LOCATING SECTIONS

Bend back the pages to locate the black marker against the required section

FOREWORD

This workshop manual provides complete maintenance and overhaul information in respect of the Commer models listed below. Where necessary throughout this publication, reference to a particular model is indicated by the use of the factory code designation applicable.

Model	Engine Type	Factory Code Designation	Commencing Chassis No.	
1½ Ton—123 in. W.B.	4-Cylinder Petrol Engine	KAH.3023	KAH.3023	000001 onwards
	"Light" Diesel Engine	KAD.3023	KAD.3023	
	6-Cylinder Petrol Engine	KAL.3023	KAL.3023	
2 ton—123 in. W.B.	4-Cylinder Petrol Engine	KAH.4023	KAH.4023	000001 onwards
	"Light" Diesel Engine	KAD.4023	KAD.4023	
	6-Cylinder Petrol Engine	KAL.4023	KAL.4023	
2 ton—135 in. W.B.	4-Cylinder Petrol Engine	KAH.4035	KAH.4035	000001 onwards
	"Light" Diesel Engine	KAD.4035	KAD.4035	
	6-Cylinder Petrol Engine	KAL.4035	KAL.4035	
3 ton—135 in. W.B.	6-Cylinder Petrol Engine	KAL.6035	KAL.6035	000001 onwards
	Perkins Four/203 Diesel Engine	KAB.6035	KAB.6035	

DIESEL ENGINE WORKSHOP MANUALS

The overhaul information in Sections "A", "B" and "C" of this manual deal with the 4-Cylinder and 6-Cylinder Petrol Engines only, and therefore all information applicable to the "Light" Diesel Engine and the Perkins Four/203 Diesel Engine is provided as follows:

"Light" Diesel Engine	Refer to the "Light" Diesel Engine Workshop Manual Publication No.638 (Part No. 6600481) and the relevant Service Data Sheets.
Perkins Four/203 Diesel Engine	Refer to the Perkins Workshop Manual which is **included at the rear of this manual.**

Locating Information.

The various units of the vehicle are dealt with in sections which are listed on page v of this manual, each being identified by a reference letter. Each section thus referred to, opens with an index page so that any particular operation may be selected in the least possible time.

The page containing the list of units is so arranged that each section is immediately located by bending back the pages observing the black marker on the outer edge of the index page to each section. Where this black marker corresponds to the section required as listed on page v, open the manual and refer to the Section Index given on that page.

Page and Illustration Numbers run consecutively throughout each section preceded by the appropriate section letter, e.g., "Page A.5" or "Fig. A.9" are the page and illustration numbers respectively under the section "COOLING SYSTEM".

Manufacturing Data, where applicable, is given at the beginning of each section and should be carefully studied when an overhaul is being carried out.

Duplicated Overhaul Information. To avoid duplication in reference to the overhaul information given for identical assemblies on the vehicles, i.e., offside and nearside hubs and bearings, stub axles and swivel pins etc., each applicable sub-section in the manual details the necessary information for overhauling a single assembly only. Therefore, when carrying out the operations, the same overhaul instructions are applicable to the corresponding opposite assembly unless otherwise stated.

Rootes Group Special Tools. Certain operations detailed in this manual are facilitated by the use of specially designed tools. A full list of these tools, together with the tool suppliers name, is given in Section "S" and the application of each tool together with its reference number is quoted throughout the manual.

COOLING SYSTEM

SECTION A

INDEX

COOLING SYSTEM
(KAH MODELS)

DATA

Type of system	Pressurised, water circulation assisted by pump, and cooled by radiator and fan
Type of pump	Centrifugal
Fan assembly	
—Number of blades	4
—Diameter	15·0 in. (38·1 cm.)
—Part number	Home P104910 Export W46911
Drive of pump and fan	"V" belt from crankshaft pulley
Cooling system control	Thermostatic and fully automatic by thermostat located in outlet housing
Thermostat	
—Commences opening at	167°F. to 176°F. (75·00°C. to 80·00°C.)
—Fully open at	195°F. (90·55°C.)
Radiator type	4 row gilled tube
Radiator relief valve	
—Location	In filler cap
—Operating pressure	4 lb./sq. in. (·28 kg./sq. cm.)
Controlled cooling	Via water distribution tube in the cylinder head. The jets formed in the distribution tube direct coolant to the exhaust valve seatings
Total capacity of system	19 pint (10·80 litre)
Drain tap location	
—Radiator	Bottom outlet pipe
—Cylinder block	Rear right hand side and controlled by a remote handle, extending forward to a point adjacent to the water pump body

MANUFACTURING DATA

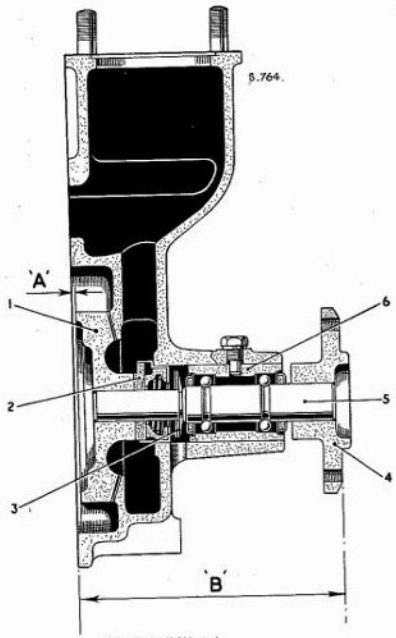
	inches	*millimetres*
Water Pump.		
Fan mounting flange bore diameter	·6239/·6247	15·847/15·867
Fit of mounting flange on bearing unit shaft	·0015 in. to ·0028 in. (·038 mm. to ·071 mm.) interference	
Impellor bore diameter	·4970/·4978	12·624/12·644
Fit of impellor on bearing unit shaft	·0002 in. to ·0020 in. (·005 mm. to ·051 mm.) interference	
Bearing unit shaft diameter		
—Front	·6262/·6267	15·905/15·918
—Rear	·498/·499	12·649/12·675
Bearing unit sleeve outer diameter	1·1806/1·1811	29·987/30·000
Bore diameter of pump body housing for bearing unit	1·1809/1·1814	29·995/30·008
Fan Belt.		
Outside circumference	44·125	1120·775
Depth	·426	10·820
Width at outside edge	·526	13·360
Angle of "V"	40°(included)	
Deflection on run between dynamo and crankshaft pulleys	½	12
Adjustment of fan belt tension	By pivoting dynamo and setting adjusting strap	

COOLING SYSTEM
(KAH MODELS)

DESCRIPTION

The cooling water is circulated by an impellor type pump, which is mounted on the front of the cylinder head, via a cover plate, and is driven together with a fan, by a "V" section belt from the pulley on the front end of the crankshaft.

The water pump consists mainly of a pump body, an impellor, a sealed bearing and shaft unit, and a fan mounting flange. The impellor is pressed on to the rear end of the shaft, which is supported in the pump body by means of the sealed double row ball bearing unit. This unit being secured in the pump body by a spigoted locating screw. The bearing unit is pre-packed with lubricant on original assembly and no further attention is required in this direction during service.



'A'—·004 in. (·1·016 mm.)
'B'—4·400/4·410 in. (111·760/112·014 mm.)

1 PUMP IMPELLOR
2 WATER SEAL ASSEMBLY
3 RUBBER THROWER RING
4 FAN MOUNTING FLANGE
5 and 6 SHAFT AND BEARING UNIT ASSEMBLY

Fig. A.1. Water pump arrangement, showing pressing dimensions

A mounting flange is pressed on to the front of the bearing unit shaft for attachment of the fan assembly and the fan pulley. To prevent coolant seeping along the shaft from the impellor, a spring loaded impellor seal is provided, and consists of a coil spring and a carbon ring, which are enclosed in a moulded rubber casing, the casing being located in a recess in the pump body, while the carbon ring of the seal is held in contact with the impellor end face by means of pressure exerted by the coil spring. An additional safeguard is provided to prevent coolant reaching the bearing unit and consists of a rubber water-thrower ring, fitted to a groove in the bearing unit shaft between the impellor seal and the bearing unit; this thrower ring functions in conjunction with a drain hole in the pump body.

The thermostat which is assembled in a housing on top of the water pump body, consists of a valve operated by metal bellows, movement of which is controlled by the temperature of the cooling water. The thermostat commences to open at approximately 172° F. (77·77°C.) and is fully open at 195°F. (90·55°C.).

A distribution tube fitted in the cylinder head directs cooling water to the exhaust valve seatings, via the jets drilled at intervals along its length, corresponding with each individual valve seat.

The radiator consists of a top and bottom tank, which are joined together by finned copper tubes. These finned tubes, which have the effect of presenting a large surface area to the air, are placed in close proximity to the fan, which draws air past the finning and so dissipates the heat from the cooling water as it passes through the tubes.

Two drain taps are provided for draining the system, one in the outlet pipe at the bottom of the radiator and the other at the rear right hand side of the cylinder block. The tap in the cylinder block is controlled by a remote handle extending forward to a position adjacent to the water pump body.

The cooling system in use on these models is pressurised, being sealed by a pressure type filler cap, which has a bayonet type fixing. The cap seats in the filler neck of the radiator header tank. The filler cap incorporates two non-adjustable valves, a pressure valve and a vacuum valve. The overflow pipe is connected to the tank filler neck above the cap seat. The pressure in the system is limited by the valve in the filler cap, which opens to allow the escape of steam or water through the overflow pipe whenever the pressure exceeds approximately 4 lb./sq. in. (·28 kg./sq. cm.). When the engine cools down, any depression in the system is relieved by the vacuum valve (in the filler cap), which opens to admit air, via the overflow pipe.

The pressurised cooling system raises the boiling point of the coolant, which gives an additional protective temperature range for high altitude conditions, tropical temperature and hard driving.

If it is desired to remove the filler cap after the engine has been running for any length of time, it should be done with caution and the cap should be turned anti-clockwise **slowly** to release the pressure within the system. The pressure will then be released gradually. This avoids the risk of the water boiling over, and hands, etc., being scalded, as could happen if the cap is removed suddenly.

OPERATION

When the cooling water in the engine has attained normal running temperature, the water is drawn by the pump from the bottom tank of the radiator through the bottom hose pipe, and discharged into the cylinder head through a water distribution tube mounted within the jacketing. The tube directs the cooling water to the exhaust valve seatings from jets drilled in its body. This arrangement ensures long life of exhaust valves and seatings and also provides controlled circulation of the water within the engine. The water circulates around the combustion chamber jacketing and then passes from the cylinder head to the cylinder block through connecting passages. After circulating around the cylinder block jacketing, the water gains heat and rises again through the connecting passages to the cylinder head, where the heated water circulates past the thermostat, through the outlet housing and then enters the radiator header tank, via the top hose pipe.

From the radiator header tank the heated water passes by convection currents and the action of the water pump, down through the finned water tubes to the bottom tank of the radiator. This finning presents a large surface area to the air and is placed in close proximity to the fan, which draws air past the fins and so dissipates the heat from the water passing down the tubes.

Circulation of the water through the radiator is prevented when the engine is cold by the thermostat remaining closed until the temperature rise in the surrounding water is sufficient to open the thermostat valve and allow circulation through the top water hose into the radiator in the normal manner. Prior to the thermostat opening, the water returns direct to the pump through a by-pass port, which connects the thermostat housing, on the engine side of the valve, to the pump. This leaves the radiator temporarily out of circuit.

After starting the engine, the water temperature will rise rapidly, as circulation through the radiator does not commence until a temperature in the engine of 167°F. to 176°F. (75·00°C. to 80·00°C.) is reached. The thermostat valve then starts to open and normal functioning of the system takes place. The thermostat is fully open at a temperature of 195°F. (90·55°C.).

FROST PRECAUTIONS

To avoid the possibility of the cooling system freezing whilst the vehicle is stationary, or whilst being driven in very cold weather, it is recommended that an anti-freeze mixture is used, and added to the cooling water in the quantities recommended by the anti-freeze manufacturers.

We recommend anti-freeze mixture based on inhibited ethylene glycol. Mixtures using alcohol as a base are not suitable, as these are prone to loss of mixture strength, by evaporation.

Before putting anti-freeze mixture of any kind in the cooling system, it is imperative that the cylinder head nuts and all the hose connections should be checked for tightness, as these mixtures have a very searching effect, and should mixture leak into the sump, very serious damage may occur owing to the possibility of engine seizure. Do not exceed the specified torque figure for the cylinder head nuts, which is 56/60 lb. ft. (7·74/8·30 kg. m.). It is also necessary for any loss of coolant to be made good with a mixture of anti-freeze compound and water of the same strength as the original mixture used in filling the system.

Vehicles protected by anti-freeze mixture in the cooling system should have a label attached to the header tank of the radiator, under the bonnet (hood), to indicate the fact. The following precautions are necessary on a vehicle so marked:

(*a*) Never fill the radiator up to the overflow pipe. Leave space for the natural expansion of the mixture, to avoid unnecessary topping up. Top up when the system is warm, using the same strength of mixture, as for the original filling.

(*b*) If the cooling system has to be emptied, run the mixture into a clean container and use again.

(*c*) If for any reason the mixture is drained and the system is refilled with water, REMOVE THE ANTI-FREEZE LABEL ON THE HEADER TANK. If an anti-freeze mixture is not used, it is essential that the complete system be drained of water, before the vehicle is left standing for any length of time during conditions of low temperature. Two drain taps are provided for draining the system, one in the outlet pipe at the bottom of the radiator and the other at the rear right hand side of the cylinder block. The tap in the cylinder block is controlled by a remote handle, which extends forward to a position adjacent to the water pump body. Warm, but not boiling water should be used when refilling the system and the lower part of the radiator blanked off until the engine has reached its working temperature. Whenever possible, soft water should be used, water having a high lime content should be avoided.

When the vehicle is used in very cold weather without anti-freeze mixture in the cooling system, great care should be taken to ensure that the radiator is warm before attempting to drive the vehicle away. If this is neglected there is a danger that the radiator may freeze if the vehicle is driven in temperatures below freezing point before the thermostat is open. Therefore in cold weather the bottom of the radiator should be blanked off so that the bottom tank keeps warm, because it is here that freezing commences.

Extra Precautions necessary when Heater(s) are fitted.

Where heater units are installed, a reliable anti-freeze mixture **must always** be used, because even when the cooling system is drained, a small amount of water remains in the heater units. If this water freezes the heater units will be seriously damaged.

When refilling the cooling system with anti-freeze mixture (or when normally refilling with soft water) it is essential to have the water control valve fully open in order to prevent air becoming trapped in the heater system. The water valve is located on the scuttle and is hand operated, being fully open when unscrewed to its fullest extent.

COOLING SYSTEM

To Clean.

Periodically the entire cooling system should be cleaned, particularly in districts where, contrary to instructions, water having a high content of lime has been used for replenishing the radiator.

Proceed in the following manner:

1. Remove the radiator filler cap.
2. With the engine still hot, open the drain tap positioned in the outlet pipe at the bottom of the radiator (or preferably remove the tap completely), also open the remote controlled tap on the right hand side of the cylinder block.
3. Allow time for the engine to cool after all the water has drained off. When cold, flush the radiator through to remove all the loose sediment by means of a hose inserted in the filler neck of the radiator.
4. Allow the system to drain again and then close the drain taps, or refit, if removed.
5. Fill the cooling system to normal level with a solution of flushing compound (several reliable brands of which are available) and run the engine as directed by the maker's of the compound. When using flushing compound it is important to avoid splashing the paintwork of the vehicle as it can have an injurious effect.

Note: It is important to drain off the flushing compound directly it has been used for its recommended period.

6. Finally, flush the system thoroughly with running water by means of a hose, inserted in the filler neck of the radiator, turn off both the drain taps and fill the system to the normal level with soft water, or anti-freeze mixture, as required.
7. In very dusty conditions, and where insects are numerous, the radiator tube system should be kept clear by blowing through with compressed air from the engine side.

ADJUSTMENTS TO THE ENGINE WHILST IN POSITION

It is recommended that the tension of the fan belt should be checked at intervals of 4,000 mile (6,000 km.) and adjusted, if necessary, as detailed in the opposite column.

To Adjust the Fan Belt.

1. Slacken the setscrew in the slot of the adjusting strap at the front of the dynamo, also the bolt at the inner end of the adjusting strap. Release the nuts and bolts that secure the dynamo to its support bracket on the cylinder block.

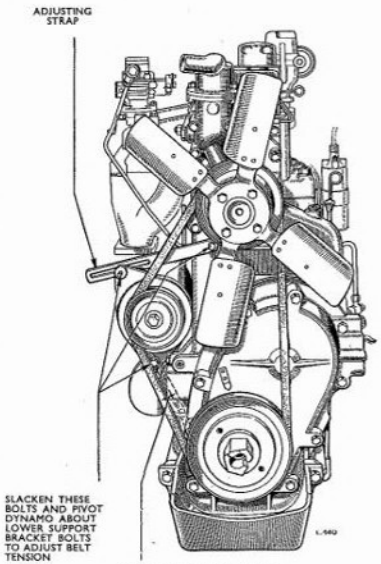


Fig. A.2. Adjusting the fan belt tension

2. Swing the dynamo away from the cylinder block to tighten the fan belt, or towards the block to slacken it.
3. When the belt can be depressed ½ in. (12 mm.) on the run between the dynamo and crankshaft pulleys, tighten the setscrew and bolt on the adjusting strap, followed by the nuts and bolts on the support bracket.

Note: Do not tighten the fan belt excessively as this would overload the water pump and dynamo bearings and in addition is liable to damage the belt.

FAN BELT

To Remove.

1. Slacken the dynamo mounting bolts, the setscrew and bolt securing the adjusting strap, and pivot the dynamo towards the cylinder block as far as possible.

2. Slip the belt over the edge of the dynamo pulley and then the crankshaft pulley, when the belt may be looped over the fan blades and withdrawn between the radiator and the fan.

Inspection.

Examine the fan belt and pulleys for wear or damage and renew as necessary (see "Manufacturing Data"). Do not fit a new fan belt to damaged pulleys otherwise the new component will wear rapidly, renew or rectify damaged pulleys and then fit the new fan belt.

To Refit.

Reverse the operations for removal and adjust the fan belt tension, as detailed on page A.5.

FAN ASSEMBLY AND FAN PULLEY

To Remove.

1. Slacken the dynamo mounting bolts, the setscrew and bolt securing the adjusting strap, and pivot the dynamo towards the cylinder block as far as possible.

2. Remove the four setscrews and washers securing the fan and pulley to the mounting flange on the water pump, and then lift away the fan and pulley.

Inspection.

1. Check the fan blades for distortion, and straighten, if necessary.

2. Examine the rivets that secure the fan blades to the fan centre for looseness, tighten or renew loose rivets, as necessary.

3. Examine the fan pulley for distortion or damage especially on the "V" formed for the fan belt. Rectify or renew the pulley, as necessary.

To Refit.

To refit the fan assembly and pulley, reverse the operations detailed for removal, and adjust the fan belt tension, as described on page A.5. Ensure a working clearance exists between the fan blades and the radiator block.

THERMOSTAT UNIT

To Remove.

1. Drain the radiator, until the water level falls below the thermostat housing.

2. Slacken the hose clips and disconnect the top water hose at the thermostat housing.

3. Remove the two nuts and spring washers that secure the thermostat housing to the water pump body and lift off the housing. Take care not to damage the joint faces of the housing and the pump.

4. Lift out the thermostat.

Inspection.

1. To check the operation of the thermostat unit, suspend the thermostat and a thermometer in a container of water.

Note: Do not rest the thermostat or thermometer on the bottom of the container as this will result in a false thermometer reading, and an incorrect opening temperature recorded for the thermostat unit.

2. Heat the water gradually, noting the rise in temperature. It is essential to agitate the water continually to ensure that both the water and thermostat are at a uniform temperature.

3. The thermostat valve should commence to open at a temperature of 167°F. to 176°F. (75·00°C. to 80·00°C.) and be fully open at 195°F. (90·55°C.). The thermostat is a sealed unit and no adjustment is provided. Always renew if doubt exists as to the correct functioning of the unit, or if a replacement is not immediately available, run temporarily without a thermostat, fitting the new unit at the earliest possible time.

To Refit.

Reverse the operations for removal, using a new joint between the thermostat housing and pump body if the old one is damaged in any way. Ensure all drain taps are closed and top up with water to the correct level.

RADIATOR

To Remove.

1. Completely drain the water from the cooling system at the drain taps provided.

2. Slacken the hose clips and disconnect the top and bottom water hoses.

3. Remove the setscrews that secure the radiator to each front baffle panel and lift out the radiator.

Inspection.

1. A furred radiator which is removed from a vehicle during overhaul should not be allowed to dry out, as when this occurs the deposit inside will set hard and will not soften when the radiator is refilled and used again. Always cleanse the radiator immediately and whilst still wet inside, or seal up the apertures and fill with water pending treatment. Alternatively, the radiator can be left immersed in a suitable tank of water.

2. Do not invert the radiator or lay it flat as this allows any sediment which has accumulated in the bottom tank to pass into the cooling ducts. Always store the radiator in its normal upright position.

3. Inspect the outer core faces of the radiator block for damage to the finning, such as damage by bending, which will restrict the normal flow of air. The finning can be straightened, with the aid of the slender blade of a screwdriver, by carefully prising the fins apart.

To Refit.

Installation of the radiator is a reversal of the removal operations. Prior to starting the engine, a check should be carried out to ensure that the fan blades are in good condition and a working clearance exists between them and the radiator block.

WATER PUMP

To Remove.

1. Drain the water from the cooling system, at the drain taps provided.

2. Remove the fan belt, fan assembly and fan pulley (see page A.6).

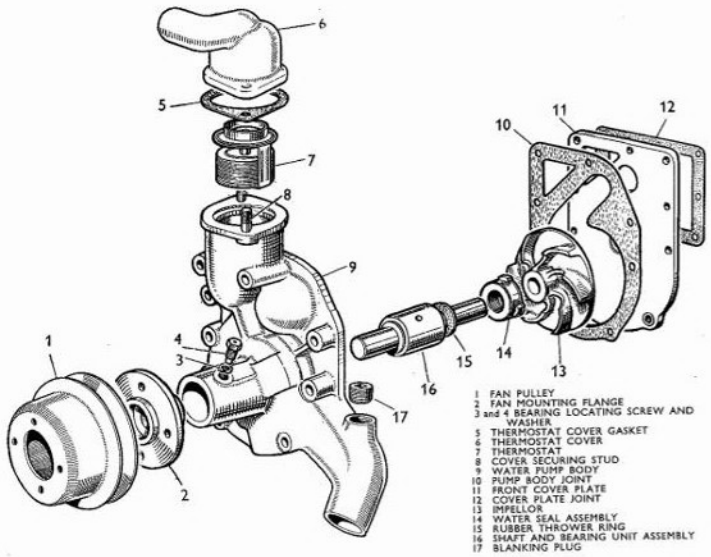


Fig. A.3. Water pump details

3. Disconnect the lead at the water temperature gauge bulb and unscrew the bulb from the pump body thermostat chamber.

4. Release the heater unit hose (if fitted) from the pump body adaptor.

5. Slacken off the hose clips and remove the top and bottom water hoses.

6. Release the two bolts securing the steady bracket, which supports the drain tap remote handle. Lift away the bracket complete with the remote handle, noting that one securing bolt passes through the pump body and screws into the cylinder head.

7. Withdraw the bolts and spring washers that secure the pump to the cylinder head, also the setscrew that secures the dynamo adjusting strap to the dynamo yoke, and then lift away the pump.

Note: The two bottom bolts do not screw into the cylinder head, but secure the bottom of the cover plate to the water pump body.

8. If it is required to detach the cover plate, remove the two setscrews that secure the plate to the cylinder head, and lift off the cover plate complete with its joint.

To Dismantle.

1. Press the shaft from the fan mounting flange, or alternatively withdraw the flange with the aid of Churchill Tool 155, in conjunction with the Adaptor Set R.G.155-6 (see Fig. A.4).

2. Remove the bearing locating screw and washer from the pump body, and push out the shaft complete with the bearing seal and impellor.

3. Press the shaft from the impellor, or alternatively withdraw the impellor from the shaft with the aid of

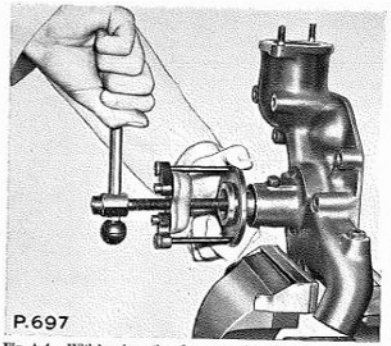


Fig. A.4. Withdrawing the fan mounting flange, using the Churchill Tool 155, in conjunction with the adaptor set R.G.155-6

Churchill Tool 155, in conjunction with the Adaptor Set R.G.155-6 (see Fig. A.5).

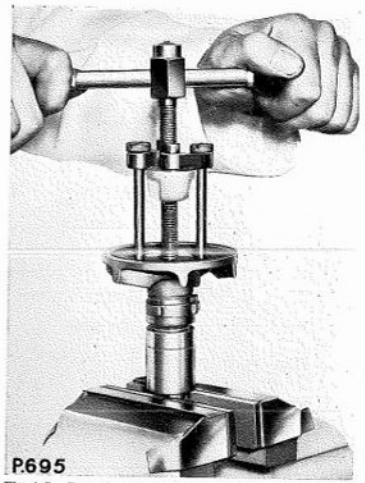


Fig. A.5. Removing the impellor, using the Churchill Tool 155, in conjunction with the adaptor set 155-6

4. Remove the seal assembly and rubber thrower ring from the shaft.

Note: The shaft and bearing form a sealed assembly and must on no account be separated. Do not wash the bearing in petrol (gasolene), paraffin (kerosene), or any other cleansing solution otherwise the lubricant will be removed. The bearing unit, being specially constructed, is packed with lubricant during manufacture and requires no further attention during service.

Inspection.

1. Examine the pump body for cracks and renew, if necessary.

2. Check the fit of the bearing assembly in the pump body. If the clearance evident is excessive, renew the pump body.

3. Rotate the bearing slowly and check for roughness, ensure also that the bearing is free from radial slackness and end float. Renew the complete bearing unit, if necessary.

4. Examine the rubber thrower ring for damage, deterioration or slackness on the spindle, and renew, if necessary.

5. Examine the impellor for cracks and corrosion, particularly around the hub and impellor vanes. Check the face of the impellor that bears against the carbon face of the seal. If no appreciable wear is visible at this point, clean up the face, ensuring it is smooth and square with the bore, which accommodates the shaft.

6. Examine the seal assembly for signs of deterioration and renew, if necessary.

To Re-assemble.

1. Assemble the bearing unit to the pump body, aligning the hole in the bearing unit with the threaded

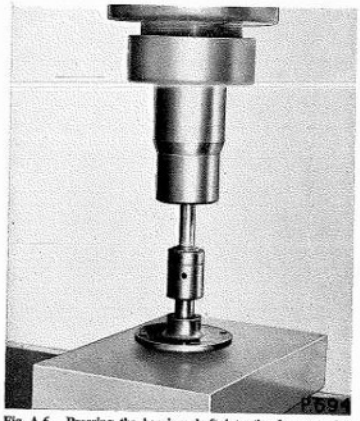


Fig. A.6. Pressing the bearing shaft into the fan mounting flange (*Pump body omitted for clarity*)

bore in the pump body and secure with the locating screw, ensuring that the larger diameter (shorter) end of the bearing shaft is positioned furthest away from the pump body mounting flange.

2. Press the larger diameter of the bearing shaft into the fan mounting flange (flange face downward), until the dimension shown in Fig. A.1 is obtained, thus guaranteeing correct alignment of the fan and crankshaft pulleys on re-assembly. It is recommended whilst pressing, that the mounting flange be suitably supported on the table of a press and the ram applied to the opposite end of the bearing shaft, as shown in Fig. A.6.

3. Fit the rubber thrower ring on the smaller diameter end of the shaft with its tapered face towards the bearing. Ensure it locates in the groove machined around the shaft.

4. Slide the seal assembly (with the carbon ring facing away from the thrower ring) on to the shaft and locate the casing of the seal in the recess provided in the pump body.

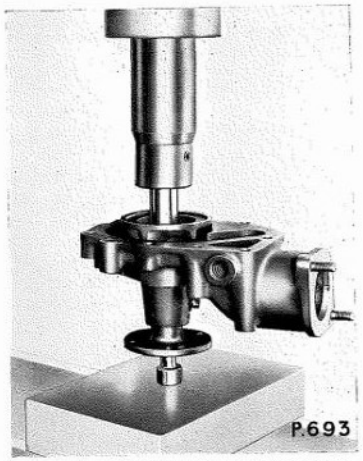


Fig. A.7. Pressing the impellor on to the bearing shaft

5. Support the front end of the shaft and press on the impellor, vanes foremost, until the outer face of the impellor is ·040 in. (1·016 mm.) below the rear face of the pump body (see Fig. A.8).

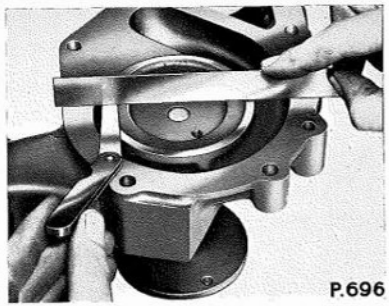


Fig. A.8. Checking the impellor end clearance, using a feeler gauge

To Refit.

Refitting the water pump to the cylinder head is a reversal of the removal procedure, but particular attention must be paid to the following points:

1. If the cover plate has been removed, refit the plate firstly to the cylinder head using a new joint, coating the joint with a suitable jointing compound, ensuring that the end of the water distribution tube locates in the hole provided in the front cover plate and is a good fit. Coat the threads of the setscrews with a jointing compound. Secure the plate with the two setscrews, locating them in the following positions:

(*a*) Fit a setscrew to the top right hand corner of the cover plate (viewed from the front).

(*b*) Fit a second setscrew to the centrally disposed spot-faced hole in the cover plate.

2. Coat the threads of the bolts that screw into the cylinder head with a jointing compound. Coat the joints between the thermostat housing and pump body, and between the pump body and cylinder head cover plate with grease.

3. Ensure all the joints and hose connections are water-tight.

4. Adjust the fan belt tension, as detailed on page A.5.

WATER DISTRIBUTION TUBE

To Remove.

1. Release the radiator grille complete with the valance panels and lamps (see "Cab and Body" section).

2. Remove the radiator and water pump (see pages A.6 and A.7 respectively).

3. Remove the cylinder head front cover plate, which is secured to the cylinder head with two setscrews. The front end of the distribution tube will now be visible. A special withdrawal tool may be used to withdraw the

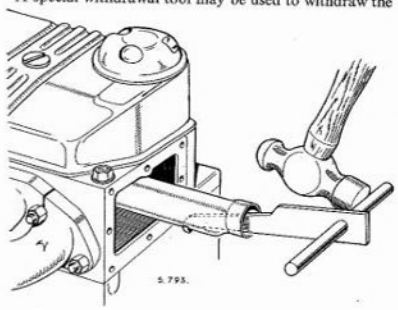


Fig. A.9. Withdrawing the water distribution tube

tube as shown in Fig. A.9, inserting the hooked end of the tool in the first water jet hole, when withdrawal is completed by tapping the tube out through the front of the cylinder head.

Note: If it is found difficult to remove the tube by this method, remove the cylinder head rear cover plate. The rear end of the tube will then be visible and may be tapped out using a block of wood, or a suitable padded drift.

Inspection and Overhaul.

Scrape all deposits from the tube and ensure that all the water jet holes are clear. Check also for signs of corrosion and renew the tube, if necessary.

To Refit.

Reverse the operations detailed for removal bearing in mind the following:

1. If the rear cover plate has been removed, refit it before the distribution tube. Coat the joint and threaded part of the securing screws with jointing compound.

2. Insert the distribution tube into the cylinder head with the jet holes facing downwards, and tap it home as far as it will go, i.e., until solid resistance is felt.

3. Refit the front cover plate to the cylinder head, using a new joint coated with a jointing compound. Ensure the front end of the water distribution tube locates in the hole provided in the front cover plate and is a good fit. Secure the cover plate in position with the two setscrews, coating the threaded part of the screws with jointing compound.

4. Smear the joints between the thermostat housing and the pump body, and between the pump body and the front cover plate with grease, prior to fitting. Coat the threaded part of the water pump retaining bolts with jointing compound, i.e., only those bolts which screw into the cylinder head.

5. Adjust the fan belt tension, as detailed on page A.5.

COOLING SYSTEM
(KAL MODELS)

DATA

Type of system	Pressurized, water circulation assisted by pump, and cooled by radiator and fan
Type of pump	Centrifugal
Fan assembly	
—Number of blades	6
—Diameter	15 in. (38·1 cm.)
Drive of pump and fan	"V" belt from crankshaft pulley
Cooling system control	Thermostatic and fully automatic by thermostat located in outlet housing
Thermostat	
—Commences opening at	179°F. (81·6°C.) to 188°F. (86·6°C.)
—Fully open at	200°F. (93·3°C.)
Radiator type	Home—4 row gilled tube Export—5 row gilled tube
Radiator relief valve	
—Location	In filler cap
—Operating pressure	4lb./sq. in. (·28 kg./sq. cm.)
Total capacity of system	24 pint (13·74 litre)
Drain tap locations	
—Radiator	Bottom outlet pipe
—Cylinder block	Rear right hand side

MANUFACTURING DATA

	inches	*millimetres*
Water Pump.		
Fan mounting flange bore diameter	·6248/·6252	15·870/15·880
Fit of mounting flange on bearing unit shaft	·0010 in. to ·0019 in. (·025 mm. to ·048 mm.) interference	
Impellor bore diameter	·4970/·4978	12·624/12·644
Fit of impellor on bearing unit shaft	·0002 in. to ·0020 in. (·005 mm. to ·051 mm.) interference	
Bearing unit shaft diameter		
—Front	·6262/·6267	15·905/15·918
—Rear	·4980/·4990	12·649/12·675
Bearing unit sleeve outer diameter	1·1806/1·1811	29·987/30·000
Bore diameter of pump body housing for bearing unit	1·1800/1·1805	29·972/29·985
Fan Belt.		
Outside circumference	38·25	971·55
Depth	·426	10·820
Width at outside edge	·526	13·360
Angle of "V"	40°	
Deflection on longest run	$\frac{5}{8}$	16
Adjustment of fan belt tension	By pivoting dynamo and setting adjusting strap	

COOLING SYSTEM

(KAL MODELS)

DESCRIPTION

The cooling water is circulated by an impellor type water pump, mounted on an extension of the timing cover. The pump is driven together with the fan, by a "V" section belt from the pulley on the front end of the crankshaft. The fan belt also drives the dynamo mounted on the left hand side of the engine.

The water pump consists mainly of a pump body, an impellor, a sealed bearing and shaft unit, and a fan mounting flange. The impellor is pressed on to the rear end of the shaft, and is supported in the pump body by means of a sealed double row ball bearing unit, which forms an assembly with the shaft. The bearing unit is secured in the pump body by a spigoted locating screw, which is centre drilled for ventilation purposes. The bearing unit is pre-packed with lubricant on original assembly and no further attention is required in this direction during service. A mounting flange is pressed on to the front of the bearing unit shaft for attachment of the fan assembly and the fan pulley. To prevent coolant seeping along the shaft from the impellor, a spring loaded impellor seal is provided, and consists of a coil spring and a carbon ring, which are enclosed in a moulded rubber casing, the casing being located in a recess in the pump body, while the carbon ring of the seal is held in contact with the impellor end face by means of the pressure exerted by the coil spring. An additional safeguard is provided to prevent coolant reaching the bearing unit and consists of a rubber water-thrower ring, fitted to a groove in the bearing unit shaft between the impellor seal and the bearing unit; this thrower ring functions in conjunction with a drain hole in the pump body.

The thermostat, assembled in the cast housing, forming part of the water outlet pipe at the front end of

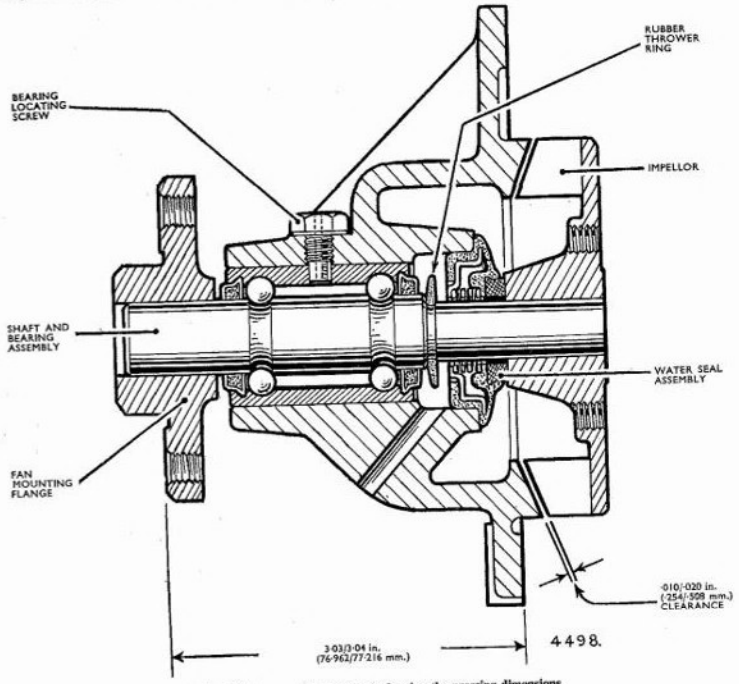


Fig. A.10. Water pump arrangement, showing the pressing dimensions

the cylinder head, consists of a valve operated by a temperature sensitive capsule, movement of which is controlled by the temperature of the cooling water. The thermostat commences to open at 179°F. (81·6°C.) to 188°F. (86·6°C.), and is fully open at 200°F. (93·3°C.). The water outlet pipe is connected to the radiator top tank by a rubber hose.

The radiator consists of a top and bottom tank, which are joined together by finned copper tubes. These finned tubes, which have the effect of presenting a large surface area to the air, are placed in close proximity to the fan, which draws air past the finning and so dissipates the heat from the cooling water as it passes through the tubes.

Two drain taps are provided for draining the system, one in the outlet pipe at the bottom of the radiator and the other at the rear right hand side of the cylinder block.

The cooling system in use on these models is pressurised, being sealed by a pressure type filler cap, which has a bayonet type fixing. The cap seats on a sealing washer in the filler neck of the radiator header tank. The filler cap incorporates two non-adjustable valves, a pressure valve and a vacuum valve. The overflow pipe is connected to the tank filler neck above the cap seat. The pressure in the system is limited by the valve in the filler cap, which opens to allow the escape of steam, or water through the overflow pipe whenever the pressure exceeds approximately 4 lb./sq. in. (·28 kg./sq. cm.). When the engine cools down, any depression in the system is relieved by the vacuum valve (in the filler cap), which opens to admit air, via the overflow pipe.

The pressurised cooling system raises the boiling point of the coolant, which gives an additional protective temperature range for high altitude conditions, tropical temperature and hard driving.

If it is desired to remove the filler cap after the engine has been running for any length of time, it should be done with caution and the cap should be turned anti-clockwise **slowly** to release the pressure within the system. The pressure will then be released gradually. This avoids the risk of the water boiling over, and hands, etc., being scalded, as could happen if the cap was removed suddenly.

OPERATION

The cooling system is not required to come into full operation until the engine has reached its normal working temperature and after starting a cold, or partly cold engine it is desirable to reach the working temperature as quickly as possible, and this is accomplished by means of the thermostat mounted in a cast body at the front end of the cylinder head.

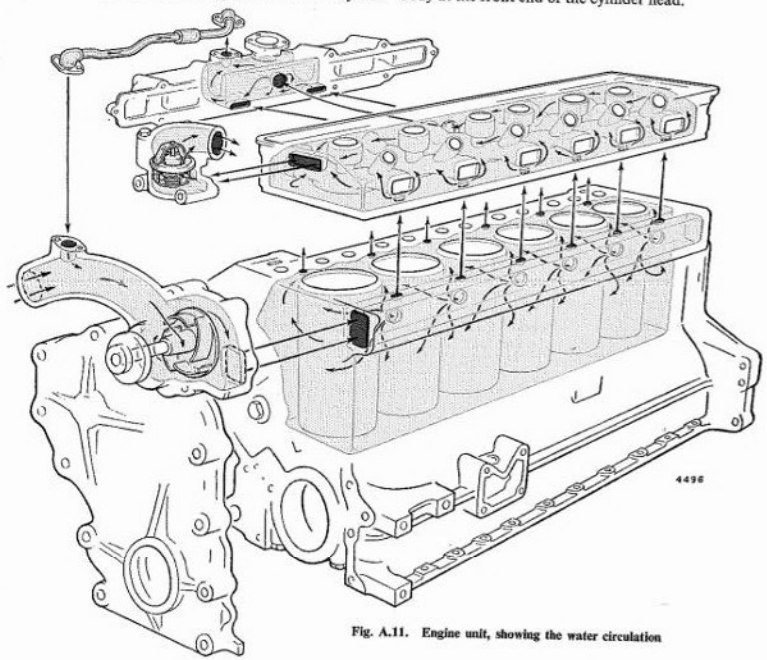


Fig. A.11. Engine unit, showing the water circulation

When the engine is cold, or partly cold, the thermostat valve remains closed, and the water pump can only circulate the water through the cylinder head, around the cylinder jackets, into the inlet manifold jackets, and back through a connecting pipe to the intake side of the water pump.

After starting the engine the water temperature will rapidly rise, but circulation of the water through the radiator does not commence until a temperature of 179°F. (81·6°C.) to 188°F. (86·6°C.) has been reached in the cylinder head jackets. At this temperature the thermostat begins to open and water commences to flow through the radiator. The thermostat becomes fully open at an engine water outlet temperature of 200°F. (93·3°C.).

With the thermostat open the heated water passes from the radiator header tank by convection currents and the action of the water pump, down through the finned water tubes to the bottom tank of the radiator. This finning presents a large surface area to the air and is placed in close proximity to the fan, which draws air past the fins and so dissipates the heat from the water passing down the tubes.

When the engine is hot, and the thermostat is open, water is drawn from the radiator bottom tank by the water pump and delivered into a long gallery on the top left hand side of the cylinder block. From this gallery water is fed up to the cylinder head through six cast holes in the cylinder block and cylinder head, so positioned that the water flows around the exhaust valve seat jackets. Six cast holes in the side of the same water gallery feed the water around the cylinder barrels, after which it enters the cylinder head by six cast holes that pass the water around the inlet valve jackets.

Water leaves the cylinder head at the front end through the thermostat housing and passes to the radiator top tank through the top water hose.

FROST PRECAUTIONS

To avoid the possibility of the cooling system freezing whilst the vehicle is stationary, or whilst being driven in very cold weather, it is recommended that an anti-freeze mixture is used, and added to the cooling water in quantities recommended by the anti-freeze manufacturers.

We recommend anti-freeze mixture based on inhibited ethylene glycol. Mixtures using alcohol as a base are not suitable, as these are prone to loss of mixture strength, by evaporation.

Before putting anti-freeze mixture of any kind in the cooling system, it is imperative that the cylinder head bolts and all the hose connections should be checked for tightness, as these mixtures have a very searching effect, and should mixture leak into the sump, very serious damage may occur owing to the possibility of engine seizure. Do not exceed the specified torque figure for the cylinder head bolts, which is 65/70 lb. ft. (8·99/9·68 kg.m.). It is also necessary for any loss of coolant to be made good with a mixture of anti-freeze compound and water of the same strength as the original mixture used in filling the system.

Vehicles protected by anti-freeze mixture in the cooling system should have a label attached to the header tank of the radiator, under the bonnet (hood), to indicate the fact. The following precautions are necessary on a vehicle so marked:

(*a*) Never fill the radiator up to the overflow pipe. Leave space for the natural expansion of the mixture, to avoid unnecessary topping up. Top up when the system is warm, using the same strength of mixture, as for the original filling.

(*b*) If the cooling system has to be emptied, run the mixture into a clean container and use again.

(*c*) If for any reason the mixture is drained and the system is refilled with water, REMOVE THE ANTI-FREEZE LABEL ON THE HEADER TANK. If an anti-freeze mixture is not used, it is essential that the complete system be drained of water, before the vehicle is left standing for any length of time during conditions of low temperature. Two drain taps are provided for draining the system, one in the outlet pipe at the bottom of the radiator, and the other at the rear right hand side of the cylinder block. Warm, but not boiling water should be used when refilling the system and the lower part of the radiator blanked off until the engine has reached its working temperature. Whenever possible, soft water should be used, water having a high lime content should be avoided.

When the vehicle is used in very cold weather without anti-freeze mixture in the cooling system, great care should be taken to ensure that the radiator is warm before attempting to drive the vehicle away. If this is neglected there is a danger that the radiator may freeze if the vehicle is driven in temperatures below freezing point before the thermostat is open. Therefore in cold weather the bottom of the radiator should be blanked off so that the bottom tank keeps warm, because it is here that freezing commences.

Extra Precautions necessary when Heater(s) are fitted.

Where heater units are installed, a reliable anti-freeze mixture **must always** be used, because even when the cooling system is drained, a small amount of water remains in the heater units. If this water freezes the heater units will be seriously damaged.

When refilling the cooling system with anti-freeze mixture (or when normally refilling with soft water) it is essential to have the water control valve fully open in order to prevent air becoming trapped in the heater system. The water valve is located on the scuttle and is hand operated, being fully open when unscrewed to its fullest extent.

COOLING SYSTEM

To Clean.

Periodically the entire cooling system should be cleaned, particularly in districts where, contrary to instructions, water having a high content of lime has been used for replenishing the radiator.

Proceed in the following manner:

1. Remove the radiator filler cap.

2. With the engine still hot, open the drain tap positioned in the outlet pipe at the bottom of the radiator (or preferably remove the tap completely), also open the tap on the right hand side of the cylinder block.

3. Allow time for the engine to cool after all the water has drained off. When cold, flush the radiator through to remove all the loose sediment by means of a hose inserted in the filler neck of the radiator.

4. Allow the system to drain again and then close the drain taps, or refit, if removed.

5. Fill the cooling system to the normal level with a solution of flushing compound (several reliable brands of which are available) and run the engine as directed by the maker's of the compound. When using flushing compound it is important to avoid splashing the paintwork of the vehicle as it can have an injurious effect.

Note: It is important to drain off the flushing compound directly it has been used for its recommended period.

6. Finally, flush the system thoroughly with running water by means of a hose, inserted in the filler neck of the radiator, turn off both the drain taps and fill the system to the normal level with soft water, or anti-freeze mixture, as required.

7. In very dusty conditions, and where insects are numerous, the radiator tube system should be kept clear by blowing through with compressed air from the engine side.

ADJUSTMENTS TO THE ENGINE WHILST IN POSITION

It is recommended that the tension of the fan belt should be checked at intervals of 4,000 mile (6,000 km.) and adjusted, if necessary, as detailed below.

To Adjust the Fan Belt.

1. Slacken the sleeve nut in the slot of the adjusting strap at the front of the timing cover, also the setscrew on the dynamo at the outer end of the adjusting strap. Release the bolts that secure the dynamo to its support bracket on the cylinder block.

2. Swing the dynamo away from the cylinder block to tighten the fan belt, or towards the block to slacken it.

3. When the belt can be depressed ½ in. (16 mm.) on the run between the fan pulley and crankshaft pulley, tighten the sleeve nut and setscrew on the adjusting strap, followed by the bolts on the support bracket.

Note: Do not tighten the fan belt excessively as this would overload the water pump and dynamo bearings and in addition is liable to damage the belt.

4. Run the engine and re-check the fan belt tension.

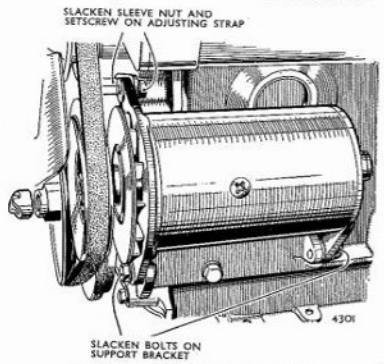


Fig. A.12. Adjusting the fan belt tension

FAN BELT

To Remove.

1. Slacken the dynamo mounting bolts, also the sleeve nut and setscrew securing the adjusting strap, and pivot the dynamo towards the cylinder block as far as possible.

2. Slip the belt over the edge of the dynamo pulley and then the crankshaft pulley, when the belt may be looped over the fan blades and withdrawn between the radiator and the fan.

Inspection.

Examine the fan belt and pulleys for wear or damage and renew as necessary (see "Manufacturing Data"). Do not fit a new fan belt to damaged pulleys otherwise the new component will wear rapidly, renew, or rectify damaged pulleys and then fit the new fan belt.

To Refit.

Reverse the operations for removal and adjust the fan belt tension, as detailed opposite.

FAN ASSEMBLY AND FAN PULLEY

To Remove.

1. Slacken the dynamo mounting bolts, also the setscrew and bolt securing the adjusting strap, and pivot the dynamo towards the cylinder block as far as possible.

2. Remove the four setscrews and lockwashers securing the fan and pulley to the mounting flange on the water pump, and lift away the fan and pulley.

Inspection.

1. Check the fan blades for distortion and straighten, if necessary.

2. Examine the rivets that secure the fan blades to the fan centre for looseness, tighten, or renew loose rivets, as necessary.

3. Examine the fan pulley for distortion, or damage especially on the "V" formed for the fan belt. Rectify or renew, as necessary.

To Refit.

To refit the fan assembly and pulley, reverse the operations detailed for removal, and adjust the fan belt tension, as described on page A.16. Ensure a working clearance exists between the fan blades and the radiator block.

THERMOSTAT UNIT

To Remove.

1. Drain the radiator, until the water level falls below the water outlet/thermostat housing.

2. Slacken the hose clips and disconnect the top water hose at the thermostat housing.

3. Remove the two nuts and spring washers that secure the thermostat cover to the housing positioned on the front face of the cylinder head and lift off the cover. Take care not to damage the joint faces of the cover and the housing.

4. Lift out the thermostat.

Inspection.

1. To check the operation of the thermostat unit, suspend the thermostat and a thermometer in a container of water.

Note: Do not rest the thermostat, or thermometer on the bottom of the container as this will result in a false thermometer reading, and an incorrect opening temperature recorded for the thermostat unit.

2. Heat the water gradually, noting the rise in temperature. It is essential to agitate the water continually to ensure that both the water and thermostat are at a uniform temperature.

3. The thermostat valve should commence to open at a temperature of 179°F. (81·6°C.) to 188°F. (86·6°C.), and be fully open at 200°F. (93·3°C.). The thermostat is a sealed unit and no adjustment is provided, always renew if doubt exists as to the correct functioning of the unit, or if a replacement is not immediately available, run temporarily without a thermostat, fitting the new unit at the earliest possible time.

To Refit.

Reverse the operations for removal, using a new joint between the thermostat housing and cover if the old one is damaged in any way. Ensure the thermostat is fitted so that the mark "TO RADIATOR" located on the bridge strap of the unit is uppermost. Ascertain that all drain taps are closed, and top up with water to the correct level.

RADIATOR

To Remove.

1. Completely drain the water from the cooling system at the drain taps provided.

2. Slacken the hose clips and disconnect the top and bottom water hoses.

3. Remove the fan assembly and the fan pulley (see page A.16).

4. Remove the front apron tie bar (see "Cab and Body" section).

5. Remove the setscrews that secure the radiator to each front baffle panel and lift out the radiator, noting on Export Models that a fan cowl is fitted and secured by setscrews to the radiator block.

Inspection.

1. A furred radiator which is removed from a vehicle during overhaul should not be allowed to dry out, as when this occurs the deposit inside will set hard and will not soften when the radiator is refilled and used again. Always cleanse the radiator immediately and whilst still wet inside, or seal up the apertures and fill with water pending treatment. Alternatively, the radiator can be left immersed in a suitable tank of water.

2. Do not invert the radiator, or lay it flat, as this allows any sediment which has accumulated in the bottom tank to pass into the cooling ducts. Always store the radiator in its normal upright position.

3. Inspect the outer core faces of the radiator block for damage to the finning such as damage by bending, which will restrict the normal flow of air. The finning can be straightened, with the aid of the slender blade of a screwdriver, by carefully prising the fins apart.

To Refit.

Installation of the radiator is a reversal of the removal operations. Prior to starting the engine, a check should be carried out to ensure that the fan blades are in good condition and a working clearance exists between them and the radiator block.

WATER PUMP

To Remove.

1. Drain the water from the cooling system, at the drain taps provided.

2. Remove the fan belt, fan assembly and fan pulley (see page A.16).

3. Release the heater unit hose (if fitted) from the pump body adaptor.

4. Slacken off the hose clips and remove the bottom water hose.

5. Remove the connecting (by-pass) pipe flange from the pump inlet, after releasing the retaining nuts.

6. Withdraw the bolt, nuts and spring washers that secure the pump to the cylinder block and the timing cover, and lift away the pump.

Note: The pump securing bolt does not screw into the timing cover, but passes through and into the cylinder block as do the long studs.

4. Remove the seal assembly and rubber thrower ring from the shaft.

Note: The shaft and bearing form a sealed assembly and must on no account be separated. Do not wash the bearing in petrol (gasolene), or paraffin (kerosene), or any other cleansing solution, or the lubricant will be removed. The bearing unit, being specially constructed, is packed with lubricant during manufacture and requires no further attention during service.

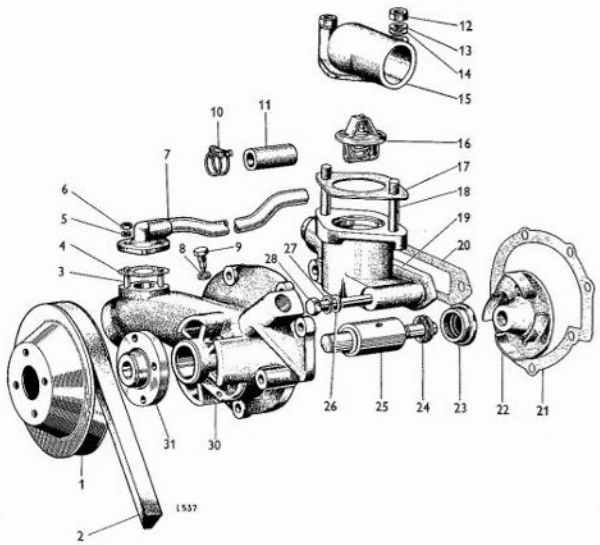


Fig. A.13. Water pump details

To Dismantle.

1. Press the shaft from the fan mounting flange, or alternatively withdraw the flange with the aid of Churchill Tool 155, in conjunction with the Adaptor Set R.G.155-2.

2. Remove the bearing locating screw and washer from the pump body and press out the shaft complete with the bearing and impellor.

3. Press the shaft from the impellor, or alternatively withdraw from the shaft with the aid of Churchill Tool 155, in conjunction with the Adaptor Set R.G.155-2.

Inspection.

1. Examine the pump body for cracks. Clean out all deposits from the pump body and check for deterioration on the face immediately in front of the impellor vanes. Renew the pump body, if necessary.

2. Check the fit of the bearing assembly in the pump body. If the clearance evident is excessive, renew the pump body.

3. Rotate the bearing slowly and check for roughness, ensure also that the bearing is free from radial slackness and end float. Renew the complete bearing unit, if necessary.

4. Examine the rubber thrower ring for damage, deterioration, or slackness on the shaft, and renew, if necessary.

5. Examine the impellor for cracks and corrosion, particularly around the hub and impellor vanes. Check also the face of the impellor that bears against the carbon face of the seal. If no appreciable wear is visible at this point, clean up the face, ensuring it is smooth and square with the bore which accommodates the shaft.

6. Examine the seal assembly for signs of deterioration and renew, if necessary.

7. Ensure the bleed hole in the base of the pump chamber on the timing cover is clear of obstruction.

To Re-assemble.

1. Assemble the bearing unit to the pump body, aligning the hole in the bearing unit with the threaded bore in the pump body, and secure with the locating screw, ensuring that the larger diameter (shorter) end of the bearing shaft is positioned facing away from the pump body mounting flange.

2. Press the larger diameter of the bearing shaft into the fan mounting flange (flange face downward), until the dimension shown in Fig. A.10 is obtained, thus guaranteeing correct alignment of the fan and crankshaft pulleys on re-assembly. It is recommended whilst pressing, that the mounting flange be suitably supported on the table of a press and the ram applied to the opposite end of the bearing shaft, as shown in Fig. A.14.

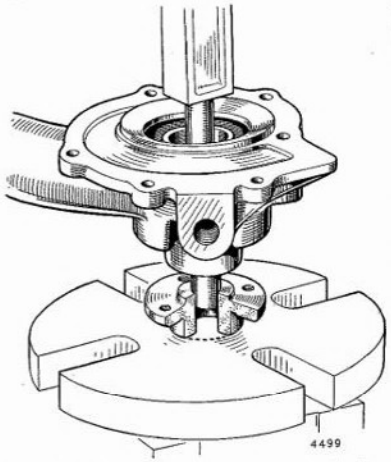


Fig. A.14. Pressing the bearing shaft into the fan mounting flange

3. Fit the rubber thrower ring on the smaller diameter end of the shaft with its tapered face towards the bearing. Ensure it locates in the groove machined around the shaft.

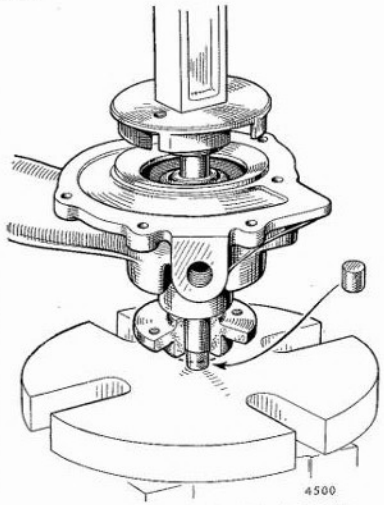


Fig. A.15. Pressing the impellor on to the bearing shaft

4. Slide the seal assembly (with the carbon ring facing away from the thrower ring) on to the shaft and locate the casing of the seal in the recess provided in the pump body.

5. Support the front end of the shaft and press on the impellor, vanes foremost, until the front face of the impellor is between ·010 in. (·254 mm.) and ·020 in. (·508 mm.) from the rear conical face of the pump body (see Fig. A.10).

To Refit.

Refitting the water pump to the timing cover is a reversal of the removal procedure, but particular attention must be paid to the following points:

1. Refit the water pump to the timing cover chamber using a new joint. Use a new joint on the connecting (by-pass) pipe at the connection with the pump intake.

2. Apply a smear of grease to the joints between the pump body and the timing cover, and between the pump intake and connecting (by-pass) pipe.

3. Ensure all the joints and hose connections are water-tight.

4. Adjust the fan belt tension, as detailed on page A.16.

FUEL SYSTEM

SECTION C

INDEX

FUEL SYSTEM

(KAH MODELS)

DATA

Fuel Tank.	
Capacity	
—KAH.30 Models	10 gallon (45·4 litre)
—KAH.40 Models	15 gallon (68·1 litre)
Position	Strap mounted to the left hand frame sidemember immediately forward of the rear axle
Filler cap	Captive type, situated in the lower left hand body side panel
Fuel Lift Pump.	
Make	AC-Delco
Model	"UE" Series—AC.7950030
Operation	Mechanical, driven by an eccentric on the camshaft
Outlet pressure (at pump level)	2·5 to 3·5 lb./sq. in. (·176 to ·246 kg./sq. cm.)
Carburettor.	
Type	Solex Downdraught B32.BI0–2
Choke tube	21
Main jet	110
Air correction jet	200
Pilot (auxiliary) jet	55
Pilot air bleed	1·5
Starter petrol jet	120
Starter air jets	8·0 (2) Fixed
Emulsion tube	No. 10
Needle valve	1·5
Starter unit	Zero progressive fast-idle type.
Air Cleaner.	
Make	AC-Delco
Model	AC.7955837
Type	Oil bath

FUEL SYSTEM

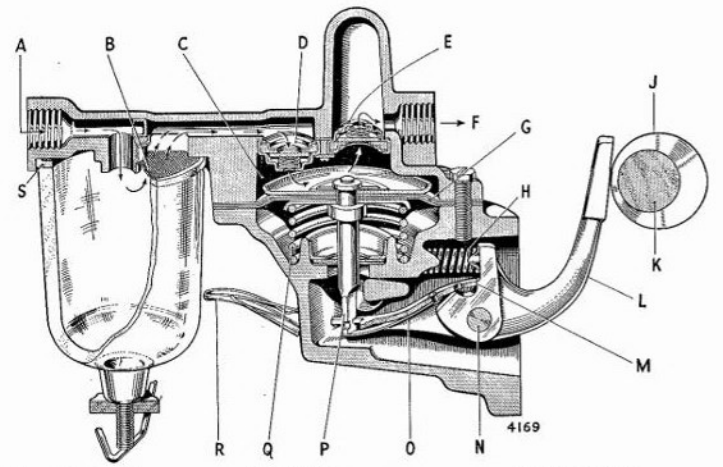
(KAH MODELS)

DESCRIPTION

The fuel system comprises a fuel tank, an AC–Delco diaphragm type fuel lift pump, a Solex downdraught carburettor, an oil bath air cleaner and an intake manifold.

The fuel tank is carried by supports riveted to the frame sidemember and is held firm by pairs of steel straps, which are riveted to the tank supports. Strips of felt are interposed between the tank and supports to prevent damage to the tank, through vibration.

Fuel is drawn from the fuel tank and pumped to the carburettor by the fuel lift pump, which is secured to the left hand side (front) of the cylinder block by two setscrews and washers. Two joints and a heat insulator are interposed between the lift pump and the cylinder block. The lift pump consists of two main assemblies, i.e., a body assembly and a cover assembly, which clamp a diaphragm unit between their outer flanges.



A LIFT PUMP INLET PASSAGE
B INLET FILTER GAUZE
C LIFT PUMP CHAMBER
D SUCTION VALVE
E DELIVERY VALVE
F LIFT PUMP OUTLET PASSAGE
G DIAPHRAGM
H ROCKER ARM SPRING
J CAMSHAFT ECCENTRIC
K CAMSHAFT
L ROCKER ARM
M CONTACT POINT
N ROCKER ARM PIN
O CONNECTING LINK
P DIAPHRAGM PULL ROD
Q DIAPHRAGM RETURN SPRING
R LIFT PUMP HAND PRIMING LEVER
S FILTER BOWL GASKET

Fig. C.1. Fuel lift pump arrangement, showing fuel flow

The body assembly comprises a rocker arm and a connecting link, both of which pivot on a pin located in the body by spring retaining clips. Attached to the link is a pull rod incorporated in the diaphragm unit. An oil seal located in the body by means of a retaining cup protects the diaphragm unit from crankcase oil splash.

Two return springs complete this assembly, one between the diaphragm and the body and the other between the rocker arm and the body. The purpose of the latter is to hold the rocker arm in constant contact with the eccentric on the camshaft.

Two valves are assembled in the cover, one operated by suction and the other by pressure; these connect with the inlet and outlet passages respectively and are held in position by a retainer, which is secured to the cover by two screws. The valves and seats form a renewable and interchangeable assembly. The inlet passage is protected by a gauze screen held in position by an inverted glass bowl, which is secured to the cover by a stirrup type retainer.

The Solex carburettor is secured to the inlet manifold by two studs and nuts, with a gasket interposed at the mating faces. It incorporates a zero progressive fast-idle starter unit to facilitate immediate cold starting and driving away in the shortest possible time, including progressive weakening of the starting mixture in accordance with the engine requirements and providing

a range of fast-idle speeds during the warming up period. The main carburettor is dustproofed and the air feed in this case is taken via the air cleaner.

The air cleaner is of the oil bath type, being clamped in a bracket, which is bolted to the cab scuttle. The air cleaner is connected to the carburettor by means of a rubber hose and clips. A moulded branch on the rubber hose houses the rocker cover breather pipe.

OPERATION

Fuel Lift Pump (see Fig. C.1).

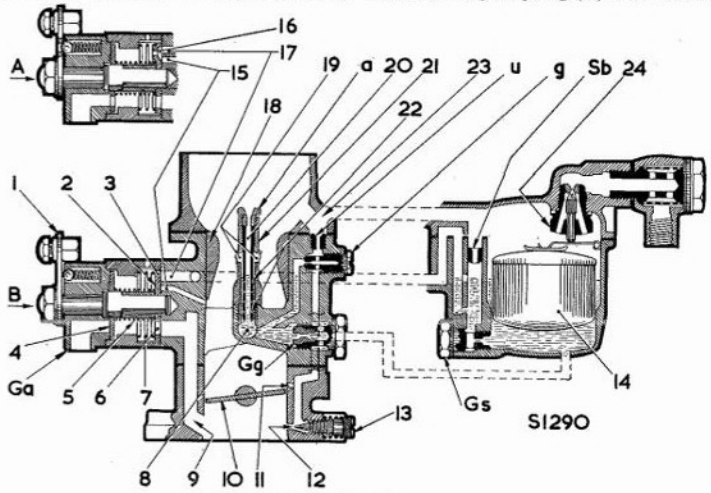
The eccentric on the camshaft contacts and pivots the rocker arm (L), which draws the diaphragm (G), down against its return spring (Q), through the medium of the connecting link (O) and the pull rod (P). This creates a partial vacuum in the lift pump chamber (C).

Fuel is drawn from the fuel tank and enters the glass bowl, via the inlet passage (A), passes through the filter gauze (B), the inlet passage and the suction valve (D), into the pump chamber. The camshaft revolves and the rocker arm (L), is brought on to the back of the eccentric when the rocker arm is disconnected from the diaphragm unit by means of the separate swivelling connecting link (O), and then the diaphragm return spring (Q) pushes the diaphragm (G) upwards, forcing the fuel through the delivery valve (E) and the outlet passage (F), into the feed pipe to the carburettor.

When the carburettor float chamber is full, the needle valve will be closed, thus creating a pressure in the lift pump chamber (C). This pressure will hold the diaphragm downwards against spring pressure and it will remain in this position until the carburettor requires more fuel, when the needle valve will again open. The diaphragm actuating linkage is in two sections, i.e., the rocker arm (L) and the connecting link (O), these make contact at a point (M) and disconnect when fuel is not required, thus the continued movement of the eccentric is absorbed in this way. Due to the pressure of the rocker arm spring (H), the rocker arm is kept in constant contact with the camshaft eccentric to eliminate noise. A steel spring blade is riveted to the underside of the connecting link (O), to prevent the pull rod from rattling in its socket.

Carburettor (see Fig. C.2).

Dustproofing. The main carburettor is dustproofed, air passing through the passage (23) to the float chamber,



A—STARTER UNIT LOCATED IN INTERMEDIATE POSITION
B—STARTER UNIT LOCATED IN FULL RICH POSITION

Gg MAIN JET
a AIR CORRECTION JET
g PILOT (AUXILIARY) JET
u PILOT AIR BLEED
Ga STARTER PETROL JET
Sb STARTER AIR BLEED
Ga STARTER AIR JET

1 STARTER UNIT OPERATING LEVER
2 STARTER DISC VALVE
3 STARTER MIXTURE INLET HOLE (RICH)
4 STARTER AIR VALVE
5 AIR VALVE SPRING
6 STARTER MIXTURE OUTLET HOLE
7 PETROL VALVE SPRING
8 RESERVE WELL
9 STARTER MIXTURE OUTLET CHANNEL
10 THROTTLE VALVE
11 BY-PASS ORIFICE
12 IDLING ORIFICE
13 VOLUME CONTROL SCREW
14 FLOAT
15 STARTER PROGRESSION CHANNEL
16 STARTER PROGRESSION HOLE
17 STARTER MIXTURE INLET CHANNEL
18 CHOKE TUBE
19 MAIN SPRAYING ORIFICES
20 EMULSION TUBE
21 SPRAYING WELL
22 EMULSION TUBE HOLES
23 FLOAT CHAMBER VENT
24 NEEDLE VALVE

Fig. C.2. Diagrammatic section of the carburettor

through (u) to the idling circuit and through (a) to the main spraying circuit, from the same source as the main air supply, i.e., all through the air cleaner. This ensures a balanced mixture, and even though the air cleaner may become partially choked in service through neglect, fuel consumption would not be affected, but it must be borne in mind that such a restriction as imposed by a choked air cleaner will reduce the volume of air and consequently the mixture which the engine can inspire, and so lead to power loss. Air to emulsify the fuel passed through the starter petrol jet (Gs) is drawn from the main filtered air supply, via the float chamber.

Zero Progressive Fast-Idle Starter Unit. Operation of the starter unit is by rotation of the starter disc valve (2) connected via the operating lever (1) to the choke control. To start from cold (see also under "Use of the Controls for Engine Starting"), place the control in the full-rich position, when the hole (3) aligns with the channel (17), and the hole (6) aligns with the channel (9).

Suction created by cranking the engine draws fuel from the starter petrol jet (Gs), which emulsified by air from the starter air bleed (Sb) travels along the channel (17), through the starter unit via the holes (3 and 6) in the starter disc valve (2), into the channel (9) and hence to the inlet manifold. As soon as the engine fires, suction increases and lifts the air valve (4) against the spring (5), admitting additional air through the starter air jets (Ga).

When the engine starts, push the choke control back about one quarter of its travel, thus bringing the starter unit into the intermediate position (see also under "Use of the Controls for Engine Starting"), when the spring loaded ball engages the register in the operating lever (1). This movement rotates the starter disc valve (2), when the elongated hole (16) in the valve (2) is brought into circuit instead of the hole (3), and connects channels (17) and (15). Thus in this position more volume and a weaker mixture is obtained by admitting additional air **into** the starter unit through the channel (15), supplementing the air drawn through the starter air jets (Ga), via the elongations in the starter air valve.

The vehicle may now be driven away without difficulty although the engine is still cold, due to the engine depression acting on the channel (15), when the throttle is opened, drawing an additional supply of mixture **out** from the starter unit past the elongated hole (16) into the channel (15) to meet the engine requirements. At the same time the depression acting on the outlet channel (9) continues to draw mixture from the channel (17), which combines with the additional air drawn from the starter air jets (Ga).

As the engine warms up, the choke control should be moved progressively towards the full-off position, the rotation of the starter disc valve (2) gradually reducing the volume and richness of the mixture through the hole (16) and the area of the outlet (6), slowing the engine down as it warms up.

The degree of enrichment supplied by the mixture from the channel (15), decreases as the valve (2) is rotated from the intermediate position to the full-off position. When the control is moved to the full-off position, i.e., pushed fully home, the starter disc valve (2) rotates and blanks off the channels (17 and 9), thus placing the starter unit out of circuit.

The Idling Circuit. This circuit supplies, through the idling orifice (12), the mixture required for idling when the engine is warm. It also provides through the by-pass orifice (11) the mixture required as the throttle is first opened, but before it opens enough for the main spraying orifices (19) to begin to discharge. This ensures smooth transfer from the idling circuit on to the main spraying system. Fuel is supplied from the reserve well (8), metered by the pilot jet (g), while the air bleed (u) provides pre-emulsion. When idling, emulsifying air is also drawn in through the by-pass orifice (11), the volume of all this mixture being controlled by a screw (13). On leaving the orifice (12) the emulsion is mixed with the air passing round the throttle valve (10), this being held slightly open by an adjustment screw on an abutment plate at the end of the throttle spindle. As the throttle valve is opened, engine depression, or suction is directed to the by-pass orifice (11), which discharges additional mixture to balance the increased volume of air passing the throttle valve (10), until the valve has opened sufficiently for the main spraying system to come into operation.

The Main Spraying Circuit. As the throttle valve (10) is opened further, air speed through the venturi, or choke tube (18) increases and the depression acting on the orifices (19) draws fuel from the float chamber, through the main jet (Gg) into the spraying well (21), via the reserve well (8). Simultaneously air enters the emulsion tube (20) via the correction jet (a) and passes out through the holes (22) in the emulsion tube into the annulus, which forms the spraying well, where it emulsifies with the fuel and is discharged from the spraying orifices (19). As the engine speed increases the fuel level in the well (21) drops and uncovers the remaining holes in the emulsion tube. In this way additional air enters the fuel stream and corrects the output from the main jet according to engine speed and load.

The Float Chamber. The level of fuel in the float chamber is controlled by the slight rise and fall of the float closing, or opening the needle valve (24) to cut off, or admit fuel from the lift pump as required.

Oil Bath Air Cleaner (see Fig. C.3).

The oil bath type of air cleaner is fitted to these models and operates as follows:

Dust laden air enters the cleaner through the opening between the oil container and the top cover. It then passes downwards through the annular passage, striking the oil lying above the shelf, and then reverses upwards into the filter element through the openings provided. Any dirt, or grit which is not precipitated into the oil when the air reverses above the shelf is caught on the wetted mesh of the filter element and washed back into the oil container bowl sump, where it gravitates out of circulation to form a sludge. The cleansed air is sucked

out through the filter element and the top cover, passing to the carburettor, via the connecting hose. The filter element is automatically oiled and washed by oil carried up by the incoming air.

The purpose of the shelf, above which the oil level rises approximately $\frac{1}{8}$ in. (3 mm.), is to regulate the quantity of oil that is drawn into the element and thereby prevent oil being drawn through the filter element and into the carburettor feed passage.

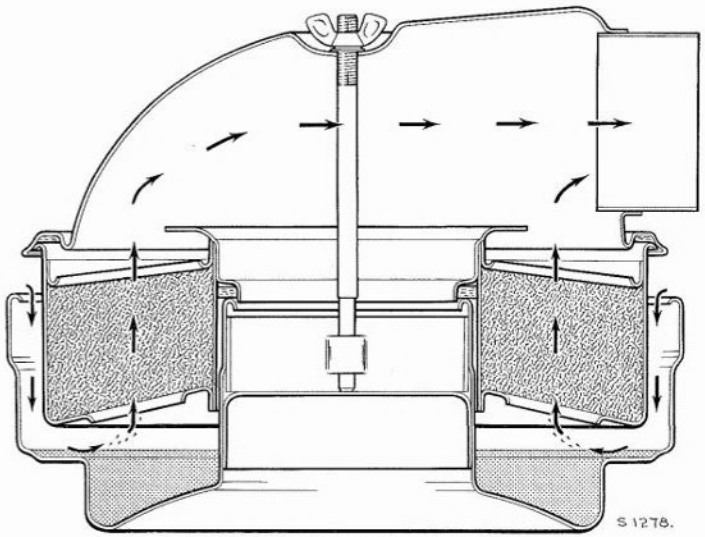


Fig. C.3. Air cleaner arrangement, showing the air flow

USE OF THE CONTROLS FOR ENGINE STARTING

Starting from Cold at Temperatures Below Freezing. Place the choke control in the "Full Rich" position (full-out). DO NOT TOUCH THE ACCELERATOR PEDAL. Operate the starter motor. When the engine starts, push the choke control into the "Intermediate" position (located by a marked resistance to the push on the choke control). If the engine is to be warmed up stationary, wait for a few seconds and then push the choke control in, to a position between "Intermediate" and "Full Off", so that the engine is running at a "fast-idle" speed. If the vehicle is to be driven away at once, do so with the control in the "Intermediate" position, pushing the control in progressively after the vehicle is moving. The warmer the engine becomes the further the control can be pushed home. With the control just out from the "Full Off" position, a "fast-idle" is provided to prevent stalling in the first minutes of running, i.e., at traffic lights, or other compulsory stops. Push the control right home as soon as the engine will idle normally thus preventing unnecessary wastage of fuel.

Starting from Cold at Temperatures Above Freezing. This may normally be carried out with the control in the "Intermediate" position. Soon after the engine has started the control should be pushed in progressively, a short distance at a time, so that a "fast-idle" is obtained.

Push the control right home as soon as the engine will idle normally thus preventing unnecessary fuel wastage.

Hot Re-Starting. Do not use the choke control. If an immediate start is not obtained, keep the accelerator pedal partly depressed during the next attempt.

ADJUSTMENTS TO THE CARBURETTOR WHILST IN POSITION

Accelerator Linkage.

If the accelerator linkage is disturbed at any time, the rod between the linkage and throttle valve operating lever must be reset so that with the accelerator pedal closed, the throttle valve is also closed. To adjust proceed as follows:

1. Ensure that the accelerator pedal is in the closed position. This will normally be held closed by a spring.

2. The throttle valve must also be in the closed position. This is attained by pushing down the operating lever as far as possible with the slow running adjustment screw (see Fig. C.10) screwed out so as not to foul the carburettor body. Ensure the stop on the inner cable of the hand throttle control does not restrict the closing of the throttle valve.

3. Disconnect the rod from the operating lever, and holding the lever in the position attained in para. 2, slightly depress the accelerator pedal, adjust the ball joint at the lower end of the rod so that the upper end can be re-inserted into the operating lever without strain. Fit the thackeray and plain washers, and secure the operating rod using a new split pin. On L.H.D. Models, ball joints are fitted at either end of the operating rod. Check the operation of the accelerator linkage by depressing the accelerator pedal fully, ensuring that the throttle valve is fully open as indicated by the throttle maximum stop contacting the carburettor body.

4. Adjust the carburettor slow running and the hand throttle control as described below.

Carburettor Controls.

To Adjust—Choke Control. Connect and adjust this control as follows:

1. Secure the end of the outer cable in the abutment clip on the starter unit cover.

2. Place the starter unit operating lever in the position that it would occupy when the device is not in use, i.e., pushed forward as far as possible.

3. Pull the operating knob away from the instrument panel about $\frac{1}{8}$ in. (3 mm.) then connect the cable to the operating lever.

To Adjust—Hand Throttle Control. With the control knob screwed right home and the accelerator pedal in in the closed position, connect this cable to the throttle operating lever in the following manner:

1. Secure the outer cable screwed ferrule to the abutment bracket with the nuts.

2. Thread the inner cable through the lever barrel.

3. Fit the stop to the inner cable so as to give a clearance of approximately $\frac{1}{16}$ in. (1·5 mm.) between the stop and the barrel on the throttle operating lever.

To Adjust—Slow Running. The slow running adjustment is effected by making alternate adjustments to the setting of the slow running adjustment screw and the mixture, or volume control screw (see Fig. C.10). Before commencing it is necessary to have the engine well warmed up.

The Slow Running Adjustment Screw is mounted on the throttle abutment plate and limits the closing of the throttle valve, thereby determining the idling speed of the engine. By screwing it in, the engine speed will increase, and vice versa.

The Mixture, or Volume Control Screw is the spring-loaded knurled-headed screw in the throttle chamber. As its name implies, it enriches, or weakens the idling mixture, by anti-clockwise, or clockwise rotation, i.e., screwing outwards to enrich and vice versa.

Too weak a mixture is recognised by the irregular behaviour of the engine, and the tendency to stall. Over-richness will cause the engine to "hunt" and tend to stall when the "hunt" becomes excessive.

To co-ordinate the two controls, proceed as follows:

1. **With the engine thoroughly warmed up** and still running, screw in slightly the slow running adjustment screw, to increase the engine speed.

2. Unscrew the volume control screw until the engine begins to "hunt", then screw it in progressively until the engine fires evenly.

3. Unscrew very slowly the slow running adjustment screw to decrease the engine speed to approximately 500 r.p.m. Do not attempt to run the engine at too low a speed.

4. If the engine "hunts" slightly, screw in the volume control screw a little further. **In no case should the screw be screwed right home.**

Note: Before attempting to adjust the idling setting, it is essential to check the condition of the sparking plugs and adjust the plug gaps carefully, also the contact breaker points.

FUEL TANK

To Remove.

1. Drain the contents of the tank at the plug provided into a suitable clean container.

Note: If the tank is being removed for cleaning purposes leave about $\frac{1}{2}$ gallon (2 litres) of fuel in the tank and refit the plug.

2. Disconnect the filler hose from the tank filler pipe after releasing the hose clips.

3. Disconnect the fuel feed pipe from the suction pipe union on the rear face of the tank.

4. Ensure that the ignition switch is in the "off" position, then disconnect the cable from the fuel gauge unit at the connector provided.

5. Support the tank and unscrew the locknuts from the setscrews, which clamp the top and bottom straps. Ease the straps clear, and lift away the tank.

To Dismantle.

1. Remove the tank gauge unit after withdrawing the screws securing the unit in position. When lifting out the gauge unit, be careful not to damage the float, or arm, as this would cause a false reading on the fuel gauge on re-assembly.

2. Release the filler neck and hose from the body side panel if necessary, after slackening the appropriate hose clips.

3. The blanking plug and washer on the upper face of the tank need not be removed unnecessarily, only if replacements are necessary.

Inspection and Overhaul.

1. Clean the tank thoroughly internally and externally. The former is most important and can be accomplished by shaking the tank vigorously with approximately ½ gallon (2 litres) of fuel inside, then still swirling the fuel from side to side in the tank, drain away all the fuel and blow out the tank with compressed air. After cleaning the tank inspect it for splits and other damage.

2. Blow through the suction pipe to ensure that it is clear of obstructions.

3. Examine the filler neck and the filler hose for signs of damage, or deterioration, and renew as necessary.

4. Ensure that the breather pipe is clear of obstructions, using a suitable length of stiff wire and finally blowing through with compressed air.

To Re-assemble.

1. Fit the gauge unit to the tank using a new gasket, so that the cable connector on the unit faces rearward when fitted to the tank.

2. Assemble the filler neck, and the filler hose to the body side panel.

3. Ensure that the sealing washers on the blanking and drain plugs are in good condition, renewing if necessary.

To Refit.

Refit the tank by reversing the removal procedure, ensuring that the strips of felt are in position between the supports and the tank. Do not over-tighten the straps as this is liable to distort the tank.

FUEL LIFT PUMP

To Test in Position.

1. Disconnect the delivery pipe to the carburettor at the pump end, leaving a free outlet from the pump.

2. Rotate the engine, when there should be a well defined spurt of fuel from the outlet union for every two revolutions of the engine crankshaft.

3. If the lift pump should fail to deliver fuel to the carburettor the following points must be first checked before removing the lift pump from the engine:

(*a*) That fuel is available in the tank and the unions on the pipe from the tank to the lift pump are fuel tight.

(*b*) The lift pump filter gauze is clean and that the gasket seating the sediment bowl is in good condition and not hard, or otherwise deteriorated (a defective gasket will allow air to enter the pump). Renew the gasket if necessary.

(*c*) The action of the lift pump, if still uncertain in operation, entails the removal of the pump from the engine for detailed examination and overhaul.

To Clean the Filter Gauze and Glass Sediment Bowl.

1. Slacken the securing nut on the stirrup retainer, swing the retainer to one side and remove the glass sediment bowl.

2. Withdraw the bowl gasket, followed by the filter gauze. Wash the gauze in clean fuel and blow dry with compressed air. Thoroughly clean the filter bowl to remove all sediment present and ensure its seating on the pump is free of all foreign matter.

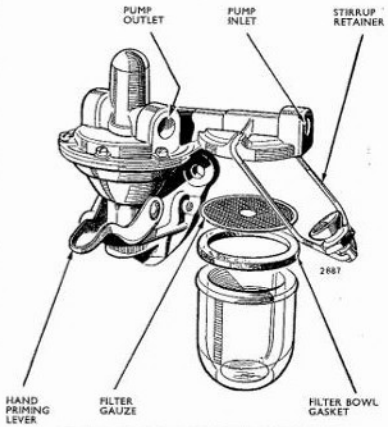


Fig. C.4. Removing the filter bowl and gauze

3. Refit the filter gauze and the bowl gasket, on to their seatings, noting that the gasket must be renewed if hard, or deteriorated in any way. Place the filter bowl in position and secure by means of the stirrup retainer. Tighten the securing nut just sufficiently to make a tight sealing joint, as excessive tightening will cause a rapid deterioration of the bowl gasket.

Hand Priming Lever.

The hand priming lever shown in Fig. C.4 is for use when for any reason, the carburettor float chamber, or pump bowl has been drained, or become empty. A few upward strokes on the priming lever on these occasions will fill the float chamber with fuel and ensure easy starting, without prolonged use of the starter and consequent excessive current drain on the battery.

Owing to the special construction of the pump it is impossible to overfill the carburettor, and after several strokes on the priming lever this will become free, indicating that the carburettor float chamber is full. Should it be found that the hand primer will not operate, turn the engine one revolution, thus freeing the pump connecting link mechanism from the pump rocker arm and the eccentric on the engine camshaft.

To Remove.

1. Raise the bonnet (hood) and secure in the open position.

2. Disconnect the fuel pipes from the inlet and outlet unions on the lift pump.

3. Remove the two setscrews securing the pump to the cylinder block and lift away the lift pump, complete with the joints and heat insulator.

To Dismantle.

1. Make a file mark across the two flanges of the pump body for location purposes on re-assembly.

2. Remove from the cover of the pump assembly, the filter bowl, gasket and filter gauze, after first unscrewing the nut and swinging the stirrup retainer to one side.

5. Remove one of the spring retaining clips from the rocker arm pin and withdraw the pin.

6. The rocker arm spring and the packing washers, together with the rocker arm and the connecting link may now be removed from the body.

7. Withdraw the valve retainer screws from the inside of the cover of the pump assembly and remove the retaining plate, valve assemblies and valve retaining gasket.

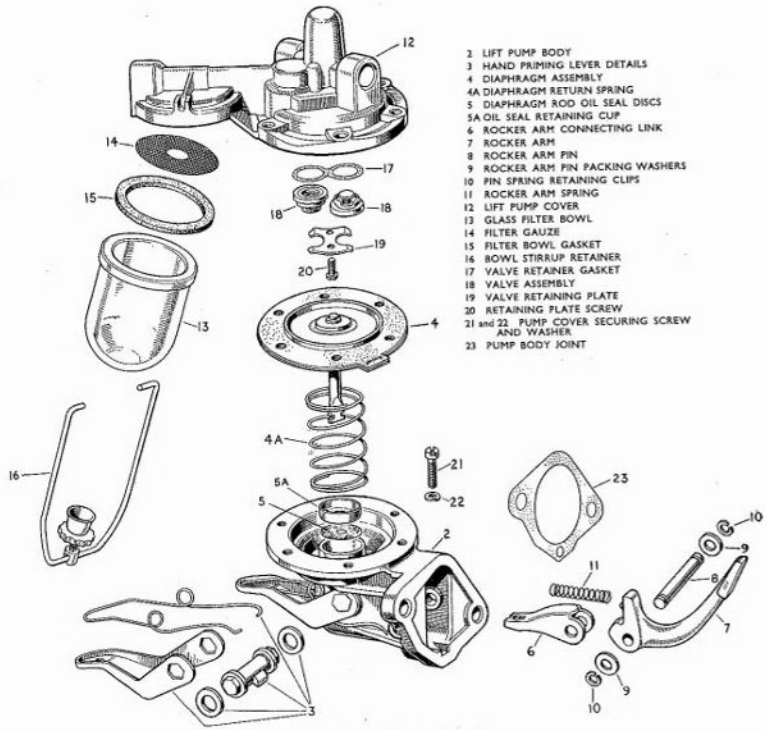


Fig. C.5. Fuel lift pump details

3. Remove the six securing screws and separate the two halves of the pump assembly.

4. Turn the diaphragm unit through an angle of 90°, when the pull rod may be disconnected from its securing slot in the connecting link and withdrawn. Remove the diaphragm spring.

Note: Do not attempt to separate the diaphragm layers.

Inspection and Overhaul.

Thoroughly clean all parts in clean paraffin, then proceed as follows:

1. Check the diaphragm for hardening, or cracking. If it shows signs of either of these conditions, it must be renewed.

2. Where any part of the hand priming mechanism is broken the complete set of parts must be renewed, the outer ends of the spindle being riveted over on original assembly to locate the various components. The priming lever return spring is renewable separately.

3. Examine the rocker arm, connecting link, and the rocker arm pin for signs of wear. If badly worn, renew. The rocker arm pin should be a light interference fit in the pump body. Check the condition and tension of the rocker arm return spring and renew as necessary. Mate the coupling on the end of the diaphragm rod with the slot provided in the connecting link, and ensure that the tension of the spring blade is such as to hold the pull rod end in firm contact with the connecting link, thus eliminating any noise from this point during operation.

4. Examine the diaphragm rod oil seal in the bottom half of the pump body for deterioration and renew if necessary, in the following manner:

(*a*) Relieve the staking securing the oil seal retaining cup in the body.

(*b*) Prise out the retainer and remove the two layers of the seal.

(*c*) Fit the new pair of oil seal discs and also a new retainer, if the original part was damaged during removal operations. Stake over the body metal in four places to secure the retainer in position.

5. The valve assemblies cannot be dismantled, but should be tested for an air-tight seal by suction, and renewed, if necessary.

6. Test the diaphragm spring, although this part very rarely requires renewal. When renewing the spring ensure that the replacement is of the same colour and consequently the same strength as the original.

7. All gaskets should be renewed as a matter of routine.

To Re-assemble.

1. Assemble the valve retainer gasket, the valves and the valve retainer, then secure in position with the two retaining screws.

2. Locate the connecting link, the packing washers, the rocker arm and the rocker arm return spring in the pump body. Insert the rocker arm pin through the aperture in the pump body, at the same time engaging the packing washers, connecting link and rocker arm. Secure the pin in the body with the two spring retaining clips.

Note: Fitting of the rocker arm pin can be simplified if a piece of rod ·24 in. (6 mm.) in diameter is inserted through the pin hole in one side of the pump body so as to engage the components, then push the rocker arm pin into position from the opposite side.

3. Position the diaphragm spring in the pump body.

4. Place the diaphragm unit over the spring (pull rod downwards) and centre the upper end of the spring in the lower cup of the diaphragm unit.

5. Press downwards on the diaphragm at the same time turning the assembly to the left in such a manner that the slots on the pull rod engage the forked end of the connecting link, ultimately turning the unit a complete quarter turn to the left. This procedure correctly positions the pull rod in the connecting link, and at the same time permits the alignment of the holes in the diaphragm with those in the pump body flange.

Note: When first inserted the diaphragm should be at the position shown in Fig. C.6, after turning the diaphragm unit through 90° to the left, the "tab" should align with the lug on the pump body and be in the position shown by the dotted lines.

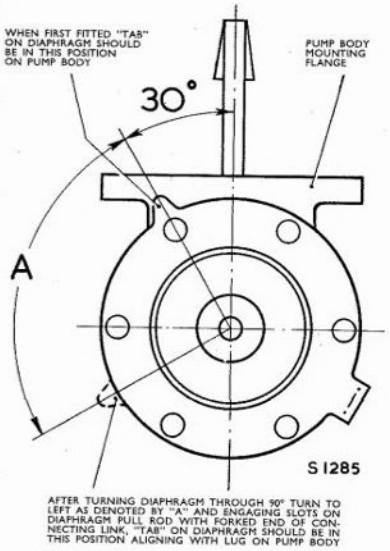


Fig. C.6. Fitting the diaphragm to the pump body

6. The two sub-assemblies of the lift pump are now ready for fitting together and this is carried out as follows:

(*a*) Push the rocker arm towards the pump body until the diaphragm is level with the body flange.

(*b*) Place the cover of the pump into the correct position as shown by the mark made on the flanges before dismantling.

(*c*) Install the cover securing screws and spring washers and tighten the screws until the heads just engage the spring washers.

(*d*) Continue to push the rocker arm firmly towards the pump body so as to hold the diaphragm at the bottom of the stroke, and while held in this position, finally tighten the cover securing screws alternately and securely. After assembly the edges of the diaphragm should be roughly flush with the outer edges of the two clamping flanges. Any appreciable protrusion of the diaphragm indicates incorrect fitting, in which case the securing screws must be released, and special care paid to maintaining inward pressure on the rocker arm, while the securing screws are re-tightened alternately and securely.

7. Refit the filter gauze, a new gasket and the filter bowl to the cover, ensuring that an air-tight joint results between the bowl and the gasket.

Testing the Fuel Lift Pump after Re-assembly.

The best method is by using an AC-Delco Bench Test Stand, on which the suction side of the pump is piped to a tin of paraffin at floor level and the outlet side of the pump connected to a stop tap and pressure gauge.

1. First flush the lift pump through to wet the valves and seats, and then completely empty it again by continuing to operate the rocker arm by hand with the suction pipe clear of the paraffin. Re-immerse the suction pipe in the paraffin and again operate the lift pump. Not more than 20 strokes should be necessary to secure delivery of paraffin from the pump outlet.

2. With the same apparatus a second test can be made by working the lift pump with the tap on the delivery side closed, pressure then being recorded on the gauge. After ceasing to work the lift pump, it should take several seconds for this pressure to return to zero, thus denoting that the valves are seating properly. Also, while there is pressure, the outer edge of the diaphragm visible between the pump body flanges, should be carefully examined for leakage, and the securing screws tightened if necessary. When working the lift pump by hand a somewhat longer stroke is obtained and the pressure developed is apt to be higher than when fitted to the engine.

3. When the above apparatus is not available the lift pump should be tested, using a container of clean paraffin.

(*a*) Flush the lift pump by immersing it in the paraffin and working the rocker arm a few times to wet the valves and seats.

(*b*) Empty the lift pump by continuing to operate the rocker arm above the paraffin bath.

(*c*) With the lift pump still held clear of the paraffin bath, place a finger over the inlet union and operate the rocker arm several times. Upon removing the finger a distinct sucking noise should be heard, denoting that the pump has developed a reasonable degree of suction. Next place the finger over the outlet union and operate the rocker arm when the air drawn into the pump chamber should be held under compression for two, or three seconds.

(*d*) Immerse the lift pump in the paraffin bath and whilst holding a finger again over the outlet union, work the lift pump rocker arm and examine the clamping flanges of the diaphragm for any signs of air leakage. Tighten the flange securing screws if necessary.

To Refit.

To install the fuel lift pump, reverse the removal procedure, using the heat insulator with new joints between the pump and the cylinder block, noting the following points:

1. Ensure that the rocker arm bears correctly against the camshaft eccentric, otherwise the rocker arm may become trapped when the pump securing setscrews are tightened.

2. After refitting the pump, hand prime at the lever provided, to fill the glass bowl and the carburettor float chamber. Run the engine for a short time and examine the pipe unions on the lift pump for the possibility of fuel leakage.

3. From the foregoing description of the operation of the lift pump it will be appreciated that the pressure of fuel at the carburettor is determined by the spring (4A, see Fig. C.5), and the further this spring is compressed the greater will be the pressure. All parts of the lift pump and the cylinder block are machined to definite limits. It will, however, be appreciated that circumstances might arise in which all the lower limits exist on one particular engine, with the result that the spring will be compressed on the downward stroke to a greater extent than is normal, resulting in an excess pressure at the carburettor.

Excessive fuel lift pump pressure can be a cause of heavy fuel consumption. This can be checked and if necessary rectified, as follows:

(*a*) Disconnect the pipe to the carburettor at the lift pump.

(*b*) A suitable pressure gauge calibrated up to 6 lb./sq. in. (·5 kg./sq. cm.) should then be connected to, and as near as possible on the same level with, the outlet union on the lift pump.

(*c*) Rotate the engine on the starter, when a reading of 2½ to 3½ lb./sq. in. (·176 to ·246 kg./sq. cm.) should be recorded on the gauge.

(*d*) To remedy excessive fuel pump pressure, it is advisable to first overhaul the fuel lift pump in order to ensure that the diaphragm has not stiffened in service.

Should the diaphragm condition be satisfactory on inspection, additional flange gasket(s), may be inserted between the pump flange and the cylinder block on refitting, until the correct pump delivery pressure of 2½ to 3½ lb./sq. in. (·176 to ·246 kg./sq. cm.) is obtained.

Care should be taken to avoid the use of excessive numbers of joints as packings, because this will lead to starvation under full throttle conditions. Always check the pressure readings on completion of the packing operation.

Important: It must be clearly understood that the actual mounting on the engine affects the output pressure of the pump and thus these tests cannot be carried out unless the pump is mounted in its normal position. The use of jigs, or other fixtures for testing AC–Delco pumps will not necessarily give the same results.

CARBURETTOR

To Remove.

1. Raise the bonnet (hood) and suitably support in the open position.

2. Slacken the hose clips, remove the rubber hose from the carburettor and after freeing the hose from the rocker cover breather pipe and the air cleaner cover, withdraw the hose from the vehicle.

3. Disconnect the distributor vacuum pipe at the carburettor union and also the fuel feed pipe and banjo union from the float chamber banjo bolt.

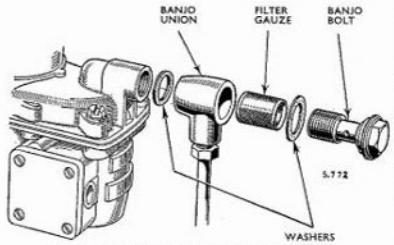


Fig. C.7. Carburettor inlet banjo union details

4. Release the split pin that secures the operating rod to the carburettor throttle operating lever, withdraw the plain and thackeray washers and disconnect the operating rod from the lever. Observe the location of the washers, so that they may be subsequently re-assembled in their original positions.

Note: On L.H.D. Models the operating rod ball joint must be disconnected from the throttle operating lever.

5. Release the choke inner cable from the starter unit operating lever and also release the cable outer casing from the abutment bracket integral with the starter unit cover.

6. Remove the stop on the end of the hand throttle control inner cable and the nuts securing the outer cable ferrule to the abutment bracket. Position the hand-throttle control clear of the manifold.

7. Remove the nuts securing the carburettor to the studs on the inlet manifold and then lift away the carburettor, and the joint.

To Dismantle (see Fig. C.8).

1. Remove the three setscrews securing the float chamber cover, which can then be lifted clear. If desired, the pilot jet air bleed can be removed from the top face of the carburettor body, whilst the needle valve may be unscrewed from the float chamber cover.

2. Lift away the float chamber cover gasket. It is advisable to renew this gasket at overhaul periods.

3. Remove the float arm and spindle from the float chamber and lift out the float assembly.

4. Unscrew the air correction jet and invert the carburettor, when the emulsion tube will drop out.

5. Remove the blanking plate if necessary, secured to the carburettor body by the four screws.

6. Remove the starter petrol jet and its seating washer.

7. Remove the pilot jet and the main jet carrier with its seating washer. The main jet can be unscrewed from its carrier.

8. Unscrew the four screws securing the throttle chamber to the carburettor body, then separate the two components together with the gasket. Unscrew and remove the volume control screw complete with its spring.

9. Remove the choke tube fixing screw, and from the bottom of the body push out the choke tube.

10. Remove the four screws at each corner of the starter unit and remove the unit. To dismantle, proceed as follows:

(*a*) Remove the locknut securing the starter operating lever to the spindle, when the locating steel ball and spring will be released.

(*b*) Separate the cover from the starter unit body. It should be noted that the disc valves are held on the spindle by peening, do not attempt to separate these components. If trouble is suspected with this unit it must be renewed as a complete assembly.

11. Remove the nut from the throttle valve spindle and lift away the throttle operating lever, the throttle abutment plate, and the flat washer.

12. It is not advisable to remove the throttle valve and spindle from the throttle chamber unnecessarily, i.e., remove only if wear, or damage exists on the components, as the screws securing the throttle valve are peened over. Should, however, removal become necessary, release the two securing screws and withdraw the throttle valve through the bore of the throttle chamber, which will allow the spindle to be withdrawn.

Inspection and Overhaul.

1. All jets and internal ducts must be clear and where possible clear them with compressed air. Do not use wire, or similar material for this purpose.

2. Clean the float chamber, removing all trace of sediment.

3. Examine the float which must be free from dents and punctures. Renew if faulty.

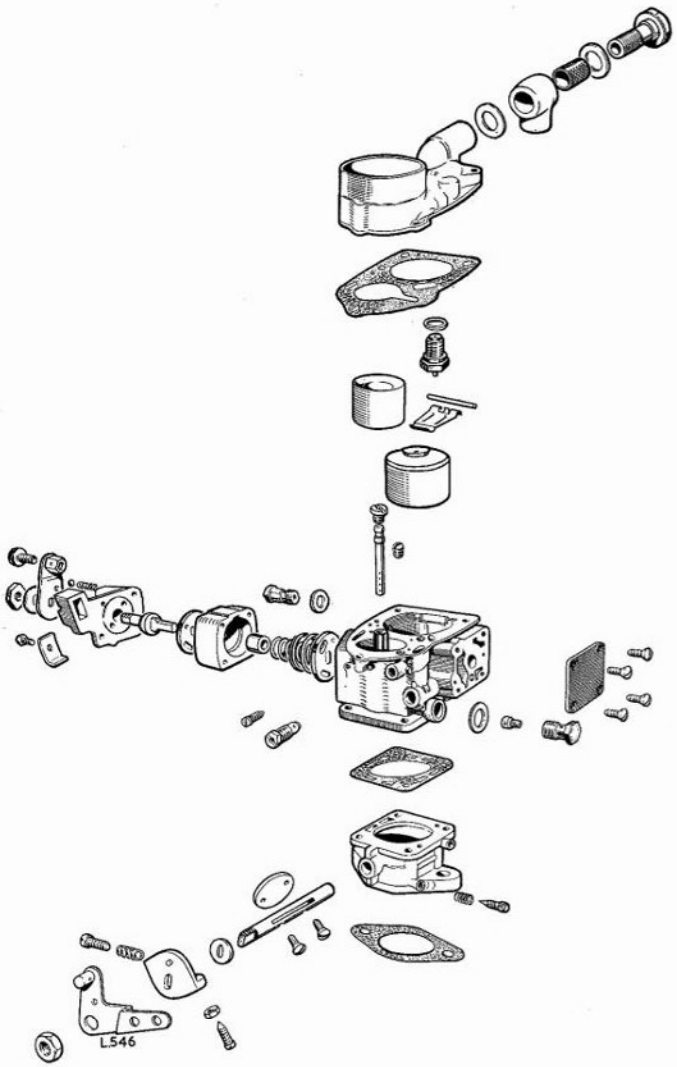


Fig. C.8. Carburettor details

To Refit.

Reverse the removal procedure, but do not over-tighten the support strap, tighten only until the air cleaner container is gripped.

ACCELERATOR LINKAGE

The accelerator shaft is centrally supported in the hollow shaft of the pedal group on R.H.D. Models, whilst on L.H.D. Models the accelerator pedal incorporates a bushed boss and is mounted on the shaft of the pedal support bracket. The accelerator relay shaft and the accelerator cross-shaft, on R.H.D. and L.H.D. Models respectively, is secured to the engine at the rear, above the clutch housing.

To Remove and Dismantle.

Raise the bonnet (hood) and secure in the open position. Release the internal engine cowl from its anchorage.

On **R.H.D. Models** disconnect and remove the accelerator linkage, proceeding in the following manner:

1. Release the throttle return spring from its locations.

2. Remove the operating rods, carburettor throttle lever to relay shaft, and relay shaft to accelerator pedal, at the ball joints, observing in the case of the connection, operating rod to throttle lever, that the split pin must first be removed, before the rod can be disconnected. It is important to note the location of the plain and thackeray washers in order to facilitate their correct positioning on re-assembly. When releasing the operating rod ball joint from the accelerator pedal lever, observe the location of the spring plate secured by the ball pin, in order that the plate may be positioned correctly on re-assembly.

3. Release the relay shaft bracket from its mounting studs on the rear right hand side of the cylinder block, and lift away complete with the relay shaft.

4. Remove the split pins securing the relay shaft in its bracket and then withdraw the shaft, noting the location of the one thackeray and two plain washers, prior to withdrawing the shaft from the bracket.

5. Release the pedal pad from the accelerator pedal.

6. Tap out the Mills pin securing the lever to the inner end of the accelerator pedal shaft, remove the lever and withdraw the distance piece. The angular position of the lever in relation to the accelerator pedal must be noted, in order to ensure correct assembly and location when drilling the new components. Lower the accelerator pedal through the toe panel and from beneath the vehicle withdraw the accelerator pedal shaft outward from the pedal support bracket.

7. It should be noted that the accelerator pedal shaft is supported in two bushes, one pressed in each end of the pedal support bracket shaft. If wear exists on these bushes, the pedal support bracket must be removed and overhauled, proceeding as follows:

(*a*) Remove the clutch pedal from the support bracket as detailed in the "Clutch and Propeller Shaft" section, under the sub-heading "Clutch Pedal and Linkage—R.H.D. Models."

(*b*) Remove the brake pedal from the support bracket (see "Brakes" section).

(*c*) Release the brake master cylinder supply pipe from the clip on top of the pedal support bracket.

(*d*) Release the pedal support bracket and shaft assembly from the frame sidemember and lift clear.

(*e*) To withdraw the internal bushes from the pedal shaft, screw a suitable size tap into each worn bush in turn to provide a purchase for extraction.

(*f*) The new bushes must be pressed into the shaft, ensuring that each bush is pressed in flush with the end of the shaft.

Note: Completely immerse the new bushes in thin oil for 24 hours prior to fitting to allow the pores of the new bushes to fill with lubricant. Do not ream the bushes after fitting, otherwise the lubricating properties of the bushes will be destroyed.

(*g*) If wear is evident on the outer diameter of the pedal shaft, the shaft and bushes may be renewed as an assembly, pressing the new shaft and bush assembly into the support bracket to the dimension as detailed under the sub-heading "Clutch Pedal and Linkage—R.H.D. Models", in the "Clutch and Propeller Shaft" section.

On **L.H.D. Models** disconnect and remove the accelerator linkage in the following manner:

1. Release the throttle return spring from its locations.

2. Remove the operating rods, carburettor throttle lever to cross-shaft, and cross-shaft to accelerator pedal, at the ball joints.

3. Release the cross-shaft brackets from their mountings on the cylinder head studs and from the studs on the rear right hand side of the cylinder block, and lift away the brackets complete with the cross-shaft. Remove the extension piece from the relay lever, positioned on the left hand end of the cross-shaft.

4. Tap out the Mills pin securing the lever to the outer end of the accelerator cross-shaft and slide off the lever and the left hand shaft support bracket. The angular position of the lever in relation to the cross-shaft set must be noted in order to ensure correct assembly and location when drilling the new components. Remove the split pins securing the cross-shaft right hand support bracket, and then withdraw the shaft from the bracket, noting the location of the one thackeray and two plain washers to facilitate correct re-positioning on assembly.

5. Remove the clutch relay shaft and clutch pedal as detailed in the "Clutch and Propeller Shaft" section, under the sub-heading "Clutch Pedal and Linkage—L.H.D. Models". Lower the accelerator pedal through the toe panel when it is possible, from beneath the vehicle, to withdraw the accelerator pedal from off the inner end of the pedal support bracket shaft.

6. Examine the accelerator pedal bush for wear, and if wear is evident, renew, pressing in the new bush until flush with the end of the pedal boss.

Note: Completely immerse the new bush in thin oil for 24 hours prior to fitting to allow the pores of the new bush to fill with lubricant. Do not ream the bush after fitting, otherwise the lubricating properties of the bush will be destroyed.

7. Inspect the support bracket shaft for wear over the area on which the accelerator pedal operates, renewing the shaft if necessary as detailed under the sub-heading "Clutch Pedal and Linkage—L.H.D. Models", in the "Clutch and Propeller Shaft" section, observing that the new shaft is pressed into the support bracket to the dimension given.

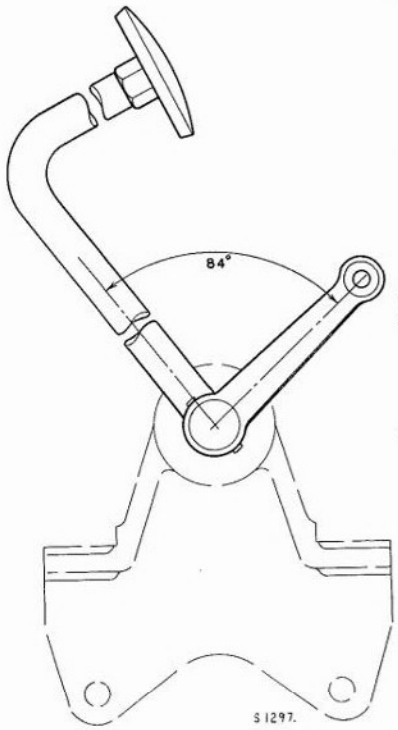


Fig. C.12. Accelerator pedal assembly, showing the angular disposition of the relay lever (R.H.D. Models)

To Re-assemble and Refit.

On **R.H.D. Models** these operations are a reversal of the removal procedure, noting the following points:

1. When the accelerator pedal shaft is in position ensure that the distance piece is located over the inner end of the shaft, and that the lever assumes the correct angular position as noted during dismantling operations (see Fig. C.12). Drill the lever and shaft, securing the components using a Mills pin.

2. Use new split pins when assembling the relay lever shaft to its bracket, ensuring that the thackeray and plain washers are located in their original positions (see Fig. C.13).

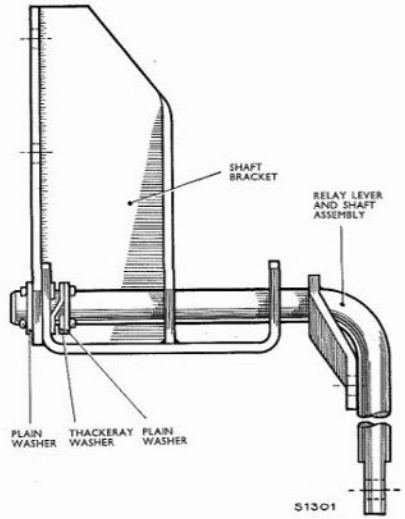


Fig. C.13. Arrangement of accelerator relay lever, shaft and bracket (R.H.D. Models)

3. Assemble the operating rod to the carburettor throttle lever, using new split pins, observing that the plain and thackeray washers are located in their original positions, and that the rod is assembled to the innermost hole in the throttle lever.

4. Locate the return spring plate in its original position, as noted during dismantling operations, and secure with the operating rod ball pin to the accelerator pedal lever.

5. Connect the return spring between the anchor plate on the engine rear mounting bracket and the spring plate on the accelerator pedal lever ball pin.

6. Check and adjust the linkage on completion to eliminate any lost motion as detailed on page C.6.

7. Check and if necessary adjust the brake and clutch pedal movement, referring to the appropriate sections.

To re-assemble and refit the accelerator linkage on **L.H.D. Models,** reverse the removal procedure, observing the following:

1. Ensure when refitting the clutch relay shaft and clutch pedal, that a plain washer is fitted between the relay shaft lever and the accelerator pedal, and between the clutch and brake pedals.

2. Use new split pins when re-assembling the cross-shaft to the right hand support bracket, ensuring that the thackeray and plain washers are located in their original positions. Fit the left hand support bracket to the opposite end of the shaft and assemble the lever, so that the lever assumes the correct angular position as noted during dismantling operations (see Fig. C.14). Drill the lever and shaft, securing the components using a Mills pin.

3. Secure the extension piece to the left hand relay lever on the cross-shaft, thus extending the lever outwards.

4. Assemble the operating rod to the carburettor throttle lever using the innermost hole in the lever for its location.

5. Connect the return spring between the anchor plate on the engine rear mounting bracket and the operating rod ball pin on the accelerator pedal lever.

6. Check and adjust the linkage on completion to eliminate any lost motion, as detailed on page C.6.

7. Check and if necessary adjust the brake and clutch pedal movement, referring to the appropriate sections.

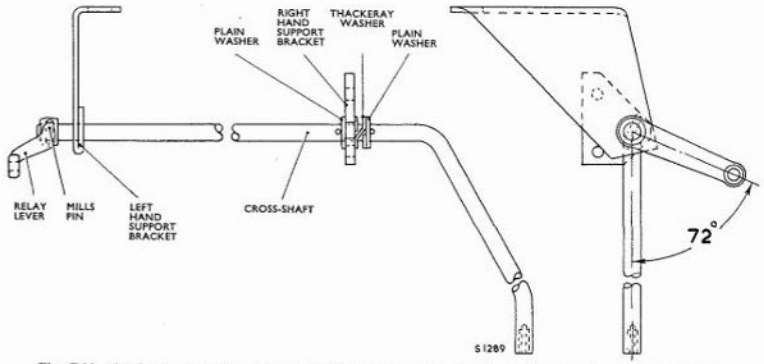


Fig. C.14. Accelerator cross-shaft arrangement, showing the angular disposition of the relay lever (L.H.D. Models)

FUEL SYSTEM

(KAL MODELS)

DATA

Fuel Tank.	
Capacity	
—KAL.30 Models	10 gallon (45·4 litre)
—KAL.40 and 60 Models	15 gallon (68·1 litre)
Position	Strap mounted to the left hand frame sidemember immediately forward of the rear axle
Filler cap	Captive type, situated in the lower left hand body side panel
Fuel Lift Pump.	
Make	AC–Delco
Model	"UG" Series—AC. 7950367
Type	Mechanical
Location	Rear right hand side of the cylinder block
Operation	Driven by an eccentric on the camshaft
Outlet pressure (at pump level)	2·5 to 3·5 lb./sq. in. (·176 to ·246 kg./sq. cm.)
Filter	Glass sediment bowl and filter gauze incorporated in the pump
Carburettor.	
Type	Solex Downdraught B32. PBIO–7
Choke tube	23
Main jet	115
Air correction jet	160
Pilot (auxiliary) jet	45
Pilot air bleed	1·2
Pump jet	40
Emulsion tube	L.30
Needle valve	2·0
Starter unit	Zero progressive fast-idle type
Accelerating pump	Mechanically actuated
Air Cleaner.	
Make	AC–Delco
Model	AC.7955837
Type	Oil bath

FUEL SYSTEM

(KAL MODELS)

DESCRIPTION

The fuel system comprises a fuel tank, AC–Delco diaphragm type fuel lift pump, a Solex downdraught carburettor, an oil bath air cleaner and an intake manifold.

The fuel tank is carried by supports riveted to the left hand frame sidemember and is held firm by pairs of steel straps, which are riveted to the tank supports. Strips of felt are interposed between the tank and supports to prevent damage to the tank through vibration.

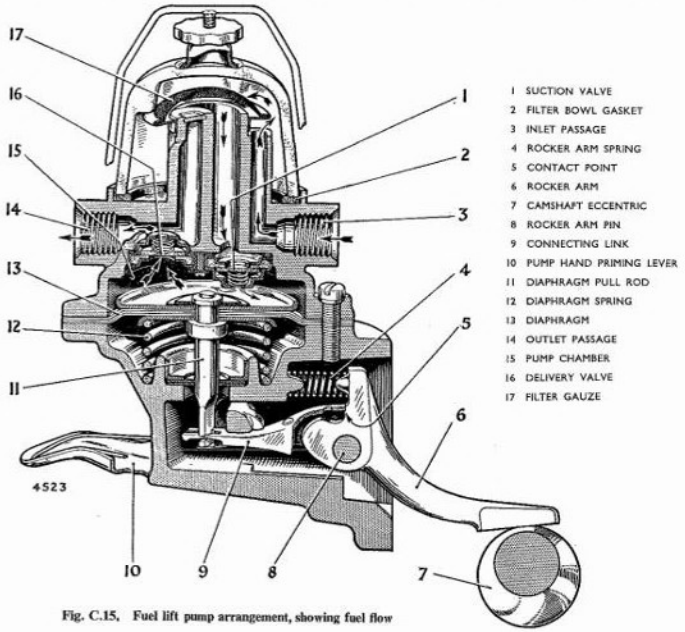
Fuel is drawn from the fuel tank and pumped to the carburettor by the fuel lift pump, which is secured to the rear right hand side of the cylinder block by two nuts and washers, a heat insulator is interposed between the pump flange and the block. The pump consists of two main assemblies, i.e., a body assembly and a cover assembly, which clamp a diaphragm unit between their outer flanges.

The body assembly comprises a rocker arm and a connecting link, both of which pivot on a pin located in the body by spring retaining clips. Attached to the link is a pull rod incorporated in the diaphragm unit. An oil seal located in the body by means of a retaining cup protects the diaphragm unit from crankcase oil splash.

Two return springs complete this assembly, one between the diaphragm and the body, and the other between the rocker arm and the body. The purpose of the latter is to hold the rocker arm in constant contact with the eccentric on the camshaft.

Two valves are assembled in the cover, one operated by suction and the other by pressure; these connect with the inlet and outlet passages respectively and are held in position by a retainer, which is secured to the cover by two screws. The valves and seats form a renewable and interchangeable assembly. The inlet passage to the pump chamber is protected by a gauze dome fitted to the top of the pump cover. The filter gauze is enclosed by a glass sediment bowl, which is secured to the cover by a stirrup type retainer.

The Solex carburettor is secured to the inlet manifold, via a cast adaptor, by means of studs and nuts. Gaskets



1 SUCTION VALVE
2 FILTER BOWL GASKET
3 INLET PASSAGE
4 ROCKER ARM SPRING
5 CONTACT POINT
6 ROCKER ARM
7 CAMSHAFT ECCENTRIC
8 ROCKER ARM PIN
9 CONNECTING LINK
10 PUMP HAND PRIMING LEVER
11 DIAPHRAGM PULL ROD
12 DIAPHRAGM SPRING
13 DIAPHRAGM
14 OUTLET PASSAGE
15 PUMP CHAMBER
16 DELIVERY VALVE
17 FILTER GAUZE

Fig. C.15. Fuel lift pump arrangement, showing fuel flow

are interposed between the mating faces. The carburettor incorporates:

(*a*) Full dust-proofing.

(*b*) A zero progressive fast-idle starter unit to facilitate immediate cold starting and driving away in the shortest possible time, including progressive weakening of the starting mixture in accordance with the engine requirements and providing a range of fast-idle speeds during the warming up period.

(*c*) A mechanically actuated accelerating device to supplement the main jet output at the moment of acceleration.

The air cleaner is of the oil bath type, being clamped in a bracket, which is bolted to the cab scuttle. The air cleaner is connected to the carburettor by means of a rubber hose and clips. A moulded branch on the rubber hose houses the rocker cover breather pipe.

OPERATION

Fuel Lift Pump (see Fig. C.15).

As the engine camshaft revolves an eccentric (7) actuates the fuel pump rocker arm (6) pivoted on the pin (8), which through the medium of the connecting link (9), draws the pull rod (11) together with the diaphragm (13) downwards against spring pressure (12), thus creating a depression in the pump chamber (15).

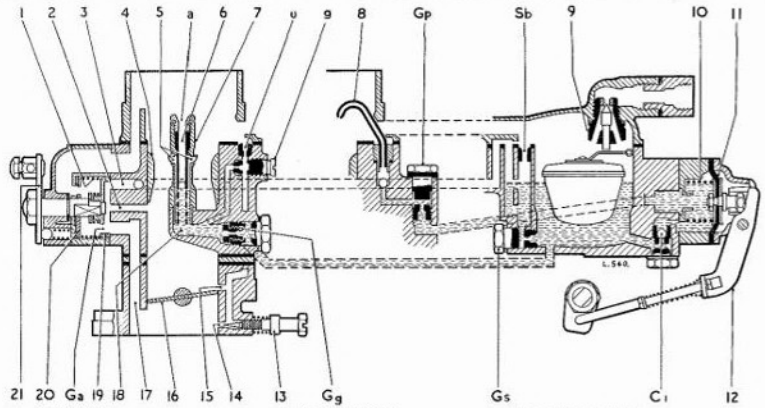
Fuel drawn from the tank enters the glass bowl from the pump intake (3). After passing through the filter gauze (17) and the inlet valve (1) it enters the pump chamber (15). On the return stroke, pressure of the spring (12) pushes the diaphragm (13) upwards forcing fuel from the chamber (15), through the delivery valve (16) and the pump outlet (14) into the feed pipe to the carburettor.

When the carburettor float chamber is full, the float will shut the needle valve, thus preventing any flow of fuel from the pump chamber (15). This will hold the diaphragm (13) downwards against spring pressure and it will remain in this position until the carburettor requires further fuel and the needle valve opens.

The rocker arm (6) operates the connecting link (9), these make contact at a point (5) and disconnect when fuel is not required, thus the continued movement of the rocker arm is absorbed in this way, when no movement at the pump diaphragm occurs. The spring (4) keeps the rocker arm (6) in constant contact with the eccentric (7) on the camshaft to eliminate noise. A steel spring blade is riveted to the underside of the connecting link (9) to prevent the pull rod rattling in its socket.

Carburettor (see Fig. C.16).

Dustproofing. The whole carburettor is dustproofed, air passing through a vent passage to the float chamber and to the starter unit, through (u) to the idling circuit and through (a) to the main spraying circuit, from the same source as the main air supply, i.e., all through the air cleaner. This ensures a balanced mixture, and even though the air cleaner may become partially choked in service through neglect, fuel consumption would not be affected, but it must be borne in mind that such a restriction as imposed by a choked air cleaner will reduce the volume of air and consequently the mixture



Gg MAIN JET
a AIR CORRECTION JET
g PILOT (AUXILIARY) JET
u PILOT AIR BLEED
Gs STARTER PETROL JET
Sb STARTER AIR BLEED
Ga STARTER AIR DRILLING
Gp PUMP JET
C1 BLEED VALVE

1 AIR VALVE SPRING
2 STARTER PROGRESSION CHANNEL
3 STARTER MIXTURE INLET CHANNEL
4 CHOKE TUBE
5 MAIN SPRAYING ORIFICES
6 EMULSION TUBE
7 SPRAYING WELL
8 INJECTOR TUBE
9 NEEDLE VALVE
10 PUMP RETURN SPRING

11 PUMP MEMBRANE
12 PUMP LEVER
13 VOLUME CONTROL SCREW
14 IDLING ORIFICE
15 BY-PASS ORIFICE
16 THROTTLE VALVE
17 STARTER MIXTURE OUTLET CHANNEL
18 RESERVE WELL
19 STARTER DISC VALVE
20 STARTER AIR VALVE
21 STARTER UNIT OPERATING LEVER

Fig. C.16. Diagrammatic section of the carburettor.

which the engine can inspire and so lead to power loss. Air to emulsify the fuel passed through the starter petrol jet (Gs) is drawn from the main filtered air supply, via the float chamber.

Zero Progressive Fast-Idle Starter Unit. Operation of the starter unit is by rotation of the starter disc valve (19) connected via the operating lever (21) to the choke control. To start from cold (see also under "Use of the Controls for Engine Starting"), place the control in the full rich position, when the slot in the starter disc valve (19) aligns with the channels (3 and 17).

Suction created by cranking the engine draws fuel from the starter petrol jet (Gs), which emulsified by air from the starter air bleed (Sb) travels along the channel (3), across the slot in the disc valve (19) into the channel (17) and hence to the inlet manifold. As soon as the engine fires, suction increases and lifts the starter air valve (20) against the spring (1), admitting additional air through the starter air jet drillings (Ga).

When the engine starts, push the choke control back about one quarter of its travel, thus bringing the starter unit into the intermediate position (see also under "Use of the Controls for Engine Starting"), when the spring loaded ball engages the register in the operating lever (21). This movement rotates the starter disc valve (19), when the slot in the disc valve aligns with the channel (2), and the two small drillings, one in the valve and the second in the body, are brought into circuit to feed from the channel (3) into the channel (17) via the disc valve slot. Thus in this position the volume of mixture from channel (3) is considerably reduced and air is admitted to the capacity of the air jet drillings (Ga). Additional air is supplied **into** the starter unit through channel (2), supplementing the air drawn through the air jet drillings (Ga), via the elongations in the starter air valve.

The vehicle may now be driven away without difficulty although the engine is still cold, due to the engine depression acting on channel (2) when the throttle is opened, drawing an additional supply of mixture **out** from the starter unit, via the small drillings and the slot in the disc valve (19) into the channel (2) to meet the engine requirements. At the same time the depression acting on the outlet port (17) continues to draw mixture from the channel (3), which combines with the air drawn from the starter air jet drillings (Ga).

As the engine warms up, the choke control should be moved progressively towards the full off position. The rotation of the starter disc valve (19) gradually reduces the volume and richness of the mixture supplied through the small drillings and the slot in the disc valve (19), and together with the reduced area of the quadrant shaped outlet recess, have the effect of slowing the engine down as it warms up.

The degree of enrichment supplied by the mixture from the channel (2), decreases as the valve (19) is rotated from the intermediate position to the full off position. When the control is moved to the full off position, i.e., pushed fully home, the starter disc valve (19) rotates and blanks off the channels (3 and 17), thus placing the starter unit out of circuit.

The Idling Circuit. This circuit supplies through the idling orifice (14), the mixture required for idling when the engine is warm. It also provides through the by-pass orifice (15) the mixture required as the throttle valve is first opened, but before it opens enough for the main spraying orifices (5) to begin to discharge. This ensures smooth transfer from the idling circuit on to the main spraying system. Fuel is supplied from the reserve well (18), metered by the pilot jet (g), while the air bleed (u) provides pre-emulsion. When idling, emulsifying air is also drawn in through the by-pass orifice (15), the volume of all this mixture being controlled by a screw (13). On leaving the orifice (14) the emulsion is mixed with air passing round the throttle valve (16), this being held slightly open by an adjusting screw on an abutment plate at the end of the throttle spindle. As the throttle valve is opened, engine depression, or suction is directed to the by-pass orifice (15), which discharges additional mixture to balance the increased volume of air passing the throttle valve (16), until the valve has opened sufficiently for the main spraying system to come into operation.

The Main Spraying Circuit. As the throttle valve (16) is opened further, air speed through the venturi, or choke tube (4) increases and the depression acting on the orifices (5) draws fuel from the float chamber, through the main jet (Gg) into the spraying well via the reserve well (18). Simultaneously air enters the emulsion tube (6), via the correction jet (a) and passes out through the holes in the emulsion tube into the annulus, which forms the spraying well, where it emulsifies with the fuel and is discharged from the spraying orifices (5). As the engine speed increases the fuel level in the well (18) drops and uncovers the remaining holes in the emulsion tube, in this way additional air enters the fuel stream and corrects the output from the main jet according to engine speed and load.

The Accelerating Pump. The accelerating pump injects, from an injector (8) situated adjacent to the main spraying orifices (5), a small quantity of fuel into the main air stream to supplement the main jet output at the moment of acceleration.

The accelerating pump is mechanical in operation and consists of a pump membrane (11) and a pump spring (10) operating in a suitably designed chamber secured to the carburettor body by four screws. Fitted externally is a pump lever (12) and an actuating rod, the latter being the connecting link between the throttle spindle actuating lever and the pump lever (12).

On depressing the accelerator pedal the actuating rod and pump lever (12) displaces the pump membrane (11) against the pump spring (10) and in so doing forces fuel through the pump jet (Gp) and the pump injector (8) into the main air stream, ensuring a condition of rapid and smooth acceleration.

The bleed valve (Ci) acts as a metering device allowing fuel to bleed back to the float chamber during gradual accelerator pedal operation, when a supplementary supply of fuel is not required.

When the accelerator pedal is depressed sharply however, the volume of fuel displaced by the membrane (11) is greater than that allowed to bleed back to the float chamber. Due to the pre-determined ratio between the membrane displacement and the volume of fuel allowed to bleed back through the bleed valve (Ci), the correct amount of fuel will be injected into the main air stream according to the rate at which the accelerator pedal is depressed.

When the accelerator pedal is released, the pump spring (10) re-asserts itself, moving the membrane (11), thus allowing fuel to enter the accelerator pump chamber, via the bleed valve (Ci), in readiness for the next acceleration requirement.

The Float Chamber. The level of fuel in the float chamber is controlled by the slight rise and fall of the flat, closing, or opening the needle valve (9) to cut off, or admit fuel from the lift pump as required.

Oil Bath Air Cleaner (see Fig. C.17).

The oil bath type of air cleaner is fitted to these models and operates as follows:

Dust laden air enters the cleaner through the opening between the oil container and the top cover. It then passes downwards through the annular passage, striking the oil lying above the shelf, and then reverses upwards into the filter element through the opening. Any dirt, or grit which is not precipitated into the oil when the air reverses above the shelf is caught on the wetted mesh of the filter element and washed back into the oil container bowl sump, where it gravitates out of circulation to form a sludge. The cleansed air is sucked out through the filter element and the top cover, passing to the carburettor, via the connecting hose. The filter element is automatically oiled and washed by oil carried up by the incoming air.

The purpose of the shelf, above which the oil level rises approximately $\frac{1}{8}$ in. (3 mm.) is to regulate the quantity of oil that is drawn into the element and thereby prevent oil being drawn through the filter element and into the carburettor feed passage.

USE OF THE CONTROLS FOR ENGINE STARTING

Starting from Cold at Temperatures Below Freezing. Place the choke control in the "Full Rich" position (full out). DO NOT TOUCH THE ACCELERATOR PEDAL. Operate the starter motor. When the engine starts, push the choke control into the intermediate, position (located by a marked resistance to the push on the choke control). If the engine is to be warmed up stationary, wait for a few seconds and then push the choke control in, to a position between "Intermediate" and "Full Off", so that the engine is running at a "fast-idle" speed. If the vehicle is to be driven away at once, do so with the control in the "Intermediate" position, pushing the control in progressively after the vehicle is moving. The warmer the engine becomes the further the control can be pushed home. With the

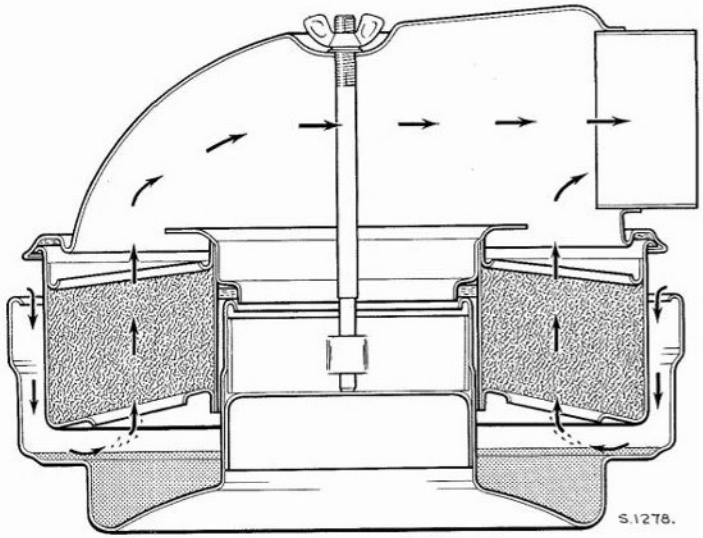


Fig. C.17. Air cleaner arrangement, showing the air flow

control just out from the "Full Off" position, a "fast-idle" is provided to prevent stalling in the first minutes of running, i.e., at traffic lights, or other compulsory stops. Push the control right home as soon as the engine will idle normally, thus preventing unnecessary wastage of fuel.

Starting from Cold at Temperatures Above Freezing. This may normally be carried out with the control in the "Intermediate" position. Soon after the engine has started the control should be pushed in progressively, a short distance at a time, so that a "fast-idle" is obtained. Push the control right home as soon as the engine will idle normally, thus preventing unnecessary fuel wastage.

Hot Re-starting. Do not use the choke control. If an immediate start is not obtained, keep the accelerator pedal partly depressed during the next attempt.

Important: Do not under any circumstances agitate the accelerator pedal, otherwise fuel will be delivered into the induction manifold from the mechanically operated accelerating pump, resulting in possible flooding of the engine.

ADJUSTMENT TO THE CARBURETTOR WHILST IN POSITION

Accelerator Linkage.

If the accelerator linkage is disturbed at any time, the rod between the linkage and throttle valve operating lever must be reset so that with the accelerator pedal closed, the throttle valve is also closed. To adjust proceed as follows:

1. Ensure that the accelerator pedal is in the closed position. This will normally be held closed by a spring.

2. The throttle valve must also be in the closed position. This is attained by lowering the operating lever as far as possible with the slow running adjustment screw (see Fig. C.22), screwed out so as not to foul the carburettor body. Ensure the stop on the inner cable of the hand throttle control does not restrict the closing of the throttle valve.

3. Disconnect the rod from the operating lever, and holding the lever in the position attained in para. 2, slightly depress the accelerator pedal, adjusting the ball joint at the lower end of the rod so that the upper end can be re-inserted into the operating lever without strain. Fit the thackeray and plain washers, and secure the operating rod using a new split pin. Check the operation of the accelerator linkage by depressing the accelerator pedal fully, ensuring that the throttle valve is fully open as indicated by the throttle maximum stop contacting the carburettor body.

4. Adjust the carburettor slow running and the hand throttle control as described below.

Carburettor Controls.

To Adjust—Choke Control. Connect and adjust this control as follows:

1. Secure the end of the outer cable in the abutment arm on the starter unit cover.

2. Place the starter unit operating lever in the position that it would occupy when the device is not in use, i.e., pushed rearward as far as possible.

3. Pull the operating knob away from the instrument panel about $\frac{1}{8}$ in. (3 mm.) then connect the cable to the operating lever.

4. Check the "choke" operating positions as follows:

(*a*) Pull the operating knob out to its full extent and check that the starter operating lever is against its front stop.

(*b*) Press the operating knob towards the instrument panel, noting that resistance is felt in the approximate intermediate position.

(*c*) Press the operating knob fully home and check that the starter operating lever is against its rear stop.

To Adjust—Hand Throttle Control. With the control knob screwed right home and the accelerator pedal in the closed position, connect this cable to the throttle operating lever in the following manner:

1. Secure the outer cable screwed ferrule to the abutment bracket with the nuts.

2. Thread the inner cable through the throttle lever barrel.

3. Fit the stop to the inner cable so as to give a clearance of approximately $\frac{1}{16}$ in. (1·5 mm.) between the stop and the barrel on the throttle operating lever.

To Adjust—Slow Running. The slow running adjustment is effected by making alternate adjustments to the setting of the slow running adjustment screw and the mixture, or volume control screw (see Fig. C.22). Before commencing it is necessary to have the engine well warmed up.

The Slow Running Adjustment Screw is mounted on the throttle abutment plate and limits the closing of the throttle valve, thereby determining the idling speed of the engine. By screwing it in, the engine speed will increase, and vice versa.

The Mixture, or Volume Control Screw is the spring-loaded knurled-headed screw in the throttle chamber. As its name implies, it enriches, or weakens the idling mixture, by anti-clockwise, or clockwise rotation, i.e., screwing outwards to enrich and vice versa.

Too weak a mixture is recognised by the irregular behaviour of the engine, and the tendency to stall. Over-richness will cause the engine to "hunt" and tend to stall when the "hunt" becomes excessive.

To co-ordinate the two controls, proceed as follows:

1. **With the engine thoroughly warmed up** and still running, screw in the slow running adjustment screw slightly, to increase the engine speed.

2. Unscrew the volume control screw until the engine begins to "hunt", then screw it in progressively until the engine fires evenly.

3. Unscrew very slowly the slow running adjustment screw to decrease the engine speed to approximately 500 r.p.m. Do not attempt to run the engine at too low a speed.

4. If the engine "hunts" slightly, screw in the volume control screw a little further. **In no case should the screw be screwed right home.**

Note: Before attempting to adjust the idling setting, it is essential to check the condition of the sparking plugs and adjust the plug gaps carefully, also the contact breaker points.

FUEL TANK

To Remove.

1. Drain the contents of the tank at the plug provided into a suitable clean container.

Note: If a tank is being removed for cleaning purposes leave about $\frac{1}{2}$ gallon (2 litre) of fuel in the tank and refit the plug.

2. Disconnect the filler hose from the tank filler pipe, after releasing the hose clips.

3. Disconnect the fuel feed pipe from the suction pipe union on the rear face of the tank.

4. Ensure that the ignition switch is in the "off" position, then disconnect the cable from the fuel gauge unit at the connector provided.

5. Support the tank and unscrew the locknuts from the setscrews, which clamp the top and bottom straps. Ease the straps clear, and lift away the tank.

To Dismantle.

1. Remove the tank gauge unit after withdrawing the screws securing the unit in position. When lifting out the gauge unit, be careful not to damage the float, or arm, as this would cause a false reading on the fuel gauge on re-assembly.

2. Release the filler neck and hose from the body side panel if necessary, after slackening the appropriate hose clips.

3. The blanking plug and washer on the upper face of the tank need not be removed unless replacements are necessary.

Inspection and Overhaul.

1. Clean the tank thoroughly internally and externally. The former is most important and can be accomplished by shaking the tank vigorously with approximately $\frac{1}{2}$ gallon (2 litre) of fuel inside, then still swirling the fuel from side to side in the tank, drain away all the fuel and blow out the tank with compressed air. After cleaning the tank inspect it for splits and other damage.

2. Blow through the suction pipe to ensure that it is clear of obstructions.

3. Examine the filler neck and the filler hose for signs of damage, or deterioration and renew as necessary.

4. Ensure that the breather pipe is clear of obstructions, using a suitable length of stiff wire and finally blowing through with compressed air.

To Re-assemble.

1. Fit the gauge unit to the tank using a new gasket, so that the cable connector on the unit faces rearward when fitted to the tank.

2. Assemble the filler neck, and the filler hose to the body side panel.

3. Ensure that the sealing washers on the blanking and drain plugs are in good condition, renewing if necessary.

To Refit.

Refit the tank by reversing the removal procedure, ensuring that the strips of felt are in position between the supports and the tank. Do not overtighten the straps as this is liable to distort the tank.

FUEL LIFT PUMP

To Test in Position.

1. Disconnect the delivery pipe to the carburettor at the pump end, leaving a free outlet from the pump.

2. Rotate the engine, when there should be a well defined spurt of fuel from the outlet union for every two revolutions of the engine crankshaft.

3. If the lift pump should fail to deliver fuel to the carburettor the following points must be first checked before removing the lift pump from the engine:

(*a*) That fuel is available in the tank and the unions on the pipe from the tank to the lift pump are fuel tight.

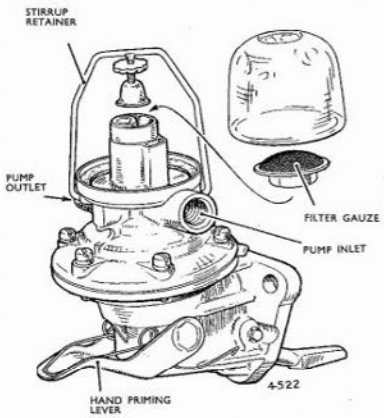


Fig. C.18. Removing the filter bowl and gauze

(*b*) The lift pump filter gauze is clean and that the gasket seating the sediment bowl is in good condition and not hard, or otherwise deteriorated (a defective gasket will allow air to enter the pump). Renew the gasket if necessary.

(*c*) The action of the lift pump, if still uncertain in operation, entails the removal of the pump from the engine for detailed examination and overhaul.

To Clean the Filter Gauze and Glass Sediment Bowl.

1. Slacken the securing nut on the stirrup retainer, swing the retainer to one side and remove the glass sediment bowl.

2. Remove the filter gauze and the bowl gasket from the lift pump cover. Wash the filter gauze in clean fuel and blow dry with compressed air. Thoroughly clean the filter bowl and the cover recess to remove all sediment present and ensure that the bowl gasket seating on the pump is free of all foreign matter.

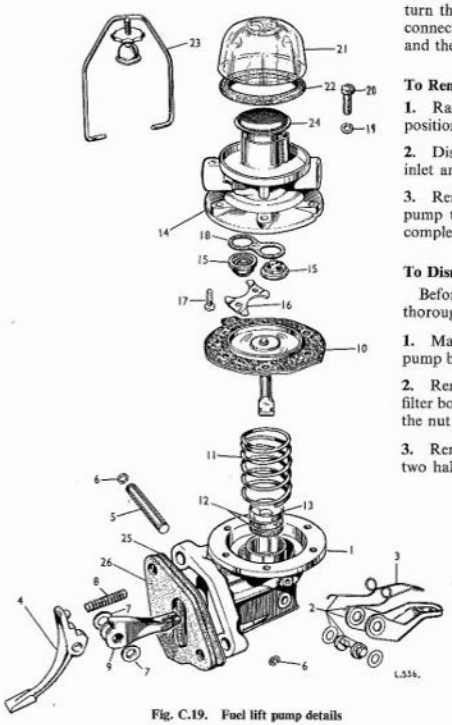


Fig. C.19. Fuel lift pump details

3. Refit the bowl gasket and the filter gauze on to their respective seatings, noting that the gasket must be renewed if hard, or deteriorated in any way. Place the filter bowl in position and secure by means of the stirrup retainer. Tighten the securing nut just sufficiently to make a tight sealing joint, as excessive tightening will cause a rapid deterioration of the bowl gasket.

Hand Priming Lever.

The hand priming lever shown in Fig. C.18 is for use when, for any reason, the carburettor float chamber, or pump bowl has been drained, or become empty. A few upward strokes on the priming lever on these occasions will fill the float chamber with fuel and ensure easy starting, without prolonged use of the starter unit and consequent excessive current drain on the battery.

Owing to the special construction of the pump it is impossible to overfill the carburettor, and after several strokes on the priming lever this will become free indicating that the carburettor float chamber is full. Should it be found that the hand primer will not operate, turn the engine one revolution, thus freeing the pump connecting link mechanism from the pump rocker arm and the eccentric on the engine camshaft.

To Remove.

1. Raise the bonnet (hood) and secure in the open position.

2. Disconnect the fuel pipes from the unions on the inlet and outlet passages of the pump.

3. Remove the two nuts and washers securing the lift pump to the cylinder block and lift away the pump, complete with the joints and the heat insulator.

To Dismantle.

Before commencing to dismantle the lift pump, thoroughly clean the exterior surfaces of foreign matter.

1. Make a file mark across the two flanges of the pump body for location purposes on re-assembly.

2. Remove from the cover of the pump assembly, the filter bowl, gasket and filter gauze, after first unscrewing the nut and swinging the stirrup retainer to one side.

3. Remove the six securing screws and separate the two halves of the pump assembly.

1 LIFT PUMP BODY
2 PUMP HAND PRIMING LEVER DETAILS
3 PRIMING LEVER RETURN SPRING
4 ROCKER ARM
5 ROCKER ARM PIN
6 PIN RETAINING CLIPS
7 PIN PACKING WASHERS
8 ROCKER ARM SPRING
9 ROCKER ARM CONNECTING LINK
10 DIAPHRAGM ASSEMBLY
11 DIAPHRAGM SPRING
12 DIAPHRAGM ROD OIL SEAL DISCS
13 OIL SEAL RETAINING CUP
14 LIFT PUMP COVER
15 VALVE ASSEMBLY
16 VALVE RETAINING PLATE
17 RETAINING PLATE SCREW
18 VALVE RETAINING GASKET
19 and 20 PUMP COVER SECURING SCREW AND WASHER
21 GLASS FILTER BOWL
22 FILTER BOWL GASKET
23 BOWL STIRRUP RETAINER

4. Turn the diaphragm unit through an angle of 90°, when the pull rod may be disconnected from its securing slot in the connecting link and withdrawn. Remove the diaphragm spring.

Note: Do not attempt to separate the diaphragm layers.

5. Remove one of the spring retaining clips from the rocker arm pin and withdraw the pin.

6. The rocker arm spring and the packing washers, together with the rocker arm and the connecting link may now be removed from the body.

7. Withdraw the valve retainer screws from the inside of the cover of the pump assembly and remove the retaining plate, valve assemblies and valve retaining gasket.

Inspection and Overhaul.

Thoroughly clean all parts in clean paraffin, then proceed as follows:

1. Check the diaphragm for hardening, or cracking. If it shows signs of either of these conditions, it must be renewed.

2. Where any part of the hand priming mechanism is broke the complete set of parts must be renewed, the other ends of the spindle being riveted over on original assembly to locate the various components. The priming lever return spring is renewable separately.

3. Examine the rocker arm, connecting link, and the rocker arm pin for signs of wear. If badly worn, renew. The rocker arm pin should be a light interference fit in the pump body. Check the condition and tension of the rocker arm return spring and renew as necessary. Mate the coupling on the end of the diaphragm pull rod with the slot provided in the connecting link, and ensure that the tension of the spring blade is such as to hold the pull rod end in firm contact with the connecting link, thus eliminating any noise from this point during operation.

4. Examine the diaphragm rod oil seal discs in the bottom half of the pump body for deterioration and renew if necessary, in the following manner:

(*a*) Relieve the staking securing the oil seal retaining cup in the body.

(*b*) Prise out the retainer and remove the two layers of the seal.

(*c*) Fit the new pair of oil seal discs and also a new retainer, if the original part was damaged during removal operations. Stake over the body metal in four places to secure the retainer in position.

5. The valve assemblies cannot be dismantled, but should be tested for an air-tight seal by suction, and renewed, if necessary.

6. Test the diaphragm spring, although this part very rarely requires renewal. When renewing the spring ensure that the replacement is of the same colour and consequently the same strength as the original.

7. All gaskets should be renewed as a matter of routine.

To Re-assemble.

1. Assemble the valve retainer gasket, the valves and the valve retainer, then secure in position with the two retaining screws.

2. Locate the connecting link, the packing washers, the rocker arm and the rocker arm return spring in the pump body. Insert the rocker arm pin through the aperture in the pump body, at the same time engaging the packing washers, connecting link and rocker arm. Secure the pin in the body with the two spring retaining clips.

Note: Fitting of the rocker arm pin can be simplified if a piece of rod ·24 in. (6 mm.) in diameter is inserted through the pin hole in one side of the pump body so as to engage the components, then push the rocker arm pin into position from the opposite side.

3. Position the diaphragm spring in the pump body.

4. Place the diaphragm unit over the spring (pull rod downwards) and centre the upper end of the spring in the lower cup of the diaphragm unit.

5. Press downwards on the diaphragm at the same time turning the assembly to the left in such a manner that the slots on the pull rod engage the forked end of the connecting link, ultimately turning the unit a complete quarter turn to the left. This procedure correctly positions the pull rod in the connecting link, and at the same time permits the alignment of the holes in the diaphragm with those in the pump body flange.

Note: When first inserted the diaphragm should be at the position shown in Fig. C.20, after turning the diaphragm unit through 90° to the left, the "tab" should align with the lug on the pump body and be in the position shown by the dotted lines.

6. The two sub-assemblies of the lift pump are now ready for fitting together and this is carried out as follows:

(*a*) Push the rocker arm towards the pump body until the diaphragm is level with the body flange.

(*b*) Place the cover of the pump into the correct position as shown by the mark made on the flanges before dismantling.

(*c*) Install the cover securing screws and spring washers and tighten the screws until the heads just engage the spring washers.

(*d*) Continue to push the rocker arm firmly towards the pump body so as to hold the diaphragm at the bottom of the stroke, and while held in this position, finally tighten the cover securing screws alternately and securely. After assembly, the edges of the

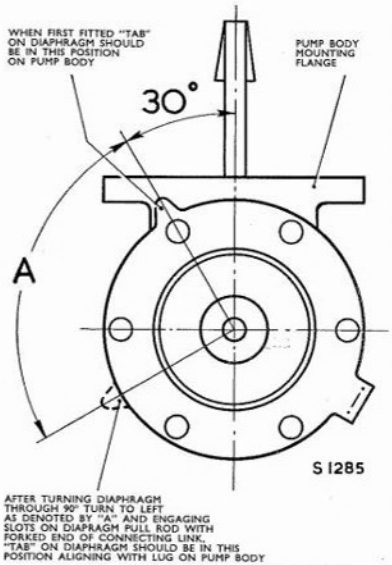


Fig. C.20. Fitting the diaphragm to the pump body

diaphragm should be roughly flush with the outer edges of the two clamping flanges. Any appreciable protrusion of the diaphragm indicates incorrect fitting, in which case the securing screws must be released, and special care paid to maintaining inward pressure on the rocker arm, while the securing screws are re-tightened alternately and securely.

7. Refit the filter gauze, a new gasket and the filter bowl to the cover, ensuring that an air-tight joint results between the bowl and the gasket.

Testing the Fuel Lift Pump after Re-assembly.

To carry out this operation refer to the instructions given under the identical heading on page C.11.

To Refit.

To install the fuel lift pump, reverse the removal procedure, using new joints to face the heat insulator, positioned between the pump and the cylinder block, noting the following points:

1. Ensure that the rocker arm bears correctly against the camshaft eccentric, otherwise the rocker arm may become trapped when the pump securing nuts and washers are tightened.

2. After refitting the pump, hand prime at the lever provided, to fill the glass bowl and the carburettor float chamber. Run the engine for a short time and examine the pipe unions on the lift pump for the possibility of fuel leakage.

3. From the foregoing description of the operation of the lift pump it will be appreciated that the pressure of fuel at the carburettor is determined by the spring (11, see Fig. C.19), and the further this spring is compressed the greater will be the pressure. All parts of the lift pump and the cylinder block are machined to definite limits. It will, however, be appreciated that circumstances might arise in which all the lower limits exist on one particular engine, with the result that the spring will be compressed on the downward stroke to a greater extent than is normal, resulting in an excess pressure at the carburettor.

Excessive fuel lift pump pressure can be a cause of heavy fuel consumption. This can be checked and if necessary rectified, as follows:

(*a*) Disconnect the pipe to the carburettor at the lift pump.

(*b*) A suitable pressure gauge calibrated up to 6 lb./sq. in. (·5 kg./sq. cm.) should then be connected to, and as near as possible on the same level with, the outlet union on the lift pump.

(*c*) Rotate the engine on the starter unit, when a reading of 2½ to 3½ lb./sq. in. (·176 to ·246 kg./sq. cm.) should be recorded on the gauge.

(*d*) To remedy excessive fuel pump pressure, it is advisable to first overhaul the fuel lift pump in order to ensure that the diaphragm has not stiffened in service.

Should the diaphragm condition be satisfactory on inspection, additional flange gasket(s), may be inserted between the pump flange and the cylinder block on refitting, until the correct pump delivery pressure of 2½ to 3½ lb./sq. in. (·176 to ·246 kg./sq. cm.) is obtained. As a general guide each additional packing reduces the outlet pressure by ½ lb./sq. in. (·035 kg./sq. cm.).

Care should be taken to avoid the use of excessive numbers of joints as packings because this will lead to starvation under full throttle conditions. Always check the pressure reading on completion of the packing operation.

Important: It must be clearly understood that the actual mounting on the engine affects the output pressure of the pump and thus these tests cannot be carried out unless the pump is mounted in its normal position. The use of jigs, or other fixtures for testing AC-Delco pumps will not necessarily give the same results.

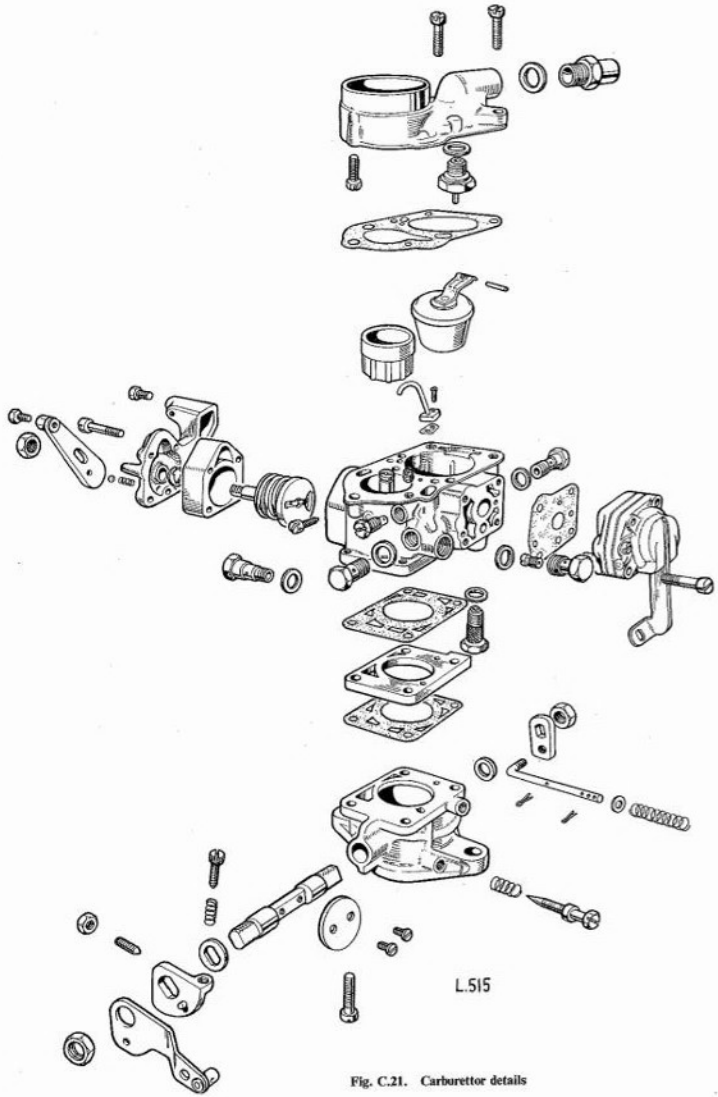


Fig. C.21. Carburettor details

CARBURETTOR

To Remove.

1. Raise the bonnet (hood) and suitably support in the open position.

2. Slacken the hose clips, remove the rubber hose from the carburettor and after freeing the hose from the rocker cover breather pipe and the air cleaner cover, withdraw the hose from the vehicle.

3. Disconnect the distributor vacuum pipe at the union in the carburettor throttle chamber.

4. Release the split pin that secures the operating rod to the carburettor throttle operating lever, withdraw the plain and thackeray washers, and disconnect the operating rod from the lever. Observe the location of the washers so that they may be re-assembled in their original positions.

5. Release the choke inner cable from the starter unit operating lever and also release the cable outer casing from the abutment arm integral with the starter unit cover.

6. Remove the stop on the end of the hand throttle control inner cable and the setscrew securing the cable abutment bracket to the cast carburettor adaptor. Position the hand throttle control and abutment bracket clear of the manifold.

7. Remove the nuts securing the carburettor to the studs on the cast adaptor, and then lift away the carburettor and joint.

8. Remove the cast carburettor adaptor as required from the manifold, after releasing the nuts and washers. Separate the joint.

To Dismantle (see Fig. C.21).

1. Remove the three setscrews securing the float chamber cover, which can then be lifted clear. If desired, the pilot jet air bleed can be removed from the top face of the carburettor body, whilst the needle valve may be unscrewed from the float chamber cover.

2. Lift away the float chamber cover gasket. It is advisable to renew this gasket at overhaul periods.

3. Withdraw the float and arm assembly, together with the float arm spindle from the float chamber.

4. Unscrew the air correction jet and invert the carburettor, when the emulsion tube will drop out.

5. Remove the split pin securing the actuating rod to the pump lever. Remove the four securing screws, one at each corner of the accelerating pump, and withdraw the pump unit together with its gasket from the carburettor body.

Note: The two screws, one at each side of the pump, hold the components together and should not be removed. If the pump is found to be faulty in operation, it must be renewed as a complete unit.

6. Remove the nut and lift away the accelerating pump actuating lever, complete with the rod and spring, from the throttle valve spindle, also the flat washer.

7. Remove the pump jet, the starter petrol jet, economy jet blank and the bleed valve assembly, together with their seating washers.

Note: The economy jet blank is the hexagon headed plug fitted adjacent to the accelerating pump at the front of the carburettor.

8. Remove the pilot jet and the main jet carrier with its seating washer. The main jet can be unscrewed from its carrier.

9. Remove the injector tube assembly, complete with the non-return ball valve, after releasing the securing screw and withdraw the tube assembly seating washer from the recess in the top face of the carburettor body.

10. Unscrew the four screws securing the throttle chamber to the body then separate the two components, together with the heat insulating washer and the two gaskets.

11. Remove the choke tube locating screw, and from the bottom of the carburettor body push out the choke tube.

12. Remove the four screws, one at each corner of the starter unit, and remove the unit.

To dismantle proceed as follows:

(*a*) Remove the locknut securing the starter operating lever to the spindle, when the locating steel ball and spring will be released.

(*b*) Separate the cover from the starter unit body, remove the circlip from the spindle, and withdraw the disc valve assembly from the starter unit body. It should be noted that the disc valves are held on the spindle by peening, and no attempt must be made to separate these components. If trouble is suspected with this unit it must be renewed as a complete assembly.

13. Remove the nut from the throttle spindle and lift away the throttle lever, the throttle abutment plate and the flat washer.

14. It is not advisable to remove the throttle valve from the throttle chamber as the screws securing the throttle valve are peened over. Should, however, removal become necessary, release the two securing screws and withdraw the throttle valve through the bore of the throttle chamber, which will allow the spindle to be withdrawn.

Inspection and Overhaul.

1. All jets and internal ducts must be clear and where possible clear them with compressed air.

Do not use wire, or similar material for this purpose.

2. Clean the float chamber, removing all trace of sediment.

3. Examine the float which must be free from dents and punctures. Renew if faulty.

4. Check the needle valve. If the needle sticks in the body, or any other fault is apparent, renew as a complete unit.

5. Check the volume control screw. If visible signs of "scoring" are apparent on the tapered portion, the screw should be renewed.

6. If the throttle valve spindle is a slack fit in the throttle chamber housing, it will invariably be found that there is also wear inside the throttle chamber, which will necessitate the renewal of the throttle chamber assembly complete.

7. If on inspection the accelerating pump is faulty in operation, or leakage is evident, the pump must be renewed as a complete unit.

8. Inspect the pump actuating rod spring and renew if weak or broken.

9. Check the carburettor mounting flange for distortion and true if necessary.

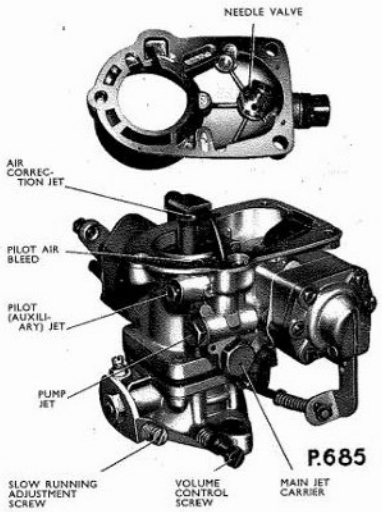


Fig. C.22. Rear view of the carburettor, showing the jets and slow running adjustment screws

10. Renew all the gaskets and fibre washers and ensure that when fitting, all traces of the original gaskets are removed.

To Re-assemble.

To re-assemble the carburettor reverse the dismantling procedure observing the following:

1. The hole in the throttle lever must mate with the dowel on the abutment plate.

2. When re-assembling the jets, ensure that the jet seating washers are in position.

3. When locating the starter operating lever on to the flats of the disc valve spindle, ensure that the quadrant shaped recess in the starter disc valve is positioned furthest away from the cable fixing on the operating lever (see Fig. C.23).

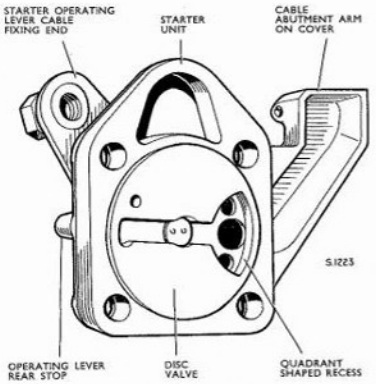


Fig. C.23. The starter unit, showing the correct re-assembly position of the disc valve in relation to the starter operating lever

4. If the throttle valve and spindle have been removed, it will be necessary to renew the securing screws and spindle due to stripped threads. Ensure that the new securing screws are peened over after fitting, to prevent any possibility of their loss into the induction manifold.

5. Ensure that the heat insulating washer is correctly positioned between the throttle chamber and the carburettor body, i.e., the two small holes in the washer must align with the corresponding holes in both assemblies. Also assemble the new gaskets above and below the heat insulating washer.

6. Fit the flat washer to the rear projection of the throttle spindle, then secure the throttle abutment plate and the throttle lever to the throttle spindle.

7. Fit the flat washer to the front projection of the throttle spindle, engage the actuating rod with the slot

in the pump lever and then secure the accelerating pump actuating lever on to the throttle spindle so that the lever end carrying the actuating rod is positioned towards the carburettor mounting flange. Ensure that the washer and the spring (located with the larger diameter coiled end outwards to abut the pump lever) are in position on the actuating rod prior to fitting. Finally secure the actuating rod in the pump lever using a new split pin positioned in the outermost hole in the rod.

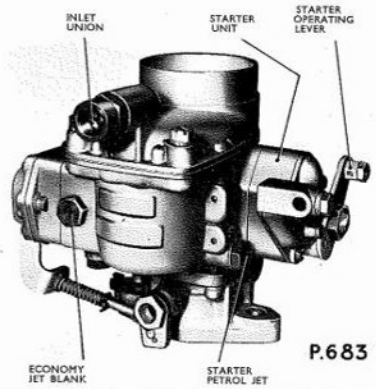


Fig. C.24. Front view of the carburettor, showing the jets and starter unit.

8. At this stage before refitting the float chamber cover, check the pump operation by filling the float chamber with fuel and manually operating the accelerating pump lever. A jet of fuel will be seen to emerge from the injector tube assembly with each operation of the pump lever. If this does not occur, check the bleed and non-return valves for correct operation and the passages for blockage.

9. When fitting the float chamber cover gasket, ensure that the holes in the gasket align with the corresponding holes in the cover and body components.

To Refit.

Reverse the removal procedure, noting the following:

1. Fit a new joint between the cast adaptor and the inlet manifold face, and between the cast adaptor and the carburettor flange, ensuring that the mating faces are clean.

2. Re-connect the choke control and the hand throttle control, and adjust as detailed on page C.24.

3. Check the throttle linkage for lost motion on completion of the refitting operation.

4. Finally start the engine and when thoroughly warm, adjust the slow running, as detailed on page C.24.

OIL BATH AIR CLEANER

The oil bath type of air cleaner is fitted as standard equipment on all KAL Models and is bracket mounted to the scuttle on the right hand side.

To Clean and Re-oil the Air Cleaner.

The intervals at which the air cleaner needs to be serviced will vary according to the conditions under which the vehicle is operating. For town work, or areas where the roads are good, every 6,000 mile (9,000 km.) can be taken as a guide for servicing the air cleaner, although in territories where the roads are bad and dust is prevalent, servicing should be carried out more frequently.

1. Slacken the two clips securing the rubber hose (air cleaner to carburettor) and remove the hose, freeing at the same time the rocker cover breather pipe.

2. Remove the nut and bolt securing the air cleaner in the strap of the support bracket, and lift away the air cleaner assembly.

3. Release the wingnut in the top cover recess. Lift away from the oil container, the top cover and filter element.

4. Rinse the filter element in clean petrol (gasoline), or paraffin (kerosine), and then dry thoroughly by blowing through the element gauze with compressed air, in the reverse direction to the normal air flow. Inspect the joint at the head of the element centre tube and renew if deteriorated in any way.

5. Empty the oil from the container and clean out any sediment collected in the sump of the oil container.

6. Refill the container with the recommended grade of clean engine oil to the level indicated on the inside, by the arrow.

7. Install the element. It is not necessary to oil the element as this is done automatically when the engine is re-started.

8. Locate the top cover in position using a new joint if the old one has deteriorated. Tighten the wingnut only until the cover and element joints are seated. Do not over-tighten, or distortion of the components may result, together with the rapid deterioration of the joints.

9. Refit the air cleaner to the support bracket. Reconnect the air cleaner outlet hose. Secure the air cleaner in the support bracket, do not over-tighten the strap, but tighten only until the air cleaner is gripped.

To Remove.

1. Raise the bonnet (hood) and suitably support in the open position.

2. Slacken the two clips securing the rubber hose (air cleaner to carburettor) and remove the hose, freeing at the same time the rocker cover breather pipe.

3. Remove the nut and bolt securing the air cleaner in the strap of the support bracket and lift away the air cleaner assembly.

Overhaul.

1. Release the wingnut in the top cover recess. Lift away from the oil container, the top cover and filter element.

2. Rinse the filter element in clean petrol (gasoline), or paraffin (kerosine), and then dry thoroughly by blowing through the element gauze with compressed air, in the reverse direction to the normal air flow. Inspect the joint at the head of the element centre tube and renew if deteriorated in any way.

3. Empty the oil from the container and clean out any sediment collected in the sump of the oil container.

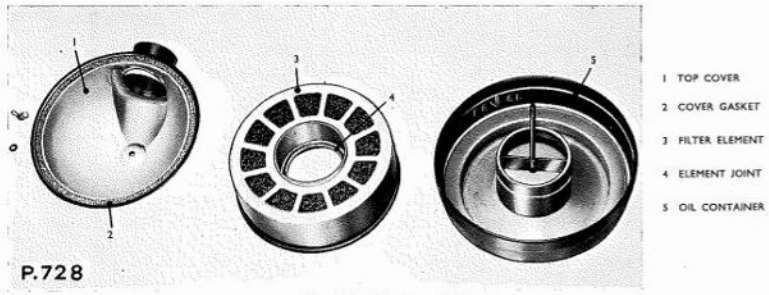


Fig. C.25. Air cleaner details

4. Refill the container with the recommended grade of clean engine oil to the level indicated on the inside, by the arrow.

5. Install the element. It is not necessary to oil the element as this is done automatically when the engine is re-started.

6. Locate the top cover in position using a new joint if the old one has deteriorated. Tighten the wingnut only until the cover and element joints are seated. Do not over-tighten, or distortion of the components may result, together with the rapid deterioration of the joints.

To Refit.

Reverse the removal procedure, but do not over-tighten the support strap, tighten only until the air cleaner container is gripped.

ACCELERATOR LINKAGE

The accelerator pedal shaft is centrally supported in the hollow shaft of the pedal group on R.H.D. Models, whilst on L.H.D. Models the accelerator pedal incorporates a bushed boss and is mounted on the shaft of the pedal support bracket. The accelerator relay shaft and bracket assembly is mounted on the right hand front engine mounting leg, and on L.H.D. Models only, a cross-shaft is secured to the cylinder head above the clutch housing.

To Remove and Dismantle.

Raise the bonnet (hood) and secure in the open position. Release the internal engine cowl from its anchorage.

On **R.H.D. Models** disconnect and remove the accelerator linkage, proceeding as follows:

1. Release the throttle return spring from its locations.

2. Remove the operating rods, carburettor throttle lever to relay shaft, and relay shaft to accelerator pedal at the ball joints, observing in the case of the connection, operating rod to throttle lever, that the split pin must be removed before the rod can be disconnected. It is important to note the location of the plain and thackeray washers, in order to facilitate their correct positioning on re-assembly. When removing the operating rod (relay shaft to accelerator pedal), observe for assembly purposes that the spring anchor plate is secured by the rod ball joint on the accelerator pedal lever.

3. Release the relay shaft bracket from its location on the front engine mounting leg and lift away complete with the relay shaft and levers.

4. Remove the Mills pin from the relay lever, and withdraw the shaft and lever assembly, thus freeing the relay lever and the washers. The angular position of the levers must be noted so that the new components may be similarly located and drilled, also observe the position of the plain and thackeray washers in order to ensure correct re-assembly.

5. Release the pedal pad from the accelerator pedal.

6. Tap out the Mills pin securing the lever to the inner end of the accelerator pedal shaft, remove the lever and withdraw the distance piece. The angular position of the lever in relation to the accelerator pedal must be noted,

in order to ensure correct assembly and location when drilling the new components. Lower the accelerator pedal through the toe panel and from beneath the vehicle, withdraw the accelerator pedal shaft outward from the pedal support bracket.

7. It should be noted that the accelerator pedal shaft is supported in two bushes, one pressed in each end of the pedal support bracket shaft. If wear exists on these bushes, the pedal support bracket must be removed and overhauled, proceeding as follows:

(*a*) Remove the clutch pedal from the support bracket as detailed in the "Clutch and Propeller Shaft" section, under the sub-heading "Clutch Pedal and Linkage—R.H.D. Models".

(*b*) Remove the brake pedal from the support bracket (see "Brakes" section).

(*c*) Release the brake master cylinder supply pipe from the clip on top of the pedal support bracket.

(*d*) Release the pedal support bracket and shaft assembly from the frame sidemember and lift clear.

(*e*) To withdraw the internal bushes from the pedal shaft, screw a suitable size tap into each worn bush in turn to provide a purchase for extraction.

(*f*) The new bushes must be pressed into the shaft, ensuring that each bush in pressed in flush with the end of the shaft.

Note: Completely immerse the new bushes in thin oil for 24 hours prior to fitting to allow the pores of the new bushes to fill with lubricant. Do not ream the bushes after fitting, otherwise the lubricating properties of the bushes will be destroyed.

(*g*) If wear is evident on the outer diameter of the pedal shaft, the shaft and bushes may be renewed as an assembly, pressing the new shaft and bush assembly into the support bracket to the dimensions as detailed under the sub-heading "Clutch Pedal and Linkage—R.H.D. Models", in the "Clutch and Propeller Shaft" section.

On **L.H.D. Models** disconnect and remove the accelerator linkage in the following manner:

1. Release the throttle return spring from its locations.

2. Remove the operating rods, carburettor throttle lever to relay shaft, relay shaft to cross-shaft, and cross-shaft to accelerator pedal, at the ball joints. Observe in the case of the connection, operating rod to throttle lever, that the split pin must first be removed before the rod can be disconnected. It is important to note the location of the plain and thackeray washers in order to facilitate their correct positioning on re-assembly. When removing the operating rod (relay shaft to cross-shaft), observe for assembly purposes that the spring anchor plate is secured by the rod ball joint on the cross-shaft lever.

3. Release the relay shaft bracket from its location on the front engine mounting leg and lift away complete with the relay shaft and levers.

4. Remove the Mills pin from the relay lever and withdraw the shaft and lever assembly, thus freeing the relay lever and the washers. The angular position of the levers must be noted so that the new components may be similarly located and drilled, also observe the position of the plain and thackeray washers in order to ensure correct re-assembly.

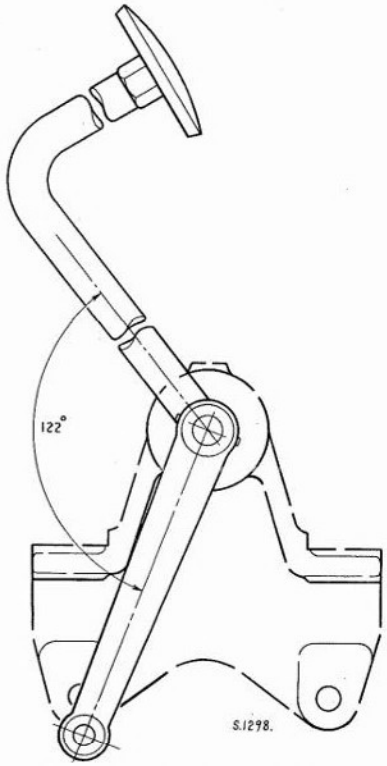


Fig. C.26. Accelerator pedal assembly, showing the angular disposition of the relay lever (R.H.D. Models)

5. Release the cross-shaft brackets from their mountings on the cylinder head, and lift away the brackets complete with the cross-shaft.

6. Tap out the Mills pin securing the lever to the outer end of the accelerator cross-shaft and slide off the lever and the right hand shaft support bracket. The angular position of the lever in relation to the cross-shaft set must be noted in order to ensure correct assembly and location for drilling the new components. Remove the split pins securing the cross-shaft left hand support bracket, and then withdraw the shaft from the bracket, noting the location of the one thackeray and two plain washers to facilitate correct re-positioning on assembly.

7. Remove the clutch relay shaft and clutch pedal as detailed in the "Clutch and Propeller Shaft" section under the sub-heading "Clutch Pedal and Linkage—L.H.D. Models. Lower the accelerator pedal through the toe panel when it is possible from beneath the vehicle to withdraw the accelerator pedal from off the inner end of the pedal support bracket shaft.

8. Examine the accelerator pedal bush for wear, and if wear is evident, renew, pressing in the new bush until flush with the ends of the pedal boss.

Note: Completely immerse the new bush in thin oil for 24 hours prior to fitting to allow the pores of the new bush to fill with lubricant. Do not ream the bush after fitting, otherwise the lubricating properties of the bush will be destroyed.

9. Inspect the support bracket shaft for wear over the area, on which the accelerator pedal operates, renewing the shaft if necessary as detailed under the sub-heading "Clutch Pedal and Linkage—L.H.D. Models", in the "Clutch and Propeller Shaft" section, observing that the new shaft is pressed into the support bracket to the dimension given.

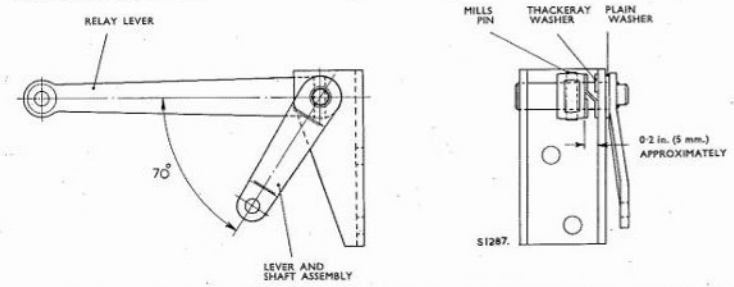


Fig. C.27. Accelerator relay shaft arrangement, showing the angular disposition of the relay levers (R.H.D. Models)

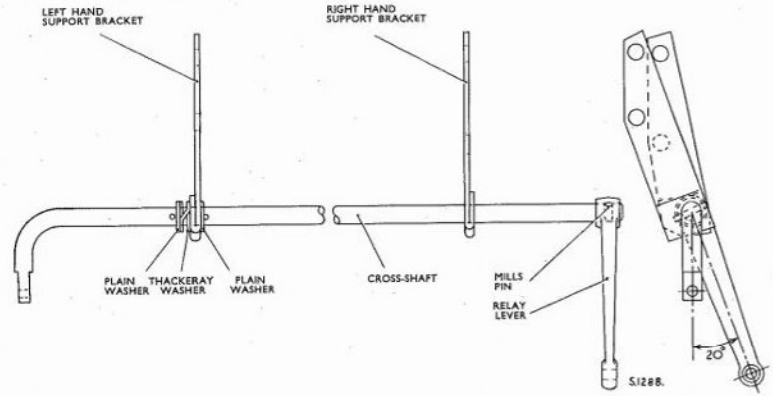


Fig. C.28. Accelerator cross-shaft arrangement, showing the angular disposition of the relay levers (L.H.D. Models)

To Re-assemble and Refit.

On **R.H.D. Models** these operations are a reversal of the removal procedure, noting the following points:

1. When the accelerator pedal shaft is in position ensure that the distance piece is located over the inner end of the shaft, and that the lever assumes the correct angular position as noted during dismantling operations (see Fig. C.26). Drill the lever and shaft, securing the components using a Mills pin.

2. Assemble the relay lever, and the shaft and lever assembly to the support bracket, ensuring that the levers assume the correct angular position (see Fig. C.27). Drill the relay lever and shaft, securing the components using a Mills pin. The location of the relay lever should be such as to compress the thackeray washer to approximately ·2 in. (5 mm.). The plain washer should be positioned on the outside of the bracket abutting the shaft lever.

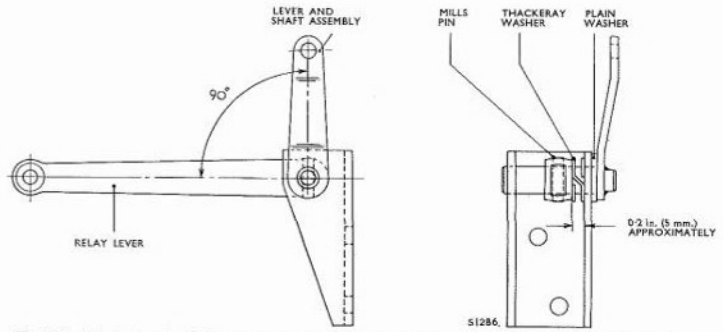


Fig. C.29. Accelerator relay shaft arrangement, showing the angular disposition of the relay levers (L.H.D. Models)

3. Use new split pins when assembling the operating rod to the carburettor throttle lever and ensure that the thackeray and plain washers are located in their original positions. Ensure that the spring anchor plate is secured on the operating rod ball pin which locates in the accelerator pedal lever.

4. Locate the return spring between the anchor plate positioned on the accelerator pedal lever and the return spring bracket on the chassis sidemember.

5. Check and adjust the linkage on completion to eliminate any lost motion as detailed on page C.24.

6. Check and if necessary adjust the brake and clutch pedal movement, referring to the appropriate sections.

To re-assemble and refit the accelerator linkage on **L.H.D. Models,** reverse the removal procedure, observing the following:

1. Ensure when refitting the clutch relay shaft and clutch pedal, that a plain washer is refitted between the relay shaft lever and the accelerator pedal, and between the clutch and brake pedals.

2. Use new split pins when re-assembling the cross-shaft to the left hand support bracket, ensuring that the thackeray and plain washers are located in their original positions. Fit the right hand support bracket to the opposite end of the shaft and assemble the lever, so that the lever assumes the correct angular position (see Fig. C.28). Drill the lever and shaft, securing the components using a Mills pin.

3. Assemble the relay lever, and the shaft and lever assembly to the support bracket, ensuring that the levers assume the correct angular position (see Fig. C.29). Drill the relay lever and shaft, securing the components using a Mills pin. The location of the relay lever should be such as to compress the thackeray washer to approximately ·2 in. (5 mm.). The plain washer should be positioned on the outside of the bracket abutting the shaft lever.

4. When refitting the operating rods, ensure that the spring anchor plate is secured on the ball pin, which locates in the right hand cross-shaft relay lever.

5. Locate the return spring between the anchor plate positioned on the right hand cross-shaft relay lever and the return spring bracket positioned on the rear engine mounting.

6. Check and adjust the linkage on completion to eliminate any lost motion, as detailed on page C.24.

7. Check and if necessary adjust the brake and clutch pedal movement, referring to the appropriate sections.

CLUTCH AND PROPELLER SHAFT

SECTION D

INDEX

CLUTCH AND PROPELLER SHAFT

CLUTCH DATA

Make	Borg and Beck
Type	
KAH.30 and KAH.40 models	9.A.6. (Specification 9/145E)
KAD.30, KAD.40, KAB.60 models	10.A.6. (Specification 10/125)
KAL.30, KAL.40, KAL.60 models	10.A.6. (Specification 10/166)
Driven plate	Single dry plate
Clutch release	Ball bearing
Clutch pedal free movement	1 in. (25 mm.)

	Type 9.A.6. (9/145E)	**Type 10.A.6. (10/125)**	**Type 10.A.6. (10/166)**
Clutch thrust springs			
Colour	Yellow/Light Green	Light Green	Yellow/Light Green
Number of springs	9	12	12
Free length	2·688 in. (68·28 mm.)	2·560 in. (65·02 mm.)	2·688 in. (68·28 mm.)
Mean poundage at assembled height	140 lb. (63·5 kg.)	110 lb. (49·9 kg.)	140 lb. (63·5 kg.)
Damper springs			
Colour	Dark Grey/Light Green	Brown/Cream—3 off Light Grey/Cream—3 off	Dark Green
Number of springs	6	6	6
Driven plate compressed thickness	·330 in. (8·38 mm.) under 1,250 lb. (567 kg.) load	·330 in. (8·38 mm.) under 1,700 lb. (771 kg.) load	·330 in. (8·38 mm.) under 1,700 lb. (771 kg.) load
Release lever setting height (over lever tips)	1·895 in. (48·14 mm.)	1·955 in. (49·66 mm.)	1·955 in. (49·66 mm.)
Release lever plate thickness (between working faces)	·495/·505 in. (12·57/12·83 mm.)	·495/·505 in. (12·57/12·83 mm.)	·495/·505 in. (12·57/12·83 mm.)

PROPELLER SHAFT DATA

Make	Hardy Spicer
Type	Tubular steel shafts and needle roller universal joints
Outside diameter.	
KAH. 3023, KAD.3023 KAH.4023, KAD.4023, KAH.4035, KAD.4035.	
Front	2 in. (50·8 mm.)
Rear	2 in. (50·8 mm.)
KAL.3023, KAL.4023, KAL.4035, KAB.6035, KAL.6035.	
Front	2 in. (50·8 mm.)
Rear	2·5 in. (63·5 mm.)
Overall length (Coupling face to face length)	
KAH.3023, KAD.3023, KAH.4023, KAD.4023.	
Front	27·4 in. (70·07 cm.)
Rear	50·75 in. (128·9 cm.)
KAH.4035, KAD.4035.	
Front	39·45 in. (102·2 cm.)
Rear	50·75 in. (128·9 cm.)
KAL.3023, KAL.4023.	
Front	27·2 in. (69·6 cm.)
Rear	50·64 in. (128·6 cm.)
KAL.4035, KAB.6035, KAL.6035.	
Front	39·2 in. (99·6 cm.)
Rear	50·64 in. (128·6 cm.)
Universal joint	Needle roller type
Centre bearing	Ball journal bearing fitted in a tube which is spherically seated in a rubber bush and supported in a cast iron, chassis mounted housing
Lubrication	Lubricating nipples provided in each universal joint and in the sliding sleeve. The centre bearing has a lubricating nipple located in the lower section of the support housing

CLUTCH

DESCRIPTION

A single dry plate clutch is bolted to the flywheel and is completely enclosed by a clutch housing and bottom covers which are secured to the engine crankcase.

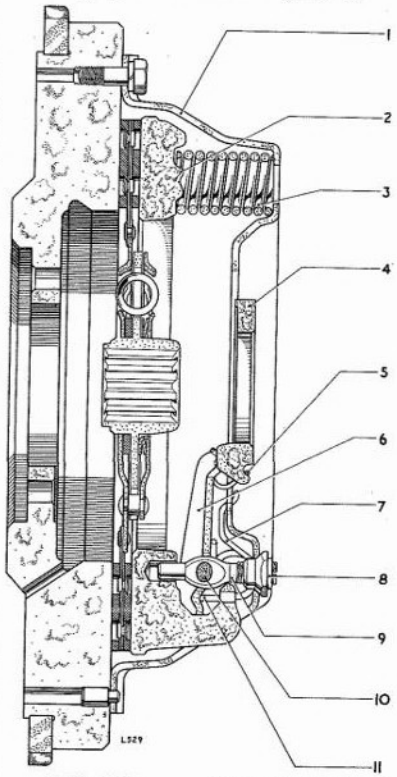
The clutch cover assembly (see Fig. D.1) consists of a pressed steel cover (1) and a cast iron pressure plate (2), loaded by thrust springs (3). Assembled with the cover are release levers (6), which pivot on floating pins (10), retained by eyebolts (9). Adjustment nuts (8) are screwed on to the eyebolts and secured by staking. Struts (11) are interposed between lugs on the pressure plate and the outer end of the release levers. Anti-rattle springs (7) restrain the release levers, and retainer springs (5) connect the release lever plate (4) to the levers.

The clutch driven plate, to which friction linings are riveted, is mounted on a splined hub and damper springs are located circumferentially around the hub. The driven plate hub slides on the splines of the gearbox primary shaft and the primary shaft spigot registers in a ball bearing race pressed into a counterbore in the engine crankshaft or flywheel according to the type of engine unit fitted.

A ball release bearing is employed which is secured to the forked ends of the clutch withdrawal lever by two retaining springs and is mounted on the tubular portion of the clutch release guide. The release guide is bored to allow the primary shaft to pass through its centre and the outer flange of the release guide is bolted to an internal web cast integrally with the clutch housing. The release bearing race is assembled in a cast iron housing and is retained by a spring ring. A steel thrust ring fits between the bearing inner race and the inner diameter of the housing and a steel disc interposed between the bearing race and the spring ring, acts as a grease retainer. To provide lubrication for the bearing, a flexible pipe is connected to a tapped hole in the housing outer diameter at one end, and at the opposite end, a lubricator nipple is located on a bracket secured to the bottom of the clutch housing flange.

A spring, attached at one end to an eyebolt screwed into the clutch housing, is hooked into an eye on the withdrawal lever and maintains the lever in the disengaged position. The withdrawal lever pivots on a fulcrum pin, mounted in a bracket, inside the clutch housing and the outer end of the lever extends through a slot in the clutch housing to connect with the clutch pedal operating rod. A domed adjusting nut on the rearmost end of the operating rod locates in the spherical seating machined in the withdrawal lever outer end and is secured by a locknut. Clutch pedal free movement is obtained by the adjustment of the domed nut on the operating rod. The forward end of the operating rod is screwed into a jaw, which in turn, is connected to a swivel pin assembled to an extension integral with the base of the clutch pedal on right hand drive models. On left hand drive models, the swivel pin is assembled to a relay lever.

On the right hand drive models, the clutch pedal is bushed and pivots on a shaft which is pressed into a combined support bracket and pedal stop, bolted to the right hand sidemember. The pedal is retained on the shaft by a plain steel washer and a spring ring.



1 STEEL COVER
2 PRESSURE PLATE
3 THRUST SPRING
4 RELEASE LEVER PLATE
5 RETAINER SPRING
6 RELEASE LEVER
7 ANTI-RATTLE SPRING
8 ADJUSTMENT NUT
9 EYEBOLT
10 FLOATING PIN
11 STRUT

Fig. D.1. Sectional view of the clutch assembly

On the left hand drive models, the clutch pedal is splined and clamped to a relay shaft that operates in bushes pressed into each end of the bore in a larger diameter shaft, which carries both the brake and accelerator pedals. At the opposite end of the relay shaft, a relay lever is welded to link with the swivel pin, jaw and clutch operating rod.

OPERATION

When the clutch pedal is depressed, movement is conveyed through the rod linkage to the withdrawal lever, which pivots on its fulcrum pin in the clutch housing and causes the forked end of the lever to move the release bearing assembly forward along the clutch release guide tube, until the thrust ring contacts the release lever plate of the clutch assembly.

Thus, when the clutch pedal is further depressed, the release lever plate is moved forward, pressing the inner ends of the release levers in the direction of the engine and, as the levers pivot on the floating pins, the outer ends of the release levers, being engaged behind lugs on the pressure plate, cause the pressure plate to be drawn away from the driven plate, thereby releasing the pressure on the driven plate which, in turn, will be disengaged from the flywheel face by the rotating motion of the latter.

At the same time as the release levers act on the pressure plate, the thrust springs assembled between the cover and the pressure plate are being compressed. With the subsequent gradual release of the clutch pedal, the thrust springs will apply pressure on the driven plate, via the pressure plate, causing the driven plate to move forward along the primary shaft splines, and contact the flywheel face, finally rotating with it as a whole, thus smoothly transferring the power of the engine to the transmission.

LUBRICATION

The clutch assembly requires no periodical lubrication but the release bearing should be lubricated every 2,000 miles (3,000 kms.) with the recommended grade of lubricant.

The lubricating nipple for this operation is situated on a bracket secured to the bottom cover of the clutch housing and is accessible underneath the vehicle. The nipple is connected to the release bearing by a flexible pipe.

Note: Care must be taken at all times to ensure that no lubricant of any description reaches the friction linings on the clutch driven plate, as this would cause clutch "slip". For this reason when lubricating the release bearing, care must be taken not to over-lubricate.

CLUTCH LINKAGE ADJUSTMENT

For the clutch mechanism to operate satisfactorily, a minimum clearance of 0·1 in. (2·6 mm.) is required between the release bearing and the release lever plate. This measurement is indicated by 1 in. (25·4 mm.) free travel on both R.H.D. and L.H.D. vehicles, at the clutch pedal pad with the clutch fully engaged. Insufficient clearance at the release bearing as indicated by inadequate free travel at the pedal will cause clutch "slip" resulting in excessive wear of both the release bearing and the driven plate linings.

Gradual wear on the clutch linings will bring the pressure plate closer to the flywheel face, thus reducing the release bearing clearance and in turn the free travel of the pedal. For this reason, a periodical check should be made every 4,000 miles (6,000 km.), and if it is found that the free travel is less than previously stated, an adjustment should be made.

To Adjust.

1. Slacken the locknut (see Fig. D.6) and turn the spherically seated adjusting nut so that the effective length of the rod is altered, until the required free travel is obtained. Tighten the locknut.

2. The withdrawal lever return spring will cause the outer end of the lever to be drawn forward, thus moving the release bearing away from the release lever plate.

3. The movement of the clutch pedal beyond the point at which the clutch driven plate is released, serves no useful purpose and only imposes undue stress on the internal parts of the clutch once the thrust springs have become coil bound. The clutch pedal, when all the components are in correct adjustment, should require 1 in. (25·4 mm.) free travel to take up the release bearing clearance. A further 4·67 in. (11·9 cm.) pedal travel, in a horizontal plane, is required, on both R.H.D. and L.H.D. models using a 9.A.6. clutch (see data page), to obtain full clutch disengagement.

On R.H.D. and L.H.D. models using a 10.A.6. clutch (see data page), a further 5·0 in. (12·7 cm.) additional pedal travel from the pedal free travel, in a horizontal plane, is required to obtain full clutch disengagement.

CLUTCH PEDAL AND LINKAGE

R.H.D. Models

To Remove. (see Fig. D.2)

1. Remove the rear engine cover.

2. Release the clamp bolt, spring washer and nut securing the clutch pedal stem to the clutch pedal lever and withdraw the pedal stem.

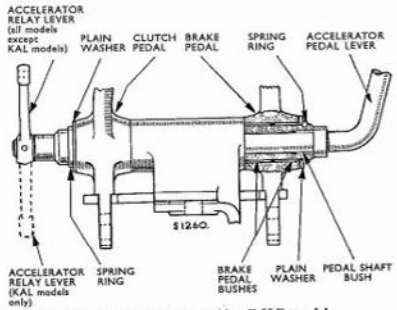


Fig. D.2. Control pedals assembly—R.H.D. models

3. Disconnect the return spring from the withdrawal lever and also from the eyebolt in the clutch housing.

4. Unscrew the self locking nut retaining the swivel pin to the pedal lever extension, noting the plain washer, and release the swivel pin from the pedal lever. The complete clutch operating rod assembly can then be withdrawn.

5. Disconnect the accelerator rod ball joint at the relay lever fitted adjacent to the clutch pedal and tap out the Mills pin which retains the relay lever to the accelerator pedal shaft. Remove the relay lever and the distance piece from the pedal shaft. Note the angular position of the accelerator relay lever before tapping out the pin in order to ensure correct re-assembly.

6. Remove the spring ring and the plain washer and slide the clutch pedal lever off the shaft.

7. If it is necessary to separate the components of the clutch operating rod assembly, remove the split pin and unscrew the slotted nut on the jaw pin, remove the pin which will release the swivel pin from the jaw. Release the locknut securing the jaw and also release the locknut securing the domed adjusting nut. Each component can then be screwed off the operating rod.

Inspection and Overhaul.

1. Check the pedal lever bushes for wear or scoring and renew if evident. The bushes are a press fit in the pedal boss and when pressing in the new bushes, ensure that each bush is flush with the appropriate boss face.

Note: Completely immerse the new bushes in thin oil for 24 hours prior to fitting to allow the pores of the bushes to fill with lubricant. Do not ream the bushes after fitting, otherwise the lubricating properties of the bushes will be destroyed.

2. Examine the pedal shaft and if badly worn, renew as follows.

(*a*) Remove the footbrake pedal (see "Brakes" section), the accelerator pedal (see appropriate "Fuel System" section) and release the brake master cylinder supply pipe at the clip secured to the top of the pedal shaft bracket.

(*b*) Remove the pedal shaft and bracket from the frame sidemember.

(*c*) Press out the worn shaft and press in the new shaft to the dimension given in Fig. D.3. Note that a bush is fitted in each end of the pedal shaft and it is advisable to renew these bushes at the same time as the shaft. Details for renewing these bushes are given in the accelerator linkage overhaul described in the appropriate "Fuel System" section.

3. Check the withdrawal lever return spring. The free length is 2·7 in. (6·9 cm.) and the spring rating is 26 lb. (11·8 kg.) per inch (25 mm.).

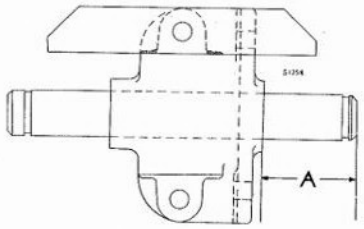
4. Ensure that the swivel pin and the jaw are not worn, renewing as necessary.

To Refit.

This operation is a reversal of the removal procedure noting the following points.

1. When refitting the jaw pin slotted nut, use a new split pin.

2. After refitting the swivel pin in the larger drilled hole in the pedal lever extension, refit the plain washer and a new self locking nut, ensuring that the nut is securely tightened.



A = 1·995/2·005 in. (50·67/50·93 mm.)

Fig. D.3. Pressing dimension for the pedal shaft in the support bracket—R.H.D. models

3. Ensure that the spring ring retaining the pedal lever on the pedal shaft is a good fit in the shaft groove. Fit a new spring ring if the fit is not satisfactory.

4. Refit the accelerator relay lever to the same angular position as noted during removal, using a new Mills pin.

5. Refit the pedal stem to the same height as the brake pedal stem and ensure that the clamp bolt, spring washer and nut is fully tightened.

6. Check the clutch pedal free travel on completion.

CLUTCH PEDAL AND LINKAGE

L.H.D. Models

To Remove. (see Fig. D.4)

1. Remove the rear engine cover.

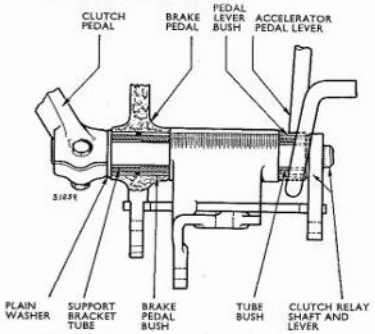


Fig. D.4. Control pedals assembly—L.H.D. models

2. Release the clamp bolt and nut securing the clutch pedal stem to the clutch pedal lever and withdraw the pedal stem.

3. Disconnect the return spring from the withdrawal lever and also from the eyebolt in the clutch housing.

4. Unscrew the self locking nut retaining the swivel pin to the relay lever extension, noting the plain washer, and release the swivel pin from the relay lever. The complete clutch operating rod assembly can then be withdrawn.

5. Remove the clamp bolt, spring washer and nut securing the clutch pedal lever to the pedal shaft and tap the pedal lever off the serrated splines on the shaft. Note the plain washer fitted between the clutch and brake pedal levers.

6. To remove the clutch pedal relay shaft and lever assembly, it will be necessary, on certain models, to release the brake and accelerator pedal connections (see appropriate sections in the manual). Remove the support bracket setscrews which will allow the bracket to be tilted, thus permitting the withdrawal of the relay shaft and lever assembly. Before tilting the support bracket, release the brake master cylinder supply pipe from the clip on top of the pedal shaft bracket.

7. If it is necessary to separate the components of the clutch operating rod assembly, remove the split pin and unscrew the slotted nut on the jaw pin, remove the pin which will release the swivel pin from the jaw. Release the locknut securing the jaw and also release the locknut securing the domed adjusting nut. Each component can then be screwed off the operating rod.

Inspection and Overhaul.

1. Check the relay shaft for slackness in the support bracket tube bushes and, if evident, renew the relay shaft and lever assembly and/or the tube bushes. To withdraw the tube bushes, tap out using a narrow flanged drift or alternatively, screw a suitable size tap into the worn bush to provide a purchase for extraction. The new bushes must be pressed into the tube ensuring that each bush is pressed in flush with the end of the tube.

Note: Completely immerse the new bushes in thin oil for 24 hours prior to fitting to allow the pores of the new bushes to fill with lubricant. Do not ream the bushes after fitting otherwise the lubricating properties of the bushes will be destroyed.

Should it be necessary to renew the support bracket tube, press out the old tube and press in the new tube to the dimension given in Fig. D.5.

2. Examine the pedal lever and shaft serrations and ensure that they are not worn or damaged also checking the clamp bolt groove on the shaft for wear.

3. Check the withdrawal lever return spring. The free length is 2·7 in. (6·9 cm.) and the spring rating is 26 lb. (11·8 kg.) per inch (25 mm.).

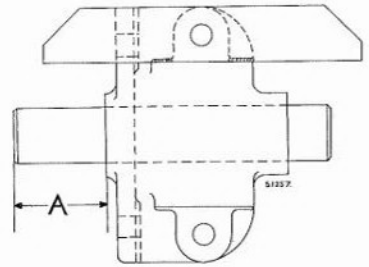
4. Ensure that the swivel pin and the jaw are not worn, renewing as necessary.

To Refit.

This operation is a reversal of the removal procedure noting the following points.

1. When refitting the jaw pin slotted nut, use a new split pin.

2. After refitting the swivel pin in the larger drilled hole in the relay lever, refit the plain washer and a new self locking nut ensuring that the nut is tightened securely.



A = 1·63/1·64 in. (41·40/41·66 mm.)

Fig. D.5. Pressing dimension for the pedal tube in the support bracket—L.H.D. models

3. Ensure that the plain washer is refitted between the clutch and brake pedal and that the pedal lever clamp bolt and nut is securely tightened.

4. Refit the clutch pedal stem to the correct height which is 6·5 in. (16·5 cm.) measured in a straight line from the stem aperture in the toe-panel to the underside of the pedal stem pad.

5. Check the clutch pedal free travel on completion.

CLUTCH RELEASE MECHANISM

To Remove.

1. Remove the gearbox (see "Gearbox" section).

2. The clutch release guide can then be removed through the clutch housing rear aperture after releasing the three retaining setscrews and spring washers. Three tapped holes in the release guide flange are provided to facilitate extraction, when necessary, using three setscrews which should be alternately screwed inwards, a turn at a time until the release guide register is free.

3. Remove the clutch housing bottom cover, releasing the support bracket for the release bearing lubricating pipe at the same time.

4. Disconnect the withdrawal lever return spring.

5. Release the two bracket setbolts accessible through the lever aperture in the clutch housing. The remaining bracket setbolt is slackened through the rear aperture of the housing.

Swing the rear end of the withdrawal lever clear of the operating rod and pivot the lever and bracket on the slackened setbolt to facilitate the removal of the two retaining springs securing the release bearing to the lever fork. Withdraw the release bearing first, followed by the withdrawal lever and bracket assembly, after removing the setbolt previously slackened.

Note: On KAH. models, the release bearing, withdrawal lever and bracket can be removed as an assembly, after removing the three bracket setbolts.

6. Remove the split pin and detach the fulcrum pin to separate the withdrawal lever from the bracket.

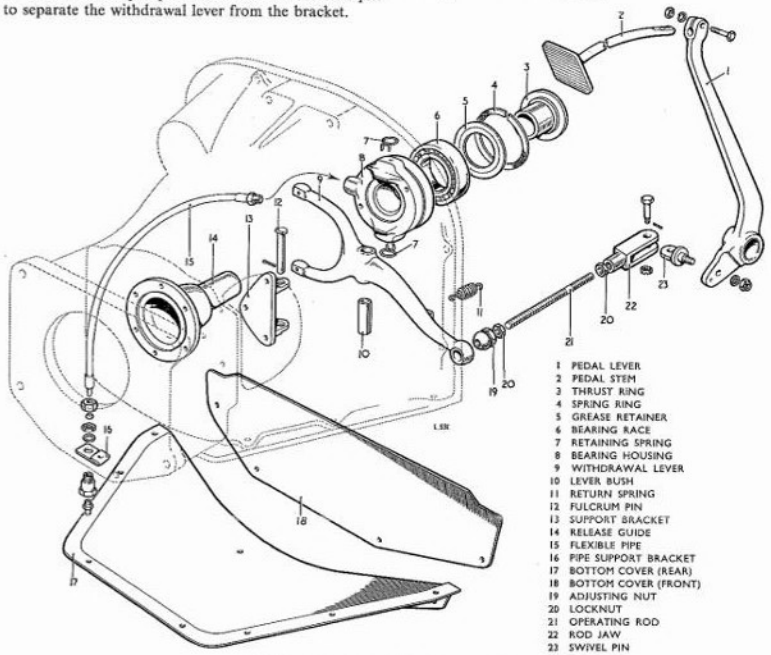


Fig. D.6. Details of the clutch release mechanism

To Dismantle.

1. Disconnect the flexible lubricating pipe from the release bearing housing.

2. Prise out the spring ring and, using a suitable drift through the two holes provided in the rear face of the bearing housing, tap out the bearing race complete with the thrust ring and the grease retainer.

3. Press the thrust ring out of the bearing race inner bore which will also release the grease retainer simultaneously.

Inspection and Overhaul.

1. Wash the bearing in white spirit and check for slackness and noisy operation. After washing and examination, if the race is to be refitted, immediately immerse the complete race in clean thin lubricating oil to prevent corrosion.

2. Ensure that the bearing outer race is a tight fit in the bearing housing and does not rotate. Renew the housing if this fault is evident.

3. Check the thrust ring for wear or scores on the surface which contacts the clutch release lever plate and renew the thrust ring as necessary. Also check that the thrust ring does not rotate in the bearing inner race, renewing if evident.

4. Inspect the withdrawal lever bush for wear or scores. Check the fit of the fulcrum pin in the bush. Renew the bush, if either of these faults are evident, by pressing out the worn bush and pressing in the new bush ensuring that the bush does not protrude beyond the boss of the withdrawal lever.

Note: Completely immerse the new bush in thin oil for 24 hours prior to fitting to allow the pores of the bush to fill with lubricant. Do not ream the bush after fitting, otherwise the lubricating properties of the bush will be destroyed.

5. Check that the fulcrum pin is free from damage or scores and fit the pin in the support bracket holes to ensure that the pin is a good fit without undue slackness. Renew the pin and/or the bracket as necessary.

To Re-assemble.

1. Locate the grease retainer on the register machined in the underside of the thrust ring flange and press the thrust ring fully into the inner race of the bearing ensuring that the grease retainer remains located on the register during this operation.

2. Pack the bearing race with grease of the recommended grade and press the bearing race complete with thrust ring fully into the bearing housing.

3. Refit the spring ring in the groove of the bearing housing and on completion, wipe all traces of grease from the exterior of the whole bearing housing assembly.

4. Finally, re-connect the flexible lubricating pipe to the tapped hole in the bearing housing.

To Refit.

Reverse the removal procedure noting the following points.

1. Ensure that the flat on the head of the fulcrum pin locates against the machined shoulder in the protruding arm of the support bracket. Use a new split pin in the eye of the fulcrum pin.

2. Refit the clutch release guide with the securing setscrews through the drilled holes in the release guide flange, as the tapped holes are for extraction purposes.

3. Re-connect the flexible lubricating pipe, nipple and support bracket when refitting the clutch housing bottom cover.

4. Refer to the "Gearbox" section for refitting the gearbox.

5. Check the clutch pedal free travel on completion of the operation.

CLUTCH HOUSING

To Remove.

The removal of the flywheel, the clutch assembly and the release bearing mechanism does not necessitate the removal of the clutch housing.

If the clutch housing requires renewal, remove as follows:—

1. Remove the engine (see "Engine" section).

2. On certain models, part of the accelerator linkage is mounted on the top flange of the clutch housing, necessitating removal of the appropriate linkage, preferably as an assembly (see the relevant sub-section in the "Fuel System" section).

3. Remove the clutch housing bottom covers, releasing the flexible lubricating pipe support bracket at the same time.

4. Remove the starter motor (see the "Electrical Equipment" section).

5. On KAH. models, it will be necessary to remove the flywheel (see "Engine" section) in order to gain access for withdrawing the clutch housing mounting setscrews obscured behind the flywheel.

On KAL. models, however, the clutch housing is removed after releasing the mounting setscrews securing the housing flange to the crankcase rear face. Note that a blanking plate is interposed between the two components and it will be necessary to release one setscrew retaining the blanking plate to the front face of the housing flange.

6. After removing the clutch housing, the clutch release bearing mechanism can be removed as detailed within this section.

To Refit.

Refitting is a reversal of the removal operations, referring to the appropriate sections in the manual, dealing with the refitting and adjustment of the major components, i.e., release bearing mechanism, flywheel, clutch unit, starter motor, accelerator linkage, engine unit and gearbox.

CLUTCH ASSEMBLY

To Remove.

1. Remove the gearbox (see "Gearbox" section).

2. Remove the clutch release guide as detailed in the previous sub-section.

3. Remove the clutch housing bottom cover, noting that the support bracket for the release bearing lubricating pipe will also be released at the same time. Temporarily secure the support bracket and lubricating pipe away from the clutch housing bottom aperture during the clutch removal and refitting operation.

4. It will be necessary to withdraw the release bearing rearwards to give clearance for the clutch assembly removal. Therefore, disconnect the return spring from the withdrawal lever, unscrew the self locking nut retaining the swivel pin at the base of the pedal lever, noting the plain washer, release the swivel pin and withdraw the clutch operating rod. The outer end of the withdrawal lever can then be pushed fully forward thus causing the release bearing to move rearwards, away from the release lever plate on the clutch assembly.

On KAH. models it will be necessary to remove the release bearing assembly to obtain sufficient clearance.

5. Before removal, mark the clutch cover relationship with the face of the flywheel in order that the clutch

cover assembly can be refitted in the original position to preserve the running balance of the engine.

By rotating the flywheel, the setscrews securing the clutch assembly to the flywheel can be slackened, a turn at a time by diagonal selection, until the pressure of the thrust springs is relieved to enable the setscrews to be unscrewed completely.

Note: On no account must the three "staked" adjusting nuts be disturbed during the clutch assembly removal.

6. If necessary, prise the clutch assembly off the locating dowels, lift clear together with the clutch driven plate and withdraw the two components through the aperture in the bottom of the clutch housing.

To Dismantle.

Satisfactory operation of the clutch is dependent on correct internal adjustment. Therefore, this component should not be dismantled for any purpose unless the proper equipment is available and the operator is fully conversant with the correct method of final adjustment on re-assembly.

To adjust the release levers accurately, Churchill Tool 99A should be used; additionally, it affords a convenient fixture upon which to dismantle and re-assemble the clutch assembly.

1 BASE PLATE
2 ACTUATOR
3 SPACERS
4 GAUGE FINGER
5 CENTRE PILLAR
6 ADAPTOR
7 CLAMPING SETBOLTS

Fig. D.7. Details of Churchill Tool 99A

1. Before dismantling, mark the clutch cover, the pressure plate lugs and the release levers, so that they may be re-assembled in the same relative position to each other, should one of them require renewal.

2. Release the retaining springs and lift off the release lever plate, after first marking for position prior to removal, to ensure the same relative positioning on re-assembly.

3. Rest the base plate of Churchill Tool 99A on a flat surface, ensuring that its face is perfectly clean and place the correct spacers (Code 99A–3) in the position marked by the letter "D" (for 9.A.6 clutch) and the letter "E" (for 10.A.6. clutch) on the base plate.

4. Place the clutch on the spacers, aligning the securing bolt holes in the cover with the appropriate tapped holes in the base plate, and with the release levers immediately over the spacers.

5. Screw the actuator into the centre hole in the base plate and press the handle down to clamp the clutch (see Fig. D.8). Screw the setbolts provided, tightly into the appropriate tapped holes in the base plate, thus securing the clutch, and remove the actuator.

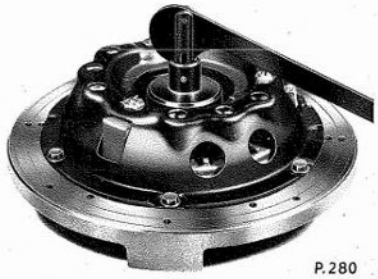


Fig. D.8. Actuator clamping the clutch

6. Remove the adjusting nuts from the release lever eyebolts, shearing away in the process the staking which locks the nuts to the eyebolts, by exerting sufficient turning force on the nuts.

Note: Once removed, the eyebolts and the adjusting nuts must be discarded, both items being renewed on re-assembly.

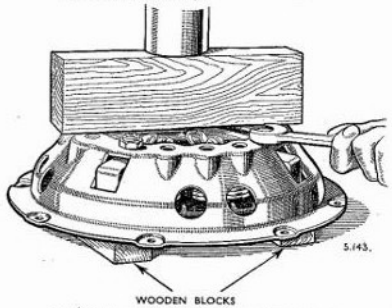


Fig. D.9. Compressing the clutch cover on a press

7. Gradually unscrew the setbolts to relieve the load on the thrust springs. Should the Churchill Tool be unavailable, ignore paras. 3 to 7 and proceed as follows:—

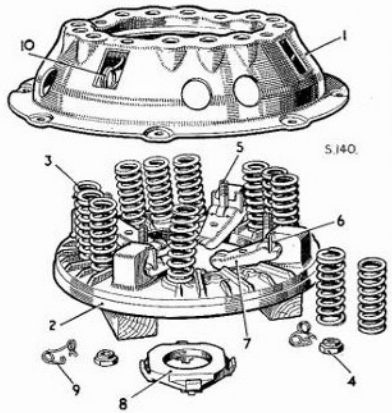
(*a*) Place the clutch cover assembly, on the bed of a screw press (or a vertical drill to be used as a press) with the pressure plate resting on wooden blocks so arranged that the cover is free to move downwards when pressure is applied. Place a wooden block or bar across the top face of the cover so that it is resting on the spring bosses as shown in Fig. D.9.

(*b*) Bring the spindle of the press down on to the wooden block so that it pushes the cover down, and, holding it under compression, shear away the staking which locks the adjusting nuts to the eyebolts by exerting sufficient turning force on the nuts. The eyebolts and the adjusting nuts must be discarded, both items being renewed on re-assembly.

(*c*) Slowly relieve the pressure on the clutch cover to prevent the thrust springs from flying out.

8. The cover can now be lifted off the pressure plate disclosing the internal parts (see Fig. D.10).

9. To remove the release levers, grasp the lever and the eyebolt between the thumb and fingers as shown in Fig. D.11, so that the inner end of the lever and threaded end of the eyebolt are as near together as possible, keeping the eyebolt pin seated in its socket in the lever. The strut can then be lifted over the ridge on the end of the lever as shown, enabling the eyebolt to be lifted from the pressure plate.



1 STEEL COVER
2 PRESSURE PLATE
3 THRUST SPRING
4 ADJUSTMENT NUT
5 EYEBOLT
6 STRUT
7 RELEASE LEVER
8 RELEASE LEVER PLATE
9 RETAINER SPRING
10 ANTI-RATTLE SPRING

Fig. D.10. Details of the clutch assembly

Inspection and Overhaul.

1. Inspect the primary shaft spigot bearing (fitted in the rear of the crankshaft or the flywheel according to the type of engine unit fitted) for wear and slackness, and renew the bearing if necessary (see "Engine" section).

2. Examine the clutch face of the flywheel and the machined face of the pressure plate for wear and scores. If badly scored, they should be reground to restore the smooth finish. Any grinding on one or both of these faces will necessitate re-adjustment of the release levers.

Note: It will be appreciated that if correct relationship between the faces of the flywheel and pressure plate is to be retained, the whole of the surface, and not only the friction areas must be reground.

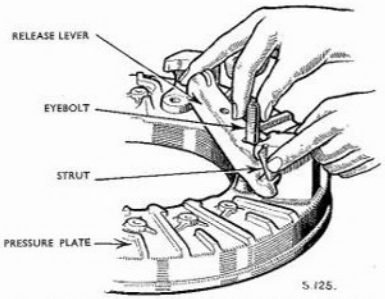


Fig. D.11. Showing the method of removing the release levers

3. Examine the friction face of the release lever plate, and if badly scored, the plate must be renewed. Inspect also the reverse side of the plate, and if appreciable grooving is apparent on the surface caused by the release lever tips, the plate must be renewed.

4. Inspect the release levers for wear. If, at the point of contact with the release lever plate, they show a flat surface, or if the groove in which the strut bears is worn appreciably, the lever should be renewed. On the concave side of the lever examine the depression in which the floating pin is seated and if the metal is worn at this point, renew the lever. Ensure that the levers are not stiff or seized on their floating pins. The latter should be a free fit in the enlarged holes in the eyebolts.

5. Check the clutch thrust springs for breakage or weakness (see "Data"), and renew as necessary.

6. Examine the clutch driven plate (see page D.13).

To Re-assemble.

During assembly, a slight smear of Duckhams K.O.12 grease should be applied to the release lever pins, contact edges of the struts, adjusting nut seats in the clutch cover, and the plain end of each eyebolt.

1. Assemble one release lever, eyebolt and release lever floating pin, holding the threaded end of the eyebolt and the inner end of the release lever as close together as possible. With the other hand, insert the strut in the slots in the pressure plate lug sufficiently to allow the plain end of the eyebolt to be inserted into the hole in the pressure plate. Move the strut upwards

into the slot in the pressure plate lug, over the ridge on the short end of the lever and drop it in the groove formed in the lever. Fit the remaining release levers in the same manner.

2. Place the thrust springs in position, seating them over the bosses in the pressure plate.

3. Position the cover on top of the assembled parts, ensuring that the anti-rattle springs (10) Fig. D.10 are in position between the release levers and cover, and that the top of the thrust springs are directly under their seats in the cover. Make sure also, that each pressure plate lug is aligned with its respective aperture in the cover.

Note: It is important that the cover, the pressure plate, and the release levers are assembled in accordance with the identification marks previously made on them. This ensures correct balance of the clutch assembly.

4. Transfer the assembly to the base plate of the Churchill Tool, the pressure plate resting on the spacers and the cover aligned with the appropriate tapped holes, as for dismantling.

5. Carefully bolt the cover tightly to the base plate, with the long bolts provided, tightening alternately by diagonal selection. Ensure that the thrust springs remain correctly seated during this operation.

6. Screw the adjusting nuts on to the protruding ends of the eyebolts until flush with the top of the eyebolts.

7. Screw the actuator into the base plate and operate the handle a number of times to settle the clutch moving parts in their working positions.

8. If the clutch is being assembled by means of a press, proceed as follows:—

(*a*) Place the assembly on wooden blocks as described for dismantling.

(*b*) The wooden block can then be laid across the cover and the assembly slowly compressed with the spindle of the press, making sure that the eyebolts and pressure plate lugs are guided through their respective holes in the cover.

(*c*) Holding the clutch under compression, screw the adjusting nuts on to the eyebolts until flush with the top of the eyebolts.

(*d*) Prior to removing the clutch unit from the press, it is advisable to operate the clutch several times, so that all the moving parts can settle in their correct working positions. This can be carried out by applying the spindle of the press to the inner ends of the release levers, using a suitable adaptor to ensure that simultaneous movement occurs at the three levers.

9. Before staking the adjusting nuts, i.e., punching the adjusting nut metal into the slot in top of the eyebolts, the setting of the release levers must be checked and adjusted if necessary, as described below.

Adjusting the Release Levers.

Satisfactory operation of the clutch is absolutely dependent upon accurate adjustment of the release levers. This can be accomplished by one of two methods.

(*a*) With the aid of Churchill Tool 99A.

(*b*) By using a new driven plate as a gauge.

It is recommended that method (*a*) be employed as this is by far the most accurate, for although the driven plate is produced to fine limits, any slight error in the parallelism of the driven plate is magnified a great deal at the release lever tips.

However, both methods are described in the following, under their appropriate heading.

Using Churchill Tool 99A.

As this tool will have been used for re-assembling the clutch, the latter will be bolted to the base plate, with the correct spacers (Code 99A-3) in which case proceed as follows:—

1. Screw the pillar firmly into the centre of the base and slide over it, the correct adaptor Code 99A-7 (for the 9.A.6. clutch) or Code 99A-8 (for the 10.A.6 clutch) the recessed face downwards, followed by the gauge finger (see Fig. D.12).

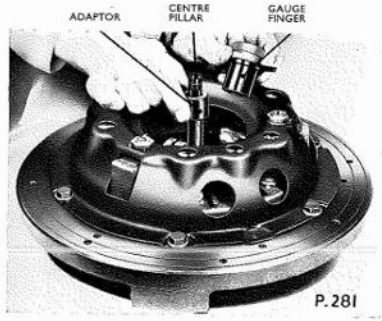


Fig. D.12. Setting up the Churchill Tool 99A to adjust the height of the release levers

2. Pressing downwards on the gauge finger, to ensure it is bearing squarely on the adaptor, adjust each lever in turn by means of the adjusting nuts until it just contacts the gauge finger (see Fig. D.13).

3. Remove the gauge finger, adaptor and pillar, then fit the actuator and operate the clutch a number of times. Refit the gauge and re-check the lever setting, making any final adjustments, if necessary.

4. Each adjusting nut must now be staked to the eyebolt. When carrying out this operation take care not to upset the adjustment previously made.

5. After the adjustment is completed, loosen the holding setbolts a turn or two at a time in diagonal sequence, until the pressure of the thrust springs is relieved which will allow the clutch assembly to be removed.

6. Locate the release plate in position on the release lever tips, as marked during dismantling ensuring that the slot in each lever tip engages a boss on the lugs of the release lever plate. Secure the plate in position by fitting the three retainer springs.

Note: When re-assembled, the run-out of the release lever plate must not exceed ·015 in. (·381 mm.) at a radius of 1·00 in. (25·4 mm.).

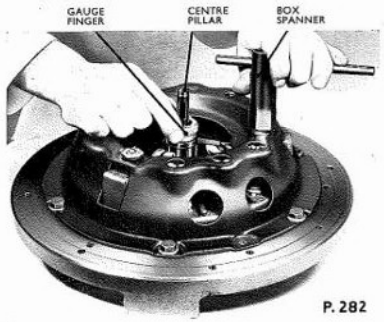


Fig. D.13. Adjusting the release lever height using the Churchill Tool 99A

Using a New Driven Plate as a Gauge.

1. Remove the flywheel from the engine (see "Engine" section), or alternatively, use a new flywheel and lay it on a surface plate.

2. By means of a scribing block, check the height of the flywheel face above the surface plate, then set the scribing block point to a dimension 1·895 in. (48·14 mm.) for the 9.A.6 clutch, or 1·955 in. (49·66 mm.) for the 10.A.6. clutch, higher than this reading.

3. Lay a new clutch driven plate, in its correct position on the flywheel face.

4. Bolt the clutch assembly in position, using three or four setscrews in the flange rim of the cover.

5. With the scribing block (the point of which has already been set, as decribed in para. (2), to a fixed height above the face of the surface plate), set the position of the release levers by means of the eyebolt adjusting nuts, so that each lever tip just contacts the point of the scriber. Adjust each release lever in this way.

Note: As the driven plate may vary slightly, it is advisable to re-check after turning the driven plate through 180°. If the readings vary, halve the error.

6. When the adjustment is correct, the adjusting nuts must be staked to the eyebolts.

7. Remove the clutch assembly from the flywheel face, and refit the flywheel to the crankshaft flange (see "Engine" section), if removed for release lever adjustment.

8. Locate the release lever plate in position on the release lever tips, as marked during dismantling ensuring that the slot in each lever tip engages a boss on the lugs of the release lever plate. Secure the plate by fitting the three retaining springs.

Note: When re-assembled, the run-out of the release lever plate must not exceed ·015 in. (3·81 mm.) at a radius of 1·00 in. (25·4 mm.).

To Refit.

The procedure for refitting the clutch unit, is a reversal of the removal operations, but the following should be observed.

1. Ensure that the shorter offset of the driven plate hub is nearest to the flywheel.

2. When refitting the clutch cover assembly to the flywheel, ensure that the identification marks made during removal are in alignment, in order to refit the cover assembly in its original position to preserve the running balance of the engine.

3. Refit the clutch release guide with the securing setscrews through the drilled holes in the release guide flange, as the tapped holes are for extraction purposes.

4. Before tightening the clutch cover bolts, line up the driven plate with the spigot bearing in the crankshaft flange or flywheel (as applicable) using a suitable mandrel or a spare primary shaft.

5. Do not remove the mandrel until the securing bolts, are fully tightened. By turning the flywheel, tighten the bolts, a turn at a time, by diagonal selection to prevent the clutch cover from being strained.

6. The splines on the gearbox primary shaft should be lightly smeared with Shell SB.2498 (Home) or Shell S.1926 (Export) grease before being entered into the driven plate hub.

7. Do not in any circumstances allow the gearbox to hang unsupported in the clutch assembly when refitting.

8. Finally, check the clutch pedal free travel on completion of the operation.

CLUTCH DRIVEN PLATE

After the clutch has been in use for a period under good conditions (i.e., with the clutch faces working on true ground surfaces, without the presence of oil and with only the amount of slip that will occur under normal working conditions), the surface of the driven plate facings will assume a high polish through which the grain of the material can be seen. Under this condition, the plate may be used again. However, when the grain cannot be seen, although a polished surface may be present, the linings must be renewed.

Inspection and Overhaul.

When the clutch cover assembly has been removed, the driven plate should be examined for wear and damage as follows:—

1. Check the internal splines of the hub for wear by placing the driven plate on to a new gearbox primary shaft and checking for backlash. If this is excessive, the driven plate must be renewed.

2. Examine the hub damper springs and if any are broken, renew the driven plate.

3. If oil has found its way on to the linings, the driven plate must be renewed or new linings fitted.

4. If the linings are worn excessively, best results will be obtained by fitting a new or exchange driven plate, already relined, which will ensure that the lining faces are parallel. However, should a new or exchange driven plate be unavailable, reline the old driven plate as follows.

To Reline the Clutch Driven Plate.

1. After removal of the old linings (the rivets may be drilled out), examination of the driven plate will show that the outer section of its diameter is divided into sectors, drilled with rivet holes, which line up with two similar circles of holes in the linings. These latter holes are alternately counterbored for the rivet heads and are drilled right through to give access to the rivet which secures the lining on the other side of the plate, each rivet passing through one lining only.

2. Place one new lining on the face of the driven plate in such a way that the counterbored holes are on the uppermost face of the lining and are lined up with the rivet holes in the driven plate, insert the rivets from the counterbored side and rivet with the riveted end on the opposite side of the plate.

3. Turn the plate over and fit the second lining in a similar manner.

4. After relining, mount the driven plate on a mandrel between centres, and check for run-out by means of a clock gauge set as near the edge of the driven plate as possible.

PROPELLER SHAFT

DESCRIPTION

On all models, the transmission line consists of front and rear propeller shafts supported by means of a centre bearing. The front shaft assembly consists of a tubular shaft incorporating a machined journal at the rear end, which mounts in the centre bearing and carries a driver coupling that, when assembled, mates with the front sliding universal joint on the rear propeller shaft. The fixed universal joint at the forward end of the tubular shaft, bolts to the gearbox driver coupling.

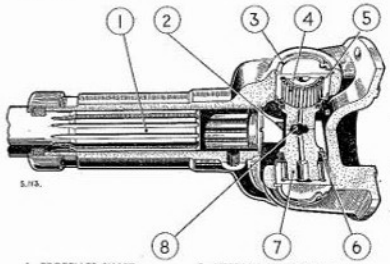


Fig. D.14. Sectional view of the universal joint assembly

The rear shaft assembly comprises a tubular shaft, incorporating at the front splined end, a sliding universal joint, and at the rear end, a fixed universal joint, the latter bolted to the rear axle pinion driver coupling.

The sliding universal joint (see Fig. D.14) consists of two yokes (or forks), one being integral with the sliding sleeve and the other forming part of a flange, which is bolted to the driver coupling located at the rear end of the front propeller shaft. The sliding sleeve is broached internally to match the splines machined in the front end of the rear propeller shaft, thus providing the necessary sliding engagement to absorb the movement of the rear axle.

The fixed universal joint, however, has one yoke (or fork) pressed in and welded direct to the tubular propeller shaft whilst the other yoke (or fork) forms part of a flange which bolts to the driver coupling fitted on the rear axle bevel pinion.

The sliding and the fixed universal joints consist mainly of a trunnion cross which is fitted to the yokes by means of bearing cages containing needle roller bearings; one bearing cage assembly fitting over each of the four journals integral with the trunnion cross, and it is upon these bearings that movement in the joint takes place.

The cages are retained by circlips located in grooves machined in the bores of each yoke, and to prevent loss of lubricant, seals are fitted between the shoulders of the trunnion cross and the bearing cages.

The centre bearing fitted to the rear of the front propeller shaft, comprises a ball journal bearing housed in a cast tube with a lubricant seal on either side. A spherical seating rubber sleeve is bonded to the tube and the assembly is carried in a housing, machined in two halves. The upper half is secured direct to the chassis crossmember by means of two studs and self locking nuts. The lower half fits over the studs and is secured by means of a further two self locking nuts.

On KAH. and KAD. models, a water excluder is fitted at the front and rear of the centre bearing assembly whereas only a front water excluder is fitted on the remainder of the models in the range.

LUBRICATION

The universal joints, the sliding sleeve and the centre bearing are each fitted with a nipple for lubrication.

Except for the lubrication which is given at the first 500 miles (800 kms.) service check, lubricate each nipple every 2,000 miles (3,000 kms.). Always use the recommended grade of lubricant.

FRONT PROPELLER SHAFT

To Remove.

1. Remove the nuts and bolts securing the rear propeller shaft to the front. Separate the flanges and lower the rear propeller shaft to the ground.

2. The nuts and bolts securing the shaft to the gearbox driver coupling must now be removed, leaving one bolt in position to take the weight at the front of the shaft, whilst the centre bearing is disconnected.

Note: The propeller shaft securing bolts are locked by means of shakeproof type washers under the heads of their nuts. These lockwashers should be clamped only once and upon removal discarded, new ones being used when subsequently refitting the shafts.

3. Remove the centre bearing lubricator nipple and extension piece.

4. Supporting the propeller shaft, withdraw the two lower self-locking nuts from the housing fixing studs and remove the lower half of the housing.

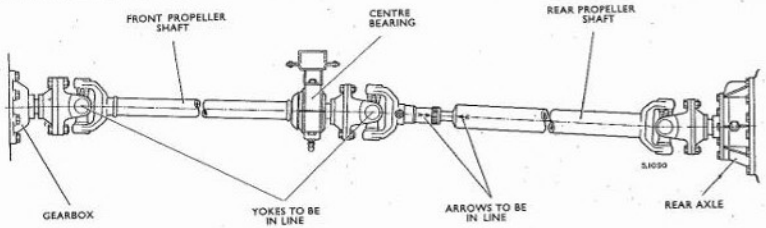


Fig. D.15. Transmission arrangement

5. Lift away the propeller shaft after releasing the single bolt left to take the weight at the front coupling (see para. 2).

To Dismantle.

1. To dismantle the centre bearing, refer to page D.18.

2. Dismantle the universal joints in accordance with the information given on page D.16.

Inspection and Overhaul.

1. Inspect the universal joint and centre bearing components, as detailed on pages D.17 and D.19 respectively.

2. Renew any bolt, which shows signs of stretching or damaged threads.

3. Ensure the propeller shaft is not damaged or running out of true.

4. Check the yoke flanges for elongation of the securing bolt holes.

To Re-assemble.

Re-assemble the universal joints and centre bearing in accordance with the information given on pages D.17 and D.19 respectively.

To Refit.

1. Secure the fixed universal joint end of the propeller shaft to the gearbox driver coupling. Lock the nuts, using new shakeproof lockwashers.

2. Raise the centre bearing assembly into the upper half of the housing, centralising the bearing tube and sleeve assembly in the housing and ensuring that the tapped bore for the lubricator extension piece lies downward and in a vertical plane to the ground. Position the lower half of the housing over the studs, ensuring that the tapped bore in the bearing tube and the drilling in the housing are in alignment. Fit the self locking nuts to the housing studs so as to be finger tight at this stage. Refit the lubricator and extension piece to the bearing tube. Tighten the self locking nuts.

3. Secure the rear propeller shaft sliding universal joint to the rear driver coupling on the front propeller shaft, using new shakeproof lockwashers under the heads of the nuts, noting that the flange yoke lugs on the front and rear propeller shafts are in line (see Fig. D.15).

4. Lubricate the centre bearing and universal joints with the recommended grade of lubricant.

REAR PROPELLER SHAFT

To Remove.

1. Remove the nuts and bolts securing the rear propeller shaft to the rear driver coupling on the front propeller shaft, and to the rear axle pinion driver coupling.

To Dismantle.

To dismantle the universal joints, refer to the information contained on page D.17.

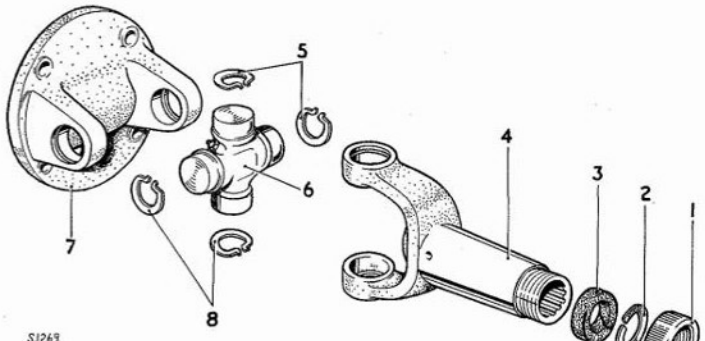
Inspection and Overhaul.

1. Inspect the universal joint components, as detailed on page D.17.

2. Renew any bolt, which shows signs of stretching or damaged threads.

3. Ensure that the propeller shaft is not damaged in any way or running out of true.

4. Check the yoke flanges for elongation of the securing bolt holes.



1 DUST CAP
2 STEEL WASHER
3 CORK WASHER
4 SLEEVE YOKE
5 CIRCLIPS
6 TRUNNION CROSS C/W BEARINGS
7 FLANGE YOKE
8 CIRCLIPS

Fig. D.16. Details of the sliding universal joint

To Re-assemble.

Re-assemble the universal joints in accordance with the information given on page D.17.

When refitting the sliding universal joint to the propeller shaft splined end, ensure that the arrows stamped on the front end of the tubular propeller shaft and the sleeve yoke of the sliding joint are in line. Tighten the dust cap by hand only.

To Refit.

Refit the rear propeller shaft by reversing the procedure given for removal, noting that the flange yoke lugs of the front and rear propeller shafts are in line (see Fig. D.15). Ensure that new shakeproof lockwashers are fitted under the heads of the coupling securing nuts.

UNIVERSAL JOINTS

To Check for Wear.

The following method can be applied when checking the universal joints of either the fixed or sliding type for wear.

1. Grasp the universal joint with the hands and test for movement between the trunnion cross and the yokes. If there is any apparent lift it will indicate that the cork sealing gaskets have become compressed and wear has taken place on the thrust faces of the cages.

2. To check for circumferential movement, hold the flange yoke with one hand and attempt to turn the propeller shaft with the other. If any movement is felt, it is essential that the trunnion cross and bearing cage assemblies be renewed.

To Remove.

Dependent upon which joint is faulty, adopt one of the following procedures.

1. The front propeller shaft universal joint. Remove the propeller shaft complete as detailed on page D.15.

2. The rear propeller shaft universal joints. Disconnect the propeller shaft at the faulty universal joint. Unscrew the dust cap from the sleeve yoke on the sliding universal joint, which will allow either the front sliding universal joint to be removed with its sleeve yoke, or the rear universal joint with the propeller shaft.

To Dismantle.

The method of dismantling either the fixed or the sliding universal joint is the same.

1. Unscrew and remove the lubricator nipple from the trunnion cross.

2. Remove the circlips securing the needle bearing and cage assemblies in their respective yokes. With a suitable scraper remove any accumulation of foreign matter from the bores in the yokes which house the bearing cages, also any burrs, etc., from around the circlip grooves. This will provide for easier extraction of the bearing cages.

3. Remove the needle bearing cages from the propeller shaft or sliding sleeve yoke, first by tapping the cage as shown in Fig. D.17, using a suitable soft nose drift slightly smaller than the outside diameter of the cage, thus pushing the opposite needle bearing cage out of the yoke far enough to be gripped and so withdrawn.

4. Tap the trunnion cross back with a drift to drive the other opposite needle bearing cage out of the yoke far enough to be withdrawn.

5. The trunnion cross together with the flange yoke may then be tilted over at an angle and removed from the propeller shaft or sliding sleeve yoke (see Fig. D.18).

Fig. D.17. Removing the needle bearing cage

6. Remove the trunnion cross from the driver coupling yoke by withdrawing the bearings from the yoke, as detailed previously in the preceding paras. 3, 4 and 5.

7. Using a screwdriver, prise the cork gaskets and retainers off the shoulders of the trunnion cross.

Inspection and Overhaul.

1. Check the journals of the trunnion cross, needle rollers, and cages for wear and signs of rusting or pitting. The bearing cages should be a light drive fit in the yoke bores. The needle rollers, cages and trunnion cross, must be renewed as a complete assembly. The cork gaskets, retainers and circlips are obtainable as separate replacements and should be renewed if the original trunnion cross and bearing assembly is refitted.

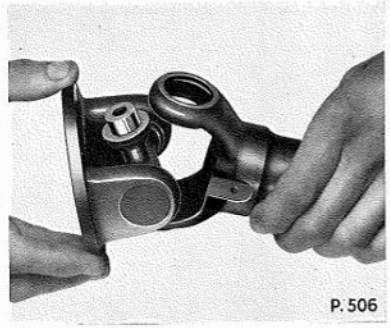


Fig. D.18. Removing the trunnion cross together with the flange yoke from the sleeve yoke

2. Check the lubricant passages in the trunnion cross for obstruction and blow through with compressed air.

3. Check for slackness of the sliding sleeve yoke on the spline end of the propeller shaft, also check the condition of the sliding sleeve cork seal and steel washer. Renew any component found appreciably worn.

4. Check the yoke flanges for elongation of the securing bolt holes.

To Re-assemble.

1. Treat the shoulders of the trunnion cross with a jointing compound before fitting the retainers squarely on to the shoulders. Wipe all traces of surplus jointing compound from the journals, after the retainers have been fitted. Insert the cork gaskets into the retainers.

2. Fit the trunnion cross to the flange yoke, tilting the trunnion to engage the yoke bores.

3. Position one of the journals of the trunnion cross so that it protrudes from a bearing cage bore in the yoke. Fit the needle bearing and cage assembly over the journal, ensuring that none of the needle roller bearings are displaced, and trapped during this operation.

Note: Retain the needle roller bearings in position with the aid of a suitable lubricant.

4. Tap the bearing cage into the yoke, using a soft nose drift slightly smaller than the outside diameter of the cage, until it is possible to insert the circlip, at the same time centralising the trunnion cross in the yoke. Fit the circlip to its respective groove.

5. Carefully move the trunnion to allow the opposite journal to protrude from the bearing cage bore in the yoke. Fit the opposite needle bearing and cage assembly to the protruding journal, ensuring none of the needle roller bearings are displaced and trapped during this operation. Tap the bearing cage into the yoke, using a soft nose drift slightly smaller than the outside diameter of the cage, again centralising the trunnion cross in the yoke as the cage nears its innermost position. Secure the cage with a circlip.

6. Refit the trunnion cross and flange yoke assembly to the propeller shaft or sliding sleeve by repeating the procedure as detailed in the preceding paras. (3) to (5).

7. Make sure that all circlips are seating correctly in their respective grooves and the cages are bearing against the circlips.

CENTRE BEARING

To overhaul the centre bearing, it is recommended that the front propeller shaft complete is detached from the vehicle.

To Remove.

Remove the centre bearing along with the front propeller shaft as detailed on page D.15.

To Dismantle.

KAH. and KAD. Models.

1. Grip the rear driver coupling in a vice, remove the self locking nut securing the coupling to the shaft.

2. Release the driver coupling from the vice and press off the coupling from the propeller shaft. Prise the two feather keys out of the shaft end.

3. The rear water excluder will remain on the driver coupling and can be tapped off, if necessary.

4. Remove the rear lubricant seal and the plain washer fitted between the driver coupling and the ball bearing race.

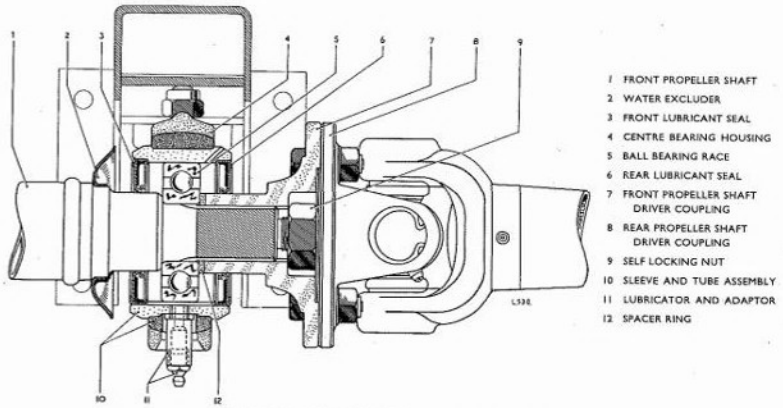


Fig. D.19. Sectional view of the centre bearing assembly

This illustration shows the type of assembly fitted to all models except KAH and KAD models

To Refit.

1. When refitting the sliding universal joint to the propeller shaft splined end, ensure that the arrows stamped on the front end of the tubular propeller shaft and the sleeve yoke of the sliding joint are in line. Tighten the dust cap by hand only.

2. Connect the front and rear propeller shafts ensuring that the flange yoke lugs on each shaft are in alignment as shown in Fig. D.15.

3. Lubricate all universal joints and the sliding sleeve at the lubricators provided.

5. Withdraw the spherical rubber sleeve and tube assembly fitted over the bearing race.

6. Press the ball bearing race off the propeller shaft and remove the front lubricant seal. The front water excluder can then be tapped off the shaft, if necessary.

All Models except KAH. and KAD. Models.

1. Grip the rear driver coupling in a vice and remove the self locking nut securing the coupling to the shaft.

2. Release the driver coupling from the vice and press the coupling off the splines of the propeller shaft.

3. Remove the rear lubricant seal and the spacer ring fitted between the coupling and the ball bearing race.

4. Withdraw the spherical rubber sleeve and tube assembly fitted over the bearing race.

5. Press the ball bearing race off the propeller shaft and remove the front lubricant seal. The water excluder, located on a machined shoulder in front of the bearing race can then be tapped off the shaft, if necessary.

Inspection and Overhaul.

1. Clean the ball bearing race in white spirit, blow out with dry compressed air and lubricate the bearing immediately by dipping in clean light oil. Rotate the bearing several times to remove excess oil and then carefully inspect for cracked balls or cages. Rotate the bearing to check for roughness and noisy operation.

2. Examine the lubricant seals and renew as necessary, particularly if the sealing lips are worn or damaged.

3. Renew the bearing sleeve and tube assembly if the rubber is deteriorated.

4. Examine the centre bearing housing halves for cracks and renew if evident. The upper half of the housing can be removed by releasing the stud nuts above the mounting flange.

5. Check the water excluder(s) for damage or distortion.

To Re-assemble.

KAH. and KAD. Models.

1. If the front water excluder has been removed, tap the excluder on the rear end of the propeller shaft until the convex face of the excluder abuts the shoulder of the foremost machined shaft diameter.

2. Locate the front lubricant seal in the counterbore inside the sleeve and tube assembly.

Note: Front and rear lubricant seals are identical components.

3. Liberally coat the ball bearing race with fresh **grease** of the recommended grade ensuring that the grease is also forced down between the ball bearings.

Place a quantity of fresh grease also in the interior of the sleeve and tube assembly and insert the bearing race to midway in the tube bore.

4. Tap the bearing race complete with the sleeve and tube assembly on the rear end of the propeller shaft using a suitable hollow drift on the bearing inner race until full abutment is obtained on the shoulder of the shaft.

The sleeve and tube assembly is centralised over the ball bearing race when the bonded rubber sleeve locates in the centre bearing housing during the refitting of the propeller shaft.

5. Add a quantity of fresh grease in the tube adjacent to the bearing race and slide the plain washer on the propeller shaft, locating against the bearing inner race. Fit the rear lubricant seal in the register at the tube rear end.

6. If the rear water excluder has been removed, tap the excluder fully on to the nose of the driver coupling with the convex side to the rear of the coupling.

7. Tap the two feather keys in the slots of the shaft, ensuring that the keys are a good fit, otherwise new keys must be fitted.

8. Refit the driver coupling ensuring that the coupling fully locates against the plain washer. Secure the coupling by fully tightening the self locking nut.

All Models except KAH. and KAD. Models.

1. If the water excluder has been removed, tap the excluder on the rear end of the propeller shaft until the convex face of the excluder abuts the shoulder of the foremost machined shaft diameter.

2. Locate the front lubricant seal in the counterbore inside the sleeve and tube assembly.

Note: The front and rear lubricant seals are identical components.

3. Liberally coat the ball bearing race with fresh **grease** of the recommended grade ensuring that the grease is also forced down between the ball bearings.

Place a quantity of fresh grease also in the interior of the sleeve and tube assembly and insert the bearing race to midway in the tube bore.

4. Tap the bearing race complete with the sleeve and tube assembly on the rear end of the propeller shaft, using a suitable hollow drift on the bearing inner race, until full abutment is obtained on the shoulder of the shaft.

The sleeve and tube assembly is centralised over the ball bearing race when the bonded rubber sleeve locates in the centre bearing housing during the refitting of the propeller shaft.

5. Add a further quantity of fresh grease in the tube adjacent to the bearing race and slide the spacer ring on the propeller shaft, locating against the bearing inner race. Fit the rear lubricant seal in the register at the tube rear end.

6. Refit the driver coupling ensuring that the coupling fully locates against the spacer ring. Secure the coupling by fully tightening the self locking nut.

To Refit.

Refit the centre bearing together with the front propeller shaft as detailed on page D.15.

GEARBOX

SECTION E

INDEX

GEARBOX

DATA

Type	Four forward speeds—one reverse
Description	Synchromesh engagement on top, third and second. Sliding gears for first and reverse
Ratios	
Fourth	Direct drive
Third	1·703 : 1
Second	3·029 : 1
First	5·770 : 1
Reverse	6·985 : 1
Lubricant capacity	4·5 pints (2·55 litres) increased by 1 pint (·56 litre) when a P.T.O. is fitted

MANUFACTURING DATA

	inches	*millimetres*
Casing		
Bore for primary shaft	3·5437/3·5432	89·997/90·01
Bore for mainshaft rear cover	6·1274/6·1250	155·626/155·575
Bore for mainshaft rear bearing (in rear cover)	3·1498/3·149	80·004/79·991
Bores for reverse gear shaft and layshaft	1·0007/·9995	25·42/25·38
Mainshaft		
Diameter of spigot	·75/·7495	19·05/19·037
Diameter of journals for 2nd and 3rd gears	1·7485/1·7475	44·41/44·388
Thickness of integral collar	·300/·297	7·62/7·54
Primary shaft		
Diameter of spigot	·787/·7868	19·988/19·982
Diameter of needle bearing housing	1·1255/1·1250	28·587/28·575
Second and third speed gears		
Diameter of bushes (fitted)	1·750/1·751	44·45/44·475
Layshaft		
Diameter of shaft	1·0000/·9995	25·4/25·38
Reverse gear		
Diameter of bush (fitted)	1·0035/1·0025	25·49/25·46
Diameter of shaft	1·000/·9995	25·4/25·38
Selector mechanism		
Diameter of selector shafts	·62425/·623	15·856/15·838
Bore in selector forks for shafts	·6275/·62525	15·92/15·87
Selector shaft ball locking springs		
Free length	·79	20·07
To exert 10 lb. (4·53 kg.) at ·65 in. (16·51 mm.)		
Reverse stop plunger—overall length	2·45	62·23
Reverse stop plunger spring		
Free length	1·246	31·65
To exert 5 lb. (2·27 kg.) at 1·16 in. (29·46 mm.)		
Reverse stop locking ball spring		
Free length	1·45	36·83
To exert 26·56 lb. (12 kg.) at 1·127 in. (31·42 mm.)		
Gearbox tower		
Cap spring		
Free length	·83	21·08
To exert 35 lb. (15·88 kg.) at ·53 in. (13·48 mm.)		

GEARBOX

DESCRIPTION

The gearbox provides four forward speeds and one reverse. Helical gears are used for top, third and second and these gears are engaged by synchromesh action. Spur gears with straight teeth are employed for first and reverse gears.

The drive from the engine is taken by the primary shaft which is splined at its forward end for mating with the clutch driven plate. Also incorporated at the forward end is a spigot which registers with a bearing pressed into the rear of the crankshaft or flywheel as applicable. A large ball bearing is fitted to the rear end of the primary shaft and registers into a bore in front of the gearbox casing. The bearing is retained on the primary shaft by a spring ring and is located by a larger spring ring fitted in a groove on the circumference of the bearing outer race and held between the front cover and the gearbox casing. The hub of the front cover is scrolled to return any lubricant seeping along the shaft of the primary shaft.

Fitted in a counterbore in the rear of the primary shaft is a needle bearing assembly which supports a spigot on the front of the mainshaft. The rear of the mainshaft is carried by a ball bearing fitted in the casing rear cover. This bearing is located in the rear cover by a register on the speedometer gear case which is bolted to the cover.

To the rear of the bearing is assembled a distance piece and the worm wheel for driving the speedometer pinion. These, together with the bearing, are locked against the second speed synchronising hub by the driver coupling, the latter being splined and secured to the mainshaft by a bolt and lock plate. To safeguard against the lubricant seeping along the driver coupling, the aperture in the speedometer gear case for the coupling incorporates a return scroll.

Assembled to the lower part of the speedometer gear case is an adaptor for the speedometer drive pinion. The pinion bore in the adaptor is off-centre and by rotating the adaptor, the pitch centre of the pinion is either moved away or nearer to, the pitch centre of the worm wheel. Thus when a different speedometer drive ratio is required it is only necessary to alter the pinion.

The third and top gear synchronising hub assembly, located at the front of the mainshaft behind the primary

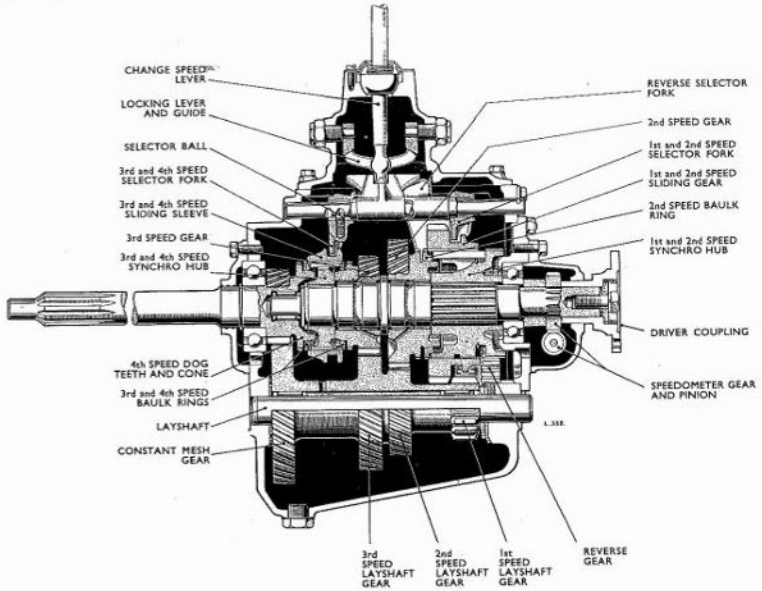


Fig. E.1. Arrangement of the gearbox assembly

shaft, consists of a synchronising hub, a sliding sleeve, three shifting plates, and two synchro circlips. The hub is splined to the mainshaft and retained by a spring ring. The outer circumference of the hub is splined for meshing with the sliding sleeve and is also slotted longitudinally to accommodate three equally spaced shifting plates. A small protrusion formed midway along each shifting plate engages with a detent groove inside the sliding sleeve. The shifting plates are loaded in the sleeve by the two synchro circlips, one on either side of the synchronising hub, which register against shoulders on the shifting plates.

A bushed third speed gear is carried on the mainshaft between the third and top gear synchronising hub assembly and a collar integral with the mainshaft. Located at each end of the synchronising hub assembly is a bronze baulk ring, which has a conical bore for mating with the cones on the primary shaft and the third speed gear. Each baulk ring has three slots for engaging the end of the shifting plates, and external dog teeth for meshing with the splines of the sliding sleeve.

The bushed second speed gear is located behind the collar integral with the mainshaft. A baulk ring similar to those previously described locates on a cone at the rear of the gear.

The second speed synchronising hub is located on the mainshaft between the second speed gear and the mainshaft rear bearing. The hub is splined internally to mate with the mainshaft splines, whilst external splines engage the first speed sliding gear. Longitudinal slots on the outer circumference of the hub locate three shifting plates in a similar manner to those described previously for the top and third speed synchronising hub. The protrusions on the shifting plates engage with a detent groove machined in the internal bore of the first speed sliding gear and in order to prevent the shifting plates from sliding too far towards the rear, the longitudinal slots do not run the whole length of the hub.

Straight tooth gears are machined on the outside of the first speed sliding gear, and, in addition to the detent groove, the internal bore of the gear is splined for meshing with the synchronising hub, and the dog teeth of the baulk ring and second speed gear.

The layshaft gear cluster is carried on needle roller bearings at the front and rear of the layshaft which is a light drive fit in bores at the front and rear faces of the gearbox casing. A tubular distance piece locates the needle roller bearings in position, and fitted also on the layshaft, between the cluster gear and gearbox casing, are steel backed thrust washers.

The layshaft is retained in the casing by a plate that locates in a slot in the shaft and is bolted to the rear face of the casing. The bushed reverse gear is carried on a plain shaft located in position by the same plate that locks the layshaft.

The selector forks operate on shafts assembled in the top of the gearbox casing. The shafts are located by a retaining plate fitted in slots at the rear ends of the shafts and bolted to the casing. Spring loaded balls housed in bosses on the selector forks engage grooves machined in the shafts to locate the position of the gears in neutral and the respective gears. A spring loaded plunger, in addition to the ball, is assembled to the reverse selector fork, the resistance of which has to be overcome by the foot of the change speed lever before reverse gear can be engaged.

The gearbox tower is bolted to the casing and houses the locking lever and guide and the change speed lever. The locking lever and guide pivots on two pins which are secured by locknuts screwed into the tower. The purpose of the locking lever and guide is to lock the remaining gears in neutral whilst the required gear is being selected. The change speed lever is spherically seated in the tower and retained in position by a cap secured by cheese headed setscrews. The two feet projections on the locking lever and guide and the foot of the change speed lever engage with slots machined in the top of the selector forks.

OPERATION

When the change speed lever is moved to engage the first gear, the foot of the lever moves the first and second selector fork rearwards along the selector shaft from the neutral position. This movement of the selector fork lifts the spring loaded ball from its location in the central groove in the shaft. Simultaneously,

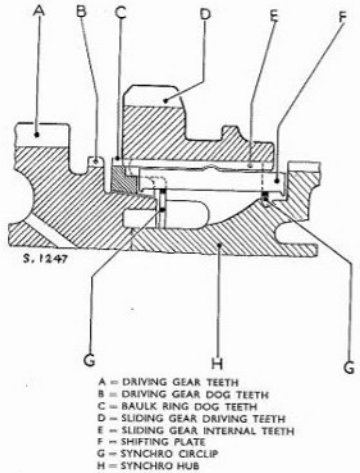


Fig. E.2. Sectional view of the first and second synchronising hub assembly

the projections on the locking lever and guide locate with slots machined in the reverse and the third and top selector forks thereby locking them in the neutral position.

Continued movement of the change speed lever causes the selector fork to move the first speed sliding gear along the synchronising hub, into engagement with the first gear on the layshaft and at the same time, the protrusions on the shifting plates are forced out of the detent grooves in the sliding gear. In this position, the spring loaded ball in the selector fork is located in the rear groove in the selector shaft.

In selecting second gear, the change speed lever moves the first and second speed selector fork forward and through neutral, until the spring loaded ball locates in the front groove of the selector shaft. The locking lever and guide remains in the same position and continues to lock the reverse and the third and top selector forks in the neutral position. Simultaneously, the first speed sliding gear is moved forward out of engagement with the layshaft first speed gear, and when the neutral position of the synchronising hub is attained, the protrusions on the spring loaded shifting plates in the hub engage the detent grooves in the sliding gear. The sliding gear continues to move forward but before second gear is actually engaged, the speeds of the mating gears are synchronised as follows (see Fig. E.3).

Continued movement of the sliding gear through neutral, forces the three shifting plates (F) forward, bringing the baulk ring into engagement with its mating cone which is integral with the second speed gear. The gear (A) will be rotating at a speed considerably different from that of the hub and therefore the baulk ring will be dragged round by friction to the extent permitted by the clearance (J). By referring to Fig. E.3(*b*), it will be seen that the baulk ring teeth (C) have now moved into the path of the sliding gear teeth (E). Their chamfered faces abut and restrict further movement until synchronisation occurs.

The teeth (E) endeavour to push the obstruction away, thereby applying a positive pressure to the cone members which increases the frictional driving effort. As further pressure is applied through the change speed lever, the speed of the gear (A) is synchronised with the sliding gear (D) and when this occurs the pressure between the abutting teeth is relieved. This allows the sliding gear to move forward and engage the teeth of the baulk ring and the driving gear dog teeth (B), forcing the spring loaded shifting plates out of the detent grooves in the sliding gear in the process.

When changing from second to third gear, the change speed lever moves the first and second speed selector fork to the rear into neutral. In this position the spring loaded ball in the fork engages the centre groove in the selector shaft, the first speed sliding gear is moved along the second speed synchronising hub, out of engagement with the second speed gear, and the protrusions on the shifting plates in the second speed synchronising hub engage the detent groove in the first speed sliding gear. The change speed lever is then moved to the right and forward to the third gear position. Simultaneously, the foot of the lever moves the locking lever and guide to the left, thus engaging the slots in the first and second and reverse selector forks to retain them in the neutral position.

The selector fork moves the third and top speed sliding sleeve to the rear, but does not engage the dog teeth of the third speed gear until the speed of the mating gears has been synchronised as described previously.

When a change from third gear to top gear is made, the change speed lever moves the third and top speed selector fork on the shaft, forward and through neutral, until the spring loaded locking ball engages the front groove of the shaft. The locking lever and guide remains in the slots on the first and second and reverse selector forks, thereby locking them in neutral. At the same time, the sliding sleeve meshes with the dog teeth of the primary shaft gear when the speed of the two gears has been synchronised.

With all the gears in neutral, reverse gear is selected by moving the change speed lever to the left and rearwards. Before the slot in the reverse selector fork can be engaged, sufficient pressure must be exerted when

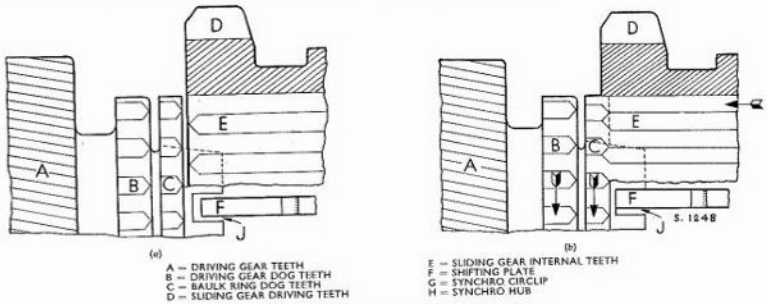


Fig. E.3. Operational diagram of the synchromesh mechanism

moving the change speed lever to the left in order to overcome the spring loaded reverse plunger. The selector fork moves the reverse gear forward into mesh with the first speed gear on both the layshaft and mainshaft. Simultaneously, the spring loaded ball in the fork locates with the front groove in the selector shaft.

LUBRICATION

Every 6,000 miles (10,000 kms.) the oil should be drained and the gearbox refilled with fresh clean oil of the recommended grade to the high level mark on the dipstick.

The drain plug is located at the bottom of the casing and the oil dipstick and filler cap combined is fitted in the filler neck at the top of the gearbox. The dipstick is accessible after removing the large rubber sealing pad, located in the cab floor cover panel, adjacent to the base of the change speed lever.

SPEEDOMETER DRIVE CABLE

To Remove.

1. At the gearbox end of the cable, unscrew the knurled nut which connects the cable to the speedometer pinion adaptor and pull the cable clear.

2. Unscrew the knurled nut securing the cable to the speedometer and then release the inner cable from the instrument. For details of this operation, refer to the "Instrument and Gauges" section under "Electrical Equipment".

3. Draw the cable into the cab taking care not to damage any electrical leads.

Inspection.

1. Examine the inner cable at the squared ends. Renew the cable if the corners have worn appreciably.

2. Check both the inner and outer cables for kinks and other damage and renew if necessary.

Note: Either cable may be renewed separately.

To Refit.

This is carried out by reversing the removal procedure smearing the inner cable sparingly with thin oil before installing it in the outer cable.

SPEEDOMETER DRIVE GEARS

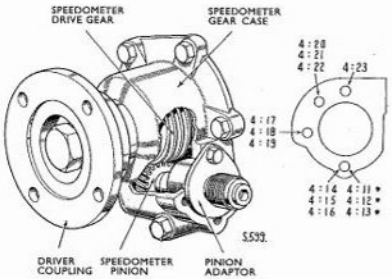
To Remove.

1. Disconnect the drive cable at the gearbox.

2. Remove the setscrew securing the speedometer pinion adaptor, then lift out the adaptor followed by the pinion.

Note: If the original pinion is being refitted, the hole to which the adaptor setscrew is fitted should be noted to enable the adaptor to be secured in the same position. Should, however, a pinion of a different ratio be fitted, the adaptor setscrew must be screwed into one of the holes appropriate for the particular ratio as shown in Fig. E.4.

3. The pinion drive gear may be removed in the following manner:



*The ratios marked with an asterisk * are obtained with an alternative pinion adaptor*

Fig. E.4. Speedometer drive gears

(*a*) Disconnect the propeller shaft from the driver coupling (see "Propeller Shaft" section).

(*b*) Unscrew and remove the coupling securing bolt, remove the spring washer and the splined locking washer, then withdraw the coupling by tapping off with a copper or lead hammer. Alternatively, use Churchill Tool 55, Legs R.G.55–8 and Adaptor Set R.G.55–10 if a tight coupling is evident.

(*c*) Unscrew the six setscrews and remove the speedometer gear case noting the joint.

(*d*) Slide the drive gear off the mainshaft.

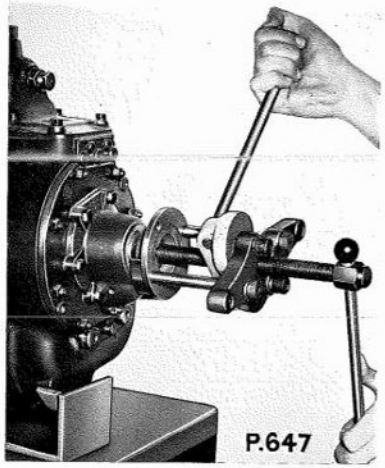


Fig. E.5. Withdrawing a tight driver coupling using Churchill Tool 55, Legs R.G.55-8 and Adaptor Set R.G.55-10

Inspection.

1. Examine the teeth of the pinion and the drive gear. If damaged or worn, the faulty component should be renewed.

2. Check the pinion thrust pad in the speedometer gear case for scores and wear and renew if necessary.

3. Check that the oil return scroll in the rear of the speedometer gear case is free from obstruction.

To Refit.

Refitting is a reversal of the removal procedure, observing the following:

1. Use a new joint between the speedometer gear case and the rear cover.

2. The position of the adaptor will depend on the size of the pinion (see Fig. E.4).

3. Before refitting the coupling securing bolt, ensure that the splined locking washer engages with the splines of the driver coupling bore and after positioning the spring washer under the securing bolt head, refit the bolt and tighten securely.

GEARBOX TOWER

To Remove.

1. Ensure the change speed lever is in the neutral position.

2. Unscrew the change speed lever knob after releasing the locknut.

3. Release the floor centre panel retaining screws and lift the panel, with the rubber bellows, off the change speed lever as an assembly. The bellows and dipstick access plug can be removed from the floor panel, if necessary.

4. Unscrew the six setscrews securing the gearbox tower assembly to the casing and remove the tower complete. Remove the tower joint.

Cover the top of the gearbox to prevent any foreign matter from entering the gearbox.

To Dismantle.

1. Remove the three cheese-headed screws retaining the tower cap and remove the cap, noting that the cap is under tension from the cap spring.

2. On removing the tower cap, the ball cap and the ball spring can be lifted off the change speed lever.

3. Lift out the change speed lever.

4. Slacken the locknuts on the two locking lever and guide pivot pins and unscrew the pins from the tower which will allow the locking lever and guide to be withdrawn.

5. The change speed lever ball peg is an interference fit in the tower and should not be removed unless renewal is necessary.

Inspection and Overhaul.

1. Examine the plain shanks of the pivot pins and the bores in the locking lever and guide for wear and renew as necessary.

2. Check the change speed lever ball spring for weakness (see "Manufacturing Data" at the beginning of this section).

3. Inspect the striker foot of the change speed lever for wear and renew the lever if necessary.

4. Examine the head of the lever ball peg in the tower and the mating slot in the lever ball for wear or damage and renew the lever, or the peg, or both, as necessary. To renew the peg, drift out the existing peg from the outside of the tower. The new peg can either be pressed or tapped into the tower bore ensuring that the peg is fully located.

To Re-assemble.

Reverse the dismantling operation noting the following points.

1. Locate the locking lever and guide centrally in the tower on the plain shanks of the pivot pins ensuring free movement without excessive end float.

Do not tighten the pivot pin locknuts until the tower is re-assembled to the gearbox.

2. Before inserting the change speed lever in the tower, smear a thin film of grease around the spherical seating in the tower. Insert the change speed lever and locate the slot machined in the lever ball with the head of the ball peg in the tower.

To Refit.

Refit the tower assembly in the reverse order of the removal operations with attention to the following points.

1. With the gears in neutral, refit the tower using a new joint, after removing the material used to protect the top of the gearbox.

2. Check that the locking lever and guide pivots freely in the slots of the selector forks. Should the lever and guide foul the slots, adjust by means of the pivot pins, screwing both pins in or out an equal amount until free movement is attained. Securely tighten the locknuts on completion of the check.

3. Ensure that the floor centre panel is secure and that the floor panel seal to the cab floor is in good condition. Ensure that the rubber bellows fits correctly in the lip of the floor panel and also around the change speed lever.

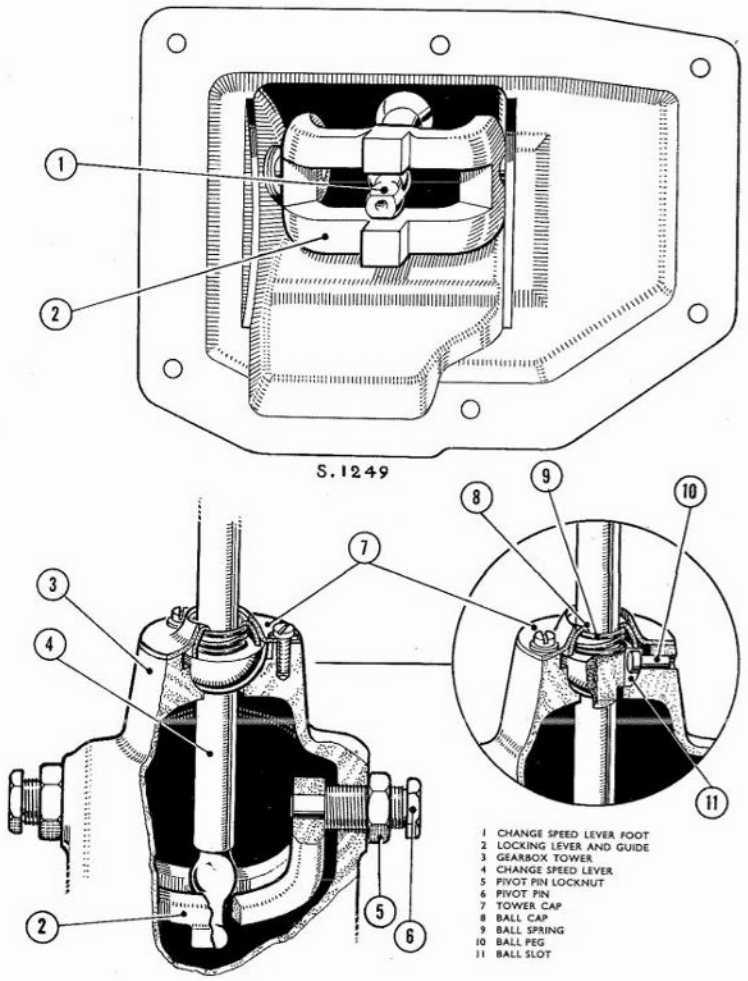


Fig. E.6. Gearbox tower assembly

SELECTOR SHAFTS AND FORKS

To Remove.

In order for the selector shafts and forks to be removed and refitted, it is necessary to remove the gearbox from the vehicle (see page E.10). After removing the gearbox, which includes removing the gearbox tower, proceed in the following manner:

1. Withdraw the two setscrews that secure the selector shafts retaining plate to the rear of the casing. Remove the plate from the slots in the shafts.

2. Using a suitable soft metal drift, drive out the shafts from the casing (front to rear) taking care not to lose the locking balls.

3. Lift out the selector forks in the following order. Third and top, reverse, and finally, the first and second fork. Remove the locking ball springs from the bosses in the fork heads.

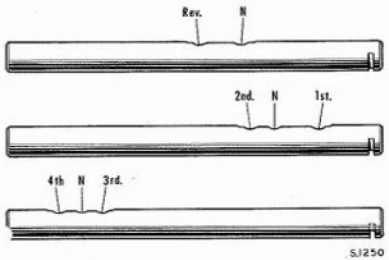


Fig. E.7. Selector shaft identification

To Dismantle.

Reverse Plunger Assembly. To remove the reverse stop plunger from the reverse selector fork head, proceed as follows:

1. Remove the small circlip retaining the plunger in the fork.

2. Push out the plunger. A strong initial pressure must be applied to move the spring loaded locking ball out of its groove in the plunger. When the plunger is removed, the locking ball and its spring will shoot out and care must be taken not to lose these items.

Inspection and Overhaul.

1. Examine the ball locking springs and the reverse stop plunger spring for damage or weakness (see page E.2 for spring data), renewing as necessary.

2. Inspect the balls for pitting or flats, renewing any ball where this is apparent.

3. Examine the selector forks for wear at the point of contact with their respective gear. Any fork that appears twisted should be renewed.

4. Examine the selector shafts for excessive wear in the ball grooves and in the track of the balls. Renew if badly worn.

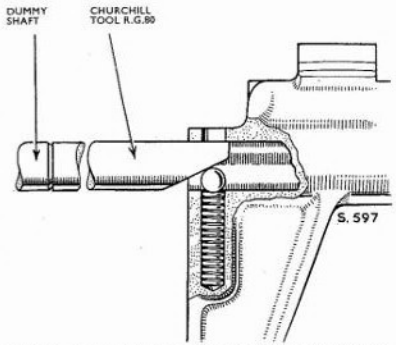


Fig. E.8. Re-assembling the locking ball and spring in the selector fork using Churchill Tool R.G.80

To Re-assemble.

1. Re-assemble the locking balls and springs in the selector forks, using Churchill Tool R.G.80 and then secure the ball and springs temporarily in position by following up R.G.80 tool with a short dummy shaft in each fork.

2. Re-assemble the reverse stop plunger to the reverse selector fork using Churchill Tool R.G.81 (see Fig. E.9) as follows:

(*a*) Drop the plunger spring into position and insert first the locking ball spring and then the locking ball into the drilling which is parallel with the selector shaft bore in the fork.

(*b*) Fully compress the locking ball into its drilling with Churchill Tool R.G.81 and insert the plunger until the plunger spigot abuts the flat on the Churchill Tool.

(*c*) Press hard on the plunger and simultaneously withdraw the Churchill Tool thus permitting the plunger spigot to enter the plunger spring and also retain the locking ball in its drilling.

(*d*) Apply a sharp tap to the plunger head to locate the locking ball in the plunger groove and complete the operation by fitting a new circlip in the plunger spigot groove.

To Refit.

1. Place the forks in position with the prongs registering in the grooves in the respective gears and refit in the following order. The first and second fork, the reverse fork next, and the third and top selector fork last.

2. Refit the selector shafts in their appropriate bores, picking up the selector forks in the process, observing the following:

(*a*) As the shafts pass through the forks, the dummy shafts used for compressing the locking balls and springs, will be pushed out, and care must be taken to prevent them from falling into the casing.

(*b*) The slots in the shafts for the retaining plate must be to the top and rear of the casing.

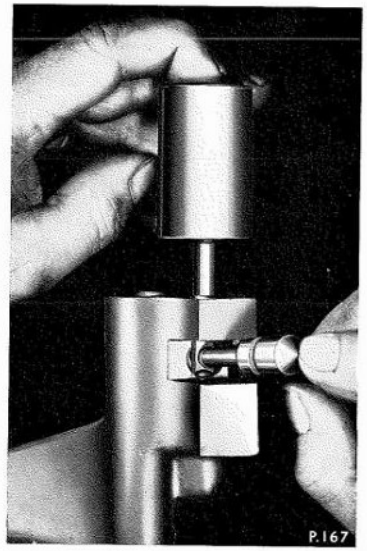


Fig. E.9. Re-assembling the reverse stop plunger to the reverse selector fork using Churchill Tool R.G.81

3. Fit the retaining plate in the shaft slots and secure with the two setscrews.

4. Refit the gearbox to the vehicle (see page E.16).

GEARBOX ASSEMBLY

To Remove.

1. Drain the oil from the gearbox at the plug provided.

2. Remove the gearbox tower (see page E.7) and suitably protect the top of the gearbox from the entry of foreign matter.

3. Unscrew the knurled nut securing the speedometer cable to the adaptor in the speedometer gear case, and withdraw the cable which should be temporarily secured clear of the gearbox.

4. Disconnect the propeller shaft at the driver coupling (see "Propeller Shaft" section).

5. Remove the power take off unit (when fitted).

6. Unscrew and remove the four nuts and washers securing the gearbox to the mounting studs in the rear face of the clutch housing.

7. Withdraw the gearbox rearwards until the primary shaft is clear of the clutch housing and then lower the gearbox assembly to the ground.

Note: At no time during the removal and refitting operations must the gearbox assembly be allowed to hang unsupported in the clutch assembly or the release bearing.

To Dismantle.

1. The gearbox tower will have been removed during the removal operation and overhaul information for this assembly is given on page E.7.

2. Remove the selector shafts and forks (see page E.9).

3. Withdraw the driver coupling and remove the speedometer gear case, the drive gear and the distance piece located at the rear of the mainshaft rear bearing (see page E.6 for removal instructions).

4. Unscrew the six setscrews and remove the side cover and the joint. This operation is not necessary when a power take off is fitted to the gearbox, as this unit will have already been removed.

5. Remove the setscrew securing the layshaft and the reverse shaft retaining plate at the rear of the gearbox casing. Slide out the retaining plate.

6. Using a soft metal drift, tap out the layshaft from the front to the rear of the casing, and allow the layshaft gear cluster to rest in the bottom of the casing.

7. Unscrew the six setscrews securing the front cover and remove the cover and the joint.

8. The primary shaft assembly complete with the bearing race, is then withdrawn from the gearbox casing by tapping out, using a soft metal drift applied against the rear face of the bearing outer race, from the inside of the casing.

9. Having withdrawn the primary shaft assembly, remove the spring ring retaining the bearing on the shaft and remove the abutment washer fitted between the spring ring and the bearing. Suitably support the bearing race, and press out the primary shaft, which will allow the bearing chip shield to be lifted off the shaft. Prise the large spring ring from the bearing outer diameter.

10. Remove the eight setscrews securing the rear cover to the casing and release the rear cover from the casing bore by screwing in, alternately, two $\frac{5}{16}$ in. U.N.C. setscrews in the two tapped holes provided in the cover flange.

11. On releasing the rear cover, the complete mainshaft assembly can be withdrawn through the rear bore in the casing.

Ensure that the top speed baulk ring is also removed with the assembly and identify the baulk ring to its gear cone for the re-assembly operation.

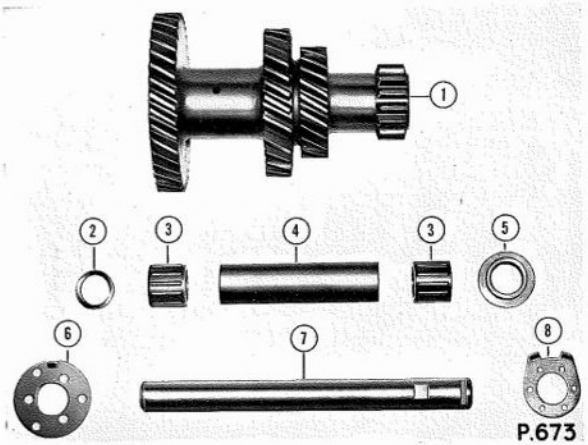


Fig. E.10. Details of the layshaft assembly

12. The mainshaft spigot roller bearing and the radiused distance washer may have been withdrawn with the primary shaft assembly. Check that both components are removed.

13. The layshaft gear cluster can then be lifted out of the gearbox casing through the mainshaft rear aperture. Note the order of removal for the small thrust washer, needle roller bearing and thrust collar at the rear end of the gear cluster; the tubular distance piece in the centre of the gear cluster and the needle roller bearing, spacing collar and the large thrust washer at the front end of the gear cluster. It will be noted that the thrust collar is an interference fit in the gear cluster bore and will require to be tapped out, using a soft metal drift through the bore interior.

14. Withdraw the reverse gear shaft from the rear of the casing, if necessary, using R.G.101B and adaptor R.G.101B-3 which can be screwed into the $\frac{3}{8}$ in. U.N.F. tapped hole in the rear of the reverse gear shaft (see Fig. E.11). After removing the shaft, the reverse gear can be lifted out of the casing.

15. To dismantle the mainshaft assembly, proceed as follows:

(*a*) Slide the top and third sliding sleeve off the synchronising hub splines, remove the three shifting plates and detach the synchro circlip which will be released with the shifting plates.

(*b*) Using the second speed gear as a base, the rear cover and bearing assembly, the first speed sliding gear, the first and second synchronising hub assembly and the second speed gear, can be pressed off the mainshaft. Ensure that the second speed baulk ring is identified to the second speed gear cone for the re-assembly operation. The three shifting plates and the two synchro circlips can be released from the synchronising hub after separating the first speed sliding gear from the hub.

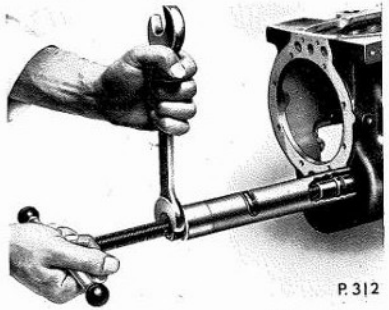


Fig. E.11. Withdrawing the reverse gear shaft using Churchill Tool R.G.101B and Adaptor R.G.101B-3

(*c*) Remove the spring ring from the groove in the front end of the mainshaft. It may be necessary to apply a light pressure on a handpress, to the mainshaft spigot, in order to remove the top and third synchronising hub from the mainshaft, using the third speed gear as a base.

Remove the hub, detach the remaining synchro circlip, and slide off the third speed gear and the third speed baulk ring.

Ensure that the third speed baulk ring is identified to the third speed gear cone for the re-assembly operation.

(*d*) Press the mainshaft rear bearing out of the rear cover.

Inspection and Overhaul.

All components should be thoroughly cleaned before inspection. When checking for wear, refer to the dimensions given under "Manufacturing Data" at the beginning of this section.

1. Casing. Check for wear and damage at the casing bores and examine the casing for cracks.

2. Gear Teeth. Examine all the gear teeth for damage or wear. Any gear with worn or damaged teeth should be renewed.

The chamfered faces of the dog teeth on the primary shaft, third speed gear and second speed gear should be inspected for wear. If badly worn, the gear should be renewed. This also applies to the corresponding chamfers on the internal splines of the third and top sliding sleeve and the first speed sliding gear.

3. Ball Bearings. The ball bearings should be cleaned in light machine oil and then checked for slackness and noisy operation, which, if apparent, will necessitate the renewal of the faulty bearing.

4. Needle Roller Bearings. Examine the needle rollers for wear or pitting. If either is present on any one roller, renew the bearing.

5. Primary Shaft. Check the spigot which registers with the pilot bearing in the crankshaft or flywheel flange, and the counterbore which accommodates the mainshaft spigot bearing, for wear or pitting. Insert the primary shaft into a new driven plate and check for burrs and backlash on the splines.

The baulk ring cone must be absolutely free from glazing, ridges and scores.

6. Baulk Rings. Ensure that the baulk ring dog teeth are in good condition. The tapered bores of the baulk rings incorporate fine, closely pitched grooves designed to break down the oil film rapidly on the gear cones as the mating faces engage. Ensure that these grooves are not worn and renew if wear is evident. If the baulk rings are to be refitted, make certain that no foreign matter is present in the grooves.

Check the baulk rings for concentricity by marking the corresponding gear cone with a thin coating of engineers' marking blue and offer up the baulk ring. Examine the result obtained which should show a corresponding blue marking on the tops of all the baulk ring grooves.

7. Synchronising Hub Assemblies. Fit the hubs on to their respective mainshaft splines and ensure they are a good fit without backlash. This condition also applies to the sliding sleeve and the first speed sliding gear which mate with the external splines of the appropriate hub.

Insert the shifting plates in the appropriate hub slots and ensure that the plates have free sliding movement along the slots. Renew any of the shifting plates whose protrusions show signs of wear. The synchro circlips should be renewed if weak or show wear at the contact faces with the shifting plates.

8. Mainshaft. Check the mainshaft for wear at the spigot, the synchronising hub splines, the collar in the centre of the shaft, and the ground portions on which the third speed gear and second speed gear bushes operate. Fit the driver coupling to its splines and check for backlash. If backlash is apparent, renew the driver coupling; should backlash again be noted, renew the mainshaft. Check the bolt holes in the driver coupling flange for elongation, and renew the coupling if evident.

9. Third and Second Mainshaft Gears. Inspect the synchronising cones for glazing, ridging or scores, and renew the gear if evident. Check the bushes for wear and renew the gear if wear is excessive. Ensure that the drillings through the gear and bush are free from obstruction.

10. Reverse Gear and Shaft. Inspect the reverse gear bush for wear and check the gear for excessive clearance on the shaft. If necessary, re-bush the gear, and/or, renew the shaft. The bush is a press fit in the gear and must be finish bored to a diameter of 1·0035/1·10025 in. (25·49/25·46 mm.) after fitting. This operation must be carried out with great care to ensure the correct alignment of the bore which must be concentric with the larger gear tooth pitch diameter within ·002 in. (·050 mm.) maximum run-out. When pressing in the new bush, prior to boring, the correct depth dimension is ·08 in. (2·03 mm.) from the rear face of the larger gear.

11. Layshaft Thrust Washers. Examine the thrust faces of the washers for wear or scores and renew as necessary.

12. Front and Rear Covers. Inspect each cover for damage or burrs on the registers and on the mating faces with the gearbox casing. Check that the oil return scroll in the front cover is free from obstruction.

13. Selector Shafts and Forks. See page E.9.

14. Gearbox Tower. See page E.7.

15. Speedometer Drive Gears and Casing. See page E.7.

To Re-assemble.

1. Insert the reverse gear shaft partly into the casing, through the rear bore, with the slotted end of the shaft to the rear. Re-assemble the reverse gear on the shaft, ensuring that the larger gear is nearest to the rear of the casing, then tap the shaft forward until the slot for the retaining plate is flush with the casing.

2. Tap the thrust collar into the rear end of the layshaft gear cluster bore, using a hide faced mallet. Always ensure that the mating faces of the collar and the cluster bore are perfectly clean before re-assembly.

The first needle roller bearing, the tubular distance piece, the second needle roller bearing and the spacing collar are then re-assembled to the bore, in that order, working from rear to front.

3. Locate the larger thrust washer, by means of its projecting tag, on the front layshaft boss inside the casing, using grease to retain the thrust washer in position. The smaller thrust washer must then be located on the rear layshaft boss in the same manner.

The re-assembled gear cluster is then lowered into the bottom of the gearbox casing.

Note: To ensure that the thrust washers remain in position whilst lowering the gear cluster in the casing, insert two short dummy shafts through the layshaft bores until they engage the washers but, at the same time, do not prevent the gear cluster from passing between the ends of the shafts.

4. Re-assemble the mainshaft as follows:

(*a*) First, re-assemble the two synchronising hub assemblies (see Fig. E.12 and E.13). Slide the first speed sliding gear on the first and second synchronising hub, noting that the selector fork groove on the gear, must be nearer to the rear of the hub than the gear teeth.

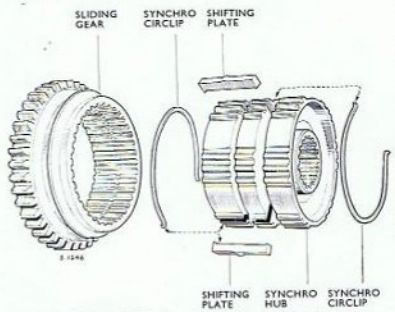


Fig. E.12. Exploded view of the first and second speed synchronising hub assembly

Insert the three shifting plates in the hub slots, with their centre protrusions outwards, and re-assemble the synchro circlip in the small groove in the recess machined in the rear section of the hub to engage the shifting plates as shown in Fig. E.12. Fit the front synchro circlip in the front recess of the hub, locating the circlip on the underside of each shifting plate, with the open end of the circlip following the opposite direction to the rear synchro circlip as shown in Fig. E.13. Ensure that the upturned ends of the synchro circlips do not foul the hub.

Position the sliding gear so that the centre protrusions of the shifting plates engage with the detent groove in the gear.

Re-assemble the top and third synchronising hub assembly, using the same procedure as with the first and second synchronising hub, noting that the tapered end of the sliding sleeve must face the same direction as the protruding boss at the end of the hub.

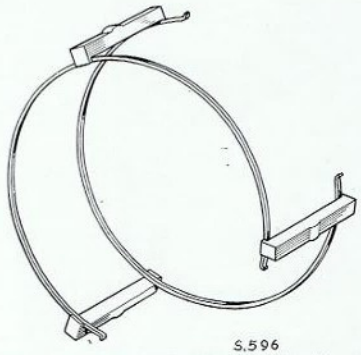


Fig. E.13. Showing the correct location of the shifting plates and the positioning of the open ends of the synchro circlips

(*b*) Position the second speed gear on the rear section of the mainshaft with the gear face farthest from the baulk ring cone, abutting the integral collar on the mainshaft. Slide on the second speed gear baulk ring until the ring mates with the gear cone.

Slide the first and second synchronising hub assembly on the mainshaft splines and lightly tap fully into position, using a hide faced mallet, ensuring at the same time, that the projecting shifting plates engage the slots in the baulk ring.

(*c*) Press the rear bearing fully into the rear cover and on completion, support the mainshaft in protected jaws in a vice and tap the bearing and cover assembly on the mainshaft using the hollow drift portion of Churchill Tool R.G.77, until the inner track of the bearing abuts the rear end of the first and second synchronising hub. After this operation, ensure that the second speed gear rotates freely on the mainshaft.

(*d*) Refit the distance piece at the rear of the rear bearing on the mainshaft, followed by the speedometer drive gear. Re-assemble the speedometer gear case and the driver coupling as detailed on page E.7. The driver coupling securing bolt should be fully tightened at a later stage when the mainshaft is re-assembled in the casing.

(*e*) Re-assemble the third speed gear on the front of the mainshaft with the gear cone farthest from the mainshaft collar. Place the third speed baulk ring on the mainshaft and engage the ring with the gear cone. Ensure that the identification marks which were made during dismantling are corresponding on the ring and gear cone.

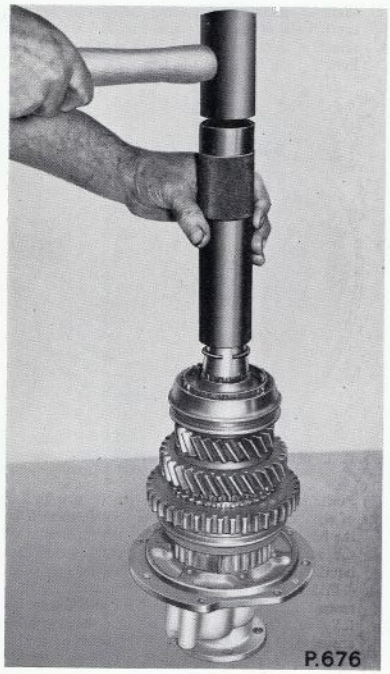


Fig. E.14. Fitting the spring ring in the mainshaft groove using Churchill Tool R.G.76 in conjunction with the hollow drift portion of R.G.77

(*f*) Slide the top and third synchronising hub assembly on the front of the mainshaft and engage the shifting plates with the slots in the third speed baulk ring. It may be necessary to lightly tap the hub to ensure that it is fully into position using a hide faced mallet.

Retain the hub by fitting a new spring ring in the groove at the front of the mainshaft, using a tapered guide, Churchill Tool R.G.76 in conjunction with the hollow drift portion of Churchill Tool R.G.77.

(*g*) Place the radiused distance washer on the mainshaft spigot, matching the radiused face of the washer with the corresponding radius on the spigot. Also, re-assemble the needle roller bearing on the mainshaft spigot.

The mainshaft assembly will then be ready for re-assembly to the gearbox casing.

(*h*) Engage second gear on the mainshaft by pushing the first speed sliding gear along the hub until the internal splines of the gear engage with the dog teeth on the second speed gear.

Before re-assembling the mainshaft in the gearbox casing, ensure that the reverse gear is positioned at the rear end of the reverse gear shaft; enter the mainshaft assembly through the aperture in the rear of the casing and at the same time, lift the mainshaft sufficiently to enable the first speed sliding gear teeth to clear the teeth of the reverse gear thus preventing the reverse gear from being pushed out of position along the shaft. Secure the rear cover to the casing, with the eight setscrews and spring washers, thus locating the mainshaft assembly in position.

Note: Use a new joint between the rear cover and the gearbox casing.

5. Re-assemble the primary shaft as follows:

(*a*) Position the bearing chip shield on the primary shaft.

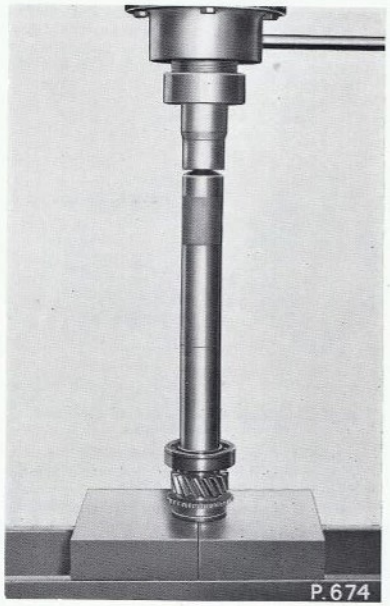


Fig. E.15. Pressing the ball bearing on the primary shaft using the Churchill Hollow Drift portion of R.G.77 and the extension adapter R.G.77-1 with the Churchill Pad R.G.79 to protect the gear cone

(*b*) Press the ball bearing on the primary shaft using the Churchill Hollow Drift portion of R.G. 77 and the extension adaptor R.G. 77–1 with the Churchill Protector Pad R.G. 79 to safeguard the gear cone from damage (see Fig. E.15). Ensure that the bearing is re-assembled to the shaft with the retaining ring groove, in the bearing outer circumference, farthest from the primary shaft gear.

(*c*) Place the abutment washer on the shaft next to the bearing and then refit the small retaining ring in the primary shaft groove to secure the ball bearing, using the tapered guide and hollow drift of Churchill Tool R.G.77 with the extension adaptor R.G.77-1. Always use a protector pad (Churchill Tool R.G.79) to safeguard the gear cone from damage during this operation.

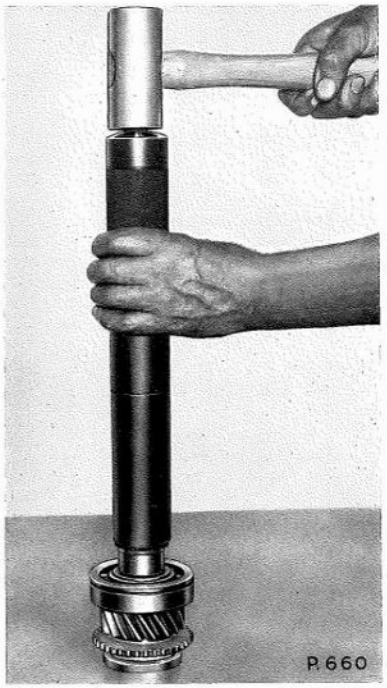


Fig. E.16. Refitting the bearing retaining ring in the primary shaft groove using Churchill Tool R.G.77 with the extension adaptor R.G.77-1 and the Churchill Pad R.G.79 to protect the gear cone

(*d*) Finally, the large retaining ring is then refitted to the groove in the bearing outer circumference.

6. Place the top speed baulk ring on the primary shaft gear cone and insert the assembled primary shaft through the front bearing aperture in the casing until the mainshaft needle roller bearing engages the small counterbore in the rear of the primary shaft. At the same time, register the primary shaft ball bearing in the casing bore and using the hollow drift portion of R.G.77, with the extension adaptor R.G.77-1, tap the bearing into position, until the large retaining ring on the bearing outer circumference fully contacts the casing. As the bearing is being tapped into position, engage the slots in the top speed baulk ring with the protruding ends of the shifting plates. Take care not to jam the baulk ring during this operation.

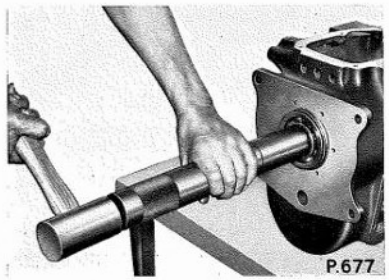


Fig. E.17. Refitting the assembled primary shaft in the gearbox casing using the hollow drift of Churchill Tool R.G.77 with the extension adaptor R.G.77-1

7. Refit the front cover to the casing using the six setscrews and spring washers and a new joint. Ensure that the oil drain channel in the cover is at the bottom and that the joint does not obstruct the corresponding drain hole in the gearbox casing.

8. To enable the layshaft to be re-assembled, slowly invert the gearbox and rotate the primary shaft to allow the primary shaft gear to mesh with its corresponding gear on the layshaft as the gear cluster rolls into position.

Remove the two dummy bars retaining the thrust washers and insert the layshaft, slotted end first, into the front bore of the casing. To assist in aligning the thrust washers and collars in the gear cluster, a tapered shaft (Churchill Tool R.G.78) pushed in ahead of the actual layshaft, will facilitate this operation.

9. Lock the reverse gear shaft and the layshaft in position by refitting the retaining plate in the slot in each shaft and securing the plate to the rear of the casing with the setscrew and spring washer.

10. Refit the selector shafts and forks as detailed on page E.9.

Note: At this stage, the driver coupling securing bolt should be fully tightened and in order to accomplish this operation, engage two gears simultaneously to lock the mainshaft.

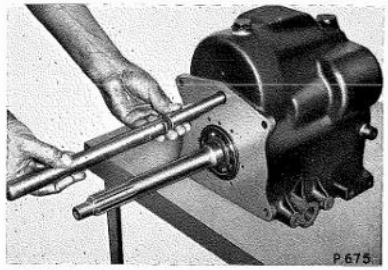


Fig. E.18. Refitting the layshaft by first inserting the tapered shaft, Churchill Tool R.G.78, to assist in aligning the thrust washers and collars

11. Refit the side cover using the six setscrews, spring washers and a new joint. This operation is not necessary if a power take off is fitted to this aperture.

To Refit.

To refit the gearbox assembly, reverse the removal procedure noting the following points.

1. Ensure that the splined hub of the driven plate is aligned with the primary shaft spigot bearing, prior to refitting the gearbox.

2. Check the primary shaft splines for burrs and lightly smear the splines with grease.

3. Do not allow the gearbox to hang unsupported in the clutch assembly during this operation.

4. Refit the power take off (when fitted).

5. Refit the gearbox tower assembly as detailed on page E.7.

6. Refill the gearbox with the recommended grade of oil to the high level mark on the gearbox dipstick.