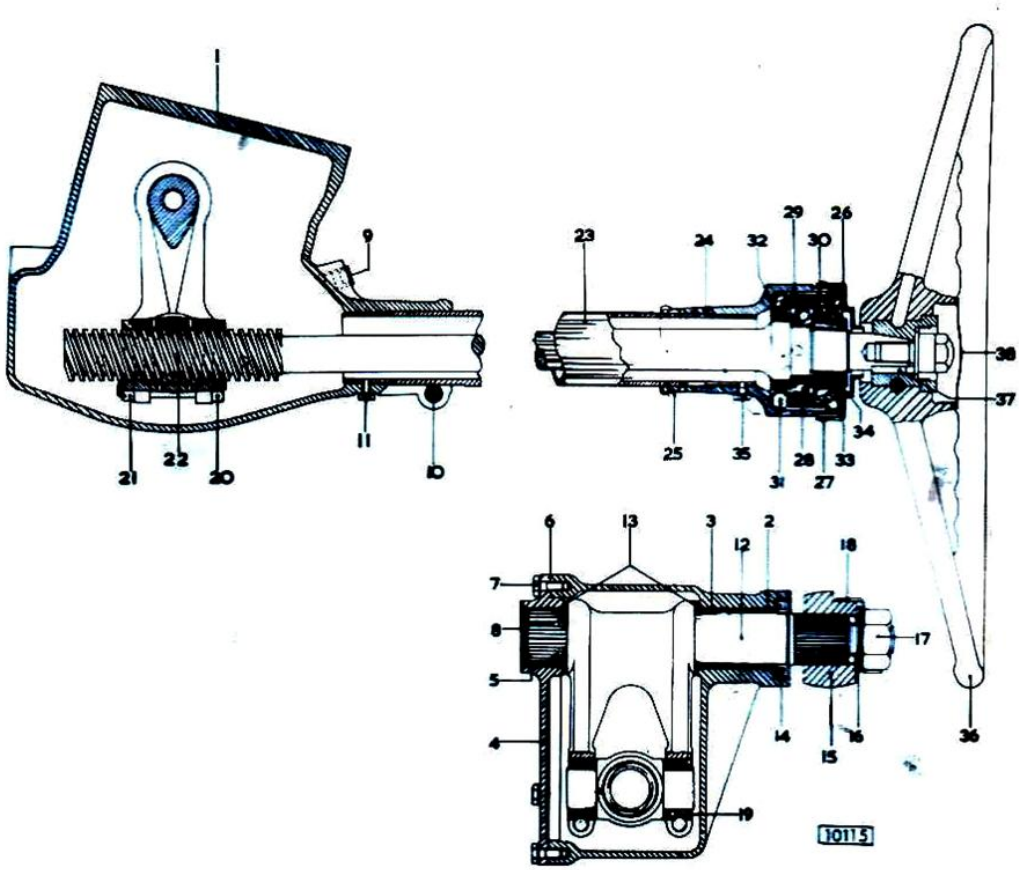


Fig. 1 Sectioned view of the steering column

1 Steering box
2 Bush — outer
3 Bush — inner
4 Cover plate and bush
5 Bush
6 Cover plate joint
7 Cover plate setscrew
8 Welch washer
9 Filler plug
10 Clamp bolt
11 Screwed dowel
12 Rocker shaft
13 Thrust washers
14 Rocker shaft oil seal
15 Steering drop arm
16 Washer
17 Nut
18 Lockwasher
19 Trunnion Bush
20 Bush bolt
21 Nut
22 Worm shaft and worm nut
23 Steering column
24 Bearing housing
25 Clamp bolt and nut
26 Bearing housing cover
27 Circlip
28 Bearing
29 Bearing cage
30 Bearing cage cover
31 Rubber buffer
32 Felt oil retainer
33 Retainer nut
34 Retainer nut circlip
35 Bearing housing dowel
36 Steering wheel
37 Key
38 Cap

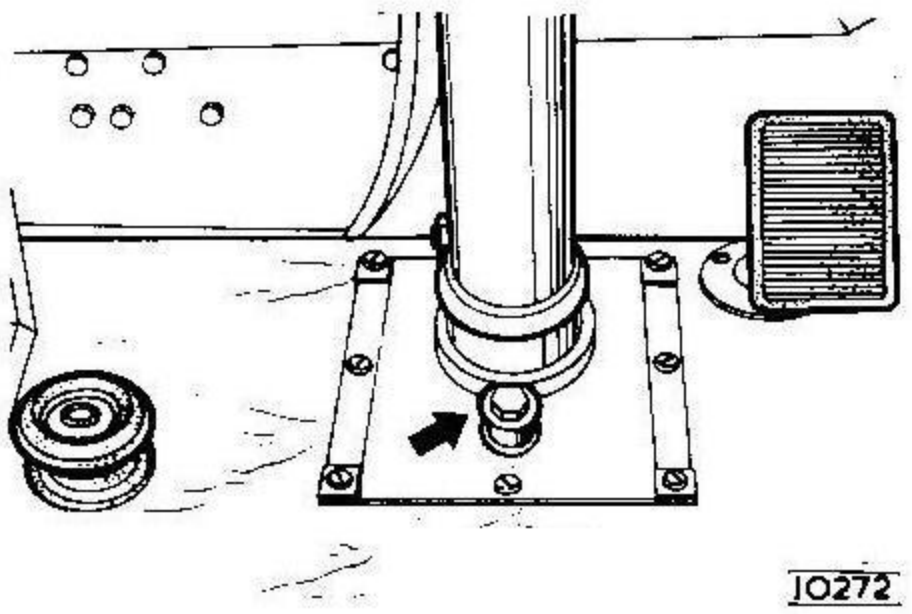


Fig. 2 Location of filler plug

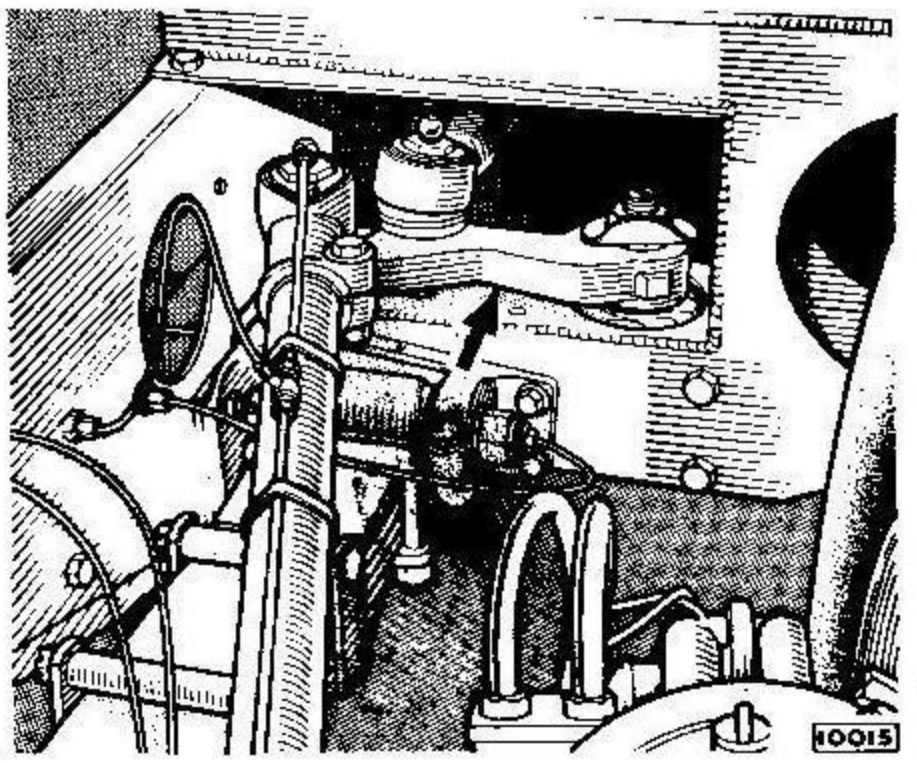


Fig. 3 Location of relay lever

THE STEERING UNIT

Removal

Remove the steering wheel centre cap, turn the centre screw to withdraw the steering wheel from its taper. Remove the wheel taking care to retain the key.

Remove the steering box gaiter and driver's floor plate retaining screws and remove the floor plates.

Detach the selector switch control bracket and the horn switch bracket from the steering column and remove the clips securing the switch cables to the column.

Extract the split pin and remove the nut from the rocker shaft. Remove the steering drop arm using a suitable extractor.

Remove the four bolts and nuts securing the steering box to the chassis frame.

Lift the steering box clear.

Refitting

Refitting is the reverse of the removal procedure, but care must be taken to fit the drop arm correctly in order to ensure the correct radial movement of the arm.

To fit the arm, turn the steering column until the punch marks on the rocker shaft line up with the punch marks on the steering box.

Insert a ½" dia. (12.7 mm) rod in the hole drilled in the lug cast on the steering box. Register the rod with the hole drilled in the lug on the drop arm and feed the arm on to the splines of the rocker shaft. Refit the nut and split pin to secure the drop arm to the shaft.

The drop arm and steering box will now be in the straight ahead position. If a new arm or rocker shaft is to be fitted it is essential to check that the splines of the shaft do not protrude beyond or are flush with the face of the drop arm when the nut is fully tightened.

Failure to ensure this may prevent the nut from locking the arm to the tapered shaft splines.

IMPORTANT: REMOVE THE REGISTER ROD ON COMPLETION.

Dismantling

Remove the six setscrews and lockwashers securing the steering box side cover in position, remove the side cover and joint and collect the oil in a suitable container.

Remove the bearing housing cover circlip from the top of the steering column, unscrew and remove housing cover. Note relation of shaft to nut.

This is important since the nut must be replaced in the original position when refitting.

The worm shaft can now be withdrawn complete with the thrust bearing from the steering column outer. Lift the bottom rubber buffer out of the bearing housing.

If it is required to remove the bearing from the worm shaft, first lift off the top rubber buffer, remove the retaining nut circlip and unscrew the retaining nut. Lift out the upper felt oil retainer, and unscrew and remove the bearing case cover. Withdraw the bearing case, bearing

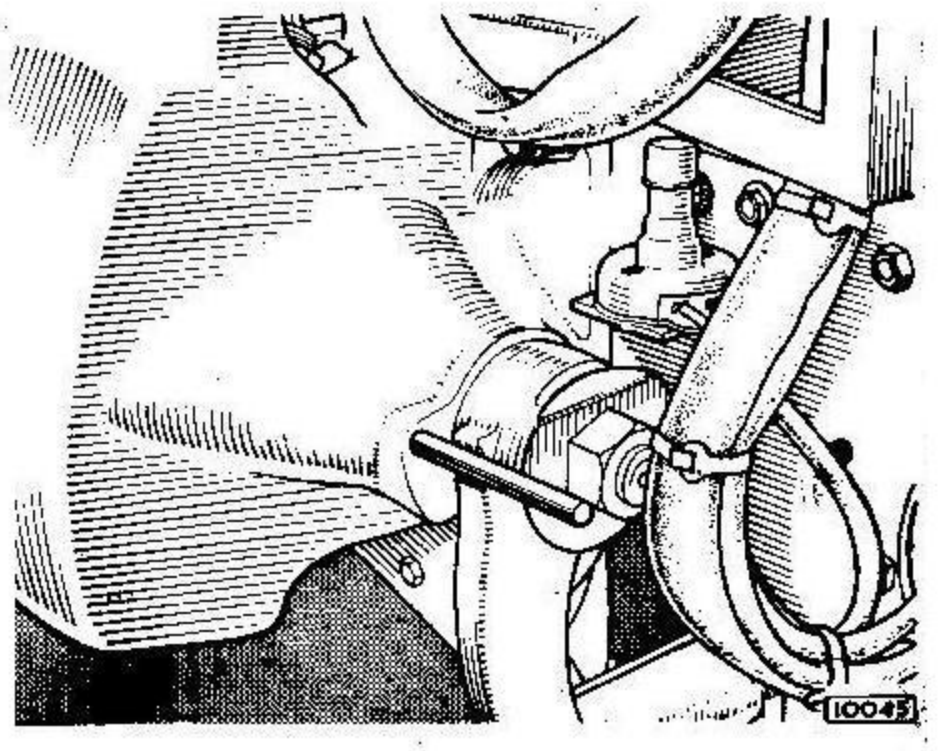


Fig. 4 Aligning the drop arm with register rod

and lower felt oil retainer off the shaft; remove the bearing and oil retainer from the bearing case. Turn the worm nut through 90° to clear the edges of the cover plate aperture and withdraw the rocker shaft complete with the arm, worm nut assembly and inner and outer thrust washers.

Note the size and part number of rocker shaft thrust washers on either side of the rocker shaft arm for reference on assembly. Wash all parts thoroughly and examine the rocker shaft bushes for wear, renew if necessary. Examine the rocker shaft oil seal and remove only if it is necessary to fit a replacement.

To remove the worm nut from the rocker shaft arm, extract the split pins, remove the nuts and withdraw the trunnion bush bolts. Remove the trunnion bushes and lift out the worm nut.

Re-assembly

Re-assembly is the reverse of the dismantling procedure.

The permissible end float of the rocker shaft is between .003"–.005" (.076–.127 mm) and any necessary adjustment is effected by fitting thrust washers available in varying thicknesses, the range of which is as follows, 0.93" (2.32 mm), 0.0955" (2.38 mm), 0.098" (2.4 mm), 0.1005" (2.51 mm) and 0.105" (2.62 mm).

Refit the trunnion bushes and worm nut.

Locate the trunnion bushes in the trunnion arms and insert the pinch bolts.

Tighten the pinch bolts sufficiently to allow the bushes to be adjusted by lightly tapping the bushes towards the faces of the worm nut until the recommended clearance of 0.002" (0.05mm) is obtained. Tighten the bolts.

This also ensures that the bushes and worm nut are central with the worm shaft.

When re-assembling it is important that the original thrust washers are fitted in the same order from which they were removed, and the worm nut screwed back into its original position. If, after the end cover has been replaced, the float is excessive, adjustment should be made by an exchange of thrust washers of a greater thickness

it is ESSENTIAL that the centre of the nut coincides exactly with the centre of the worm shaft since any mis-alignment will result in a heavy steering. Refit the steering box after refilling to the correct level with oil of the specified grade.

Re-coat the drop arm with grease to prevent rust formation

THE RELAY LEVER

The relay lever should not require any maintenance with the exception of the routine lubrication service until the vehicle is docked for the major overhaul.

The lever assembly should then be removed from the chassis, stripped, cleaned, re-assembled and any bearing adjustment found necessary made.

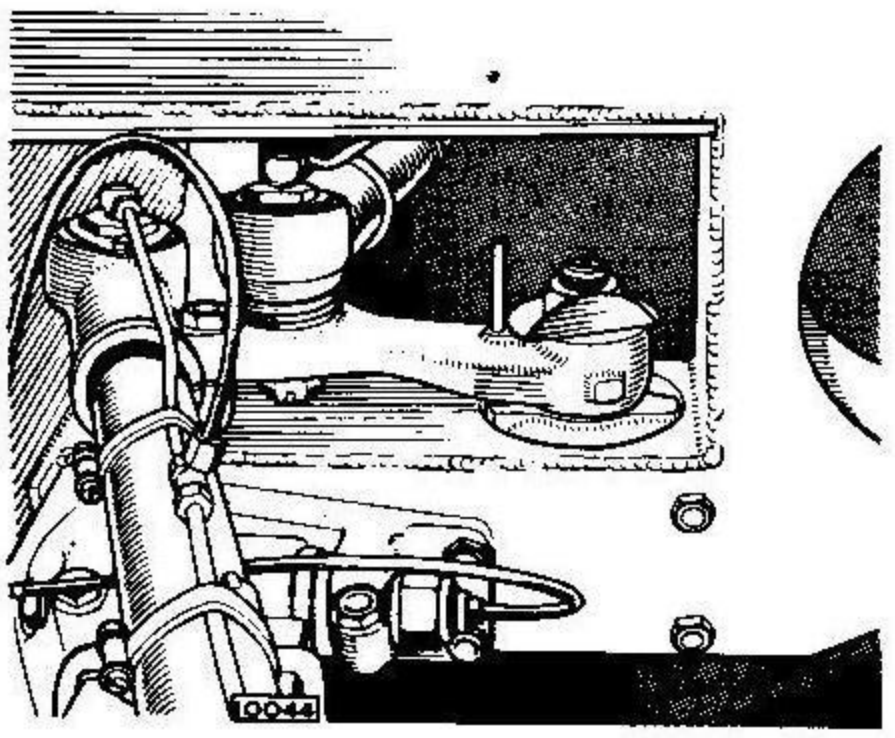


Fig. 5 Aligning the relay lever with register rod

Removal

Disconnect the lubricator pipe union.

Disconnect the two ball joints from the lever; remove the nut securing the lever to the pivot shaft and withdraw the lever utilizing a suitable extractor.

Remove the rubber "O" ring (when fitted)

Remove the eight nuts, bolts, nuts and washers securing the assembly to the outrigger bracket and withdraw the unit from beneath the vehicle.

Refitting

Refitting is the reverse of the removal procedure, but care must be taken to fit the relay arm correctly in order to ensure the correct radial movement of the lever in conjunction with steering column drop arm and the road wheels. To fit the relay lever, insert a ¼" dia. (6.4 mm) rod in the hold drilled in the top face of the relay bracket. Register the rod with the hole drilled in the lug on the relay lever and feed the lever on to the pivot shaft. Refit the nut and split pin to secure the relay lever to the shaft. The lever will now be in the straight ahead position.

IMPORTANT: REMOVE THE REGISTER ROD ON COMPLETION.

Dismantling

Remove the lock wire from the four setscrews and cover.

Collect the shims fitted between the cover and the pivot bracket.

Withdraw the pivot shaft and collect the upper thrust washer.

Remove the oil seal from the top of the pivot bracket.

Clean all parts in cleaning solvent.

Renew the "O" ring between the lever and the pivot bracket if worn or perished.

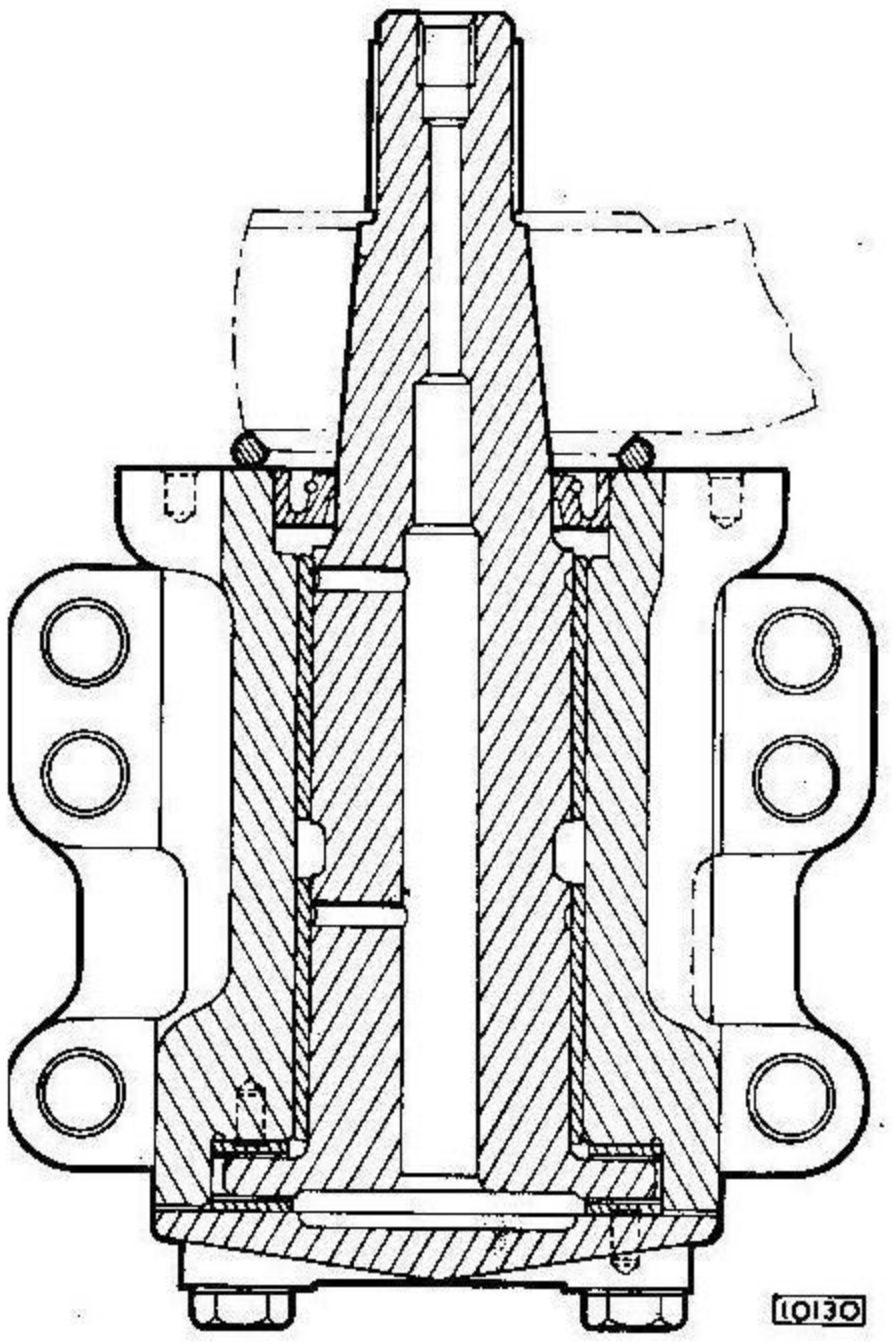


Fig. 6 Sectioned view of relay lever pivot bearing

Re-assembly

Replace the bearings and oil seal if worn or damaged.

When pressing in the new bearings care must be taken to ensure that the top edge of the upper bush and the bottom edge of the lower bush do not protrude beyond the bore face.

Re-assembly is the reverse of the removal procedure.

Adjust the pivot shaft end float by the following method :—

Fit the bottom cover, after inserting the shaft and thrust washers and tighten the set screws until all end float is removed. Measure the gap between the bottom cover and select shims to give .003" – .004" (0.190 – 0.1016 mm) end float.

Shims are available in three sizes:– .005" (0.127 mm), .007" (0.180 mm), .010" (0.254 mm).

Remove the bottom cover, withdraw the shaft and lubricate the bearings with the recommended grade of lubricant. Refit the shaft, bottom cover, and shims.

Refit the oil seal with the lips uppermost and pack the area between the lips with grease before fitting the 'O' ring and relay lever.

STEERING BALL JOINTS

All ball joints should be checked for wear during major overhaul docking periods.

Ball pins and bearing cups are replaceable if wear is evident.

Dismantling

Disconnect the ball joint from the steering lever, drop arm or relay lever by removing the split pin and nut and withdrawing the ball pin. Disconnect the automatic lubricator pipe union if fitted. Remove the cover lock plate setscrew and lockplate. Unscrew and remove the end cover and lift out the spring.

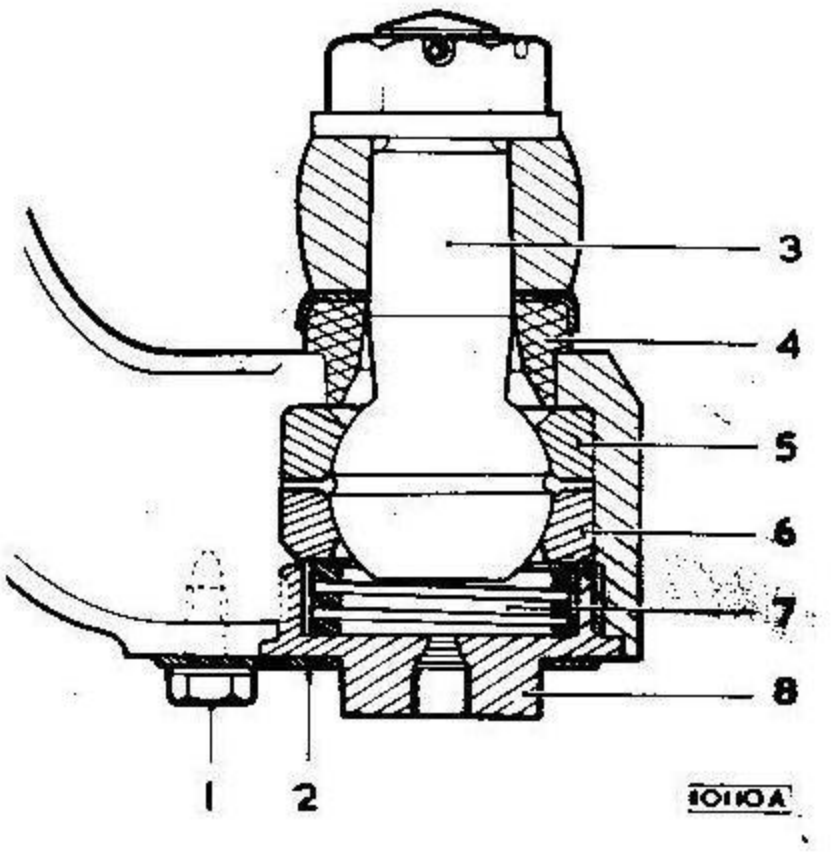


Fig. 7 Sectioned view of the ball pin assembly

1 Lockplate setscrew
2 Lock plate
3 Ball pin
4 Oil seal
5 Upper cup
6 Lower cup
7 Spring
8 End cover

Drive out the ball pin together with the ball pin upper cup taking care to retain the oil seal and dirt shield. Lift out the ball pin lower cup.

Wash all parts in cleaning solvent.

Re-assembly

Renew the ball pin and cups if worn or damaged. Place the upper ball pin cup in position, insert the ball pin; fit the lower ball pin cup and spring. Lightly oil the ball pin and cups. Screw in the socket cover until the ball pin can just be moved in the socket by hand. Replace the locking plate and setscrew and refit ball joint. Re-connect the lubricator pipe if fitted. If the lubricator pipe has been allowed to drain, prime before tightening the union, see Section B "Lubrication".

If the first and second drag links have been disconnected, check the steering geometry by the following procedure.

Centralize the drop arm and relay lever by inserting the register pins, see "Steering Unit – Refitting" and "Relay Unit – Refitting". Position the front road wheels in the "straight-ahead" position.

Adjust the drag links if necessary to ensure that the ball pins enter the drop arm, relay and steering levers correctly with the pins central in the ball joints.

The length of the second drag link is approximately 31.5" (80.01 cm).

IMPORTANT: REMOVE THE REGISTER RODS ON COMPLETION.

STEERING (POWER ASSISTED)

SPECIFICATION AND DATA

Power Ram Unit	
Make	Hydrosteer
Pressure Pump Unit	
Make	Hobourn-Eaton.
Type	Roller

GENERAL DESCRIPTION

The Hydrosteer direct coupled system is fitted as an optional extra to operator's requirements.
The system is hydraulic in operation and consists basically of a steering booster (power ram unit), pressure pump and reservoir.
The steering booster incorporates a control valve connected direct to a double acting power ram coupled by flexible pipes to an engine driven pressure pump. The system utilises the standard steering box and should the hydraulic power fail for any reason the driver will still be able to steer the vehicle manually.
The reservoir is mounted on a bracket attached to the air cleaner mounting in the engine compartment.

ROUTINE MAINTENANCE

WEEKLY

Checking the Reservoir Oil Level
Check the fluid level in the reservoir and top up as necessary to the level on the dipstick.

FIRST 500 MILES (800 KM)

Check the unions for leaks.
Check fluid hoses for chafing.

EVERY 2500 MILES (4000 KM)

Lubricate the ram unit ball pins with the recommended grade of lubricant.

EVERY 5000 MILES (8000 KM)

Check condition of hoses.
Check unions for leaks.

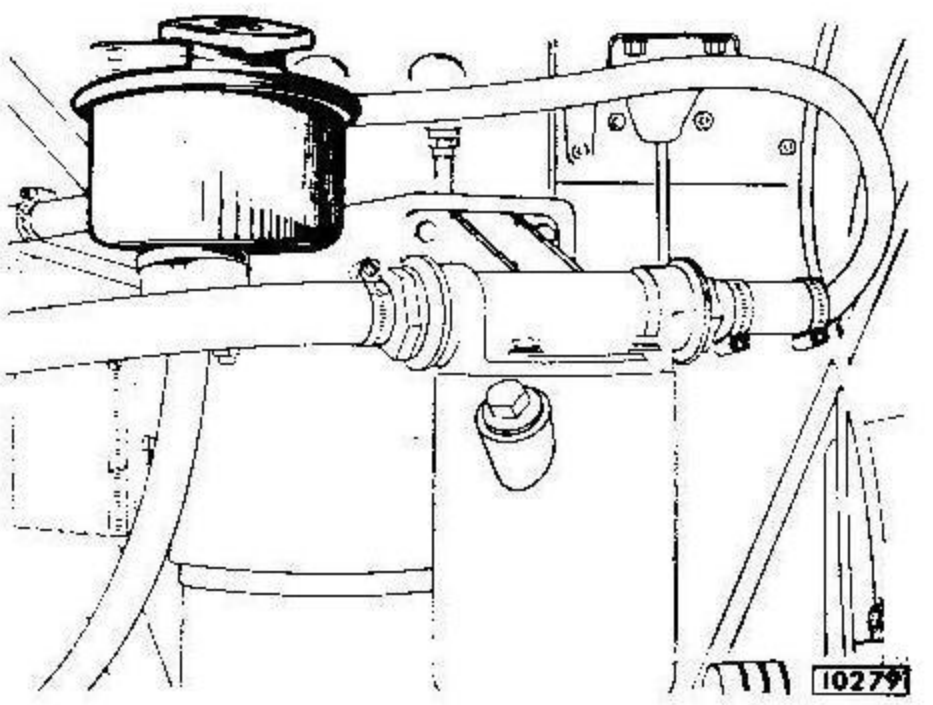


Fig. 8 Location of reservoir

RECOMMENDED LUBRICANTS

MOBIL	CASTROL	ESSO	SHELL	B.P.	DUCKHAM	REGENT CALTEX/ TEXACO.
ATF 201	Castrol T.Q.F.	Esso Glide	Shell Donax T.7	Autran B	Q-matic	Texamatic 6991 Type F

STEERING

THE STEERING BOOSTER

Manual effort from the steering box is directed to the control valve spool by means of the manual ball pin. Power assistance from the ram is directed to the steered wheels by the power ball pin.

The control valve spool is held in the neutral, or central position, by means of a pre-compressed spring and by the hydraulic forces acting on the reaction areas.

For steering efforts less than required to overcome the valve pre-load the spool remains central and the fluid circulates freely on open circuit from the pump, through the valve and back to the reservoir. There being no resistance to flow, no pressure build-up occurs and steering remains purely manual.

For steering efforts greater than the valve pre-load, the spool is displaced toward one end of the body, thus directing the fluid to the appropriate side of the piston. The pressure quickly builds up until it is sufficient to overcome the resistance at the wheels, thus transmitting the required steering assistance. The flow of oil and resulting movement of the cylinder is maintained, within the limits of the wheel travel, so long as the driver continues to turn the steering wheel enough to keep the spool displaced from its centre position.

It is important to note that the driver always operates against a load which is derived from the spring pre-load, plus the pressure build-up on the reaction rings. Since this pressure is dependant on the pressure of the oil pushing on the piston it is proportional to the required steering force, thereby giving the driver the necessary "feel of the road".

In the event of the road wheels being subjected to shock load, the valve spool is moved in the appropriate direction to direct the fluid to that side of the piston, which will resist the movement. This blocking action is effective in damping out the kick-backs normally felt at the steering wheel.

When it is required to steer manually (without the advantage of power assistance), the small relief valve in the valve body permits free circulation of oil between both ends of the cylinder and the steering force is not appreciably increased over that required for the manual steering system.

Straight Ahead Driving

When the wheels are in the straight ahead position, the central valve spool is held in the centre or neutral position. In this position, oil from the pump flows past the valve spool lands and returns to the reservoir through the port in the control valve body.

Since only a small amount of back pressure exists in the system under this condition, the pump delivers oil at a low pressure which is transmitted to both sides of the power cylinder piston through the flexible pipes so that a balanced condition exists.

Steering Assistance

When the steering wheel is first turned to the right or left a force is exerted on the control valve spool, thereby displacing it towards one end of the body. With the spool in this position the oil passage to one end of the ram is closed to pump pressure. As the oil from the pump flows into the power ram the pressure increases until it is sufficient to force the steering booster in the appropriate direction, thus providing the power assistance for the turn. The oil displaced from the other end of the ram flows back through the control valve to the reservoir.

Operation Without Power Supply

If the pump fails to deliver oil pressure for any reason, the vehicle may be steered manually. Under this condition, the power steering system operates in the following manner:–

When the steering wheel is turned, the movement transmits the manually applied force to the control valve spool. The spool moves approximately .062 max. (1.58 mm) until it contacts its step then the full manual effect is transmitted mechanically to the steering linkage. With the valve spool in the off centre position oil is directed to either end of the power cylinder through the cylinder relief valve. Thus, manual movement of the power cylinder is not restricted by the necessity of forcing oil back through the pump and steering effort is not appreciably increased over that required for the manual steering system.

Maintenance Procedure

Service inspection of the complete hydraulic power steering system should be made at regular intervals.

The hydraulic oil serves to lubricate the internal working parts of the valve and cylinder assemblies. In addition grease fittings are provided for the ball and cup anchorage. Apply grease gun regularly every 2,500 miles (4000 km), using good quality grease as recommended for normal ball socket assemblies.

No adjustments are required. The valve port openings are built into the valve and cannot be changed. The centring springs are preloaded by the space into which they fit and the pre-load cannot be changed. Barring accidents, the direct-coupled unit is expected to last the life of the vehicle, except perhaps for the piston red seal and some 'O' ring replacements.

To Fill System

Extreme care should be taken to prevent dirt and other foreign matter from entering the system and on no account must dirty oil be used, proceed as follows:–

1. Fill the reservoir slightly higher than normal.
2. Start engine and allow to idle for short time.
3. With engine idling turn steering wheel back and forth several times from extreme locks to expel all air from the system.

4. Check oil in reservoir and top up to correct level. Repeat 3 and 4 if necessary. The fluid level should be checked weekly.

Servicing

Cleanliness and care throughout the entire servicing procedure cannot be over emphasised. The major parts of the unit, particularly the valve assembly, are machined to very close limits and the precision edges on these parts are vitally important to smooth operation.

Do not clamp or mark sealing surface of the piston rod as damage will result to the seals and bring about the need for more service repairs.

When it becomes necessary to service the unit, remove and discard all 'O' rings and seals using new ones of the correct part number only, when reassembling. Parts should be cleaned with a suitable solvent, washed and dried. Lubricate all new seals and 'O' rings with SAE 10 oil before reassembling.

In the event of a unit becoming faulty or damaged, it is strongly recommended that it be returned to the manufacturer for servicing or exchanged for a reconditioned unit under the service replacement scheme. Should circumstances make this impracticable, however, then the appropriate servicing instructions should be referred to.

FAULT FINDING

The hydrosteer Direct-Coupled system has been designed to provide trouble-free service, but like any mechanical device or system, the units may become worn or maladjusted. As a result, the normal smooth operation of the system may be affected. The information given below is intended to help in quickly locating and correcting difficulties that may be encountered.

1. Loss of Power Assistance

A sequence for checking through the system to determine the cause of loss of power assistance is detailed in the following paragraphs.

2. Binding

If binding or sticking is noticed when the steering wheel is turned, check the following items:—

(a) Movement of the manual ball pin.

The operating sleeve may be binding in the locating sleeve probably due to inadequate lubrication. These parts will have to be removed, freed and if necessary renewed.

(b) Control Valve Spool.

Check the operation of the spool in the valve housing. If it is binding, inspect for burrs or damage and if necessary renew the control valve spool and housing.

3. Excessive Free Play in the Steering

If excessive free play is noticed when steering, check the following items:—

(a) Manual Ball Pin Cups.

Check for excessive clearance between the ball pin and ball cups, check for wear or faulty Belleville washers and replace as necessary.

(b) Loose Locating Sleeve

If the locating sleeve is loose, remove the split pin at the ball pin end, remove the end cover, tighten fully, then loosen one quarter turn to provide the correct tension on the Belleville washers and replace the split pin.

4. Heavy Steering

Heavy steering should not be confused with binding. Heavy steering is experienced over the whole travel of the front wheels while binding is normally only experienced over a portion of the front wheel travel. If the steering is heavy the following points should be checked.

(a) Low Pump Output

If it is suspected that the pump output pressure is low, first check the pressure relief valve and spring and, if correct, strip the pump, examine and renew parts as necessary.

(b) Power Cylinder Assembly

If the steering is still heavy after overhauling the pump, dismantle the power cylinder assembly and inspect the control valve spool and spool bore. Deep scoring or scratches will allow internal leaks and cause heavy steering. If the control valve assembly is in good condition the trouble is probably due to excessive leakage in the power cylinder. In this case the inner tube and piston ring may have to be renewed.

5. Noisy Operation

To locate the cause of noise in the system check the following items:—

(a) Reservoir Oil Level

Check the oil level in the pump reservoir. If the oil is low, air is probably being drawn into the system by the pump. Top up with a good quality oil of specification

S.A.E. 10W (S.A.E., 5W when the temperature is consistently below 10°F (−12°C).

(b) Pump Parts

The pump assembly or certain parts of it may be worn. Dismantle the pump and renew as necessary.

(c) Check that the hose feeding the pump from the reservoir is not blocked. Blockage in this line will cause air to be drawn into the system.

6. Steering Chatter.

Steering chatter may be caused by one of the following items:—

(a) Piston Rod End Float

The anchorage of the piston rod may require adjustment or renewal of worn parts.

(b) Anchor Bracket

Check that the anchor bracket is properly secured to the frame member of the vehicle

REMOVAL

Disconnect the pipe line unions from the booster unit and catch the oil which will drain away.
Disconnect the ball joint from the steering linkage.
Withdraw the split pin and remove the nut, steel washers and rubber washers securing the ram unit to the chassis anchorage bracket.

DISMANTLING

After removal of the unit from the vehicle, drain oil from cylinder by moving the piston rod in and out several times from one extreme end of its travel to the other, then proceed as follows:—

1. First remove anchorage parts from end of piston rod.

(a) For ball and cup type anchorage the outer ball cup will have to be removed on dismantling from vehicle.

Clamp the ball on piston rod firmly in a vice equipped with suitable soft jaws, ensuring that locking pin is accessible. With suitable pin punch drive out the pin. Remove ball from the rod by applying a spanner to the

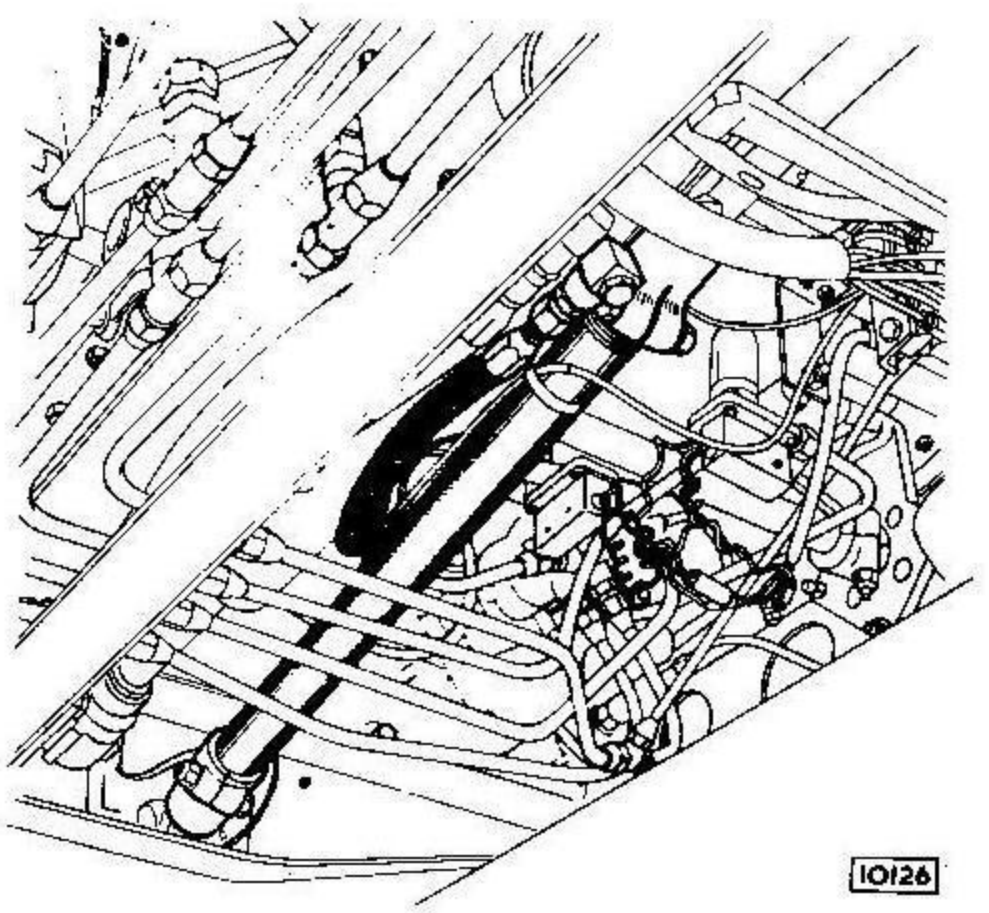


Fig. 9 Location of power steering ram unit

flats on the piston rod. Slide off the inner ball cup and rubber abutment cover.
(b) For rubber buffer type anchorage the split pin, castellated nut, one rubber pad and steel washer will have been removed on dismantling from the vehicle. Remove remaining rubber pad and steel washer.
2. Remove the two spring covers and grease retaining pads from the ball pins. Remove the two grease nipples and the split pins from the ends of the unit.
3. At the ball pin end unscrew the end cover and remove the two Belleville washers and the ball cup.
4. Unscrew the lock ring immediately below the ball cup and remove the spacer, the power ball pin and the second ball cup.
5. Pull out the spring locking clip from its slot and unscrew ball cup holder and ball cup. The manual ball pin can then be removed.
6. Unscrew the lock ring at the bearing end and remove the complete piston rod assembly from the unit. When removing parts from the piston rod slide them off at the piston end of the rod in order to eliminate any possibility of damage due to dirt or burrs.
7. Remove the split pin, castellated nut and steel washer that secure the piston and remove the piston from the rod. The piston ring should also be removed.
8. Slide the bearing assembly off the rod from the piston end and remove the 'O' ring.
9. Remove lipped scraper, which is a light press fit, from bearing. From the inside of bearing remove circlip, scraper housing, scraper ring, flat metal washer, vellumoid washer, gland seal and gland spacer.
10. The valve body, spool and inner tube assembly may now be removed by a few light blows on a wooden block

inserted in the ball pin end and resting on the ball cup.
11. Remove the inner tube from the valve body. It is a light press fit on the body and it should be removable without undue force.
12. Slide out the spool assembly and remove the locating sleeve. Extract the ball cup, Belleville washers and backing plate by tapping the end of the operating sleeve on a wooden block.
13. Remove the circlip from the valve body and slide out the end cover. Remove the 'O' rings from the end cover and the bore of the valve body.
14. Unscrew the plug and pin at the cylinder end of the valve body using a suitable Allen key and remove the cylinder relief valve spring and ball.
15. On units of 2" cylinder bore, or above, a locating collar is fitted. This locating collar and the locating pins are a press fit on the valve body and should not be removed unless loose or damaged.
16. Remove split pin from spool nut, unscrew nut and remove the steel washer. The operating sleeve, spacer and collar may now be removed. Slide off the reaction ring and remove the 'O' ring from its outer diameter. Remove the spring and reaction washer and extract the small 'O' ring from its location on the spool spindle.

Inspection of the Power Cylinder

1. Thoroughly clean all parts of the power cylinder and inspect for wear and damage.
2. Examine the spool and body for burrs and scoring. Burrs may be removed with a very fine emery cloth.

CAUTION: Do not round off the sharp edges on the valve spool or the operation of the valve may be affected.

3. With all 'O' rings removed insert the spool into the valve body and check its fit. With a light film of oil the spool should pass freely through the body.
4. Inspect the mating surfaces of the operating sleeve and locating sleeve for wear or damage. The surfaces should be free from burrs and scores.
5. Check the fit of the operating sleeve in the locating sleeve. The operating sleeve should slide freely within the locating sleeve when lightly lubricated.
6. Examine the inner tube, piston, piston ring, piston rod and bearing for wear or scoring and renew if necessary.
7. For rubber buffer type anchorage inspect the rubbers and steel washers for wear or damage. Renew if necessary.
8. Normally during an overhaul all 'O' rings should be removed and discarded with new rings fitted on reassembly. Split pins should also be renewed on reassembly.

Assembly of the Power Cylinder
(A) Valve Body Assembly.

1. Assemble the cylinder relief valve ball and spring to the valve body and screw home the plug and pin.
2. If any of the locating pegs are loose or damaged, replace with new pegs by tapping lightly into the holes provided.
3. If the inner tube locating collar requires replacing, assemble carefully under a small press, or by a few light taps with a wooden mallet, lining up the slot in the collar to the locating peg in the outer diameter of the valve body. (This applies to units of 2" bore cylinders and above only, 1¾" and 1½" bore units do not fit a locating collar).
4. Assemble new 'O' rings into the valve body and onto the end cover, slide the end cover into the body and secure with the circlip. Assemble a new 'O' ring onto the outside diameter of the body.

CAUTION: Extreme care must be taken when fitting 'O' rings to avoid damage which would cause subsequent leakage.

5. Assemble the inner tube on the valve body or locating collar if fitted. This is a light press fit and should be assembled carefully by means of a few light taps with a wooden mallet, lining up the slot in the inner tube with the locating peg.

(B) Valve Spool Assembly

1. Fit new 'O' rings to the spool and reaction ring. Assemble the reaction washer, spring and reaction ring to the spool. Both the reaction washer and reaction ring are fitted to the spool chamfer first.
2. Assemble the collar onto the threaded part of the spool and assemble the spacer to locate around the collar. The spacer should be positioned so that the holes in it line up with the corresponding holes in the valve body. Assemble the operating sleeve on to the collar, fit the steel washer and locking nut. Tighten to a torque between 110 to 200 lb. (1.2 to 2.2 kgm) ensuring that the hole in spool lines up with a slot in the nut. Fit split pin.
3. Grease the operating sleeve and slide the locating sleeve over it.

(C) Piston Rod Assembly
NOTE: To eliminate the possibility of damage to any parts, assembly should always be made from the piston end of the rod.
1. Insert a new gland seal, flat face first, carefully onto the small end of the special tool then place the gland spacer in position in the bearing. Insert the tool in the bearing and press home the seal, using the other part of the tool.
2. Insert vellumoid washer behind the gland seal. Back this up with a metal washer, square sectioned rubber scraper, scraper housing and insert circlip Press home lip scraper.
3. Assemble a new 'O' ring onto the outer diameter of

the bearing and slide the bearing onto the piston rod. This operation should be carried out from the piston end of the rod using a special taper sleeve tool.
4. Assemble the piston ring onto the piston and then assemble the piston to the piston rod flat face first, fit the flat washer and castellated nut. Tighten the nut to 35—45 lbs.ft., (5—6 kgm) do not overtighten, as this may cause the piston to swell and bind in the tube. Fit the split pin securely.

(D) Final Assembly
1. Compress the piston ring and slide the piston rod assembly into the inner tube as far as it will go, locating the recessed end of the bearing in the end of the tube.
2. Slide the spool assembly into the body, taking care to prevent damage to the sealing edges. The assembly must be positioned so that the small hole in the spacer locates on the dowel in the end of the valve body.
3. Assemble the backing plate into the bore of the operating sleeve chamfer first and ensure that it is correctly seated. Place two Belleville washers back to back (inner diameters together) into the recess of the ball cup. A smear of grease will help to retain the Belleville washer in position. Assemble the ball cup into the ball cup holder using a smear of grease again. Screw the ball cup holder into the operating sleeve for a few threads only to retain it in position.
4. Hold the outer tube and slide the complete inner assembly into the outer tube from the anchorage end. Care should be taken to see that the hose ports in the valve body line up radially with the ports in the outer tube. Screw the bearing lock ring into the end of the outer tube until the ports line up longitudinally and a slot in the bearing is in line with the split pin hole. This operation should be carried out with the power cylinder horizontal otherwise the spool will tend to fall out of the valve body.
5. Apply a liberal coating of grease to the spherical surface of the manual ball pin and assemble through the holes in the outer tube and sleeves, ensuring that the limit peg is located correctly in the two elongated slots provided.
Screw home the cup to its limit, using special tool. Screw back one quarter turn and then line up the nearest slot to the two holes drilled in the circumference of the operating sleeve. This should provide the correct tension on the Belleville washers. Lock with the spring clip using a special tool.
6. Assemble the next ball cup, with the larger outside diameter and ensure that it is correctly located. Apply a liberal coating of grease to the power ball pin and assemble it into position through the hole in the outer tube.
7. Assemble the spacer and screw home the lock ring using special tool, first ensuring that the spacer and the locating sleeve are in mid-position radially. The lock ring must be tightened securely to ensure satisfactory locking on the components between itself and the bearing.
8. Assemble the outer ball cup and place two Belleville washers back to back (inner diameters together) into the recess provided in the ball cup.
9. Screw home the end cover and then back off one-quarter turn to provide the proper tension on the Belleville washers. The reassembly of the unit may mean that the end split pin holes now do not line up with the slots. On no account may the lock rings be adjusted to line up. Re-drill split pin holes with 9/64" diameter drill and fit split pins.
10. Screw in the grease nipples and apply a grease gun. Assemble the two grease retaining pads and the two spring covers.
11. For ball and cup type anchorage first slide the rubber abutment cover and inner ball cup onto the piston rod. Screw home the anchor ball and lock with the locking pin.
Final assembly with the outer ball cup is made when installing to vehicle. Grease spherical surfaces before assembly.
For rubber buffer type anchorage slide on steel washer and one rubber pad, flat face first, onto end of piston rod. Final assembly of second rubber pad (reverse to first pad) and steel washer is then made when installing to vehicle and secured by the castellated nut. This nut should be tightened until the outer steel washer is against the shoulder provided on the piston rod and lock with split pin.

Refitting
Refitting is the reverse of the removal procedure.
Refill the reservoir with the recommended grade of oil and bleed the system as follows:—
1. Fill the reservoir slightly higher than normal.
2. Start the engine and allow to idle for a short time.
3. With the engine idling turn the steering from lock to lock a few times to expel all air from the system.
4. Check the oil level in the reservoir and top up to the correct level.

THE PRESSURE PUMP
The pressure pump which provides hydraulic pressure in the system is the Hobourne — Eaton unit of the roller type and incorporates a combined flow and relief valve.
The pump is mounted on the engine in line with the alternator, replacing the alternator jack shaft drive fitted to vehicles with standard steering.

OPERATION
Pressure from the pump is caused by six rollers in slots in a circular carrier, keyed to the pump drive shaft. These rollers circulate inside an eccentrically mounted cam ring. Owing to the eccentricity, the gap between each pair of rollers widens and narrows during the cycle, drawing oil from the inlet side of the pump and forcing it to the flow control valve.

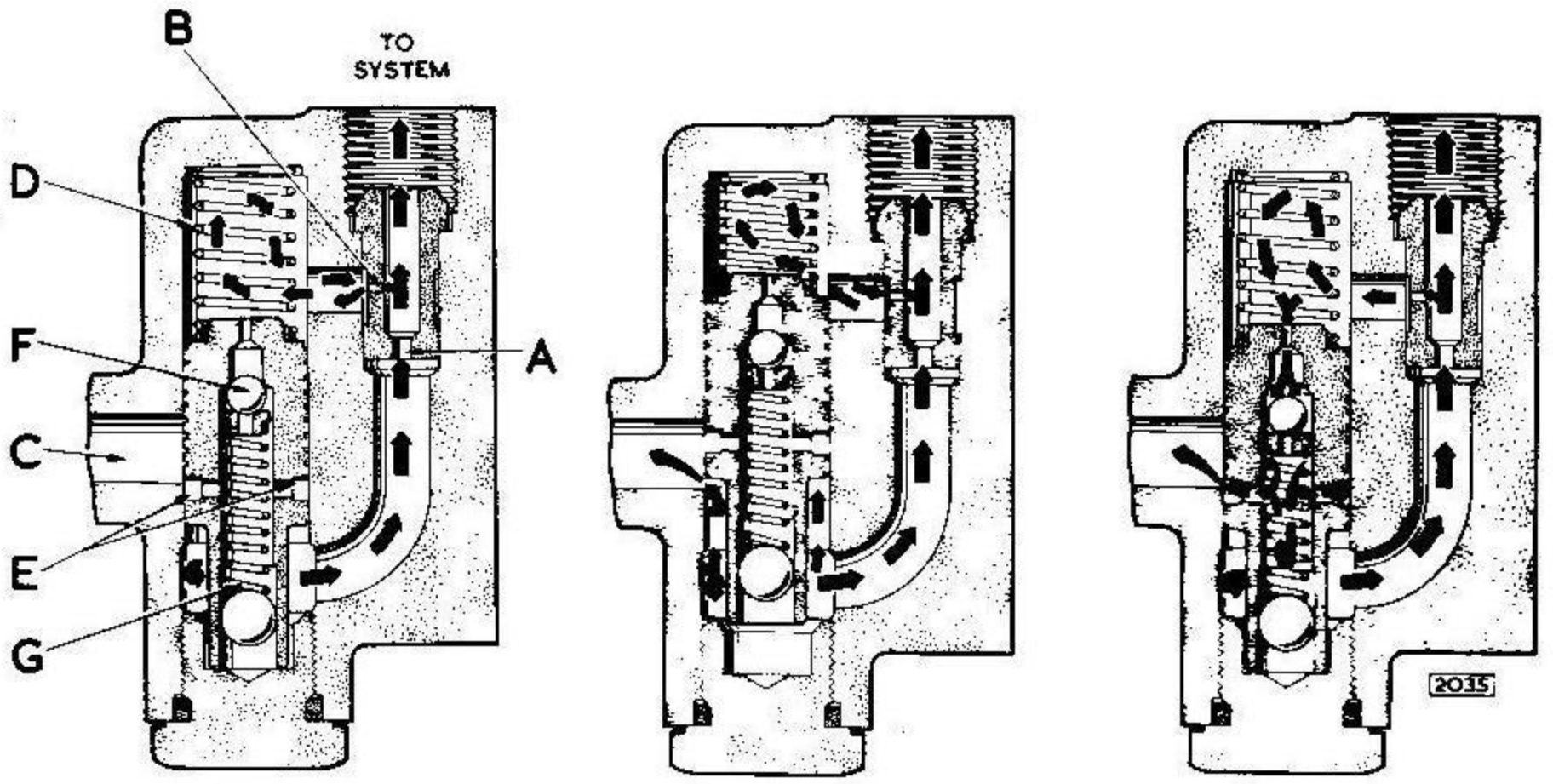


DIAGRAM I. DIAGRAM 2. DIAGRAM 3.

Fig. 10 Diagram showing the operation of the combined flow and and relief valve

When the pump comes into operation, and oil flow commences, a drop in pressure caused by the primary orifice (A, Dia. 1, Fig.8) occurs. Oil at this lower pressure passes through the secondary orifice (B) and enters the chamber containing spring (D) (Condition in Dia. 1). This pressure difference increases with the oil flow causing the control valve to move against the spring (D) and when a pre-determined flow has been reached the valve uncovers the by-pass hole (C) leading to the intake side of the system.

Any further increase in flow causes the by-pass hole to be uncovered further and thus a constant flow is maintained (Condition in Dia. 2).

Should the line pressure become excessive, the ball (F) in the valve moves against the spring (G) and oil flow from the chamber containing spring (D) by-passes through the annular holes (E) (Condition in Dia. 3).

When this occurs, a further pressure drop caused by the secondary orifice (B) causes the valve to move up to its normal by-pass position irrespective of the oil flow conditions. As soon as the line pressure drops the ball valve closes and the pressure difference is restored bring the constant oil flow back to normal.

REMOVAL

Disconnect the high and low pressure hoses at the pump unions and the hose ends in a raised position to prevent oil drainage. Alternatively, allow the oil to drain into a clean container.

Release the four hose clips securing the flexible coupling to the alternator and pump.

Slacken the mounting strap and withdraw the alternator away from the pump coupling.

Remove the pump coupling from the pump coupling boss.

Remove the setscrews and detach the pump and pump mounting bracket from the engine.

Remove the setscrew and lockwasher from the pump shaft and withdraw the drive coupling. Collect the key from the shaft.

Remove the bolts and lockwashers and detach the pump from the mounting bracket.

Withdraw the setscrew and lockwasher from the opposite end of the shaft, remove the alternator coupling boss and collect the key.

DISMANTLING, INSPECTION AND ASSEMBLY

NOTE: Thoroughly clean the exterior of the pump assembly using care to ensure that dirt does not enter the inlet or discharge holes.

During assembly operations, extreme caution should be used to prevent any dirt from entering the pump. All parts should be lightly oiled before assembly.

Clamp body in vice.

Remove adaptor and gasket.

(NOTE: The Venturi director is pressed into the pump cover and should not be removed).

Remove six socket head cap screws and lockwashers securing pump body to cover, and remove pump from vice. Separate cover from body vertically to prevent parts

falling out. The shaft end protruding from the body should be held in place during this operation to prevent it from coming away with the cover, and so causing internal parts to be dropped.
Remove 'O' ring seals from grooves in pump body.
Remove shaft, complete with carrier, from body. Remove snap rings from shaft and slide carrier off and remove drive pin.
Remove roller vanes and cam ring from body, and lift out cam lock peg.
Remove oil seals from pump body and cover, ensuring that no damage is caused to shaft bearings.
Remove valve cap, valve, and flow control spring from pump body.
CAUTION. Place all parts where they will not be damaged or subject to contamination.
Wash all parts in a suitable solvent. Air dry or wipe clean with a lint free cloth if air is not available.
Check pump body and cover for wear. Renew either part if faces or brushes are worn.
Grease lips of new shaft seals and assemble in body and cover, with lips towards roller assembly. An Arbor Press is generally employed with a 1.7/32" diameter piece of steel bar as a press tool. Press in seals until they are fully home but ensure seals are not crushed.
Refit the cam locking peg. Inspect the cam for wear and replace if worn or damaged. Refit the cam with the slot over the locking peg. Ensure that the cam is seated correctly.
Insert the drive shaft from the seal side of the body, ensuring that there are no sharp edges on the shaft to damage the oil seal lip.
Refit the drive pin to the shaft and having inspected the roller carrier, fit it in to position as shown in Fig.4. Ensure that the correct face of the carrier slots are driving the rollers. Refit the snap ring.
Inspect the rollers paying particular attention to the finish on the ends. Replace if scored, damaged or out of round, refit the rollers.
Check the end float of the carrier and rollers in the pump body using feeler gauges and a straight edge across the cam surface. If the end float exceeds .002" (.051 mm) the rollers and carrier should be replaced.
Refit the flow control spring in the valve bore. The spring should be replaced if the tension is not between 8-9 lb (3.63 – 4.08 kg.) at 0.82" (20.8 mm).
Refit the valve in the pump body with the exposed ball bearing end entering last. Ensure that the valve is not sticking. Refit the cap sealing ring and tighten the cap to 30–35 lb.ft. (4.15–4.84 kg.M.)

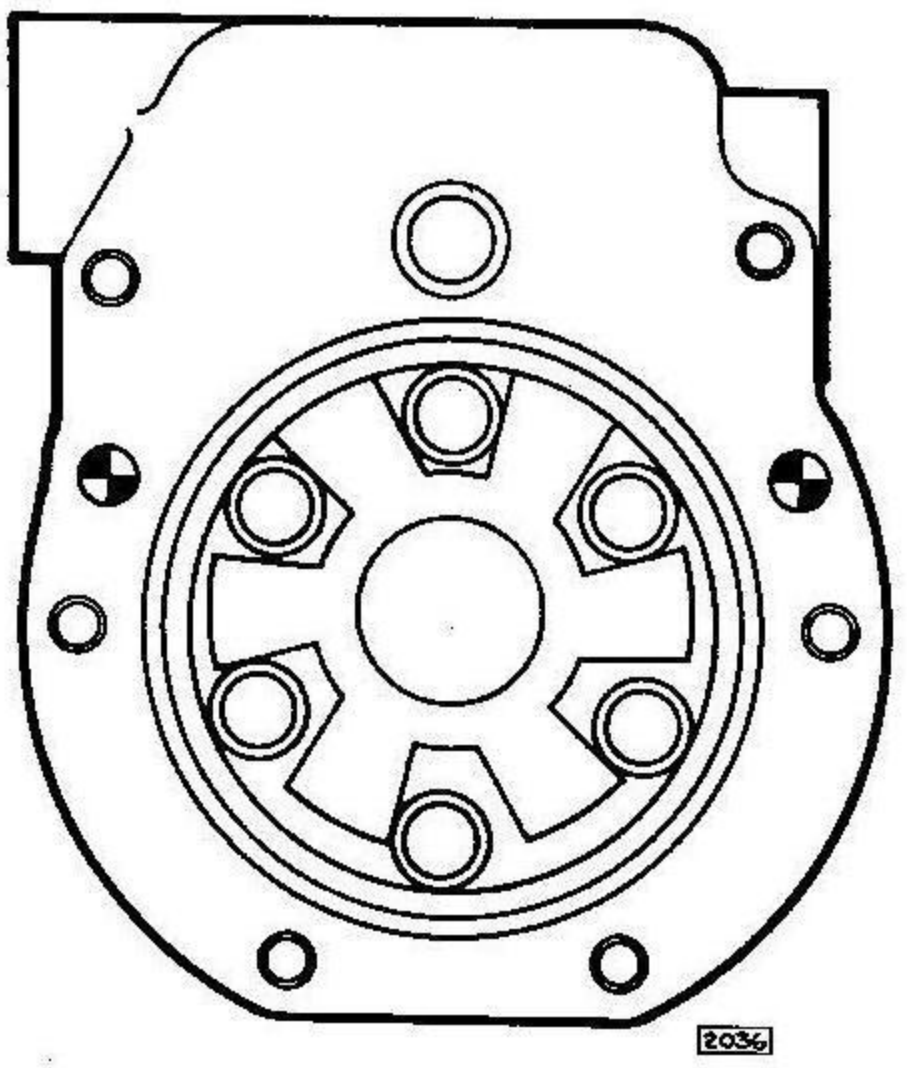


Fig. 11 The roller carrier and rollers in position

Fit new sealing rings to the pump body joint face. Fit the thrust washer to the cover and refit the pump cover to the body, secure with the six cover screws and tighten evenly to a torque of 18 lb.ft. (2.49 kg.m.).

IMPORTANT: Check the drive shaft rotation for freedom after tightening the cover screws. There must be no binding.

Renew gasket in groove on top of pump housing and replace adaptor.

REFITTING

Refitting is the reverse of the removal procedure.
NOTE: When tightening the pump/alternator coupling clips the alternator will move approximately 1/16" (1.6 mm) towards the flywheel.
It is therefore essential that the four coupling clips are fully tightened before the alternator clamp strap is secured.

FRONT AND REAR SUSPENSION AND HYDRAULIC DAMPERS

SECTION O

INDEX

FRONT AND REAR SUSPENSION AND HYDRAULIC DAMPERS

SPECIFICATION AND DATA

SPRINGS

Front Spring — Dual Rate	
Make	Fox or Woodhead
Width	4" (101.6 mm)
Spring eye centres — flat	50" (1270 mm)
Free camber	(Neg) 0.58" (14.5 mm)
Camber under unladen static conditions	(Neg) 2.58" (65.7 mm)
Total thickness	4.625" (117.5 mm) Later models.
No. of leaves	12
Deflection under unladen static conditions	2.0" (50.8 mm)
Diameter of shackle pin	1.25" (31.7 mm)
Shackle clearance	0.014" (.35 mm)
Static load (unladen)	2315 lbs. (1074.6 kg)
Rear Springs — Single Rate	
Make	Fox or Woodhead
Width	4" (101.6 mm)
Spring eye centres — flat	62" (1574.8 mm)
Free camber	(Pos) 0.97" (24.25 mm)
Camber under unladen static conditions	(Neg) 1.45" (36.83 mm)
Total thickness	5.3125" (134.9 mm)
No. of leaves	13
Deflection under unladen static conditions	2.45" (62.23 mm)
Diameter of shackle pin	1.25" (31.7 mm)
Shackle clearance	0.014" (.35 mm)
Static load unladen	4678 lbs (2116.7 kg)

HYDRAULIC DAMPERS

Shock absorber — front	Armstrong D.A.S.12
Shock absorber — rear	Armstrong Telescopic AT 11

DESCRIPTION

The road springs are semi—elliptical secured at the front end by eye bolts through brackets attached to the chassis frame, and at the rear end by shackle pins and shackles. All shackles are adjustable for end float.
Armstrong Telescopic Dampers control the rear springs, the front springs being controlled by Armstrong double acting hydraulic dampers.

ROUTINE MAINTENANCE

EVERY 2,500 MILES (4,000 KM)

Shackle pins — Lubricate
Attach the grease gun to each shackle pin and lubricate with the recommended grade of lubricant until the grease is seen to exude from the spring side faces.
On vehicles fitted with automatic chassis lubrication this operation will not be necessary.

FIRST 5,000 MILES (8,000 KM)

Spring Mountings
Check spring/axle mountings and tighten if necessary. It is essential when carrying out this check that the vehicle is in its normal riding position, that is, with the full weight on the suspension.

Hydraulic Dampers
Check the front and rear damper mountings. In the

instance of the front damper it should be noted that the link pins are provided with two flats adjacent to the link to enable the pin to be held stationary whilst tightening the securing nuts. It is essential that the vehicle is in its normal riding position, that is, with the full weight on the suspension before carrying out this check.

EVERY 5,000 MILES (8,000 KM)

Road Springs

Clean off all road dirt from the road springs and spray with penetrating oil. Shield the brake shoe assemblies during the operation to prevent contamination of the shoes with the oil spray.

Front Hydraulic Dampers

Check the fluid level of the front dampers by removing the filler/level plug situated in the body of the unit above the operating spindle. Fill slowly with the recommended damper fluid until the level rises to the bottom of the orifice and refit the plug.

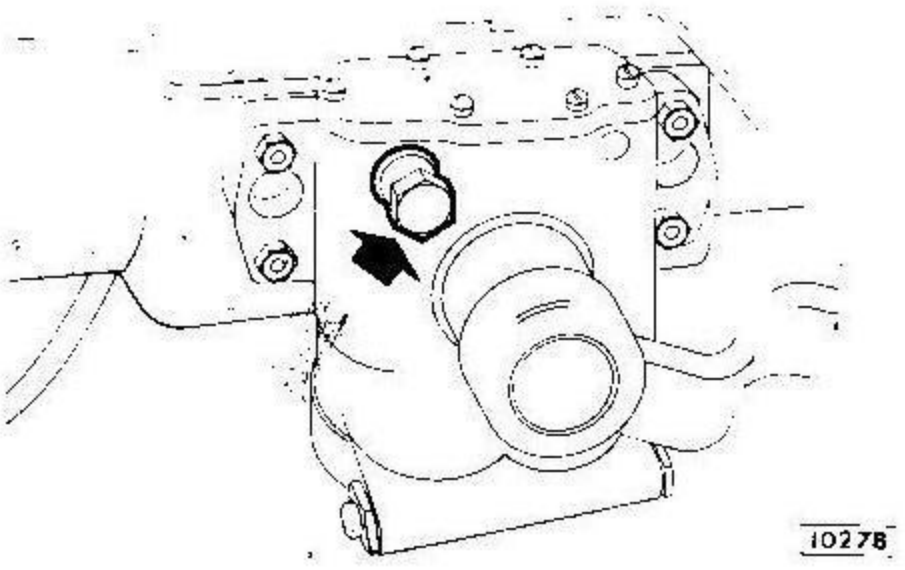


Fig. 1 The filler/level plug

NOTE: Clean off all road dirt from the damper before removing the plug to prevent the ingress of dirt into the unit.

Access to the filler plug is gained from underneath the vehicle unless the road wheels have been removed.

Check the condition of the rubber bushes in the link and renew if necessary.

The rear dampers are of the sealed type and no routine maintenance topping up is necessary or provided for.

EVERY 10,000 MILES (16,000 KM)

Road Spring Shackles

Check all spring shackles for end float. Slacken the two pinch bolts adjacent to the two large self-locking nuts by releasing the two smaller self-locking nuts. Tighten the two shackle pin nuts until the washers between the spring eye and shackle, and the chassis bracket and shackle are equally nipped. Release the shackle pin nuts one flat to obtain the specified clearance 0.014" (.35 mm).

Tap the end of each shackle pin lightly with a soft mallet and check the clearance with a feeler gauge. Readjust if required. Finally tighten the two pinch bolts.

THE SHACKLE PINS

Removal

Jack up the vehicle and place suitable stands in position to support the weight of the frame and lower the frame on to the stands. Jack up the axle until the spring is free of load and remove the road wheel.

Disconnect the lubrication pipe from the shackle pin if automatic lubrication is fitted.

Extract the split pins, remove the nuts and withdraw both the shackle pin clamping bolts. Withdraw the shackle pin outwards.

Refitting

Ensure that the hole in the shackle is correctly aligned with the hole in the bracket or the spring eye and insert the shackle pin.

Position the slots of the shackle pin in correct relation to the clamping bolt holes and fit the bolt and nuts. Tighten the inner nut only.

Adjust the shackle clearance as detailed in the 10,000 miles (16,000 km) Routine Maintenance Service. Tighten the outer clamping bolt nut and fit the split pins.

Reconnect the automatic lubrication pipe.

The shackle pins may be rotated through 180° when worn so that their life can be extended.

NOTE: If the lubricant pipe has been allowed to drain during the shackle pin removal, it will be necessary to bleed the pipe before fitting as detailed in Section B "Lubrication".

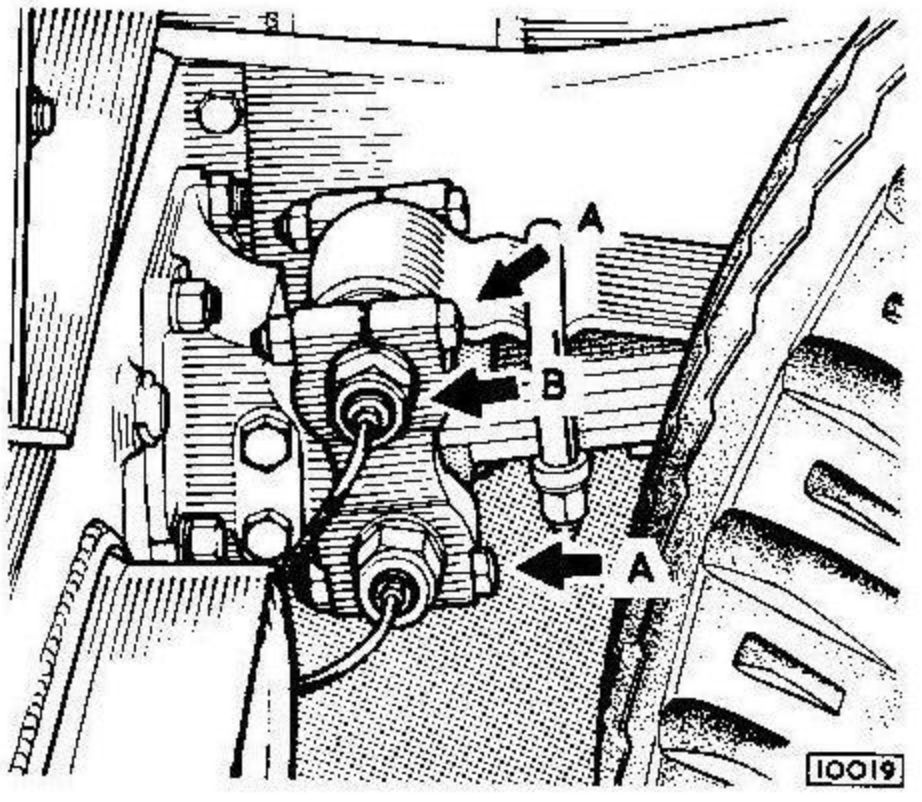


Fig. 2 The road spring shackle

1 The pinch bolt and nut 2 Shackle pin nut

SPRINGS

Removal
Jack up the frame and axle (front or rear) and remove the road wheel as described under "Shackle Pin – Removal".
If removing a rear spring, remove the locknut and nut, the washer and the lower mounting rubber from the stem of the damper bottom mounting. Remove the nuts from the four spring mounting bolts. Withdraw the four bolts downward and remove the damper bottom bracket for rear spring removal and withdraw the four bolts from the top when removing the front spring and remove the spring locating plate.
Support the spring and remove the shackle pins as described under "Shackle Pin – Removal".
Lift the spring out from under the chassis.

Refitting
Refitting is the reverse of the removal procedure. Re-adjust the shackle clearance as detailed under the 10,000 miles (16,000 km) "Routine Maintenance" Service. Re-bleed the automatic lubrication pipe as detailed in Section B "Lubrication".
NOTE: Springs should be fitted with the clamp bolt nuts towards the tyres.

Checking
Before refitting the spring, check the camber and static load deflection to the figures stated in "Specification and Data".

THE HYDRAULIC DAMPERS

Armstrong Telescopic At 11 dampers are fitted to the rear springs and Armstrong D.A.S. 12 Hydraulic double action dampers to the front springs.
No adjustment of either type is required or provided for. The only maintenance necessary is the periodical examination of the anchorage to the chassis and spring, the fixing bolts being tightened as necessary and the topping-up service to the front dampers.

Topping-up the Hydraulic Dampers
Disconnect the damper link. Remove the filler plug and top up with the recommended grade of fluid; while doing so move the lever to the full extent of the stroke to expel any air which may be in the damper.
It is ESSENTIAL that the unit is perfectly clean before carrying out any topping-up operation. Dirt which may enter through the filler plug will seriously effect the working of the internal valves.

Checking Resistance
If the damper does not appear to be working correctly, it may be checked as follows:–

(i) Remove from the vehicle and clean thoroughly.
(ii) Secure the damper in a vice, operate to the full extent of its stroke. If movement is not even throughout the full range, replace with reconditioned or a new unit. Renew rubber bush mountings if worn or damaged. Under no circumstances must oil be allowed to contact the bushes and any cause must be traced and rectified immediately.

CHASSIS FRAME

SECTION P

INDEX

CHASSIS FRAME

SPECIFICATION AND DATA

	30'0" chassis	33'0" chassis	36'0" chassis
Wheel Base	16'3"(4.95m)	18'6"(5.625m)	18'6"(5.635m)
Frame Width (front axle)	2'6½"(77.4cm)	2'6½"(77.4cm)	2'6½"(77.4cm)
Frame Width (rear axle)	3'8"(111.7cm)	3'8"(111.7cm)	3'8"(111.7cm)
Front Overhang	6'10¾"(2.09m)	6'10¾"(2.09m)	6'10¾"(2.09m)
Rear Overhang	6'11¼"(2.12m)	7'3" (2.21m)	9'9" (2.78m)
Overall Length	30'2½" (9.2m)	32'9" (9.98m)	36'0"(10.97m)
Maximum Width (outriggers)	7'6"(2.28m)	7'8½"(2.35m)	7'8½"(2.35m)
Maximum Width (engine covers)	7'9½"(2.37m)	8'0"(2.44m)	8'0"(2.44m)
Ground Clearance (transfer box)	9¾" (24.9cm)	9¾" (24.9cm)	9¼" (23.4cm)
Ground Clearance (rear axle)	5½" (13.9cm)	5.7/8"(14.9cm)	5½" (13.9cm)

GENERAL DESCRIPTION

The chassis frame consists of two channel side members upswept to clear the front and rear axle units. These two side members are braced by six tubular cross members. To the rear end of the chassis is attached the sub—frame carrying the engine, gearbox and radiator units. A further channelled cross member is attached to the front of the chassis frame and forms the mounting for the steering unit, brake pedal bearing and valve, and accelerator control master cylinder.

The third cross member carries a relay lever assembly for the handbrake operation. The cross member immediately forward of the rear axle has cast ends which provide the front support for the rear springs and attached to the cross shaft are brackets carrying the rear brake operating chambers and way shaft. The exhaust silencer is attached by brackets to the rear cross member.

ROUTINE MAINTENANCE

FIRST 250 MILES (400 KM)

Check and tighten all chassis frame nuts and bolts

EVERY NORMAL DOCKING PERIOD

Recheck chassis frame mountings.

Frame Alignment—Checking

All the chassis frame components are of the bolted construction type and are replaceable if damaged.

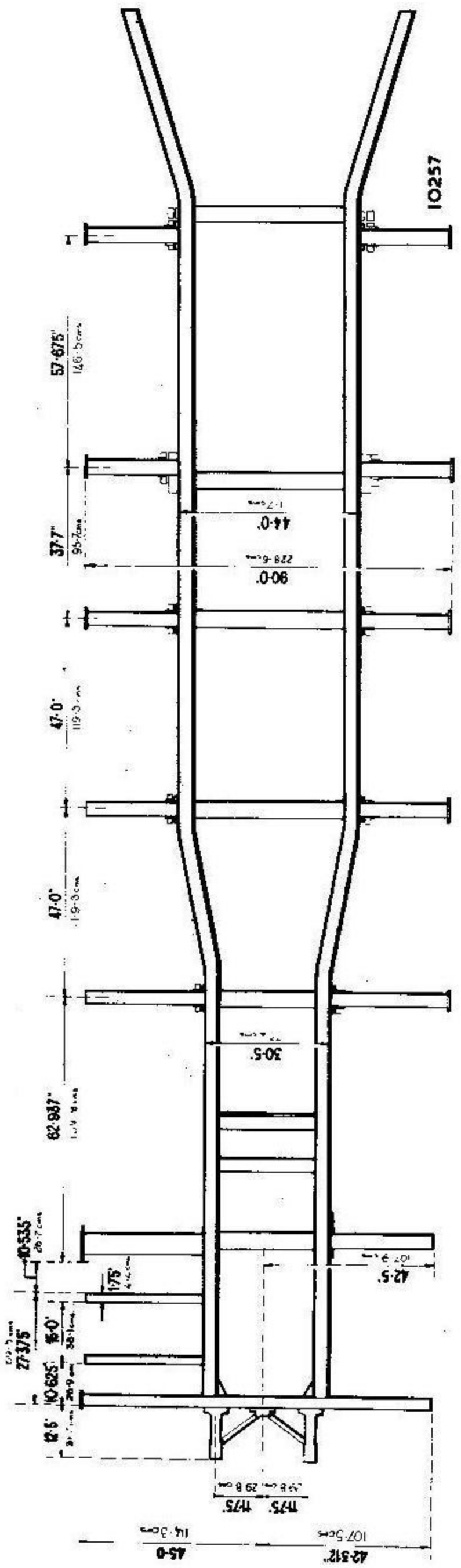
If the vehicle has been involved in an accident which may have caused possible distortion to the chassis frame, check by placing the vehicle on level ground.

Check also against the figures given in the "Data" section, and in Figures 1,2 and 3.

Renew all faulty units and components. Under no circumstances should the holes be drawn with a file or similar tool to enable the bolts to be fitted.

It is important that all chassis frame nuts and bolts be fully tightened and re—checked after 250 miles (400 km) service.

CHASSIS FRAME



1 Dimensional layout of 30' 0" double deck chassis

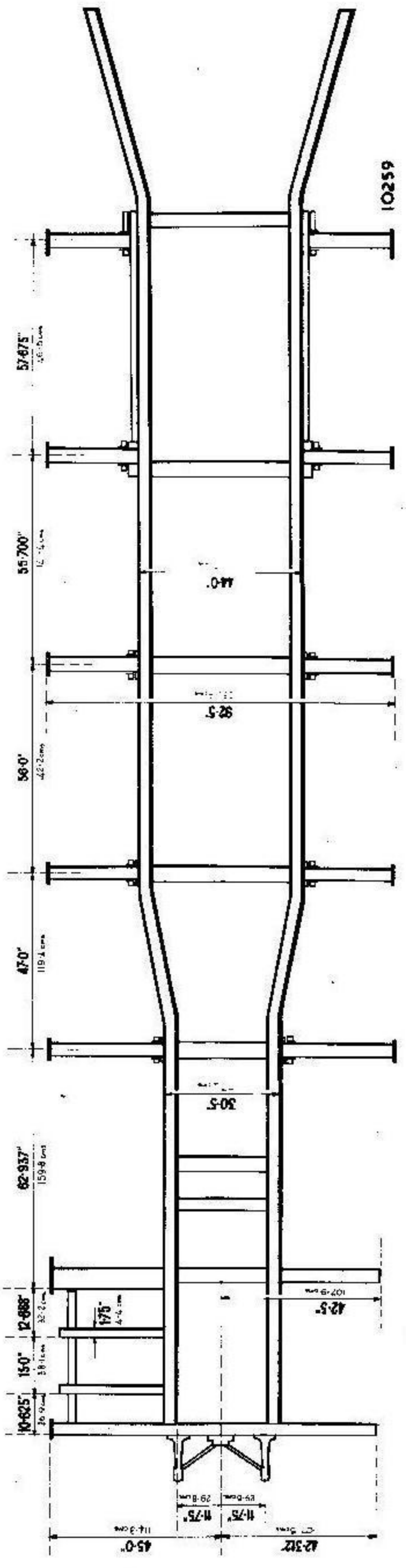


Fig. 2 Dimensional layout of 33' 0" double deck chassis

CHASSIS FRAME

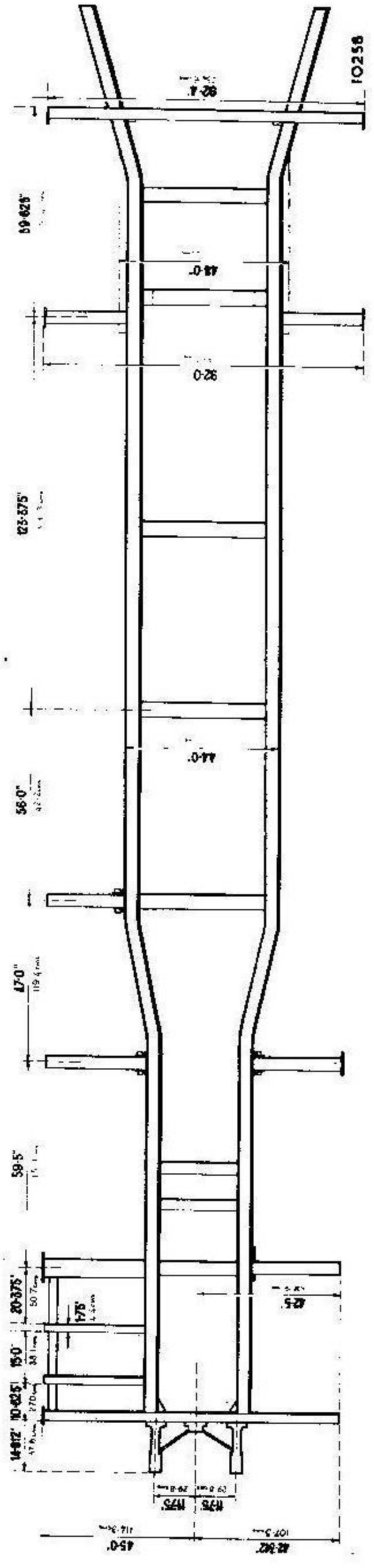


Fig. 3 Dimensional layout of the 36' 0" single deck chassis.

ENGINE COMPARTMENT COVERS

SECTION Q

INDEX

ENGINE COMPARTMENT COVERS

THE ENGINE COMPARTMENT COVERS
(Double deck—chassis)

DESCRIPTION
The engine compartment covers consist of a one piece fibre glass cover surround with a detachable bonnet. The opening of the bonnet is deeper than on previous models in order to provide better access to the engine and transmission units.
A detachable side panel is provided in the left hand side of the surround to provide access to the compressor drive belts and timing chest. A louvered grill in the right hand side of the surround provides the air intake for the radiator.

THE FRONT PANEL
Removal
Raise the panel, after depressing the release button, by lifting the handle set in the bottom edge.
Remove the two self—locking nuts and plain washers from each of the five hinge brackets.
Extract the split pin and remove the plain washer and clevis pin from the telescopic jack top pivot joint.
Support the panel in the open position, lift until the studs in the hinge brackets are clear of the surround structure and remove by withdrawing rearwards.
NOTE: On vehicles equipped with engine compartment illumination lamps it may be necessary to detach the lamp holders by withdrawing the fixing screws to gain access to the hinge bracket nuts.

Refitting
Refitting is the reverse of the removal procedure.

The Front Panel Catch — Adjustment
Release the two catch securing nuts and utilizing the elongated holes in the bracket adjust until the bonnet will lock without rattle.

THE COVER SURROUND
Removal
Disconnect the rear lamp cables (these may vary with body types). On vehicles equipped with plug and socket connectors unscrew the locking ring and withdraw the plug with attached cables.
Remove three setscrews, cup washers and rubber washers from the right-hand and left-hand side mountings and three setscrews from the rear cross frame mounting.
Remove the oil bath air cleaner intake pipe, release the radiator filler cap hose clips and detach the hose connection.
Remove the cover surround.

Refitting
Refitting is the reverse of the removal procedure.

THE SIDE PANELS

Removal
The left-hand side panel is retained in position by three budget locks. Insert the key and turn anti-clockwise to remove.
The radiator air intake grill is secured by ten self-tapping screws. Withdraw to remove the grill.

Refitting
Refitting is the reverse of the removal procedure.
Check the condition of the rubber sealing strip when refitting the left-hand panel. Renew if damaged or worn.

THE TOP COVER JACK

Removal
Raise the top cover. Extract the split pins, plain washers and clevis pins from the top and bottom jack pivots and remove the jack. It will be necessary to support the top cover when the jack is removed.

Refitting
Refitting is the reverse of the removal procedure

Adjusting
Adjust by increasing or decreasing the adjustable eye bolt extension from the jack, release the locknut and adjust the length of the eyebolt centre to the end cover locknut face to a dimension of 2" (50.8 mm).
Refit the jack to the cover and make any minor adjustments necessary.
NOTE: Any adjustments made should ensure that the cover is maintained in the open position without any free movement whilst retaining the fully closed position.

THE ENGINE COMPARTMENT COVERS
(Single deck chassis.)
The engine compartment covers on the 'FLEETLINE' single deck chassis are component parts of the body structure.
All detail reference for these items should be made to the Coachbuilder.

FIBRE GLASS COMPONENT REPAIRS
Any accidental damage sustained by the fibre glass panels and components can be easily repaired by the normal fibre glass repair procedure.
For the convenience of those operators not having the necessary equipment, a Factory Repair Service is available details of which can be obtained on application to:

THE SERVICE DEPARTMENT
DAIMLER TRANSPORT VEHICLES LIMITED
COVENTRY, ENGLAND

ELECTRICAL SYSTEM

SECTION R

INDEX

ELECTRICAL SYSTEM

ELECTRICAL SYSTEM

DESCRIPTION

The electrical equipment, manufactured by C.A.V. Limited, operates on a 24 volt system, power being generated by an alternative current generator mounted on the engine. The four 6 volt batteries are mounted in a carrier forward of the rear axle.
The control board, battery isolation switch, and the booster socket are mounted as follows:—

Fleetline — Double Deck
On a bracket attached to the top flange of the right-hand frame side member forward of the rear bulkhead.

Fleetline — Single Deck
In a box attached to the side of the right-hand frame member forward of the rear bulkhead.
Accessibility to the components is provided by the Coachbuilder.
Components may be mounted on the left-hand side of the vehicle at Operator's request.
The combined switch/fuse board mounted in the drivers compartment, the exact location being to Operators requirements, contains the start, panel, and road lamp switches; oil, air and alternator monitor lights and the two switches for engine start and stop control.

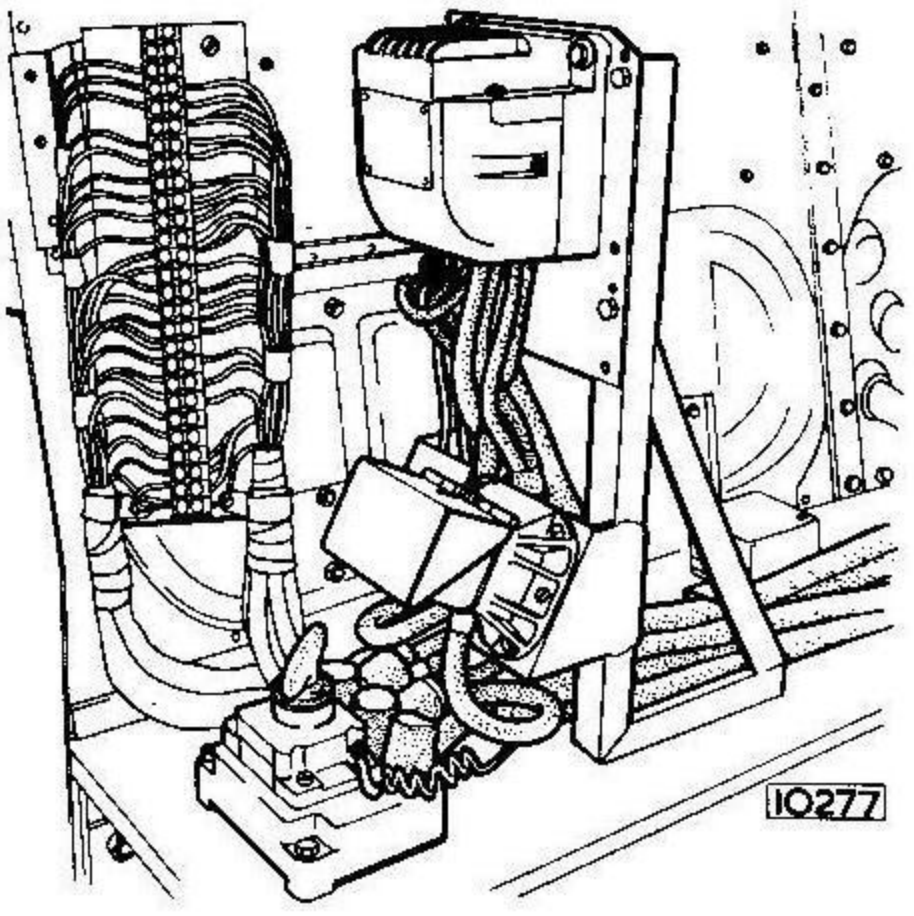


Fig. 1 Location of control board battery isolation switch and booster socket (when fitted). (FLEETLINE double deck chassis)

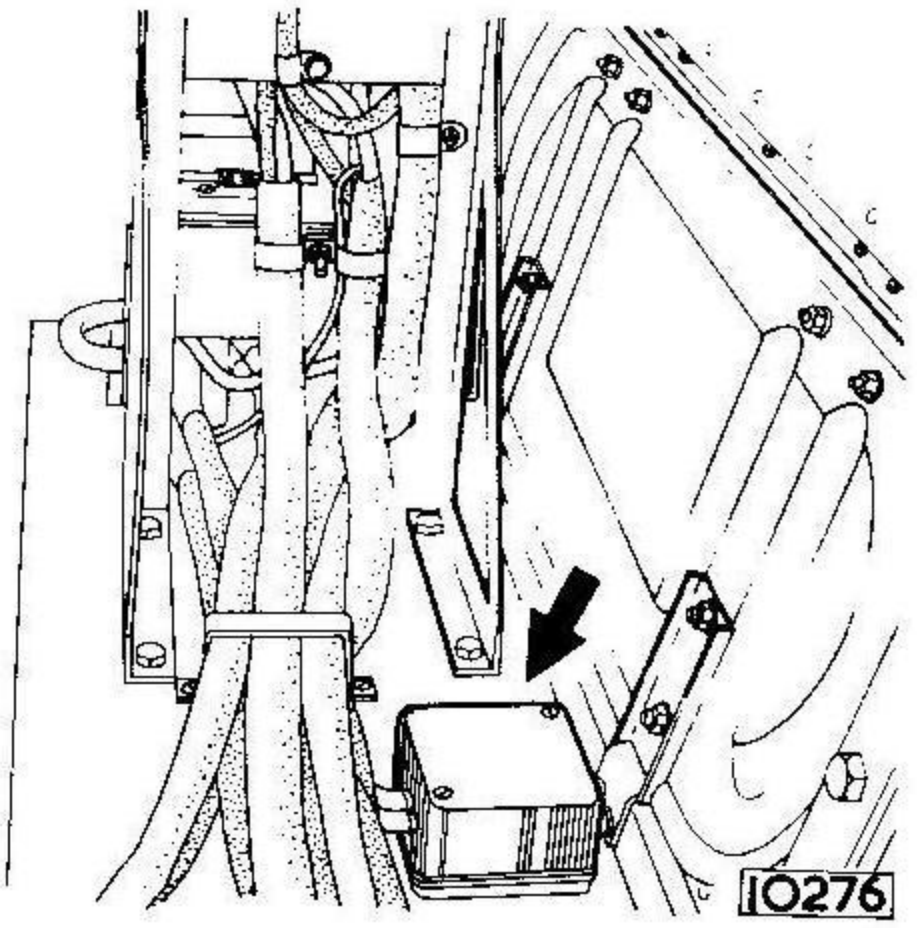


Fig. 2 Location of control board fuse box

The instrument panel mounted on the column below the steering wheel contains the electric speedometer and air pressure gauges with the gear control switch attached to the left hand side of the panel, the horn button and automatic cancelling flasher switch being attached to the right hand side of the panel.
The head lamp dipper switch is mounted on a bracket attached to the forward frame cross member and is controlled by a foot operated plunger located in the floor board to the left of the steering column.
The engine stop solenoid and relay are mou on brackets in the engine compartment adjacent to th tid flywheel.

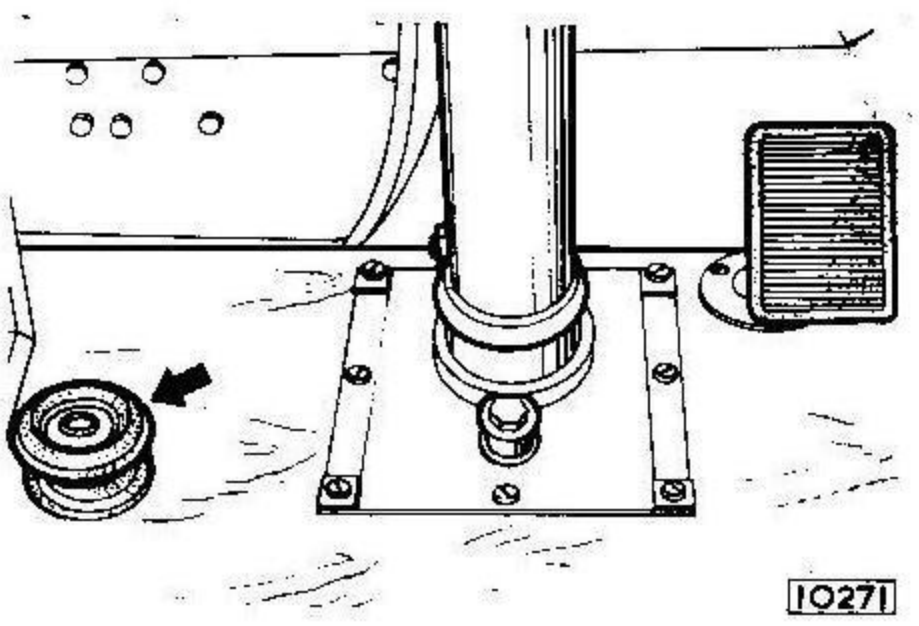


Fig. 3 Location of dipper switch

ELECTRICAL SYSTEM

The single horn is mounted on a bracket attached to the right hand frame side member located under the driver's floor plates. Twin horns are available if required.
A second "emergency" stop button may be mounted in the rear of the vehicle operating in conjunction with the engine stop solenoid.
Further safety switches are installed which will prevent the engine being started when:

(1) The engine compartment cover is raised.
(2) The gear selector switch is in any position other than neutral.

The reversing light operates automatically when the reverse gear is selected and an under engine cover light can be fitted to operate when the cover is raised. The light is automatically extinguished when the cover is lowered.
Two or four headlamp systems are fitted to suit individual operators requirements. With the four headlamp system, the two outer lamps have main and dipped (meeting) beams, the two inner lamps having main beams only; operation of the dipper switch to the dipped position extinguishes all main beams, current being supplied to the dipped filaments only. All chassis components including head, side and fog lamps (when fitted) are to the Daimler specification and all body details including stop, tail and direction indicator lamps are to the Coach Builder's specification.

ROUTINE MAINTENANCE

WEEKLY

Battery — Electrolyte Level
Check that all battery terminals are clean and tight. Wipe away all moisture and dirt from the tops of the batteries, remove the filler plugs and check the electrolyte level. Add distilled water only to bring the level to ¼" (7 mm) above the separators.
NOTE: Under no circumstances must tap water be added otherwise damage will be caused to the plates.
WARNING: Do not use a naked light when checking the electrolyte level since the escaping gas is highly inflammable.

EVERY 50,000 MILES (80,000 KM)

The Electrical Wiring System
Check all wiring connections and tighten as necessary.

BATTERY

The four 6 volt batteries are mounted in a carrier forward of the rear axle.
All maintenance and removal can be carried out through a trap in the floor of the vehicle or by raising a panel in the body side.

Checking the Specific Gravity
Remove the vent plugs. Insert an accurate hydrometer into each cell in turn and withdraw sufficient electrolyte to enable a reading to be recorded. Specific gravity should be between 1.270 and 1.280 in temperate climates and 1.200 — 1.220 in tropical conditions. If the electroyte level is too low to allow a reading to be taken add distilled water to the specified level and recharge for half an hour before taking a fresh reading.

CHARGING FROM AN INDEPENDENT SOURCE

Charge at 15 amps until the specific gravity in each cell shows no rise after three hourly tests.
If the temperature when taken with a thermometer rises above 110°F in temperate climates or 120° under tropical conditions during charge, interrupt the charge until the temperature of the electrolyte has fallen to the air temperature. Should the specific gravity of any cell be outside the limits specified by the battery manufacturer on completion of charge, a correction must be made.
Raise by adding electrolyte with specific gravity 1.350 at 60°F and lower by adding distilled water. Always maintain level to ¼" (7.0mm) above separators.

BATTERY STORAGE

To ensure that they are maintained in the best condition, batteries should be regularly charged and discharged.
If the vehicle is to be out of commission for some time and the batteries are to be stored, check that they are fully charged and given a refresher charge at the normal charge rate every month.

SWITCH/FUSE BOARD

The combined switch and fuse board is hinged to allow access to the switch and panel connections warning light to the four fuses. The circuits covered by the fuses are:—

(i) Auxiliaries. Horn, Direction Indicators, Stop Lamps and Gear Change Control.
(ii) Fog Lamps.
(iii) Side and Tail Lamps.
(iv) Head Lamps.

To lower the switch/fuse panel, remove the two chrome thumbscrews and lower the panel to the hinge stop.

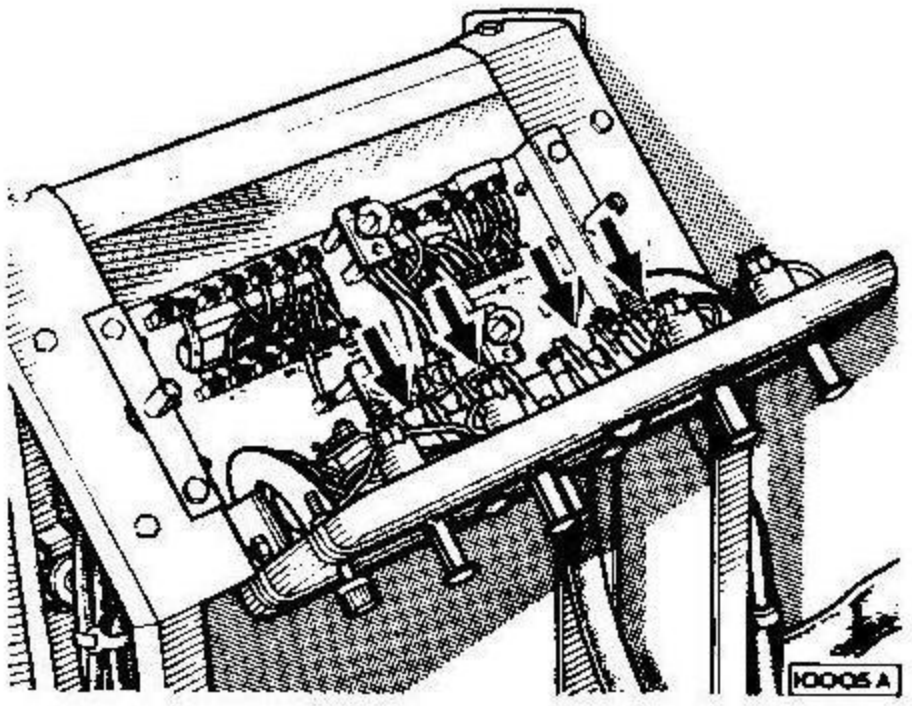


Fig. 4 The panel lowered to gain access to the fuses (shown in chassis form)

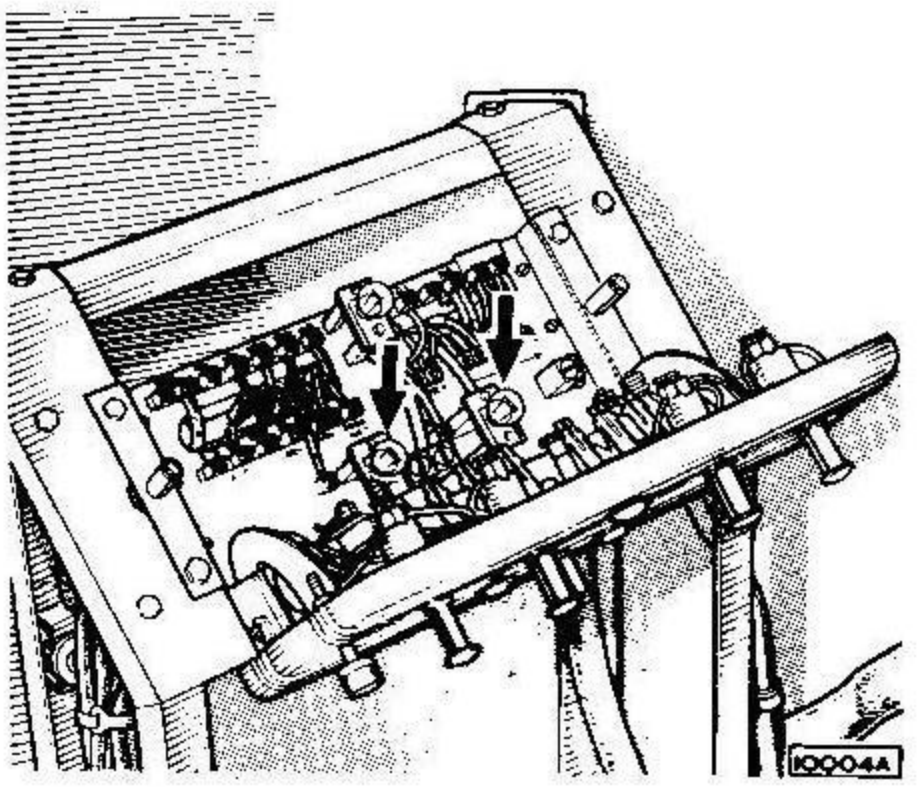


Fig. 5 The panel lowered to gain access to the monitoring lamps (shown in chassis form)

FUSES

To repair

To repair a blown fuse, lower the switch/fuse panel to the horizontal position. Press down the extended portion of fuse holder and remove portion of blown fuse. Replace with new wire. Spare fuse wire is carried on a post attached to the instrument panel.

NOTE: Always replace a blown fuse with wire of the same value. Under no circumstances should wire of a heavier gauge be used.

MONITOR LAMPS

Replacing Faulty Bulb

Lower the switch/fuse panel to the horizontal position. Unscrew the bulb from the holder and replace with a bulb of the same wattage.

C.A.V. A.C.7/B ALTERNATOR

DESCRIPTION

Alternator

The alternator is a three phase machine of the revolving field and stationary armature type and is self—limiting in current output. Built—in rectification of the generated alternating current is provided by means of six silicon diodes contained within the slip ring end shield and connected in a three phase bridge circuit between the stator and output terminals. A second rectifier bridge is formed by using three auxiliary low current diodes in conjunction with three of the six main diodes and this supplies the energy for the alternator field coil via the slip ring and brushes. A 1.0μF. capacitor is mounted in the slip ring end shield and is connected across the output to protect the diodes from any high transient voltages generated within the alternator system by the switching of transient loads.

The rotor and stator are housed between end shields and the rotor shaft is carried in a roller bearing at the drive end and a ball bearing at the slip ring end. The drive end bearing is capped and is secured by a clamp plate and circlip. The slip ring end bearing is secured on the rotor shaft by a circlip and clamped in the housing by a clamp plate.

The electrical output of the machine is delivered through a five-position terminal block housed in a formed well in the slip ring end shield and is connected as follows:—

Alternator terminal D +	Main positive dc output
Alternator terminal D -	Main negative dc output
Alternator terminal A -	Alternator field positive connection
Alternator terminal F -	Alternator field negative connection

440 Regulator

This is a fully transistorised voltage regulator with no moving parts, requiring no service attention and is non-repairable. The transistors, diodes and resistors are mounted on a printed circuit base contained within a sealed aluminium case that is suitably finned for maximum heat dissipation. No cut-out relay is required as the rectifier bridge in the alternator prevents current flowing from the battery through the stator when the

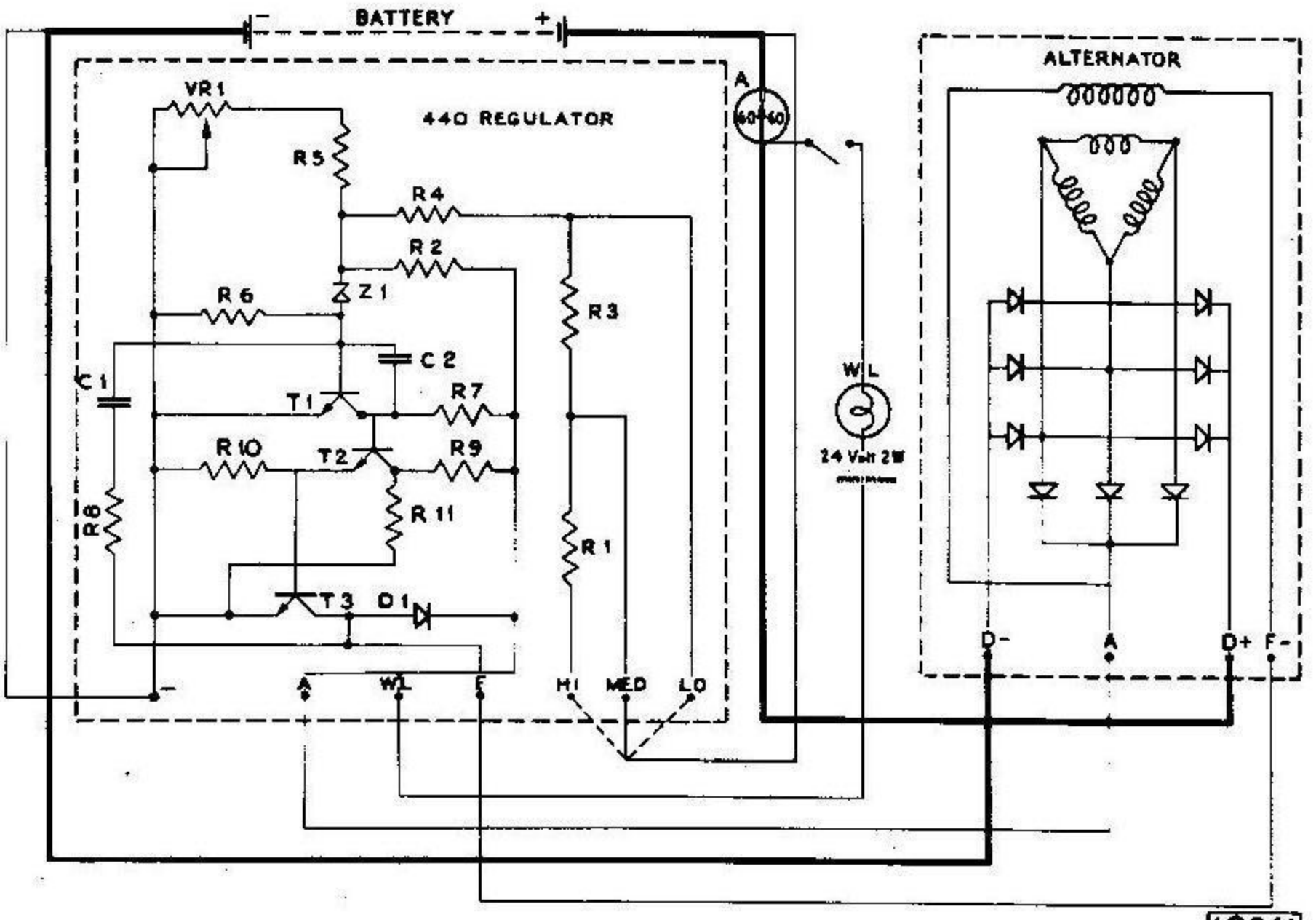


Fig. 6 Theoretical circuit diagram of the alternator and 440 regulator

alternator is stationary or when generating less than the battery voltage. Because the alternator is self-limiting in current output, the regulator has only to control voltage which it does by regulating the alternator field current and thus the output voltage.

Three different voltage settings are available on terminals marked HI (high) MED (medium) and LO (low), to vary the output for different circumstances such as changes in requirements, ambient temperatures, electrical loadings etc.

460-1 Control Board

Basically this consists of a 440 regulator with a separate moulded base and cover. An ammeter shunt is fitted and four main and five auxiliary terminals are provided.

448/2M Fast Fuse

A specially designed fast acting fuse for the protection of diodes etc. in the alternator system in the event of accidental reversed battery connections. It consists of a high purity silver strip surrounded by a fine quartz sand and enclosed within a cylindrical ceramic body. The design of the silver strip and accurate machining to tolerances of one ten thousandths of an inch ensures that the current restricting section of the fuse link ruptures at high speed in advance of the first peak of the fault current.

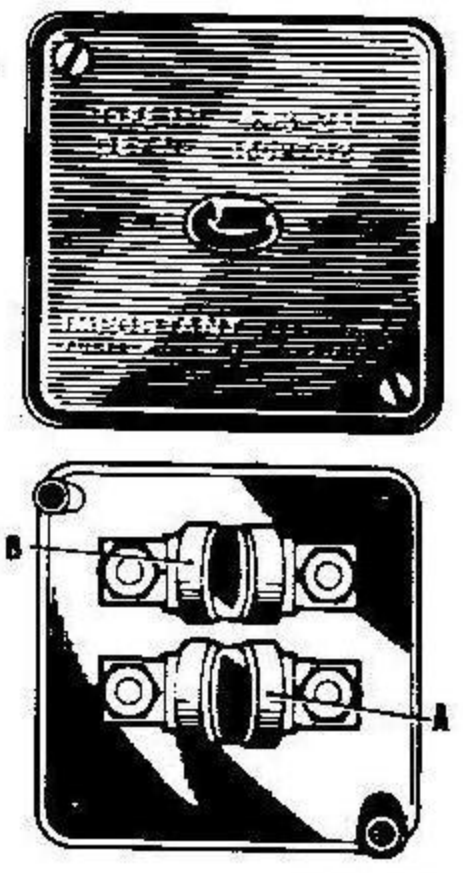


Fig. 7 The fuse box show with the cover removed

A Main fuse
B Spare fuse

WARNING: It is ESSENTIAL when testing the vehicle electrical system with a high voltage insulation tester of the megometer type that all connections to the alternator, and control board are disconnected. This is most important as transistors are incorporated in the control board. If this procedure is not carried out damage may result to the transistors due to the high output of the test generator.

General Precautions

Although the transistorised regulator offers many advantages such as reliability, long life, consistently accurate regulation, small size etc., the transistors in the regulator and the diodes in the alternator are sensitive to voltage changes and high temperatures. It is therefore essential that certain precautions are taken to avoid irreparable damage to the system when carrying out maintenance.

1. Should it be necessary at any time to disconnect a lead from the system it is essential that the engine be shut down to avoid damage to the system.
2. Whenever a lead is disconnected it should be identified in relation to its terminal to facilitate accurate reconnection, particularly in regard to regulator connections. Short circuiting or reverse polarity, no matter how brief, will cause immediate and permanent damage to transistors and diodes.
3. The battery must NEVER be disconnected whilst the alternator is running, nor should the battery be connected into the system without first checking for correct polarity and voltage.

Routine Maintenance

General routine maintenance is not necessary.

Periodically check that the alternator and the control box are free from build-up of dirt.

Keep the alternator clean with a cloth moistened in parrafin or white spirit. Ensure that the ventilation slots and air spaces are clear and unobstructed.

DATA

	AC7B Standard Alternator	AC7B Low CIS Alternator
VOLTAGE (Nominal)	24 volts	24 volts
MAXIMUM OUTPUT		
Cold	64A @ 27.5V	52A @ 27.5V
Hot	58A @ 27.5V	45A @ 27.5V
CUTTING-IN SPEED (ALTERNATOR)		
Cold	560 rpm	430 rpm
Hot	600 rpm	485 rpm
BRUSH SPRING-LOADING	8-10oz (227-283g)	8-10oz (227-283g)
MINIMUM USABLE BRUSH LENGTH	5/16 inches (7.9mm)	5/16 inches (7.9mm)
SLIP RING MINIMUM DIAMETER	0.875 inches (22.22mm)	0.875 inches (22.22mm)

Checking Operation of System "in situ"

The AC7B battery charging system is so designed that a flow of current indicated either by the extinguishing of the warning light, or as shown on the ammeter, is sufficient evidence that the system is in proper working order.

Accordingly, no open circuit, voltage, or current output checks should be performed on the installation.

UNLESS:–

1. The warning light fails to illuminate when the alternator is stationary and the warning light switch is closed, or fails to extinguish when the alternator is running.
2. No charging current shows on the ammeter.
3. The battery is flat, indicating insufficient charging current.
4. The battery is "boiling", indicating loss of voltage control.

If any of the above conditions appear in the charging system, the procedure indicated in the "Fault Finding" Section of this manual should be followed in order to trace the source of trouble.

Alternator System

In order to simplify fault finding "in situ" on the AC7B battery charging system, the fault finding chart Page R.8 has

FAULT FINDING CHART

WARNING LIGHT DOES NOT APPEAR WHEN START SWITCH IS CLOSED.

CHECK WARNING LIGHT BULB – CHANGE IF FAULTY.

NO FAULT DISCOVERED.

CAREFULLY CHECK ALL REGULATOR, ALTERNATOR AND BATTERY CONNECTIONS.

NO FAULT DISCOVERED.

OPEN START SWITCH, DISCONNECT "F" LEAD AT REGULATOR AND CLIP LEAD TO REGULATOR NEGATIVE TERMINAL, CLOSE SWITCH. IF WARNING LIGHT ILLUMINATES REGULATOR IS FAULTY, IF WARNING LIGHT DOES NOT LIGHT, ALTERNATOR IS FAULTY.

WARNING LIGHT DOES NOT GO OUT WHEN ENGINE IS RUNNING.

CAREFULLY CHECK ALL REGULATOR, ALTERNATOR AND BATTERY CONNECTIONS.

NO FAULT DISCOVERED.

OPEN START SWITCH, DISCONNECT "F" LEAD AT REGULATOR AND CLIP LEAD TO REGULATOR NEGATIVE TERMINAL CLOSE SWITCH AND RUN ENGINE AT FAST IDLE.

IF NO OUTPUT APPEARS → ALTERNATOR IS FAULTY.

IF OUTPUT APPEARS → REGULATOR IS FAULTY.

WARNING LIGHT GOES OUT BUT ALTERNATOR DELIVERS REDUCED OUTPUT AND WILL ONLY PROVIDE FULL OUTPUT AT APPROX. MAXIMUM SPEED.

REMOVE ALTERNATOR FROM INSTALLATION AND APPLY OPEN CIRCUIT DIODE CHECK.

WARNING LIGHT FLASHES INTERMITTENTLY WHEN BATTERY IS FULLY CHARGED AND NO LOADS ARE SWITCHED IN.

CHECK FOR EXCESSIVE RESISTANCE IN REGULATOR NEGATIVE SENSING LEAD. — IF NO FAULT → REGULATOR IS FAULTY

BATTERIES OVERCHARGING.

CHECK REGULATOR POSITIVE SENSING LEAD AND ITS CONNECTION AT REGULATOR. — IF NO FAULT → REGULATOR IS FAULTY

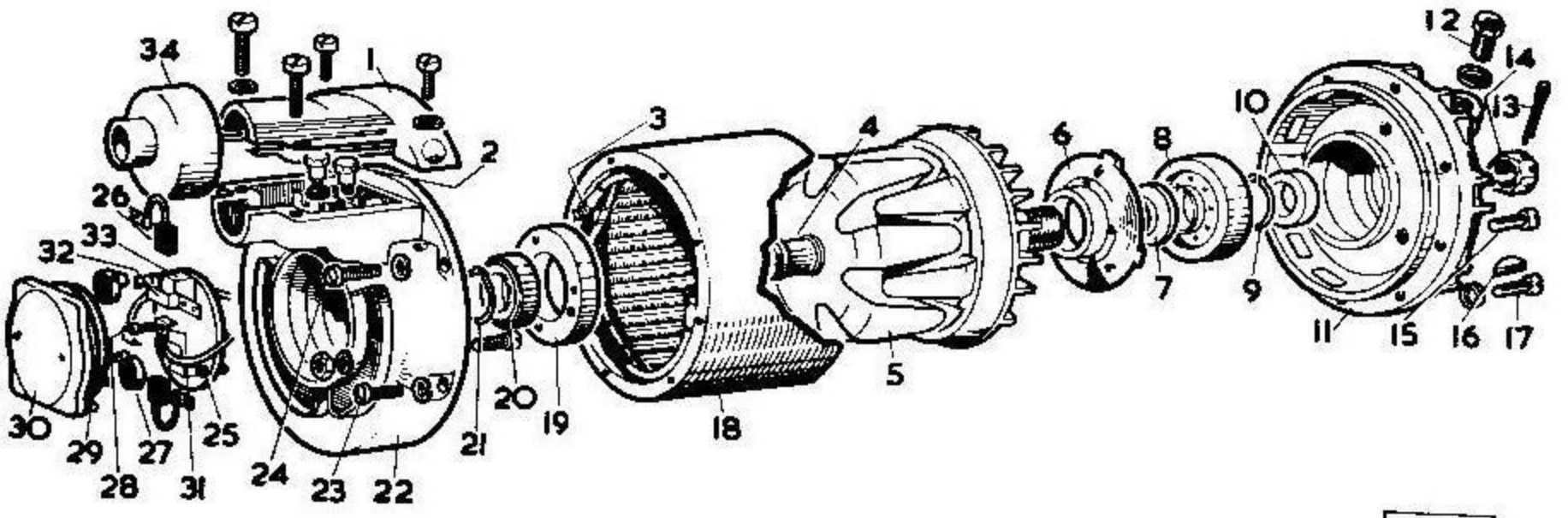


Fig. 8 Exploded view of the C.A.V. AC7/B alternator

1 Terminal cover
2 Terminal screw
3 Stator lead connections
4 Slip rings
5 Rotor assembly
6 Bearing clamp plate
7 Bearing spacer
8 Bearing – drive end
9 Circlip
10 Oil seal
11 Drive end shield
12 Setscrew
13 Split pin
14 Nut
15 Clamp plate securing screws
16 Woodruff key
17 Drive end shield securing screws
18 Stator
19 Bearing clamp plate
20 Slip ring end bearing
21 Circlip
22 Slip ring end shield
23 Screws
24 Clamp plate securing screws
25 4 B.A. nuts
26 Brushes
27 Brush spring
28 Terminal screw
29 Seal
30 Brush cover
31 Brush leads
32 Brush holder
33 Brush holder plate
34 Cable guide

been designed to cover almost all the electrical faults that could be encountered in service operation of the system. No test equipment is required other than the ammeter fitted in the charging system. Simply look for the sympton listed on the left of the chart that is applicable to the installation under test, and then carry out the step by step procedure linked to the particular symptom until the fault is located.

The instructions contained in the chart must be followed implicitly; any errors or divergence from the listed instructions will almost certainly give false readings or result in damage to the installation. For all terminal connections refer to the wiring diagram Fig. 27

BE CAREFUL TO MAKE THE CORRECT CONNECTIONS TO THE REGULATOR. WRONG CONNECTIONS OR SHORT CIRCUITS, NO MATTER HOW BRIEF, CAN CAUSE IRREPARABLE DAMAGE.

Removal

Disconnect the battery.

Remove the cover and disconnect the cables from the alternator. Note the location of the cables for reference when refitting.

Detach the drive shaft, release the clamp strap bolt and withdraw the alternator.

Dismantling

NOTE: Before dismantling, lightly scribe a guide line across the edge of both endshields and the stator to ensure correct alignment of endshields and stator when assembling the alternator.

Refer to Fig. 8 for location of numbered components.

1. Remove split pin (13) and nut (14) and remove the drive shaft coupling (not shown in illustration). Remove woodruff key (16).
2. Unscrew the securing screws of the slip ring end brush cover (30) and remove the brush cover from the end shield (22).
3. Lift the brush springs (27), withdraw the brushes (26) and disconnect the brush leads (31) from the brush holders (32) by removing the two screws (28) and washers. Identify the leads in relation to the brush holder to facilitate correct re-connection.
4. Unscrew and remove the two nuts (25) and washers securing the brush holder plate (33). Remove the brush holder plate.
5. Remove the three screws (24) and washers from the base of the slip ring compartment.
6. Remove the eight screws (17) and washers securing the drive end shield and ease off the end shield (11) complete with the rotor assembly (5). The end shield is notched to permit the use of a screwdriver to help ease the end shield from the stator.

NOTE: Handle the rotor assembly with great care and in particular avoid any damage to the slip ring assembly when withdrawing the rotor assembly from the stator.

7. Remove the three screws and washers securing the stator lead connections (3) to the heat sinks.

8. Remove seven screws (23) and washers and separate the slip ring end shield from the stator.

9. Remove the four screws (15) and washers securing the drive end shield (11) and the bearing clamp plate (6), and separate the drive end shield from the rotor assembly. The outer cage of the drive end roller race will be retained in the drive end shield. Do not remove the outer cage of the bearing unless the bearing requires renewal. The cage may be removed by striking the inside edges of the drive end shield sharply against the corner of a suitable soft wood block. The bearing cage is a slide fit in the end shield and after several sharp blows in this manner will separate from the end shield.

10. If the oil seal (10) is suspect it may be levered out from the inside of the drive end shield and discarded.

11. To remove the roller race from the drive end of the rotor shaft first remove the circlip (9). Draw the inner race of the roller bearing off the shaft by inserting three ¼ UNF screws into the three inner holes tapped in the bearing clamp plate (6). To ensure that these screws do not foul the ends of screws securing the fan to the rotor claws the ends of each screw should have a 1/32inch chamfer. Tighten each alternate screw in turn until the roller bearing inner race is free of the rotor shaft.

12. Remove the three ¼ UNF screws used to detach the inner race and detach the bearing spacer (7) and clamp plate (6).

13. Do not remove the slip ring end bearing (20) unless the bearing is suspect. If the bearing requires renewal it may be renewed as follows:—

(a) Remove the bearing circlip (21) and ease it carefully over the slip rings to prevent any scoring of the slip ring surfaces.

(b) Insert two 5/16 UNF screws into the two holes tapped in the bearing clamp plate (19). Tighten each screw alternately and draw the bearing off the shaft. Do not damage the surface of the slip rings in this operation.

(c) Remove the two 5/16 UNF screws used to draw the bearing off the shaft and detach the bearing clamp plate from the rotor.

NOTE: Do not remove a heat sink assembly from the Slip Ring End Shield unless it is established that there is a fault in one or more of the diodes. Accordingly, the diodes should be subjected to the tests detailed on Page R.12 under Slip Ring End Shield in the Component Testing section of this manual. If a faulty diode is detected, proceed as instructed in the Inspection and Repair Section.

Inspection and Repair

All parts which require cleaning should be cleaned and then each part should be inspected overall for signs of cracking, corrosion, serviceability of threads where applicable, and any evidence of excessive wear. When renewing defective parts refer to the Service Parts (Publication No. 4209) for the particular machine.

Remove foreign material from the rotor shaft and stator frame using a clean non-fluffy cloth moistened with white spirit.

CAUTION: Spirit must not be allowed to contact leads of stator and must not contaminate the protective coating of the rotor core.

Examine the windings of the stator for security, condition of finish and freedom from contamination. Inspect the stator leads for security and deterioration of insulation.

Check that the slip rings are concentric within 0.002 inches (0.05mm) and examine them for pitting or scoring. If skimming is required mount the rotor in a suitable lathe using the bearing journals of the rotor shaft for location. Lightly skim the slip rings with either a diamond tool or a highly finished tungsten carbide tipped cutting tool. Remove the minimum amount of metal to ensure a fine finish and maintain concentricity to within 0.002 inches (0.05 mm). Minimum permissible slip ring diameter is 0.875 inches (22.22 mm).

When handling the rotor, special care must be exercised to ensure that the surfaces of the slip rings are not damaged and that the position of the slip ring shaft, which is an extension of the main rotor shaft, is not disturbed. If these precautions are not carried out it is possible that eccentricity of the slip rings may be caused and this will lead to early failure in service of both brushes and slip rings. It is therefore recommended that the concentricity of slip rings be finally checked prior to final assembly. (The maximum permissible eccentricity is 0.002 inches (0.05mm)).

Brushes must be renewed if worn below 5/16 inches (7.9 mm) in length.

Check circlips and brush springs for correct tension and renew all defective items. Brush spring pressures should be within the limits of 8-10 oz (227-283 g).

Inspect the bearings for serviceability and reject a bearing that is defective on any count. The slip ring end bearing is a sealed type and cannot be lubricated, in consequence, any sign of dryness or over-heating necessitates renewal of the bearing. Although not obligatory, it is good practice to renew bearings at major overhauls to ensure complete reliability in service.

Examine all sub-components, not dismantled, for security and condition.

Heat Sink Removal

Individual diodes cannot be removed. If faulty, the heat sink assembly of three diodes and heat sink (Fig 9) must be changed. The replacement heat sink is supplied with lengths of wire attached to the diodes. Individual wires can be cut to suit the point of connection.

To remove a heat sink, proceed as follows:

1. Scrape away the plastic compound from the main terminal tags. Unsolder the diode leads and separate the three leads on both main terminals. Free the lead on the faulty heat sink from the securing sleeve.
2. Cut the lead or leads from the auxiliary diode about ¾ to 1 inch from the diode. Disconnect and remove the leads from the thermostat if fitted.
3. Remove the fixing screws, washers and insulating bushes. One fixing screw secures the lead to the terminal R and consequently has only one insulating bush and a spacer.
4. Withdraw the heat sink.

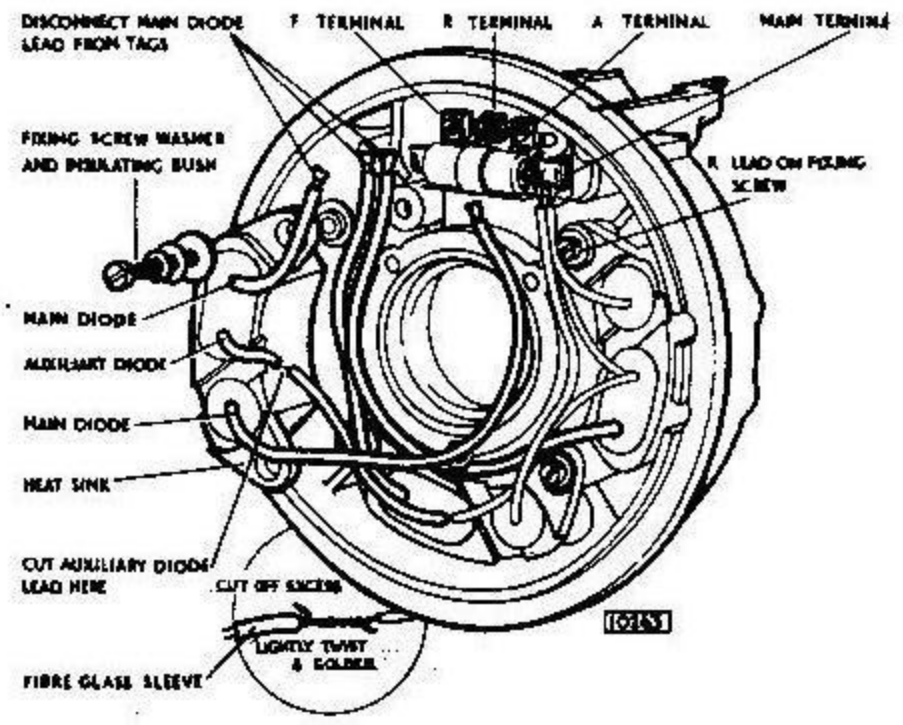


Fig. 9 Heat sink assembly

Heat Sink Replacement

1. Fit the new heat sink in position (Fig 9). Place the main leads one to the right end and one to the left and pass them through the securing sleeve.
2. Replace the insulating bushes, washers and fixing screws and secure the screws.

NOTE: The fixing screw nearest the terminal block on the right hand side (Fig 9) secures the lead from terminal R and consequently has only one insulating bush and a spacer.

3. The main diode leads must be cut so that when the end is bared the bared end of the cable is flush with the end of the terminal. Solder the three leads to the respective terminal. If fitted, the capacitor leads are soldered to the main terminals. Replace the thermostat leads, if fitted.
4. To connect the auxiliary diode lead or leads to the severed leads, slide a small length of glass sleeving of suitable diameter over the lead to be joined. Cut the lead from the diode allowing sufficient for overlap. Lightly twist the bared ends together and solder the joint. Slide the glass sleeving over the joint and seal the ends with ICI Silcoset 151.
5. On the ventilated alternators, fill the entire terminal block, covering all terminals, with ICI Silcoset 151. (Silcoset 151 must not be used on totally enclosed alternators).

COMPONENT TESTING

Equipment Required:

1. A British Standard first grade moving coil dc ammeter 0-100 amperes range.
2. Avometer or similar test meter.
3. 100 volt Megohm meter or similar non-destructive 100 volt Flash Tester.
4. 24 volt battery capable of supplying at least 40 amperes at 24 volts.
5. Adjustable carbon pile resistor or similar adjustable resistance capable of carrying 40 amperes.

Stator

Insulation Testing

Subject the stator to an insulation test at 100 volts between the terminal end of each lead and the frame using the 100V Megohm meter. The resistance should be 10 megohms minimum. If necessary, clean and thoroughly dry the stator and again check the insulation resistance.

Continuity Test

Connect a 24V supply in series with a variable resistor and an ammeter to any two of the three-phase leads. Pass a current of 40 amperes through the windings and measure the volts at the leads. Repeat the test on each pair of leads. The indicated volts should be the same each time, in the range 6.2 to 6.4 volts. If the result in each test is not the same, change the stator.

Rotor

Insulation Testing

Subject the rotor to an insulation test at 100 volts between each slip ring and the shaft using the 100V Megohm tester. The resistance should be 10 megohms minimum. If necessary, clean and thoroughly dry the rotor and again check the insulation resistance.

Continuity Test

Using a suitable meter, measure the resistance between the slip rings. Ensure the rings are clean and free from grease. The resistance should be between 14.3 and 16 ohms. In later production models the resistance should be between 9.5 and 10.5 ohms. Because of the wide difference in these test figures it will be immediately apparent which model is being tested.

Slip Ring End Shield
Diode Testing
Check each diode in the assembled heat sinks by using a 44-48 watt lamp connected in series with a probe in the positive line of a 24-volt supply and a second probe connected to the negative line of the supply.
The tests in the following table will indicate faulty diodes:

TEST No.	POSITIVE PROBE CONNECTION	NEGATIVE PROBE CONNECTION	DIODE UNDER TEST	SERVICEABLE INDICATION
1	EACH HEAT SINK IN TURN	D+	POSITIVE	LAMP ILLUMINATED
2	D+	EACH HEAT SINK IN TURN	POSITIVE	NO ILLUMINATION
3	D-	EACH HEAT SINK IN TURN	NEGATIVE	LAMP ILLUMINATED
4	EACH HEAT SINK IN TURN	D-	NEGATIVE	NO ILLUMINATION
5	EACH HEAT SINK IN TURN	'A' TERMINAL	AUXILIARY	LAMP ILLUMINATED
6	'A' TERMINAL	EACH HEAT SINK IN TURN	AUXILIARY	NO ILLUMINATION

If any diode is faulty, change the heat sink containing the faulty diode.

Reassembly
Normal workshop practice should be followed, taking care to keep all components, tools and working surfaces clean, dry and free from grease. For the purpose of these assembly instructions it is assumed that the alternator has been completely stripped, with bearings and oil seals removed from the rotor shaft.
Although the bearings and oil seals may appear satisfactory it is strongly recommended that they are renewed when the alternator is stripped for a major overhaul. New 'O' sealing rings and gaskets must be fitted when assembling the alternator.

1. Offer up the slip ring end shield (22) (Fig 8) to the stator, positioning the end shield so that the previously scribed lines on the end shield and stator align with each other.
2. Fit and securely tighten the eight screws (23) and washers securing the slip ring end shield to the stator.
3. Fit the three screws and washers through the stator lead connections (3), fit the nuts and washers and tighten securely.
4. Fit the bearing clamp plate (16) over the drive end of the rotor shaft with the coned side facing towards the rotor.
5. Fit the bearing spacer (7) over the shaft with the chamfered side facing the rotor.
6. Thoroughly grease the inner race of the drive end bearing (8) with Aero Shell 6B, or Starfak Special, or Mobilgrease 384 and then fit the inner race over the rotor shaft. Carefully press or drive the inner race fully home along the rotor shaft using a brass or copper drift to prevent damage. Secure the inner race in position with the bearing retaining clip (9).
7. Fit the outer race of the drive end bearing into its position in the drive end shield and tap it fully home with a brass or copper drift to avoid damage. Lightly grease with Aero Shell 6B, or Starfak Special or Mobilgrease 384.
8. Lightly grease the inner lip of the oil seal (10) with Duckhams KG 25 grease and fit the oil seal into position in the drive end shield (11), ensuring that the lips of the oil seal face outwards towards the drive pulley.
9. Offer up the drive end shield to the rotor assembly, taking care that the screw holes in the bearing clamp plate (6) coincide with the screw holes in the drive end shield. Ensure that the rotor shaft slides smoothly through the oil seal in the drive end shield without damage to the oil seal. Carefully ease the drive end shield into position so that the bearing

outer race fits snugly over the roller bearing inner race. Engage the four screws (15) and washers through the drive end shield into the bearing clamp plate and securely tighten the screws. Tighten each diametrically opposite pair of screws in turn to pull the bearing clamp plate up evenly.

10. Fit the bearing clamp plate (19) over the slip ring end of the rotor shaft with the lipped side of the plate facing the rotor and the recessed side facing the slip rings.
11. Carefully manipulate the slip ring end bearing (20) over the slip rings to avoid damage and then drive it fully home on the shaft, using a brass or copper drift to avoid damage. Secure the bearing in place by fitting the bearing retaining circlip (21) in its groove in the rotor shaft.
12. Mount the assembled stator and slip ring end shield on the bench so that the terminal box is uppermost. Rotate the rotor so that the three holes in the slip ring end bearing clamp plate (19) are positioned at 2 o'clock, 6 o'clock and 10 o'clock respectively. Keep the holes so positioned and check that the guide line scribed on the drive end shield will align correctly with the scribed line on the stator.
13. Offer up the assembled rotor and drive end shield to the assembled stator and slip ring end shield. Carefully guide the slip rings through the end shield to avoid damage to the rings. The holes in the slip ring end bearing clamp plate should coincide with the three holes in the brush compartment of the end shield and the scribed lines of drive end shield and stator align with each other.
14. Fit the eight screws (23) and washers into the drive end shield and secure the end shield to the stator. Tighten each opposite pair of screws securely to ensure that the end shield is evenly tightened into position on the stator.
15. Fit the three screws (24) and washers through the three holes in the base of the brush compartment. Ensure that the slip ring end bearing clamp plate is correctly positioned, engage the screws with the threaded holes in the bearing clamp plate and securely tighten the screws. After tightening the screws, spin the rotor and check that it spins freely. (Any fault will necessitate dismantling and rectification).
16. Wipe out any surplus grease that may have found its way into the brush compartment. Inspect the slip rings and ensure that they are clean and undamaged. (Any damage to the slip rings will necessitate dismantling and rectification as laid down in the section Inspection and Repair.) Fit the brush holder plate (33), straight edge towards the field lead entry, into the brush compartment and secure it in place with the two 4BA nuts, (25), plain washers and spring washers. Securely tighten the two nuts. Clean the connection tags on the brush leads (31) and connect the brush leads and the field current leads correctly to the brush holder (32) as noted on dismantling. Make certain that the connection is secure and electrically sound. Lift the brush springs (27) and insert the brushes (26) into the holders. Allow the brush springs to retain the brushes and check that each brush slides smoothly in its holder and bears correctly on the slip ring.
17. Fit a new seal (29) to the brush cover (30) and secure the cover in place on the slip ring end shield by means of two screws and washers. Tighten screws securely.
18. Fit the woodruff key and coupling to the drive shaft. Fit the nut and tighten fully to press the coupling home on the shaft. Secure with the split pin.

Refitting

Alternators should be bench tested before refitting to the engine if the necessary equipment is available.
Refitting is the reverse of the removal procedure.
Care must be taken to ensure that the cables are reconnected as noted when removing.

BENCH TESTS

Equipment required:

1. A test machine capable of speeds up to 4000 rpm with a 3-4 hp variable speed drive.
2. A 24 volt battery of 50 ampere hour capacity.
3. A variable resistive load of at least 60 amperes capacity.
4. A 24 volt 440 regulator.
5. A 100 volt Megohm Meter or similar non-destructive Flash Tester.
6. A British Standard first grade moving coil dc ammeter. 0-100 amperes range.
7. A British Standard first grade moving coil dc voltmeter. 0-50 volt range.
8. Avometer or similar test meter.

NOTE: A maximum speed and endurance test of the alternator under full load conditions would require a test unit capable of delivering an output of 4hp at 4000 rpm. Such powerful test units are not readily available and in consequence the following tests are based upon performance figures that require lesser powers and speeds from the test unit.

Insulation Testing

Test the alternator for insulation faults with the Megohm Meter or flash tester before connecting to the test circuit. Connect the insulation tester between earth and one of the terminals D+,D-, A.and F- in turn.
Be careful to keep one probe on the alternator frame to avoid applying full test voltage between any two terminals on the alternator.

If the Megohm Meter is used the minimum resistance should be 10 megohms.

Continuity Testing

Check the continuity of the field coil circuit with the Avometer by positioning the probe of the instrument on pins A and F-. The meter should indicate a low resistance that is variable according to the brush contact with the slip rings. Rotation of the rotor with the meter connected should produce a small deflection of the meter pointer; a large scale change in resistance indicates either sticking brushes or dirty slip rings. On machines fitted with a thermostat in the field circuit a high resistance may indicate an open circuit thermostat. Rectify any faults before proceeding with further tests.

Performance Testing

Fit the alternator to the test unit and connect a 440 regulator, warning lamp, switch, voltmeter, ammeter, battery and adjustable resistive load of up to 60 amperes as shown in the test circuit in Fig. 10.

Test No. 1

Set the adjustable resistor to take a current of 10-15 amperes from the battery. Switch the warning lamp into circuit and slowly run the alternator up to the cutting-in speed, the instruments should indicate 24 volts with zero amperage at this speed.

NOTE: Performance characteristics of the alternator, both hot and at normal operating temperatures are shown in the following tables.

After about 20 minutes running time at full output the machine will warm up to its normal operating temperature, so the particular output for the alternator under test is at the discretion of the operator and is dependent upon whether the machine is hot or cold.

Test No.2.

Outputs of 20, 30, 40 and 50 amperes with their respective alternator speeds are indicated and these should be used as test points.

Proceed as follows:– Set the resistive load at approximately 50 amperes to prevent the voltage regulator from tapering off the alternator output if the battery is fully charged. Run the alternator at the indicated speed and check the output. Commence the test with the lowest indicated output and progress in sequence through the indicated outputs and speeds up to the highest figure possible with the test unit employed.

A tolerance of ± 5% on the output figures at the indicated speeds is permissible, but outputs that fail to reach the required figures indicate a faulty machine. Do not persist with the tests if a fault is indicated but stop the test machine and rectify the fault.

Caution: Do not remove any connections while the alternator is running.

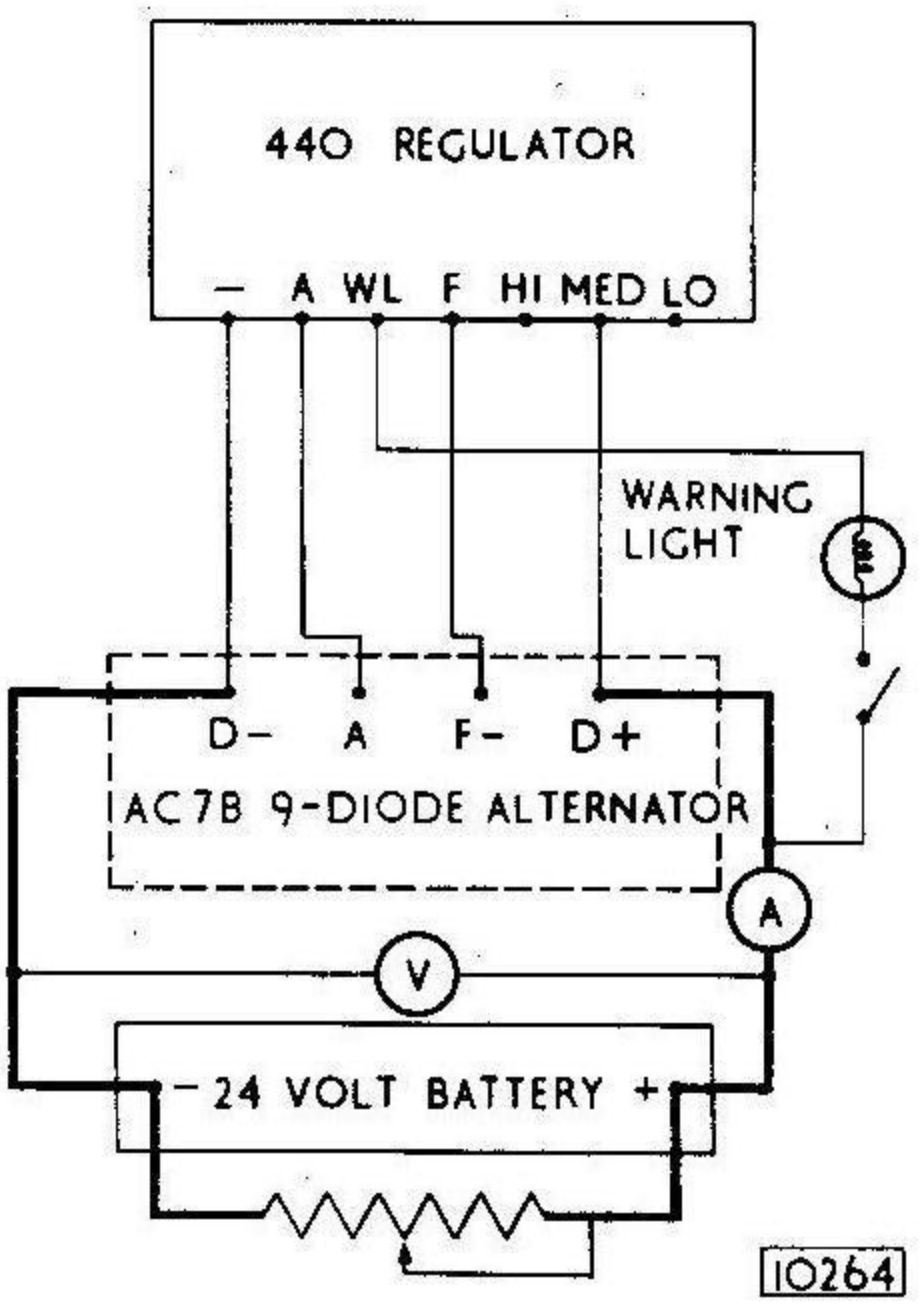


Fig. 10 Alternator test circuit

Performance Figures
(Standard Alternator).

Alternator Speed R.P.M.	Charging Rate Hot	Cold
765		20
800	20	
880		30
940	30	
1020		40
1130	40	
1260		50
1510	50	

(Low CIS Alternator).

600		20
695	20	
740		30
880	30	
1010		40
1425	40	

THE CONTROL BOARD

Faulty 460/1 control boards (incorporating 440 regulators) as indicated following tests given in the Fault

Finding Chart, Page R.8 should be returned to the Makers for attention.
The control board is mounted on a bracket attached to the top flange of the right-hand frame side member forward of the rear bulkhead on the double deck chassis (see Fig 1) and in a box attached to the frame side member on the single deck chassis.
Units may alternatively be mounted on the left-hand side of the vehicle if required.
Access to the control board is normally obtained after removal of the trap covers in the saloon floor. This may vary however due to the type of body fitted.

WARNING. Care must be taken when reconnecting the cables to the control board
Wrong connections or short circuited terminals will damage the transistors beyond repair.
Check the cable connections before removing the unit from the chassis.

STARTER MOTOR
C.A.V.SL524 (Optional Equipment U624)

DESCRIPTION

The starter (cranking) motor is of the axial type, the armature and shaft being capable of an axial movement. When extended the starter pinion engages with the flywheel before the full starter torque is applied to crank the engine.
The field winding is divided into two main field and two auxiliary coils, each made up of an auxiliary shunt coil and an auxiliary series coil.
When the starter switch is operated, a small current passes through the auxiliary coils causing the armature to rotate slowly. Simultaneously, the magnetic field set up pulls the armature forward, which brings the pinion gently into mesh with the engine flywheel teeth.
This movement of the armature causes a tripping disc to operate a switch trigger which releases the contacts of the solenoid switch and so allows the main circuit to be completed. The full current from the batteries then flows through the armature and series field coils, and the starter exerts its full torque on the engine.
An overload device consisting of a screw and spring loaded clutch arrangement is fitted to prevent damage to the pinion teeth due to excessive overload.

Operational Check

If the starter (cranking) motor does not operate when the button is pressed, check that the batteries are fully charged and cable connections in good order, then carry out the following tests.
Connect a voltmeter between the solenoid (SOL) terminal and the negative (-) on the starter motor and press the starter button. If no reading is indicated on the meter check for fault in wiring between button on starter or in windings of solenoid switch.
If the solenoid switch clicks when the button is pressed it indicates that the switch is working, on first contacts only. Check for faulty armature adjustment or worn switch trigger.
Should the starter crash into engagement, inspect switch trigger and tripping plate for wear on the step and slotted portions respectively.
Intermittent starter operation with starter switch depressed can be caused through burnt second contacts on solenoid switch, starter brushes worn, or, faulty connections between starter button and batteries or inter-connectors. Check for fault.
A worm drive-end bearing will cause slow engagement and considerable loss of power due to armature fouling pole shoes. Inspect bearings for wear.
If starter operates but does not turn the engine, the starter drive clutch may be slipping, or, the flywheel teeth or pinion worn. Check for cause and rectify.

Removal

The starter motor is accessible after removing the central lower panel allocated on the forward face of the rear bulkhead.

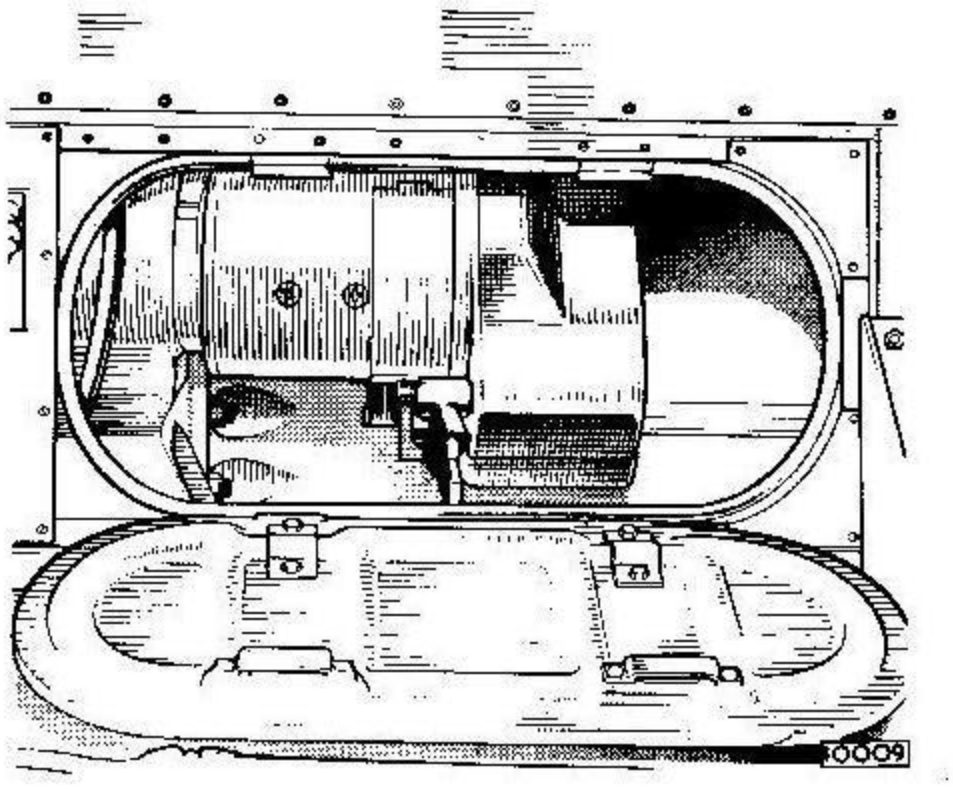


Fig. 11 Bulkhead panel lowered to gain access to starter motor

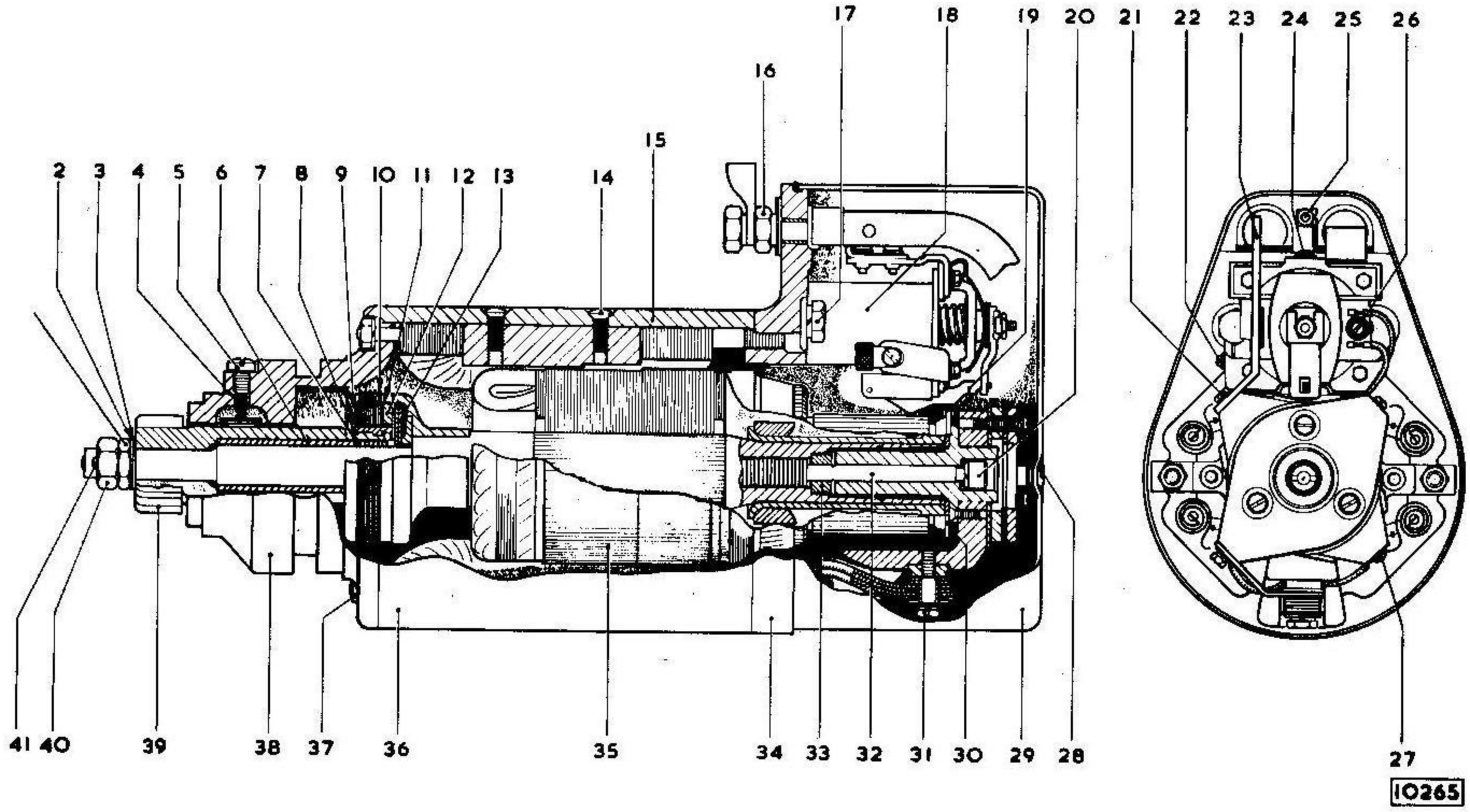


Fig. 12 Sectioned view of an axial starter motor (typical)

1 Nut
2 Washer
3 Shim
4 Spring
5 Lubricating plug
6 Shims
7 Pinion spring
8 Clutch inner race
9 Spring ring
10 Clutch plates
11 Shim washers
12 Back plate
13 Pressure plates
14 Pole fixing screw 15 Yoke
16 Terminal nut
17 Solenoid fixing screw
18 Solenoid switch
19 Trigger
20 Nut
21 Negative connector screw
22 Connector screw
23 Negative connector
24 Connector screw
25 Connector terminal
26 Connector screw
27 Brush lead screw
28 Commutator cover screw
29 Commutator cover
30 Tripping disc
31 Main field connection screw
32 Armature plunger
33 Retaining nut
34 Commutator end shield
35 Armature
36 Clutch outer race
37 Main fixing bolt
38 Drive end shield
39 Pinion
40 Nut
41 Split pin

To remove the panel, insert a square-ended carriage key in the locks and turn to release the locks. Lift the panel away from the bottom fixings.
Disconnect the main and solenoid cables from the rear end of the starter motor.
Release the nut securing the clamp and withdraw the motor through the panel aperture.
Note the loose spacer ring fitted to the pinion housing.

Refitting
Refitting is the reverse of the removal procedure.

Dismantling
The dismantling procedure is identical for both model starter motors.

1. Unscrew screws (28) (Fig 12) and remove the commutator cover (29). On SL5 starters, also remove retaining clips and screws.
2. Unscrew the brush lead screws (27), lift the brush springs and remove the brushes from their holders. Removal of the brush lead screws also frees the field connections to the brushgear.

IMPORTANT
At this stage the leads to the brushgear and solenoid switch should be marked so that they can be identified easily when the starter is assembled.

3. Remove the nut (20) from the armature plunger.
4. Remove the main fixing bolts or screws (37). Tap the drive-end shield (38) gently away from the yoke (15) with a hide or wooden mallet, and withdraw the shield complete with armature (35).
5. Hold the armature in an armature clamping device, or in a vice fitted with soft metal or wood jaw clamps.
6. Remove the lubricating plug (5) and the spring (4) from the drive-end shield.
7. Remove the split pin (41), nuts (40) and (1), and washers (2) and (3) from the front end of the pinion (39), and slide the pinion and drive-end shield off theaarmature shaft.
8. Remove the pinion spring (7).
9. Collect the clutch inner race (8), clutch plates (10), shim washers (11), back plate (12) and pressure plates (13) from the clutch assembly.

NOTE: The clutch plates should be tied together in the order of removal so that they can be replaced in their original positions in the clutch when the starter is assembled.

10. Withdraw the shim(s) (6).
11. Unscrew the armature plunger retaining nut (33).
12. Withdraw the armature plunger (32) from the bore of the armature.
13. Remove screws (24), (22) and (26) securing the positive terminal connector, main field coil ends and auxiliary field connections to the solenoid switch, duly marking them for ease of assembly.
14. Remove the screw (31) holding the main field connections to the connector at the bottom of the commutator-end shield.
15. Separate carefully the commutator-end shield from the yoke by tapping with a hide or wooden mallet.
16. Disconnect the solenoid coil leads, duly marking them for ease of assembly.
17. Unscrew the negative terminal nuts (16), and also the screw (21) securing the negative connector to the brushgear. Remove the negative connector. (Not on earth return machines).
18. Unscrew the solenoid fixing screws (17), and remove the solenoid switch.

INSPECTION AND REPAIR

Commutator
The surface of the commutator should be clean and free from grooves, pits, or uneven discolouration. For moderate surface cleaning, a very fine grade of glass paper (not emery cloth or carborundum paper) may be used, as described under MAINTENANCE. If the surface condition is severe however, the component should be set up on a lathe and the commutator skimmed.
A coarse cut should first be made to remove sufficient copper to clear traces of pitting or distortion. If mica is used as the insulating material between the commutator segments, this insulation should be undercut, that is, it should be removed to a depth not exceeding the width of the insulation. Certain proprietary tools are available for this purpose, but an old hacksaw blade, ground to the width of the insulation, will make a serviceable tool in case of emergency.
Finally, the component should again be set up on the lathe and a fine finishing cut taken using a diamond or tungsten carbide tipped tool to obtain the desired quality of finish. After machining, the commutator and armature must be cleaned thoroughly preferably by means of compressed air, or by the use of hand bellows.

Armature Windings
Armature windings can be tested for continuity and short circuits by means of a 'growler' armature tester. If a 'growler' is not available, the armature should be tested by substitution. Should the armature be faulty, the clutch outer race (36) should be pressed off the shaft and the armature returned direct to the nearest C.A.V. agent.
When the clutch outer race is pressed onto the armature shaft care should be taken to ensure that the press bears on the end of the armature shaft and NOT on the commutator. If this procedure is not followed, the force exerted by the press may distort the commutator segments.

Field Windings
Field windings can be tested for short circuits to the yoke and poles by means of test probes connected to a mains

supply not exceeding 110 volt and in series with a 15 watt lamp of suitable voltage positioned on the live side of the system. One probe should be applied to the yoke at a position where it is free from enamel and insulation, and the other applied to the ends of each of the windings in turn. If the lamp does not light then the insulation is intact. Alternatively a 100v Megohm meter can be used. Open circuits can be detected easily by means of an ohmeter. The instrument should be connected across each of the windings in turn, and, if infinity or maximum ohms is obtained, then an open circuit is indicated in the winding being tested.

Internal short circuits in the coils can best be detected by means of a low reading ohmeter. If such an instrument is not available and the existing windings are suspect, they should be checked by substitution.

Unserviceable coils should be renewed as follows:

1. Unscrew the pole fixing screws (14) and withdraw the poles and windings, noting the position of the windings to facilitate reassembly. Each pole has a small step machined on its surface, and is marked with a number which corresponds with a number stamped on the end of the yoke. When replacing the pole, the steps should all be positioned towards the commutator end of the yoke, and the numbers should correspond.
2. Fit the new windings to the poles as dismantled, so that they bed down as far as possible on the poleshoe wings.
3. Assemble the poles and the windings into the yoke, and insert the pole fixing screws.
4. Apply 'Duralac' sealing compound (specification DTD 369A) to the pole screws and seats and tighten the screws using a proprietary pole screwdriver. The screws should be tightened down firmly to exclude any space between the mating surfaces of the poles and the yoke. This condition can be checked by a thin feeler gauge.

NOTE: The windings will bed down more easily if the yoke windings and poles are heated gently in an oven before the pole fixing screws are tightened. If the coils are loose on the pole shoes they must be tightened either by fitting a leatheroid spacer or taping the coils otherwise insulation is liable to break down due to fretting.

Bearings

The pinion should be inserted into its bearing in the drive-end shield, and the commutator end of the armature pushed onto the bearing pin in the commutator-end shield. Both bearings should then be checked for excessive sideplay.

If the bearing pin is worn, it is recommended that the complete commutator-end shield assembly should be replaced, as the shield spigot is machined concentric with the bearing pin after the pin has been assembled.

Provided facilities exist for accurate machining, the drive-end bearing may be removed from its shield and renewed. If such facilities are not available, the complete drive-end shield and bearing assembly should be returned to C.A.V. Depot or Agent for replacement. If the bearing is to be renewed the following procedure should be adopted:

1. Push the lubricating wick well away from the bore so that it does not get trapped during the pressing operations.
2. Press the old bearing out of the shield.
3. Press in the new bearing from inside the shield, using a split dolly to prevent the lubricating wick from being trapped between the end of the bearing and the edge of the oil reservoir. If the pads have hardened they should be replaced.
4. Set up the shield in a lathe in such a manner that when machining of the bearing bore is complete, the bore is perfectly concentric with the shield spigot where it registers with the yoke.
5. Turn the bearing bore to between 35.05 and 35.10 mm diameter, and ensure that the surface finish is of the highest quality.
6. Turn both ends of the bearing flush with the faces of the castings if necessary.
7. When fitting a new or used pinion, a clearance between the pinion and bearing should be 0.05 to 0.10 mm.

Brushgear

The brushgear insulation should be checked as detailed below, using a 110 Volt mains supply, test probes and lamp as described under Field Windings. If the lamp lights during any of these tests the insulation is faulty. Alternatively a 100 Volt Megohm meter can be used.

(a) Between the positive and negative brush holders.
(b) Between the positive brush holder and the frame.
(c) Between the negative brush holder and the frame.

The brush leads should be clear of any obstruction likely to impede movement, and the brushes should be free in their holders. If a brush is inclined to stick, it should be removed and the inside of the holder cleaned with a clean cloth moistened in white spirit. The brush must be replaced in its original position so that the curvature of its contact surface conforms accurately with the commutator periphery.

The brush spring pressure should be checked by means of a spring balance hooked under the spring or trigger lip.

Brush spring pressures

BS6, U6	18 to 24	510 to 680
SL5	40 to 52	1134 to 1474

Clutch
If the clutch plates (10) (Fig 12) are badly worn or discoloured they must be renewed. Individual new parts should not be inserted unless facilities exist for testing the slipping torque. If such facilities do not exist, and parts of the clutch need renewing, a complete new interior should be fitted, or alternatively, the clutch together with the armature, pinion and drive-end shield should be returned to a C.A.V. Depot or Agent for attention. The method of adjusting the slipping torque is given below.

Pinion
If the teeth of the pinion (39) Fig 12 are badly worn or damaged, the pinion should be changed. Ensure that the new pinion has the same number of teeth and is made of the same material as the old component, that is either bronze or steel.

Solenoid Switch
The method of overhauling the solenoid switch is described on Page R.21

ASSEMBLY AND ADJUSTMENT

The figures in brackets refer to Fig.12.

1. Hold the armature in an armature clamping device, or in a vice fitted with soft metal or wood jaw clamps.

NOTE: In all cases where grease is referred to in the following text, use Shell Nerita or B.P. Energrease.

2. Smear the spring and thrust washer on the armature plunger (32) liberally with grease. Insert the plunger into the bore of the armature, and tighten the plunger retaining nut (33).

NOTE: Before assembling the clutch, carefully examine all parts for wear, distortion and the presence of burrs or sharp edges which can cause clutch slip. Burrs or sharp edges should be removed with an abrasive stone from the following parts in working contact leaving a minute radius.

(a) Thread tops on inner race and pinion sleeve.
(b) Slots on inner and outer races.
(c) Edge of clutch plates.

3. Insert the pressure plates (13), back plate (12) and shim washers (11) into the clutch outer-race (36).
4. Smear the clutch springs (9) lightly with grease, and place them in their holes in the clutch inner race (8). Each spring should be inserted with its largest diameter first.
5. Grease the clutch plates (10) lightly and place them on the splines of the clutch inner race, taking care to fit bronze and steel alternately. Fit a steel plate first so that it takes the pressure of the clutch springs.

NOTE: On SL5, and U6 starters the clutch incorporates guide pins, a spring locking ring and a new pinion spring with spacing ring. See Fig. 13.
Starters type SL5. and similar types have steel clutch plates 'Sulfinuz' finished (dull grey) and these must be assembled 'dry' no grease to be applied. These new steel plates supplied as spares have a protective covering of grease which must be removed with a suitable solvent, wiping only will not suffice.

6. Assemble the clutch inner race complete with clutch plates and spring ring.
7. Grease the pinion spring (7) Fig. 12. and slide it onto the armature shaft, together with spacing ring (if fitted).
8. Grease the bore of the pinion (39) and insert the rubber sealing ring (when fitted) also shims (6).
9. Insert the pinion into the drive-end shield (38). To prevent damage to the felt lubricating pad, the pinion should be twisted in the direction of the spiral of the pinion thread whilst the lubricating pad is lifted from inside the casting.
10. Slide the pinion and the drive-end shield onto the armature shaft. Push the pinion forward and rotate until its thread engages in the internal thread in the clutch inner race. Hold it in this position and replace the shim (3), washer (2), and nut (1). Make sure that the shim locates over the shoulder of the shaft and tighten the nut securely. After the nut has been tightened, the pinion must be capable of a small endways movement on the armature shaft.
11. Where facilities exist, the slipping torque of the clutch should now be adjusted as follows:—
    (a) Clamp the armature to the bench using a clamp bracket or in a workshop vice the jaws of which are protected by aluminium, wood or soft brass shields and fit torque socket 6244—1 (for 11 teeth pinions) or socket 6244—2 (for 13 teeth pinions).

The torque socket is a special tool obtainable from Messrs. C.A.V. Ltd., quoting the above Part No.

(b) Adjust the clutch to an initial slipping torque as follows:—
U624 starters 120 — 140 lb ft (16.6 — 19.4 Kg m)
SL524 starters should be set at:—
Clutches re-assembled with new steel plates 55 — 65 lb ft (7.6 — 9.0 Kg m)
Clutches re-assembled with used steel plates 70 — 80 lb ft (9.66 — 11.0 Kg m) (or checking undisturbed clutch)

(c) Adjustment is made by removing or adding shims (11) Fig. 1 between the clutch plates (10) and back plate (12). The shims are made in two thicknesses 0.1 mm and 0.15 mm.

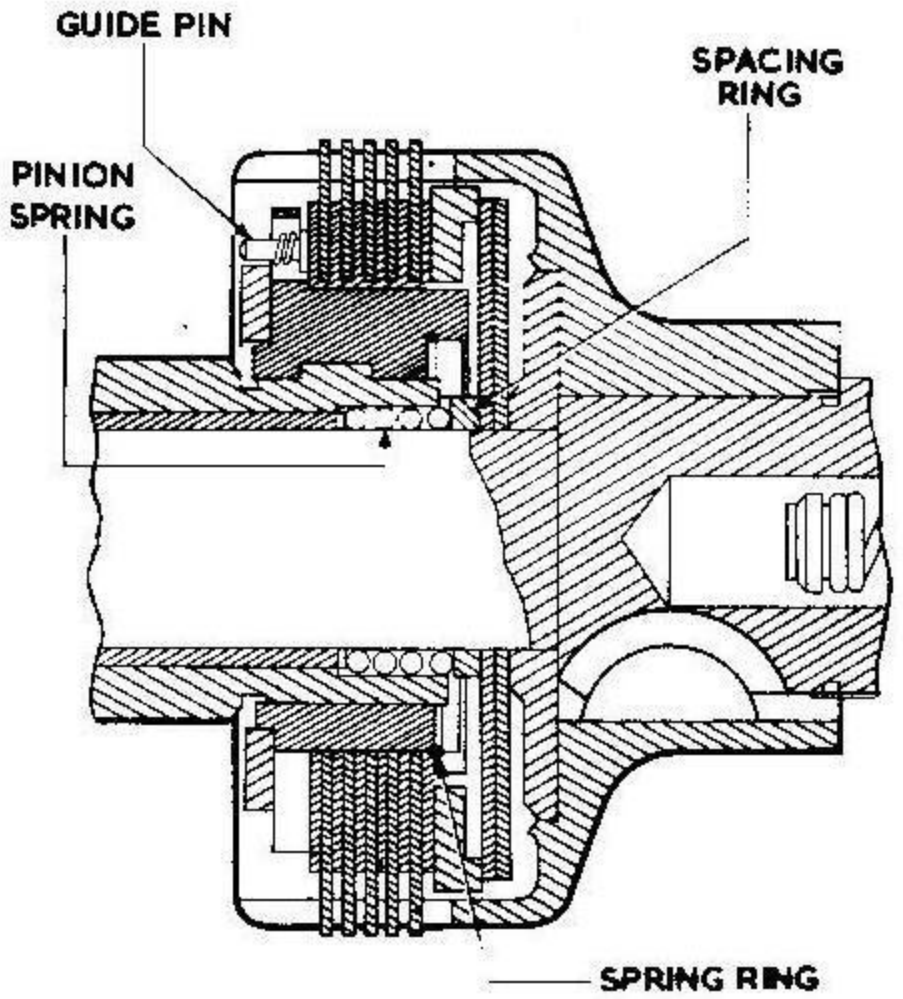


Fig. 13 Sectioned view of the clutch assembly

Adding shims will increase the slipping torque and vice versa.

(d) Slip the clutch 10 times and then re-adjust the clutch to slip at the following final setting:– U624 starters 100 – 120 lb ft (13.8 – 16.6 Kg m)

NOTE: Starters type SL524 should be maintained at the initial setting of 55 – 65 lb ft (new) and 70 – 80 lb ft (used). There is a tendency for these starter clutch settings to climb during service by amounts varying between 5 – 20 lb ft so that a routine check should be made when they come in for repair to see that the torque setting has not exceeded 80 lb ft. Wear on these 'Sulfinuz' finished plates is negligible, therefore used plates can be built into clutches and adjusted up to 80 lb ft but new plates must be adjusted at 55 – 65 lb ft.

12. Replace the castellated nut (40) tighten securely and insert the split pin.
13. Pour approximately 12 cc of oil into the oil filler holes in the drive-end shield. Allow sufficient time for the lubricating pad to absorb the oil, and then replace the spring (4) and lubricating plug (5). Wipe off any surplus oil which may have run into the inside of the drive-end shield.
14. Fit the commutator-end shield to the yoke (15), with 'Durulac' sealing compound ensuring that the dowel in the yoke is correctly located.
15. Fit the solenoid switch (18) to the commutator-end shield (34) and secure in position with the fixing screws (17), after applying 'Durulac' sealing compound to threads.
16. Assemble the negative connector (23) to the commutator end shield and replace nuts (16) and screw (21) where applicable.
17. Reconnect the solenoid winding leads to their respective terminals.
18. Replace screws (22), (24) and (26) securing the main field coil ends, positive terminal connector, and auxiliary field connections to the solenoid switch.
19. Replace the screws and insulating pieces (31) holding the main field connections to the connector at the bottom of the commutator-end shield. Not applicable to those starters with 'pressed' brush gear, the main field connection being secured by one of the screws (27).
20. Assemble the armature and drive-end shield to the yoke and apply 'Durulac' sealing compound to spigots and register between yoke and end-shields.
21. Replace the main fixing bolts or screws (37) together with sealing washers and tighten to 6 – 8 lb ft.
22. Spin the armature to ensure that it is not binding and is free to rotate.
23. Fit the washers and nut (20) to the armature plunger, and tighten.
24. Replace the brushes, taking care that each brush is replaced in its original position. If new brushes are to be fitted, they must be bedded to the commutator.
25. Connect the brush leads and field leads to the brush gear with screws (27). On those starters with pressed brush gear do not forget to fit the brush interconnectors. All these leads should have been duly marked during dismantling as the number and disposition of the leads vary with the starter type.
26. Check that the relationship between the trigger (19) and the tripping disc (30) is correct, by pulling the armature forward until the trigger is raised to its highest extent by the tripping disc. When the trigger is raised there should be an ample gap between the shoulder on the trigger and the bottom of the slot in the catch plate.

TESTING

Engagement Mechanism

The following procedure should be adopted:

1. Connect the starter to a battery of suitable voltage.
2. Insert a strip of insulating material between the moving contact and the second stage contact of the solenoid switch (18) to prevent the second stage contacts from closing.
3. Press the starter button. The first stage contacts of the solenoid switch should close, and the pinion should revolve in its normal direction of rotation.

At the same time, the pinion should move forward a distance of approximately 1 inch (25.4 mm).

NOTE: Do not keep the starter button depressed longer than is necessary to check that the starter is functioning satisfactorily, otherwise the auxiliary windings may be damaged by overheating.

4. Remove the insulating strip from the second stage contacts.

Performance Tests

For the purposes of these tests, the brushes must be bedded over at least 80% of their contact area. The following procedure should be adopted:

1. Fit the starter to a starter test rig and connect the power supply. The gap between the starter pinion and the test rig flywheel must be set at 0.125 in (3.175 mm).

2. Check the lock torque, the running torque, and the light running torque of the starter. Test figures for particular versions of the starter are given the Electrical Test Data Sheets, Publication No. 11501/1. obtainable from Messrs. C.A.V. Ltd.,

3. When these tests have been successfully completed, the commutator end cover and sealing ring should be fitted carefully and the machine subjected to insulation tests. Fit nuts (28) and locking washer. Certain starters also have a securing clip.

Insulation Tests

Using test probes connected to a mains supply of 110 Volt maximum and in series with a 15 watt lamp of suitable voltage, check the insulation of the machine as detailed below. If the lamp lights during any of the tests the insulation is faulty. Alternatively a 100 volt megohm meter can be used.

(a) Between the positive terminal and the frame.
(b) Between the negative terminal and the frame.

SOLENOID SWITCHES

DESCRIPTION

Solenoid switches are simple two-stage units designed for use with axial-type starters, and consist of a solenoid operating coil assembly and two pairs of contacts. The switches are mounted inside the starter housing above the commutator, and protected by the commutator end cover.

OPERATION

When the solenoid operating coil (6), Fig. 14, is energised, the magnetic field set up in the winding draws in the solenoid plunger until the first stage contacts are closed, and the catch plate (2) rests on the step in the trigger (3). This position is held until the trigger is raised by the tripping disc on the starter armature, thus allowing the plunger to travel fully home and close the second stage contacts. Both contacts will remain closed until the operating coil is de-energised. The moving contact actuated by the coiled spring (7), will then return to its normally open position.

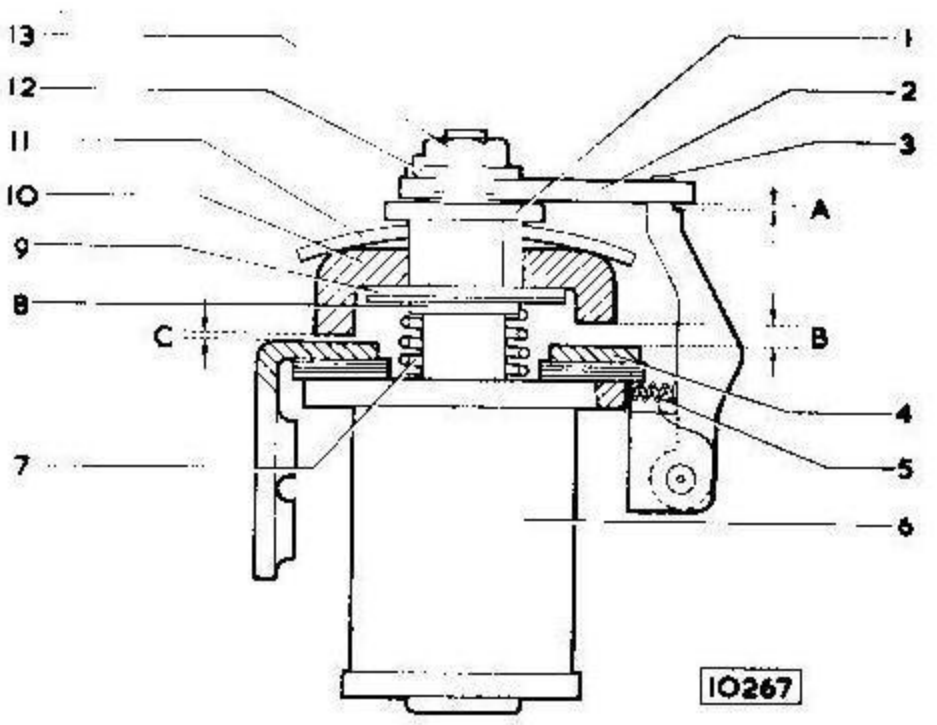


Fig. 14 Sectioned view of the solenoid switch

1 Contact guide
2 Catch plate
3 Trigger
4 Fixed contacts
5 Trigger spring
6 Operating coil
7 Coil spring
8 Insulating washers
9 Adjusting washers
10 Moving contact assembly
11 Contact leaf spring
12 Lock washer
13 Nut

DISMANTLING

Dismantling of the units should be carried out as follows:

BBNG and BBNFA SWITCHES

1. Bend back the tags of the lock washer (12) Fig. 14 and unscrew the nut (13).
2. Withdraw the catch plate (2), contact guide (1), contact leaf spring (11), moving contact (10), adjusting washers (9), insulating washer (6) and return spring (7).
3. Remove the trigger spring (5).

INSPECTION AND REPAIR

Moving Contact

The moving contact (10) can be cleaned with spirit or very fine carborundum paper. If it is very badly burnt or pitted however, it should be set up in a lathe and refaced. The moving contact is machined at an angle of 4° 6½', and this angle must be maintained when the contact is refaced. It is important that after machining, the contact surfaces are smooth, flat, and on the same plane. An uneven surface will result in poor contact and the whole operation will have to be repeated. A maximum of 0.5 mm may be removed from the contact faces. If this is insufficient, a new moving contact or moving contact assembly should be fitted.

Fixed Contacts

The fixed contacts (4) can also be cleaned with spirit or very fine carborundum paper. If the contact faces are badly burnt or pitted they should be refaced on a lathe while still in position on the switch. A maximum of 0.5 mm should be removed and if this is insufficient to remove all traces of burning and pitting, the contacts should be renewed. As new contacts are supplied in an unmachined state, they must be assembled to the switch and faced on a lathe before being placed in service.
If machining facilities are not available, the switch should be returned to a C.A.V. Agent for attention.

Solenoid Winding

If the solenoid winding becomes broken or damaged, the complete switch should be returned to a C.A.V. Agent for attention, as the stirrup surrounding the operating coil is riveted in position and must not be removed.

Catch Plate and Trigger

The catch plate and trigger should be inspected for wear. If the shoulder on the trigger, and the bottom of the slot in the catch plate, show signs of "rounding off" the two components must be renewed.

ASSEMBLY AND ADJUSTMENT

The units should be assembled as follows:

1. Smear the solenoid plunger at the point of entry into the switch body lightly with petroleum jelly, and also the leaf spring (11) Fig. 14 at the point of contact with moving contact (10). Apply sparingly to avoid any surplus getting on to the contact faces.
2. Replace the return spring (6), and ensure that it locates over the lip on the periphery of the switch bore.
3. Replace the trigger spring (5).
4. Assemble the insulating washer (8), adjusting washers (9), moving contact (10) contact spring (11), contact guide (1) and catch plate (2).
5. Locate the end of the trigger in the slot in the catch plate, and then replace the lock washer (12) and nut (13). Tighten the nut securely.
6. Check that gaps between the contacts 'B' and 'C' (Fig. 14) are within the limits detailed below. If not, adjusting washers (9) must be added or removed until the correct gap is obtained. The washer (9) must not be removed as it acts as a locating spigot for the return spring. The adjusting washers are made in four thicknesses, 0.1, 0.2, 0.3 and 1.0 mm, and a combination of these sizes should be used to obtain the correct gaps.
7. Check that gap 'A' between the catch plate and the shoulder on the trigger is within the limits detailed below:
8. After the adjustments have been successfully completed, lock the nut (13) by means of the tabs on the lock washer (12).

Volts	Gap A	Gap B	Gap C
24	2.0± 0.1 mm	3.8± 0.3 mm	1.0± 0.1 mm

Simple Service Setting

After the mechanical settings have been carried out the following check may be made. Push the plunger forward until the first contacts just touch; the gap between the trigger and catch plate should then be approximately 1 mm, that is, the plunger can move a further 1 mm before the catch plate hits the trigger.
Trip the trigger and push plunger until second contacts just touch, from this point until the plunger completes its travel the distance should be approximately 1 mm.

ENGINE STOP SOLENOID

An engine stop solenoid works in conjunction with the stop button on the instrument panel through the relay mounted adjacent to the solenoid unit. Access to the unit is obtained by raising the engine compartment cover.

Maintenance

No maintenance of this system is necessary. If solenoid should fail to work, check for fault in electrical circuit as follows:—

Checking

i. Connect voltmeter to terminals W1 and W2 on the relay.
ii. Switch on start switch on panel and press stop button.

iii. Note reading on voltmeter. If no reading is shown, check for break in cables between relay and panel switch and negative feed.
iv. If reading is shown connect voltmeter to terminals on solenoid and repeat checking operation.
v. If reading is not shown check for break in cable between relay and solenoid. Check relay by substitution.
vi. If reading is shown replace solenoid.

Adjustment
To guarantee satisfactory operation of the engine stopping solenoid it is important to maintain correct adjustment of the linkage between the solenoid plunger and the fuel pump "cut off" lever so as to provide for the full travel of the plunger as follows:—

(1) Check that the solenoid is firmly secured.
(2) Remove the split pin and withdraw the clevis pin from the fork joint.
(3) Energise the solenoid so the armature moves to the "stop" position.
(4) Move the fuel "cut off" lever on the fuel pump to the stop position by hand.
(5) Slacken off the locknut and adjust the fork end until the lower portion of the lever hole shows 1 mm in the eye of the fork.
(6) Move the fuel "cut off" to bring the holes in the lever and the fork end in line. Refit the clevis pin and insert the split pin. Tighten the locknut.
(7) Start the engine and check that the engine will shut down at full throttle when the stop solenoid is brought into operation

LAMPS

C.A.V. lamps are fitted to suit individual operators requirements. The head, side and fog lamps (when fitted) are to DAIMLER specification, all other lamps being to the coachbuilder's.

THE FOUR HEADLAMP SYSTEM

Light Unit Replacement
The Outer Headlamps
Remove the headlamp surround and withdraw the three cross headed screws and unit retaining ring.
Remove the light unit and detach the cable plug adaptor. There being no separate bulb in a sealed beam unit, the complete unit must be changed if filament failure is experienced.

The Inner Headlamps
Release the three crossheaded screws and turn the light unit anti-clockwise to remove. Detach the cable adaptor. Do NOT disturb the two slotted screws otherwise the head lamp setting will be upset.

Headlamp Setting
To obtain the best possible results from the four headlamp system it is essential that they are correctly adjusted.
If for any reason re-alignment of the headlamp becomes necessary use an approved beam setter details of which can be obtained from the lamp manufacturers.
If for any reason, a beam setter is not available the following procedure should be carried out.
Place the vehicle on a level surface in front of a garage wall; the vehicle should be at least 25'0" (7.6 m) away and square to the wall.
Carry out the work with conditions as dark as possible so that the pattern of the light areas can be clearly seen.
With the headlamps in the full beam position, that is, not dipped, the beams should be parallel with the ground and with each other; measurement should be taken from the centre of the lamps and the horizontal and vertical axis of the light areas.

The Outer Headlamps
To adjust, remove the lamp surround and adjust by two screws, one located at the top centre and the second at the centre left hand side.
The top screw is for vertical adjustment, that is, to raise or lower the beam. Turn the screw anti-clockwise to lower and clockwise to raise the beam.
The side screw is for horizontal adjustment that is, to turn the beam right or left. To move the beam to the right turn the screw clockwise, to move the beam to the left, turn the screw anti-clockwise.

The Inner Headlamps
The setting of the inner beams is by two similar screws diagonally opposite to each other. To raise the beam turn the upper screw clockwise, and to lower turn the lower screw clockwise.

THE TWO HEADLAMP SYSTEM

Bulb Replacement
British Pre-focus (B.P.F.) bulbs are fitted to C.A.V. headlamps. To replace a faulty bulb extract the three retaining screws from the chromium surround ring, remove the surround and the rubber dust excluder ring. Press the light unit inwards against the three spring loaded adjustment screws and turn anti-clockwise to disengage it

through the key hole slots. Release the bayonet adaptor and withdraw the defective bulb.
Fit the new bulb noting that the notch in the flange of the bulb coincides with a ridge in the bulb holder.
Refit the light unit, dust excluder and front ring.
NOTE: If the setting of the three adjuster screws has not been altered during the removal of the light unit, the setting of the headlamps will remain unaltered. Any alteration of the adjuster screws will necessitate re-adjustment of the headlamp, see "Headlamp — Setting". It is essential that the correct replacement bulb is fitted.

Headlamp Setting

The headlamps should be set so that when the vehicle is carrying its normal load the driving beams are projected parallel with each other and parallel to the road.

When setting the lamps remove the front ring and dust excluder ring.

For vertical trimming, screw in or out the top spring loaded screw.

Horizontal trimming is effected with the two side screws.

HORNS
C.A.V. MODEL W.T.618

DESCRIPTION
A single C.A.V. — 24 volt W.T. 618 Horn is fitted as standard equipment, twin horns (high and low note) being available to suit Operator's requirements.
The horn(s) are normally mounted at the front of the vehicle beneath the driver's floor.
It is important to keep the horn mounting bolts tight and to maintain rigid the mounting of any units fitted near the horns.
Electrical connections and cables should be checked occasionally and rectified as necessary.

Removal
Remove the two screws securing the horn to the mounting bracket, remove the screw securing the cover from the horn. Detach the cover and withdraw the cables.

Refitting
Refitting is the reverse of the removal procedure.

Adjusting
Adjusting is effected after removal of the domed cover by means of the fixed contact screw.
Connect a 0—20 first grade moving coil ammeter in series with the horn. Release the contact locknut and adjust the contact until the horn will pass 5 amperes at 24 volts.
Tighten the locknut and recheck.
The horn must be firmly mounted in a vice or fixture when adjusting.
When checking or adjusting the current must be pure D.C. — not rectified A.C.

Relay — **Checking**
Check that current is available at relay contact terminals when the horn button is depressed.
Check relay by substitution.

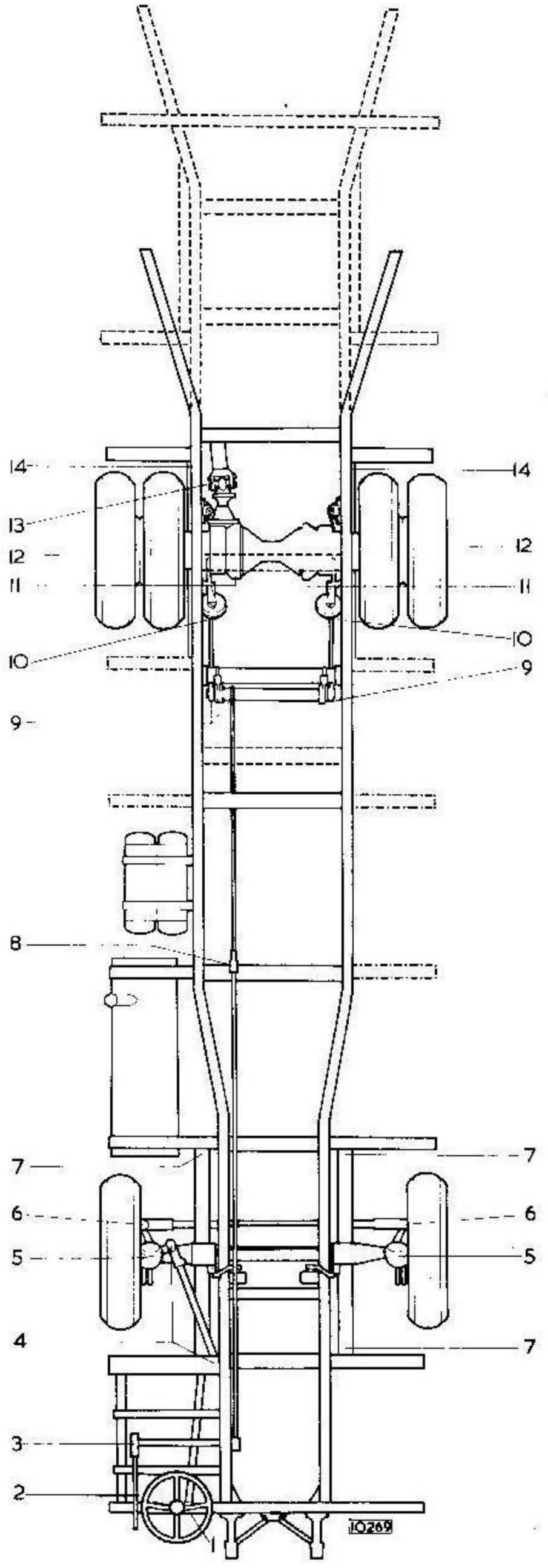


Fig. 15 *Location of lubrication points. The basic chassis is shown in full. Dotted lines are included in the single deck chassis layout. Chain dotted lines represent additions for the double deck chassis.*

1 — Accelerator pedal linkage.
2 — Foot brake control linkage
3 — Handbrake control ratchet and pivot
4 — Steering relay lever and drag link.
5 — Front wheel swivels.
6 — Track rod ball joints.
7 — Front road springs and shackles.
8 — Handbrake relay lever.
9 — Handbrake wayshaft.
10 — Handbrake fork ends.
11 — Rear axle drain plugs.
12 — Rear hub bearings.
13 — Propeller shaft joint.
14 — Rear road springs and shackles.

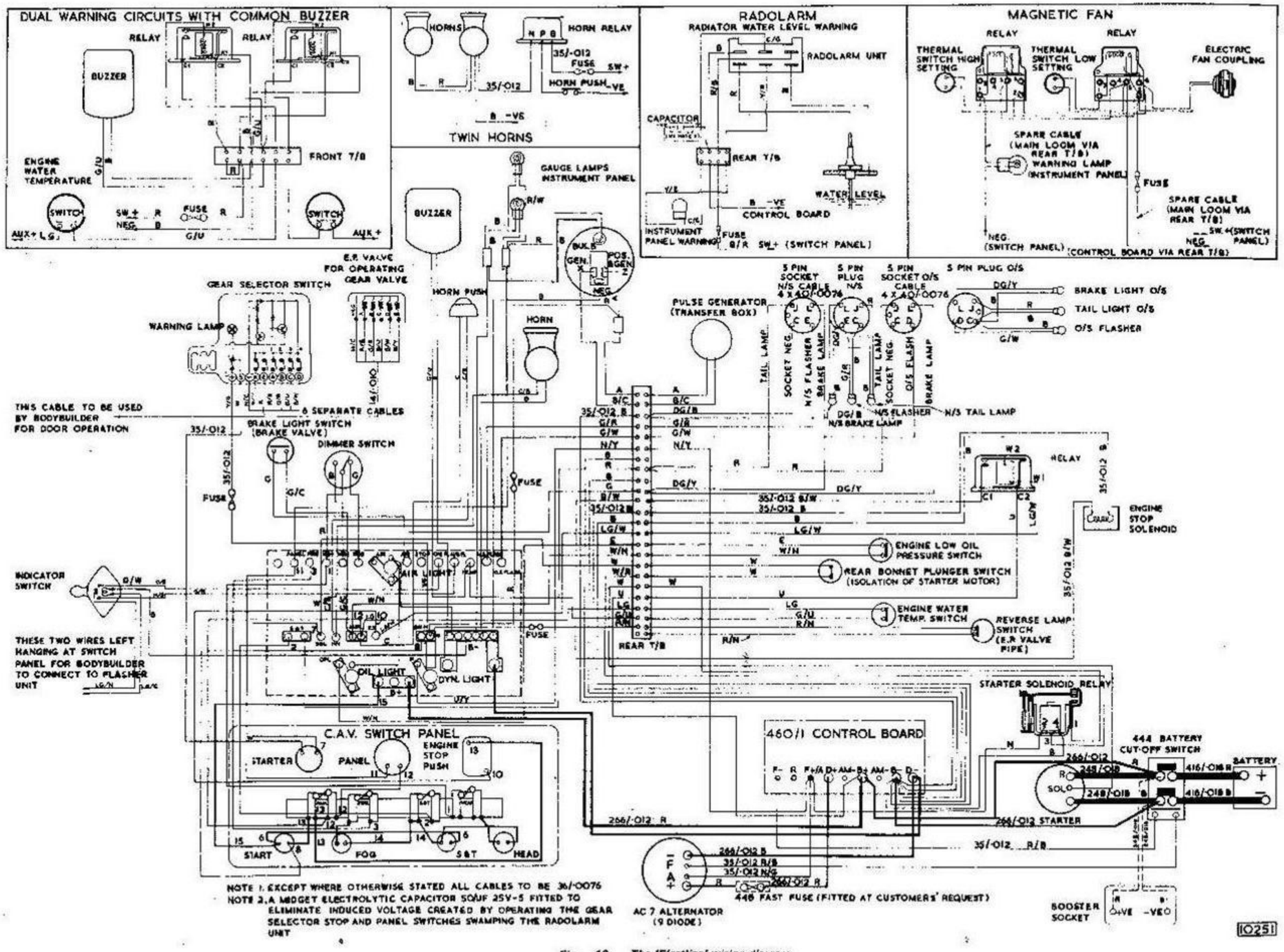


Fig. 16 The 'Fleetline' wiring diagram.

MISCELLANEOUS EQUIPMENT

SECTION S

INDEX

MISCELLANEOUS EQUIPMENT
'ASHANCO' EXHAUST BRAKE

GENERAL DESCRIPTION

The "ASHANCO" electrically operated exhaust brake, manufactured by Thomas Ash & Co. Ltd., 19, Rea Street South, Birmingham 5, England, is fitted as optional equipment to Operator's requirements.

The brake unit consists of a circular damper blade attached to a spindle operating in the valve body.

The movement of the spindle is controlled by a solenoid plunger actuated electrically through a micro switch attached to the brake pedal.

The turning movement of the spindle and damper blade closes the chamber in the body preventing the passage of the exhaust gasses through the exhaust manifold down pipe and thereby creating a back pressure in the exhaust manifold.

ROUTINE MAINTENANCE

EVERY 2,000 MILES (3,200 KM)

Check all nuts and bolts for tightness especially the solenoid fixing nut (5) Fig:4.

Lubricate linkage sparingly with engine oil.

EVERY 10,000 MILES (16,000 KM)

Brake Unit – Checking

Check movement of butterfly valve. This should be quite free.

Check that the link arm (37) Fig.2 is tight on the spindle.

Check that the return spring (46) opens the valve smartly when the solenoid linkage is released. Weak springs should be replaced immediately.

Operate the pedal switch to energise the brake solenoid and check the setting of the solenoid plunger, as detailed on page S.5 , with the valve in the closed and open position. Ensure that accumulated dirt or grease is not preventing free movement of the plunger. This must be kept clean but not lubricated.

Clean operating linkage for wear. Test the spindle for excessive movement in valve body.

Check electrical connections to solenoid terminal block for tightness and condition of wiring.

Pedal Switch – Checking

Examine the fixing for tightness and the cover for freedom of movement, check that the return spring allows the switch to open smartly when the pressure is released from the pedal.

The interior micro switch (3) Fig:5 can be heard to snap open or closed when working correctly.

Voltage Cut-Out – Checking

Check all connections for tightness. Examine the contacts and clean if necessary.

Resetting if required should be carried out as detailed on Page S.6 .

THE EXHAUST BRAKE UNIT

Removal

Disconnect the leads from the solenoid terminal block.

Withdraw the bolts and nuts securing the unit to the exhaust pipe and manifold flanges and detach the unit.

Re-fitting

Refitting is the reverse of the removal procedure. Refit with the arrow on the label attached to the valve body pointing towards the silencer. The arrow indicates the direction of the gas flow. Check that all flange surfaces are clean and smooth and bolt up securely. Renew gaskets if worn or damaged.

Dismantling (Fig. 2)

Remove the split pin (49) and locknuts (47) from the actuating arm (43) and withdraw the spring (46).

Remove the split pin (50) and withdraw the roller pin (41) from the link arm (37).

Remove two setscrews (35) and lockwashers (36) and release the end cap (34).

Remove the spindle nut (48) and washer (39) from the spindle (33).

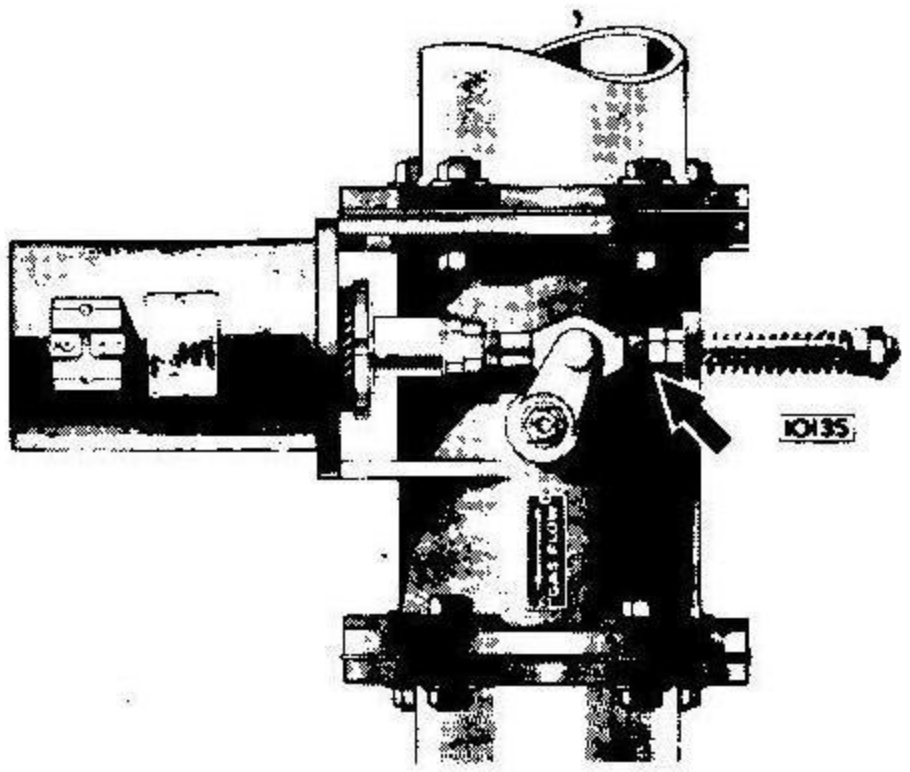


Fig. 1 The valve unit
(The arrow shows the solenoid adjustment nuts)

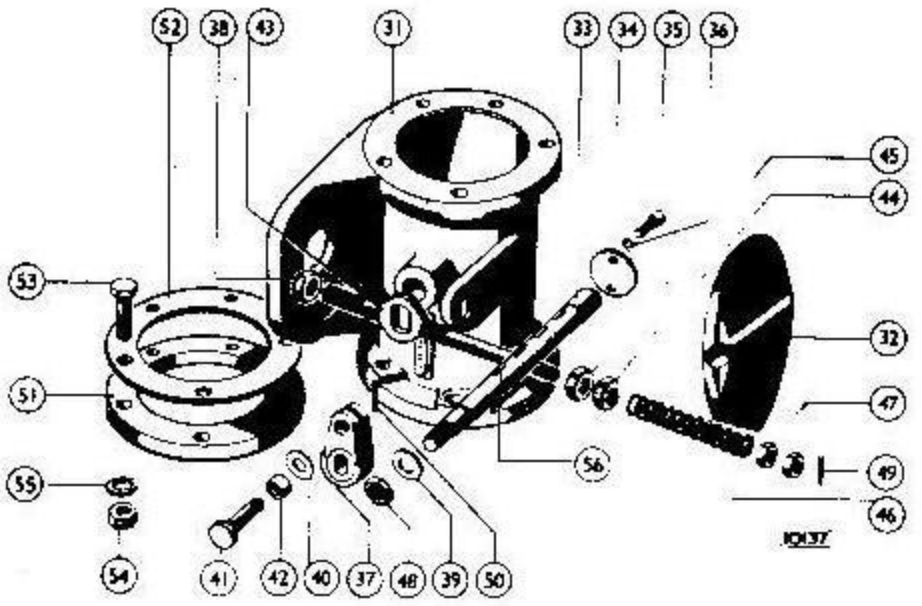


Fig. 2 Exploded view of the Ashanco Exhaust Brake

31 Exhaust valve body
32 Damper blade
33 Spindle key(s)
34 End cap
35 Fixing screw
36 Lockwasher
37 Link arm
38 Locknut
39 Washer
40 Washer
41 Roller pin
42 Roller
43 Actuating arm
44 Stop nut
45 Locknut
46 Spring
47 Spring retaining nut
48 Spindle nut
49 Split pin
50 Split pin
51 Mating flange
52 Gasket
53 Joint bolt
54 Joint nut
55 Washer
56 Key

Remove the solenoid fixing nut (5) Fig. 4 and withdraw the solenoid from the body platform.
Stand the body on the bearing boss at the opposite side to the linkage and with a hide mallet drive the spindle down for about 6" (12.7 mm). This will release the link arm (37) from the flats on the spindle (33), the link arm can then be removed.
The roller (42) will now be freed from the slot in the actuating arm and the arm complete with solenoid plunger can be withdrawn through the hole in the body platform.
NOTE: The spindle (33) and damper blade (32) should only be removed if it is necessary to replace either of these items or to give attention to the bearing bosses of the body.

Should this be necessary proceed as follows:—
Use a brass or copper drift and press or drive the spindle from the threaded end and out through the blade and the far side of the body. Examine the dismantled components for wear.
Check the internal diameters of the spindle bearings, these should not exceed .630" (16 mm) and .755" (19.14 mm) respectively. Re-boring and bushing is recommended if diameters are greater than those given above. The standard bore sizes are .625" – .626" (15.87 – 15.9 mm) and .750" – .751" (19.05 – 19.07 mm).
Check the damper bore and keyway for tightness on the spindle. Examine the periphery for corrosion and check the fit in the body.
Check the fit of the spindle in the blade. This should be a tap fit. The bearing diameters when new should be .615" (15.62 mm) and .740" (18.79 mm). If worn to more than .005" (.127 mm) below these dimensions replacement is advisable.
Check that the two flats are not worn and that these are a tight fit in the link arm (37).

Reassembly
When fitting a new damper blade the fit of the blade in the body should be checked as follows:
Prepare a length of 5/8" (15.9 mm) diameter bar to be an easy fit in the blade and the small bearing of the body. Make and fit a sleeve with an outside diameter of .748" (19 mm) and a bore to fit easily on the 5/8" (15.9 mm) bar and insert in the large bearing of the body.
Position the damper blade in the body with the shorter portion nearest the solenoid platform and in contact with the bore at this point.
Push the bar through the bearings and blade to retain the blade in the body and check for correct fit.
The correct cold clearance is .018" (.45 mm) at each side. This clearance is gradually reduced around the periphery of the damper until contact is established with the bore at the tips.
Remove the test bar and bearing bush and re-assemble the valve components.
Stand the body on the 5/8" (15.9 mm) bearing.
Line up the bore of the blade with the bearings and position the spindle with the keys in line with the keyway of the blade.
Drive the spindle through the blade and into the bearing on the far side of the body.
NOTE: Leave the ¾" (19.1 mm) diameter boss of the spindle standing out approximately 3/8" (9.5 mm) at this stage.
Check that the roller pin (41) is free from steps and is a good fit in the link arm (37).
Check the clearance between the outside of roller (42) and the flats of the slot in the actuating arm. If this clearance is greater than .025" (.635 mm) replacement is advisable. The roller should be a good fit on the roller pin.

Check that the slotted hole in the link arm is a tight fit on the flats of the spindle (33).
Fit the nut (38) to upper ½" thread of the actuating arm and nuts (45) and (44) in that order to the lower ½" thread.
Insert the arm through the platform into the lug of the body (31).

IMPORTANT
To ensure that the slot in the arm (43), which is offset relative to the centre line, is correctly positioned, take a first measurement from the edge of the slot nearest the spindle to the edge of the spindle, rotate the arm one half turn and take a second measurement. The correct position is that having the greater measurement.
Position the roller (42) in the slot of arm (43) and locate the fork end of the link arm (37) over the roller and slot, swing the link arm to allow the threaded end of the spindle to enter the centre of the slot in link arm. Line up spindle flats to flats in one arm and fit washer (39) and nut (48) to spindle.
Screw down the nut to force link arm on to spindle.
NOTE: To enable the arm to be drawn fully home the spindle should be driven through from the other side of the body with a brass drift. When correctly positioned the larger end of the spindle will be approximately 1/16" (1.6 mm) below the face of the bearing boss.
Assemble the following items to complete the linkage, roller pin (41), washer (40), split pin (50), spring (46), and retaining nuts (47).

Reassembly of Solenoid Brake Valve
Position the fixing nut and lockwasher over the thread of the actuating arm and screw down the plunger to the bottom of the thread.
Position the insulating washer on the solenoid body extension, slide the solenoid on to the plunger and pass the extension through the 1½" (38.1 mm) diameter hole in body platform.
Secure with the nut and washer.
NOTE: The nut should be fully tightened before refitting the valve unit to the vehicle. A special "C" spanner can be obtained from the manufacturers of the unit. A brass drift may be used if the spanner is not to hand.
Adjust the solenoid plunger and damper blade as follows:—
Operate the linkage by hand to close the valve unit fully and screw the plunger up or down until the machined ring on the plunger is visible below the solenoid extension. See Fig.1.
This will ensure that there is always clearance between the plunger nose and solenoid top cover when the valve is closed. Tighten the ½" locknut to secure the plunger in this position.
Open the valve fully and adjust the solenoid to 7/8" (22.2 mm) dimension as shown in (A) Fig.3. Adjust by screwing the nuts (44) Fig.2 and (45) up or down on the actuating arm (43). Lock the nuts securely when the correct setting is obtained.
Adjust the retaining nuts (47) to set the return spring length at 2½" (63.5 mm). Lock the nuts and fit the split pin.

THE SOLENOID

Dismantling
Solenoids may be treated with a sealing compound covering the sides of the base of the terminal block or have a jointing compound between the terminal block and body face only. The compound must be chipped away to expose the attachment screws.
Remove the internal connections to the terminal block (7) Fig.4; remove the two screws securing the terminal block to the body and lift off the block and support.
Grip the solenoid in a vice, using a pair of shaped clamps made from steel tube.
Remove the cover (3) utilizing a flat strip to which has been attached two ¼" (6.4 mm) diameter studs at positions to match the hole centres in the top cover.
Remove the three spring washers (6) and withdraw the coil and former (1) by applying pressure to the inner tube of the former from threaded extension end of the solenoid.
The coil connecting leads should be carefully passed through the body aperture during removal of coil.

Reassembly
Reassembly is the reverse of the dismantling procedure.
Care should be taken to ensure that the coil connections do not foul the edges of the aperture in the body when refitting the terminal block.
The top cover should be locked in position when screwed tight home in the body by soaking the top edge of the body over the cover in one or two positions with a small chisel.
Sealing compound should be applied to the base of the terminal block to prevent ingress of moisture during service. This should be George Ellison or a non-conductive pipe jointing compound.

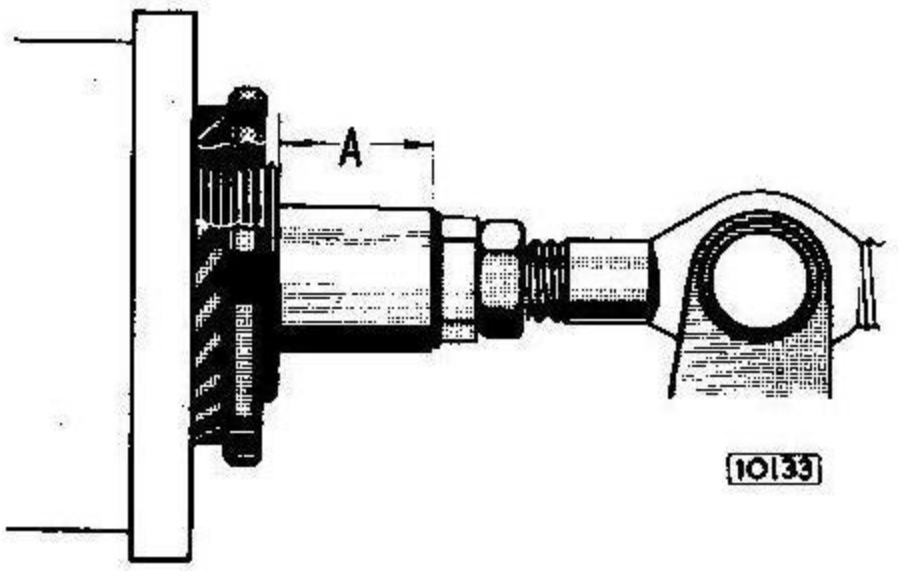


Fig. 3 The solenoid adjustment location

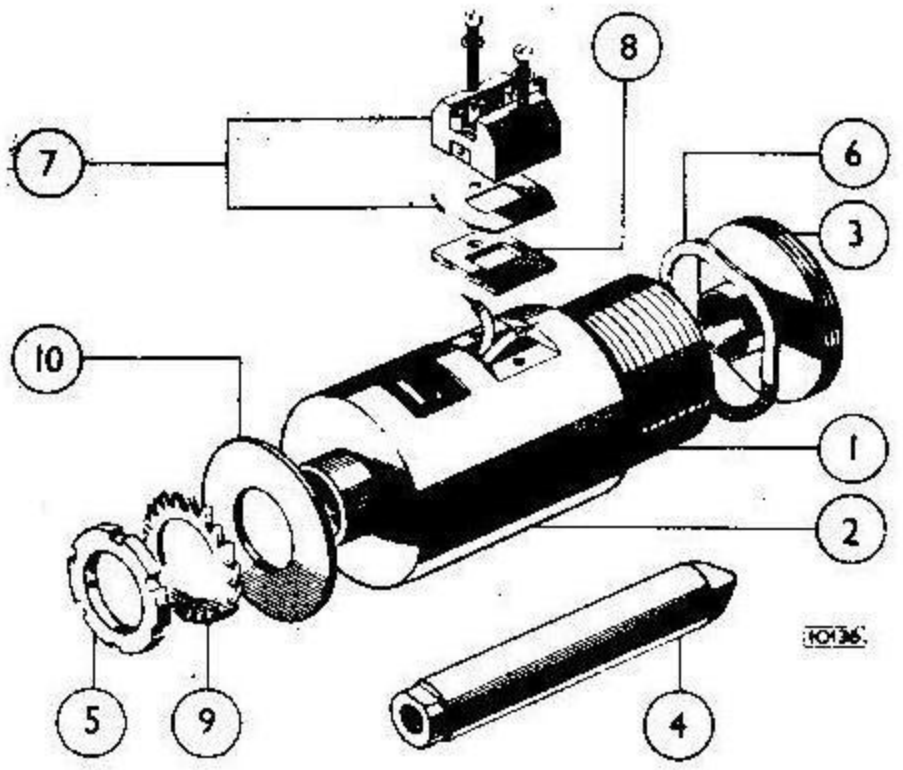


Fig. 4 Exploded view of the solenoid

1 Coil
2 Body
3 Top cover
4 Plunger
5 Fixing nut
6 Spring wash (3 to each solenoid)
7 Terminal
8 Terminal block support
9 Shakeproof washer
10 Insulating washer

Testing

The maximum current reading taken with a true voltage of 24 volts should not exceed 4.2 amperes.
Internal shorting should be suspected if higher readings are obtained.

THE PEDAL SWITCH FIG'5.

Removal

Disconnect the cables from the terminals, unscrew the two fixing nuts and remove the switch from the vehicle.

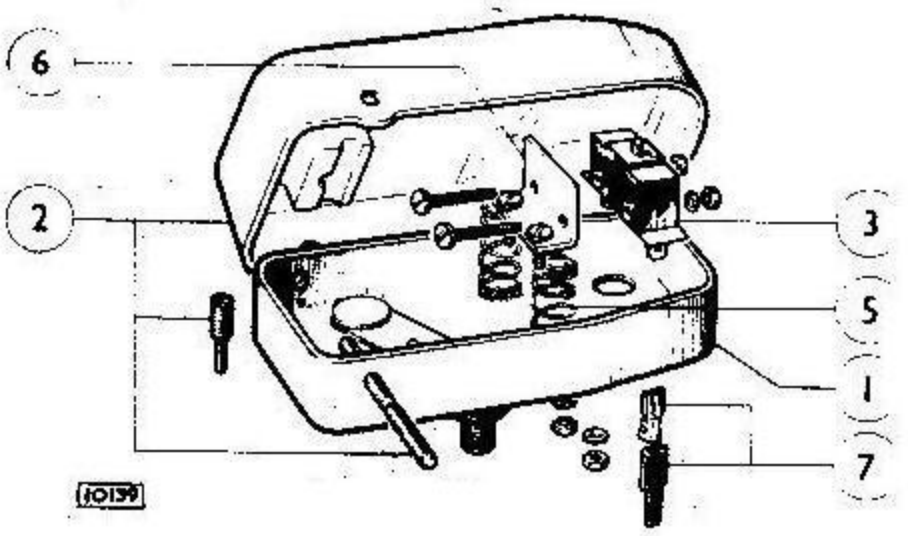


Fig. 5 The pedal switch

1 Switch base
2 Clamp screw, spindle and cover
3 Micro-switch
5 Springs
6 Switch bracket

Withdraw the clamp screw, spindle and cover (2) exposing the switch (3).
Remove the securing screws and nuts and withdraw the switch.
The terminals and insulation strips are now clear to be examined and replaced if necessary.

Refitting

Reassembly and refitting the pedal switch is the reverse of the removal procedure.
Replace the springs (5) if broken or weak. It may be necessary to make and fit small bushes to the base (1) should the spindle bearing holes be worn oversize.

THE VOLTAGE CUT-OUT, FIG.6.

Mechanical Setting

Slacken off the screws (A) attaching the flat spring to the frame.
Seperate the main contacts (E) and the auxiliary contacts (F).
Insert a .006 (.15 mm) feeler gauge between the back of the armature and the frame.
Press the armature firmly down to the core and back against the feeler.
The gap, if any, which appears between the top of the frame and the underside of the armature hinge is to be closed by inserting packing pieces until contact is established with the spring. Care should be taken against

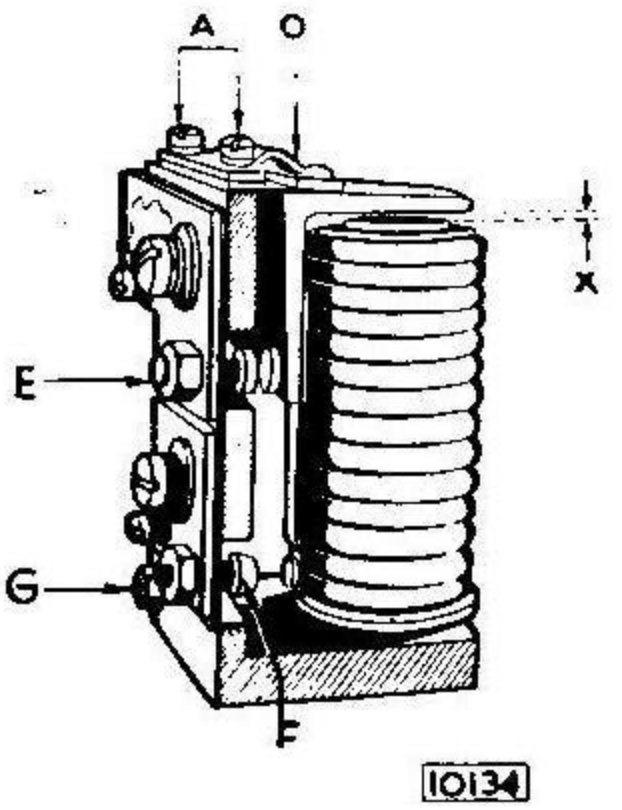


Fig. 6 The voltage cut-out
('X' shows the gap between the armature and core)

A Screws
E Main contacts
F Auxiliary contacts
G Adjustment screw
O Armature stop

using an excess of packing and so distorting the spring.
Tighten the screws (A) attaching the armature to the frame.
Screw down the main contact (E) until the gap between the armature tip and the core is .008"/.010" (.2 – .25 mm) with the armature held down.
With a .008" (.20 mm) feeler gauge between the main contacts (E) hold the armature down and adjust the auxiliary contacts (F) to touch.
Lock both (E) and (F) in the above position.
With the contacts in the open position the gap (X) between the armature tip and the core should measure .020" (.5 mm). This figure is obtained by bending the armature stop (O).

Electrical Setting
Variation of the tension of the leaf spring of the armature by the adjustment of screw (G) will alter the point in the engine revolution range at which the cut-out opens or closes.
This setting is best made on the vehicle with the engine running but if an independent voltage supply is available together with a D.C. Volt meter and a variable resistance the setting can be carried out on the bench as detailed below:

(1) Connect the supply (24 volts) through a resistance to the terminals of the coil.
(2) Connect the voltmeter across the same terminals.
(3) Release the locknut of adjusting screw (G) and turn the screw to remove tension from the armature leaf spring.
(4) Adjust the resistance to obtain the maximum voltage reading on the voltmeter.
(5) Vary the voltage and adjust the tension on the leaf spring by turning the adjusting screw until the contacts close when a reading of 16 volts is reached, and open when the reading falls below this reading Lock the adjusting screw nut.

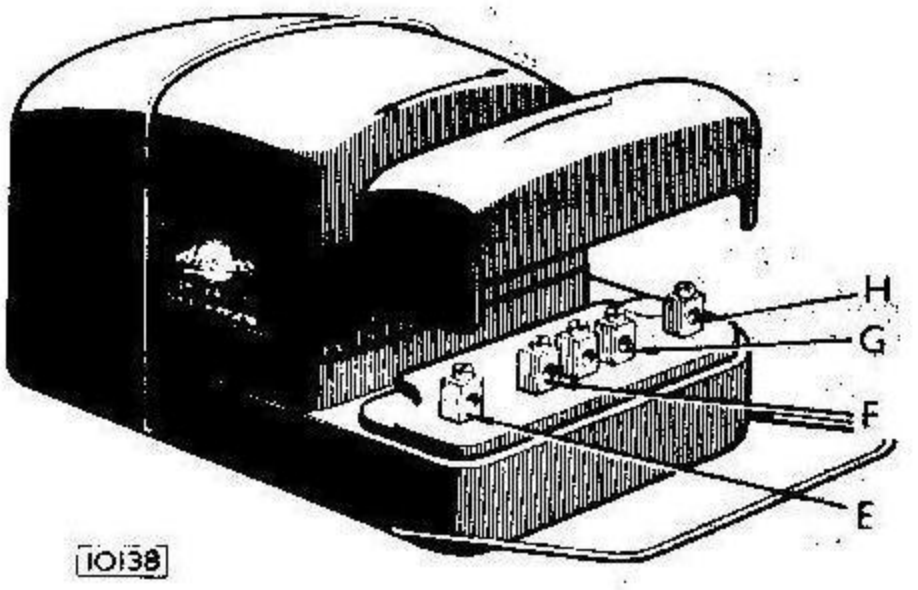


Fig. 7 The cut-out unit (showing connections)

E Dynamo + (pos)
F Pedal switch
G Dynamo – (Neg)
H Brake solenoid

LLEWELLYN FLUID FLYWHEEL GLAND (TYPE OF 60B/6HR)

"LLEWELLYN" fluid flywheel glands, manufactured by LLEWELLYN GLANDS LTD., 56, NORWOOD ROAD, SOUTHALL, MIDDLESEX, ENGLAND, are fitted as alternative equipment to operator's requirements, replacing the Daimler gland fitted as standard.

DESCRIPTION (Fig.8).
The gland is self-adjusting and self-aligning thus ensuring a perfect oil seal under all conditions.
Sealing is effected by the spring-loaded Floating Ring (F) mating with the Rubbing Plate (N), pressure being maintained by the Pressure Ring (K).
The drive from the rotating output shaft is transmitted through the Sleeve (A) to the Floating Ring (F) by the Driving Ball (B) and the Driving Key (C).
The Sleeve (A) is mounted fluid-tight on the rotating output shaft and the Rubbing Plate (N) is similarly fitted in the rotating Housing (M).

ROUTINE MAINTENANCE
No routine maintenance is necessary. If the gland is removed from the fluid flywheel for any reason it must NOT be refitted unless it has been serviced.

REMOVING
Remove the trailing link yoke as detailed in "SECTION G – The Fluid Flywheel and Trailing Link Coupling.
Remove the nuts and lockwashers securing the Clamping Plate (R) Fig.8.
Detach the Housing (M) and associated parts to expose the components of the gland.
Remove the Housing Joint (Q) and withdraw the Sleeve (A) and associated parts.

REFITTING
Refitting is the reverse of the removal procedure.

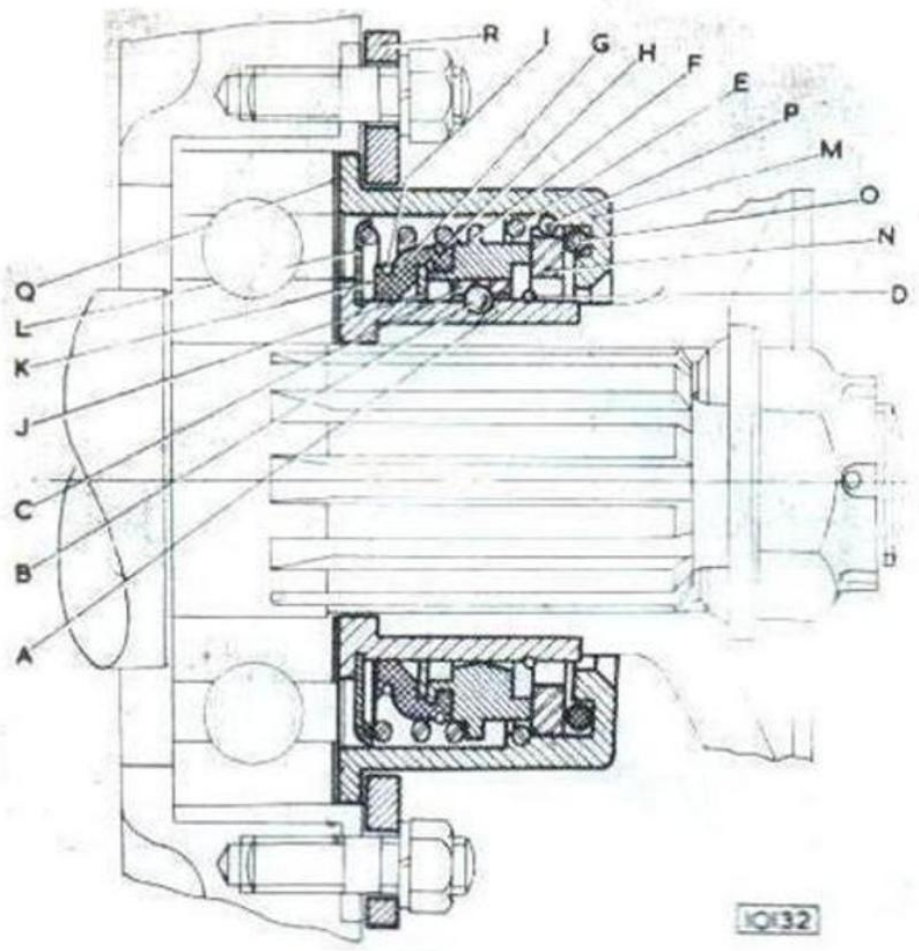


Fig. 8 The Llewellyn gland seal

A Sleeve
B Driving ball
C Driving key
D Floating ring circlip
E Floating ring circlip
F Floating ring
G Flexible seal
H Spring bolt – seal body
I Spring bolt – seal lip
J Seal backing plate
K Pressure spring
L Pressure spring plate
M Housing
N Rubbing plate
O Rubbing plate 'O' ring seal
P Rubbing plate locking ball
Q Housing joint
R Clamping plate

Refit the Sleeve (A) and associated parts.
Refit the Housing Joint (Q) the Housing (M) and associated parts and the Clamping Plate (R).
Refit the trailing link yoke as detailed in "Section G – The Fluid Flywheel and Trailing Link Coupling".
Check that the Sleeve (A) is a sliding fit in the shaft. If necessary, remove any burrs from the shaft.
Care must be taken to ensure that the lead bronze face of the Floating Ring (F) is not damaged.
When re-assembling do NOT use any jointing compound.

SERVICING

Service Exchange

Service exchange facilities (subject to glands not being badly damaged) are available for both home and export markets.
Each gland consists of the following units:–

(1) Sleeve (A) and associated parts
(2) Housing (M) and associated parts

Both units must be returned for reconditioning to the manufacturers.

Service Kits

If the cost of returning the glands for service exchange would be prohibitive, service kits, for export only, are available from Llewellyn Glands Ltd.

Each service kit comprises the following items

(1) Driving Ball (B)
(2) Driving Key (C)
(3) Flexible Seal (G)
(4) Spring Belt – Seal Body (H)
(5) Spring Belt – Seal Lip (I)
(6) Seal Backing Plate (J)
(7) Rubbing Plate "O" Ring Seal (O)
(8) Rubbing Plate Locking Ball (P)

Dismantling

Dismantle the Sleeve (A) and associated parts as follows:–
Remove the Pressure Spring (K) by lifting over the Pressure Spring Plate (L) with a small hooked tool.
Remove the Floating Ring Circlip (D).
Withdraw the Spring Belts – Seal Body (H) and Seal Lip (I)
Insert a small screwdriver, which has had the sharp edges removed, between the Floating Ring (F) and the Flexible Seal (G), gently lever apart and remove the Floating Ring (F).
Withdraw the Driving Key (C).
Grind the Driving Ball (B) flat to sleeve height and tap out with a centre punch.
Remove the Seal Backing Plate (J) and the Flexible Seal (G).
Dismantle the Housing (M) and associated parts as follows:–
Remove the Rubbing Plate Circlip (E) and withdraw the Rubbing Plate (N) and the Rubbing Plate Locking Ball (P).
Withdraw the Rubbing Plate "O" Ring Seal (O).
Thoroughly clean all individual metal parts in cleansing solvent.

Reassembling

Reassemble the Sleeve (A) and associated parts as follows:–
Refit the Flexible Seal (G) and Seal Backing Plate (J).
Refit the Driving Ball (B) and Driving Key (C). This may require drilling slightly deeper with a No.13 ball-nosed drill to ensure that the Floating Ring (F) slides freely.
Refit the Floating Ring (F); broach a new keyway and relap before fitting.
Refit the Spring Belts – Seal Body (H) and Seal Lip (I).
Refit the Floating Ring Circlip (D).
Fit the Pressure Spring (K) over the Pressure Spring Plate (L). Do NOT attempt to fit the Pressure Spring (K) over the Floating Ring (F).
Reassemble the Housing (M) and associated parts as follows:–
Refit the Rubbing Plate "O" Ring Seal (O), the Rubber Plate (N), the Rubbing Plate Locking Ball (O) and the Rubbing Plate Circlip (E). Relap the Rubbing Plate (N).
Smear all parts with a good quality grease before reassembling.
NOTE: No responsibility can be accepted by Llewellyn Glands Ltd. for glands serviced other than in their own works.

Printed in England by Technical Print Services Limited, 4 Fletcher Gate, Nottingham.