

# Section A – ENGINE – PETROL MODELS

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**ENGINE REMOVAL AND DISMANTLING PROCEDURE****Removing engine**                      **Operation A/2**

1. If fitted, remove the spare wheel from bonnet panel.
2. Remove the bonnet panel.
3. Disconnect the battery leads.
4. Disconnect the air intake pipe from the carburetter and remove air cleaner.
5. Drain the coolant from system (one tap at bottom L.H. side of radiator and one tap at L.H. side of cylinder block).
6. Disconnect the side lamp leads at snap connectors at each side of the grille panel assembly and the front lamp harness from the junction box at R.H. side of scuttle, then pull the wiring clear to front of engine.
7. Detach the top hose at radiator header tank and the bottom hose from water pump inlet.
8. Remove the fan blades.
9. Remove the bolts securing the grille panel to the front cross member and front wings.
10. Lift the radiator, grille panel and headlamps assembly upward, then forward to clear the vehicle.
11. Disconnect the exhaust pipe from exhaust manifold.
12. Disconnect the heater pipes (if fitted) at the engine side of scuttle.
13. Disconnect the petrol pipe at carburetter.
14. Disconnect the throttle return spring, throttle linkage (at a ball joint) and the cold start control cable at carburetter and clamp. If fitted, disconnect the engine governor operating rod. Section T.
15. Disconnect:  
Dynamo wiring; ignition coil leads; starter lead from switch; oil pressure switch wire; mixture control switch wire (at rear of cylinder head).
16. Secure a sling to the engine and with suitable lifting tackle just take the strain.
17. Remove the front floor and gearbox cover.
18. Support the gearbox assembly with a jack or packing blocks.
19. Remove the remaining nuts and washers securing the gearbox to the flywheel housing.
20. Remove the bolts from engine front support brackets and allow the engine to move forward and thus clear the gearbox input shaft. Ensure

that the speedometer cable and all wires, etc., are clear, then hoist the engine gently from the vehicle.

21. Drain the oil from sump.
22. Bolt the engine to a suitable stand.

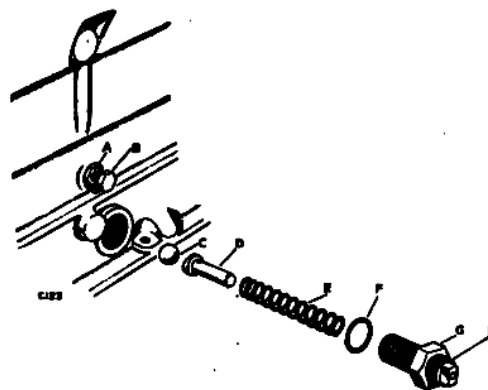
**DISMANTLING ENGINE****Externals**                                      **Operation A/4**

1. Disconnect the accelerator linkage (at a ball joint), distributor vacuum pipe and remove carburetter. Detach sparking plug covers and leads, remove locating screw and withdraw the distributor. Remove sparking plugs.
2. If fitted, disconnect the heater pipe and flow control tap from cylinder head.
3. Remove the exhaust rocker cover.
4. Remove the dynamo and starter motor.
5. Remove the exhaust and inlet manifolds.
6. Remove the external full flow oil filter complete.
7. Disconnect the oil feed pipe—gallery to cylinder head.
8. Remove the dipstick and tube, then drain and remove sump.

**Oil pump**    **Operation A/6**

1. Slacken the locknut securing oil pressure adjusting screw, then remove screw, washer, spring, plunger and ball (which may remain in the pump and can be removed when the pump complete is withdrawn).
2. Remove the pump locating screw.
3. Withdraw the pump, leaving the drive shaft in position.
4. If necessary, withdraw the oil pump drive shaft. Operation A/18.

*Note:* See Section AO for details of oil pump strip and assembly.



**Fig. A-1—Oil pressure relief valve**

- |                           |                                |
|---------------------------|--------------------------------|
| A—Locknut                 | E—Spring                       |
| B—Locating screw—oil pump | F—Washer                       |
| C—Ball                    | G—Locknut                      |
| D—Plunger                 | H—Adjusting screw—oil pressure |

**Vibration damper**

**Operation A/8**

1. Remove the starter dog, using spanner Part No 263055 or 530102.
2. Withdraw the vibration damper complete.
3. Remove the plate, shims (if fitted), rubber disc, driving flange and second disc from the damper flywheel. Six set screws.
4. If necessary, remove the flywheel bush.

**Water pump and front cover**

**Operation A/10**

1. Remove the thermostat housing from the cylinder head complete with thermostat, outlet pipe, inlet elbow and joint washer.
2. Remove the copper tube and rubber joint ring from either the bottom face of the thermostat housing or the top face of the water pump casing.
3. Remove the water pump complete with joint washer and inlet pipe; as the pump casing is spigoted in the block, it will be necessary to oscillate it slightly as it is removed.

To strip water pump completely for overhauling purposes, refer to Section L.

4. Remove the securing bolts and remove the front cover.

**Timing chain tensioner and chain wheels**

**Operation A/12**

1. Remove the crankshaft oil thrower.
2. Release the pawl from the ratchet, compress the tensioner spring by lifting the jockey pulley arm as far as possible, and fit clip, Part No. 262748, over the tensioner.

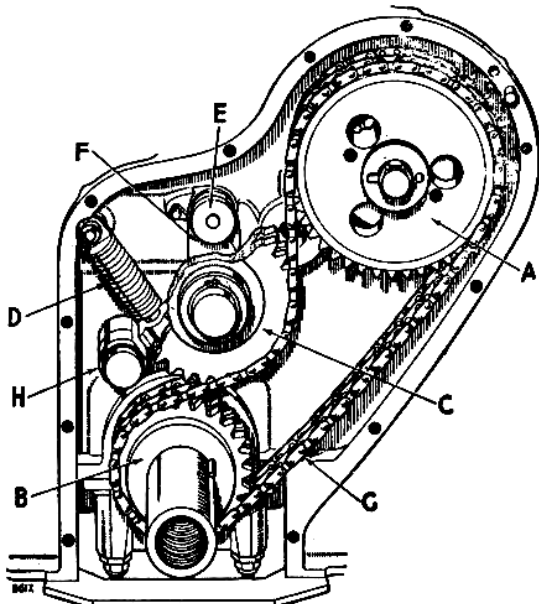


Fig. A-2—Timing chain and tensioner

- |                         |                               |
|-------------------------|-------------------------------|
| A—Camshaft chainwheel   | E—Pawl                        |
| B—Crankshaft chainwheel | F—Ratchet                     |
| C—Jockey pulley         | G—Timing chain (driving side) |
| D—Hydraulic tensioner   | H—Jockey pulley arm           |

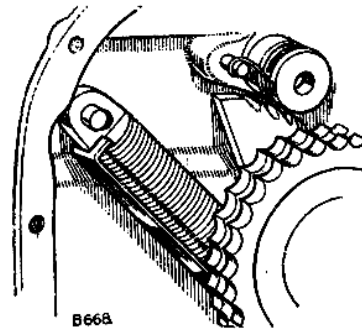


Fig. A-3—Clip for timing chain tensioner

3. Remove the jockey pulley; remove the driving chain.
4. Withdraw the jockey pulley arm and tensioner.
5. Carefully remove the special clip and part the tensioner spring, piston, cylinder and, if necessary, extract the ball and the two retaining springs from the cylinder.
6. If necessary, extract the pawl pivot pin (5/16 in. B.S.F. tapped hole); remove the pawl and pawl spring.
7. Remove the camshaft chainwheel, using extractor, Part No. 262750, or Part No. 507231.

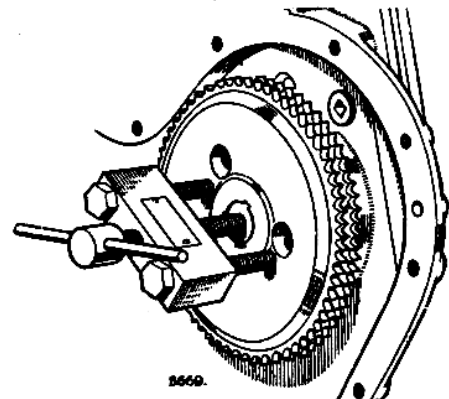


Fig. A-4—Removing camshaft chainwheel

8. If necessary, remove the crankshaft chainwheel, using a claw extractor.
9. Wash and dry all tensioner components and renew any worn part.

**Cylinder head and inlet rocker gear**

**Operation A/14**

1. Remove the inlet rocker cover.
2. Remove the rocker shaft complete with all components.  
*Note:* The 3/8 in. (spanner size) nuts have 7/16 in. threads.
3. Remove the components and lay out in the following order: Rear bracket (located by set screws); spring; R.H. rocker; bracket; L.H. rocker; two brackets; spring; R.H. rocker; bracket; L.H. rocker; spring; front bracket.
4. Withdraw the push rods and insert them in a piece of cardboard pre-pierced and marked.
5. Loosen the securing bolts evenly and lift the cylinder head clear.

- Using a valve spring compressing tool, Part No. 276102, remove the valve assemblies. The valves should be inserted in a piece of cardboard pre-pierced and marked. Retain the springs in pairs; they are selected to ensure an interference fit.

#### Exhaust valves Operation A/16

- Slacken the tappet adjusting screws right back.
- Set each rocker on the back of its cam, and using a valve spring compressing tool, Part No. 276102, remove the valve assemblies. The valves should be inserted in a piece of cardboard pre-pierced and marked. Retain the springs in pairs; they are selected to ensure an interference fit.

#### Exhaust rocker shafts and distributor housing Operation A/18

- Remove the plug and fibre washer from the flywheel end of the cylinder block.

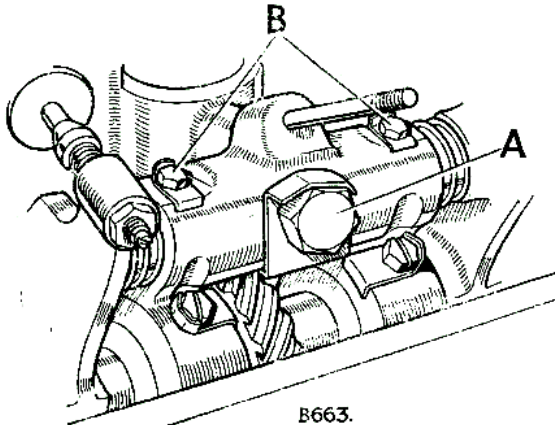


Fig. A-5—Exhaust rocker shaft and distributor housing location bolts

A—Distributor housing location bolt.  
B—Exhaust rocker shaft location bolts.

- Remove the location bolts; two for the rocker shafts and a hollow bolt for the distributor housing. Withdraw the distributor housing, and remove oil pump drive shaft.
- Withdraw the rear shaft using extractor, Part No. 262749.  
Lay out the components in order:—  
Spring; R.H. rocker; washer; R.H. cam follower; washer; L.H. rocker; spring. Same order applies to both rocker shafts.
- Repeat for the front shaft.

#### Camshaft and camshaft bearing removal Operation A/20

- Remove the camshaft thrust plate.
- Remove the bolt and lock washers locating each of the three front bearings.
- Withdraw the camshaft until the third bearing is clear of No. 2 bearing housing; split the bearings and lay aside. Remove the camshaft and front bearing.  
Split the front bearing and remove.

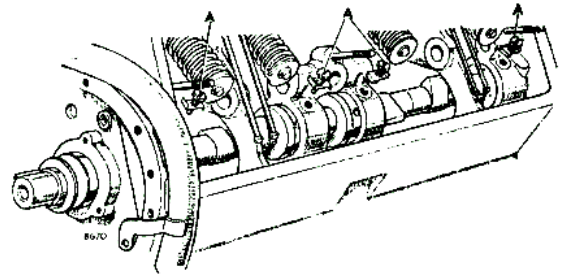


Fig. A-6—Camshaft bearing location bolts  
A—Location bolts

- If necessary, remove the bolt and lock washer from the rear bearing. Remove the rear camshaft cover.
- Remove the rear bearing; preserve all bearings in their respective pairs.

#### Flywheel Operation A/22

- Remove the clutch assembly, then the flywheel securing bolts and withdraw the flywheel. The primary pinion bush may be extracted if necessary.

#### Pistons and connecting rods Operation A/24

- Remove the connecting rod caps, bearings and bolts.
- Push each connecting rod up and turn, in order to engage the slots at the bottom of the cylinder bore. Remove the circlips; withdraw the gudgeon pin, using extractor, Part No. 278668; remove the piston.

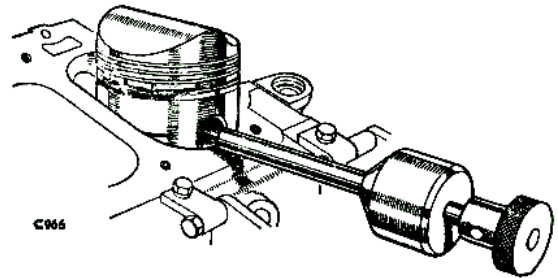


Fig. A-7—Removing gudgeon pin

- Lower each connecting rod, turning the crankshaft as necessary to effect withdrawal.
- Remove the piston rings.  
*Note:* Mark all components in sets.

#### Crankshaft, main bearing and rear bearing oil seal Operation A/26

- Remove the flywheel housing.
- Remove the main bearing caps and shells. The lower half of the rear main oil seal may be removed complete with rear main bearing cap.
- Lift out the crankshaft and remaining bearing halves. The bearing halves must be preserved in pairs. Ensure that the thrust washers are retained in original housings if used again.

## ENGINE ASSEMBLY

Camshaft Operation A/28

*Note:* The bearings must be fitted dry and must be a hand push fit in the cylinder blocks; they must always be renewed in paired halves and the numbers stamped on one of the end faces of each of the bearing halves must be adjacent.

The rear bearing is provided with four lateral holes.

1. Checking bearing clearance on camshaft, if new bearings are fitted, make sure that they can be dismantled and assembled without difficulty.
2. Insert the camshaft partly into the cylinder block, assemble the bearings on to the shaft with the locating holes in line with the holes in the housing, and push the shaft into position.
3. Line up the locating holes in the bearings and housings, and before replacing the set bolts, squirt oil down the holes to lubricate the bearings until oil pressure is built up. Replace set bolts. See Fig. A 6.
4. Fit the camshaft thrust plate and chain wheel. The camshaft should have .003 in. (0,07 mm) to .005 in. (0,12 mm) end-float, measured between the chain wheel and the thrust plate.

## Crankshaft, main bearing and seals

Operation A/30

1. To check that the bearing caps have not been filed, first assemble the caps without bearing shells to the crankcase, ensuring that they are correctly located by means of the dowels. Tighten both securing bolts for each cap, then slacken one bolt of each pair right off. There should be no clearance at the joint face.

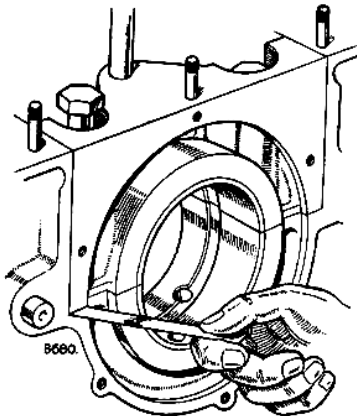


Fig. A-8—Checking main bearing nip

2. Remove the bearing caps and fit the bearing shells, locating by means of the tags. Tighten the caps down and slacken off one bolt of each pair. Check the bearing nip, as illustrated in Fig. A-8, ensuring that the clearance does not exceed .004 to .006 in. (0,10 to 0,15 mm). The nip can be corrected by selective assembly of bearing shells; these are available in slightly varying thicknesses.

3. When the bearing nip has been checked, remove the caps and bearing shell bottom halves. Position a standard-size thrust bearing at each side of centre bearing shell—top half, and fit the crankshaft.
4. Refit the bearing shell bottom halves and bearing caps. Tighten the securing bolts evenly and check each bearing in turn for correct clearance. The crankshaft should resist rotation when a feeler paper, .0025 in. (0,06 mm) thick, is placed between any one bearing shell and crankshaft journal, and turn freely by hand when the feeler paper is removed. Adjust by selective assembly of bearing shells.
5. Check the crankshaft end-float with a feeler gauge (Fig. A-9); adjust at centre bearing by selective assembly of thrust washers to give .002 to .006 in. (0,05 to 0,15 mm) end-float.

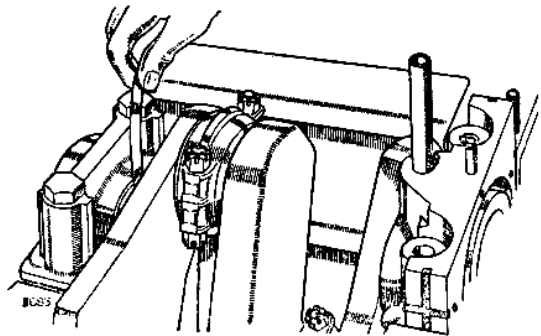


Fig. A-9—Checking crankshaft end-float

6. Remove the bearing caps, bottom half shells and crankshaft.
7. To the rear main bearing cap fit neoprene seals in recess at each side, and on the rear face fit the lower half of crankshaft rear bearing seal.
8. Fit the top half of crankshaft rear bearing oil seal to the crankcase. Lubricate bearing face with Silicone MS4 Compound.
9. If the crankshaft end-float reading, obtained in Item 5, was not within the limits, fit suitable oversize thrust bearings. The variation of thrust bearing thickness at each side must not exceed .003 in. (0,07 mm) to ensure that the crankshaft remains centralised.

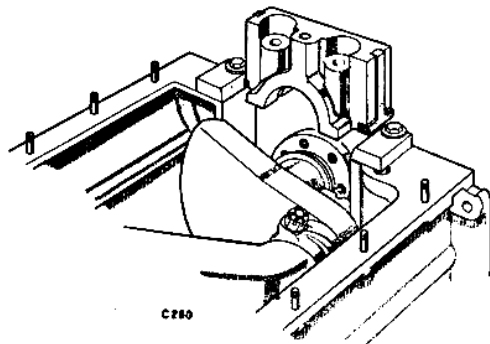


Fig. A-10—Guide in position on cylinder block

Lubricate the crankshaft journals, main bearing shells and thrust bearings, then refit crankshaft.

Smear bearing face of crankshaft rear bearing oil seal with Silicone MS4 compound.

Fitment of the rear main bearing cap with side seals in position, will be facilitated by using a lead tool (Part No. 270304) fitted to the sump studs adjacent to rear bearing cap aperture.

It will be found advantageous to cut a slight lead on to the bottom edges of the side seals, as this will prevent them from folding under the cap during fitment, thus causing an oil leak due to the cap not seating properly. Smear seals with Silicone MS4 Compound when fitting.

### Connecting rods

### Operation A/32

1. The oil hole in gudgeon pin bush is pre-drilled and care must be taken to ensure that the oil holes of bush and connecting rod will align when the bush is pressed into position. The gudgeon pin bushes should be a .001 to .002 in. (0,02 to 0,05 mm) interference fit in connecting rods. Ream the bush when fitted to connecting rod to allow a .0003 to .0005 in. (0,007 to 0,012 mm) gudgeon pin clearance. Ensure that correct alignment is maintained while reamering.

This fit is selected to give the smallest possible clearance consistent with a smooth revolving action.

2. Fit each connecting rod to a suitable test rig and check for twist and mal-alignment.

3. To check that the connecting rod has not been filed:—

Select the correct cap for each connecting rod, as denoted by the number stamped near the joint faces. This number also indicates the crankpin to which it must be fitted.

Assemble the connecting rods, less shell bearings, with corresponding numbers together.

Tighten the securing nuts, then slacken one of them right off and check that there is no clearance at the joint face.

4. Check the bearing nip as follows:—

Fit the bearing shells and tighten both securing nuts—slacken one nut as before and check the nip with a feeler gauge; this should be .002 to .004 in. (0,05 to 0,10 mm).

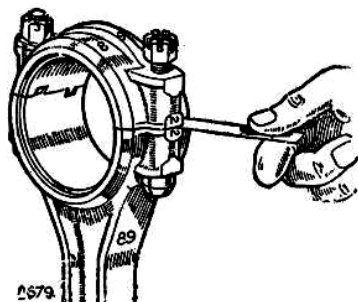


Fig. A-11—Checking big-end bearing nip

5. If the bearing nip is too great, decrease by rubbing down the joint faces of the bearings on fine emery cloth; if the bearing nip is too small, select another pair of bearings, and re-check the bearing nip.

If the bearing nip is still small, re-check that the connecting rod has NOT been filed (see Item 3).

6. Assemble the big-end of each connecting rod to its respective crankpin, then check for correct end-float, by inserting a feeler gauge between the end face of the rod and the crankpin shoulder. End-float should be .009 to .013 in. (0,23 to 0,33 mm).
7. Remove the connecting rods from the crankshaft, ensuring that the bearing shells are kept with the rods to which they were fitted.

### Pistons

### Operation A/34

1. When fitting pistons, standard or oversize, the cylinder bore clearance should be in accordance with the dimensions laid down in the data section. When reboring, the block must be honed to suit the selected pistons. In the absence of suitably accurate measuring instruments, a long feeler .0025 in. (0,06 mm) thick may be inserted against the thrust side of the bore as illustrated in Fig. A-12 and the piston located crown downward. The piston should become a tight fit when the top of the skirt (immediately below the bottom scraper ring) enters the bore.

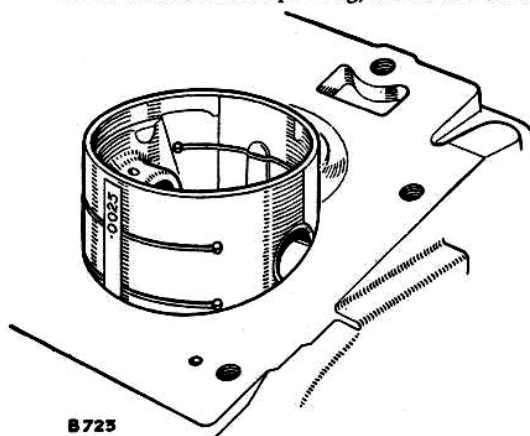


Fig. A-12—Checking piston clearance

### Piston ring fitting

Check gap and side clearance. To check gap, support the ring in the cylinder bore with an old piston.

Stepped scraper rings, where used, must be fitted with the larger diameter at the top.

Compression "T" or "Top" on one face.

3. The gudgeon pin, when cold and dry, should be an easy sliding fit in the connecting rod and should have a slight interference fit in both piston bores, i.e. so that it can be pressed in by hand, but will not fall out under its own weight.

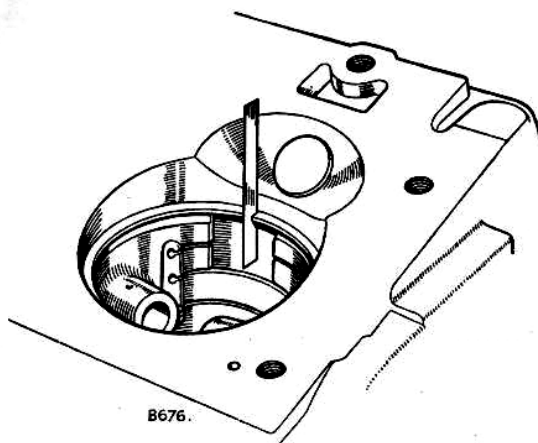


Fig. A-13—Checking piston ring gap

**Pistons to connecting rods Operation A/36**

1. Enter the connecting rod, without bolts, up into the cylinder bore and engage in the cylinder block slots.
2. Enter the skirt of the piston into the top of the bore, with the flat top of the piston in line with the oil hole in the connecting rod.
3. Fit the gudgeon pin, using thimble Part No. 272103, to align piston and connecting rod. Lock the pin in position with circlips.

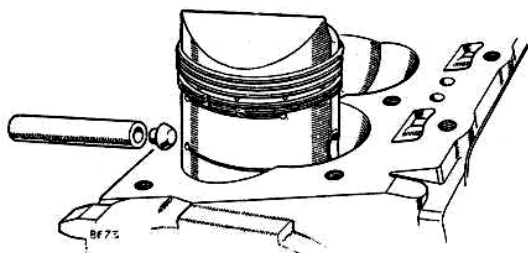


Fig. A-14—Fitting gudgeon pin

**Piston and connecting rod to cylinder block and crankshaft Operation A/38**

1. The connecting rod bolts are a tight fit in the rod and must be tapped into place with a 'Z' shaped bar.
2. Turn the crankshaft until the crank journals relative to numbers 1 and 4 cylinders are at B.D.C. Squirt oil on to the journal, refit appropriate bearings to cap and connecting rod, pull the rod down to the journal and fit cap, ensuring that the oil hole in the connecting rod is on the opposite side to the camshaft. Tighten the nuts to 30 lb/ft. (4 mKg) on 1948-53 models and to 40 lb/ft. (5,5 mKg) on 1954-58 models and then turn on to the next split pin hole. Fit split pin.

**Re-boring Operation A/40**

1. Re-boring conforms to normal practice. It is necessary to employ a jig block, Part No. 261287, to enable standard equipment to be used.

It should also be noted that on early engines the upper portion of the bores is chromium plated; the chromium is too hard for standard cutters,

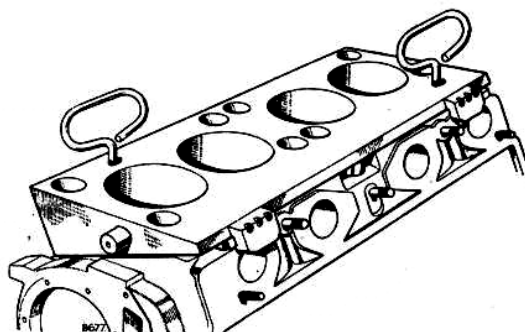


Fig. A-15—Re-boring jig block

so that the first cut, starting from the top of the bore, must be sufficiently deep to cut behind the plating.

2. If the cylinder block has already been bored out to maximum size, cylinder liners may be fitted.

**Cylinder liners****Operation A/42**

1. Fitting conforms to standard practice; note the following points:—
2. Machine the cylinder block bores as follows:
 

1948-51 1.6 litre	....	2.937 in. + .001
		(74,60 mm + 0,025)
1952-54 2.0 litre	....	3.188 in. + .001
		(80,97 mm + 0,025)
1955-58 2.0 litre	....	3.245 in. + .001
		(82,42 mm + 0,025)

This gives an interference fit of .003 to .004 in. (0,075 to 0,10 mm).

3. Prior to pressing in the liner, allowance must be made for twist up to 3/16 in. (5 mm) clockwise. To facilitate re-alignment should the liner not be positioned correctly at the first attempt, scribe lines down the sides of the liner from the two peaks and make corresponding marks on the cylinder block.
4. Press in the liner, using press block Part No. 262864, until the top edge is level with the bottom of the exhaust valve pocket. Blend to the shape of the cylinder block.
5. Bore to suit the selected pistons. Operations A/40 and A/34.
 

Liners for the 1.6 litre engine can be bored out to a maximum of .040 in. (1,00 mm).

Liners for the 2.0 litre engine can only be bored out to suit standard or .010 in. (0,25 mm) oversize pistons.

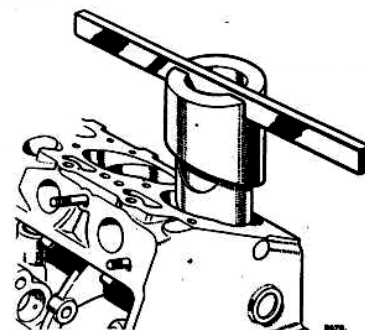


Fig. A-16—Fitting cylinder liner

**Flywheel housing and flywheel****Operation A/44**

1. Ensure that the rear main bearing oil seal is in good condition, then secure the flywheel housing to cylinder block.
2. Fit the flywheel and tighten the securing bolts to 70 lb/ft (9,8 mKg).
3. Check the run-out on the flywheel face as illustrated by Fig. A-17. The run-out must not exceed .005 in. (0,12 mm) at outer edge of face.

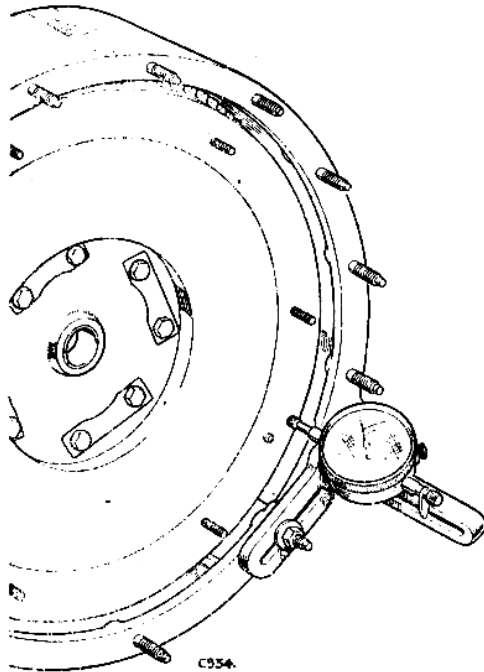


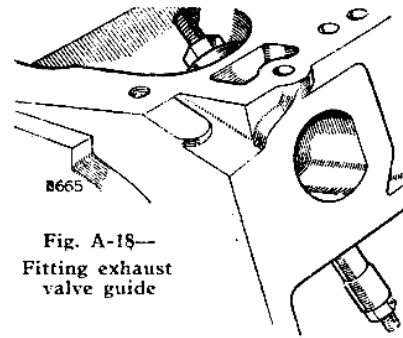
Fig. A-17—Checking run-out on flywheel face

**Exhaust valves****Operation A/46**

1. Grind the seats to  $45^\circ + \frac{1}{4}$ , using 'Vibro-centric' equipment.
2. Face the valves to  $45^\circ - \frac{1}{4}$  and lap into their respective seats.
3. Wash each valve, seat, port and guide in paraffin.
4. Locate each valve into their respective guides and, using compressor Part No. 276102, fit the spring assemblies, caps and split cones. A new 'O' ring seal must be fitted to each guide.

**To fit new guides**

5. Remove the guide with a drift, Part No. 263051.
6. Pull in the new guide, using tool Part No. 262753, and ream to .3448 in.—.0005 (8,757 mm—0,012)
7. Repeat items 1 to 4 inclusive.

Fig. A-18—  
Fitting exhaust  
valve guide**To fit new seats**

*Note.*—Special attention is needed to prevent possible injury from flying fragments when the insert is broken.

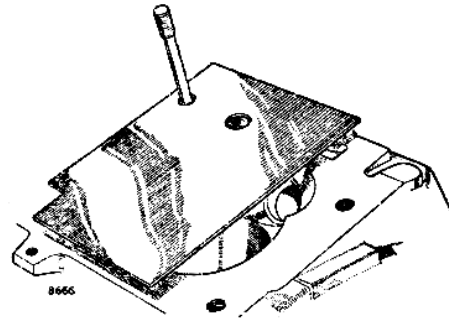


Fig. A-19—Removing exhaust valve seat

8. Secure protection plate, Part No. 263050, over the appropriate cylinder bore, and cover the opening below the insert with a heavy pad of rag.
9. Break the insert by means of a chisel applied through the hole in the plate.
10. Remove the valve guide by means of a piloted drift, Part No. 263051.

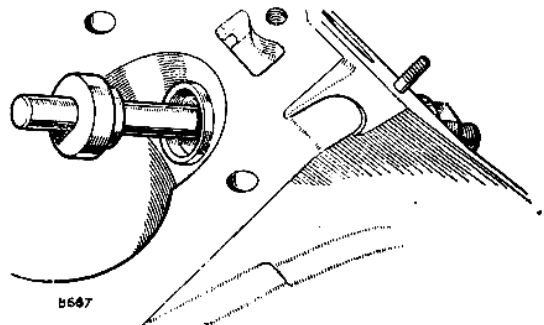


Fig. A-20—Fitting exhaust valve seat

11. Clean the seat recess and pull the new insert into position, using tool Part No. 262752. It is not necessary to heat the block or freeze the insert, but light taps on the tool may be required to ensure that the insert enters smoothly.



12. Continue precautions against fragmentation for a few minutes, as the insert may shatter a short time after fitting.
13. Pull in the new valve guide, using tool Part No. 262753.
14. Repeat items 1 to 4 inclusive.

### Exhaust rocker shafts assembly

#### Operation A/48

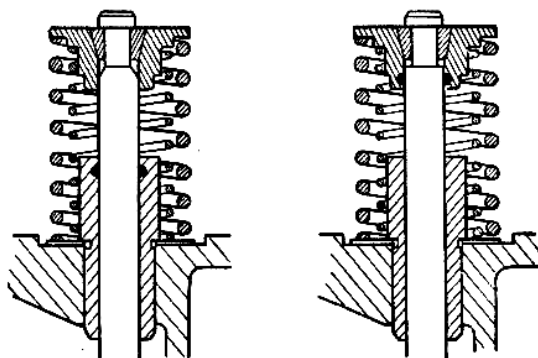
*Note.*—When fitting a replacement rocker or cam-follower, it is essential that the component be fitted with the special protective coating of grease still adhering.

1. Fit new bushes in the rockers and followers as necessary and drill through the 1/16 in. (1,58 mm) oil feed hole. The bush must be a *light drive fit* in the rocker or follower and a *sliding fit* on the shaft. Ream in position to .593 in. +.001 (15,081 mm + 0,025).
2. Replace shafts by inserting front shaft through the locating hole and assembling component parts in the following order: spring; R.H. rocker, washer; R.H. cam-follower; L.H. cam-follower; washer; L.H. rocker; spring.
3. Repeat for rear shaft, ensuring that, with both shafts in position, the oil feed holes in the rocker shafts are facing towards the cylinder block. The front of each shaft is marked 'F'.
4. Fit the plugs and fibre washer; for tappet adjustment see Operation A/54.

### Inlet valves

#### Operation A/50

1. Cut the valve seats (in cylinder head) to  $30^\circ + \frac{1}{4}$  only when necessary; normally they require cutting only at every second or third decarbonising operation.
2. Face the valves to  $30^\circ - \frac{1}{4}$  and lap into their respective seats.
3. Wash each valve, seat, port and guide in paraffin.
4. Locate each valve into their respective guides and, using compressor Part No. 276102, fit the spring assemblies, caps and split cones. A new 'O' ring seal must be fitted to each guide.



Later seal Fig. A-21

Early seal

### To fit new guides

5. Remove the guide with a drift, Part No. 263051.
6. Press in the new guide, and ream to .3448 in. — .0005 (8,757 mm — 0,012).
7. Repeat items 1-4, noting that the seat must be ground in the event of a new guide being fitted.

### Cylinder head and rocker gear

#### Operation A/52

1. Smear the joint face of cylinder block and cylinder head gasket with engine oil, then fit the gasket and cylinder head to cylinder block.
2. Locate head and gasket with the securing bolts, fitting all bolts except those which also secure the rocker shaft pedestals, but do not tighten at this stage.
3. Insert the push-rods into their original position, through cylinder head and locate in the cam-followers.
4. Fit new bushes in the rockers as necessary. The bush must be a *light drive fit* in the rocker and a *sliding fit* on the shaft. Press a new bush in with its shoulder on the same side as the rocker pad; drill through the oil feed holes—7/64 in. (2,77 mm) to the push-rod and 1/16 in. (1,58 mm) in the top of the rocker. Ream in position to .005 in. +.001 (12,7 mm + 0,025).

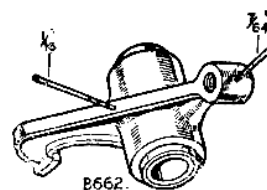
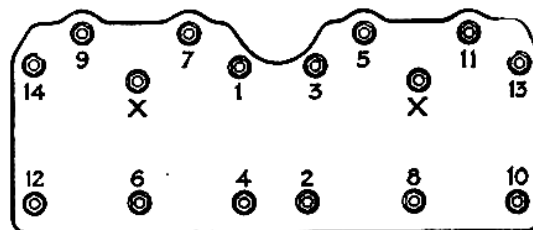


Fig. A-22—  
Drilling oil feed holes

5. Fit the component parts to the rocker shafts in the following order: Rear bracket (located by set screw); spring; R.H. rocker; bracket; L.H. rocker; two brackets; spring; R.H. rocker; bracket; L.H. rocker; spring; front bracket.
6. Fit the rocker shaft to the cylinder head. When in position, the oil feed holes in the rocker shaft must face the push-rods. Tighten all the bolts down in the manner illustrated by Fig. A-23:  $\frac{7}{8}$  in. bolts to 50 lb./ft. (7 mKg);  $\frac{3}{4}$  in. bolts to 30 lb./ft. (4 mKg).



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Fig. A-23—

Order of tightening cylinder head bolts. Those marked X also secure the rocker shaft.

**Tappet adjustment****Operation A/54**

The exhaust tappets may be set with the engine hot or cold.

The inlet tappets should be set with the engine at running temperature.

1. Set the valve receiving attention fully open by engaging the starting handle and turning the engine, then rotate the engine one complete revolution, to bring the tappet on the back of the cam.

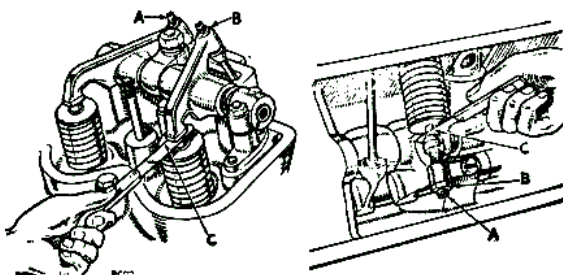


Fig. A-24—Tappet adjustment

A—Tappet adjusting screw      B—Locknut  
C—Feeler gauge

2. Slacken the tappet locknut and using a feeler gauge, rotate the adjusting screw to give the correct clearance .010 in. (0,25 mm) inlet and .012 in. (0,30 mm) exhaust, bearing down on the screw to take up all the clearance at the push-rod ends.

Tighten the locknut.

3. Repeat for the remaining tappets.

**Chain wheels, timing chain, adjuster and valve timing****Operation A/56**

1. Fit the crankshaft chain wheel on to shaft and key.
2. Turn the crankshaft in direction of rotation until the E.P. mark on the flywheel is in line with the timing pointer.
3. Replace the camshaft chainwheel and key (do not secure at this stage), rotate the camshaft and set No. 1 exhaust tappet at .010 in. (0,254 mm).
4. If removed, refit the pawl pivot pin, pawl and spring.
5. Fit dial test indicator and bracket, Part No. 262751, so that the "fully open" position of No. 1 exhaust valve can be ascertained in the following manner:—

- (a) Turn the camshaft in direction of rotation until the lobe of cam has nearly opened the valve fully, then stop rotation and mark the chain wheel and timing case to record the position.

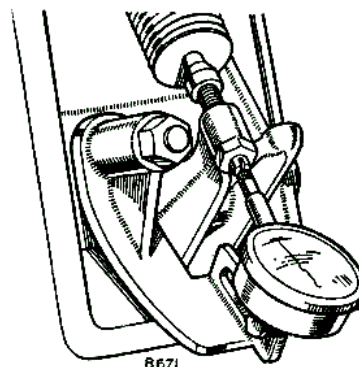


Fig. A-25—Checking exhaust valve fully open position

- (b) Note the reading on dial test indicator, then continue to turn the chain wheel slowly in direction of rotation until the needle has again reached the same position.
- (c) Mark the chain wheel at a point opposite to the mark on timing case and make a third mark on the chain wheel, exactly midway between those made previously.
- (d) Turn the camshaft against direction of rotation until the third mark is in line with that on timing casing, whereon the valve should be fully open.

Fit the timing chain with "no slack" on the driving side. It may be necessary to remove and re-position the camshaft chain wheel to obtain this "no slack" condition on the driving side when the flywheel and camshaft are correctly positioned. The camshaft chain wheel is provided with three irregularly spaced keyways to facilitate accurate timing.

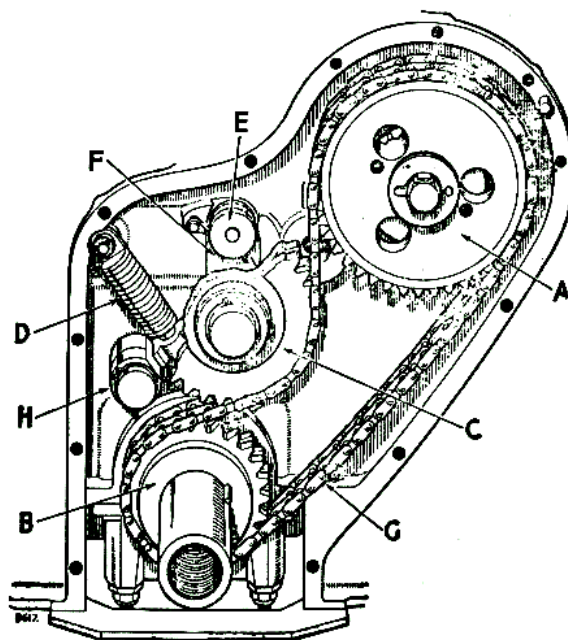


Fig. A-26—Timing chain and tensioner

A—Camshaft chain wheel      E—Pawl  
B—Crankshaft chain wheel      F—Ratchet  
C—Jockey pulley      G—Timing chain (driving side)  
D—Hydraulic tensioner      H—Jockey pulley arm

6. Fit the jockey pulley arm to its locating spindle.
7. Assemble the hydraulic tensioner, compress and retain the spring with clip, Part No. 262748, and fit complete assembly to its locating spindle. Position the ball-end in its seat on the pulley arm, holding the ratchet pawl clear, and push arm upwards to the extent of its travel. Remove the special clip and fit jockey wheel.
8. Release the pulley arm and allow jockey wheel to take up slack in the timing chain.
9. Check the timing by rotating the engine and correct if necessary, by moving the camshaft chain wheel to one of the other key-ways.
10. Finally, secure the tensioner with a split pin and plain washer, secure the jockey wheel with a circlip and secure the camshaft chainwheel by locating the lock washer in one of the vacant key-ways and bending over the tag. Fit the oil thrower to the crankshaft noting that, correctly located, it curves away from the chain.

#### Water pump and front cover Operation A/58

1. Renew the joint washer and smear with a light grease.
2. Fit front cover to block (two locating dowels) and secure with bolts.
3. For details of assembly procedure for water pump, refer to Section L.
4. Fit new joint washer, smear with light grease and offer assembly to cylinder block, complete with copper tube and rubber joint ring in recess on top of water pump.
5. Locate securing bolts and tighten.
6. Fit thermostat housing complete with thermostat, outlet pipe, inlet elbow and joint washer, to cylinder head, taking care not to dislodge the copper and rubber washer.

#### Vibration damper Operation A/60

1. If stripped, examine the flywheel bush. Renew if necessary, noting that it should be a press fit in the flywheel and an easy fit on the driving flange.
2. When reassembling the damper, discard any shims which may have been previously fitted. These have been found to be unnecessary. Tighten the screws fully.
3. Mount the unit on a suitable mandrel, using a slave location key and rotate on centres. Adjust the run-out on the front face by tightening the screws at the point where a dial test indicator gives a minus reading. Secure the screws by staking.

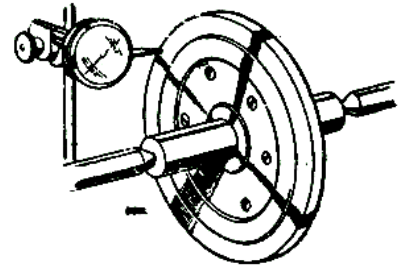


Fig. A-27—Checking vibration damper run-out

4. Balance statically, using putty or similar material. Weigh the putty and drill balancing holes in the flywheel. *Note:* A hole  $\frac{3}{8}$  in. (9,52 mm) dia. x  $\frac{1}{4}$  in. (6,35 mm) deep represents  $1\frac{1}{2}$  grams.

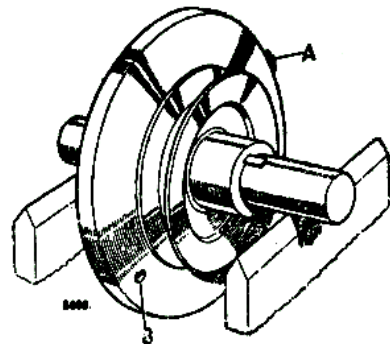


Fig. A-28—Balancing vibration damper  
A—Putty B—Balancing hole

5. Refit damper on crankshaft, securing with a lock washer and starting dog. Tighten the starting dog, using spanner Part No. 263055.

#### Oil pump

#### Operation A/62

1. For details of assembly procedure for oil pump, refer to Section AO.
2. With the gauze oil strainer secured in position, offer the pump up to the engine.

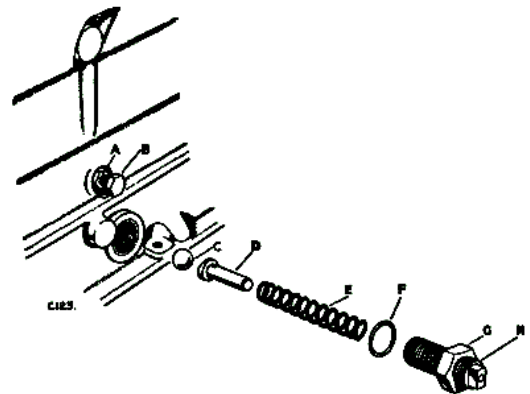


Fig. A-29—Oil pressure relief valve

- |                           |                                |
|---------------------------|--------------------------------|
| A—Locknut,                | E—Spring                       |
| B—Locating screw—oil pump | F—Washer                       |
| C—Ball                    | G—Locknut                      |
| D—Plunger                 | H—Adjusting screw—oil pressure |

3. Fit the pump locating screw and locknut.
4. Fit the relief valve assembly. Do not tighten the locknut at this stage.
5. Refer to Section AO for details of oil pressure adjustment.

#### Distributor and ignition timing

##### Operation A/64

1. Rotate the engine in running direction until the F.A. 15° mark (1948-53 models) or the F.A. 10° mark (1954-58 models) on the flywheel is in line with the pointer, with both valves on No. 1 cylinder closed.
2. Fit the oil pump drive shaft so that when fully engaged in oil pump, the broad segment of driving spigot will be nearest to No. 3 exhaust port. The crankshaft may have to be rotated slightly to allow engagement of driving shaft in oil pump, and when this is necessary, item 1 must be repeated.
3. Secure the distributor housing in position with the hollow oil feed bolt, then fit distributor drive shaft.
4. Locate a cork washer in recess in top of distributor housing.
5. Check the distributor contact breaker clearance and adjust if necessary, .014 to .016 in. (0,35 to 0,40 mm). Set the octane selector so that the fourth line from the L.H. side of the calibrated slide is against the face of distributor body casting.
6. Rotate the distributor spindle until the rotor is at the firing point for No. 1 cylinder. The broad side of the driving spigot should be towards No. 3 exhaust port and vacuum unit facing forward when the distributor is located.
7. Mount distributor and secure to distributor housing.
8. Slacken the pinch bolt at the base of the distributor body; rotate the distributor bodily in the opposite direction to the arrow on the rotor arm, until the contact breaker points are just opening with the fibre cam follower on the leading side of the cam; retighten the pinch bolt.

#### Checking with 12 volt timing lamp

- (a) Connect a lead between the distributor L.T. terminal and the centre pole of the bulb; earth the bulb body.

(b) Rotate the distributor; the bulb will glow exactly when the points begin to open.

9. Adjust as required by slackening the pinch bolt and turning the distributor bodily, or for fine adjustments, by means of the vernier screw.

#### Externals

1. Fit the oil filter complete and joint washer.
2. Fit the exhaust rocker cover and joint washer.
3. Fit the oil feed pipe, gallery to cylinder head.
4. Fit the exhaust and inlet manifolds, and joint washers.
5. Fit the dynamo and starter motor; adjust the dynamo belt tension to allow the belt to move  $\frac{1}{8}$  to  $\frac{3}{8}$  in. (12 to 19 mm) when pressed by thumb between the crankshaft and water pump pulleys.
6. If removed, refit heater pipes, etc., to cylinder head.
7. Fit the inlet rocker cover and joint washer.
8. Fit the sparking plugs, covers and rubber sealing rings, and connect plug leads to distributor.
9. Fit the carburetter, and connect vacuum pipe between carburetter and distributor, connect fuel feed pipe from pump. Connect the accelerator linkage to the carburetter.
10. Fit the oil sump, noting rubber seal, packing strip and three distance pieces at rear.
11. Fit the dipstick and tube.

#### Engine, to refit

##### Operation A/66

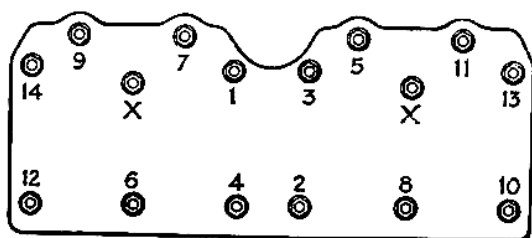
1. Reverse removal procedure—fit new mounting rubbers if necessary. Refill with lubricating oil, 10 imperial pints (5,5 litres), and coolant, 17 imperial pints (9,75 litres).
2. See Section M for details of carburetter adjustments.
3. See Section AO for details of oil pressure adjustment.
4. Check for oil and coolant leaks—rectify as necessary.

**MAINTENANCE PROCEDURE****Removing cylinder head Operation A/68**

1. If necessary, remove the spare wheel from the bonnet panel.
2. Remove the bonnet panel.
3. Remove the radiator cap; drain off coolant.
4. Disconnect the battery leads.
5. Remove the air cleaner. Section M.
6. Disconnect the throttle return spring, throttle linkage (at a ball joint), the mixture control (at the carburetter and clamp) and hand throttle control (if fitted) at the lever and clamp. If fitted, remove the engine governor. Section T.
7. Disconnect: Oil feed pipe from the cylinder head; petrol pipe at the carburetter; mixture control switch wire (at rear of cylinder head); H.T. wire from the coil; L.T. wire from the distributor.
8. Remove the distributor vacuum pipe.
9. Pull off the plug covers and detach the distributor cap. Remove the sparking plugs.
10. Disconnect the top water hose at the radiator.
11. Release the dipstick tube bracket.
12. Remove the inlet rocker cover.
13. Remove the inlet rocker shaft complete. *Note:* The  $\frac{3}{8}$  in. nuts (spanner size) have  $\frac{7}{16}$  in. threads. Lift out the push rods.
14. Remove the distributor complete with clamp.
15. Remove the cylinder head complete, together with the rubber seal between the water pump and thermostat housing, which should be preserved.

**Fitting cylinder head Operation A/70**

1. Reverse the removal procedure.
2. Renew all joint washers.
3. Pull down the cylinder head bolts evenly to the correct tension in the order shown in Fig. A-29.



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Fig. A-30—Order of tightening cylinder head bolts  
Those marked X also secure the rocker shaft.

4. Carry out ignition timing. Operation A/64.

5. Adjust the tappet clearances. Exhaust .012 in. (0,30 mm) and inlet .010 in. (0,25 mm). Operation A/54.

6. Run the engine for a few minutes and check for leaks.

**Decarbonising, valve grinding and lapping Operation A/72**

1. Remove the cylinder head and inlet rocker shaft. Operation A/68.
2. Remove the valves. Operations A/14 (inlet), A/16 (exhaust).
3. Remove the carbon from the cylinder head face and ports, using a blunt scraper. Do not use a wire brush or sharp tools. On no account must the cylinder head be sandblasted.
4. Remove the carbon from the cylinder block combustion chambers, exhaust ports and piston tops, using a blunt scraper.
5. Clean out the small water holes on the right-hand side of the cylinder block and head faces.
6. Renew valve guides or seats as necessary. Operations A/46 and A/50. Grind in the valves.
7. Check and clean the sparking plugs.
8. Refit the cylinder head. Operation A/70.
9. Carry out ignition timing. Operation A/64.
10. Adjust the tappet clearances—exhaust .012 in. (0,30 mm) and inlet .010 in. (0,25 mm). Operation A/54.
11. Run the engine for a few minutes and check for leaks.

**Tappet adjustment Operation A/74**

1. Remove the rocker covers. The exhaust tappets may be set either hot or cold. The inlet valves should be set with the engine at running temperature.
2. Engage the starting handle and set the tappet clearance by the method described in Operation A/54. Exhaust .012 in. (0,30 mm) and inlet .010 in. (0,25 mm).

**Rocker gear removal Operation A/76**

1. Remove the rocker covers.
2. To remove the inlet rocker gear, see Operation A/68, items 1, 2, 12 and 13.
3. To remove the exhaust rocker gear, see Operation A/18. *Note:* It is not necessary to remove the oil pump drive shaft.

**Rocker gear fitment Operation A/78**

1. Reverse removal procedure and set tappet clearance as directed in Operation A/54. Exhaust .012 in. (0,30 mm) and inlet .010 in. (0,25 mm).

**Timing chain renewal**                      **Operation A/80**

1. Remove bonnet top.
2. Remove the radiator. Section L.
3. Pivot the dynamo inwards and remove the fan belt.
4. Unscrew the starting dog and remove the damper.
5. Remove the front cover and mark the camshaft and crankshaft chain wheels, then mark the casing opposite these marks.
6. Release the pawl from the ratchet, compress the tensioner spring by lifting the jockey pulley arm as far as possible, then fit clip, Part No. 262748, over the tensioner.
7. Remove the jockey pulley; remove the driving chain and discard.
8. With the marks on chain wheels and casing aligned, fit the new chain with "no slack" on the driving side.
9. Fit the pulley arm and jockey wheel and check that the exhaust valve of No. 1 cylinder is fully open when the timing pointer is in line with the E.P. mark on the flywheel. See Operation A/56.
10. Complete the assembly by reversing the removal procedure.

**Piston and connecting rod removal.****Operation A/82**

1. Remove cylinder head. Operation A/68.
2. Drain the oil from the sump. Jack the front end of vehicle up, and position suitable stands beneath the chassis side members.
3. Remove sump carefully to avoid damage to the joint washer. Remove the connecting rod caps, bearings and bolts.
4. Push each connecting rod up and turn to engage the slots at the bottom of the cylinder bore. Remove the circlips; withdraw the gudgeon pin, using extractor Part No. 263052; remove the piston.
5. Lower each connecting rod, turning the crankshaft as necessary to effect withdrawal.

**Piston and connecting rod—fitment****Operation A/84**

1. Reverse the removal procedure, using tool Part No. 263053 to refit the gudgeon pins, noting that when cold and dry, the gudgeon pin should be an *easy sliding fit* in the connecting rod and should have a *slight interference fit* in both piston bores, i.e. so that it can be pressed in by hand but will not fall out under its own weight.

2. Fit the connecting rods with the oil spray hole on the opposite side to the camshaft. Tighten the nuts to 30 lb/ft. (4 mKg) on 1948-53 models and to 40 lb/ft. (5,5 mKg) on 1954-58 models.
3. Refit sump and joint washer. Refit the cylinder head, Operation A/70.
4. Refill with oil.

**External oil filter, 1955-58 models—removal**  
**Operation A/86**

1. Jack the front end of vehicle up and position suitable stands beneath the side members. Place a drip tray under the filter.
2. Remove the securing bolts and withdraw the filter complete.

**External oil filter, 1955-58 models—fitment**  
**Operation A/88**

1. Fit a new gasket between the filter head and cylinder block, then reverse removal procedure.

**External oil filter element, 1955-58 models—renewal**  
**Operation A/90**

1. See item 1 of Operation A/86.
2. Unscrew the bolt at base of container, then remove the element and container complete.
3. Discard the old element and the large rubber sealing ring from filter head.
4. Wash the container thoroughly in paraffin or petrol, fit the new element and rubber sealing ring, ensure that all the sealing washers are in position, and that the container is correctly located in the top cover. Tighten securing bolts in base of container.

**External oil filter, to renew, 1948-54 models**

1. Disconnect the inlet and outlet pipes from the filter.
2. Slacken the four set bolts securing the filter mounting bracket and clip to the cylinder block; withdraw and discard the filter.
3. Fit the new filter by reversing this procedure, and refill the engine with one of the recommended lubricants.
4. Run the engine for five minutes and inspect and rectify any oil leaks.
5. Check the engine oil level and top up as necessary.

## DEFECT LOCATION

(Symptom, Cause and Remedy)

## A—ENGINE FAILS TO START

1. Incorrect starting procedure—*See Instruction Manual.*
2. Starter motor speed too low—*Check battery and connections.*
3. Faulty ignition system—*Section P.*
4. Water or dirt in fuel system—*Section M.*
5. Carburetter flooding—*Section M.*
6. Defective fuel pump—*Section M.*
7. Defective starter motor—*Section P.*
8. Starter pinion jammed in flywheel—*Rotate starter shaft with spanner to free pinion.*
9. Starter pinion not engaging—*Clean drive sleeve and pinion with paraffin.*

## B—ENGINE STALLS.

1. Low idling speed—*Section M.*
2. Faulty sparking plugs—*Rectify.*
3. Faulty coil or condenser—*Renew.*
4. Faulty distributor points—*Rectify or renew. Section P.*
5. Incorrect tappet clearance—*Adjust.*
6. Incorrect mixture—*Adjust carburetter. Section M.*
7. Foreign matter in fuel system—*Section M.*

## C—LACK OF POWER

1. Poor compression—*If the compression is appreciably less than the correct figure, (Page A-16) the piston rings or valves are faulty. Low pressure in adjoining cylinders indicates a faulty cylinder head gasket.*
2. Badly seating valves—*Rectify or renew.*
3. Faulty exhaust silencer—*Renew.*
4. Incorrect ignition timing—*Rectify.*
5. Leaks or restrictions in fuel system—*Section M.*
6. Faulty sparking plugs—*Rectify.*
7. Clutch slip—*Section B.*
8. Excessive carbon deposit—*Decarbonise.*
9. Brakes binding—*Section H.*
10. Faulty coil, condenser or battery—*Section P.*

## D—ENGINE RUNS ERRATICALLY

1. Faulty electrical connections—*Rectify.*
2. Defective sparking plugs—*Rectify.*
3. Low battery charge—*Recharge battery. Section P.*
4. Defective distributor—*Rectify.*
5. Foreign matter in fuel system—*Section M.*
6. Faulty fuel pump—*Section M.*
7. Sticking valves—*Rectify or renew.*
8. Incorrect tappet clearance—*Adjust.*
9. Defective valve springs—*Renew.*
10. Incorrect ignition timing—*Rectify.*
11. Worn valve guides or valves—*Renew.*
12. Faulty cylinder head gasket—*Renew.*
13. Damaged exhaust system—*Rectify or renew.*

## E—ENGINE STARTS, BUT STOPS IMMEDIATELY.

1. Faulty electrical connections—*Rectify low tension circuit.*
2. Foreign matter in fuel system—*Section M.*
3. Faulty fuel pump—*Section M.*
4. Low fuel level in tank—*Replenish.*

## F—ENGINE FAILS TO IDLE

1. Incorrect carburetter setting—*Section M.*
2. Faulty fuel pump—*Section M.*
3. See defect D, 7-12.
4. See defect D, 1-4.

## G—ENGINE MISFIRES ON ACCELERATION

1. Distributor points incorrectly set—*Rectify. Section P.*
2. Faulty coil or condenser—*Renew.*
3. Faulty sparking plug—*Rectify.*
4. Faulty carburetter—*Section M.*

## H—ENGINE KNOCKS

1. Ignition timing advanced—*Adjust.*
2. Excessive carbon deposit—*Decarbonise.*
3. Incorrect carburetter setting—*Section M.*
4. Unsuitable fuel—*Adjust octane selector.*
5. Worn pistons or bearings—*Renew.*
6. Distributor advance mechanism faulty—*Rectify. Section P.*
7. Defective sparking plugs—*Rectify or renew.*
8. Incorrect tappet clearance—*Adjust.*
9. Incorrect valve timing—*Adjust.*

## J—ENGINE BACKFIRES

1. Ignition defect—*Section P.*
2. Carburetter defect—*Section M.*
3. Incorrect valve timing—*Adjust.*
4. Incorrect tappet clearance—*Adjust.*
5. Sticking valve—*Rectify.*
6. Weak valve springs—*Renew.*
7. Badly seating valves—*Rectify or renew.*
8. Excessively worn valve stems and guides—*Renew.*
9. Loose timing chain—*Rectify tensioner.*
10. Excessive carbon deposit—*Decarbonise.*

## K—BURNED VALVES

1. Insufficient tappet clearance—*Adjust.*
2. Sticking valves—*Rectify.*
3. Weak valve springs—*Renew.*
4. Excessive deposit on valve seats—*Re-cut.*
5. Distorted valves—*Renew.*

## L—NOISY VALVE MECHANISM

1. Excessive tappet clearance—*Adjust.*
2. Sticking valves—*Rectify.*
3. Weak valve springs—*Renew.*
4. Faulty valve mechanism—*Renew worn parts.*

## M—MAIN BEARING RATTLE

1. Low oil pressure—*See N.*
2. Excessive bearing clearance—*Renew bearings; grind crankshaft.*
3. Burnt-out bearings—*Renew.*
4. Loose bearing caps—*Tighten.*

## N—LOW OIL PRESSURE

1. Thin or diluted oil—*Refill with correct oil.*
2. Low oil level—*Replenish.*
3. Choked pump intake filter—*Clean.*
4. Faulty release valve—*Rectify.*
5. Excessive bearing clearance—*Rectify.*
6. Excessive camshaft bearing clearance—*Rectify.*
7. Loose or restricted oil line—*Rectify.*

## GENERAL DATA

Capacity (piston displacement)		Maximum torque, 1948-51	
1948-51 models	.... 1,595 cc (97.34 cu.in.)	models	.... 80 lb/ft. (11 mKg) at 2,000 r.p.m.
Capacity (piston displacement)		Maximum torque, 1952-58	
1952-58 models	.... 1,997 cc (121.9 cu.in.)	models	.... 101 lb/ft. (14 mKg) 1,500 r.p.m.
Number of cylinders	.... 4	Firing order	.... 1—3—4—2
Bore, 1948-51 models	.... 69,5 mm (2.736 in.)	Compression pressure (at starter motor cranking speed, i.e., 300 r.p.m. with engine hot and carburetter butterfly fully open)	.... 125 lb/sq.in. 8,8 kg/cm <sup>2</sup>
Bore, 1952-58 models	.... 77,8 mm (3.063 in.)		
Stroke	.... 105 mm (4.134 in.)		
Compression ratio	.... 6.9-1		
B.H.P.	.... 52 at 4,000 r.p.m.		

## DETAIL DATA

<b>Camshaft</b>		Maximum permissible run-out on flywheel face	.... .005 in. (0,12 mm)
Journal diameter	.... .874 in.—.0005	Maximum refacing depth	.... .030 in. (0,75 mm)
Clearance in bearing	.... .001 to .002 in. (0,025 to 0,050 mm)	Minimum thickness after grinding:	
End-float	.... .003 to .005 in. (0,075 to 0,12 mm)	88 models, 1956-58	.... 1.204 in. (30,5 mm)
<b>Camshaft bearings</b>		Other models, 1948-56	.... 1.047 in. (26,5 mm)
Type	.... Split Mazak die casting	Markings:	
Internal diameter	.... .876 in.—.001	T.D.C.	.... When opposite pointer, No. 1 piston is at top dead centre
<b>Connecting rods</b>		E.P.	.... When opposite pointer, No. 1 exhaust valve should be fully open. 114° before T.D.C.
Bearing fit on crankpin	.... .001 to .0025 in. (.025 to 0,063 mm)	F.A. 15°, 1948-53 models	.... When opposite pointer, indicates firing point of No. 1 cylinder
Bearing nip	.... .002 to .004 in. (0,05 to 0,10 mm)	F.A. 10°, 1954-58 models	.... When opposite pointer, indicates firing point of No. 1 cylinder.
End-float at big-end	.... .009 to .013 in. (0,23 to 0,33 mm)	Primary pinion bush	
Gudgeon pin bush fit in small end	.... .001 to .002 in. (0,025 to 0,050 mm) interference	Fit in flywheel	.... .001 to .003 in. (0,025 to 0,075 mm) interference
Gudgeon pin bush—internal diameter—reamed in position	.... .8755 in.—.0005 (22,187 mm—0,0127)	Internal diameter—reamed in position	.... .878 in. (22,3 mm)
Fit of gudgeon pin in bush	.... .0003 to .0005 in. (0,0075 to 0,0127 mm) clearance	Fit of shaft in bush	.... .003 to .004 in. (0,075 to 0,10 mm) clearance
<b>Crankshaft</b>		<b>Gudgeon pin</b>	
Journal diameter	.... 2.005 in. (50,80 mm)	Fit in piston (selective assembly)	.... Zero to .0003 in. (zero to 0,0075 mm) interference
Crankpin diameter	.... 1.875 in. (47,52 mm)	Fit in connecting rod bush (selective assembly)	.... .0003 to .0005 in. (0,0075 to 0,0127 mm) clearance
End-float	.... .002 to .006 (0,05 to 0,15 mm)	<b>Main bearings</b>	
Regrind sizes:		Clearance on crankshaft journal	.... .001 to .002 in. (0,025 to 0,05 mm)
Undersize	Journal dia. Crankpin dia.	Bearing fit	.... .001 to .002 in. (0,025 to 0,05 mm)
.010 in.	1.990 in. 1.865 in.		
.020 in.	1.980 in. 1.855 in.		
.030 in.	1.970 in. 1.845 in.		
.040 in.	1.960 in. 1.835 in.		
<b>Flywheel</b>			
Number of teeth	.... 97		
Thickness at pressure face	.... 1.094 in. (27,6 mm)		



**Pistons**

Type	Light alloy, tin plated
Clearance in bore, measured at bottom of skirt at right angles to gudgeon pin	.0012 to .0017 in. (0,030 to 0,043 mm)
Clearance in bore, measured at top of skirt at right angles to gudgeon pin	.0022 to .0027 in. (0,055 to 0,068 mm)
Gudgeon pin bore, early models	.6872 in. + .0002 in. (17,45 mm + 0,005)
Gudgeon pin bore, late models	.8747 in. + .0002 (22,21 mm + 0,005)

**Piston rings**

Compression (2)	
Type	Taper periphery
Gap in bore	.015 to .020 in. (0,38 to 0,50 mm)
Clearance in groove	.0005 to .002 in. (0,012 to 0,05 mm)
Scraper ring (upper) Early models only	
Type	Stepped
Gap in bore	.012 to .017 in. (0,3 to 0,4 mm)
Clearance in groove	.0005 to .002 in. (0,012 to 0,05 mm)
Scraper ring (lower)	
Type	Slotted, H section
Gap in bore	.012 to .017 in. (0,3 to 0,4 mm)
Clearance in groove	.0005 to .002 in. (0,012 to 0,05 mm)

**Rocker gear**

Rockers and cam followers:		
	Inlet	Exhaust
Reamed bore	.500 in. + .001 (12,7 mm + 0,025)	.593 in. + .001 (15,081 mm + 0,025)
Clearance on shaft	.001 to .002 in. (0,025 to 0,050 mm)	.001 to .003 in. (0,025 to 0,075 mm)

**Tappet clearance**

Exhaust, engine hot or cold	.012 in. (0,30 mm)
Inlet, engine at running temperature	.010 in. (0,25 mm)

**Timing chain tensioner**

Driving chain	
Type	Endless roller, pre-stretched
Diameter of rollers	$\frac{1}{4}$ in. (6,35 mm)
Chain tensioner spring	
Free length	4.200 in.
Length in position	1.937 in.
Load in position	15 $\frac{1}{2}$ lb $\pm$ $\frac{1}{2}$ (7 Kg $\pm$ $\frac{1}{2}$ )
Hydraulic chain tensioner	
Inlet valve lifts at	4 to 12 lb/sq.in. (0,30 to 0,80 Kg/cm <sup>2</sup> )

**Thrust bearings, crankshaft**

Type	Semi-circular, steel backed, tin plated
Thickness	.093 in.—.002 (2,36 mm — 0,05)
Oversizes	.0025 in., .005 in., .0075 in. and .010 in.

**Torque loadings**

Connecting rod bolts	40 lb/ft. (5,5 mKg)
Cylinder head bolts:	
7/16 in. B.S.F.	50 lb/ft. (7 mKg)
3/8 in. B.S.F.	30 lb/ft. (4 mKg)
Main bearing bolts	80 lb/ft. (11 mKg)
Flywheel securing bolts	70 lb/ft. (9,7 mKg)

**Valves**

Inlet valve	
Diameter (stem)	.343 in.—.001
Face angle	30°— $\frac{1}{4}$
Exhaust valve	
Diameter	.343 in.—.001
Face angle	45°— $\frac{1}{4}$

**Valve seat—inlet**

Type	Integral
Angle	30° + $\frac{1}{4}$

**Valve seat—exhaust**

Type	Removable insert
Angle	45° + $\frac{1}{4}$
Fit in cylinder block	.005 in. to .007 in. (0,12 to 0,17 mm) interference

**Fit of inlet and exhaust**

valves in guides	.002 to .003 in. (0,05 to 0,08 mm) clearance
------------------	--

**Valve guides**

Length—inlet	1.968 in.—.016
Length—exhaust	2.250 in.—.016
Reamed bore	.3448 in. + .0005 (8,757 mm + 0,012)

**Valve springs**

Free length, inner	.... 1.817 in. (46,0 mm)
Free length, outer	.... 1.845 in. (46,8 mm)
Compressed length, inner	.... 1.469 in. (36,3 mm)
Compressed length, outer	.... 1.625 in. (41,2 mm)
Pressure, valve closed, inner	.... 10 lb. $\pm \frac{1}{2}$ (4,5 kg $\pm \frac{1}{2}$ )
Pressure, valve closed, outer	.... 32.8 lb. $\pm 1$ (14,8 kg $\pm \frac{1}{2}$ )
Pressure, valve open, inner	.... 17.9 lb. $\pm 1$ (8,1 kg $\pm \frac{1}{2}$ )
Pressure, valve open, outer	.... 74.0 lbs. $\pm 1$ (33,5 kg $\pm \frac{1}{2}$ )

**Valve timing**

Inlet opens	.... 9° B.T.D.C.
closes	.... 45° A.B.D.C.
peak	.... 83° B.B.D.C.
Exhaust opens	.... 42° B.B.D.C.
closes	.... 16° A.T.D.C.
peak	.... 66° A.B.D.C.

**Vibration damper**

Fit of bush in flywheel	.002 to .004 in. (0,05 to 0,10 mm) interference
Clearance of bush or driving flange	.... .005 to .007 in. (0,12 to 0,17 mm)
Run-out on front face	.005 in. (0,12 mm) maximum
Permissible out-of- balance	.... 3 grams

# Section A – ENGINE – DIESEL MODELS

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## ENGINE REMOVAL AND DISMANTLING PROCEDURE

### Removing engine Operation A/402

1. If fitted remove the spare wheel from bonnet.
2. Disconnect the bonnet support stay and remove the bonnet.
3. Disconnect the hose from inlet manifold, unscrew the securing wing nut and lift the air cleaner and hose clear.
4. Disconnect the battery leads and remove the L.H. battery.
5. Drain the coolant from system (one tap at bottom L.H. side of radiator and one tap at L.H. side of cylinder block).
6. Disconnect the side lamp leads at each side of the grille panel assembly and the front lamp harness from the junction box at R.H. side of scuttle, then pull the wiring clear to front of engine.
7. Detach the top hose at radiator header tank and the bottom hose from water pump inlet.
8. Remove the fan blades.
9. Remove the bolts securing the grille panel to front cross member and front wings.
10. Lift the radiator, grille panel and headlamps assembly upward, then forward to clear the vehicle. Remove the L.H. battery support.
11. Loosen the bolts securing the intermediate to front exhaust pipe and disconnect the exhaust pipe from exhaust manifold.
12. Disconnect the heater pipes (if fitted) at the engine side of bulkhead.
13. Disconnect the wiring from starter motor, dynamo, oil pressure warning switch and glow-plug lead at resistance on bulkhead.
14. Disconnect the fuel inlet and outlet pipes from fuel lift pump and injection pump, then disconnect the three pipes joined at scuttle, lower R.H. side.
15. Remove the accelerator control rod, then the cut-off control cable from the steady bracket on engine and from the lever on injection pump.
16. Fit the engine sling to the support brackets at front and rear of cylinder head and with suitable lifting tackle just take the strain.
17. Remove the front floor and gearbox cover.
18. Support the gearbox assembly with a jack or packing blocks.
19. Remove the clutch slave cylinder bracket from the flywheel housing and pull back the complete assembly as far as possible.
20. Remove the remaining nuts and washers securing the gearbox to the flywheel housing.
21. Remove the bolts from engine front support brackets, allow the engine to move forward and thus clear the gearbox input shaft. Ensure that

the speedometer cable, etc., and all wires are clear, then hoist the engine gently from the vehicle.

22. Drain oil from sump.
23. Bolt the engine to a suitable stand.

## DISMANTLING ENGINE

### Externals Operation A/404

1. Disconnect the fuel spill gallery pipe from injectors and remove the fuel feed pipes— injection pump to injectors.
2. Remove the securing straps, then withdraw the injectors and seating washers. Make sure the small steel washer is also removed from out of the orifice in the cylinder head.
3. Release the accelerator pull-off spring and remove the injection pump; disconnect the wiring, then remove heater plugs carefully to avoid damage to element.
4. Remove the inlet and exhaust manifolds, then the starter, fan belt and dynamo.
5. Disconnect the heater pipes and water tap from cylinder head if fitted. Remove the fuel filter from mounting bracket at R.H. front of engine.
6. The rearmost tappet chamber cover and fuel lift pump may be removed as one unit; the foremost tappet chamber cover and oil filler pipe may also be removed together.
7. Remove the external full-flow oil filter complete with oil pressure warning switch.
8. Disconnect the oil feed pipe—gallery to cylinder head and the hose, thermostat to water pump casing.
9. Drain the oil and remove the sump.

### Oil pump Operation A/406

1. Remove the securing bolts and withdraw the pump assembly.
2. Withdraw the driving shaft from the pump upper casing.
3. Unscrew the securing nut and remove the filter gauze assembly.

*Note.*—See Section AO for oil pump strip and assembly.

### Vertical drive shaft gear Operation A/408

1. Lift the drive shaft gear and external bush assembly clear, with a pair of snipe-nosed pliers, after removing the locating screw from the external filter adaptor joint face. The split bush may be removed by tapping to release the dowels. Do not remove the aluminium plug in the gear unless absolutely necessary. A new plug must be fitted if the old one has been removed.

### Vibration damper Operation A/410

1. Remove the starting nut and tab washer, then withdraw the vibration damper assembly from crankshaft.

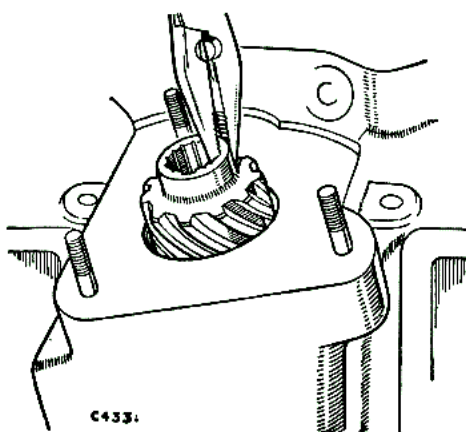


Fig. A-401—Removing the vertical drive shaft gears

2. Unscrew the set bolts securing the back plate to flywheel, withdraw the back plate, rubber discs and shims. Extract the bushes from flywheel and back plate if necessary.

#### Water pump and front cover

##### Operation A/412

1. Remove the front cover and water pump assembly. For overhaul of water pump, see Section L.

#### Timing chain tensioner and chain wheels

##### Operation A/414

1. Remove the ratchet securing bolt and withdraw the ratchet and spring. Compress the chain tensioner spring and unscrew the lower fixing bolts and remove the chain tensioner assembly. Lift off the timing chain and remove the chain wheels.
2. The screwed plug and ball may be removed from the piston if necessary and the piston pressed from its housing if unduly worn.
3. The tensioner cylinder and bush must be renewed complete if the bush is unduly worn.
4. The bushes in idler wheel and ratchet arm should also be removed if worn beyond reasonable limits.

#### Rocker gear and cylinder head

##### Operation A/416

1. Remove the rocker gear cover, unscrew the bolts securing the rocker shaft support brackets, and lift the rocker gear assembly complete from the cylinder head.
2. Unscrew the rocker cover securing studs from the centre and end support brackets and the locating set bolts from the intermediate support brackets. Remove the component parts from the rocker shafts but retain the items in their correct relative positions.

3. Withdraw the push rods and insert them in a piece of cardboard pre-pierced and marked.
4. Remove the cover and joint washer, then lift out the thermostat.
5. Loosen the securing bolts evenly and lift the cylinder head clear.
6. Using a valve spring compressing tool, Part No. 276102, remove the valve assemblies.
7. If necessary remove the hot plugs by inserting a copper drift through the injector aperture, then tap evenly and gently around the inside of hot plug. Avoid using a hammer if possible and thus minimise the possibility of damage. The push rod tubes may also be removed if necessary by drifting them out, using tool Part No. 274399.
8. Drift the valve guides from the cylinder head using tool, Part No. 274401 (exhaust) and 274400 (inlet). Remove and scrap the seals.

#### Tappet guide, roller and tappet

##### Operation A/418

1. Remove the locating bolts from R.H. side of cylinder block and lift out the brass tappets. With a piece of bent wire remove the rollers; then remove the tappet guide.  
The guide, roller and tappet are marked to ensure correct refitment. The rollers have a chamfer on their front face inside diameter.

#### Camshaft removal

##### Operation A/420

1. Remove the camshaft front thrust plate, then withdraw the camshaft.

#### Flywheel

##### Operation A/422

1. Remove the clutch assembly, then the flywheel securing bolts and withdraw the flywheel. The primary pinion bush may be extracted if necessary.

#### Pistons, connecting rods and liners

##### Operation A/424

1. Turn the crankshaft until the pistons of numbers 1 and 4 cylinders are at B.D.C. Remove the big end bolt securing nuts of numbers 1 and 4 connecting rods, then withdraw the piston and connecting rod assemblies from the top of cylinder block.  
Retain the bearing shells in pairs, preferably taped together on the crankpins from which they were removed, until ready for inspection. Repeat for numbers 2 and 3 assemblies.  
Remove the piston rings, gudgeon pin retaining circlips and press out the gudgeon pins; if necessary remove the small end bushes from connecting rods.

2. After marking the top with a scribe to ensure correct refitment, the liners may be withdrawn by hand and the sealing rings removed from the crankcase end of cylinder block bores.

*Note:* Ensure that the component parts are retained in their correct relative positions.

#### Crankshaft, main bearings and rear bearing seal Operation A/426

1. Remove the main bearing caps, lift the crankshaft clear and place in a suitable stand.

Retain the shell bearings in pairs adjacent to the journal from which they were removed.

2. The rear bearing seal halves may be removed from the cylinder block and bearing cap.

#### Camshaft bearing removal Operation A/427

*Note:* When new camshaft bearings are to be fitted, the front and front intermediate bearings must be removed and new ones fitted before removing the rear bearings. See Items 1 to 5 of Operation A/428 for bearing fitment.

2. Unscrew the  $3\frac{1}{2}$  in. (88,9 mm.) long stud from the joint face at front of cylinder block.
3. Drift the front camshaft bearing in to the foremost tappet chamber using tool, Part No. 274388, then withdraw the bearing from the chamber aperture.

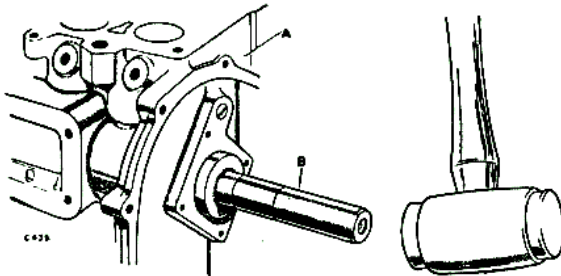


Fig. A-402—Outer camshaft bearing removal  
A—Cylinder block. B—Drift.

The front intermediate bearing is removed by drifting it into the fuel injection pump drive chamber, using the same tool, but it must be collapsed before withdrawing from the drive aperture as illustrated by Fig. A-403.

*Note:* The inner bearing should be positioned at the innermost lower side of the chamber, before inserting a suitable bar which should then be tapped lightly against the bearing. Care must be taken to avoid damage to the machined faces in the chamber.

4. Fit new front and front intermediate bearings, Items 1 to 5 Operation A/428, before removing the rear bearings by drifting them, using the same tools and method employed when removing the foremost bearings.

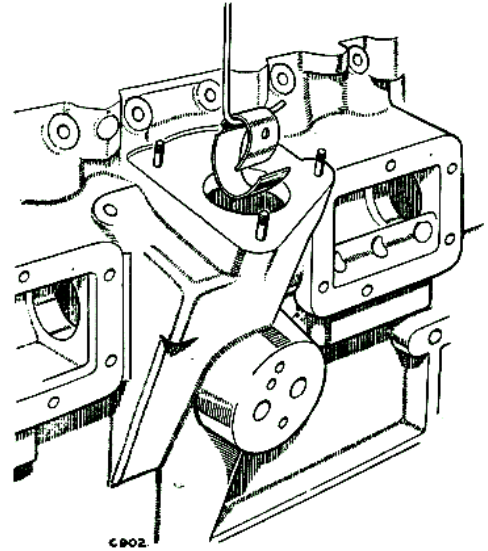


Fig. A-403—Inner camshaft bearing removal

### ENGINE ASSEMBLY

#### Camshaft bearings Operation A/428

When replacing camshafts it should be noted that  $2\frac{1}{4}$  litre petrol engine camshafts are marked "Petrol" between No. 1 and No. 2 cam lobes. This is to differentiate between Diesel camshafts which are similar in all respects other than the positioning of the cam lobes.

*Note:* When new camshaft bearings are to be fitted, the front and front intermediate bearings must be removed and new ones fitted before removing the two rearmost bearings. See Items 2 to 4 inclusive of Operation A/420 for bearing removal procedure.

1. Fit a guide tool, Part No. 274385, into the two old rearmost bearings with the part of flange marked "TOP" uppermost, then insert three end cover set bolts loosely for location purposes. Position a new bearing on to the handle end of bearing fitting bar, Part No. 274382, and locate by means of the peg and semi-circular cut-out, then slide a spacer, Part No. 274383, on to the fitting bar and engage the locating shoulder
2. Place a new bearing on spigot, Part No. 274384, and position it inside the foremost tappet chamber with the bearing nearest the front intermediate housing.

Insert the bearing fitting bar into the front bearing housing and feed the spigot on to the bar; withdraw the spigot handle. Turn the

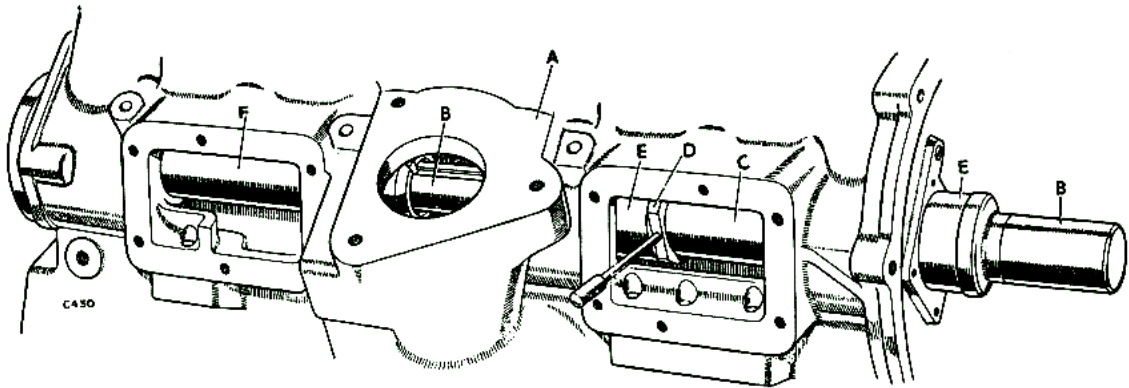


Fig. A-404—Fitting camshaft front bearings

A—Cylinder block. C—Spacer. E—New bearings.  
B—Bearing fitting bar. D—Spigot. F—Guide tube.

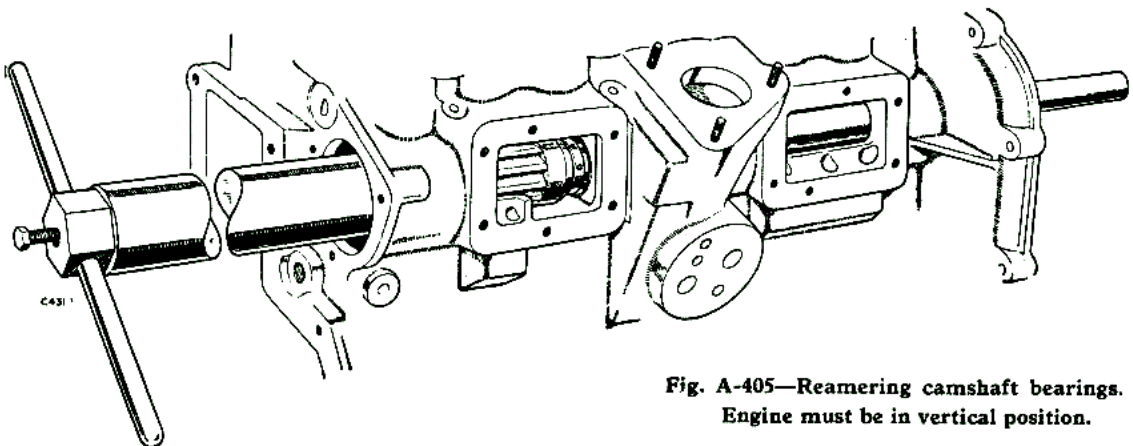
- spigot to engage the locating shoulder in the spacer, then press the fitting bar inward, turning as necessary to engage the bar slot with the peg in guide tube.
- When the fitting bar has been pressed in as far as possible by hand, ensure that all locating points are properly engaged, then drive the bearings into position with a hide-faced hammer. Remove the bearing fitting tools and check the oil holes for alignment. Remove the two rearmost bearings—Item 4, Operation A/420.
  - Fit new camshaft rear bearings in the same manner as for front bearing fitment, but remove the spacer from fitting bar and use guide tool, Part No. 274386, instead of the guide tube used when fitting front bearings.
  - Locate a guide plug, Part No. 274394, in the front new camshaft bearing and locate, using the end-plate screws. Do not tighten these screws until the reamer, Part No. 274389, is put into position and the guide collar immediately in front of the cutter is entered into the rearmost bearing, which is first to be cut. This precaution is to ensure correct alignment of the reamer.

Before commencing the reamering operation it is necessary to turn the engine block to a vertical position, i.e. front end facing downwards, in order that the weight of the reamer will assist in the cutting operation. As each bearing is cut the reamer should be held steady by the operator whilst an assistant, using a high pressure air line, blows away the white metal cuttings, before allowing the reamer to enter the next bearing.

After the rearmost and the two intermediate bearings have been cut, remove the guide plug Part No. 274394, before cutting the foremost bearing. Remove the reamer handle and carefully remove the reamer, turning it in the same direction as for cutting. Care must be taken to prevent the reamer damaging the foremost bearing as the reamer is removed.

*Note:* No lubricant is necessary for the reamering operation, best results are obtained when the bearings are cut dry.

Remove the plugs from the ends of oil gallery passage and clean the gallery and oil feed passages to camshaft and crankshaft bearings, using compressed air. Refit the plugs flush with the face of the cylinder block and lock in position.

Fig. A-405—Reamering camshaft bearings.  
Engine must be in vertical position.

**Crankshaft, main bearings and seal****Operation A/430**

*Note:* Crankshafts considered unserviceable because of wear on the journals must not under any circumstances be reconditioned, and no undersize main bearings are supplied.

It is most important, therefore, that when a Diesel crankshaft becomes unserviceable it should be scrapped out, and damaged to ensure that it cannot be subsequently reconditioned. A new crankshaft of the latest type must be fitted.

1. To check that the bearing caps have not been filed, first assemble the caps without bearing shells to the crankcase, ensuring that they are correctly located by means of the dowels. Tighten both securing bolts for each cap, then slacken one bolt of each pair right off. There should be no clearance at the joint face.

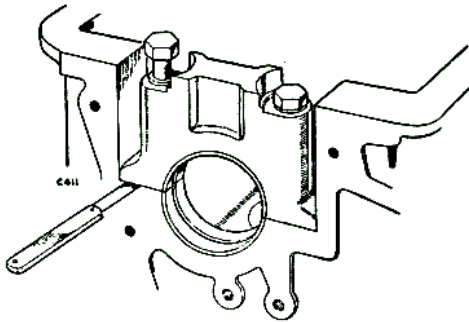


Fig. A-406—Checking main bearing nip

Check the main bearing nip as follows —

Remove the bearing caps and fit the bearing shells, locating by means of the tags. Tighten the caps down and slacken off one bolt of each pair. Check the bearing nip, as illustrated in Fig. A-406, ensuring that the clearance does not exceed .004 to .006 in. (0,10 to 0,15 mm). The nip can be corrected by selective assembly of bearing shells; these are available in slightly varying thicknesses.

2. When the bearing nip has been checked, remove the caps and bearing shell bottom halves. Position a standard size thrust bearing at each side of centre bearing shell—top half, and fit the crankshaft.
3. Refit the bearing shell bottom halves and bearing caps. Tighten the securing bolts evenly and check each bearing in turn for correct clearance. The crankshaft should resist rotation when a feeler paper, .0025 in. (0,06 mm) thick, is placed between any one bearing shell and crankshaft journal, and turn freely by hand when the feeler paper is removed. Adjust by selective assembly of bearing shells.

4. Mount a dial test indicator, then check and note the crankshaft end-float reading which should be .002 to .006 in. (0,050 to 0,15 mm).
5. Remove the bearing caps, bottom half shells and crankshaft.
6. To the rear main bearing cap fit neoprene seals in recess at each side, and on the rear face fit the lower half of crankshaft rear bearing seal.

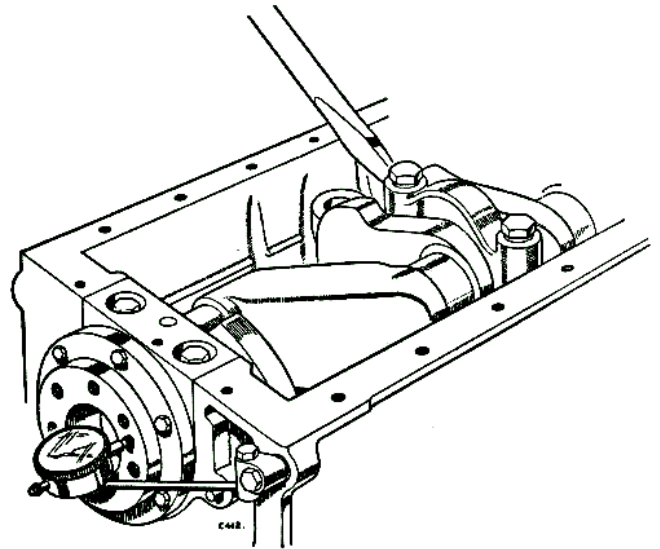


Fig. A-407—Checking crankshaft end-float

7. Fit the top half of crankshaft rear bearing oil seal to the crankcase. Lubricate bearing face with Silicone MS4 Compound.
8. If the crankshaft end-float reading, obtained in Item 4, was not within the limits, fit suitable oversize thrust bearings. The variation of thrust bearing thickness at each side must not exceed .003 in. (0,07 mm) to ensure that the crankshaft remains centralised.

*Note:* It will be found advantageous to carry out Items 5, 6 and 7 of Operation A/434 relating to connecting rods at this stage.

9. Lubricate the crankshaft journals, main bearing shells and thrust bearings, then refit crankshaft. Fitment of the rear main bearing cap, with side seals in position, will be facilitated by using a lead tool (Part No. 270304) fitted to the sump studs adjacent to rear bearing cap aperture. See Fig. A-408.

Smear bearing face of crankshaft rear bearing oil seal with Silicone MS4 Compound.

It will be found advantageous to cut a slight lead on to the bottom edges of side seals as this will prevent them from folding under the cap during fitment, thus causing an oil leak due to the cap not seating properly. Lubricate seals with Silicone MS4 Compound.



**Cylinder liners and seals Operation A/432**

1. Smear the sealing ring grooves at the crankcase end of cylinder block bores, and the liner sealing rings, with Silicone MS4 Compound, then fit a ring to the upper and lower grooves of each bore.

Lightly coat the underside of the liner flange and the mating recess in the cylinder block with Hylomar SQ 32 M sealing compound, using a fairly stiff brush for application.

The coated joint faces may be allowed to dry thoroughly before assembly if desired, but a minimum drying time of ten minutes must be allowed.

A small hole is drilled through the cylinder block into the middle groove to provide evidence of coolant leakage past the top sealing ring.

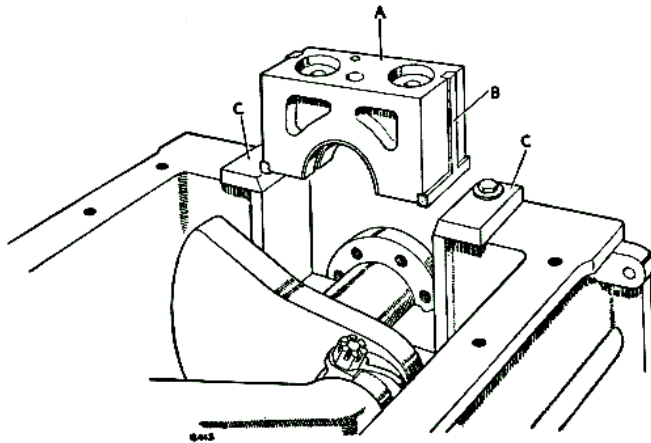


Fig. A-408—Fitting rear bearing cap and seal assembly  
A—Bearing cap. B—Seal. C—Lead tool.

2. Press the liners into their respective bores by hand and align the marks made whilst dismantling.

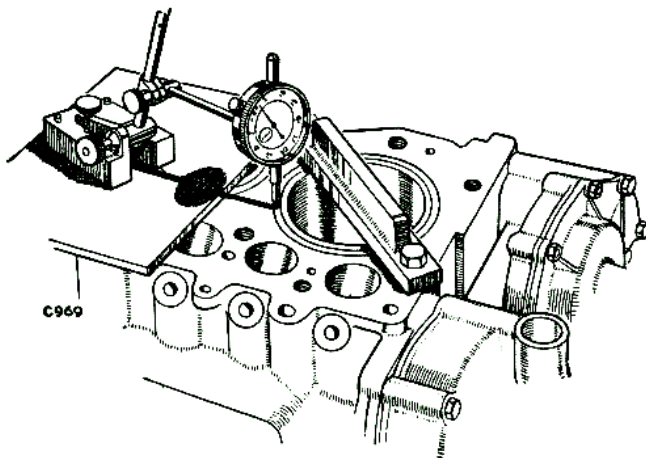


Fig. A-409—Checking cylinder liner extension

3. Clamp each liner in turn in the manner illustrated and tighten the securing bolts to 65 lb/ft. (8,9 Kg/m) torque. Mount a dial test indicator

and check that the outer edge of the cylinder liner is from .002 to .004 in. (0,050 to 0,10 mm) above the cylinder head joint face. See Fig. A-410. Adjust if necessary by removing liner and adding a suitable shim washer under the flange. Clamp and re-check liner as described above. Shim washers are available .002 in. (0,50 mm) and .004 in. (0,10 mm) thick.

**Connecting rods Operation A/434**

1. The oil hole in gudgeon pin bush is pre-drilled and care must be taken to ensure that the oil holes of bush and connecting rod will align when the bush is pressed into position. The gudgeon pin bushes should be a .001 to .002 in. (0,025 to 0,050 mm) interference fit in connecting rods. Ream the bush when fitted to connecting rod to allow a .0003 to .0005 in. (0,0076 to 0,0127 mm) gudgeon pin clearance. Ensure that correct alignment is maintained while reamering.

This fit is selected to give the smallest possible clearance consistent with a smooth revolving action.

2. Fit each connecting rod to a suitable test rig and check for twist and mal-alignment.
3. To check that the connecting rod and cap have not been filed:—
  - (a) Select the correct cap for each connecting rod, as denoted by the number stamped near the joint faces. This number also indicates the crankpin to which it must be fitted. Assemble the connecting rods, less shell bearings, with corresponding numbers together.
  - (b) Tighten the securing bolts, then slacken one of them right off and check that there is no clearance at the joint face.

Check bearing nip as follows:—

- (c) Fit the bearing shells and tighten both securing bolts—slacken one bolt as before and check the nip with a feeler gauge; this should be .002 to .004 in. (0,050 to 0,10 mm).

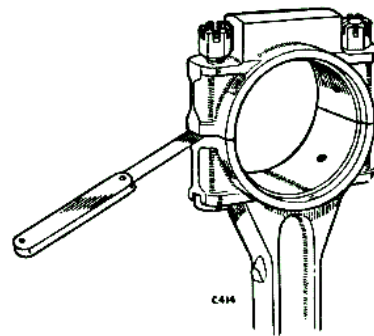


Fig. A-410—  
Checking the big-end bearing nip

- (d) The nip can be corrected by selective assembly of the bearing shells; these are available in slightly varying thickness. Do not file the rod or cap.

4. Fit liner retainers (Part No. 274411) to joint face of cylinder block, then rotate assembly in the stand to bring crankshaft uppermost.
5. Assemble the big-end of each connecting rod to its respective crankpin, then check for correct clearance.

The connecting rod should resist rotation when a .0025 in. (0,0635 mm) shim paper is fitted between the crankpin and one-half of big-end bearing shell, then move freely by hand when the shim paper is removed. Adjust by selective assembly of bearing shells.

Bearing clearance should be .001 to .0025 in. (0,025 to 0,063 mm).

6. Check the connecting rod end-float on crankpin by inserting a feeler gauge between the end face of rod and the crankpin shoulder. End-float should be .007 to .011 in. (0,177 to 0,279 mm).
7. Remove the connecting rods from crankshaft, ensuring that the bearing shells are kept with the rods to which they were fitted.

### Pistons

### Operation A/436

1. When fitting pistons, the clearance in liner bore should be in accordance with the dimensions laid down in the Data Section. In the absence of suitably accurate measuring instruments, a long feeler, .004 in. (0,10 mm) thick, may be inserted in the thrust side of the liner bore, as illustrated in Fig. A-411, and the piston located crown downward. The piston should become a tight fit when the bottom of skirt enters the bore.

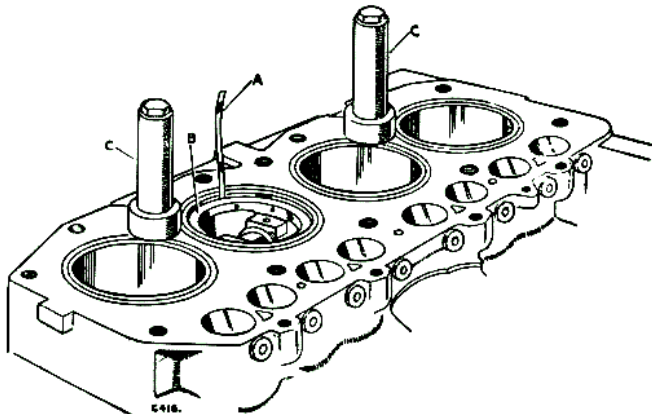


Fig. A-411—Checking piston clearance  
A—Feeler gauge. B—Piston. C—Liner retainer.

2. The gudgeon pin, when cold and dry, should be a slight interference fit in both bores of the piston—see Data. It must be fitted by hand pressure but must not be able to fall out of either bore under its own weight.

Lubricate the gudgeon pin when the correct size has been selected for a particular piston, but do not fit and remove the pin from piston unnecessarily thereafter, or the slight interference fit may be lost.

3. Check the piston ring gaps in the liner bores, using an old piston as illustrated in Fig. A-412, to keep the rings square in the bore.

The second and third compression rings are bevel edged and must be fitted with the side marked "T" uppermost; the top chromium plated compression and the oil scraper ring has a square friction edge and may be fitted either way. Fit the piston rings and check the clearance in ring groove. See Data Section.

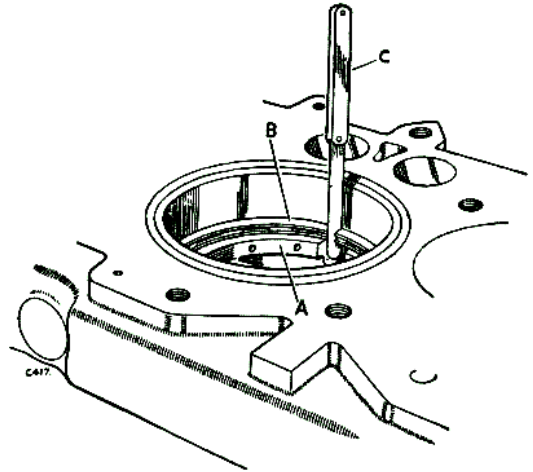


Fig. A-412—Checking a piston ring gap  
A—Scrap piston. B—Piston ring. C—Feeler gauge.

Note: It will be seen that provision is made for the fitment of two oil scraper rings. The second groove is for service purposes only.

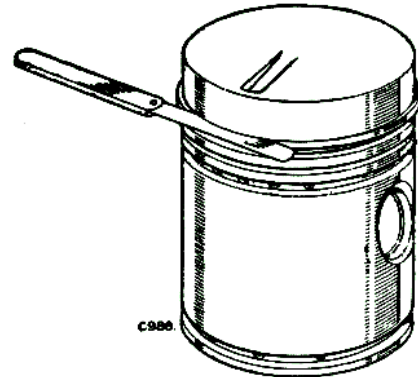


Fig. A-413—Checking ring clearance in groove

### Pistons to connecting rods

4. Fit the connecting rod to the piston with the oil spray hole of rod on the same side as the swirl-inducing recess in piston crown. Lock the gudgeon pin in position with circlips.

### Piston and connecting rod to cylinder block and crankshaft

### Operation A/438

Note: See Items 1 to 6 of Operation A/434 inclusive for gudgeon pin bearing fitment and big-end shell bearing selection.

1. Turn the crankshaft until the crankpins relative to numbers 1 and 4 cylinders are at B.D.C. Insert the connecting rods and pistons for these cylinders from the top of cylinder block, with the oil spray hole in connecting rod and turbulence recess in piston towards the R.H. side of engine—toward the camshaft. Secure the big ends to crankpins, using new nuts and tightening to 35 lb/ft. (4,3 Kgs/m).
2. Repeat Item 1 for numbers 2 and 3 cylinders.

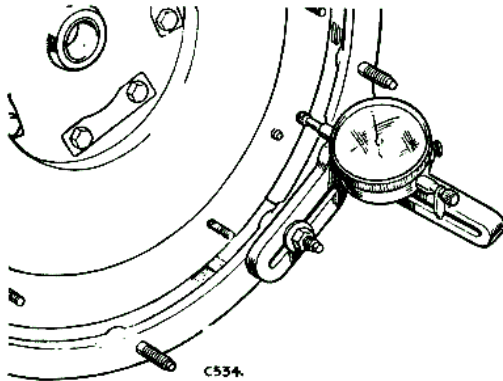


Fig. A-414—Checking run-out on flywheel face

**Flywheel housing and flywheel**

**Operation A/440**

1. Ensure that the oil seal is in good condition, then secure the flywheel housing to cylinder block.
2. Fit the flywheel and tighten the securing bolts to 50 lbs/ft. (6,9 Kgs/m) torque.
3. Check the run-out on flywheel face as illustrated by Fig. A-414. The run-out on flywheel face must not exceed .002 in. (0,050 mm).

**Camshaft fitment**

**Operation A/442**

Note: For replacement and line boring of camshaft bearing, see Items 1 to 5 of Operation A/428 inclusive.

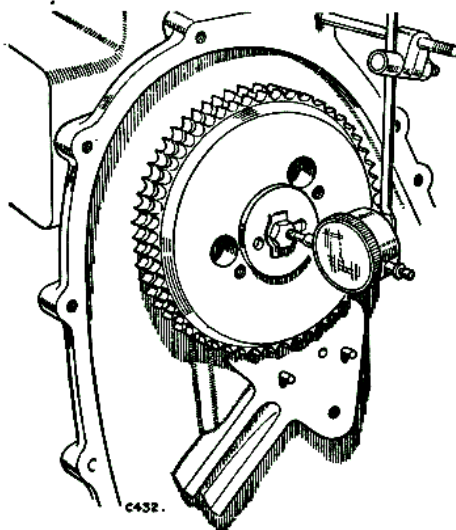


Fig. A-415—Checking camshaft end-float

1. Insert the camshaft—keyed end to extend at front of engine.
2. Fit the front thrust plate and secure the camshaft chain wheel but do not bend up the locking tab for securing bolt at this stage. Check the camshaft end-float with a dial test indicator as illustrated by Fig. A-415 and ensure that the reading is within .0025 to .0055 in. (0,063 to 0,139 mm).  
Adjust by selective assembly of the front thrust plate.

**Tappet assembly and fitment**

**Operation A/444**

1. Before fitting the tappet assembly into the block, thoroughly clean all parts and check that the tappet will move freely in the tappet guide when held in the hand and shaken up and down.
2. Fit tappet guides into the cylinder block, ensuring that the locating hole lines up with the hole in the cylinder block.

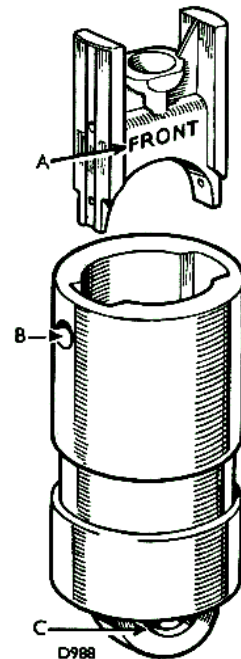


Fig. A-416—Tappet guide and roller

- The tappet guides must not be too tight in the block or they may be damaged by insertion of the locating screw in cases when they are not properly aligned.
3. Gently insert the roller into the guide, with the chamfer to the front. Do not drop the roller, as it is easily damaged.
  4. Fit tappet into the guide and locate on to the roller. The tappet is marked "Front" and must be facing the front of the guide.
  5. Fit the tappet locating screws and washers; the locating screws must be screwed up with the fingers and then tightened; if they are not free, remove and investigate reason.
  6. Lock the locating screws in pairs, using 20 s.w.g. iron wire.

**Valve gear, hot plugs and thermostat to cylinder head**

**Operation A/446**

1. Pull the inlet and exhaust valve guides into position, using tool Part No. 274406. Locate an "O" ring seal in each inlet and exhaust valve guide after the valves have been ground and lapped in.

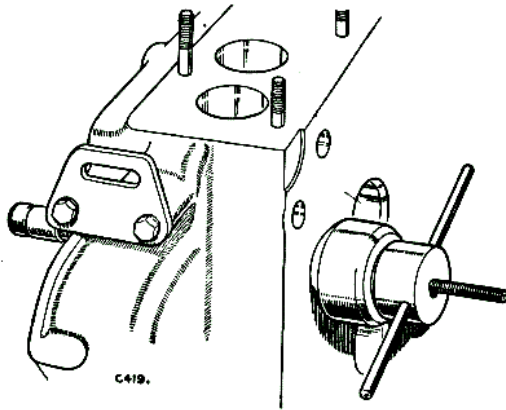


Fig. A-417—Fitting valve guides

2. If the push rod tubes were removed, new tubes complete with new sealing rings, smeared with Silicone M.S.4 Compound, should be pulled into position, using tool Part No. 274402. Ensure that the chamfers on tube and in cylinder head are in full contact and that the "flat" of tube is at right angles to a line drawn between the centre of push rod tube and centre of hot plug, as illustrated by Fig. A-418.

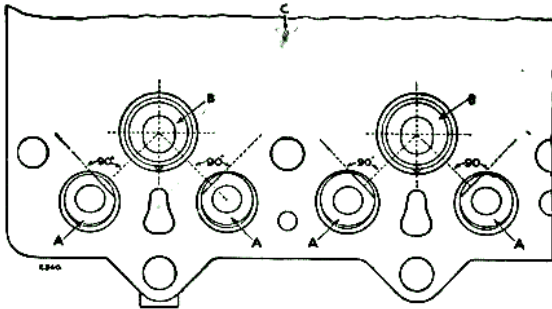


Fig. A-418—Correct position of push-rod tubes in relation to hot plugs  
A—Push rod tubes. B—Hot plug.  
C—Cylinder head inverted.

3. Fit the valves, springs, cups and split cotters, ensuring that the components are retained in their original sets and positions.
4. Test the thermostat before fitment to cylinder head, by immersing in hot water. Expansion should commence between 164°F and 173°F and be complete at 193°F.  
Insert the thermostat in the housing in cylinder head with rubber 'O' ring and fit the joint washer and cover.
5. If the hot plug and peg assemblies have been removed, these must now be replaced by tapping gently into position with a hide-faced hammer. When fitted they must be checked with a clock gauge to ensure that they do not protrude above the level of the cylinder head face more than .002 in. (0,050 mm) and are not recessed below the level of the cylinder head face more than .001 in. (0,025 mm).

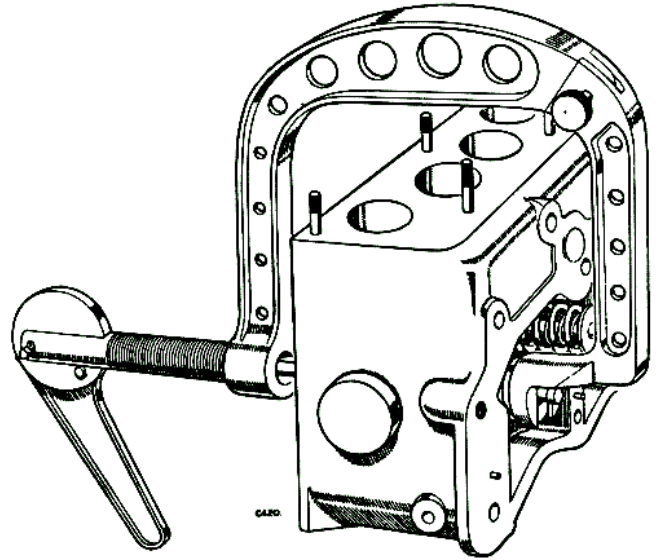


Fig. A-419—Compressing valve springs.

6. The fitment of wooden plugs in the injector nozzle apertures will be found advantageous at this stage.

#### Cylinder head and valves assembly to cylinder block

##### Operation A/448

When fitting the cylinder head, dummy studs ( $\frac{1}{2}$  in. U.N.F. x 5 in. long) must be used to locate the gasket.

1. Smear the joint face of cylinder block and cylinder head gasket with engine oil, then fit the gasket and cylinder head assembly to cylinder block, using the two studs to facilitate alignment.

It is strongly recommended that the head should be fitted before fitment of the rocker shaft assembly, otherwise damage to the push rod seats may occur.

2. Locate head and gasket with the securing bolts, fitting all bolts except those which also secure the rocker shaft pedestals, but do not tighten at this stage.

#### Push rods

3. Insert the push rods into their original positions, through cylinder head and locate in the tappets.

#### Rocker shaft assembly

##### Operation A/450

1. If necessary, press new bushes into the rockers. The oil holes in the rocker bushes are pre-drilled and care must be taken to ensure that the oil holes of bush and rocker will align when pressed into position.
2. Reamer the bush to .530 in. +.001 (13,4 + 0,02 mm) to obtain the correct clearance. The reamer and rocker assembly must be held in such a manner as to ensure the correct alignment of the reamed hole.

3. Align the lubricated rocker shafts, with the bored ends together, and slide a support bracket on to each shaft. The locating hole in each bracket must be positioned immediately above the chamfered hole in shaft, 4.75 in. (120,65 mm) from the plugged end, and then secured with a locating screw and spring washer.
4. Assemble the remaining components with the plugged end of the shafts in the end brackets and the bored end of both shafts located in the centre bracket.
5. Fit the rocker cover securing studs to the rocker brackets.
6. Slacken off all tappet adjusting screws and offer the rocker assembly to cylinder head. Fit the bracket securing bolts, but do not tighten.
7. Tighten down the cylinder head bolts in the order indicated by Fig. A-420. The  $\frac{1}{2}$  in. U.N.F. bolts, including those that also secure the rocker brackets must be pulled down to 75 lb/ft. (10,3 Kg/m) whilst the  $\frac{5}{16}$  in. U.N.F. bolts securing the rocker brackets only are pulled down to 12-13 lb/ft. (1,6-1,7 Kg/m).

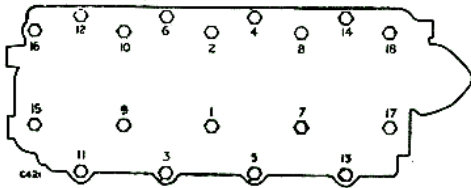


Fig. A-420—Order of tightening cylinder head bolts

8. It is important before rotating the camshaft to adjust all the tappets which are slack. Rotate the camshaft a quarter revolution at a time and after each movement adjust any tappets which are slack. When all excessive clearance has been eliminated adjust the tappets to the correct clearance.

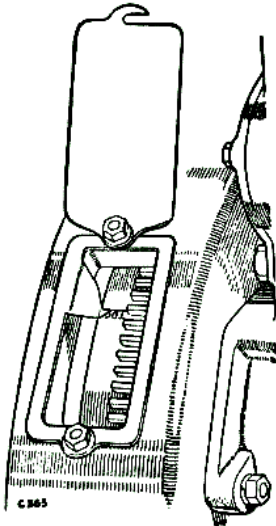


Fig. A-421—  
Timing pointer

#### Chain wheels, timing chain, adjuster and valve timing Operation A/452

1. Fit the crankshaft chain wheel on to shaft and key.
2. Turn the crankshaft in direction of rotation until the E.P. mark on flywheel is in line with the timing pointer.
3. Fit a dial test indicator so that the "fully open" position of the valve can be ascertained in the following manner:—

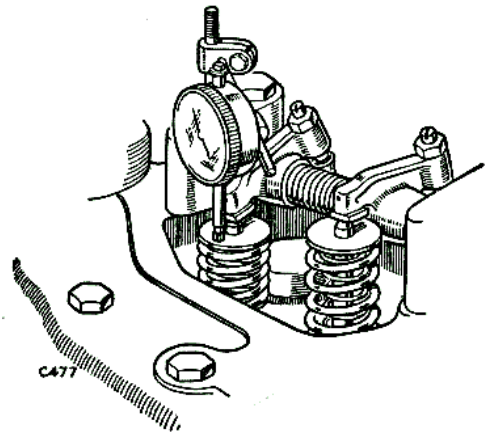


Fig. A-422—Checking exhaust valve "fully open" position

- (a) Turn the camshaft in direction of rotation until the lobe of cam has nearly opened the valve fully, then stop rotation and mark the chain wheel and timing casing to record the position.
  - (b) Note the reading on dial test indicator, then continue to turn the chain wheel slowly in direction of rotation until the needle has again reached the same position.
  - (c) Mark the chain wheel at a point opposite to the mark on timing casing and make a third mark on the chain wheel, exactly between those made previously.
  - (d) Turn the camshaft against direction of rotation until the third mark is in line with that on timing casing, whereon the valve should be fully open.
4. Fit the timing chain with "no slack" on the driving side. It may be necessary to remove and re-position the camshaft chain wheel to obtain this "no slack" condition on the driving side when the flywheel and camshaft are correctly positioned.
  5. Fit new bushes to the chain tensioner components as necessary; ensure that the fits and clearances are in accordance with those laid down in the Data Section. Position the ball in chain tensioner piston and secure with the retaining clip. Fit the compression spring over piston, locate the cylinder assembly and compress the spring. Place the idler wheel on

bearing arm and offer the assembly to the cylinder block, locating by means of the dowels. Screw the stepped bolt with ratchet and spring in position into cylinder block, then finally secure with two set bolts.

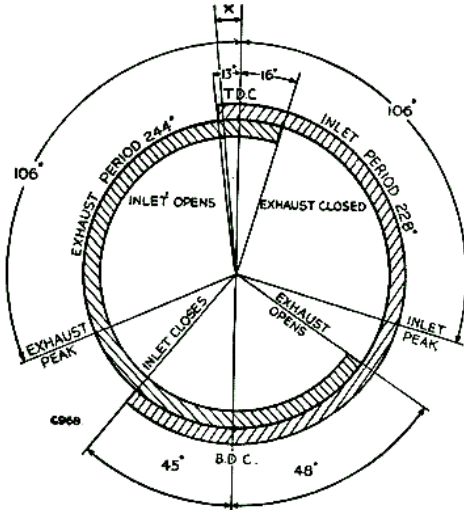


Fig. A-423—Timing diagram

X—Injection point is 17°

- Turn the flywheel against direction of rotation approx. 90° then slowly in direction of rotation, checking that the exhaust valve reaches the "fully open" position, as indicated by the dial

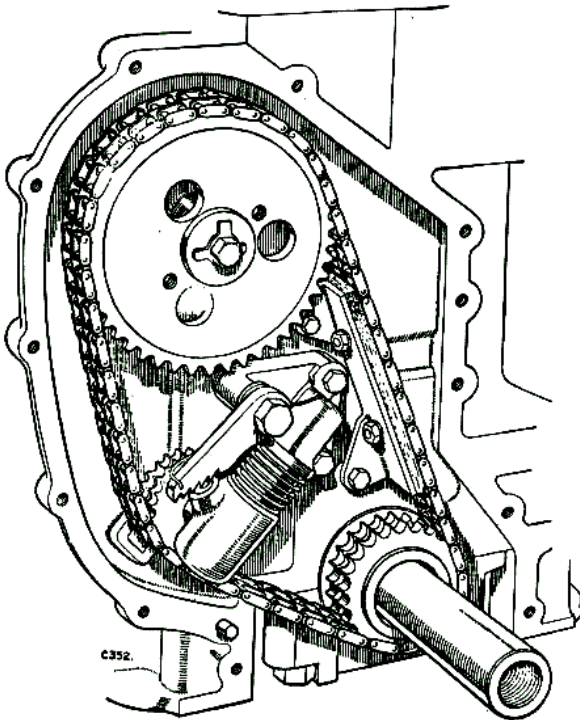


Fig. A-424—Timing gear arrangement.

test indicator, exactly when the "E.P." mark on flywheel is in line with the pointer on flywheel housing.

Adjust if necessary by means of the six irregularly spaced keyways in the timing chain wheel. This arrangement allows a variation of 2° between each position.

Lock the set bolt securing camshaft chain wheel when timing has been set satisfactorily.

- Secure the timing chain vibration damper to the front of cylinder block.

### Tappet adjustment

### Operation A/454

Two methods of setting the tappet clearance may be used, the first necessitates revolving the crankshaft 16 times approximately, and the second, two revolutions only.

#### 1. Method 1

Turn the crankshaft in direction of rotation until the selected valve is fully open and then continue for a further revolution whereon the tappet concerned will be resting on the cam dwell. Adjust the tappet clearance to .010 in. (0,25 mm) with a feeler inserted between the rocker and valve stem.

Re-check clearance after tightening locknut. Repeat for each valve in turn.

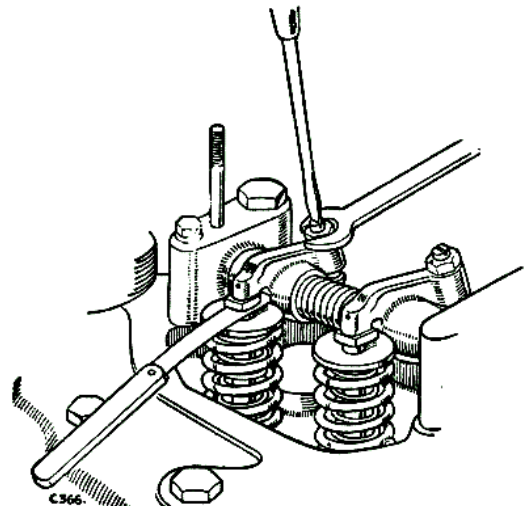


Fig. A-425—Adjusting tappets

#### 2. Method 2

Turn the crankshaft in direction of rotation until number 8 valve (counting from front end of engine) is fully open. In this position the tappet for number 1 valve is on the dwell of its cam and the tappet clearance may be set with a .010 in. (0,25 mm) feeler inserted between the rocker and valve stem. Recheck the clearance after tightening the locknut.

The tappets should be set in the following order:

- Set No. 1 tappet with No. 8 valve fully open.
- Set No. 3 tappet with No. 6 valve fully open.
- Set No. 5 tappet with No. 4 valve fully open.
- Set No. 2 tappet with No. 7 valve fully open.
- Set No. 8 tappet with No. 1 valve fully open.
- Set No. 6 tappet with No. 3 valve fully open.
- Set No. 4 tappet with No. 5 valve fully open.
- Set No. 7 tappet with No. 2 valve fully open.

#### Water pump assembly and fitment to front cover

Operation A/456

1. See "Coolant System" for water pump assembly.
2. Renew the joint washer, then locate and secure the pump to front cover.

#### Front cover to cylinder block

Operation A/458

1. Examine the crankshaft oil seal and replace if necessary.
2. Position new joint washers and fit the front cover and water pump assembly to cylinder block.
3. Fit the water pump pulley to hub.

#### Vibration damper assembly and fitment

Operation A/460

1. If necessary renew the bushes in flywheel and backplate with an interference fit of .002 in. (0,05 mm) to .004 in. (0,10 mm).
2. Bolt the flywheel and backplate together, and reamer the bushes (ensuring that the bore is axially concentric) to allow a clearance fit on driving flange of .001 to .003 in. (0,025 to 0,076 mm).
3. Remove the securing bolts and withdraw the backplate from flywheel.
4. Fit a rubber disc to each side of the driving flange, mount the flywheel and backplate, with the arrows on backplate and flange aligned, then fit the set bolts and locking tabs. Discard any shims which may have been previously fitted, as these have been found to be unnecessary. Fit the securing bolts and tighten fully.

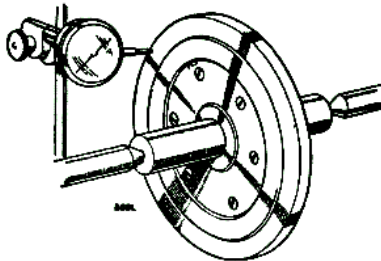


Fig. A-426—Checking vibration damper run-out

5. Mount the unit on a suitable mandrel and rotate between centres. Check the run-out with a

dial test indicator and adjust to within .005 in. (0,127 mm) by means of the securing bolts.

Finally bend up the locking tabs to secure the set bolts.

6. Locate the vibration damper on crankshaft and key, then secure with the starting dog and tab washer.

#### Vertical drive shaft gear assembly

Operation A/462

1. Fit the circlip to groove dividing the upper and lower internal splining and enter the tapered splined plug in the end furthest from gear teeth, small end first.
2. Drift the plug into the gear until it abuts on the circlip.
3. Lubricate the split bush and fit it to the gear with the reduced diameter nearest the teeth.

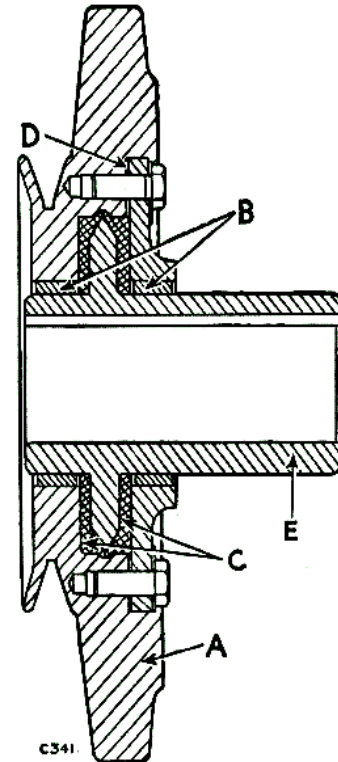


Fig. A-427—Sectioned view of vibration damper

- |                        |                  |
|------------------------|------------------|
| A—Flywheel and pulley. | D—Shims.         |
| B—Bushes.              | E—Driving flange |
| C—Rubber discs.        |                  |

#### Injection pump timing

Operation A/464

1. A—Early engines.

On early engines the flywheel is marked SI.

- (i) Early, unmodified engines.

In order to time these engines correctly, turn the crankshaft in the direction of rotation, until the timing pointer is exactly in line with the SI mark, with both valves on No. 1 cylinder closed.

- (ii) Early engines with latest type pistons and early type hot plugs.

The injection pump timing for these engines must be altered to 17° B.T.D.C. Turn the crankshaft in the direction of rotation, until the timing pointer is .1 in. (2,5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

- (iii) Early engines with latest type pistons and hot plugs.

The correct timing for these engines is 16° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is .2 in. (5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

#### B. Late engines.

On late engines the flywheel is marked 16° and 18°.

- (i) Late engines with latest type pistons and early type hot plugs.

The correct timing for these engines is 17° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is exactly between the 16° and 18° mark on the flywheel, with both valves on No. 1 cylinder closed.

- (ii) Late engines with latest type pistons and hot plugs.

This type of engine must be timed at 16° B.T.D.C.

Turn the crankshaft until the timing pointer is exactly in line with the 16° mark on the flywheel, with both valves on No. 1 cylinder closed.

*Note:* Engines fitted with late type hot plugs are identified by a splash of red paint on the cylinder head.

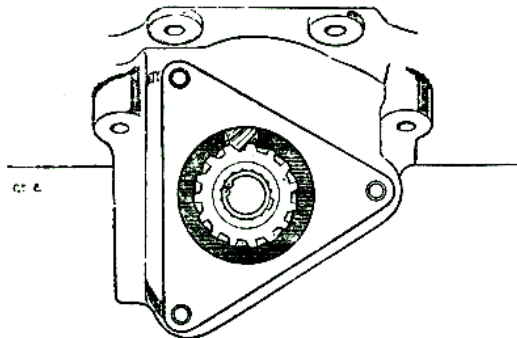


Fig. A-428—Driving gear in correct timing position

2. Insert the driving gear assembly for injection and oil pumps complete with split bushes, then mesh with camshaft gear so that when fully engaged, the master spline is approx. 20° from the centre line of engine (measured from front end) and the locating holes are correctly

aligned. Lock the driving gear assembly in position with a grub screw.

It is very important that the backlash in the vertical drive shaft is taken into account when timing the injection.

3. Remove the inspection cover from injection pump and rotate the spindle in direction of rotation until the line marked "A" on driving plate aligns with mark on timing ring.
4. Offer the pump to engine with the fuel inlet connection forward and engage in the splined drive.

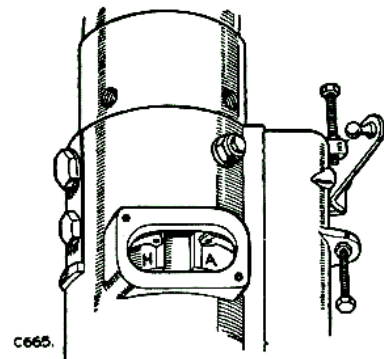


Fig. A-429—Distributor timing marks correctly aligned

Observe the markings through inspection aperture in injection pump side and make any final necessary adjustment by turning the pump body to align the timing marks.

#### *Note 1:*

It will be found advisable to use a mirror when checking markings.

#### *Note 2:*

It is very important that the injection pump is timed as accurately as possible. Two or three degrees retardation can cause excessive white smoke when starting from cold and running at light load. Two or three degrees advance can cause excessive black smoke at low speed, full load.

The timing must be checked by turning the engine until the timing marks on the pump are dead in line and then checking the timing marks on the flywheel. In this way any slight error is magnified by the 2 : 1 ratio of camshaft to crankshaft and the large diameter of the flywheel. An error of a given width on the pump markings will be 12 times that width if transferred to the flywheel.

5. Tighten pump down and re-check setting. Replace inspection cover on pump and flywheel housing.

#### Oil pump

#### Operation A/466

1. Insert the longer splined end of driving shaft into the pump and locate in the driving gear.
2. With the inlet port rearward, and the splined upper end of driving shaft aligned to the vertical drive gear, offer the pump to engine and secure in position.



3. Fit a tab locking washer and seal to the filter gauze and nut assembly. Screw the unit into the pump inlet port and position the filter square with sump bottom; lock in position.

*Note:* No provision is made for oil pressure adjustment.

#### Externals

1. Fit the lubricating oil filter assembly and joint washer.
2. Secure the breather pipe and oil filler assembly over the forward tappet chamber aperture, and steady bracket to top of cylinder block.
3. Mount and secure the fuel lift pump and cover plate assembly over the rear tappet chamber aperture.
4. Mount and secure the fuel oil filter assembly.
5. Fit the starter motor.
6. Fit the dynamo driving belt and adjust the tension to allow the belt to move  $\frac{1}{8}$  to  $\frac{1}{16}$  in. (8 to 11 mm) when pressed by thumb between the camshaft and water pump pulleys.
7. Connect the oil feed pipe and pressure gauge assembly between cylinder head and cylinder block rear end.
8. Secure the coolant pipe to thermostat and water pump casings.
9. Position the joint washer and fit the rocker and valve gear cover.
10. Fit the oil sump.
11. Smear new injector copper joint washers with grease and fit one to each injector. Insert a new corrugated sealing washer into each injector nozzle recess in cylinder head, with the raised portion upward, then locate the injector nozzles; do not tighten the clamping straps fully at this stage.

*Note:* Ensure that the bottom steel washer (corrugated) is replaced correctly, when refitting injectors. See Fig. A-430.

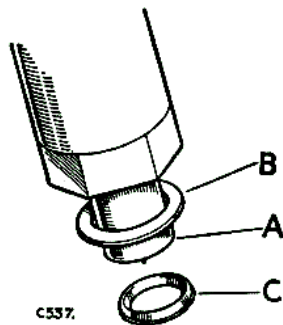


Fig. A-430—Position of injection nozzle washers  
A—Nozzle B—Copper washer C—Steel washer

*Note:* For injector assembly and check, see Section M.

12. Connect the injector pipes to the injector pump. Turn the injectors to align with the pipes and connect.  
Do not overtighten the clamping strap.

13. Fit the heater plugs to cylinder head and tighten.

#### Engine, to refit

#### Operation A/468

1. Reverse removal procedure—fit new mounting rubbers if necessary. Refill with lubricating oil, 11 pints (6 litres) and coolant, 17 pints (9,75 litres).
2. See Section M, Fuel Section, for method of priming injection pump, then Section Q for resetting controls and slow-running adjustment procedure.
3. Check for oil and water leaks—rectify as necessary.

#### *Note:*

At all times when the diesel engine is running, it is necessary to ensure that the oil bath air cleaner is fastened securely in the vertical position.

If adjustments are made with the engine running and the oil bath cleaner balanced on top of the engine, it is possible, should the cleaner tip to one side, for oil to be drawn into the intake manifold and hence into the engine, where it will act as a fuel and cause the engine to overspeed out of control and serious damage may result.

Should it be necessary to run the engine with the air cleaner out of the normal position, the rubber hose should be disconnected from the inlet manifold and the whole oil bath removed from the vehicle.

### MAINTENANCE PROCEDURE

#### Removing cylinder head Operation A/470

1. Open the tap at base of radiator and drain the coolant from this point only.
2. Disconnect the horn leads at the snap connectors adjacent to horn; ensure that the rubber insulators are left fitted to the main harness and thus avoid the danger of "shorting".
3. Remove the pin securing stay to bonnet and lift the bonnet clear of vehicle.
4. Remove the air cleaner and flexible air intake pipe complete.
5. Unscrew the dome nuts securing rocker cover and lift the cover clear.
6. Remove the rocker pedestal securing bolts, then pressing the extreme end pedestals towards the centre of rocker shaft, lift the complete rocker assembly clear.
7. Withdraw the push rods but ensure that they are retained in correct order for refitment.
8. Disconnect the pipes from main fuel filter; the pipe—"filter to injection pump"—must be removed completely to prevent distortion.
9. Remove the bolts securing filter to support bracket at engine, detach the heater plug earth lead and withdraw the filter.
10. Disconnect the fuel "bleed back" pipe from injection nozzle and from union nut on main fuel return pipe.

11. Remove the fuel pipes— injection pump to injection nozzle.
12. Fit aluminium caps to the injection pump outlet unions, to the fuel lift pump outlet, to fuel return pipe union and to the injection nozzle inlet and outlet unions.
13. Remove the injection nozzle securing straps and withdraw the nozzle assemblies.
14. Disconnect the leads and remove the heater plugs.
15. Remove the top coolant hose and the thermostat by-pass hose.
16. Disconnect the oil-feed pipe from rear of cylinder head—R.H. side—and the front exhaust pipe from exhaust manifold.
17. Loosen the cylinder head bolts evenly, then remove them completely and lift the head clear.
18. Remove the inlet and exhaust manifolds if necessary.

#### Fitting cylinder head Operation A/472

1. Reverse the removal procedure.

When fitting the cylinder head, dummy studs ( $\frac{1}{2}$  in. U.N.F. x 5 in. long) must be used to locate the gasket. If this procedure is not adopted there is danger of the gasket being nipped on the liner spigot.

Make sure the injector washers are fitted correctly. See Fig. A-430.

2. Renew all joint washers.
3. Pull down the cylinder head bolts evenly to the correct tension in the order shown in Fig. A-431.

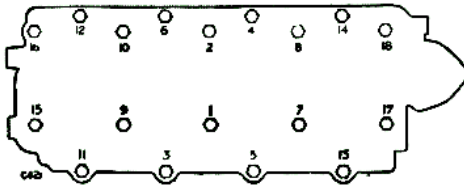


Fig. A-431—Order of tightening cylinder head bolts.  
 $\frac{1}{4}$  in. bolts to 75 lb/ft. (10,3 Kg/m).  
 $\frac{3}{8}$  in. bolts to 12 to 13 lb/ft. (1,6 to 1,7 Kg/m).

4. Adjust tappet clearances to .010 in. (0,25 mm)—Operation A-454.
5. Refill radiator.
6. Prime the fuel system. See Section M.
7. Run the engine and check for leaks.
8. It is important that the cylinder head bolts are retightened to the torque figures above after 30 minutes' running.

#### Decarbonising, valve grinding and lapping Operation A/474

1. Remove the cylinder head—Operation A/470.
2. Using valve spring compressing tool, part number 276102, remove the valves, valve springs and retaining collets.

Position each valve with its springs and collets together and chalk mark the bench to ensure refitment to the guide from which they were removed.

Inner and outer valve springs are a selected interference fit and must not be interchanged.

3. Remove the carbon from the cylinder head, face, and ports, then from the piston crown and swirl-controlling recess, using a blunt scraper.
4. Examine the valves and valve guides for wear and renew as necessary. The guides may be drifted out using tools, part number 274400 inlet and 274401 exhaust, and new ones fitted with tool, part number 274406. See Fig. A-417—Page A-46.
5. Reface the valves to  $45^\circ - \frac{1}{4}^\circ$  and lap them into their seats.

Use the valve seat re-cutting tools (part number 274413 inlet and 274414 exhaust) only when necessary and then remove the minimum amount of metal.

6. Wash the valves, seats and ports thoroughly with paraffin and wipe dry with a non-furry rag. Fit a new rubber seal to each guide.
7. Refit the valves, springs and collets, then pour paraffin into each port and check the valve seats for tightness.

#### Tappet adjustment Operation A/476

1. Disconnect the rubber air intake hose from the induction manifold and from air cleaner.
2. Remove the rocker gear cover.
3. Engage the starting handle and set the tappet clearance to .010 in. (0,25 mm) by either of the methods described under "Tappet adjustment" on Page A-48.
4. Replace the cover and rubber hose.

#### Rocker gear removal Operation A/478

1. See Items 2 to 6 of Operation A/470.

#### Rocker gear fitment Operation A/480

1. Reverse removal procedure and set tappet clearance to .010 in. (0,25 mm) as directed under "Tappet adjustment", Page A-48.

#### Timing chain renewal Operation A/482

1. Lift off bonnet top—Items 2 and 3 of Operation A/470.
2. Remove the radiator—Section L.
3. Pivot the dynamo inwards and remove the fan belt.
4. Unscrew the starting nut and withdraw the vibration damper.
5. Remove the front cover and water pump assembly.

6. Mark the camshaft and crankshaft chainwheels and mark the casing opposite these marks, then remove the timing chain tensioner and timing chain. Discard the old chain.
7. With the marks on chain wheels and casing aligned, fit the new chain with no "slack" on the driving side.
8. Refit the chain tensioner.
9. The timing should be checked to ensure that the exhaust valve of No. 1 cylinder is fully open when the timing pointer is in line with the E.P. mark on the flywheel.
10. Refit the front cover, vibration damper, fan belt, radiator and bonnet top by reversing removal procedure.
11. Refill radiator—17 pints (10,0 litres).

**Piston and connecting rod—removal****Operation A/488**

1. Drain the oil from sump.
2. Remove the cylinder head—Operation A/470, and fit liner retainers, Part No. 274411.
3. Jack the front end of vehicle up and position suitable stands beneath the chassis side-members.
4. Remove the sump carefully to avoid damage to the joint washer.
5. Turn the crankshaft to bring the connecting rod concerned to B.D.C., then remove the connecting rod cap and push the rod and piston upward to remove.

**Piston and connecting rod fitment****Operation A/490**

1. With the crankpin at B.D.C., insert the connecting rod and piston assembly from the top of cylinder block with the oil spray hole in connecting rod and turbulence recess in piston towards the R.H. side of engine (nearest the camshaft).
2. Fit new connecting rod cap nuts and tighten to 35 lb./ft. (4,8 Kgs/m) torque.
3. Refit the sump and joint washer.
4. Replace the cylinder head—Operation A/472.
5. Refill with oil—11 pints (6 litres).

**Cylinder liner replacement Operation A/492**

1. Remove the cylinder head—Operation A/470.
2. Remove piston and connecting rod—Operation A/488.

3. Cover the oil hole in crankpin with masking tape or some similar material to prevent the entry of foreign matter to the crankshaft oilways.
4. Press the liner upward and then withdraw it from the top of cylinder bore.
5. Clean the liner bore spigot at top of cylinder block and the area inside the block immediately surrounding the lower liner bore. Remove and discard the two sealing rings from the grooves at lower bore, wipe the grooves clean and ensure that the small hole drilled through the L.H. side of cylinder block into the middle groove, is clear.
6. Smear the top and bottom grooves and two new sealing rings with Silicone Compound M.S.4, then fit the rings to the top and bottom grooves.
7. Apply a small amount of Silicone Compound M.S.4 to the outer walls of liner and refit to cylinder block.
8. Check the liner extension above cylinder block joint face in the manner instructed by Items 2 and 3 of Operation A/432.
9. Refit the piston and connecting rod—Operation A/490.

**External oil filter—removal Operation A/494**

1. Jack the front end of vehicle up and position suitable stands beneath the side members. Place a drip tray under the filter.
2. Disconnect the lead at oil pressure switch on filter head.
3. Remove the securing bolts and withdraw the filter complete.

**External oil filter—fitment Operation A/496**

1. Fit a new gasket between the filter head and cylinder block then reverse removal procedure.

**External oil filter element—renewal****Operation A/498**

1. See Item 1 of Operation A/494.
2. Unscrew the bolt at base of container, then remove the element and container complete.
3. Discard the old element and the large rubber sealing ring from filter head.
4. Wash the container thoroughly in paraffin, fit the new element and rubber sealing ring, then replace the container.

## DEFECT LOCATION

(Symptom, Cause and Remedy)

### A—ENGINE FAILS TO START.

1. Incorrect starting procedure—*See Instruction Manual.*
2. Starter motor unserviceable—*Section P.*
3. Batteries in low state of charge—*Remove and charge.*
4. Heater plug circuit broken—*Section P.*
5. Foreign matter in fuel system—*Section M.*
6. Supply of fuel to injection nozzles restricted—*Section M.*
7. Insufficient compression—*Check tappet clearance, cylinder head for tightness, cylinder head gasket, valve seats, valve springs, pistons, piston rings and liners for wear.*
8. Injection nozzles setting incorrect—*Reset—Section M.*
9. Injection nozzle auxiliary spray hole blocked—*Clean—Section M.*

### B—ENGINE STALLS.

1. Slow-running incorrectly adjusted.—*See Section Q.*
2. Incorrect tappet clearance—*Adjust.*
3. Injection nozzle setting incorrect—*Reset—Section M.*
4. Injection nozzle auxiliary spray hole blocked—*Clean—Section M.*
5. Insufficient compression—*See item 7 of "A" above.*

### C—REDUCED POWER AND ROUGH RUNNING.

1. Broken valve spring—*Renew.*
2. Incorrect tappet clearance—*Reset.*
3. Burnt valve—*Renew, reset tappet clearance and tighten injection nozzles.*
4. Broken piston rings—*Renew damaged parts as necessary.*
5. Compression uneven—*See Item 7 of "A" above.*
6. Injection nozzles burnt—nozzle valve seating badly—*Service—Section M.*
7. Incorrectly timed injection pump—*Check and adjust.*
8. Fuel supply restricted—*Clean filters—Section M.*
9. Injection nozzles improperly tightened—*Check sealing washer and re-tighten.*
10. Fuel pumps not delivering properly—*Section M*

### D—ENGINE OVERHEATING.

1. Defective coolant system—*See "Defect Location"—Section L.*
2. Defective lubrication system—*See "Defect Location"—Section AO.*
3. Defective injection nozzles—*See "Defect Location"—Section M.*
4. Incorrect injection pump timing—*Check and adjust.*
5. Restricted fuel supply—*Section M.*

### E—LOW OIL PRESSURE.

1. Defective lubrication system—*See "Defect Location"—Section AO.*

### F—BLACK SMOKE ISSUES FROM EXHAUST

1. Defective fuel injection nozzle—*Section M.*
2. Injection pump incorrectly timed—*Check and adjust.*

### G—WHITE VAPOUR ISSUES FROM EXHAUST.

1. Coolant leaking into combustion chamber—*Ascertain cause.*

*Note:—Do not confuse with the issue of vapour immediately after starting and caused by condensation in the exhaust pipe.*

## GENERAL DATA

Capacity (piston displacement) ....	2,052 cc.	B.M.E.P. ....	105 lbs/sq.in. (7,382 Kg/cm <sup>2</sup> ) at 2,000 R.P.M.
Number of cylinders ....	4	Maximum torque ....	87 lbs/ft. (12,00 Kg/m) at 2,000 R.P.M.
Bore ....	3.375 in. (85,725 mm)	Firing order ....	1 - 3 - 4 - 2
Stroke ....	3.5 in. (88,9 mm)	Piston speed at 3,500 R.P.M. ....	2,040 ft./min.
Compression ratio ....	22.5 to 1		
B.H.P. ....	52 at 3,500 R.P.M.		

## DETAIL DATA

## Camshaft

Journal diameter ....	1.842 in.—.001 (26,70 mm—0,02)
Clearance in bearing....	.001 to .002 in. (0,02 to 0,05 mm)
End-float ....	.0025 to .0055 in. (0,06 to 0,14 mm)
Cam lift—inlet ....	.262 in. (6,65 mm)
Cam lift—exhaust ....	.279 in. (7,10 mm)

## Camshaft bearings

Type ....	Split—steel backed, white metal lined
Internal diameter (line reamed in position)	1.843 in.+.0005 (46,812 mm+0,012)

## Connecting rods

Bearing fit on crankpin	.001 to .0025 in. (0,02 to 0,06 mm) clearance
Bearing nip ....	.002 to .004 in. (0,05 to 0,10 mm)
End-float at big end ....	.007 to .011 in. (0,177 to 0,280 mm)
Gudgeon pin bush fit in small end ....	.001 to .002 in. (0,02 to 0,05 mm) interference
Gudgeon pin bush internal diameter—reamed in position	1.1875 in.+.0005 (31,87 mm+0,012)
Fit of gudgeon pin in bush ....	.0003 to .0005 in. (0,007 mm to 0,012) clearance

## Crankshaft

Journal diameter ....	2.5 in.—.001 (63,5 mm—0,021)
Crankpin diameter ....	2.126 in.—.001 (54 mm—0,02)
End-float (controlled by thrust washers at centre bearing) ....	.002 to .006 in. (0,05 to 0,15 mm)

## Flywheel

Number of teeth ....	100
Thickness at pressure face ....	1.375 in.—.015 (85,725 mm—0,39)
Maximum permissible run-out on flywheel face ....	.002 in. (0,05 mm)
Maximum refacing depth ....	.030 in. (0,76 mm)
Minimum thickness after grinding ....	1.330 in. (33,5 mm)

## Markings

T.D.C. ....	When opposite pointer, No. 1 piston is at top dead centre
E.P. ....	When opposite pointer, No. 1 exhaust valve should be fully open
SI, 17° or 16°. ....	When opposite pointer, See Pages A-49 and 50 for details start of injection is indicated.
Primary pinion bush	
Fit in flywheel ....	.001 to .003 in. (0,02 to 0,083 mm) interference
Internal diameter—reamed in position	.875 in.+.002 (22,237 mm+0,0510)
Fit of shaft in bush	.001 to .0035 in. (0,02 to 0,08 mm) clearance

## Gudgeon pin

Fit in piston ....	Zero to .0002 in. (0,005 mm) interference
Fit in connecting rod bush ....	.0003 to .0005 in. (0,076 to 0,127 mm) clearance

**Injection pump**

Type .... Distributor, self-governing

Injection takes place.... SI, 17° or 16°. See pages A-49 and 50 for details

**Injector**

Type .... C.A.V. Pintaux

Size .... BDNO/SP6209

**Liners**

Internal diameter .... 3.375 in. +.001  
(85,725 mm +0,02)

**Fit in cylinder block**

Top—upper .... .005 to .015 in. (0,13 to 0,38 mm) clearance

Top—lower .... .001 to .003 in. (0,02 to 0,08 mm) clearance

Bottom .... .001 to .003 in. (0,02 to 0,08 mm) clearance

**Main bearings****Clearance on crankshaft**

journal .... .001 to .0025 in. (0,02 to 0,06 mm)

Bearing nip .... .004 to .006 in. (0,10 to 0,15 mm)

**Push rod tubes**

Fit in cylinder head .... .0005 to .002 in. (0,01 to 0,051 mm) interference on large diameter. Full contact fit at chamfered edges of tube and cylinder head.

**Oil pump assembly**

Type .... Spur gear

Drive .... By splined shaft from camshaft gear

End-float of gears .... .002 to .005 in. (0,02 to 0,12 mm)

Radial clearance of gears .... .0005 to .002 in. (0,012 to 0,05 mm)

Backlash of gears .... .004 to .008 in. (0,10 to 0,20 mm)

Oil pressure, engine warm at 2,000 R.P.M

.... 50 to 60 lbs/sq.in. (3,515 to 4,220 Kgs/cm<sup>2</sup>)

**Relief valve spring**

Free length .... 2.840 in. (52,93 mm)

Length in position under a load of 10 lbs. (4,53 Kg) 2.45 in. (61,23 mm)

**Pistons**

Type .... Light alloy, with recess in crown

Clearance in liner bore, measured at bottom of skirt at right angles to gudgeon pin .... .004 to .005 in. (0,10 to 0,12 mm)

Fit of gudgeon pin in piston .... Zero to .0002 in. (0,005 mm) interference

Gudgeon pin bore .... 1.187 in. +.002 (47,57 mm +0,05)

**Piston rings****Compression No. 1**

Type .... Square friction edge—chromium plated

Gap in liner bore .... .010 to .015 in. (0,25 to 0,38 mm)

Clearance in groove .... .0025 to .0035 in. (0,063 to 0,089 mm)

**Compression—Nos. 2 and 3**

Type .... Bevelled friction edge. Marked 'T' on upper side.

Gap in liner bore .... .010 to .015 in. (0,25 to 0,38 mm)

Clearance in groove .... .0025 to .0035 in. (0,063 to 0,089 mm)

**Scraper No. 4**

Type .... Slotted, square friction edge, double landed

Gap in liner bore .... .010 to .015 in. (0,25 to 0,38 mm)

Clearance in groove .... .0025 to .0035 in. (0,063 to 0,089 mm)

**Rocker gear**

Bush internal diameter (reamed in position) .... .530 + .001 in. (13,4 + 0,02 mm)

Shaft clearance in rocker bush .... .001 to .002 in. (0,02 to 0,04 mm)

Tappet clearance .... .010 in. (0,25 mm) hot or cold

**Timing chain tensioner**

Fit of bush in cylinder .... .003 to .005 in. (0,07 to 0,12 mm) interference

Fit of bush in idler wheel .... .001 to .003 in. (0,02 to 0,07 mm) interference

Fit of idler wheel on stub shaft .... .001 to .003 in. (0,02 to 0,07 mm) clearance

Fit of piston in cylinder bush .... .0005 to .001 in. (0,01 to 0,02 mm) clearance

**Thrust bearings, crankshaft**

Type	.....	Semi-circular, steel back, tin plated on friction surface
Standard size, total thickness	.....	.093 in.—.002 (2,362 mm—0,05)
Oversizes	.....	.0025 in. (0,06 mm) .005 in. (0,12 mm) .0075 in. (0,18 mm) .010 in. (0,25 mm)

**Torque loadings**

Connecting rod bolts	35 lb/ft. (4,84 Kg/m)
Cylinder head ( $\frac{1}{4}$ in. U.N.F.)	75 lb/ft. (10,3 Kg/m)
Main bearing bolts ( $\frac{9}{16}$ in. U.N.F.)	85 lb/ft. (11,75 Kg/m)
Rocker shaft support bracket bolts ( $\frac{5}{16}$ in. U.N.F.)	12 to 13 lb/ft. (1,6 to 1,7 Kg/m)
Flywheel securing bolts	50 lb/ft. (6,91 Kg/m)

**Valves**

<b>Inlet valve</b>	
Diameter (stem)	.311 in.—.001 (7,92 mm—0,02)
Face angle	45°— $\frac{1}{4}$
<b>Exhaust valve</b>	
Diameter (stem)	.343 in.—.001 (8,71 mm—0,02)
Face angle	45°— $\frac{1}{4}$
Fit of inlet and exhaust valves in guides	.0005 to .003 in. (0,01 to 0,07 mm) clearance
<b>Valve seat</b>	
Seat angle (inlet and exhaust)	45° + $\frac{1}{4}$

**Valve springs—inlet**

<b>Inner</b>	
Length—free	1.61 in. (40,89 mm)
Length under 17.5 lbs. (7,9 Kgs) load	1.383 in. (35,12 mm)
<b>Outer</b>	
Length—free	1.768 in. (44,90 mm)
Length under 46 lbs. (21 Kgs) load	1.508 in. (38,30 mm)

**Valve springs—exhaust**

<b>Inner</b>	
Length—free	1.61 in. (40,9 mm)
Length under 18.5 lbs. (8,37 Kgs) load	1.372 in. (34,8 mm)
<b>Outer</b>	
Length—free	1.768 in. (44,9 mm)
Length under 48 lbs. (21,76 Kgs) load	1.497 in. (38,0 mm)

**Valve timing**

Inlet opens	13° B.T.D.C.
Inlet closes	45° A.B.D.C.
Inlet peak	106° A.T.D.C.
Exhaust opens	48° B.B.D.C.
Exhaust closes	16° A.T.D.C.
Exhaust peak	106° B.T.D.C.

**Vertical drive shaft gear**

Backlash	.006 to .010 in. (0,1524 to 0,254 mm)
Internal diameter of bush	1.00 in. +.001 (25,4 mm + 0,02)
Fit of gear in bush	.001 to .003 in. (0,02 to 0,07 mm) clearance

**Vibration damper**

Fit of bushes in fly- wheel and back plate	.002 to .004 in. (0,05 to 0,10 mm)
Internal diameter of bushes (reamed in position)	1.917 in. + .001 (47,70 mm + 0,02)
Fit of bushes on driv- ing flange	.001 to .003 in. (0,02 to 0,07 mm) clearance
Maximum permissible run-out of flywheel	.002 in. (0,05 mm)





# Section AO — ENGINE LUBRICATION

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### Oil pump, Petrol models

#### To remove Operation AO/2

1. Drain the oil and remove sump.
2. Slacken the locknut securing oil pressure adjusting screw, then remove screw, washer, spring, plunger and ball (which may remain in the pump and can be removed when the pump complete is withdrawn).
3. Remove the pump locating screw.
4. Withdraw the pump, leaving the drive shaft in position.
5. If necessary, withdraw the oil pump drive shaft.

Note: On engines numbered 860001 to 16102271 and 16131648 a cylindrical oil pump filter was fitted into the side of the sump.

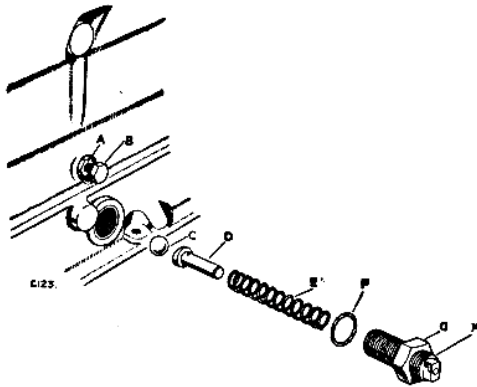


Fig. AO-1—Oil pressure relief valve.

A—Locknut  
B—Locating screw—oil pump  
C—Ball  
D—Plunger

E—Spring  
F—washer  
G—Locknut  
H—Adjusting screw—oil pressure

#### To overhaul and refit Operation AO/4

1. Remove the oil strainer from the pump.
2. Remove the oil pump cover and lift out the gears.
3. Remove the idler gear spindle. If necessary, press out the idler gear bush and drive out the bush in the pump body.
4. Clean parts, examine for wear and renew as necessary.
5. If removed, press a new bush into the body and ream in position to .5625 in. + .001 (14,28 mm + 0,025), ensuring correct alignment with the bore at the bottom end of the pump body. The bush should be a *light drive fit* in the pump body.

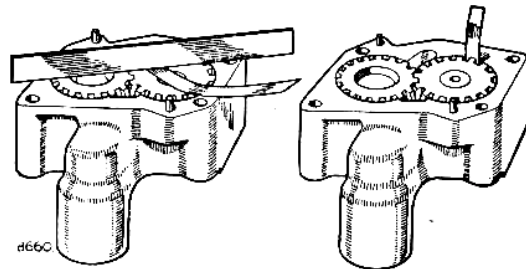


Fig. AO-2—Checking clearance of oil pump gears, Petrol models.

6. Check the radial clearance (.001 to .004 in., 0,02 to 0,10 mm), backlash (.008 to .012 in., 0,20 to 0,30 mm) and end-float (.003 to .005 in., 0,075 to 0,13 mm steel gear, and .004 to .006 in., 0,10 to 0,15 mm aluminium gear) of the gears; renew parts as necessary. If incorrect, oil flow would be insufficient.
7. Complete the assembly.
8. Refit by reversing removal procedure.
9. Adjust the oil pressure. Operation AO/6.

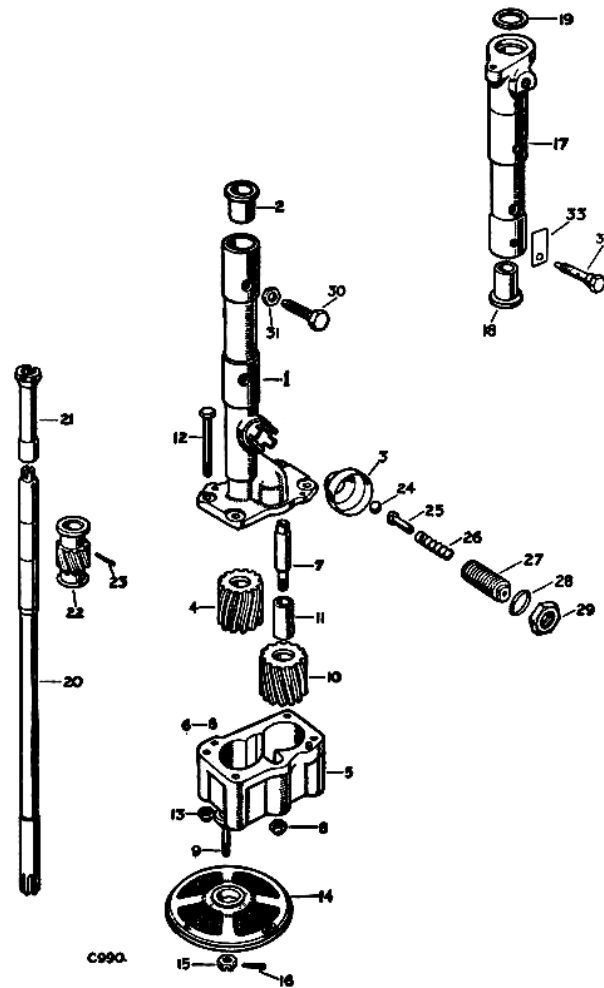


Fig. AO-3—Exploded view of oil pump and driving gear, Petrol models.

- |       |   |       |   |
|-------|---|-------|---|
| 1     | Oil pump body assembly                              | 18    | Bush for drive shaft                        |
| 2     | Bush for drive shaft                                | 19    | Cork washer for housing                     |
| 3     | Oil pump shield                                     | 20    | Oil pump drive shaft                        |
| 4     | Oil pump gear, driver                               | 21    | Drive shaft for distributor                 |
| 5     | Oil pump cover assembly                             | 22    | Oil pump driving gear                       |
| 6     | Dowel locating body                                 | 23    | Taper pin, fixing gear to shaft             |
| 7     | Spindle for idler wheel                             | 24    | Steel ball                                  |
| 8     | Self-locking nut ( $\frac{3}{8}$ " ) fixing spindle | 25    | Plunger                                     |
| 9     | Stud for oil strainer                               | 26    | Spring                                      |
| 10    | Oil pump gear idler assembly                        | 27    | Adjusting screw                             |
| 11    | Bush for idler gear                                 | 28    | Washer                                      |
| 12-13 | Fixings—cover to body                               | 29    | Locknut                                     |
| 14    | Oil strainer for pump                               | 30-31 | Fixings—oil pump to cylinder block          |
| 15-16 | Fixings—oil strainer to pump                        | 32    | Oil feed bolt, locating distributor housing |
| 17    | Distributor housing assembly                        | 33    | Locker for bolt                             |
- } For oil pressure release valve

The chart below covers all currently recommended lubricants for use in engines and all other units.

These recommendations apply to temperate climates, where operational conditions vary between approximately 10°F and 90°F.

PETROL ENGINE								
COMPONENTS	S.A.E.	B.P.	DUCKHAM'S	ESSO	MOBIL	SHELL	WAKEFIELD	REGENT
ENGINE, AIR CLEANER AND GOVERNOR	20W	Energol SAE 20W	Duckham's NOL Twenty	Esso Estra 20W/30	Mobiloil Arctic	Shell X100 SAE 20/20W	Castrolite	Havoline 20/20W
DIESEL ENGINE								
ENGINE AND AIR CLEANER	20W	Energol Diesel D20W	NOL Diesel Engine Oil 20	Essolube HD20	Mobiloil Arctic	Rotella 20/20W	Castrol CR20	RPM Delco Special 20
ALL MODELS								
GEARBOX AND TRANSFER BOX DIFFERENTIALS AND SWIVEL PIN HOUSINGS STEERING BOX AND STEERING RELAY UNIT (SEALED) REAR POWER TAKE-OFF, PULLEY UNIT AND CAPSTAN WINCH	90EP	Energol EP SAE 90	Duckham's NOL EP 90	Esso Expee Compound 90	Mobilube GX 90	Spirax 90EP	Castrol Hypoy	Universal Thuban 90
LUBRICATION NIPPLES	—	Energrease L-2	Duckham's LB 10 Grease	Esso Multi-purpose Grease H	Mobilgrease MP	Retinax A	Castrolase LM	Marfak Multi-Purpose 2

NOTE 1: -20°F = -28°C; 0°F = -17°C; 10°F = -12°C; 32°F = 0°C; 90°F = 32°C.

NOTE 2: The multi-grade oils listed above are recommended for use under the S.A.E. number as shown in the chart; they are also approved for use under the higher range of S.A.E. grades that they cover.

NOTE 3: Information on oil recommendations for use under extreme winter or tropical conditions can be obtained from The Rover Co. Ltd., Technical Service Department.

**Oil pressure relief valve, Petrol models****To adjust****Operation AO/6**

1. Fit a slave oil pressure gauge in place of the warning light switch, run the engine and ensure that there is at least 20 lb./sq.in. (1,4 kg/cm<sup>2</sup>) oil pressure.
2. Warm the engine to running temperature and adjust the pressure by means of the valve to 55-65 lb./sq.in. (3,8-4,5 Kg/cm<sup>2</sup>) at 30 m.p.h. (50 k.p.h.) in top gear. Tighten the screw to increase pressure and vice versa. If necessary, renew the release valve spring.
3. Refit the warning light switch and lead.

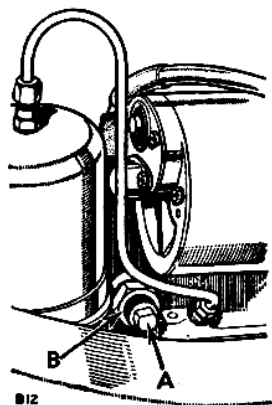


Fig. AO-4—Oil pressure adjustment  
1948-54 models

A—Adjusting screw.

B—Locknut.

**External oil filter, 1948-54 models, to renew**

1. Disconnect the inlet and outlet pipes from the filter.
2. Slacken the four set bolts securing the filter mounting bracket and clip to the cylinder block; withdraw and discard the filter.
3. Fit the new filter by reversing this procedure, and refill the engine with one of the recommended lubricants.
4. Run the engine for five minutes and inspect and rectify any oil leaks.
5. Check the engine oil level and top up as necessary.

**External oil filter, 1955-58 Petrol models****Element to renew****Operation AO/8**

1. Position a suitable drip-tray beneath the filter, then unscrew the bolt at the base of the filter container. Withdraw the container complete with element and large rubber sealing washer. Discard the element and wash the container thoroughly in petrol.

2. Place a new filter element in the container and reassemble the unit, using the new large rubber sealing washer supplied with element. Ensure that the sealing washers are in position and intact and that the container is correctly located.
3. Fill crankcase sump with clean oil—11 pints (6 litres)—to the "high" mark on dipstick, run the engine and check for oil leaks at the filter and then add more oil as necessary. Figure for capacity includes 1 pint (0,5 litre) for filter.

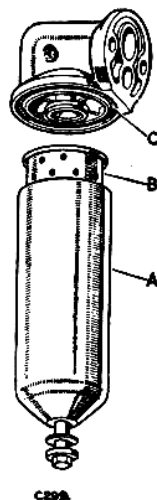
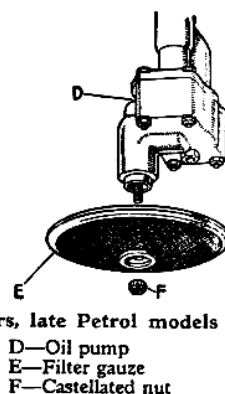


Fig. AO-5—Engine oil filters, late Petrol models

A—Container  
B—Element  
C—Gasket



D—Oil pump  
E—Filter gauze  
F—Castellated nut

**Filter—to remove and clean Operation AO/10**

1. Remove the bolts securing the filter head to the adaptor, then withdraw complete unit.
2. Unscrew the container bolt and renew element. Operation AO/8.
3. Remove the relief valve, spring and ball from the filter head, then wash these parts thoroughly in petrol.
4. Reverse dismantling procedure and refit the assembly to the cylinder block with a new joint washer interposed.

**Oil pump, Diesel models****To remove****Operation AO/12**

1. Drain the oil and remove sump.
2. Remove the securing bolts and withdraw pump assembly.
3. Withdraw the driving shaft from pump upper casing.
4. Unscrew the securing nut and remove filter gauze assembly.

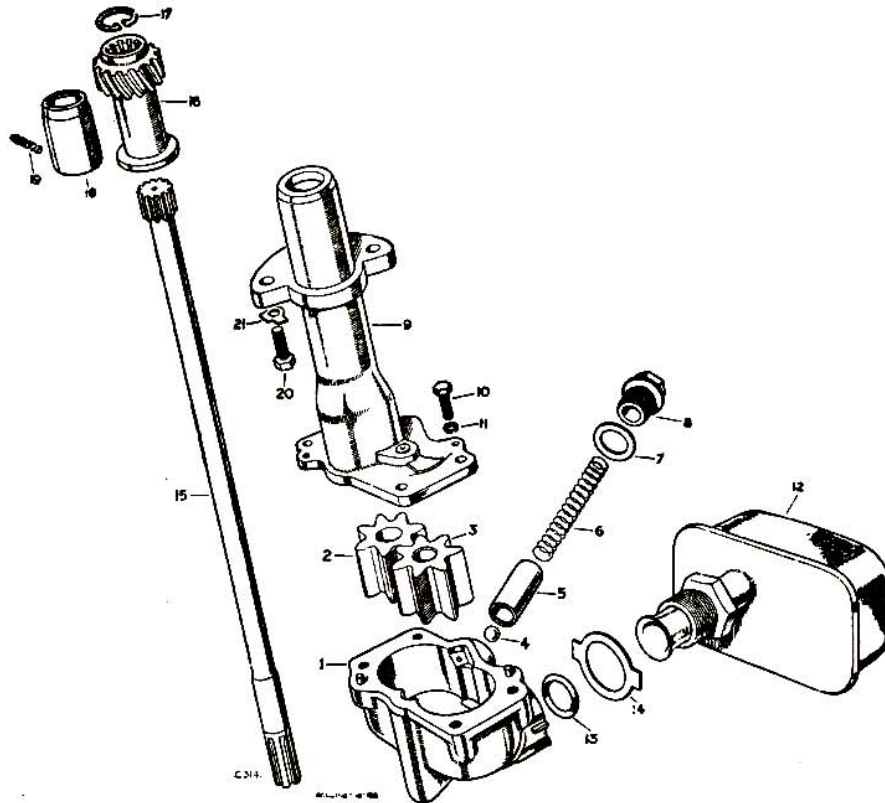


Fig. AO-6—Exploded view of oil pump and driving gear, Diesel models.

- |                         |                           |
|-------------------------|---------------------------|
| 1 Lower casing          | 11 Spring washer for bolt |
| 2 Driving gear          | 12 Filter gauze assembly  |
| 3 Driven gear           | 13 Oil seal               |
| 4 Relief valve ball     | 14 Tab washer             |
| 5 Relief valve plunger  | 15 Driving shaft          |
| 6 Relief valve spring   | 16 Driving shaft gear     |
| 7 Washer                | 17 Circlip                |
| 8 Plug                  | 18 Bush—drive shaft gear  |
| 9 Upper casing          | 19 Locating screw         |
| 10 Set bolt for casings | 20 Securing bolt          |

5. Remove the bolts securing the upper casing to lower body, tap them gently apart and withdraw the gears. The idler gear spindle may be removed if necessary.
6. Unscrew the relief valve plug and remove the spring, plunger and ball.

**To overhaul and refit**      **Operation AO/14**

1. Check the external diameter of the gears and the internal diameter of the gear housings, using a ring gauge and plug gauge, Part Nos. 276095 and 276094 respectively. With the gauges an exact fit in the bore of the housing, and on the outer diameter of the gears, a radial clearance of .0005 in. (0,01 mm) will exist between the gears and housing.

It should not be possible to interpose a feeler strip of more than .002 in. (0,05 mm) thickness between the gear perimeter and ring gauge, or a feeler strip of more than .003 in. (0,08 mm) thickness between the gear perimeter and gear housing, thus allowing a maximum radial clearance of .003 in. (0,08 mm) between the gear and housing.

2. Press the short, stepped end of idler spindle into the pump body and fit the cast iron idler wheel. Mesh the steel gear with the idler gear, inserting the splined end first.
3. Lay a straight edge across the joint face of pump body and check the end-float with a feeler gauge. This should be between .002 and .005 in. (0,0508 to 0,127 mm).

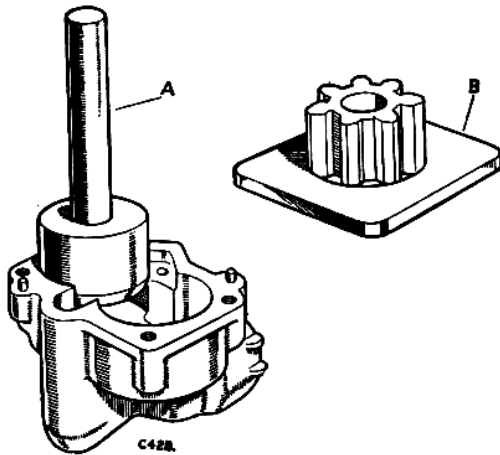


Fig. AO-7—Checking for radial clearance,  
Diesel models  
A—Plug gauge B—Ring gauge

4. Smear the joint faces of pump body and cover lightly with suitable jointing compound, then bolt together.
  5. Insert the relief valve ball, plunger and spring. Secure with plug and washer.
- Note:* No provision is made for oil pressure adjustment.
6. Insert the longer splined end of driving shaft into the pump and locate in the driving gear.
  7. With the inlet port rearward, and the splined upper end of driving shaft aligned to the drive gear, offer the pump to engine and secure in position.

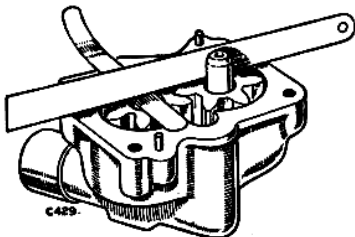


Fig. AO-8—Checking end-float of the gears,  
Diesel models

8. Fit a tab locking washer and seal to the filter gauze and nut assembly. Screw the unit into the pump inlet ports and position the filter square with sump bottom; lock in position.
9. Refit the crankcase sump and refill with oil—13 pints (7 litres)—to the “high” mark on dipstick, run the engine and check for oil leaks at the sump joint face, then add more oil as necessary. Figure for capacity includes 2 pints (1 litre) for filter.

### External oil filter, Diesel models

#### Element—to renew Operation AO/16

1. Position a suitable drip-tray beneath the filter, then unscrew the bolt at base of the filter container. Withdraw the container complete with the element, which must be discarded.
2. Wash the container thoroughly in petrol, fit a new element, new inner and outer top sealing rings, then replace the container.
3. Fill crankcase sump with clean oil (13 pints (7 litres)) to the “high” mark on dipstick, run the engine and check for oil leaks and then add more oil as necessary. Figures for capacity includes 2 pints (1 litre) for filter.

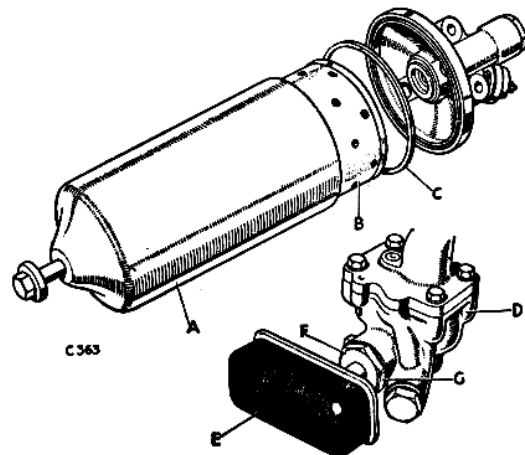


Fig. AO-9—Engine oil filters, Diesel models.

A—Container D—Oil pump F—Nut for filter gauze  
B—Element E—Filter gauze G—Locker for nut  
C—Gasket

#### Filter—to remove and clean

##### Operation AO/18

1. Disconnect the leads from the oil pressure switch.
2. Remove the bolts securing the filter head to cylinder block, then withdraw the complete filter assembly.
3. Unscrew the container bolt and renew element. Operation AO/16.
4. Remove the pressure switch, also the relief valve spring and ball from the filter head, then wash these parts thoroughly in petrol.
5. Reverse dismantling procedure and refit the assembly to the cylinder block with a new joint washer interposed.

## DEFECT LOCATION

## Symptom, Cause and Remedy

## A—WARNING LIGHT REMAINS "ON"—ENGINE RUNNING

1. Low oil pressure—*See item B.*
2. Oil pressure switch unserviceable—*Renew.*
3. Electrical fault—*Check circuit.*

## B—LOW OIL PRESSURE

Ascertained by gauge fitted in place of switch and with sump oil level correct.

1. Dirty gauze filter on pump—*Remove sump, remove filter gauze and clean in petrol with a stiff brush. Refill with clean oil.*
2. Pump body joints loose—*Tighten.*
3. Foreign matter on pump ball valve seat—*Remove and clean.*

4. Relief valve plunger sticking—*Remove and ascertain cause.*
5. Weak relief valve spring—*Renew.*
6. Incorrectly adjusted relief valve (2 litre Petrol only)—*Adjust to 55 to 65 lb/sq. in. (3,8 to 4,5 Kg/cm<sup>2</sup>)*
7. Gears excessively worn—*See Operations AO/4 and AO/14*
8. Excessively worn bearings—main, connecting rod big-end, camshaft, etc.—*Ascertain which bearings and rectify.*

## C—WARNING LIGHT FAILS TO GLOW —

When engine is stopped and ignition (petrol engines) or auxiliary services (Diesel) switch is "on".

1. Bulb filament broken—*Renew bulb. Section Q.*
2. Oil pressure switch unserviceable—*Renew.*
3. Electrical fault—*Check circuit.*

## DATA

## Oil pump—Petrol models

Type	....	....	Gear
Drive	....	....	Skew gear from camshaft
End-float of gears:			
Steel gear	....	.003 to .005 in. (0,075 to 0,13 mm)	
Aluminium gear	....	.004 to .006 in. (0,10 to 0,15 mm)	
Radial clearance of gears			
....	....	.001 to .004 in. (0,02 to 0,10 mm)	
Backlash of gears			
....	....	.008 to .012 in. (0,20 to 0,30 mm)	

## Oil pressure, engine warm

At 2,000 R.P.M.	....	55 to 65 lb./sq.in. (3,8 to 4,5 Kg/cm <sup>2</sup> )
-----------------	------	--

## Oil pressure relief valve

Type	....	Adjustable
Relief valve spring:		
Free length	....	3.050 in. (77,47 mm)
Compressed length at 13 lb. (5,89 Kg) load	....	1.990 in. (50,54 mm)

## Oil pump—Diesel models

Type	....	....	Spur gear
Drive	....	....	Splined shaft from camshaft
End-float of gears			
....	....	.002 to .005 in. (0,025 to 0,12 mm)	
Radial clearance of gears			
....	....	.0005 to .002 in. (0,012 to 0,050 mm)	
Backlash of gears			
....	....	0.004 to .008 in. (0,10 to 0,20 mm)	

## Oil pressure, engine warm

At 2,000 R.P.M.	....	50 to 60 lb./sq.in. (3,515 to 4,220 Kg/cm <sup>2</sup> )
-----------------	------	--

## Oil pressure relief valve

Type	....	Non-adjustable
Relief valve spring:		
Free length	....	2.840 in. (52,93 mm)
Compressed length at 10 lb. load (4,53 Kg.)	....	2.45 in. (61,23 mm)





## Section C

# GEARBOX UNIT — ALL MODELS

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Defect location .....	C-34	Fourwheel drive .....	C-13 & 30
Gearbox and transfer assembly .....	C-17 & 22	Freewheel .....	C-13
Gearbox unit mounting rubbers.....	C-22	Front output shaft housing .....	C-30
Main gearbox .....	C-23	Reverse stop .....	C-16 & 33
		Transfer box .....	C-26

### LIST OF ILLUSTRATIONS

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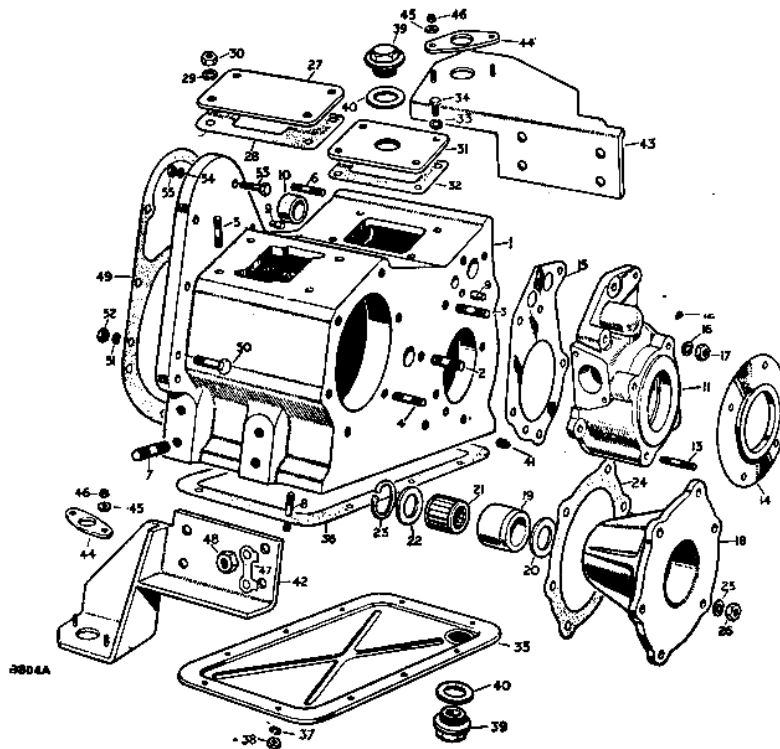
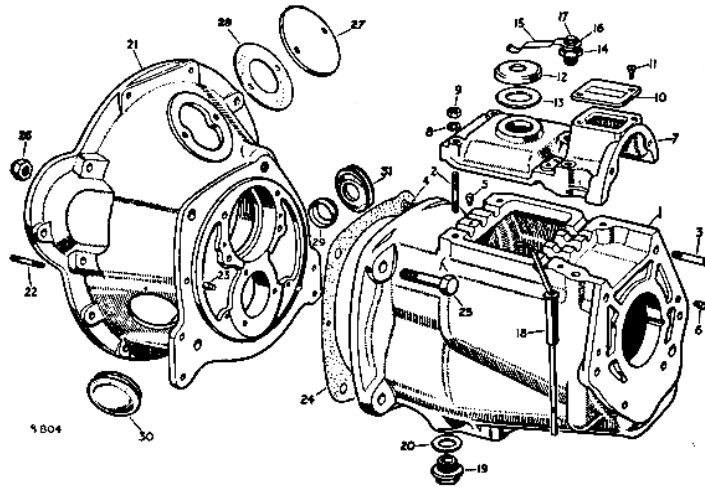


Fig. C-1—Layout of the gearbox unit casings

## Key to Fig C-1

1	Gearbox casing assembly	16-17	Fixings for spring
2	Stud for top cover and gear change plate	18	Oil level dipstick
3	Stud, short, for transfer casing	19	Drain plug for gearbox
4	Stud for bell housing	20	Washer for plug
5	Dowel locating top cover	21	Bell housing assembly
6	Dowel locating transfer casing	22	Stud for withdrawal race housing
7	Top cover for gearbox	23	Dowel locating gearbox
8-9	Fixings for top cover	24	Joint washer bell housing to gearbox,
10	Inspection cover plate for selectors	25-26	Fixings for gearbox casing
11	Set screw fixing cover plate	27	Top cover for bell housing
12	Oil filler cap	28	Rubber seal for top cover
13	Joint washer for cap	29	Centre for dust cover
14	Plug for retaining spring	30	Grommet for bell housing hole
15	Retaining spring for cap	31	Grommet for bell housing shaft
<hr/>			
1	Transfer box casing assembly	25-26	Fixings for housing
2	Stud for intermediate shaft	27	Cover plate for P.T.O. selector
3	Stud for speedometer housing, short	28	Joint washer for cover plate
4	Stud for mainshaft housing	29-30	Fixings for cover plate
5	Stud for top cover plate	31	Cover plate for transfer gear change
6	Stud, short, for transfer shaft housing	32	Joint washer for cover plate
7	Stud for engine mounting	33-34	Fixings for plate
8	Stud for bottom cover	35	Cover plate, bottom, for transfer box
9	Dowel locating speedometer housing	36	Joint washer for bottom cover
10	Bush for shaft guide	37-38	Fixings for cover
11	Housing assembly for speedometer pinion	39	Plug, top and bottom
12	Insert for pinion	40	Joint washer for plug
13	Stud for transmission brake	41	Oil level plug
14	Mudshield for housing	42	Rear mounting foot L.H.
15	Shim for speedometer pinion housing	43	Rear mounting foot R.H.
16-17	Fixings for housing	44	Adjuster for mounting foot
18	Housing assembly, rear mainshaft bearing	45	Plain washer
19	Bush for housing	46	Self-locking nut
20	Retaining plate, inner		} For
21	Bearing for mainshaft		} adjuster
22	Retaining plate, outer	47-48	Fixings for feet
23	Circlip fixing bearing	49	Joint washer, transfer box to gearbox
24	Joint washer for bearing housing	50-52	Fixings for transfer box
		53-55	Fixings for transfer box

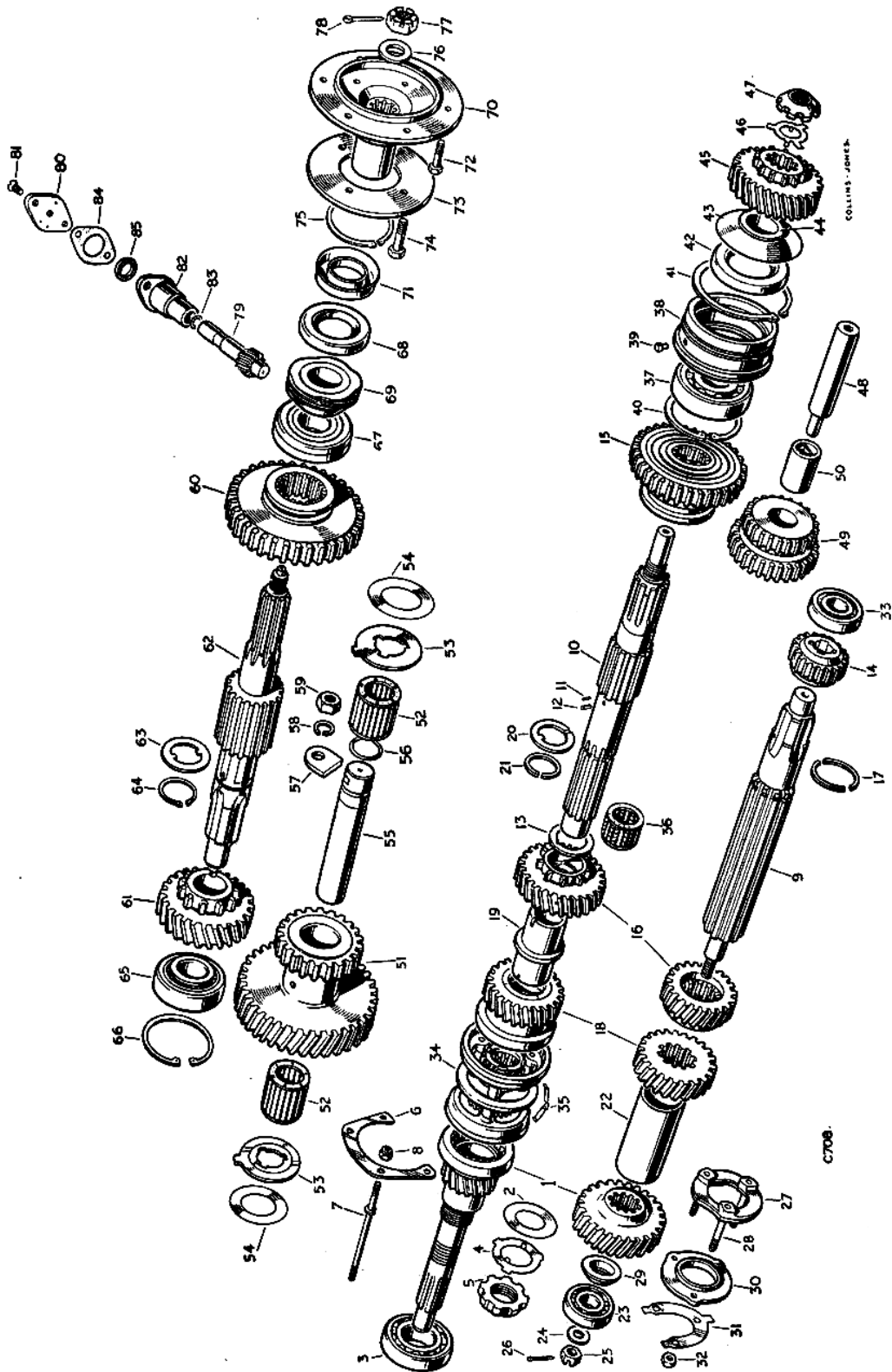


Fig. C-2—Layout of the gearbox units: shafts and gears.

Key to Fig. C-2

- |       |  |       |                                       |
|-------|--|-------|---------------------------------------|
| 1     | Primary pinion and constant gear               | 44    | Distance piece, rear of mainshaft     |
| 2     | Shield for primary pinion                      | 45    | Mainshaft gear for transfer box       |
| 3     | Ball bearing for primary pinion                | 46-47 | Fixings for gear                      |
| 4-5   | Fixings for bearing                            | 48    | Shaft for reverse gear                |
| 6-8   | Fixings for bearing                            | 49    | Reverse wheel assembly                |
| 9     | Layshaft                                       | 50    | Bush for reverse wheel                |
| 10    | Mainshaft                                      | 51    | Gear, intermediate                    |
| 11    | Peg for 2nd gear thrust washer                 | 52    | Roller bearing for intermediate gear  |
| 12    | Peg for mainshaft distance sleeve              | 53    | Thrust washer for intermediate gear   |
| 13    | Thrust washer for 2nd speed gear               | 54    | Shim for intermediate gear            |
| 14    | 1st speed layshaft gear                        | 55    | Shaft for intermediate gear           |
| 15    | 1st speed mainshaft gear                       | 56    | Sealing ring for intermediate gear    |
| 16    | 2nd speed layshaft and mainshaft gear          | 57    | Retaining plate for shaft             |
| 17    | Split ring for 2nd speed layshaft gear         | 58-59 | Fixings for plate                     |
| 18    | 3rd speed layshaft and mainshaft gear          | 60    | Low gear wheel                        |
| 19    | Distance sleeve for mainshaft                  | 61    | High gear wheel                       |
| 20    | Thrust washer for 3rd speed mainshaft gear     | 62    | Output shaft, rear drive              |
| 21    | Spring ring fixing 2nd and 3rd mainshaft gears | 63    | Thrust washer for high gear wheel     |
| 22    | Sleeve for layshaft                            | 64    | Circlip fixing washer to shaft        |
| 23    | Bearing for layshaft, front                    | 65    | Bearing for output shaft, front       |
| 24-26 | Fixings for bearing to layshaft                | 66    | Circlip fixing bearing to case        |
| 27    | Bearing plate assembly for layshaft            | 67    | Bearing for output shaft, rear        |
| 28    | Stud for bearing cap                           | 68    | Oil seal for output shaft             |
| 29    | Distance piece for layshaft                    | 69    | Speedometer worm complete             |
| 30    | Retaining plate for layshaft front bearing     | 70    | Flange for output shaft, rear drive   |
| 31-32 | Fixings for cap and bearing                    | 71    | Mudshield for flange                  |
| 33    | Bearing for layshaft, rear                     | 72    | Fitting bolt for brake drum           |
| 34    | Synchronising clutch                           | 73    | Retaining flange for brake drum bolts |
| 35    | Detent spring for clutch                       | 74    | Fitting bolt for propeller shaft      |
| 36    | Roller bearing for mainshaft                   | 75    | Circlip retaining bolts and flange    |
| 37    | Ball bearing for mainshaft                     | 76-78 | Fixings for flange                    |
| 38    | Housing for mainshaft bearing, rear            | 79    | Speedometer pinion                    |
| 39    | Peg, housing to casing                         | 80    | Retaining plate for pinion            |
| 40    | Circlip, bearing to housing                    | 81    | Screw fixing plate to housing         |
| 41    | Circlip, housing to casing                     | 82    | Sleeve for pinion                     |
| 42    | Oil seal for rear of mainshaft                 | 83    | Sealing ring for sleeve               |
| 43    | Oil thrower for mainshaft                      | 84    | Joint washer for sleeve               |
|       |  | 85    | Oil seal for pinion                   |

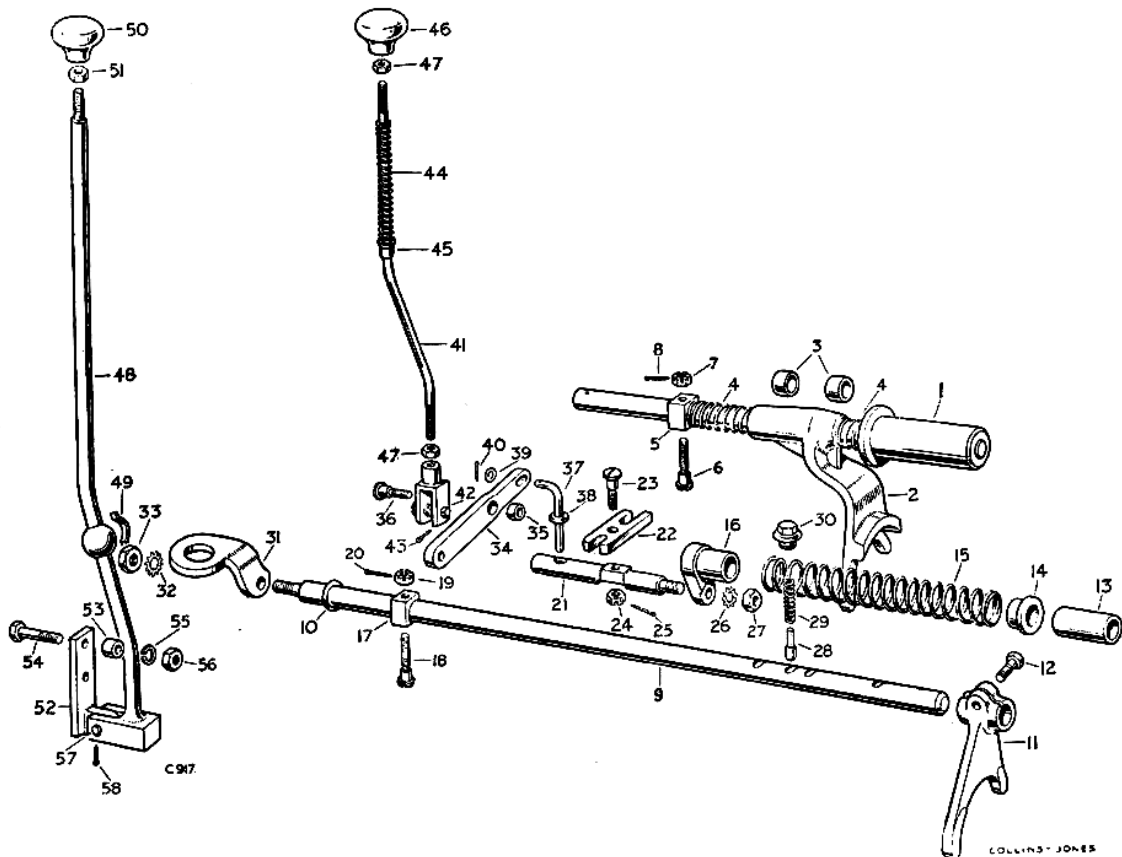
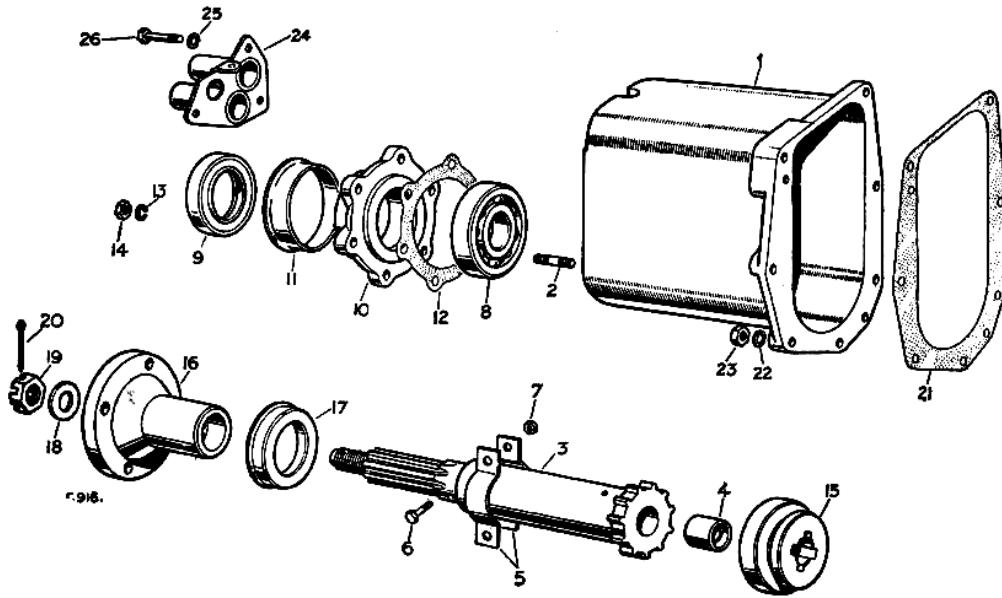


Fig. C-3—Layout of the gearbox unit: front wheel drive, transfer gear controls and front output shaft and housing

## Key to Fig. C-3

1	Output shaft housing assembly	12	Joint washer for retainer
2	Stud for oil seal retainer	13-14	Fixings for retainer
3	Front output shaft assembly	15	Locking dog, four wheel drive
4	Bush for shaft	16	Flange for transfer shaft
5	Oil thrower for output shaft	17	Mudshield for flange
6-7	Fixings for oil thrower	18-20	Fixings for flange
8	Bearing for front output shaft	21	Joint washer for transfer housing
9	Oil seal for shaft	22-23	Fixings for housing
10	Retainer for oil seal	24	Dust cover plate for selector shafts
11	Mudshield for retainer	25-26	Fixings for dust cover
<hr/>			
1	Selector shaft, four wheel drive	31	Link for selector shaft
2	Selector fork complete, four wheel drive	32-33	Fixings for link
3	Bush for selector fork	34	Lever assembly, four wheel drive
4	Spring for selector fork	35	Bush for lever
5	Block for selector shaft	36	Special bolt, lever to housing
6-8	Fixings for block	37	Locking pin, four wheel drive lever
9	Selector shaft, transfer gear change	38	Sealing ring, four wheel drive locking pin
10	Sealing ring for transfer gear change shaft	39-40	Fixings for locking pin
11	Selector fork, transfer gear change	41	Selector rod, four wheel drive
12	Set bolt fixing fork	42	Clevis complete for rod
13	Distance tube for transfer selector shaft	43	Split pin for clevis
14	Locating bush for selector shaft spring	44	Spring for selector rod
15	Spring for gear change selector shaft	45	Special bush for spring
16	Connector, gear change to pivot shaft	46	Control knob for rod
17	Block for selector shaft	47	Locknut for knob and clevis
18-20	Fixings for block	48	Transfer gear change lever complete
21	Pivot shaft for selector shafts	49	Spring for transfer gear change lever
22	Coupling, selector shafts to pivot	50	Knob for gear change lever
23-25	Fixings for coupling	51	Locknut for knob
26-27	Fixings for pivot shaft	52	Bracket for gear change lever
28	Plunger for transfer selector shaft	53	Distance piece for bracket
29	Spring for plunger	54-56	Fixings for bracket
30	Plug	57-58	Fixings for gear lever

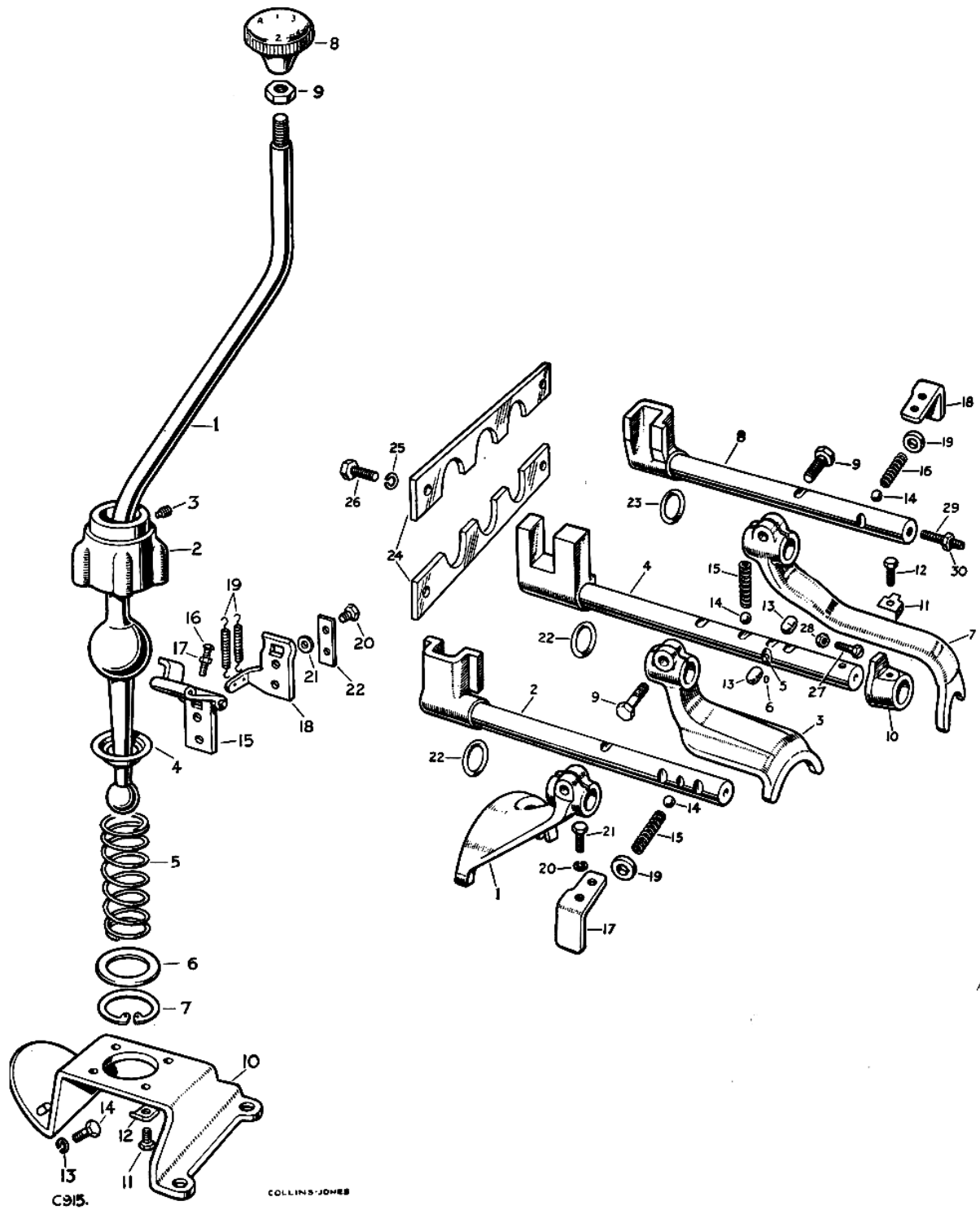


Fig. C-4—Layout of the gearbox unit: main gear change lever and selectors



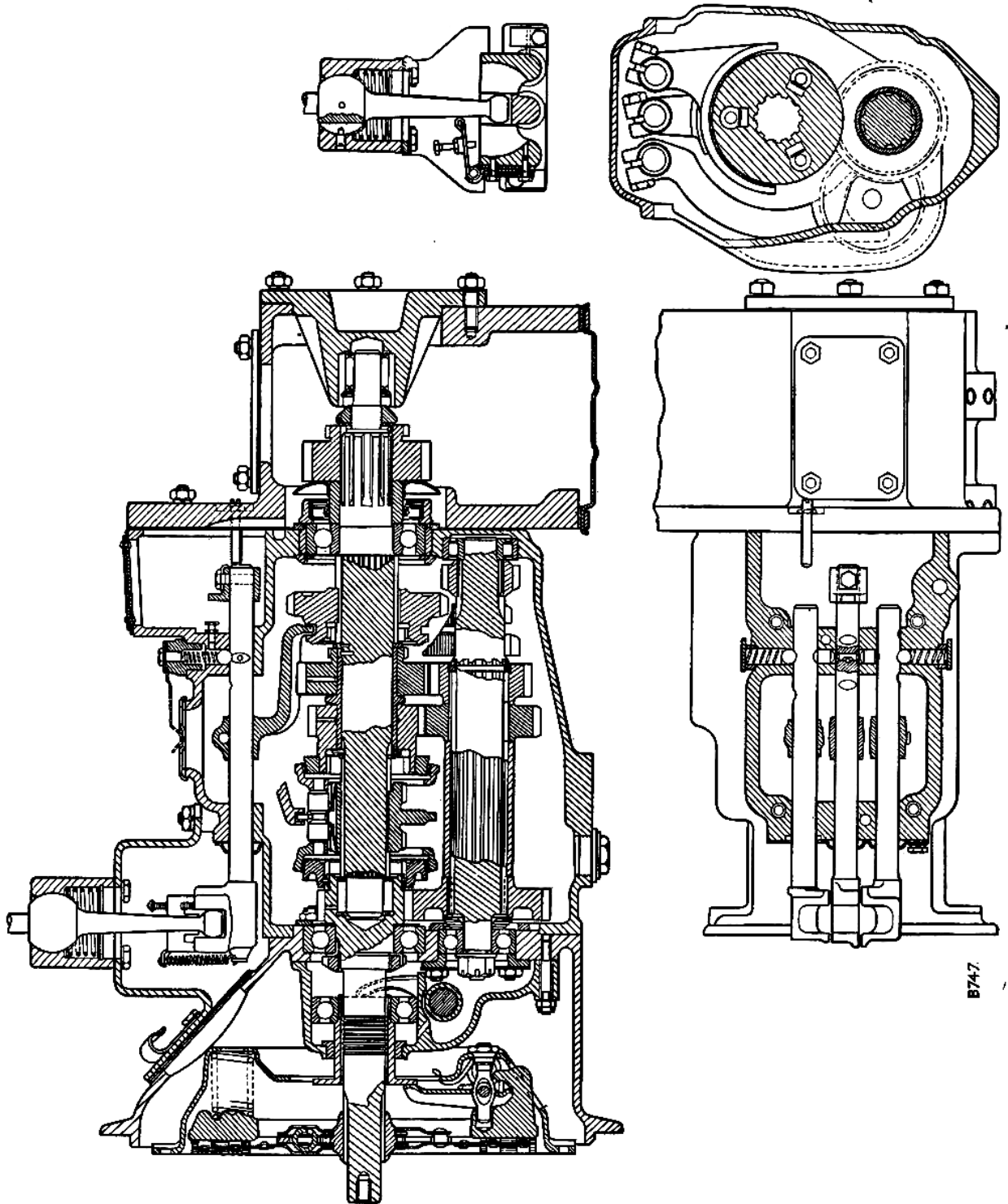
Key to Fig. C-4

1	Gear change lever	1	Selector fork, 3rd and 4th speed
2	Housing for lever	2	Shaft for fork, 3rd and 4th speed
3	Locating pin for lever ball	3	Selector fork, 1st and 2nd speed
4	Spherical seat for gear lever	4	Shaft assembly for fork, 1st and 2nd speed
5	Retaining spring for lever	5	Interlocking pin
6	Retaining plate for spring	6	Peg fixing interlocking pin
7	Circlip fixing retaining plate	7	Selector fork, reverse
8	Knob for lever	8	Shaft for fork, reverse
9	Locknut for knob	9	Set bolt fixing forks to shafts
10	Mounting plate for gear change	10	Stop for 2nd speed
11-12	Fixings for housing	11-12	Fixings for stop
13-14	Fixings for mounting plate	13	Interlocking plunger
15	Reverse stop hinge complete	14	Steel ball for selectors
16	Adjusting screw	15	Selector spring, forward
17	Locknut	16	Selector spring, reverse
18	Bracket for reverse stop spring	17	Retaining plate L.H.
19	Spring for reverse stop	18	Retaining plate R.H.
20-22	Fixings for hinge and bracket	19	Rubber grommet
		20-21	Fixings for retaining plates
		22	Seal for selector shafts
		23	Cork seal for reverse shaft
		24	Retaining plate for sealing ring
		25-26	Fixings for retaining plate
		27	Set bolt
		28	Locknut
		29	Adjustable stop for reverse selector shaft
		30	Locknut for stop

} For selector springs, side

} For hinge

} In cover for 2nd gear stop



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Fig. C-5—Cross-section of gearbox unit: elevation

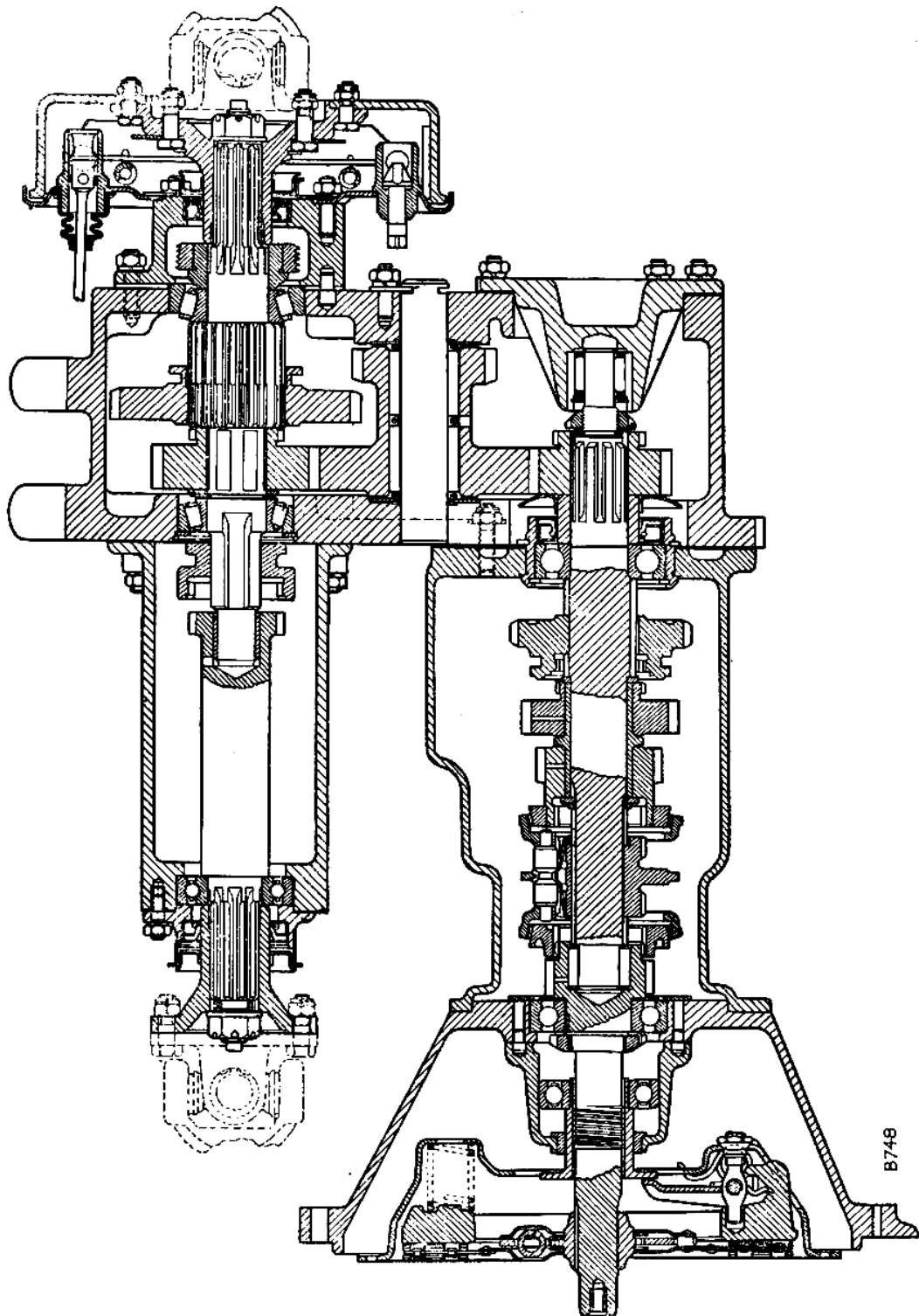


Fig. C-6—Cross-section of gearbox unit with dog clutch controlling front-wheel drive plan.

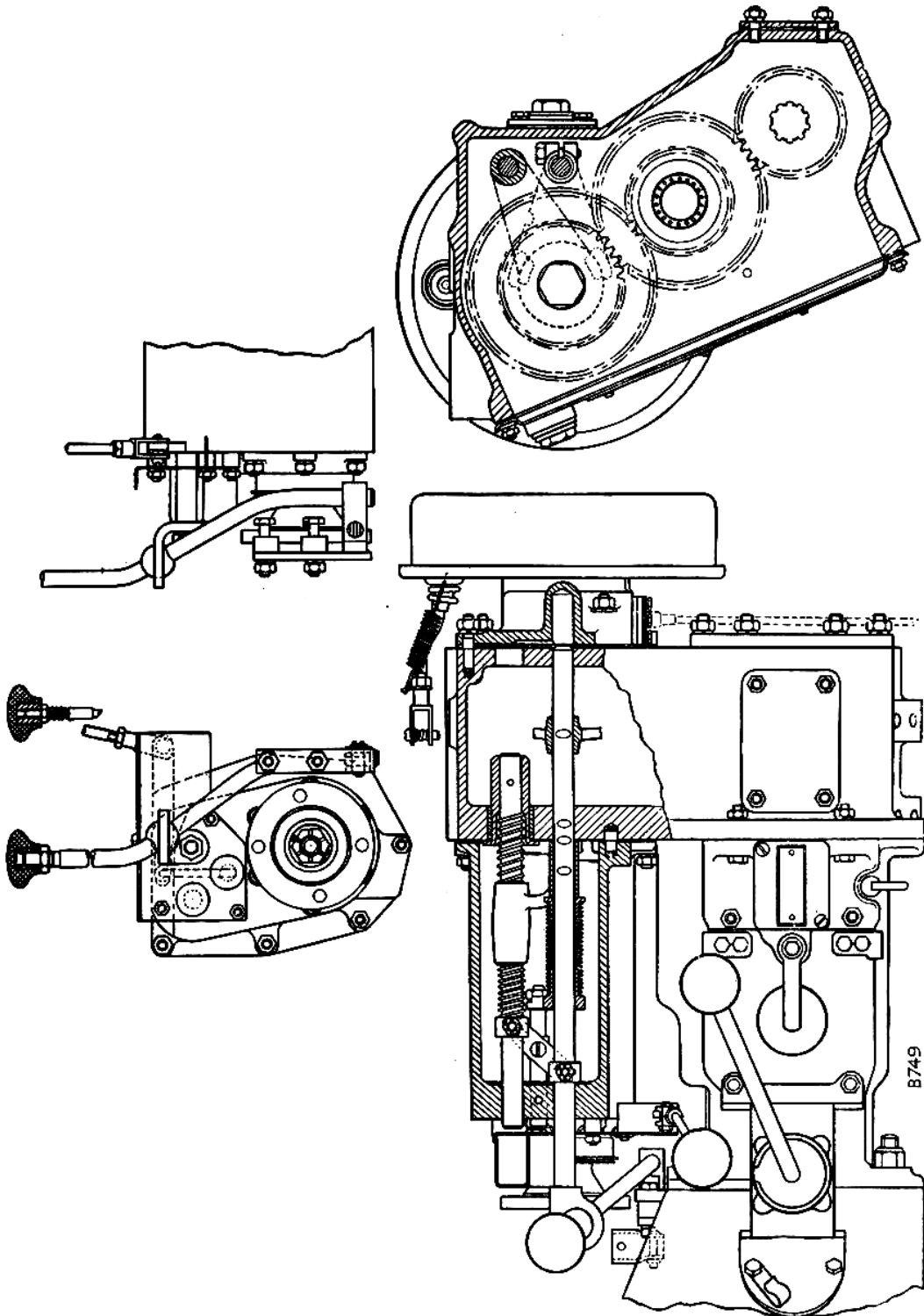


Fig. C-7—Cross-section of gearbox unit: controls.

## 1948-53 models

**Freewheel components (gearbox in position)**  
**To renew** **Operation C/2**  
 (Gearboxes numbered prior to 16102314 and 16131688)

1. Position the vehicle over a pit or raise it as high as possible with a high-lift jack.
2. Remove the transfer box drain plug and drain off the oil into a suitable receptacle.
3. Place the transfer gear change lever in the low position, *i.e.*, to the rear.
4. Remove the front propeller shaft (see Section D).
5. **R.H.D. models only.** Remove the clutch return spring, from the front end first. Withdraw the split pin and remove the clevis pin connecting the operating rod to the lever on the clutch cross-shaft. Withdraw the split pin and remove the joint pin and two washers securing the cross-shaft to the connecting tube on the clutch shaft. Slide the cross-shaft through the bushes as far as possible towards the chassis side member.
6. Slacken the locknut and remove the freewheel control pivot and eyebolt complete from the output shaft housing.
7. Draw out the freewheel operating rod.
8. Remove the special nut and shakeproof washer securing the transfer control link to the selector shaft and slide the link up the transfer gear change lever.
9. Withdraw the split pin and remove the castle nut and plain washer securing the front axle driving flange; carefully remove the flange, avoiding damage to the oil seal.
10. Remove the plug and joint washer from the left-hand side of the output shaft housing and withdraw the transfer selector spring and ball.
11. Remove the seven nuts and spring washers securing the output shaft housing and carefully remove the housing, complete with joint washer, forward and down below the chassis.  
*Note:* On gearboxes numbered 860001 to 861988, it is essential that the locking dog remains in the output shaft housing, otherwise it will prevent the unit clearing on removal.
12. Remove the seven nuts and spring washers securing the freewheel housing to the transfer casing; the two upper nuts can be conveniently reached through the seat box centre panel aperture.
13. Slacken the rear engine and gearbox unit mounting bolts.
14. Lever the gearbox unit slightly upwards to allow the bottom freewheel housing boss to clear the chassis and remove the housing, complete with joint washer, in a similar manner to the output shaft housing.

15. Remove the freewheel components as required and rebuild the unit.
16. Re-assemble by reversing the sequence of operations detailed for removal, paying attention to the following points:—
17. Prior to fitting the freewheel housing, ensure that the freewheel operating shaft, guide and spring work freely in the transfer casing.
18. Prior to replacing the output shaft housing, place a suitable guide thimble over the end of the transfer selector shaft, to prevent damage to the oil seal.
19. Check the operation of the transfer and freewheel controls.
20. Refill the transfer box with oil of the correct grade.

## 1948-53 models

**Four-wheel drive mechanism (gearbox in position)**  
**To remove** **Operation C/4**  
 (Gearboxes numbered 16102314 and 16131688 onwards)

1. Position the vehicle over a pit or raise it as high as possible with a high-lift jack.
2. Remove the transfer box drain plug and drain off the oil into a suitable receptacle.
3. Remove the front propeller shaft (see Section D).
4. **R.H.D. models only.** Remove the clutch return spring, from the front end first. Withdraw the split pin and remove the clevis pin connecting the operating rod to the lever on the clutch cross-shaft. Withdraw the split pin and remove the joint pin and two washers securing the cross-shaft to the connecting tube on the clutch shaft. Slide the cross-shaft through the bushes as far as possible towards the chassis side member.
5. Remove the yellow knob, locknut, spring and bush from the front-wheel drive control rod.
6. Remove the red knob and locknut from the transfer lever.
7. Remove the R.H. floorboard.
8. Withdraw the split pin and remove the castle nut and plain washer securing the front axle driving flange; carefully remove the flange complete with dust seal, avoiding damage to the oil seal.
9. Remove the special nut and shakeproof washer securing the transfer control link to the selector shaft; remove the split pin and spring-loaded clevis pin and remove the transfer lever.
10. Remove the dust cover from the front of the output housing by removing the three nuts, spring washers and distance pieces.

11. Remove the front-wheel drive control lever assembly by withdrawing the special pivot screw.
  12. Remove the seven nuts and spring washers securing the output housing to the transfer box (this action also releases an earth lead). Slacken the gearbox mountings and lift under the left-hand support. Withdraw the output housing complete with output shaft, front-wheel drive dog clutch, the dog clutch selector shaft and fork and a joint washer, clear of the chassis cross-member. Withdraw the dog clutch selector shaft and dog clutch from the rear of the housing. Remove the top cover plate from the transfer box, hold in low transfer and remove the output housing upwards through the floorboard aperture. Leave the transfer selector shaft and link in position protruding from the transfer box.
  13. Remove the split pin, castle nut and special screw from the transfer selector shaft and remove the block.
  14. Slide the following parts from the transfer selector shaft:—
    - (a) Link, link pin and connector assembly.
    - (b) Spring.
    - (c) Spring locating bush.
    - (d) Distance tube.
  15. Detach the link from the link pin by removing the special screw, castle nut and split pin.
 

*Note:* The connector should not be removed from the link pin unless absolutely necessary, as difficulty will be experienced in effecting correct alignment on re-assembly.
  16. Remove the output shaft from the output housing.
  17. Remove the split pin, castle nut and special screw from the dog clutch selector shaft and remove the block.
  18. Slide the two springs and selector fork from the dog clutch selector shaft.
  19. If necessary, remove the two bushes from the selector fork boss.
  20. If necessary, remove the spigot bush from the rear end of the output shaft.
  21. Remove the six nuts and spring washers securing the oil seal retainer to the front face of the output housing and remove the retainer complete with oil seal and joint washer.
  22. If necessary, remove the oil seal from the retainer.
  23. If necessary, withdraw the output shaft front bearing from the output housing.
- 1948-53 models**
- Four-wheel drive mechanism (gearbox in position)**
- To replace Operation C/6**  
(Gearboxes numbered 16102314 and 16131688 onwards)
1. If necessary, replace the output shaft front bearing in the output housing. The bearing must be a push fit on the shaft and a light drive fit in the housing.
 

Renew the shaft, bearing and housing as necessary.
  2. If removed, fit a new oil seal in the retainer with its knife edge inwards.
  3. If removed, replace the spigot bush in the rear end of the output shaft, pressing it in flush with the face of the shaft. The bush must be reamed in position to .875 in. (22,22 mm) giving .001 in. to .002 (0,02 mm to 0,05) clearance on the transfer box output shaft.
  4. If removed, renew the two oilite bushes in the dog clutch selector fork boss; the bushes must be pressed in flush with the end faces of the boss and must have .001 in. to .002 clearance on the selector shaft.
  5. Check the two dog clutch selector springs in accordance with the following data and renew as necessary:—
 

Free length: 2.750 in. (69,5 mm)  
Solid length: .640 in. (16 mm)  
Maximum load: 13 lb. (5,8 kg)  
Rate: 6½ lb./in. (2,7 kg)
  6. Check the transfer selector shaft spring in accordance with the following data and renew as necessary:—
 

Free length: 7.156 in. (182,7 mm)  
Length in position: 3.875 in. (98,4 mm)  
Load in position: 24 lb. (10,8 kg)  
Rate: 7.31 lb./in. (3,2 kg).
  7. Replace the oil seal retainer on the output housing and secure with six nuts and spring washers.
  8. Fit the two springs and selector fork (crank to the rear) over the dog clutch selector shaft.
  9. Replace the block on the selector shaft and secure by means of the special screw, castle nut and split pin.

10. If the connector has been detached from the link pin, replace it with the hole for the locking peg vertical and the cutaway on the link pin underneath; ensure that the connector is square with the pin and secure lightly with the nut and shake-proof washer.
11. Secure the link to the link pin by means of the special screw, castle nut and split pin. The threaded end of the screw must be downwards and the shorter end of the link towards the transfer selector, with the longer arm of the jaw at the opposite end to the rear.
12. Slide the following parts on the transfer selector shaft:—
  - (a) Distance tube.
  - (b) Spring locating bush with its smaller diameter to the front.
  - (c) Spring.
  - (d) Compress the spring and fit the link and connector assembly until the block is over the hole in the shaft. Fit the special screw from the bottom, through the coupling jaw, block and selector shaft and secure with the castle nut and split pin.
13. Fit the dog clutch over the splines on the transfer box output shaft.
14. Fit the dog clutch selector shaft assembly into the bush in the transfer box, ensuring that the link engages the screw correctly.
15. Fit the output housing joint washer. If necessary, tighten the connector on the link pin.
16. Place the housing over the selector shafts (from the top). Before pushing the housing home, select two-wheel drive in high transfer gear (through the transfer box) and fit the output shaft over the transfer box shaft and through the housing. Secure with the seven nuts and spring washers, picking up the earth lead under one of the nuts.
17. Complete the assembly by reversing the sequence of removal operations.
18. Adjust the front-wheel drive rod to ensure efficient extraction and replacement of the locking peg; it is important to avoid the spring becoming coilbound as under such conditions the operation appears correct, but the peg is not extracted sufficiently to engage four-wheel drive.
19. Check the whole assembly for correct operation.

#### 1948-53 models

##### Main gear change lever

##### To overhaul

##### Operation C/8

On vehicles numbered 860001 to 861500, the main gear change lever is bolted to the gearbox cover panel, while on later vehicles it is secured directly to the gearbox unit. The overhaul operations differ extensively between the two patterns.

##### Vehicles numbered 860001 to 861500

1. Remove the gearbox cover panel, complete with the gear change lever and reverse stop, from the vehicle.
2. Remove the five bolts, spring washers and nuts securing the gear change lever to the cover and lift off the lever, complete with shim plates, which should be preserved.
3. Remove the knob and locknut from the lever.
4. Remove the five bolts, anti-rattle springs and nuts securing the ball retainers to the lever and remove the upper (small) and lower (large) ball retainers.
5. Remove the two bolts, spring washers and nuts securing the reverse stop housing to the gearbox cover and remove the housing, spring retainer plate and shim plates, which should be preserved.
6. Remove the detent ball spring, detent ball, plunger and spring from the housing.
7. Renew any worn components.
8. Fit the plunger and spring, detent ball and spring in the reverse stop housing and hold them in position with the retainer plate. Secure the housing and retainer to the cover plate, complete with the shim plates, by means of the two bolts, spring washers and nuts. It may be necessary, at a later stage, to adjust the thickness of shim plates to allow ease of operation of the reverse stop unit; the plates are available .128 in. and .036 in. thick.
9. Fit the upper and lower ball retainers to the gear change lever and secure them with the five bolts, anti-rattle springs and nuts.
10. Replace the locknut and knob on the lever.
11. Fit the complete gear change lever to the gearbox cover panel, together with the shim plates, and secure it by means of the five bolts, spring washers and nuts. After fitting the unit in the vehicle, it may be necessary to adjust the thickness of shim plates, to ensure that the lever selector makes good contact, but does not "bottom" in the gearbox selectors; the plates are available .128 in. and .036 in. thick.
12. Replace the complete gearbox cover panel in the vehicle and check the operation of the gear change lever and reverse stop; adjust the shims as necessary.

##### Vehicles numbered 861501 onwards

1. Remove the freewheel control ring or front wheel drive control knob, locknut and spring; remove the knobs and locknuts from the main and transfer gear change levers.
2. Remove the brake pedal rod and pad (see Section H).
3. Remove the clutch pedal and pad (see Section B).
4. Remove the left-hand and right-hand toe plates (see Section R).

5. Remove the gearbox cover.
6. Detach the two springs from the reverse stop hinge. Prise up the locking tabs and remove the two set bolts, lockplate and two plain washers securing the reverse stop to the reverse selector; remove the reverse stop hinge (complete with adjusting screw and locknut) and the spring bracket.
7. Remove the two set bolts, spring washers and distance pieces securing the gear change lever mounting plate to the bell housing and the two nuts and spring washers securing the plate to the gearbox top cover; remove the mounting plate and gear change lever complete.
8. Prise up the locking tabs and remove the four set bolts and lockers securing the gear change lever housing to the mounting plate; remove the plate.
9. Remove the circlip from the lever housing and draw out the spring retaining washer, spring and spherical seat; withdraw the gear lever from the housing. If necessary, remove the lever ball locating pin from the housing.
10. Renew any worn components.
11. Replace the lever ball locating pin in the housing (if removed on stripping) and secure it by "staking".
12. Fit the gear change lever in the housing; replace the spherical seat, spring and retaining washer and secure the whole with a circlip.
13. Fit the housing to the mounting plate and secure it by means of four lockers and set bolts.
14. Fit the mounting plate to the gearbox unit; secure it by means of two spring washers and nuts at the gearbox top cover and two set bolts and spring washers at the bell housing aperture.
15. Fit the reverse stop hinge and spring bracket to the reverse selector and secure them by means of two plain washers, one lockplate and two set bolts (the plain washers should be fitted under the lockplate). Replace the two reverse stop springs.
16. Adjust the reverse stop as described below.
17. Replace the gearbox cover.
18. Replace the left-hand and right-hand toe plates (see Section R).
19. Replace the clutch pedal rod and pad (see Section B).
20. Replace the brake pedal rod and pad (see Section H).
21. Replace the freewheel control ring or front wheel drive control knob, locknut and spring; replace the locknuts and knobs on the main and transfer gear change levers.

## 1948-53 models

## Reverse stop

## To adjust

## Operation C/10

1. The screw and locknut on the reverse stop hinge should be adjusted so that:
  - (a) the hinge rides easily up the gear lever when reverse gear is selected, and
  - (b) appreciable resistance is felt on moving the gear lever to the reverse gear position.
2. This adjustment should be carried out on any gearbox removed for attention, before the gearbox cover is fitted.
3. It can also be carried out at any time after:
  - (a) detaching the access panel from the right-hand side of the gearbox cover on vehicles fitted with a freewheel control ring, or
  - (b) selecting reverse gear and sliding the access panel up the front wheel drive control rod.

## 1948-53 models

## Gearbox dipstick (lower oil level)

## To modify

## Operation C/12

All main gearboxes numbered prior to 16102100 and 16131500 have an oil capacity of 4 pints (2,5 litres); the oil capacity is reduced to 2½ pints (1,5 litres) on later gearboxes to counteract the possibility of oil passing along the primary pinion and giving rise to clutch slip.

Early gearboxes should be so modified at overhaul as follows:—

1. Make a new "H" mark on the dipstick  $\frac{1}{2}$  in. (12,7 mm) below the existing mark, i.e.,  $5\frac{3}{4}$  in. (148,5 mm) below the handle flange; obliterate the original mark.
2. Alternatively, discard the original dipstick and rebuild the gearbox with a new dipstick, Part No. 235242.

## 1948-53 models

## Transfer box (lower oil level)

## To modify

## Operation C/14

All 1948 to mid-1950 transfer boxes have an oil capacity of 6 pints (3,5 litres); the oil capacity is reduced on later gearboxes to 4½ pints (2,5 litres) to counteract the tendency for oil to pass from the transfer box to the main gearbox. Early transfer boxes should be modified at overhaul as follows:—

1. The oil level should be lowered by  $\frac{3}{4}$  in. (22 mm). Mark off the new position for the level plug on the rear face of the transfer box by scribing a line vertically downwards from the centre of the lower right-hand stud securing the centre power take-off cover plate. Mark off a point  $2\frac{1}{4}$  in. (57 mm) below the centre of the stud.
2. Drill a  $\frac{3}{16}$  in. (5 mm) hole at this point and tap  $\frac{1}{4}$  in. Whit.
3. Fit a suitable  $\frac{1}{4}$  in. Whit. set bolt ( $\frac{1}{2}$  in. (13 mm) long) and fibre washer to act as a plug.
4. Clean out all swarf from the transfer box.



5. Ensure that an oil flinger is fitted in front of the transfer drive gear on the rear of the gearbox mainshaft (see Fig. C-2).

## 1948-53 models

## Gearbox only

## To remove

## Operation C/16

1. Disconnect the battery.
2. Remove the hood or hard top, for convenience in working.
3. Remove the centre inspection panel from the seat box.
4. Remove the hand brake lever and linkage (see Section H).
5. Remove the freewheel control ring or the front wheel drive control knob, locknut and spring; remove the knobs and locknuts from the main and transfer gear change levers. (Transfer lever knob only on vehicles numbered 860001 to 861500.)
6. Remove the brake pedal rod and pad (see Section H).
7. Remove the clutch pedal rod and pad (see Section B).
8. Remove the left-hand and right-hand toe plates (see Section R).
9. Remove the gearbox cover. On vehicles numbered 860001 to 861500, the main gear change lever assembly will be removed with the cover.
10. Remove the petrol tank and tool locker lids, by detaching the eight bolts, spring washers and nuts securing the hinges to the back rest panel.
11. Remove the five bolts, spring washers and nuts securing the top fixing angle on the seat box to the back rest panel.
12. Remove the six set bolts, spring and plain washers securing the side fixing angles to the seat box.
13. Remove the two bolts, spring washers and nuts securing the floor sills to the dash.
14. Remove the seat box complete.
15. Remove the rear axle propeller shaft (see Section D).
16. Disconnect the front axle propeller shaft and rear power take-off propeller shaft (if fitted), at the gearbox end in both cases.
17. **R.H.D. models only.** Remove the clutch return spring, from the front end first. Withdraw the split pin and remove the clevis pin securing the clutch operating rod to the cross-shaft lever. Withdraw a split pin and washer and tap out the joint pin connecting the cross-shaft to the connecting tube. Slide the cross-shaft clear of the bell housing, towards the chassis side member.

18. **L.H.D. models only.** Remove the clutch return spring, from the front end first. Withdraw the split pin and remove the clevis pin securing the clutch operating rod to the clutch shaft lever.

19. Disconnect the speedometer cable at the gearbox end either by removing the bolt, spring washer and nut securing the cable to the pinion bush on the drive housing or by detaching the retaining plate and three set bolts and spring washers securing the cable to the drive housing; withdraw the cable clear of the gearbox.

20. Remove the self-locking nuts from the two rear engine and gearbox unit bearer bolts and withdraw the bolts; the bearer rubbers, washers and shims may normally be left in position in the vehicle.

*Note:* It may be necessary to remove the right-hand bearer from the transfer casing, as in some cases it will not clear the hand brake bell crank lever.

21. Remove the thirteen nuts and plain washers securing the bell housing to the engine flywheel housing.

22. Place a jack under the rear end of the engine and raise it approximately  $\frac{1}{2}$  in. (12 mm) above its normal position; this will enable the bell housing flange to clear the chassis cross-member and also prevent any strain being taken on the primary pinion shaft.

23. Place a suitable sling round the gearbox unit, raise it upwards and to the rear and remove the unit from the vehicle.

## 1948-53 models

## Gearbox only

## To replace

## Operation C/18

1. Replacement of the gearbox unit is effected by reversing the sequence of operations detailed for removal.
2. Should the engine and gearbox unit mounting rubbers, etc., have been disturbed, they should be fitted as shown at Fig. C-8. The nip on the pads is adjusted by the addition or removal of shims on the top of the central distance tube; it should be checked on replacement and adjusted as necessary. The correct setting is with the top shim approximately  $\frac{1}{16}$  in. (1.5 mm) below the top face of the upper rubber pad.  
On early 1952 models onwards, the rear mounting brackets are adjustable laterally, to facilitate alignment with the mounting rubbers.
3. Refill the main gearbox and transfer box with oil of the correct grade.
4. Adjust the transmission brake as described in Section H.

## 1948-53 models

**Gearbox unit****To strip****Operation C/20**

Operation C/20 details the differences which will be found on 1948-53 gearboxes. See following pages for main gearbox and transfer box strip and reassembly.

**Gearboxes numbered prior to 16102314 and 16131688**

1. Mount the gearbox unit on a suitable stand.
2. Remove the drain plugs (and joint washers) from the bottom of the main gearbox casing and transfer casing and drain off the oil into a suitable receptacle.

**Remove the controls as follows:**

3. **Gearboxes numbered 861501 onwards.** Remove two spring washers and nuts at the main gearbox top cover and two set bolts, spring washers, cover plate and rubber seal at the bell housing and lift off the main gear change lever assembly. Strip the assembly.  
Remove the reverse stop hinge unit.
4. **Gearboxes numbered 860001 to 861500.** Remove the two nuts, spring washers and distance pieces (or cover plate and rubber seal) securing the bell housing inspection cover and remove the cover.
5. Remove the transfer gear change cover plate and joint washer from the transfer casing; this is secured either by four set screws or four set bolts and spring washers.
6. Remove the special screw, spring washer and nut securing the freewheel control pivot to the eyebolt in the front of the output shaft housing; remove the pivot and eyebolt (complete with locknut).
7. Remove the special nut and shakeproof washer securing the transfer selector link to the front of the selector shaft.
8. Remove the split pin and clevis pin securing the transfer gear change lever to the bracket on the bell housing; remove the lever complete with link.
9. Remove the two bolts, spring washers, distance pieces and nuts securing the transfer lever bracket to the bell housing and remove the bracket.
10. Remove the return spring for the freewheel lever; remove the spring anchor from the output shaft housing by withdrawing the set bolt, spring washer and distance piece. Remove the freewheel lever guide by removing the two set bolts and spring washers securing it to the output shaft housing. Remove the special screw and distance piece securing the freewheel lever to the output shaft housing and remove the lever complete with the operating wire or rod.
11. Remove the plug and joint washer from the left-hand side of the output shaft housing and withdraw the transfer shaft selector spring and ball.

12. Remove the front axle drive flange and dust shield from the output shaft, by removing the split pin, castle nut and plain washer.
13. Withdraw the freewheel operating rod from the output shaft housing.
14. Remove the seven nuts and spring washers securing the output shaft housing to the freewheel housing and withdraw the housing complete with joint washer. If necessary, remove the output shaft and selector shaft oil seals from the housing.
15. **Gearboxes numbered 861989 onwards.** The output shaft front bearing will remain on the output shaft protruding from the freewheel housing. Withdraw the bearing from the shaft.
16. **Gearboxes numbered 860001 to 861988.** The front portion of the output shaft ("transfer shaft") will be retained in the output shaft housing. Remove the circlip retaining the front bearing in the housing and drive out the transfer shaft and bearing from the housing; withdraw the bearing from the shaft. Remove the distance washer, locking dog and distance piece from the output shaft in the freewheel housing.

**Remove the freewheel unit as follows:**

17. Remove the seven nuts and spring washers securing the freewheel housing to the transfer casing and withdraw the housing complete with joint washer. Withdraw the spring guide and freewheel operating spring from the transfer casing.
18. Remove the pinch bolt securing the freewheel operating fork to the operating shaft and remove the fork and shaft.
19. Remove the freewheel locking dog.
20. Remove the circlip retaining the output shaft rear bearing in the freewheel housing; drive out the output shaft and freewheel assembly from the housing.
21. Remove the circlip securing the rear bearing to the output shaft and withdraw the bearing.
22. **Gearboxes numbered 860001 to 861988.** If necessary, remove the bush from the front bore of the output shaft.
23. Remove the spring ring and retaining plate securing the inner member to the outer member. Remove the inner member complete with the fixed cam roller shoes (which can be removed if necessary by removing the securing set screws), nine graded rollers, three free cam roller shoes and three shoe springs. Remove the pilot bearing from the outer member.
24. Prise up the tab washers and remove the six set bolts and two locking plates securing the freewheel outer member to the output shaft.
25. If necessary, remove the operating shaft bush from the freewheel housing.

**Gearboxes numbered 16102314 and 16131688 onwards**

26. Mount the gearbox unit on a suitable stand.
27. Remove the drain plugs (and joint washers) from the bottom of the main gearbox casing and transfer casing and drain off the oil into a suitable receptacle.

**Remove the controls as follows:**

28. Remove two spring washers and nuts at the main gearbox top cover and two set bolts, spring washers, cover plate and rubber seal at the bell housing and lift off the main gear change lever assembly. Strip the assembly.  
Remove the reverse stop hinge unit.
29. Remove the transfer gear change cover plate and joint washer from the transfer casing (four set bolts and spring washers).
30. Remove the plug and joint washer from the top of the transfer casing and withdraw the transfer shaft selector spring and plunger.
31. Withdraw the split pin and remove the castle nut and plain washer securing the front axle driving flange; carefully remove the flange complete with dust seal, avoiding damage to the oil seal.
32. Remove the special nut and shakeproof washer securing the transfer control link to the selector shaft; remove the split pin and spring-loaded clevis pin and remove the transfer lever.
33. Remove the dust cover from the front of the output housing, by removing the three nuts, spring washers and distance pieces.
34. Remove the front wheel drive control lever assembly by withdrawing the special pivot screw. Remove the split pin and plain washer securing the locking peg to the lever. Disconnect the operating rod from the lever (spring-loaded clevis). If necessary, press out the bush from the lever.
35. Remove the seven nuts and spring washers securing the output housing to the transfer box (this action also releases an earth lead). Withdraw the output housing complete with output shaft, front wheel drive dog clutch, the dog clutch selector shaft and fork and a joint washer. Leave the transfer selector shaft and link in position protruding from the transfer box.
36. Remove the split pin, castle nut and special screw from the transfer selector shaft and remove the block.
37. Slide the following parts from the transfer selector shaft:—
  - (a) Link, link pin and connector assembly.
  - (b) Spring.
  - (c) Spring locating bush.
  - (d) Distance tube.
38. Detach the link from the link pin by removing the special screw, castle nut and split pin.

*Note:* The connector should not be removed from the link pin unless absolutely necessary, as difficulty will be experienced in effecting correct alignment on re-assembly.

39. Remove the output shaft, dog clutch selector shaft and dog clutch from the output housing.
40. Remove the split pin, castle nut and special screw from the dog clutch selector shaft and remove the block.
41. Slide the two springs and selector fork from the dog clutch selector shaft.
42. If necessary, remove the two bushes from the selector fork boss.
43. If necessary, remove the spigot bush from the rear end of the output shaft.
44. Remove the six nuts and spring washers securing the oil seal retainer to the front face of the output housing and remove the retainer complete with oil seal and joint washer.
45. If necessary, remove the oil seal from the retainer.
46. If necessary, withdraw the output shaft front bearing from the output housing.

**Gearboxes numbered prior to 16102314 and 16131688****Assemble the freewheel unit as follows:**

1. Fit the freewheel outer member to the front output shaft and secure it with two lockplates and six set bolts.
2. Place the inner member pilot bearing in the outer member.
3. Fit the inner member, complete with three fixed cam roller shoes, in the bearing; place the nine graded rollers in position and fit the free cam roller shoes and springs.
4. Fit the toothed retaining plate in the outer member and secure it with a circlip.
5. If necessary, press a new operating shaft bush into the freewheel housing and ream it to .625 in.
6. Fit the output shaft rear bearing into the freewheel housing and secure it with a circlip. The bearing must be a push fit in the housing.
7. Fit the freewheel assembly into the freewheel housing and press the output shaft through the bearing. The shaft must be a light press fit in the bearing. Secure the shaft with a circlip.
8. **Gearboxes numbered 860001 to 861988.** If necessary, renew the oilite bush in the front bore of the output shaft. The bush is a drive fit in the shaft; the front (transfer) shaft should be an easy fit in the bush bore.
9. Push the freewheel operating shaft through the bush in the freewheel housing, with the spring to the front. Fit the freewheel selector fork on the shaft and secure it with the pinch bolt.

10. Place the locking dog in mesh with the fork and slide the shaft along, so that the freewheel is in the "fixed" position. Ensure that the splines on the inner member and locking dog are in alignment.
  11. Slide the freewheel operating spring over the operating shaft guide and fit the guide into the bushes in the transfer casing. Compress the spring and secure it by means of a small peg pushed through the hole in the guide.
  12. Fit the complete freewheel, together with a joint washer, to the transfer casing, locating it on two dowels; secure with seven nuts and spring washers.
  13. Release the operating spring by removing the peg from the guide and check the freewheel unit for ease of operation.
  14. **Gearboxes numbered 861989 onwards.** Drive the output shaft front bearing on to the output shaft until it abuts the shoulder. The bearing must be a drive fit on the shaft.
  15. **Gearboxes numbered 860001 to 861988.** Fit the transfer shaft bearing in the output shaft housing and secure it with a circlip. The bearing must be a drive fit in the housing. Drive the transfer shaft through the bearing until it abuts the shoulder. The shaft must be a drive fit in the bearing.  
Replace the distance piece, locking dog and distance washer on the output shaft protruding from the freewheel housing.
  16. If necessary, renew the output shaft and selector shaft oil seals in the output shaft housing.
  17. Fit a suitable protection thimble over the end of the transfer operating shaft.
  18. Fit the complete output shaft housing, together with a joint washer, to the freewheel housing; locate the dowel and secure with seven nuts and spring washers. Remove the thimble.
  19. Insert the freewheel operating rod through the seal in the housing and enter it into the operating shaft.
  20. Examine the outer diameter of the front axle drive flange for damage which may have caused failure of the original oil seal and rectify or renew the flange as necessary. Fit the flange and dust shield to the output shaft and secure it with a plain washer, castle nut and split pin.
  21. Replace the transfer change selector ball and spring in the boss on the left-hand side of the output shaft housing and secure them with a plug and joint washer.
- Assemble the controls as follows:**
22. If necessary, renew the bush and operating wire in the freewheel operating lever and fit the complete lever to the output shaft housing by means of the special screw; the distance piece should be placed between the lever and the housing.
  23. Replace the lever guide and secure it to the top of the housing with two set bolts and spring washers.
  24. Secure the lever return spring anchor to the housing by means of a set bolt and spring washer, with the distance piece between the anchor and the housing.
  25. Replace the lever return spring.
  26. Fit the transfer lever bracket to the bell housing, securing it by means of two bolts, spring washers and nuts, with the distance pieces between the bracket and bell housing.
  27. Replace the transfer selector link on the transfer gear change lever.
  28. Fit the link over the end of the selector shaft and secure the lever to the bracket by means of a clevis pin and split pin. Secure the link to the selector shaft with a special nut and shakeproof washer.
  29. Screw the pivot eyebolt, complete with locknut, into the tapping in the front face of the output shaft housing. Fit the pivot to the eyebolt by means of a special screw, spring washer and nut.
  30. Check the operation of the transfer gear change and freewheel controls, adjusting the eyebolt and pivot as necessary, so that:
    - (a) With the transfer change lever right forward, high transfer gear is engaged and the freewheel operating rod is pushed to the rear, *i.e.*, the freewheel is "free". In this position the freewheel lever should engage the slot in the operating rod.
    - (b) With the transfer change lever pulled half-way back, the transfer box should be in neutral. The freewheel operating rod should be retained in the free position by means of the lever.
    - (c) With the transfer change lever right back, low transfer gear is engaged; the freewheel should remain free. When the control wire is pulled or the knob is depressed, so disengaging the lever from the operating rod, the rod should move forward to set the freewheel in the fixed position.
    - (d) On returning to high transfer gear, the freewheel rod should be forced to the free position as at paragraph (a).
  31. When the controls have been adjusted correctly, complete the assembly as follows:
  32. Replace the transfer gear change cover plate and secure it by means of either four set screws or four set bolts and spring washers.
  33. **Gearboxes numbered 861501 onwards.** Assemble the main gear change lever. Fit the lever assembly, cover plate and rubber seal to the gearbox unit, securing them by means of two set bolts and spring washers at the bell housing and two nuts and spring washers at the gearbox top cover.  
Fit and adjust the reverse stop hinge.
  34. **Gearboxes numbered 860001 to 861500.** Fit the bell housing inspection cover and secure it and the cover plate and rubber seal with two spring washers and nuts.

35. Fill the main gearbox and transfer casing with oil of a suitable grade.  
The gearbox unit is now ready for installation in the vehicle.
- Gearboxes numbered 16102314 and 16131688 onwards**
- Assemble the controls as follows:**
36. If necessary, replace the output shaft front bearing in the output housing. The bearing must be a **push fit** on the shaft, and a **light drive fit** in the housing. Renew the shaft, bearing and housing as necessary.
37. If removed, fit a new oil seal in the retainer with its knife edge inwards.
38. If removed, replace the spigot bush in the rear end of the output shaft, pressing it in flush with the face of the shaft.  
The bush must be reamed in position to .875 in.
39. If removed, renew the two oilite bushes in the dog clutch selector fork boss; the bushes must be pressed in flush with the end faces of the boss and must have .001 to .002 in. clearance on the selector shaft.
40. Check the two dog clutch selector springs in accordance with the following data and renew as necessary:—  
Free length: 2.750 in.  
Solid length: .640 in.  
Maximum-load: 13 lb.  
Rate:  $6\frac{1}{2}$  lb./in.
41. Check the transfer selector shaft spring in accordance with the following data and renew as necessary:—  
Free length: 7.156 in.  
Length in position: 3.875 in.  
Load in position: 24 lb.  
Rate: 7.31 lb/in.
42. Replace the oil seal retainer on the output housing and secure with six nuts and spring washers.
43. Fit the two springs and selector fork (crank to the rear) over the dog clutch selector shaft.
44. Replace the block on the selector shaft and secure by means of the special screw, castle nut and split pin.
45. If the connector has been detached from the link pin, replace it with the hole for the locking peg vertical and the cutaway on the link pin underneath; ensure that the connector is square with the pin and secure lightly with the nut and shakeproof washer.
46. Secure the link pin by means of the special screw, castle nut and split pin. The threaded end of the screw must be downwards and the shorter end of the link towards the transfer selector, with the longer arm of the jaw at the opposite end to the rear.
47. Replace the transfer shaft selector spring and plunger and secure with the plug and joint washer.
48. Slide the following parts on to the transfer selector shaft:—  
(a) Distance tube.  
(b) Spring locating bush with its smaller diameter to the front.  
(c) Spring.  
(d) Compress the spring and fit the link and connector assembly until the block is over the hole in the shaft. Fit the special screw from the bottom, through the coupling jaw, block and selector shaft and secure with the castle nut and split pin.
49. Fit the dog clutch over the splines on the transfer box output shaft.
50. Fit the dog clutch selector shaft assembly into the bush on the transfer box, ensuring that the link engages the screw correctly.
51. If they have been separated, the position of the connector and link should now be adjusted as follows:—
52. (a) The most efficient method of carrying out this operation is to use a dummy output housing with a large aperture in the side through which the connector securing nut can be tightened. Place the dummy housing over the selector shafts and locate the link pin by means of a suitable peg. Tighten the connector securing nut and remove the housing.  
(b) If a dummy housing is not available, the actual output housing can be used to align the selectors by sliding it over the shafts back to front. (*Note:* The transfer casing must be detached from the main gearbox, to enable the output housing to clear the bell housing.) Tighten the connector nut with the link in alignment with the two selector shafts. By this method, the locking peg hole in the link pin is not necessarily vertical, a fact which will only appear when the assembly is complete; for this reason the use of a dummy housing is to be preferred.
53. Fit the output housing joint washer.
54. Fit the output shaft in its housing and slide the housing over the selector shafts. Select two-wheel drive in high transfer gear (through the aperture in the transfer casing) and push the housing home; secure with the seven nuts and spring washers.
55. If necessary, renew the bush in the front wheel drive control. Connect the operating rod to the lever and secure the locking peg by means of the plain washer and split pin.
56. Replace the control lever assembly and secure with the pivot screw.
57. Replace the dust cover and secure by means of three nuts, spring washers and distance pieces.
58. Replace the transfer lever and secure with the spring-loaded clevis pin and split pin. Secure the lever to the selector shaft by means of the control link, special nut and shakeproof washer.

59. Examine the outer diameter of the front axle drive flange for damage which may have caused failure of the original oil seal and rectify or renew the flange as necessary. Fit the flange and dust shield to the output shaft and secure it with a plain washer, castle nut and split pin.
60. Check the transfer gear change and dog clutch controls for correct operation and adjust as necessary.  
Adjust the front wheel drive control rod to ensure efficient extraction and replacement of the locking peg; when the gearbox is installed in the vehicle, it is important to avoid the spring becoming coilbound, as under such conditions the operation appears correct, but the peg is not extracted sufficiently to engage four-wheel drive.
61. Replace the transfer gear change cover plate and secure it by means of four set bolts and spring washers.
62. Assemble the main gear change lever.  
Fit the lever assembly, cover plate and rubber seal to the gearbox unit, securing them by means of two set bolts and spring washers at the bell housing and two nuts and spring washers at the gearbox top cover.  
Fit and adjust the reverse stop hinge.
63. Fill the main gearbox and transfer casing with oil of a suitable grade.  
The gearbox unit is now ready for installation in the vehicle.

## 1954-58 models

## Gearbox and transfer box assembly

To remove Operation C/22

1. Remove the hood, hard top or cab, for convenience in working.
2. Remove the front wheel drive control knob, locknut and spring; remove the knob and locknut from the transfer gear change lever.
3. Remove the floor board assembly and gearbox cover. Section R.
4. Remove the seat box complete. Section R.
5. L.H.D. models only. Remove the hand brake lever and linkage. Section H.
6. R.H.D. models only. Remove the hand brake rod and the expander rod from the relay lever.
7. Disconnect the front axle propeller shaft, rear axle propeller shaft and rear power take-off propeller shaft (if fitted), at the gearbox end.
8. L.H.D. models only. Remove the clutch cross-shaft rod from the connecting tubes.
9. R.H.D. models only. Disconnect the universal joint sleeve from the clutch relay shaft and the cross-shaft from the connecting tube. Slide the universal joint sleeve together with the rubber dust cover along the cross-shaft and remove the cross-shaft complete with universal joint sleeve and rubber dust cover.

10. Disconnect the speedometer cable at the gearbox and withdraw the cable clear of the gearbox. Disconnect the earth lead at the transfer box.
11. Remove the gearbox unit bearer bolts, top bearer rubbers, washers, shims and distance tubes.
12. Place a suitable sling around the gearbox unit, raise it approximately 1 inch (25 mm).
13. Place a jack under the rear end of the engine; this prevents any strain being taken on the primary pinion shaft.
14. Withdraw the gearbox unit and remove it from the vehicle.

## To refit

## Operation C/24

1. Reverse the removal procedure.
2. The nip on the gearbox unit mounting rubber pads is adjusted by the addition or removal of shims on the top of the central distance tube.  
The correct setting is with the top shim approximately 1/16 in. (1,5 mm) below the top face of the upper rubber pad.  
*Note:* The rear mounting brackets are adjustable laterally, to facilitate alignment with the mounting rubbers.
3. If necessary, refill the main gearbox, 2½ pints (1,5 litres) and transfer box, 4½ pints (2,5 litres) with oil.
4. Adjust the transmission brake. Section H.
5. Adjust the four-wheel drive control rod. Operation C/48.

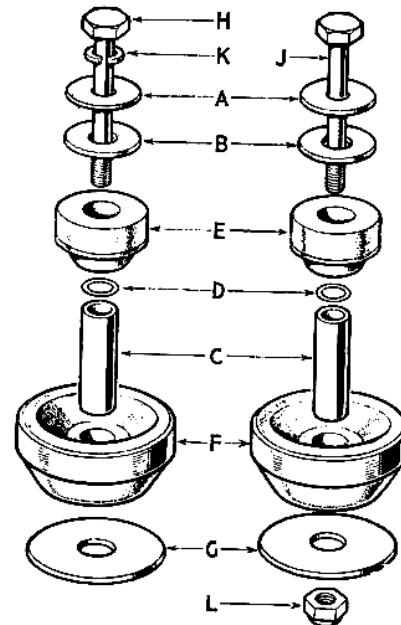


Fig. C-8—Gearbox unit mounting bolts and pads.

- |                        |                        |
|------------------------|------------------------|
| A—Plain washer (upper) | G—Plain washer (lower) |
| B—Rubber washer        | H—Front bolt           |
| C—Distance tube        | J—Rear bolt            |
| D—Shim                 | K—Spring washer        |
| E—Top rubber           | L—Self-locking nut     |
| F—Bottom rubber        |                        |

## All models

## Main gearbox

To remove **Operation C/26**

1. For removal procedure, see Operations C/16 and C/22.

To strip **Operation C/28**

1. Mount the gearbox on a suitable stand.
2. Drain off the gearbox and transfer box oil.
3. Remove the main gear change lever assembly, then the reverse stop hinge. Operation C/50.
4. Remove the transfer box and front output shaft housing complete. Operation C/34.

## Dismantle the main gearbox as follows:

5. Disconnect the connecting tube from the clutch cross-shaft.
6. Remove the dust-proofing grommets from the bell housing apertures.
7. Remove and strip the clutch withdrawal unit from the bell housing, Section B.
8. Remove the oil filler cap and joint washer from the gearbox top cover.
9. Remove the filler cap retaining clip.
10. Remove the plug retaining the 1st/2nd speed selector spring in the top cover and withdraw spring.
 

*Note:* To prevent the selector ball falling into the gearbox, with the top cover removed, pack the hole with grease.
11. Remove the retaining plates for the side selector springs, the rubber grommets and the 3rd/4th and reverse selector springs.
12. Remove the selector cover plate from the gearbox top cover.
13. Remove the selector shaft end cover securing set bolts.
14. Remove the gearbox top cover, together with the upper selector end cover. Remove the two selector balls and locking plunger from the gearbox and the 1st/2nd speed selector ball from the top cover. Remove the 2nd gear stop from the top cover.
15. Select 1st gear (centre selector to rear); remove the reverse gear selector by lifting and turning the selector shaft one quarter of a turn to the left. Move the 1st/2nd speed selector to the neutral position and remove it; remove the 3rd/4th selector. Remove the lower selector end cover.
16. Withdraw the reverse selector fork and the sealing ring from the shaft.
17. Remove the 2nd speed stop from the end of the 1st/2nd selector shaft. Withdraw the selector fork and the sealing ring from the shaft.
18. Withdraw the 3rd/4th selector fork and the rubber sealing ring from the shaft.
19. Remove the castle nut from the front of the layshaft. (To lock the shaft for nut removal, select top and 2nd speeds simultaneously.)

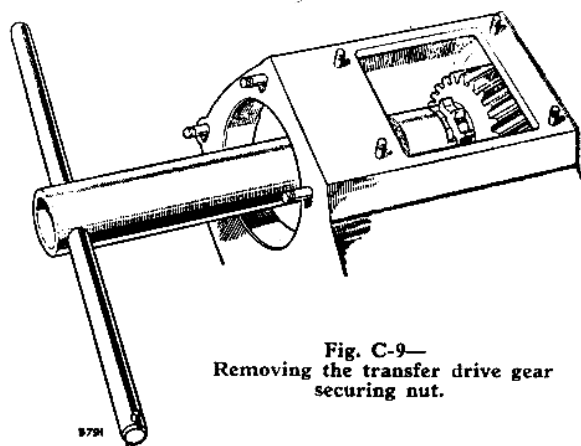


Fig. C-9—  
Removing the transfer drive gear  
securing nut.

20. Remove the nut at the rear of the mainshaft retaining the transfer drive gear. Withdraw the gear and distance piece and oil flinger from the mainshaft.
21. Remove the bell housing complete with joint washer, tapping the layshaft out of the front bearing, so that it remains in the gearbox. Remove the needle roller bearing from the front end of the mainshaft. Remove the constant gear and conical distance piece from the bell housing.
22. Remove the layshaft front bearing retaining plate.
23. Remove the layshaft bearing plate; press out the layshaft front bearing, remove the pinion bearing retaining plate. Press out the primary pinion and bearing from the bell housing. Remove the nut securing the primary pinion bearing; press the bearing and shield off the pinion shaft. (The nut has a left-hand thread.)
24. Remove the synchronising clutch unit from the mainshaft and then withdraw the layshaft complete from the gearbox and strip it as follows:
25. Remove the distance sleeve. Remove the 3rd and 2nd speed gears. Remove the split ring retaining the 2nd speed gear. Press off the rear bearing and 1st speed gear.
26. Drive out the mainshaft complete from the rear and strip it as follows:
27. Remove the 1st speed gear. Prise out the spring ring inside the 3rd speed gear cone and discard it; remove the 3rd speed gear thrust washer and gear. Remove the distance sleeve and 2nd speed gear. Remove the peg locating the distance sleeve and withdraw the located 2nd speed gear thrust washer.
28. Remove the circlip retaining the mainshaft rear bearing housing to the rear face of the gearbox casing. Tap out the peg-located bearing housing complete from the rear. Remove the oil seal from the housing. Remove the circlip retaining the bearing in the housing and press out the bearing.
29. Drive out the reverse gear shaft from inside the gearbox; the gearbox casing must be warmed to facilitate this operation. Remove the reverse

gear and, if necessary, press out the bush from the gear.

30. To remove the outer race of the layshaft rear bearing from the gearbox casing, proceed as follows:

Make a plunger (preferably from hardwood) about 12 in. (300 mm) long and approximately  $1\frac{1}{8}$  in. (43,50 mm) in diameter, i.e. to just fit into the outer race. Stand the gearbox casing on end and fill the race housing with thick oil, insert the plunger and tap it down sharply. In most cases the oil will force the outer ring upwards out of the casing; if necessary, the gearbox casing may be warmed to facilitate removal of the race.

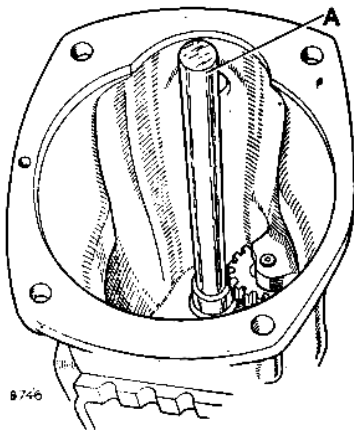


Fig. C-10—  
Removing lay-  
shaft rear bearing  
outer race.  
A—Plunger.

#### To assemble

#### Operation C/30

1. Wash all the component parts thoroughly and lay them out for inspection. Renew all lock-washers, split pins, spring rings and joint washers.
2. Check all the bearings for wear and damage, and renew them as necessary.
3. Check all the gears for damage marks and rectify or renew them as necessary. The constant, 2nd and 3rd speed gears are only supplied in mated pairs; all other gears may be replaced singly.
4. Examine the casing for signs of damage or cracks and renew it as necessary. A casing may also be scrap as a result of excessive wear in a bearing bore; such wear will be obvious during the course of assembly.
5. Press the layshaft rear bearing outer race into the gearbox casing with the lipped edge to the rear. It must be a *drive fit*. It may be necessary to warm the casing to assist in this operation.

#### 1948-53 models

Press the layshaft rear bearing outer race into the gearbox casing with the lipped edge to the rear. It must be a *drive fit*. It may be necessary to warm the casing to assist in this operation.

6. If necessary, renew the reverse gear bush, bell out its extremities and ream it in position to .812 in. (20 mm). The bush should be a

*press fit* in the gear. Place the reverse gear (with the smaller wheel to the rear) in position in the gearbox and drive the shaft through the gearbox casing and the gear. It will be necessary to warm the casing to assist in this operation. The shaft must be a *drive fit* in the casing.

#### 1948-53 models

If necessary, renew the reverse gear bush and ream it in position to .812 in. (20,63 mm). Place the reverse gear (with the smaller wheel to the rear) on its shaft and drive the shaft into the gearbox casing. It may be necessary to warm the casing to assist in this operation. The shaft must be a *drive fit* in the casing.

7. Press the mainshaft rear bearing into the bearing housing until it abuts the flange in the housing bore; the bearing must be a *press fit* in the housing. Secure the bearing with a circlip.
8. Smear the outer diameter of the oil seal with jointing compound and press it into the other end of the housing, with the knife edge inwards.
9. Fit the location peg in the bearing housing and push the complete housing into the gearbox casing from the inside, until the housing flange abuts the casing. The housing must be a *push fit* in the casing; secure the housing with a circlip.

#### 1948-53 models

Fit the location peg in the bearing housing and push the complete housing into the gearbox casing from the inside, until the housing flange abuts the casing. The housing must be a *push fit* in the casing. Secure the housing with a circlip at the rear face of the casing.

#### Mainshaft

10. If removed, replace the rear thrust washer. Do not fit the large bush locating peg at this stage.
11. Slide on the mainshaft bush with the large locating slot to the rear, together with the second speed gear, synchromesh cone to the rear.
12. Place the third speed gear on the bush with the gear wheel against the shoulder, and secure with the second thrust washer and the old spring ring.
13. While pressing the third speed gear hard against the bush shoulder, the end-float of the second speed gear, measured between the gear and the bush shoulder, should be .004 to .007 in. (0,10-0,17 mm).

The third speed gear end-float should be the same, measured with the second speed gear pressed hard against the bush shoulder.

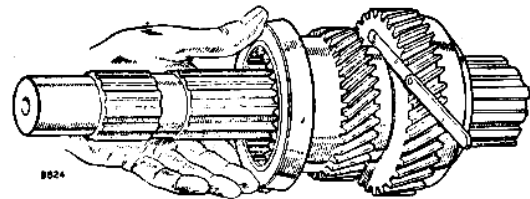


Fig. C-11—Measuring mainshaft gear end-float.



# Section D – PROPELLER SHAFTS – ALL MODELS

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### Propeller shaft (front and rear axle drives)

Wear on the thrust faces of the bearings can be located by testing the lift in the joint, either by hand or with the aid of a length of wood suitably pivoted.

Any circumferential movement of the shaft relative to the flange yokes indicates wear in the roller bearings or the splined joint.

Lubricant may seep from the bearings after a lengthy period of service, owing to failure of the bearing seals.

If an oil leak is severe, or is neglected, failure of the needle roller bearings may result.

If any of these defects are apparent, the complete shaft should be removed from the vehicle and rectified as described.

### To remove Operation D/2

1. Disconnect the propeller shaft from the differential input flange.
2. Disconnect the propeller shaft from the transfer box output flange.

3. Withdraw the propeller shaft complete.

### Propeller shaft (rear power take-off drive)

#### To remove Operation D/4

See Section T.

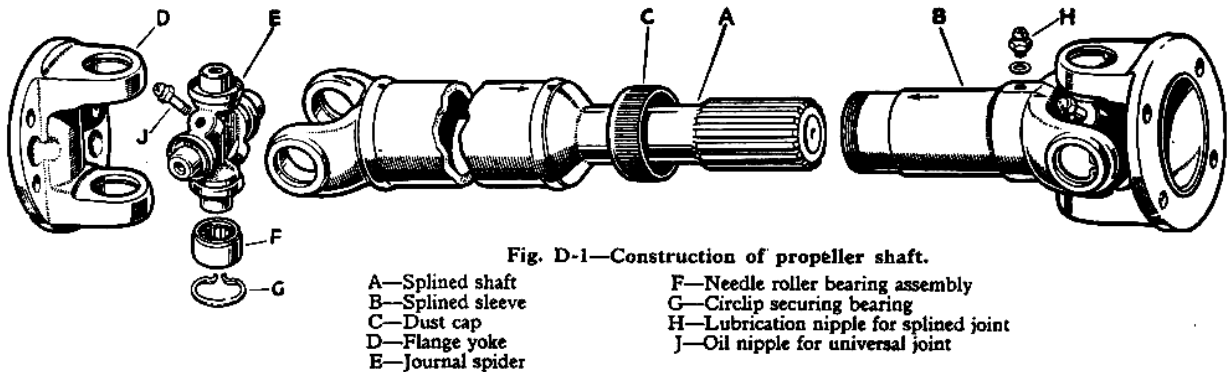
#### To strip Operation D/6

1. Unscrew the dust cap and withdraw the sliding joint from the splined shaft.

Dismantle each universal joint as follows:

2. Clean the enamel and dirt from the four circlips and the tops of the bearing races.
3. Remove the circlips.
4. Hold the joint in the left hand with one of the splined sleeve (or shaft) yoke lugs uppermost and tap the radius of the yoke lightly with a soft-nosed hammer.

The top bearing should then begin to emerge from the yoke. (Fig. D-2.)



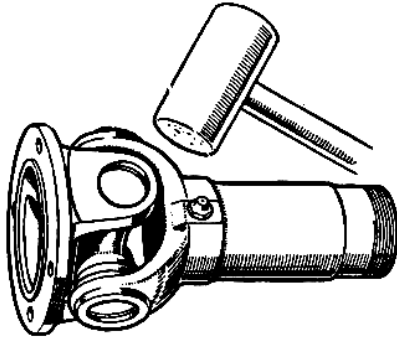


Fig. D-2—Removing a yoke bearing. Stage 1.

5. Turn the joint over and withdraw the bearing. (Fig. D-3.)

Always remove a bearing downwards, to avoid dropping the needle rollers. It may be necessary to tap the bearing race from the inside with a small drift; in such cases, care should be taken to prevent damage to the bearing race.

6. Repeat these operations for the opposite bearing.

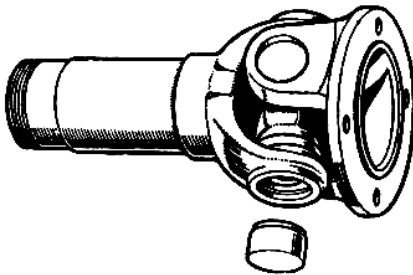


Fig. D-3—Removing a yoke bearing. Stage 2.

7. The splined sleeve (or shaft) yoke can now be removed (Fig. D-4).
8. Rest the flange yoke on a short piece of tubing of suitable diameter (slightly larger than the bearing race) and drive out the two remaining bearings, using a brass drift Fig. D-5).
9. Wash all the parts and lay them out for inspection.

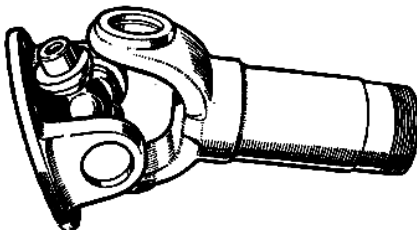


Fig. D-4—Removing the splined sleeve or shaft.

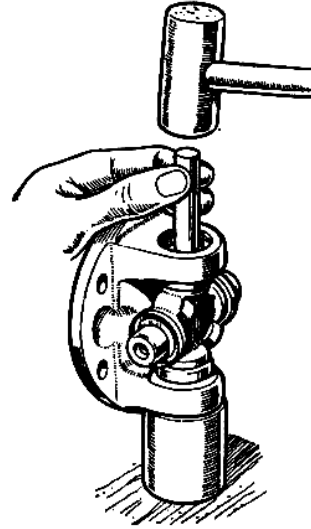


Fig. D-5—  
Removing the  
flange yoke.

#### To assemble

#### Operation D/8

The parts most likely to show signs of wear after long usage are the bearing races and the spider journals. Should looseness in the fit of these parts, load markings or distortion be observed, they must be renewed complete, as oversize journals or bearing races are not supplied. Replacement journal assemblies comprise a spider complete with cork oil seals and four bearings.

The other parts likely to show signs of wear are the splined sleeve yoke and splined shaft. A total of .004 in. (0,1 mm.) circumferential movement, measured on the outside diameter of the splines, should not be exceeded. If wear beyond this limit has taken place, a new propeller shaft complete must be fitted.

1. Assemble the needle rollers in the bearing races, if necessary using a smear of vaseline to retain them in place. About half fill the races with oil (S.A.E. 140).
2. Insert the journal in the flange yoke holes and, using a brass drift slightly smaller in diameter than the hole in the yoke, lightly tap the first bearing into position.

It is essential that the bearing races be a *light drive fit* in the yoke trunnions. In the event of wear taking place in any of the eight yoke cross holes, rendering them oval, a new propeller shaft complete must be fitted.

3. Repeat the operation for the other three bearings comprising the universal joint, and assemble the other joint similarly.
4. Replace the circlips and ensure that they are firmly located in their grooves. If the joint appears to bind, tap the ears slightly with a soft-nosed hammer.

5. Liberally smear the splines of the sliding joint and splined shaft with oil and replace the joint on the shaft, making sure that the arrows marked on the splined sleeve yoke and shaft are in line (Fig. D-1).
6. Screw up the dust cap as far as possible by hand.

3. The centre ball bearing must be a *light drive fit* on the shaft; if a new bearing is loose on the shaft, the complete shaft must be renewed.
4. The centre ball bearing must be a *press fit* in the housing; if a new bearing is loose in the housing, the complete housing must be renewed.

**Centre bearing assembly (rear power take-off drive—109 only)**

**To strip Operation D/10**

1. Remove the rear driving flange from the front shaft.
2. Drift off the flange from the splined shaft.
3. Hold the centre bearing housing firmly in a vice and drift the shaft, complete with the bearing and dust plate, from the housing. Remove the two Woodruff keys from the shaft.
4. Press the centre ball bearing and dust plate off the shaft.
5. Wash all the parts and lay them out for inspection.

**To assemble Operation D/12**

1. Reverse the stripping procedure.
2. Insert the bolts securing the front and rear propeller shafts together, in the rear flange, before fitting the flange on the splined shaft.

**Propeller shaft (front and rear axle drives)**

**To refit Operation D/14**

1. Wipe the faces of the transfer box and differential flanges clean.
2. Replace the propeller shaft and ensure that the register engages and that the joint faces bed down correctly all round.
3. Secure the propeller shaft, sleeve end, to the transfer box output flange. Tighten the nuts evenly.
4. Secure the propeller shaft to the differential input flange (with the nuts behind the input flange). Tighten the nuts evenly.

**Propeller shaft (rear power take-off drive)**

**To refit Operation D/16**

1. See Section T.

**DEFECT LOCATION**

**Symptom, Cause and Remedy**

**A—VIBRATING PROPELLER SHAFT**

1. Balance marks out of alignment—*Check alignment of balance marks on the splined sleeve yoke and shaft.*
2. Worn splines—*Renew.*
3. Shaft out of balance—*Tighten the securing nuts; renew the shaft if still out of balance.*

**B—UNIVERSAL JOINTS NOISY**

1. Lack of lubrication—*Lubricate or renew bearings.*
2. Securing nuts loose—*Tighten.*
3. Worn bearings or worn spline—*Renew.*

**GENERAL DATA**

<b>86 and 88 in.</b>	
Type:	Hardy Spicer needle bearing
Tubular shaft—	
diameter	.... 2 in. (50,8 mm.)
wall thickness	.... $\frac{3}{8}$ in. (2,4 mm.)
Overall length (face to face in neutral position)—	
Front axle drive	.... 23.812 in. (654 mm.)
Rear axle drive	.... 21.812 in. (554 mm.)

<b>107 and 109 in.</b>	
Type:	Hardy Spicer needle bearing
Tubular shaft—	
diameter	.... 2 in. (50,8 mm.)
wall thickness	.... $\frac{3}{8}$ in. (2,4 mm.)
Overall length (face to face in neutral position)—	
Front axle drive	.... 23.812 in. (654 mm.)
Rear axle drive	.... 42.812 in. (1,087 m.)



# Section E—REAR AXLE—ALL MODELS

## INDEX

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Data, detail	E-7		

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E-3	Layout of rear axle, fully floating shafts	E-3			

Data, details and illustrations concerning the differential assembly will be found in Section F

### Axle shaft assembly

#### Semi-floating type

##### To remove Operation E/2

1. Jack up the rear of the vehicle under the chassis frame.
2. Drain off the rear axle oil.
3. Remove the road wheel and the brake drum.
4. Depress the brake pedal and wedge it in that position; detach the brake pipe at the wheel brake unit.
5. Remove the brake components. Section H.
6. Withdraw the shaft assembly complete with anchor plate.

##### To strip Operation E/4

1. Stand the axle shaft on its splined end and press down squarely on the brake anchor plate and bearing housing flange, using the special annular press block, Part No. 242415 (Fig. E-1). A pressure of up to 20 tons will be required, and it may be necessary to assist the operation with sharp blows on the bearing housing, using a brass drift. Remove the collar.
2. Remove the oil seal and sleeve, the bearing and housing, the brake anchor plate and the distance washer, and oil retaining ring (if necessary).

3. Remove the ball bearing from the housing and the oil seal from the sleeve.
4. The road wheel studs are peened over in the axle shaft flange and the peening should be filed before withdrawing a faulty stud.

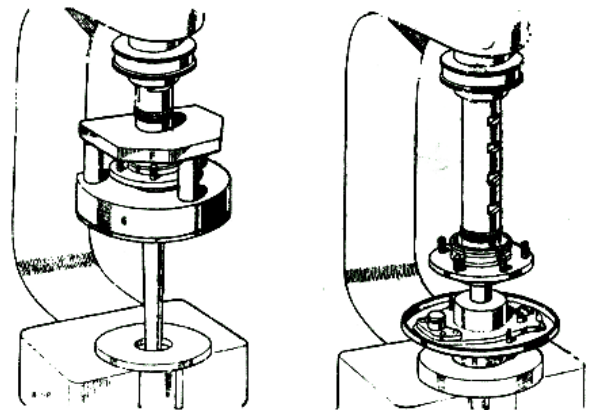


Fig. E-1—Stripping and assembling half-shaft.

##### To assemble Operation E/6

1. Renew the road wheel studs as necessary.
2. Replace the distance washer, chamfer side down.
3. Examine the bearing for excessive side play or roughness. The bearing should be a *light press fit* in the bore of the hub and on the axle shaft.

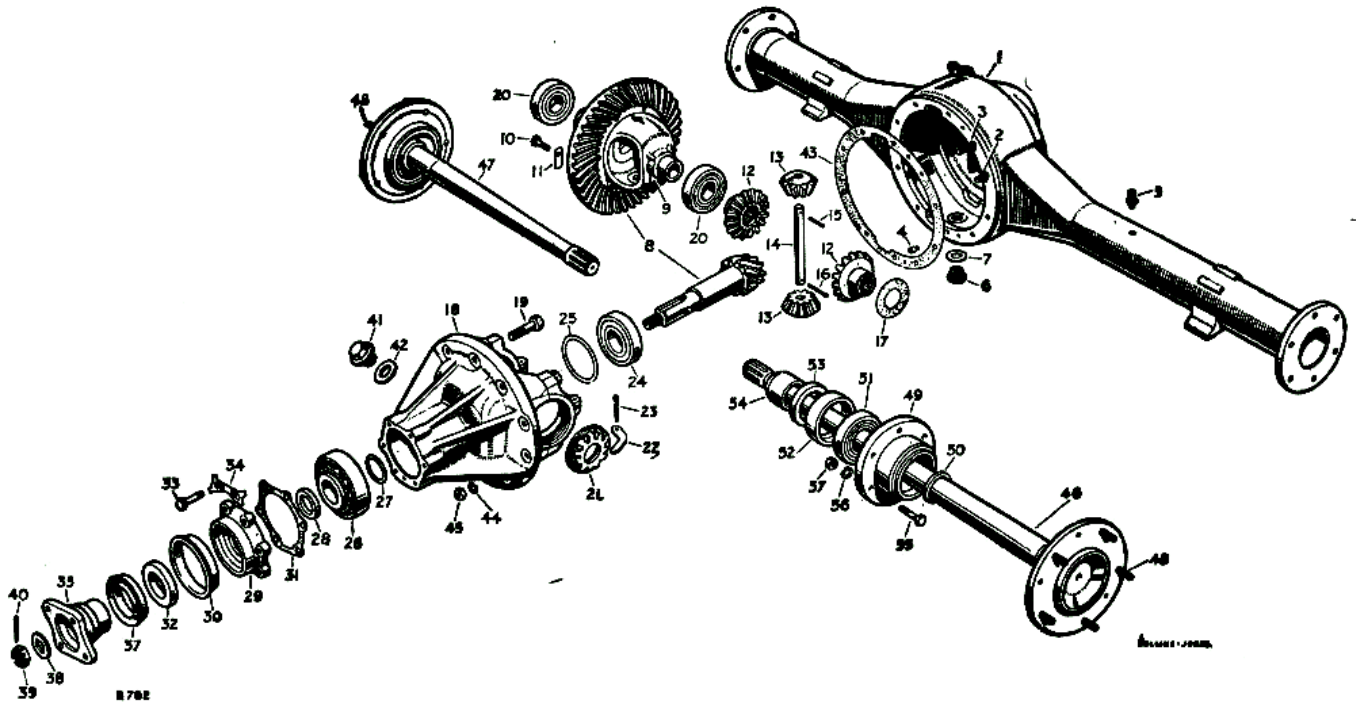


Fig. E-2—Layout of rear axle, semi-floating shafts.

- |       |  |       |                                |
|-------|--|-------|--------------------------------|
| 1     | Rear axle casing                         | 28    | Washer for bearing             |
| 2-3   | Bolts fixing differential                | 29    | Retainer for oil seal          |
| 4     | Dowel locating differential              | 30    | Mudshield for retainer         |
| 5     | Breather                                 | 31    | Joint washer for retainer      |
| 6-7   | Oil drain plug                           | 32    | Oil seal for pinion            |
| 8     | Crownwheel and bevel pinion              | 33-34 | Fixings for retainer           |
| 9     | Differential casing                      | 35    | Driving flange                 |
| 10-11 | Fixings for crownwheel                   | 37    | Dust shield for driving flange |
| 12    | Differential wheel                       | 38-40 | Fixings for driving flange     |
| 13    | Differential pinion                      | 41-42 | Oil filler plug and washer     |
| 14    | Spindle for pinions                      | 43    | Joint washer for differential  |
| 15-16 | Fixings for spindle                      | 44-45 | Fixings for differential       |
| 17    | Thrust washer for differential           | 46    | Axle shaft, L.H.               |
| 18    | Bevel pinion housing                     | 47    | Axle shaft, R.H.               |
| 19    | Bolt fixing bearing cap                  | 48    | Stud for road wheel            |
| 20    | Roller bearings for differential         | 49    | Housing for hub bearing        |
| 21    | Serrated nut                             | 50    | Distance washer                |
| 22    | Lock tab                                 | 51    | Bearing for hub                |
| 23    | Split pin                                | 52    | Sleeve for oil seal            |
| 24    | Bearing for bevel pinion, pinion end     | 53    | Oil seal for hub               |
| 25    | Shims for bearing adjustment, pinion end | 54    | Retaining collar               |
| 26    | Bearing for bevel pinion, flange end     | 55-57 | Fixings for bearing housing    |
| 27    | Shims for bearing adjustment, flange end |       |                                |

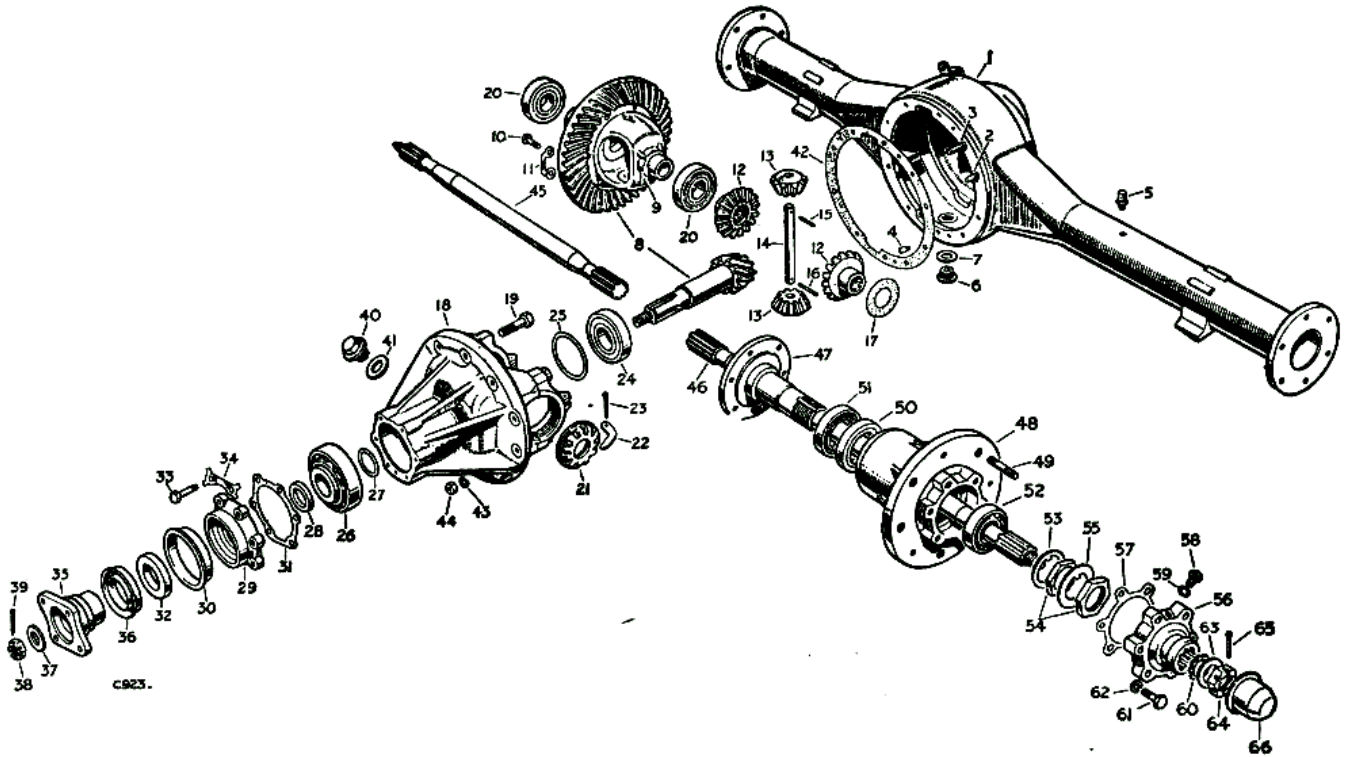


Fig. E-3—Layout of rear axle, fully floating shafts.

- |       |  |       |                                      |
|-------|--|-------|--------------------------------------|
| 1     | Rear axle casing                         | 31    | Joint washer for retainer            |
| 2-3   | Bolts fixing differential                | 32    | Oil seal for pinion                  |
| 4     | Dowel locating differential              | 33-34 | Fixings for retainer                 |
| 5     | Breather                                 | 35    | Driving flange                       |
| 6-7   | Oil drain plug                           | 36    | Dust shield for driving flange       |
| 8     | Crownwheel and bevel pinion              | 37-39 | Fixings for driving flange           |
| 9     | Differential casing                      | 40-41 | Oil filler plug and washer           |
| 10-11 | Fixings for crownwheel                   | 42    | Joint washer for differential        |
| 12    | Differential wheel                       | 43-44 | Fixings for differential             |
| 13    | Differential pinion                      | 45    | Axle shaft, R.H.                     |
| 14    | Spindle for pinions                      | 46    | Axle shaft, L.H.                     |
| 15-16 | Fixings for spindle                      | 47    | Rear hub bearing sleeve              |
| 17    | Thrust washer for differential           | 48    | Rear hub assembly                    |
| 18    | Bevel pinion housing                     | 49    | Stud for road wheel                  |
| 19    | Bolt fixing bearing cap                  | 50    | Hub bearing, inner                   |
| 20    | Roller bearings for differential         | 51    | Oil seal for inner bearing           |
| 21    | Serrated nut                             | 52    | Hub bearing, outer                   |
| 22    | Lock tab                                 | 53-55 | Fixings—for hub bearing              |
| 23    | Split pin                                | 56    | Driving member for rear hub          |
| 24    | Bearing for bevel pinion, pinion end     | 57    | Joint washer for driving member      |
| 25    | Shims for bearing adjustment, pinion end | 58    | Filler plug for hub driving member   |
| 26    | Bearing for bevel pinion, flange end     | 59    | Joint washer for filler plug         |
| 27    | Shims for bearing adjustment, flange end | 60    | Oil seal for rear axle shaft         |
| 28    | Washer for bearing                       | 61-62 | Fixings—driving member to rear hub   |
| 29    | Retainer for oil seal                    | 63-65 | Fixings—axle shaft to driving member |
| 30    | Mudshield for retainer                   | 66    | Hub cap, rear                        |

5. Renew the bearing or bearing housing as necessary, and fit the bearing in the housing; replace the assembly and brake anchor plate on the axle shaft.
6. Place the securing collar over the axle shaft with the chamfer towards the splined end and press it on until it abuts the bearing. A pressure of at least 2½ tons will be required for this operation, as a suitable collar, with an interference fit of .0028 in. (0,07 mm) on the shaft, must be chosen by selective assembly. A suitable press block (Part No. 262757) is illustrated at Fig. E-1.
7. Renew the oil seal as necessary and fit it in the sleeve with the lip away from the axle shaft flange.
8. Press the oil seal and sleeve over the securing collar into the bearing housing.

**To refit****Operation E/8**

1. Replace the axle shaft in the axle casing, entering the splined end into the differential.
2. Replace the brake components. Section H.
3. Connect the brake pipe to the wheel cylinder.
4. Refit the brake drum and road wheel.
5. Bleed the brake system. Section H.
6. Lower the vehicle off the jack and refill the differential with oil.

**Rear hub assembly, fully-floating axle****To adjust****Operation E/10**

1. Adjust the end-float of the hub bearing by adjusting the hub inner nut, tightening the locknut and checking the end-float by means of a dial test indicator mounted on to one of the wheel studs (see Fig. E-4). Take the reading by pushing the hub as far as possible towards the axle centre, note the indicator reading, pull the hub outwards and again take the indicator reading, the total hub movement so measured should be .004 in. to .006 in. (0,10 mm to 0,15 mm). When the correct end-float has been obtained, bend over two tabs of the locking washer. As a safeguard, the end-float should be checked once more after locking the nuts.

**To remove****Operation E/12**

1. Jack up the rear of the vehicle under the chassis frame.
2. Drain off the rear axle oil.
3. Remove the road wheel and brake drum.

4. Depress the brake pedal fully, and wedge it in that position, detach the brake pipes at the wheel brake unit.
5. Remove the brake components. (Section H.)
6. Withdraw the shaft and hub assembly, complete with anchor plate, from the flange, by removing the six securing bolts, spring washers and nuts.

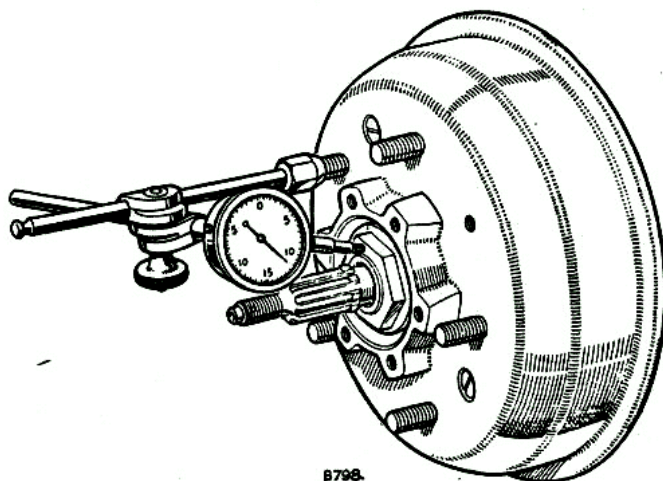


Fig. E-4—Checking hub end-float, fully floating shafts.

**To strip****Operation E/14**

1. Remove the hub cap (*press fit*) on the driving member.
2. Remove the driving member and joint washer from the axle shaft and the hub. Remove oil seal.
3. Prise up the locking tabs and remove the locknut, lock washer and adjusting nut from the rear bearing sleeve.
4. Remove the thrust washer and hub complete with the outer roller bearing. Remove brake anchor plate. Withdraw the oil seal and bearings from the hub if necessary.

**To assemble hub****Operation E/16**

1. Before assembling the hub, examine the outside diameter of the inner bearing distance piece, on which the oil seal runs, for signs of damage or roughness. Renew as necessary. The distance piece should be a *press fit* on the rear hub bearing sleeve. Any clearance between these two parts will allow oil to leak past on to the brake linings.
2. Examine the two hub bearings and renew them as necessary. Both bearings should be an *easy fit* on the rear hub bearing sleeve and a *press fit* in the hub. If new bearings are slack in the hub, the hub itself should be renewed.
3. Pack the bearings with grease, using a wheel-bearing lubricator, before pressing them into the hub.
4. Examine the oil seal and renew as necessary; press the seal into the hub with the knife edge towards the inner bearing until the oil seal face



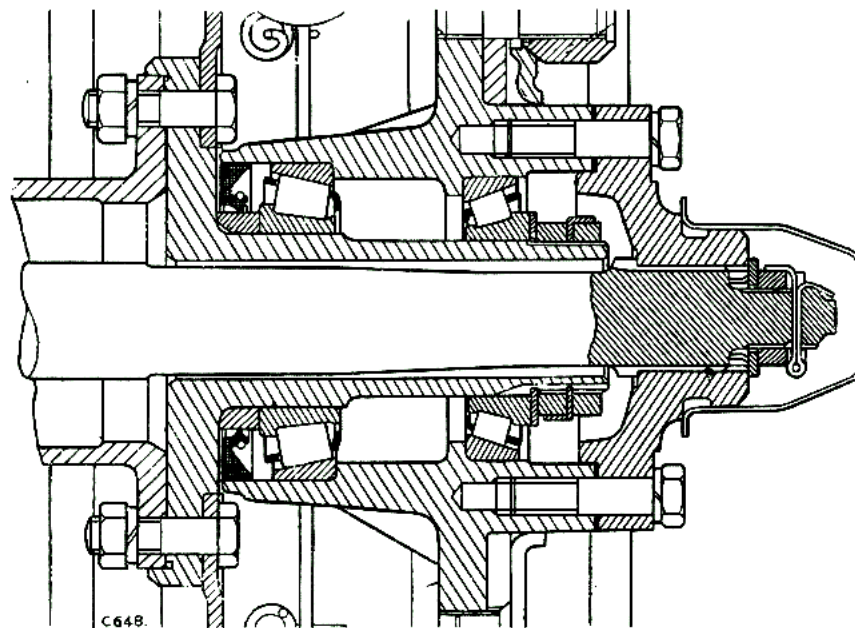


Fig. E-5—Cross-section of fully floating rear hub.

is flush with the rear face of the hub. If the seal is pressed too far in, the element will fail to register on the rear hub bearing sleeve distance piece, so allowing oil to leak past and on to the brake linings.

**To assemble complete unit. Operation E/18**

1. Bolt the rear hub bearing sleeve and brake anchor plate into position and then slide the complete hub on to the rear hub bearing sleeve.
2. Fit the keyed thrust washer, adjusting nut, lock washer and locknut. Adjust the hub end-float, Operation E/10.
3. Slide the axle shaft through the rear hub bearing sleeve until it locates in the splines of the differential unit. Place a joint washer on to the driving member, then slide the member on to the spline at the end of the axle shaft, securing it to the hub with the six set bolts and washers.
4. Replace oil seal and secure the axle shaft to the driving member by using the slotted nut, plain washer and split pin. Take care not to over-tighten. Tap the hub cap into place.
5. Fill the hub with one-third of a pint (0,190 litres) of oil, through the oil filler plug in the driving member. Replace the filler plug and joint washer.
6. Refill the rear axle with 3 pints (1,75 litres) of oil.

7. Replace brake components and reconnect the brake pipes, bleed and adjust the brakes (Section H).

**Differential pinion oil seal**

**To renew** **Operation E/20**

Proceed as detailed under Section F, Operation F/2.

**Differential assembly  
Semi-floating type axle**

**To remove** **Operation E/22**

1. Jack up the rear of the vehicle.
2. Drain off the axle oil.
3. Remove the road wheels and brake drums.
4. Depress the brake pedal and wedge it in that position; detach the brake pipes at the wheel brake units.
5. Remove the wheel brake components. Section H.
6. Withdraw the shafts complete with driving member about 6 in. (150 mm) from the axle casing.
7. Disconnect the propeller shaft at the differential input flange.

8. Remove the differential assembly from the axle casing.

#### Fully-floating type axle

To remove the differential on the fully-floating type axle, it is only necessary to remove the hub caps and six bolts securing the driving member. The axle shafts can then be removed.

*Note:* If any difficulty is anticipated when adjusting the differential, it is recommended that the unit be replaced by a new assembly (obtainable from our Spares Department) and the old one returned for reconditioning.

#### To strip, examine and assemble

##### Operation E/24

Proceed as detailed under Section F, Operations F/6, F/8 and F/10. For data see Section F.

#### To refit

##### Operation E/26

1. Fit the differential assembly in the axle casing.
2. Connect the propeller shaft to the input flange.
3. Push the axle shafts into the splines of the differential, and secure in position.
4. Replace the wheel brake components. Section H.
5. Replace the brake drums and road wheels.
6. Connect the brake pipes to the wheel brake units and bleed the brake system. Section H.
7. Lower the vehicle to the ground.
8. Refill the axle with oil, 3 pints (1,75 litres).

#### Axle complete

#### To remove, Method I

##### Operation E/28

1. Jack up the rear of the vehicle.
2. Remove both road wheels.
3. Depress the brake pedal and wedge it in that position. Disconnect the flexible brake pipe at the Tee-piece on the differential casing.
4. Disconnect the propeller shaft at the differential input flange. Disconnect one extremity of each check strap.
5. Disconnect one end of each shock absorber.
6. Lower the vehicle on to suitable stands placed under the chassis.

7. Jack up each of the road springs under the shock absorber plate and remove the U-bolt nuts.

8. Lower the springs so that they are relaxed but still on the jacks.

9. Remove the self-locking nuts and shackle bolts from the rear end of the springs, lower the jacks, springs, and axle to the ground, and remove the axle.

#### To remove, Method II

##### Operation E/30

An alternative method for removal eliminates removal of the shackle pins; proceed as follows:—

1. Jack up the rear of the vehicle.
2. Drain off the axle oil.
3. Remove the road wheels and brake drums.
4. Depress the brake pedal and wedge it in that position; detach the brake pipes at the wheel brake units.
5. Remove the wheel brake components. Section H.
6. Withdraw the shaft and hub assemblies complete from the axle casing.
7. Disconnect the flexible brake pipe at the Tee-piece on the differential casing.
8. Disconnect the propeller shaft at the differential input flange.
9. Remove the differential assembly from the axle casing.
10. Lower the vehicle on to suitable stands placed under the chassis.
11. Jack up each of the road springs under the shock absorber plate and remove the U-bolt nuts.
12. Lower the springs so that they are relaxed but still on the jacks.
13. Remove the axle casing by manoeuvring it past the road springs and check straps.

#### To refit

##### Operation E/32

1. Replace the axle assembly by reversing the removal procedure (Method I or II).
2. Bleed the brake system. Section H.
3. Refill the differential with oil, 3 pints (1,75 litres) and lower the vehicle off the jacking stands.

**GENERAL DATA: Semi-floating type**

Fitted to all 80, 86, 88 and 107 basic models. 109 models up to 121704761 and 107 Station Wagon up to 131701305.

*Note:* Fully floating axle shafts are fitted to 109 models from 121704770, 107 Station Wagon from 131701306; they are also available as an optional extra on the 88 models.

Oil capacity .... 3 pints (1,75 litres)  
 Hub bearing lubrication Pre-packed with grease  
 Final drive .... Spiral bevel  
 Ratio, axles numbered  
 860001 to 861319 .... 4.88 to 1  
 Ratio, axles numbered  
 861320 onwards .... 4.7 to 1

**GENERAL DATA: Fully floating type**

Oil capacity .... 3 pints (1,75 litres)  
 Hub bearing lubrication 1/3rd pint (0,190 litres)  
 Initial assembly only  
 Final drive .... Spiral bevel  
 Ratio .... 4.7 to 1

**DETAIL DATA: Semi-floating type**

Fit of retaining collar on shaft .... .0028 in. (0,07 mm) interference (selective assembly)

**DETAIL DATA: Fully floating type**

Rear hub assembly:  
 Rear hub end-float .... 0.04 to .006 in. (0,010 to 0,16 mm)  
 Clearance of hub bearing in rear hub bearing sleeve .... .0002 to .0013 in. (0,005 to 0,033 mm)  
 Fit of hub bearing in hub .... .001 to .003 in. (0,025 to 0,075 mm) interference



# Section G

## STEERING UNIT AND LINKAGE – ALL MODELS

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Longitudinal steering arm	G-8	Track rod	G-11
		Wheel alignment	G-11

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### WORM AND NUT TYPE STEERING UNIT

#### Steering control tube

#### To remove Operation G/2

1. Disconnect the steering column wiring from the junction box on the dash panel.
2. Release the clip securing the wiring to the steering box and slide the rubber grommet (against the bottom of the steering box) off the wiring.
3. Remove the control tube clamp and joint washer from the control tube; pull the conical rubber washer in the cover plate off the wiring.
4. Pull the control tube and wiring up through the steering column and remove.
5. Remove the horn button and dipper switch unit from the control tube and disconnect the wiring from the unit as necessary. Section P.

#### To refit Operation G/4

1. Renew the wiring, horn button and dipper switch unit and control tube bushes as found necessary.
2. Position the felt bush at the top of the tube and the two rubber bushes at equal intervals down the tube.

3. Insert the complete assembly into the steering column and pull the wiring clear at the bottom.

4. Slide the rubber washer over the bottom of the control tube; fit the clamp and joint washer on the bottom cover plate.

5. Position the control unit with the dipper switch at the bottom and secure the tube in the clamp.

6. Slide the rubber grommet over the wiring up to the clamp.

7. Reconnect the steering column wiring to the junction box on the dash panel, Section P, and secure the wiring to the steering box with a clip.

#### Steering wheel

#### To remove Operation G/6

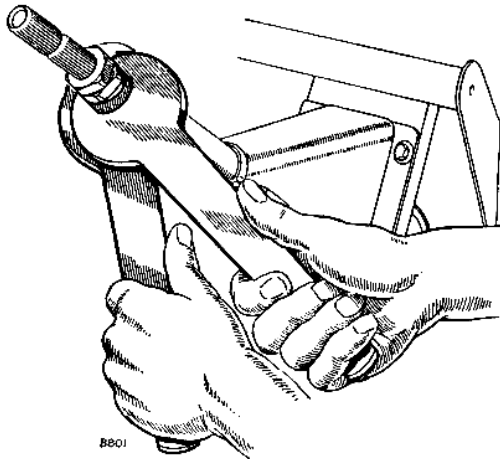
1. Remove the steering control tube. Operation G/2.
2. Remove the steering wheel from the steering inner column.

#### To replace Operation G/8

Reverse the removal procedure.

**Steering column thrust bearing****To adjust** **Operation G/10**

1. Remove the steering wheel. Operation G/6. The control tube and steering wheel need only be withdrawn as far as necessary for the adjustment to be made.
2. Pull the spring and dust cover clear of the thrust adjustment.

**Fig. G-1—Adjusting steering column thrust bearing.**

3. To remove any end-float in the inner column, unscrew the locking (upper) nut and screw down the adjusting (lower) nut until there is 7 to 9 lb./in. (0,08 to 0,10 mKg) pre-load on the thrust ball race; in practice this means that the end-float just disappears. Tighten the locking nut, using the special spanners, Part No. 263099.
4. Replace the steering wheel and control tube. Operation G/8.

**Drop arm****To renew** **Operation G/12**

1. Remove the longitudinal steering rod ball joint from the drop arm.

*Note:* If the ball joint pin is tight in the drop arm, the longitudinal steering tube and drop arm should be removed together. Operation G/22.

2. Withdraw the drop arm. Renew the drop arm if necessary.
3. Set the road wheels straight ahead and the steering unit in the midway position between full lock in each direction.
4. Fit the drop arm on the rocker shaft, selecting a suitable position on the splines, so that it lines up with the ball-joint pin.

*Note:* A suitable wedge-shaped tool must be used to open the slot in the drop arm when removing and replacing it on the splined end of the rocker shaft. This avoids damage to the splines and the side cover plate.

5. Reconnect the ball joint to the drop arm.
6. Fill the steering box with clean oil.

**Steering unit****To remove** **Operation G/14**

1. Disconnect the battery. Section P.
2. Remove the air cleaner. Section M.
3. Remove the steering control tube. Operation G/10.
4. Remove the steering wheel, dust cover and spring. Operation G/6.
5. Remove the steering column clip and rubber strip from the support bracket on the dash.
6. Remove the steering column support bracket.
7. Remove the steering column rubber grommet.
8. Withdraw the drop arm from the rocker shaft.
9. Remove the steering box from its support plate.
10. Withdraw the steering unit from under the front wing.

**To strip** **Operation G/16**

1. Remove the bottom cover plate complete with joint washer.
2. Remove the side cover plate complete with joint washer.
3. Withdraw the rocker shaft, taking care not to damage either of its bushes.
4. Rotate the inner column to unscrew the main nut and withdraw the nut.
5. Remove the locking nut and adjusting nut from the top of the inner column, using the special spanner, Part No. 263099 (Fig. G-1); remove the eighteen 7/32in. (5,5 mm) steel balls forming the thrust race.
6. Withdraw the inner column upwards through the outer column.  
*Vehicles Chassis No. 4710 series and early 5710 series.*  
Remove the rocker shaft cork sealing washer and retainer from the steering box.  
*Vehicles Chassis No. late 5710 series onwards.*  
Remove the rocker shaft rubber sealing washer and retainer from the steering box.
8. Drive or press out the two rocker shaft bushes, if necessary.

**To assemble** **Operation G/18**

1. Examine the inner column and main nut for wear, which will give rise to excessive play between the two parts; renew as necessary.
2. Examine the thrust race components and renew if badly worn.

3. Press in the new rocker shaft bushes if the original parts were removed. The bushes should be a *light drive fit* in the steering box and reamed in position to the dimension given in the data.

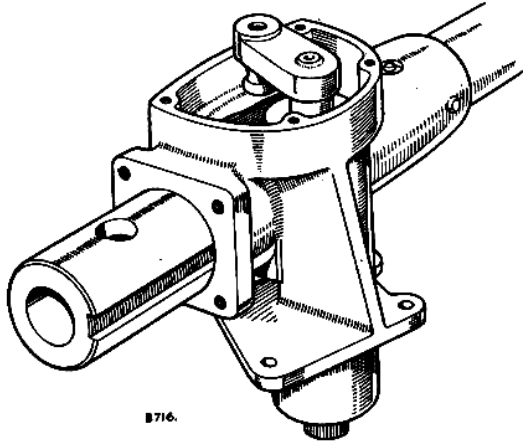


Fig. G-2—Replacing main nut in steering box.

4. Assemble the unit by reversing the stripping procedure, particular attention being paid to the following points:—
  - (a) Replace the nut in the steering box, *threaded portion first*.
  - (b) Ensure that the top face of the rocker shaft is almost flush with the top face of the side cover plate joint washer (available .010 in. and .020 in. thick) by means of a straight edge, as the rocker shaft must not have any end-float with the side cover plate in position.
  - (c) Replace the drop arm by using a wedge-shaped tool to slightly open the slot in the drop arm while replacing it on the rocker shaft, in order to eliminate any possibility of damage to the side cover plate.

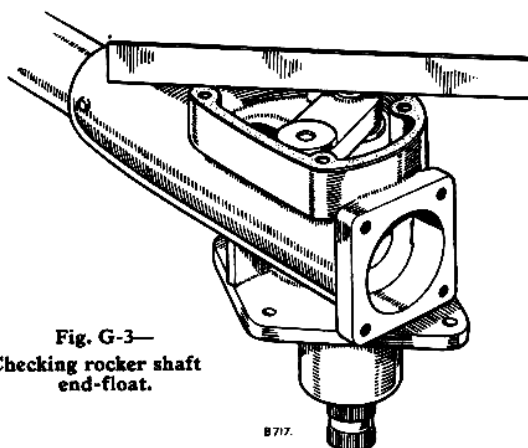


Fig. G-3—  
Checking rocker shaft  
end-float.

The thrust race should be packed with grease on assembly.

5. Adjust the thrust race. Operation G/10.

**To refit** **Operation G/20**

1. Reverse the removal procedure.
2. Before connecting the drop arm to the rocker shaft, set the road wheels straight ahead and the steering inner column in the midway position between full lock in each direction.
3. Fill the steering box with oil (see Instruction Manual).

**Longitudinal steering tube**

**To renew** **Operation G/22**

1. Raise the upper relay lever slightly to allow the ball joint pin to clear the lever and remove the longitudinal tube ball joint from the lever.
2. Withdraw the drop arm from the rocker shaft splines.
3. Withdraw the longitudinal tube and drop arm together towards the front of the vehicle under the radiator grille panel.
4. Disconnect the ball joint from the drop arm.
5. Unscrew the ball joints from the tube. (One left-hand and one right-hand thread.)
6. Examine the ball joints for wear in the body and pin, and renew the complete units as necessary; replace the rubber covers if damaged. Ball joints are supplied as complete units; only the rubber cover and retaining rings can be obtained separately. (Fig. G-1.) Renew the tube if necessary.
7. Fit the ball joints to the tube, leaving the clips slack at this stage.
8. Fit the drop arm to one ball joint.
9. Replace the tube and drop arm under the radiator grille panel.
10. Set the road wheels in the straight ahead position and the steering wheel in the midway position between full lock in each direction.
11. Fit the drop arm to the steering rocker shaft, Operation G/20, selecting a suitable position on the splines so that it is approximately vertical.
12. Fit the front ball joint to the upper relay lever, turning the tube to increase or decrease its effective length, so that the relay lever is not disturbed. Tighten the ball joint clips.
13. Check that the road wheels reach full lock (as determined by the limit stops on the swivel pin housings) in each direction.
14. Top up the steering unit.





Key to Fig. G-4

Steering Unit, Wheel and Drop Arm

1 Steering box assembly—R.H.D.	} 86 and 107 models	63 Rubber seal	} 86, 88, 107 and 109 models		
2 Bush for rocker shaft—inner, grooved		64 Cover for seal			
3 Bush for rocker shaft—outer, plain		65 Screw			
4 Inner column and nut		66 Special washer			
5 Rocker shaft for steering box		67 Spring washer			
6 Sealing washer		68 Nut	} 86 and 107 models		
7 Retaining washer		69 Dust shield			
8 Side cover plate		70 Spring for dust shield			
9 Joint washer		71 Steering wheel	} 86, 88, 107 and 109 models		
10 Bolt for cover plate		72 Bolt			
11 Bottom cover plate		73 Plain washer			
12 Joint washer		74 Nut			
13 Bolt		} For bottom cover plate	75 Horn button and dipper switch complete	} 86 and 107 models	
14 Spring washer					
15 Stud for control tube clamp		} 88 and 109 models	76 Horn button only	} 86 and 107 models	
16 Fixed ball race	77 Steering wheel centre cover				
17 Ball race ring	78 Horn push bracket				
18 Steel ball	79 Clip for horn push bracket				
19 Adjustable ball race	80 Yoke assembly for push bracket				
20 Locknut for ball race	81 Set bolt for bracket				
21 Oil filler and level plug	82 Horn push				
22 Air release plug	83 Special screw		} 88 and 109 models		
23 Washer for plug	84 Spring washer				
24 Special bolt	85 Nut				
25 Castle nut	} Fixing horn push to bracket		86 Lead—horn push to junction box		} 86 and 107 models
26 Split pin					
27 Drop arm	} 86 and 107 models		87 Cable cleat on steering column		
28 Steering box assembly			88 Dip switch		
29 Bush for rocker shaft			89 Drive screw for dip switch		
30 Outer column		90 Lead—dip switch to junction box			
31 Joint washer—steel		91 Control tube complete			
32 Joint washer—paper		92 Felt bush			
33 Bolt		93 Rubber tube—intermediate			
34 Spring washer		94 Oil retaining washer—bottom			
35 Inner column		95 Grommet for control tube wires			
36 Bush for inner column		96 Clamp for control tube			
37 Oil seal		97 Joint washer for clamp			
38 Main nut assembly		98 Spring washer	} Clamp to steering box cover		
39 Set bolt		99 Nut			
40 Lock washer		} For retainer	100 Bolt	} Control tube to clamp	
41 Steel ball					
42 Roller	} 88 and 109 models	101 Spring washer	} 86, 88, 107 and 109 models		
43 Adjustable ball race		102 Nut			
44 Steel balls		103 Support bracket on dash			
45 Rocker shaft		104 Bolt			
46 Adjuster screw		105 Plain washer			
47 Locknut for adjuster screw		106 Spring washer			
48 Oil seal for rocker shaft		107 Nut			
49 Washer for oil seal		108 Support bracket for steering column			
50 End plate		109 Clip for steering column			
51 Joint washer—steel		110 Rubber strip for clip			
52 Joint washer—paper		111 Bolt			
53 Bolt		112 Spring washer			
54 Spring washer		113 Nut			
55 Side cover plate		114 Bolt			
56 Joint washer		} For fixing support bracket to dash bracket		115 Plain washer	
57 Bolt					
58 Spring washer	} For side cover plate	116 Spring washer	} 86, 88, 107 and 109 models		
59 Oil filler plug					
60 Special nut	} 86 and 107 models	117 Nut			
61 Lock washer					
62 Drop arm	} 86 and 107 models	118 Support bracket—86 and 107 models			
		119 Bolt			
		120 Plain washer			
		121 Spring washer			
		122 Nut			
		123 Bolt			
		124 Spring washer			
		125 Nut			
		126 Locking plate—88 and 109 models			

Relay Unit and Steering Arms

1 Housing for relay shaft	} 86, 88, 107 and 109 models	34 Spring ring and retainer, cover to ball	} 86, 88, 107 and 109 models	
2 Shaft for steering relay levers		35-37 Fixings for ball joints		
3 Split bush for housing		38 Ball joint		
4 Washer for spring		39-40 Fixings for ball joint clips		
5 Spring for bushes		41 Steering drag link assembly		
6 Thrust washer for shaft		42 Ball joint assembly R.H. thread		
7 Distance piece for shaft		43 Ball joint assembly L.H. thread		
8 Oil seal for shaft		44 Rubber cover for ball joint		
9 Retainer for oil seal		45 Spring ring, cover to body		
10 Joint washer for retainer		46 Spring ring		
11-12 Fixings for retainer		47 Retainer		
13 Plug for oil hole		} Cover to ball		48-50 Fixings for ball joints
14 Joint washer for plug				
15 Relay lever, upper		} 86, 88, 107 and 109 models		51 Clip for ball joint
16-18 Fixings for lever				52-53 Fixings for ball joint clips
19-21 Fixings for housing	54 Longitudinal steering tube assembly			
22 Flange plate for relay mounting	55 Ball joint assembly R.H. thread			
23-24 Fixings for flange plate	56 Ball joint assembly L.H. thread			
25 Relay lever, lower	57 Rubber cover for ball joint			
26-28 Fixings for lever	58 Spring ring, cover to body			
29 Steering track rod assembly	59 Spring ring			
30 Ball joint assembly R.H. thread	60 Retainer			
31 Ball joint assembly L.H. thread	} Cover, to ball		61-63 Fixings for ball joints to levers	
32 Rubber cover for ball joint				
33 Spring ring, cover to body	} 86 and 107 models		64 Clip for ball joint	
			65-66 Fixings for ball joint clips	

### RECIRCULATING BALL TYPE STEERING UNIT

#### Steering unit—to remove Operation G/24

1. Unscrew the clamp bolt and withdraw the steering wheel.
2. Disconnect the clamp securing the horn switch and support bracket to the steering outer column, then remove the assembly complete with leads.
3. Remove the spare wheel if mounted on bonnet, disconnect the support and lift the bonnet clear.
4. R.H.D. models only—Remove the air cleaner.
5. Remove the name plate and withdraw the radiator grille.
6. Loosen the bolt securing the upper relay lever to the relay unit and prise the lever clear.
7. Turn the steering wheel to allow the longitudinal steering arm to move fully forward, then slacken the clamping bolt nearest the drop arm and unscrew the longitudinal arm complete with relay lever.
8. Remove the bolts securing the steering support bracket to chassis side-member, scuttle and wing valance.
9. The support clip, rubber strip, support brackets and seal must now be removed from the dash.
10. Withdraw the steering unit complete with support plate, drop arm and ball joint from under the front wing.
11. Remove the securing screw and extract the drop arm, using special tool (Part No. 262776).
12. Unscrew the castellated nut and remove the ball joint from drop arm by tapping the side adjacent to taper smartly with a hammer.

#### Steering unit—to refit Operation G/26

1. Refit the support plate to chassis side-member, scuttle and wing valance.
2. Mount the steering unit less drop arm, then secure at dash and support plate. Refit the horn switch and bracket assembly.
3. Turn the inner steering column lock to lock and select the intermediate position.
4. Replace the steering wheel with one series of spokes pointing forward and secure.
5. Screw the ball joint into the longitudinal arm and lock in the original position.
6. Fit the longitudinal arm complete with upper relay lever to the drop arm and insert the assembly along the top of chassis side-member. Connect the upper relay lever to relay unit.
7. With the front wheels positioned "straight ahead" and the steering wheel in the intermediate position, fit the drop arm to the rocker shaft. The longitudinal arm may require adjusting slightly to align the splines of drop arm and steering rocker shaft.
8. Check the steering, lock to lock, for correct functioning. Adjust if necessary by altering the length of the longitudinal arm.

#### Steering unit—to dismantle Operation G/28

1. Remove the side cover and drain off the oil.
2. Lift off the main nut, roller, and withdraw the rocker shaft.
3. With the outer column held in a vice, unscrew the nuts holding the steering box and tap the inner column at the steering wheel end with a hide-faced hammer to partially remove the box.
4. Withdraw the box and inner column complete. The dust cover at the top of steering column will be freed by this last operation and care must be taken to ensure that this or balls from the steering box are not inadvertently lost.
5. Make provision for catching the balls, and with a hide-faced hammer, gently tap the box away from the inner column sufficiently to remove the outer ball race.

*Note:* The main nut should be positioned approximately midway on the cam during this operation.

6. Turn the inner column to unscrew the main nut assembly and withdraw the column completely from the steering box. Remove the main nut assembly.
7. Remove the end cover, shims, ball race and any balls that may have dropped into the steering box.
8. The ball transfer tube may be removed from the main nut.
9. If oil leakage and bearing wear is excessive, remove the retaining washer, oil seal and press out the bush from steering box.
10. Remove the bush and seal from top of outer column, if excessively worn.

#### Steering unit—to assemble Operation G/30

1. Press the Tufnol bush with oil seal into the top outer steering column tube.

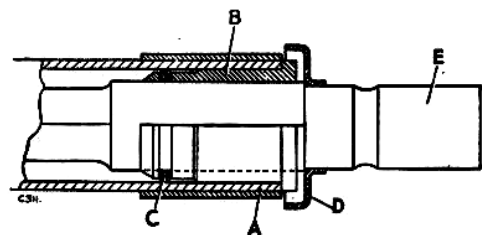


Fig. G-5—Sectioned view of steering column top.

A—Column outer tube      C—Seal  
B—Tufnol bush              D—Dust cover  
E—Inner shaft

2. If removed fit the rocker shaft bush to the steering box.
3. Locate the rocker shaft seal and retaining washer.

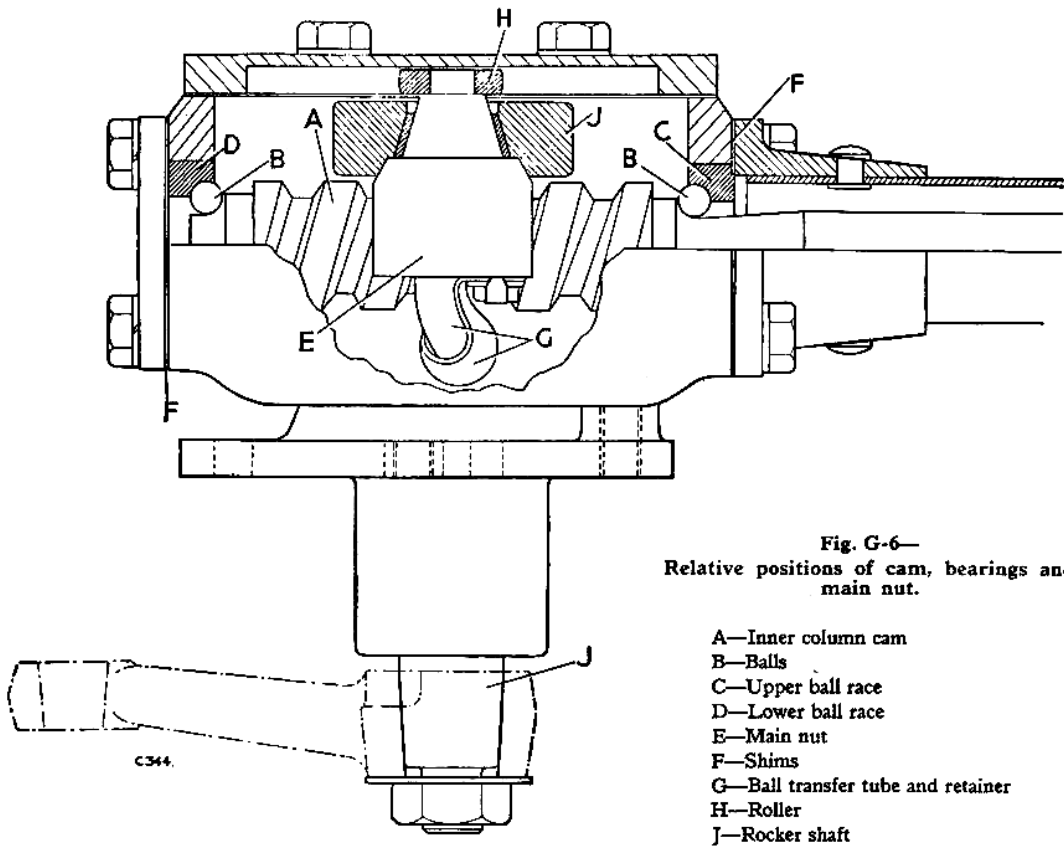


Fig. G-6—  
Relative positions of cam, bearings and main nut.

- A—Inner column cam
- B—Balls
- C—Upper ball race
- D—Lower ball race
- E—Main nut
- F—Shims
- G—Ball transfer tube and retainer
- H—Roller
- J—Rocker shaft

4. Grease any thickness shim and two paper washers each side of the shim, to the flange on the outer column, then mount the outer column in a vertical position in a vice (Tufnol bush downwards).
5. Place one of the ball races, less ball bearings, over the inner column and slide the inner column into the outer column and Tufnol bush, ensuring it is free to rotate. Lift the inner column a little, grease the ball race and load with ten ball bearings, ensuring that none fall down the inside of the outer column.
6. Assemble the main nut, replacing balls as necessary and retain them in position with grease. Locate the assembly in steering box and lower on to the cam end of the inner column.
7. Carefully rotate the inner column, ensuring that the ball bearings in the main nut are not dislodged, and the steering box is up the correct way. (Filler plug towards the outer column.)
8. Grease the lower ball race and stick ten balls in position. Locate the outer ball race, shims, joint washer and end cover, then carefully tighten, ensuring that none of the balls are dislodged.

*Note:* The inner shaft should have no end-float, but to ensure that the bearings are not over-stressed, sufficient shims must first be fitted to allow an end-float

reading and then shims equivalent in thickness to this reading, be removed.

The steering unit may now be elevated into a horizontal position.

9. Fit the main nut, roller, replace the rocker shaft, joint washer and cover, ensuring that the roller is correctly located in the cover slot.
10. With the main nut at mid-position on cam, tighten the adjusting screw on side cover by hand until resistance is felt as it contacts the rocker shaft; tighten a further tenth of a turn and lock the adjusting screw.
11. Refit the dust cover to top end of steering column.

**Steering wheel**

To remove Operation G/32

1. Unscrew the clamping bolt at hub and withdraw the wheel.

**Drop arm**

To remove Operation G/34

1. The complete steering unit must be removed before the drop arm can be extracted—see Operation G/24.

To refit

See Operation G/26.

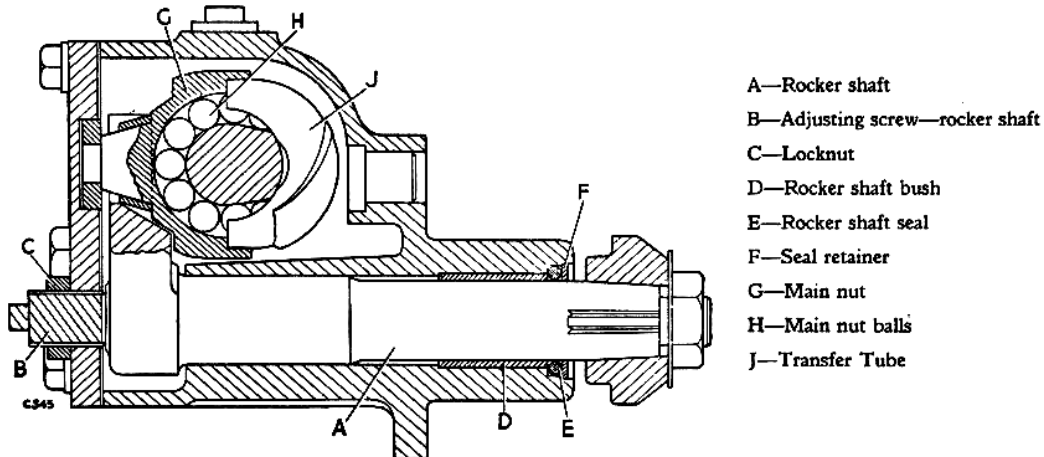


Fig. G-7—Sectioned view of rocker shaft and steering box.

**Longitudinal steering arm****To remove****Operation G/36**

1. Remove the radiator grille, loosen the clamping bolt securing the upper relay lever and prise the lever off the relay unit.
2. Turn the steering wheel to allow the longitudinal steering arm to move fully forward, loosen the clamping bolt nearest to drop arm and unscrew the longitudinal arm complete with relay lever. Withdraw the assembly from the front of vehicle.
3. Unscrew the castellated nut securing the ball joint to the drop arm, then with a solid metallic object on one side of the drop arm adjacent to the taper, tap the other side with a hammer to loosen the ball joint.
4. Turn the steering wheel to move the drop arm rearwards and remove the ball joint.

**To replace****Operation G/38**

1. Reverse the removal procedure, ensuring that the longitudinal arm is screwed back on to exactly the former position.
2. Check the "lock to lock" movement and alter if necessary by adjusting the length of the longitudinal arm.

**Steering relay unit****To remove****Operation G/40**

1. Remove the air cleaner and battery. Section P.
2. Remove the bolts securing the radiator grille panel to the front wings.
3. Remove the bolts securing the grille panel to the chassis frame; remove the front apron panel; when the bolts are clear, the rubber packing pieces between the panel and frame may also be withdrawn. It will now be possible to move the radiator assembly slightly to assist in the removal of the relay unit, but care must be taken to prevent damage to the coolant hoses.

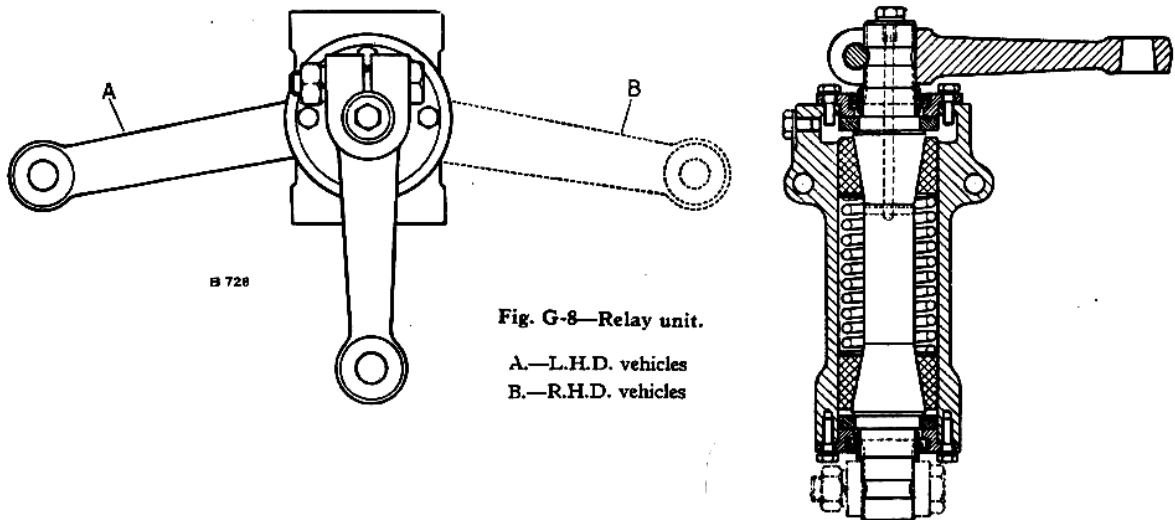


Fig. G-8—Relay unit.

A.—L.H.D. vehicles  
B.—R.H.D. vehicles

4. Raise the upper relay lever slightly to allow the ball joint pin to clear the lever; disconnect the longitudinal tube ball joint from the upper relay lever.
5. Detach the lower relay lever from the relay unit shaft.
6. Remove the relay unit upwards, tapping gently with a hide-faced hammer, if necessary. The flange plate can be left in position on the underside of the chassis cross-member.

**To strip****Operation G/42**

1. Remove the upper relay lever.
2. Drain off as much oil as possible by removing the oil filler and bleed plugs.
3. Remove the bottom plate complete with oil seal and joint washer.

Secure a sack over the bottom half of the relay box and mount relay in a vice with the bottom pointing downwards into the sack.

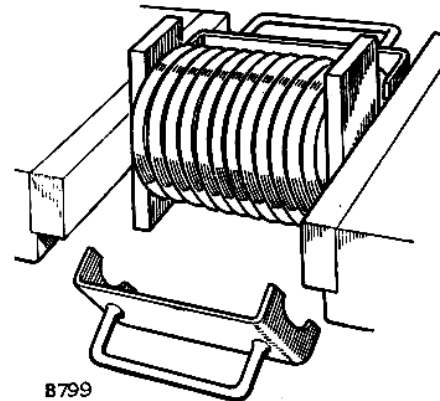
CAREFULLY tap out the shaft, Tufnof bushes and spring into the sack.

*Note:* The spring is compressed to over 100 lb. (45 kg) when in position, and will cause serious damage if care is not exercised.

4. Remove the bottom end plate and brass thrust washer.

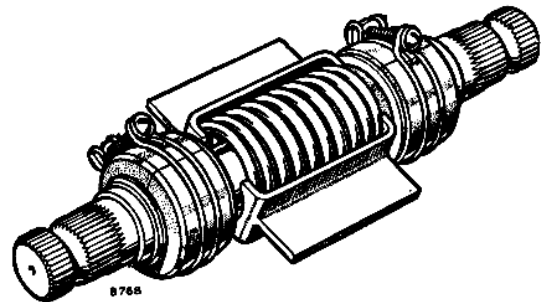
**To assemble****Operation G/44**

1. Examine the oil seals in the end caps and renew them if damaged. Examine the distance pieces on the shaft (which form tracks for the oil seals) for damage which may have caused failure of the seals; renew them as necessary.
2. Renew the split Tufnof bushes if worn or damaged.
3. Check the spring in accordance with given data. Renew the spring if necessary.
4. Fit the top end plate and joint washer to the housing.
5. Fit one split bush to the taper on the shaft and secure tightly with a suitable 2 in. hose clip (Part No. 50320).
6. Hold a suitable bar (Part No. 262768) over each end of the spring and compress it to a length of 3 in. (76 mm) in a vice, with the bars central and vertical. Place a suitable clip (Part No. 262769) over each side of the spring, as shown at Fig. G-9. Release the vice and remove the spring and clips complete.

**Fig. G-9—**

Method of compressing steering relay spring.

7. Slide a washer over the shaft and fit the spring to the shaft so that it abuts the washer and bush.
8. Slide a second washer over the shaft and fit the second split hush to the shaft, securing it with a hose clip as for the first one (Fig. G-10).

**Fig. G-10—Assembling steering relay shaft assembly.**

9. Remove the clips retaining the spring, slide the lower brass thrust washer over the top end of the shaft and carefully enter the assembly, top end first, into the housing; push the shaft into the housing, up towards the bleed plug end, so leaving the first hose clip free. Remove the clip and push the shaft home; release the second hose clip.
10. Fit a thrust washer to the bottom end of the shaft and fit the end cap and joint washer.
11. Fit the upper relay lever.
12. Fill the housing with oil, and fit the filler and bleed plugs and joint washers.
13. If the assembly is in order, it should need a force of at least 12 lb. (5,5 kg) to turn the relay lever and shaft, using a spring balance in the relay lever boss.

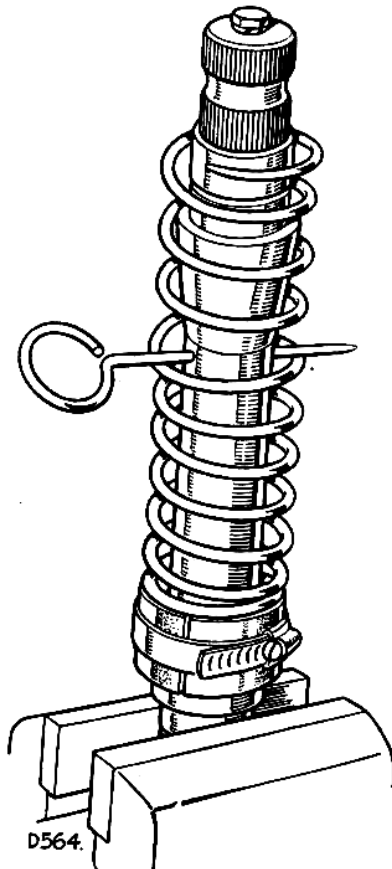


Fig. G-11—Alternative method of compressing steering relay spring

#### Alternative method to assemble relay unit

1. Examine all parts and renew as necessary.
2. Fit the top end plate and joint washer to the housing.
3. Fit one split bush to the taper on the bottom end of the shaft, and secure tightly with a suitable 2 in. hose clip (Part No. 50323).
4. Place a steel washer on to the shaft, next to the inner side of the Tufnol bush.
5. Place the spring over the shaft and insert the special tool (Part No. 510309) through the coils of the spring and right through the lubrication cross-drilling in the shaft.
6. The spring can now be wound down the tool until the steel washer and the split Tufnol bush can be secured to the taper on the other end of the shaft with a hose clip.
7. Remove the special tool (Part No. 510309).
8. Place a brass thrust washer on the top end of the shaft, lubricate the shaft and insert into the housing.

9. With a plastic hammer gently tap the shaft into the housing until the first hose clip slides off the Tufnol bush, remove the clip completely from the shaft.
10. Continue to tap the shaft into the housing until the second clip is freed and the shaft abuts the top end cover.
11. Fit the bleed and filler plugs, fill the unit with oil, replace the bottom end thrust washer, joint washer, end cover and tighten the retaining bolts.
12. Fit the upper relay lever.
13. If the unit is in order, it should require a force of at least 12 lb. (5,5 kg) to turn the relay shaft, using a spring balance in the relay lever boss.

#### To refit

#### Operation G/46

Reverse the removal procedure.

The lower relay lever must be fitted as illustrated at Fig. G-8.

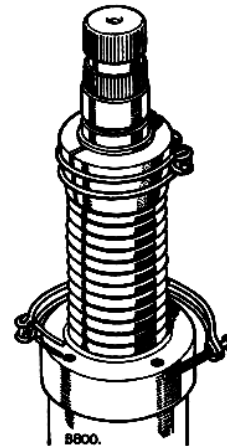


Fig. G-12—Replacing steering relay shaft and bushes in housing.

#### Drag link

#### To renew

#### Operation G/48

1. Disconnect the drag link ball joints from the lower relay lever and steering arm. Remove the drag link complete.
2. Unscrew the ball joints from the drag link tube (one left-hand and one right-hand thread).
3. Examine the ball joints for wear in the body and pin and renew the complete units as necessary; replace the rubber covers if damaged. Ball joints are supplied as complete units; only the rubber cover and retaining rings can be obtained separately. (Fig. G-1.) Renew the tube if necessary.
4. Fit the ball joints to the tube, leaving the clips slack at this stage.
5. Secure one end of the drag link to the lower relay lever.

6. Set the road wheels straight ahead and the steering wheel in the midway position between full lock in each direction.
7. Secure the other end of the drag link to the steering arm, turning the tube to increase or decrease its effective length, so that the relay lever and steering arm are not disturbed.
8. Tighten the ball joint clips.
5. If correction is required to the toe-in, slacken the clips securing the ball joints to the track rod and turn the rod to decrease or increase its effective length as necessary, until the toe-in is correct.
6. Tighten the ball joint clips.

#### Steering ball joints

#### To renew Track rod Operation G/50

1. Disconnect the track rod ball joints from the steering arms; remove the track rod complete.
2. Unscrew the ball joints from the track rod tube (one left-hand and one right-hand thread).
3. Examine the ball joints for wear in the body and pin, and renew the complete units as necessary; replace the rubber covers if damaged. Ball joints are supplied as complete units; only the rubber cover and retaining rings can be obtained separately (Fig. G-1); renew the tube if necessary.
4. Fit the ball joints to the tube, leaving the clips slack at this stage.
5. Secure the ball joints to the steering arms and adjust the toe-in. Operation G/50.

#### Wheel alignment

#### To check and adjust Operation G/52

1. No adjustment is provided for castor, camber or swivel pin inclination.
2. The toe-in is adjustable; proceed as follows:
3. Set the vehicle on level ground with the road wheels in the straight-ahead position, and push it forward a short distance.
4. Measure the toe-in with the aid of a tracking stick or suitable proprietary equipment; it should be 3/64 in. to 3/32 in. (1,2 mm to 2,4 mm).

#### To check Operation G/54

1. The steering ball joints have been designed in such a way as to retain the initial filling of grease for the normal life of the ball joint; however, this applies only if the rubber boot remains in position on the joint. The rubber boots should be checked every 3,000 miles (5,000 km) to ensure that they have not become dislodged or the joint damaged. Should any of the rubber boots be dislodged, proceed as follows:—
2. Remove the ball end from the drop arm lever by tapping smartly around the eye of the pin.
3. Remove the rubber boot.
4. Thoroughly clean all parts.
5. Place the castle nut upside down on the pin and screw on a few threads, then place the ball joint under a press or between the jaws of a vice and carefully force the pin and ball down against the spring. In this position the interior of the ball joint can be cleaned and lubricated.
6. Apply grease around the taper, and fill the rubber boot.
7. Reassemble, using new rubbers and spring rings as required.
8. When refitting track rod and ball joints to the drop arms, ensure that the ball joints are aligned with each other, in order to allow full unrestricted movement of the steering linkage.
9. When refitting longitudinal steering arm and drag link, ensure that the ball joint body is parallel with respective steering arms, in order to allow full movement.

## DEFECT LOCATION

## Symptom, Cause and Remedy

## A—EXCESSIVE LOOSENESS OR BACKLASH IN THE STEERING

1. Steering rocker shaft incorrectly adjusted or badly worn—*Adjust or renew.*
2. Steering linkage loose or worn—*Rectify or renew.*
3. Swivel pins and bearings loose or worn—*Section F.*
4. Loose or worn front wheel bearings—*Section F.*
5. Steering box securing bolts loose—*Tighten.*

## B—TIGHT STEERING

1. Low or unequal tyre pressures—*Section S.*
2. Steering box oil level low—*Replenish.*
3. Steering rocker shaft adjusted too tightly—*Adjust.*

## C—RATTLE IN STEERING COLUMN

1. Steering rocker shaft incorrectly adjusted or badly worn—*Adjust or renew.*

## D—VEHICLE PULLS TO ONE SIDE

1. *Section F.*

## E—VEHICLE WANDERS

1. *Section F.*

## F—WHEEL SHIMMY

1. *Section F.*

## GENERAL DATA

WORM AND NUT TYPE  
STEERING UNIT

Type	....	Worm and nut
Ratio	....	15 : 1
Thrust adjustment	....	7-9 lb/in. (0,08 to 0,10 mKg) pre-load on bearing at top of column
Number of turns of steering wheel from lock to lock	....	2.4

RECIRCULATING BALL TYPE  
STEERING UNIT

Type	....	Recirculating ball
Ratio	....	Straight ahead 15.6 : 1 Full lock .... 23.8 : 1
Inner column end-float	....	Nil
Rocker shaft end-float	....	Nil
Number of turns of steering wheel from lock to lock	....	3.3

## DETAIL DATA, ALL MODELS

## Relay shaft clearances

in bushes	....	.003 to .0045 (0,08 to 0,12 mm)
-----------	------	---------------------------------

## Longitudinal steering tube

## Ball joints

Type	....	Non-adjustable; 7/16 in. B.S.F. thread
------	------	--

Tightening torque	....	30 lb/ft. (4 Kgm)
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## Steering relay unit

## Bushes

Type	....	Tufnol cones
------	------	--------------

## Spring:

Number of working coils	....	10
Free length	....	7¼ in. (184 mm)
Fitted length	....	3 in. (72,2 mm)
Load at fitted length	....	104 lb. (47 Kg)

## Wheel alignment

Wheel camber	....	1½°
Wheel castor	....	3°
Swivel pin inclination	....	7°
Toe-in	....	3/64 to 3/32 in. (1,2 mm to 2,4 mm)



# Section J – SUSPENSION

## INDEX

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## SUSPENSION DATA

### Front road springs

#### Land-Rover 80, 1948-53

	<i>Type 1</i>	<i>Type 2</i>	<i>Type 3</i>
Fitted to vehicles numbered	Prior to 862115	862115 to 06113529 8670001 to 06200419 8680001 to 06300030	06113530 06200420 and 06300031 onwards
Number of leaves	9	9	9
Width of leaves	1 $\frac{3}{4}$ in. (44,45 mm)	1 $\frac{3}{4}$ in. (44,45 mm)	2 $\frac{1}{2}$ in. (63,5 mm)
Thickness of leaves	6 (upper) x .203 in. (5,16 mm) and 3 x .180 in. (4,57 mm) or 2 (upper) x .218 in. (5,56 mm) and 6 x .187 in. (4,76 mm)	6 (upper) x .203 in. (5,16 mm) and 3 x .180 in. (4,57 mm) or 3 (upper) x .218 in. (5,56 mm) and 6 x .187 in. (4,76 mm)	9 x .165 in. (4,2 mm)
Static load	617 lb. (280 kg)	755 lb. (342 kg)	524 lb. (237 kg)
Camber under static load	Flat	Flat	1.63 in. (27 mm)
Rate	200 lb./in. (2,304 kg/m)	230 lb./in. (2,649 kg/m)	190 lb./in. (2,189 kg/m)
Free camber	3 $\frac{1}{2}$ in. (89 mm)	4 in. (102 mm)	4.39 in. (102,5 mm)

#### Land-Rover 86 and 88, 1954-58

	<i>Driver</i>	<i>Passenger</i>
Number of leaves	10	10
Width of leaves	2 $\frac{1}{2}$ in. (63,5 mm)	2 $\frac{1}{2}$ in. (63,5 mm)
Thickness of leaves	top plate x 11/64 in. (4,36 mm) and 9 x 9/64 in. (3,57 mm)	top plate x 11/64 in. (4,36 mm) and 9 x 9/64 in. (3,57 mm)
Static load	610 lb. (277 kg)	508 lb. (230 kg)
Camber under static load	2 $\frac{1}{2}$ in. (63,5 mm)	2 $\frac{1}{2}$ in. (63,5 mm)
Rate	152 lb./in. (1,74 kg/m)	152 lb./in. (1,74 kg/m)
Free camber	6.5 in. (165 mm)	5.875 in. (149 mm)

Land-Rover 107 and 109, 1954-58

	Driver	Passenger	
Number of leaves	9	9	Up to Chassis No. 57200469
Width of leaves	2½ in. (63,5 mm)	2½ in. (63,5 mm)	
Thickness of leaves	9 x .165 in. (4,2 mm)	9 x .165 in. (4,2 mm)	
Static load	750 lb. (340 kg)	636 lb. (288 kg)	
Camber under static load	2¾ in. (69,85 mm)	2¾ in. (69,85 mm)	
Rate	190 lb./in. (2,19 kg/m)	190 lb./in. (2,19 kg/m)	From Chassis No. 57200470 onwards
Free camber	6.70 in. (170,18 mm)	6.08 in. (154,43 mm)	
Number of leaves	11	11	
Width of leaves	2½ in. (63,5 mm)	2½ in. (63,5 mm)	
Thickness of leaves	11 x 11/64 in. (4,3 mm)	11 x 11/64 in. (4,3 mm)	
Static load (vehicle unladen)	750 lb. (340 kg)	750 lb. (340 kg)	
Camber under static load	2¾ in. (69,85 mm)	2¼ in. (57,1 mm)	
Rate	260 lb./in. (46,5 kg/cm)	260 lb./in. (46,5 kg/cm)	
Free camber	5½ in. (142,9 mm)	5¾ in. (130 mm)	

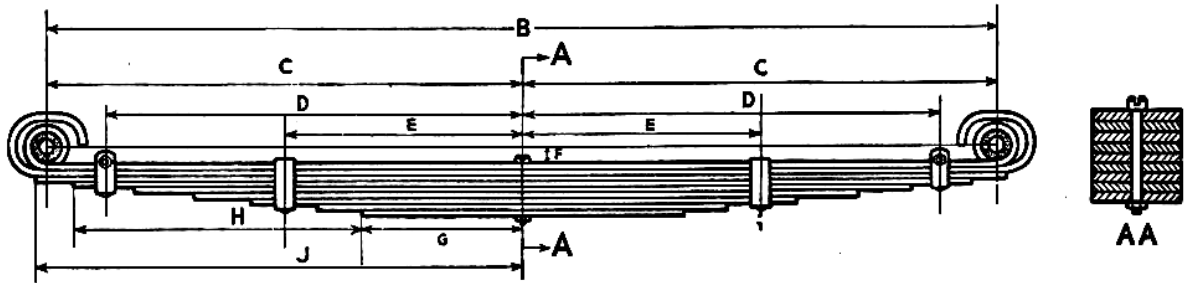


Fig. J-1—Dimensions with spring flat.

(Land-Rover 80 and 86, 1948-53)

- B—36½ in. (921 mm)
- C—18½ in. (460 mm)
- D—15½ in. (403 mm)
- E—8½ in. (222 mm)
- F—25/32 in. (19,8 mm)
- G—5 in. (127 mm)
- H—5 x 2½ in. (5 x 60,3 mm) (Types 1 and 2) and 5 x 2¼ in. (5 x 57,2 mm) (Type 3)
- J—18½ in. (467 mm) (Except Type 1)

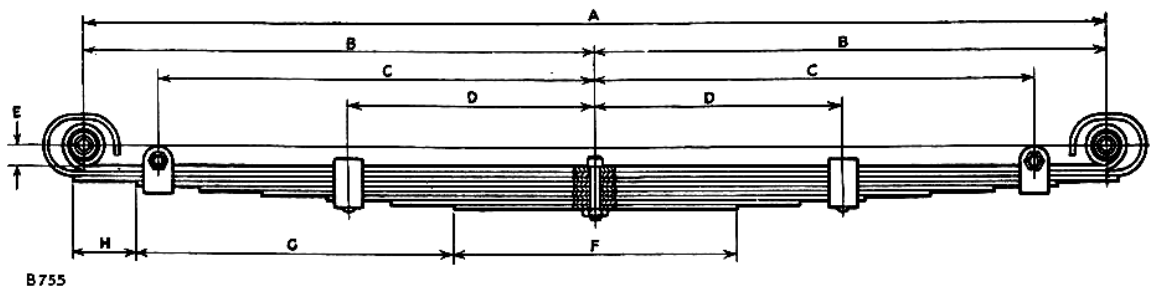


Fig. J-2—Dimensions with spring flat.

(Land-Rover 86 and 88, 1954-58—Driver and Passenger side)

- A—36½ in. (921 mm)
- B—18½ in. (460,5 mm)
- C—15½ in. (394 mm)
- D—86 and 88 model 10 in. (254 mm)  
107 and 109 model 8½ in. (222 mm)  
Alternative: 10¾ in. (263,5 mm), 11 in. (279,4 mm)
- E—.720 in. (18,28 mm)
- F—86 and 88 model 10 in. (254 mm)  
107 and 109 model 10 in. (254 mm)  
Alternative: 9¾ in. (247,7 mm)
- G—86 and 88 model 11¼ in. (286 mm)  
107 and 109 model 11¼ in. (286 mm)  
Alternative: 11½ in. (288,9 mm)
- H—86 and 88 model 2¼ in. (54 mm)  
107 and 109 model 2¼ in. (54 mm)  
Alternative: 2½ in. (57,1 mm)

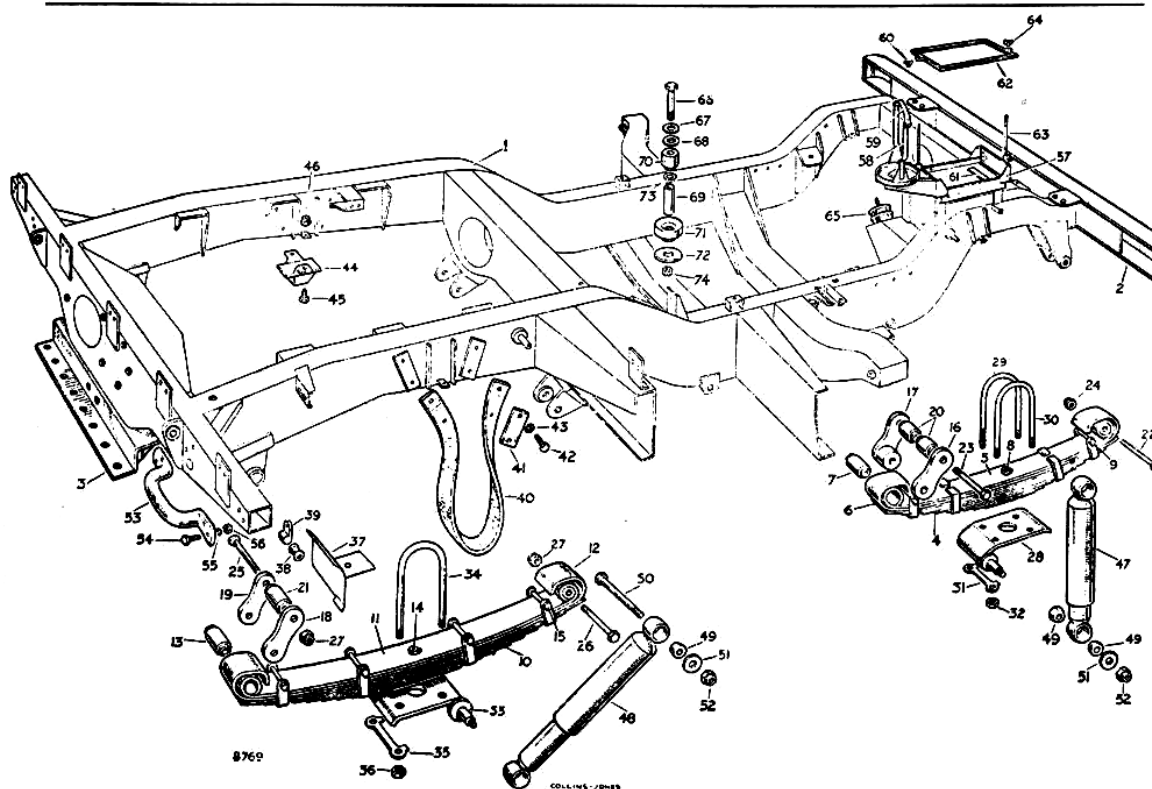


Fig. J-3—Layout of suspension.

- |       |                                       |       |   |
|-------|---------------------------------------|-------|---|
| 1     | Chassis frame                         | 37    | Shield for brake pipe, R.H.                     |
| 2     | Front bumper                          | 38    | Rubber grommet for brake pipe                   |
| 3     | Rear draw bar                         | 39    | Clip for grommet                                |
| 4     | Road spring complete, front, driver's | 40    | Check strap for rear axle                       |
| 5     | Main leaf } For front                 | 41    | Plate for check strap                           |
| 6     | 2nd leaf } spring                     | 42-43 | Fixings for check strap                         |
| 7     | Bush for front spring                 | 44    | Rubber buffer for axles, front and rear         |
| 8     | Dowel for front spring                | 45-46 | Fixings for buffers                             |
| 9     | Bolt } For spring                     | 47    | Shock absorber, front                           |
|       | Nut } clip                            | 48    | Shock absorber, rear                            |
| 10    | Road spring complete, rear, driver's  | 49    | Rubber bush for shock absorbers                 |
| 11    | Main leaf } For rear                  | 50-52 | Fixings for shock absorbers                     |
| 12    | 2nd leaf } spring                     | 53    | Lifting handle, rear                            |
| 13    | Bush for rear spring                  | 54-56 | Fixings for handles                             |
| 14    | Dowel for rear spring                 | 57    | Battery casing and air cleaner support complete |
| 15    | Bolt } For                            | 58    | Air cleaner clamp, side                         |
|       | Nut } spring clip                     | 59    | Air cleaner clamp, top                          |
| 16    | Shackle plate, tapped                 | 60    | Wing nut for clamp                              |
| 17    | Shackle plate, plain                  | 61    | Rubber strip for battery                        |
| 18    | Shackle plate, tapped                 | 62    | Battery cover                                   |
| 19    | Shackle plate, plain                  | 63    | Battery fixing rod                              |
| 20    | Bush in chassis frame, front spring   | 64    | Wing nut fixing battery                         |
| 21    | Bush in chassis frame, rear           | 65    | Suspension rubber for engine, front             |
| 22    | Shackle pin, front                    | 66    | Bolt, rear                                      |
| 23    | Shackle pin, springs to frame, front  | 67    | Plain washer, top                               |
| 24    | Self-locking nut, front               | 68    | Rubber washer                                   |
| 25    | Shackle pin, rear                     | 69    | Distance tube                                   |
| 26    | Shackle pin, springs to frame, rear   | 70    | Top rubber                                      |
| 27    | Self-locking nut, rear                | 71    | Bottom rubber                                   |
| 28    | Bottom plate for front spring, R.H.   | 72    | Plain washer bottom                             |
| 29-32 | Fixings for front springs             | 73    | Shim  |
| 33    | Bottom plate for rear spring, R.H.    | 74    | Special nut                                     |
| 34-36 | Fixings for rear springs              |       |   |

Fixing engine unit to chassis frame at front and rear

Rear road springs

Land-Rover 80, 1948-53

	Driver	Passenger
Number of leaves	9 or 10	9 or 10
Width of leaves	1 3/4 in. (44,45 mm)	1 3/4 in. (44,45 mm)
Thickness of leaves	10 x .203 in. (5,16 mm) or 7 x .218 in. (5,56 mm) and 2 x .187 in. (4,76 mm)	10 x .203 in. (5,16 mm) or 7 x .218 in. (5,56 mm) and 2 x .187 in. (4,76 mm)
Static load	455 lb. (206 kg)	365 lb. (165 kg)
Camber under static load	2.38 in. (51,5 mm)	2.38 in. (51,5 mm)
Rate	180 lb./in. (2.074 kg/m)	180 lb./in. (2.074 kg/m)
Free camber	4 1/2 in. (114 mm)	4 in. (102 mm)

Land-Rover 86 and 88, 1954-58

	Driver	Passenger
Number of leaves	11	11
Width of leaves	2 1/2 in. (63,5 mm)	2 1/2 in. (63,5 mm)
Thickness of leaves	top plate x 1/4 in. (6,35 mm) and 10 x 3/16 in. (4,76 mm)	top plate x 1/4 in. (6,35 mm) and 10 x 3/16 in. (4,76 mm)
Static load	690 lb. (313 kg)	580 lb. (263 kg)
Camber under static load	2.5 in. (63,5 mm)	2.5 in. (63,5 mm)
Rate	166 lb./in. (1,90 kg/m)	166 lb./in. (1,90 kg/m)
Free camber	6.67 in. (154 mm)	6 in. (152 mm)
Fit of bushes in spring and chassis bores	.0025 to .0075 in. (0,065 to 0,18 mm) interference	

Land-Rover 107 and 109

	Driver	Passenger	
Number of leaves	10	10	All 107 basic models and 109 models up to vehicles numbered 121601061, and 107 Station Wagon up to 87060061
Width of leaves	2 1/2 in. (63,5 mm)	2 1/2 in. (63,5 mm)	
Thickness of leaves	top plate x 1/4 in. (6,35 mm), 7 x 3/16 in. (4,76 mm) and 2 x 5/16 in. (7,93 mm)	top plate x 1/4 in. (6,35 mm), 7 x 3/16 in. (4,76 mm) and 2 x 5/16 in. (7,93 mm)	
Static load	840 lb. (381 kg)	720 lb. (326 kg)	
Camber under static load	2.0 in. (50 mm)	2.0 in. (50 mm)	
Initial rate	145 lb./in. (1,67 kg/m)	145 lb./in. (1,67 kg/m)	
Final rate	250 lb./in. (2,88 kg/m)	250 lb./in. (2,88 kg/m)	
Free camber	7 1/4 in. (184 mm)	6 7/8 in. (166,6 mm)	
Fit of bushes in spring and chassis bores	.0025 to .0075 in. (0,065 to 0,18 mm) interference		

Land-Rover 109 and 107 Station Wagon

	Driver	Passenger	
Number of leaves	11	11	From vehicles numbered: 109 models 121601602 up to 121700416 107 Station Wagon 87060062 up to 131700042
Width of leaves	2 1/2 in. (63,5 mm)	2 1/2 in. (63,5 mm)	
Thickness of leaves	top plate x 1/4 in. (6,35 mm), 6 x 3/16 in. (4,76 mm) and 4 x 5/16 in. (7,93 mm)	top plate x 1/4 in. (6,35 mm), 6 x 3/16 in. (4,76 mm) and 4 x 5/16 in. (7,93 mm)	
Static load	1,158.5 lb. (525 kg)	1,015 lb. (460 kg)	
Camber under static load	2.0 in. (50 mm)	2.0 in. (50 mm)	
Initial rate	160 lb./in. (184 kg/m)	160 lb./in. (184 kg/m)	
Final rate	360 lb./in. (4,15 kg/m)	360 lb./in. (4,15 kg/m)	
Free camber	7.187 in. (182,54 mm)	6.500 in. (165 mm)	
Fit of bushes in spring and chassis bores	.0025 to .0075 in. (0,065 to 0,18 mm) interference		

Land-Rover 107, 109 and 88 Fire Tender

	Driver	Passenger	
Number of leaves	8	8	} 88 Fire Tender from 111703274 onwards 109 models from 121700417 onwards 107 models from 131700042 onwards
Width of leaves	2½ in. (63,5 mm)	2½ in. (63,5 mm)	
Thickness of leaves	9/32 in. (7,1 mm)	9/32 in. (7,1 mm)	
Static load	1,158.5 lb. (525 kg)	1,015 lb. (460 kg)	
Camber under static load	2.0 in. (50 mm)	2.0 in. (50 mm)	
Rate	368 lb./in. (4,2 kg/m)	368 lb./in. (4,2 kg/m)	
Free camber	5.187 in. (130 mm)	4.75 in. (120 mm)	

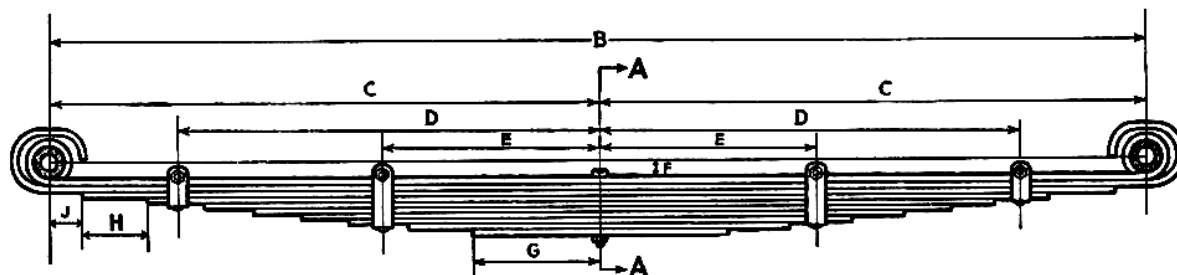


Fig. J-4—Dimensions with spring flat.

(Land-Rover 80 and 86, 1948-53)

B—42 in. (1067 mm)	E—8½ in. (216 mm) (10 leaves) or	G—5½ in. (140 mm)
C—21 in. (533 mm)	9½ in. (232 mm) (9 leaves)	H—2½ in. (57 mm)
D—16½ in. (422 mm) (10 leaves)	F—25/32 in. (19,8 mm)	J—1½ in. (32 mm)
or 16½ in. (416 mm) (9 leaves)		

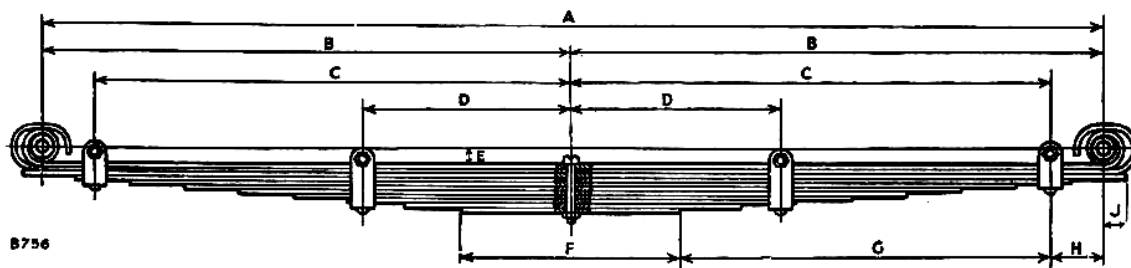


Fig. J-5—Dimensions with spring flat.

(Land-Rover 86 and 88—Driver and Passenger side, 1954-58)

A—48 in. (1,22 m)	D—9½ in. (241 mm)	G—17 1/8 in. (433 mm)
B—24 in. (610 mm)	E—.780 in. (19,81 mm)	H—1 1/8 in. (36,5 mm)
C—21 1/8 in. (543 mm)	F—11 in. (280 mm)	J—1 in. (25,4 mm)

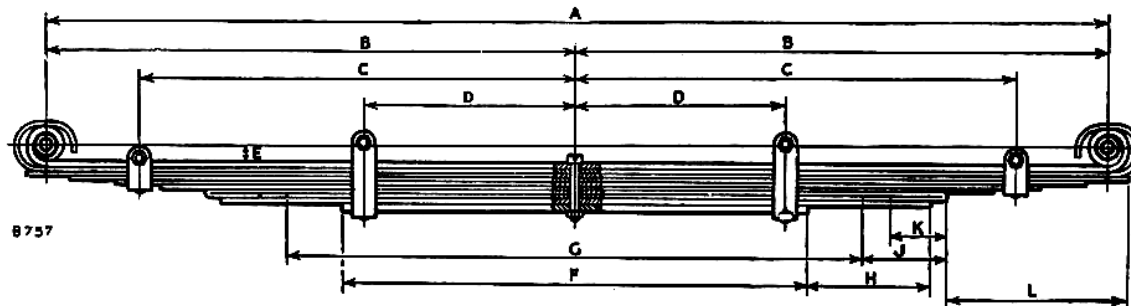


Fig. J-6—Dimensions with spring flat.

(Land-Rover 107 and 109—Driver and Passenger side, 1954-58)

A—48 in. (1,22 m)	E—.780 in. (19,81 mm)	J—3½ in. (95 mm)
B—24 in. (610 mm)	F—26 in. (660 mm)	K—2½ in. (63,5 mm)
C—19 1/8 in. (503 mm)	G—21 in. (533 mm)	L—8½ in. (209,5 mm)
D—9½ in. (241 mm)	H—5½ in. (140 mm)	

### Front springs

#### 1948-53 vehicles

The three types of front springs are not interchangeable and must be fitted only within their respective series. On any particular vehicle, the left-hand and right-hand front springs are identical.

#### 1954-58 vehicles

The driver side and passenger side front springs are not interchangeable, the free camber of the driver side spring being greater to compensate for the extra weight (driver, etc.) carried on that side of the vehicle.

The springs can be removed one at a time or both together as detailed.

#### To remove Operation J/10

1. Jack up the vehicle and support it on four jacking stands.
2. Remove the front wheel.
3. Place two supports under the axle.
4. Jack up each of the road springs under the shock absorber plates and remove the U-bolt nuts. Lower the jacks so that the axle is supported by the two stands, and the springs are relaxed.
5. Remove the self-locking nut from the shackle pin in each spring eye.
6. Remove the shackle pin from the front end of the spring.
7. Remove the shackle pin from the rear end of the spring; the pin is threaded into the *inner* shackle plate.
8. Remove the road spring complete.
9. Remove the self-locking nut from the shackle pin securing the shackle plates to the chassis. Unscrew the pin from the inner shackle plate and remove it together with the two plates.

#### To refit Operation J/12

1. If necessary, remove the shackle bushes from the chassis frame, with the aid of either a tubular drift or a suitable extractor; fit new bushes, which must be a *drive fit*.
2. If necessary, renew the rubber bushes in the spring eyes in a similar way.

#### Early models only

Select a suitable shim washer (available .090 in., .100 in., .110 in. and .120 in. thick) for each side of each bush, i.e., six in all, to give a definite clearance of not more than .005 in. between the shim and the shackle plate.

3. Replace the spring by reversing the removal procedure, taking care to tighten the shackle pins and locking nuts *after* the vehicle has been lowered to the ground.

#### Note:

IF THE SHACKLE PINS AND LOCKING NUTS ARE NOT TIGHTENED WITH THE SPRING IN THE MID-WAY POSITION, PREMATURE FAILURE OF THE BUSHES WILL OCCUR.

### Rear springs

The driver side and passenger side rear springs are not interchangeable, the free camber of the driver side spring being greater to compensate for the extra weight (driver, etc.) carried on that side of the vehicle.

The springs can be removed one at a time, or both together, as detailed.

#### To remove Operation J/14

1. Jack up the vehicle and support it on four jacking stands.
2. Remove the rear wheels.
3. Jack up each of the road springs under the shock absorber plates and remove the U-bolt nuts. Lower the jacks so that the axle is supported by its check straps and the springs are fully relaxed.
4. It is not necessary to support the rear axle on stands when removing the rear springs due to the fact that it will be supported by its check straps, as the jacks are lowered.
5. Remove the self-locking nut from the shackle pin in each spring eye.
6. Remove the shackle pin from the rear end of the spring, the pin is threaded into the *outer* shackle plate.
7. Remove the shackle pin from the front end of the spring.
8. Remove the road spring complete.
9. Remove the self-locking nut from the shackle pin securing the shackle plates to the chassis frame. Unscrew the pin from the outer shackle plate and remove it, together with the two plates.

#### To refit Operation J/16

1. If necessary, remove the shackle bush from the chassis frame bracket with the aid of a tubular drift or suitable extractor; fit a new bush, which must be a *drive fit*.
2. If necessary, renew the bushes in the spring eyes in a similar way.
3. Replace the spring by reversing the removal procedure, taking care to tighten the shackle pins and locking nuts *after* the vehicle has been lowered to the ground.

**Note:**

IF THE SHACKLE PINS AND LOCKING NUTS ARE NOT TIGHTENED WITH THE SPRING IN THE MID-WAY POSITION, PREMATURE FAILURE OF THE BUSHES WILL OCCUR.

**To overhaul****Operation J/18**

1. Remove the four leaf clips; except for the inner clips on the front springs which are bent over the top leaf, all the clips are secured by bolts and nuts.
2. Remove the spring bushes. Operation J/16.
3. Remove the centre bolt and nut to release the spring leaves.
4. Clean (or preferably degrease) the leaves and carefully examine them for signs of failure or cracks. Only the main and second leaves are supplied as replacement, so that should any other leaf be faulty, the complete spring must be renewed.
5. The recambering of road springs is not advised, but if no alternative is possible, the spring should be reset, if necessary, either to a new spring or to the data set on Pages J-1 and J-3.
6. Grease each leaf with graphite grease and reassemble the spring by fitting the centre bolt and leaf clips; fit the spring bushes.

**Hydraulic dampers****To renew****Operation J/20**

If it is suspected that a shock absorber is not functioning satisfactorily, it should be removed and placed vertically in a vice, the lower eye being secured between the jaws of the vice. It should then be extended and compressed, when a uniform resistance throughout the stroke should be noted, in both directions. Should erratic or weak resistance be found, the shock absorber should be replaced.

**Note:** The resistance felt when extending the shock absorber is very much greater than that encountered when compressing it.

No attempt must be made to strip or adjust the hydraulic dampers; if any trouble is experienced, a new damper must always be fitted.

1. Withdraw the hydraulic damper complete with four tapered rubber bushes and retaining washers.
2. Renew the retaining washers as necessary.

3. Renew the rubber mounting bushes as necessary.

4. Fit the new damper with its outer sleeve uppermost.

The plain length of all shock absorber mounting tubes should be  $1\frac{3}{8}$  in. (33,34 mm), i.e., when the securing nut is fully tightened, the compressed overall length of the two rubber bushes in the damper lug must be  $1\frac{3}{8}$  in. (33,34 mm).

It is most important that this point be checked when fitting a new shock absorber or replacing the rubber bushes. If the tube is too long, suitable washers must be fitted over the tube, to reduce the compressed length of the bushes to the correct dimension.

**Note:**

IF THE RUBBER BUSHES ARE NOT CORRECTLY NIPPED OR IF THEY ARE NOT TIGHTENED WITH THE ROAD SPRING IN THE MID-WAY POSITION, PREMATURE FAILURE OF THE BUSHES WILL OCCUR.

On 1955-57 models the lower ends of the shock absorbers are secured to the spring bottom plates by means of plain washers and split pins.

With this type of fastening, the correct nip on the rubber bushes is predetermined by the position of the split pin hole.

A tubular piece of steel with a slot cut in it, will facilitate the compression of the rubber bushes and allow the insertion or removal of split pin.

**Bump rubber****To renew****Operation J/22**

1. Remove the bump rubber secured to the underside of the chassis member.
2. Fit the new bump rubber and secure with the two bolts and self-locking nuts.

**Rear axle check strap****To renew****Operation J/24**

1. Remove the fabric check strap, complete with two clamping plates.
2. Fit the new check strap by reversing the removal procedure; take care that the strap is fitted to the rear of the brake pipe protection plate.





# Section K – CHASSIS

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### Frame alignment

#### To check

#### Operation K/10

Figs. K-2 (Land-Rover 80, 86 and 88), K-3 and K-4 (Land-Rover 107 and 109) show the various dimensions that should be used as a guide in checking frame alignment. Fig. K-1 illustrates the diagonal measurements which may be taken to check the frame for "squareness". Extreme care must be taken when checking for malalignment.

When the body is removed, the frame may easily be checked against the measurements in Figs. K-1, K-2, K-3 and K-4. If the body is in position, measurements may be taken with the aid of a plumb-bob and chalk as follows:—

1. Place the vehicle on a level floor.
2. Hold the plumb line against one of the measuring points, with the bob slightly above the floor; mark the floor directly beneath the bob.
3. Repeat for other measuring points.
4. Move the vehicle away and measure between the chalk marks.

Care should be taken when measuring diagonals, that exactly corresponding points are used on each side of the frame.

### Front bumper

The channel-section front bumper is bolted to the chassis side members, so that it may be removed to facilitate repair after accidental damage.

### Rear drawbar

The rear drawbar is bolted to the chassis frame, so that it may be removed to facilitate repair after accidental damage.

### Battery and air cleaner support

#### To remove

#### Operation K/12

1. Remove the air cleaner. Section M.
2. Disconnect the battery cables.
3. Remove the battery cover.
4. Remove the battery.
5. Remove the battery and air cleaner support from the chassis frame (this action releases the battery earth lead).

#### To replace

#### Operation K/14

Reverse the removal procedure.

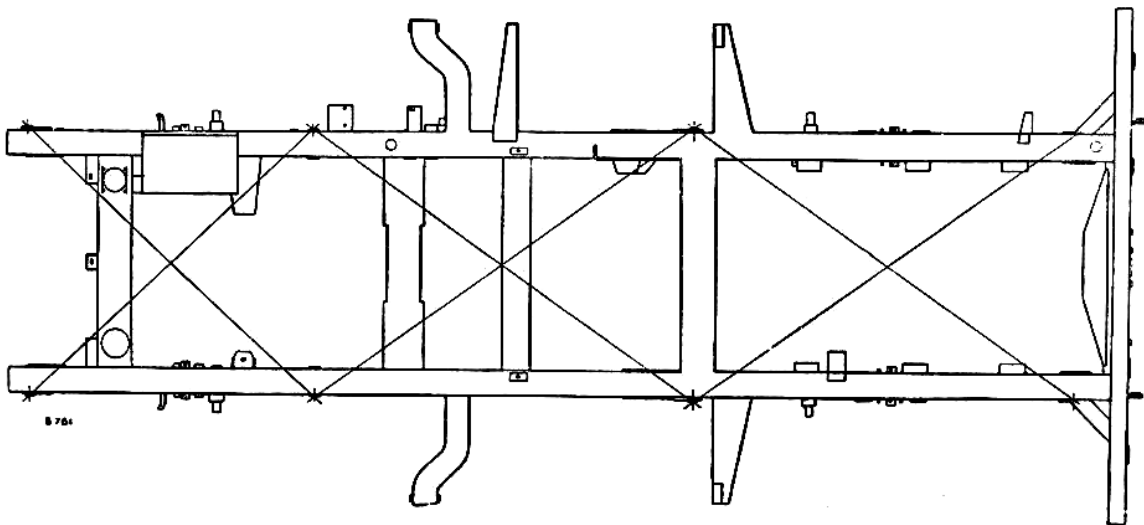


Fig. K-1—Chassis frame diagonal measurements.

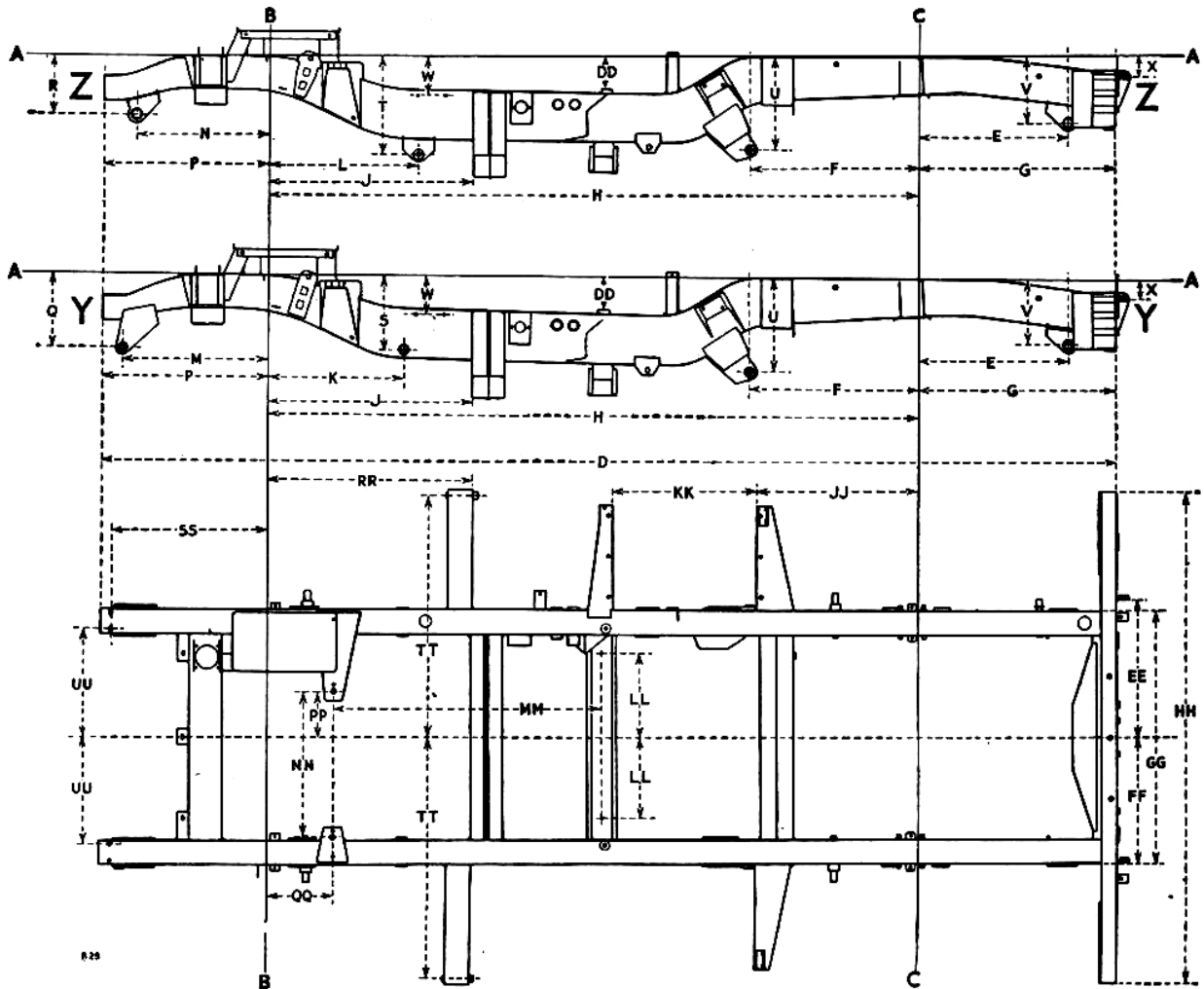


Fig. K-2—Chassis frame dimensions (Land-Rover 80)

Z—Vehicles numbered prior to 06113530, 06200410 and 06300031

Y—Vehicles numbered 06113530, 06200410 and 06300031 onwards

AA—Datum lines	Q—9 in. (228,6 mm)	JJ—20 in. (508 mm)
BB—Centre-line of front axle	R—7½ in. (181 mm)	KK—17½ in. (451 mm)
CC—Centre-line of rear axle	S—9 in. (228,6 mm)	LL—10½ in. ± ½ (257,2 mm ± 0,8 mm)
D—125 11/16 in. (3,193 m)	T—11¼ in. (298 mm)	MM—32¼ in. ± 1/16 (834,9 mm ± 0,8 mm)
E—19 in. (483 mm)	U—11½ in. (286 mm)	NN—17¼ in. ± 1/16 (450,7 mm ± 0,8 mm)
F—21 in. (533 mm)	V—7 7/8 in. (199,2 mm)	PP—5½ in. (139,7 mm)
G—25 1/16 in. (637 mm)	W—4¼ in. (120,6 mm)	QQ—8 in. (203,2 mm)
H—80 in. (2,032 m)	X—2 1/8 in. (52,4 mm)	RR—25 in. (635 mm)
J—24¼ in. (629 mm)	DD—3 7/8 in. (99,2 mm)	SS—19 11/16 in. (491 mm)
K—16½ in. (422 mm)	EE—16 11/16 in. (430 mm)	TT—29 1/8 in. ± 1/16 (747,6 mm ± 0,4 mm)
L—18 in. (457 mm)	FF—15¼ in. (387 mm)	UU—13 1/8 in. ± 1/16 (331,7 mm ± 0,8 mm)
M—18 in. (457 mm)	GG—31 in. (787 mm)	
N—16½ in. (422 mm)	HH—60½ in. (1,537 m)	
P—20 11/16 in. (523 mm)		

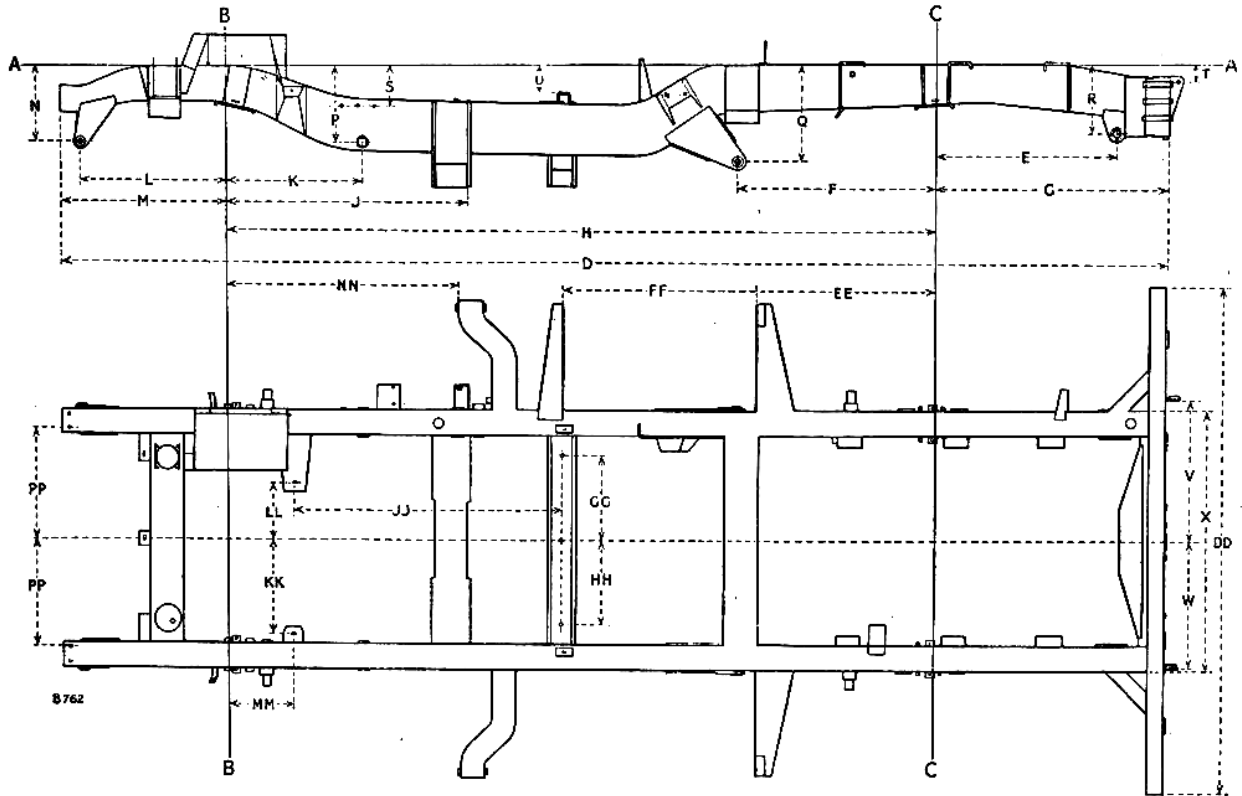


Fig. K-3—Chassis frame dimensions (Laud-Rovers 86 and 88).

- |   |  |
|---|--|
| AA—Datum line   | R—7 <sup>11</sup> / <sub>16</sub> in. (182 mm)                                       |
| BB—Centre line of front axle                            | S—4 <sup>1</sup> / <sub>2</sub> in. (121 mm)   |
| CC—Centre line of rear axle                             | T—2 <sup>1</sup> / <sub>8</sub> in. (52 mm)  |
| D—134 <sup>1</sup> / <sub>16</sub> in. (3,42 m)         | U—3 <sup>11</sup> / <sub>16</sub> in. (80,56 mm)                                     |
| E—21 <sup>1</sup> / <sub>2</sub> in. (540 mm)           | V—16 <sup>1</sup> / <sub>8</sub> in. (430 mm)  |
| F—24 in (610 mm)  | W—15 <sup>1</sup> / <sub>2</sub> in. (387 mm)  |
| G—28 <sup>1</sup> / <sub>4</sub> in. (713 mm)           | X—31 in. (787 mm)  |
| H—86 in. (2,18 m)—86 Models                             | DD—60 <sup>1</sup> / <sub>2</sub> in. (1,53 m)                                       |
| 88 in. (2,23 m)—88 Models                               | EE—21 <sup>1</sup> / <sub>2</sub> in. (552 mm)                                       |
| J—29 <sup>1</sup> / <sub>2</sub> in. (743 mm)—86 Models | FF—23 <sup>1</sup> / <sub>2</sub> in. (587 mm)                                       |
| 31 <sup>1</sup> / <sub>2</sub> in. (793,7 mm)—88 Models | GG—10 <sup>1</sup> / <sub>8</sub> in. ± <sup>1</sup> / <sub>16</sub> (257 mm ± 0,8)  |
| K—16 <sup>1</sup> / <sub>8</sub> in. (422 mm)—86 Models | HH—10 in. ± <sup>1</sup> / <sub>16</sub> (254 mm ± 0,8)                              |
| 18 <sup>1</sup> / <sub>8</sub> in. (473,1 mm)—88 Models | JJ—32 <sup>1</sup> / <sub>2</sub> in. ± <sup>1</sup> / <sub>16</sub> (835 mm ± 0,8)  |
| L—18 in. (457 mm)—86 Models                             | KK—11 <sup>1</sup> / <sub>8</sub> in. (294 mm)                                       |
| 17 in. (431,8 mm)—88 Models                             | LL—6 <sup>1</sup> / <sub>8</sub> in. (167 mm)  |
| M—20 <sup>1</sup> / <sub>4</sub> in. (523 mm)—86 Models | MM—8 in. (203 mm)—86 Models  |
| 18 <sup>1</sup> / <sub>4</sub> in. (472,2 mm)—88 Models | 10 in. (254 mm)—88 Models  |
| N—9 in. (229 mm)  | NN—28 <sup>1</sup> / <sub>2</sub> in. (718 mm)—86 Models                             |
| P—9 in. (229 mm)  | 30 <sup>1</sup> / <sub>2</sub> in. (765,2 mm)—88 Models                              |
| Q—11 <sup>1</sup> / <sub>8</sub> in. (291 mm)           | PP—13 <sup>1</sup> / <sub>8</sub> in. ± <sup>1</sup> / <sub>16</sub> (332 mm ± 0,50) |

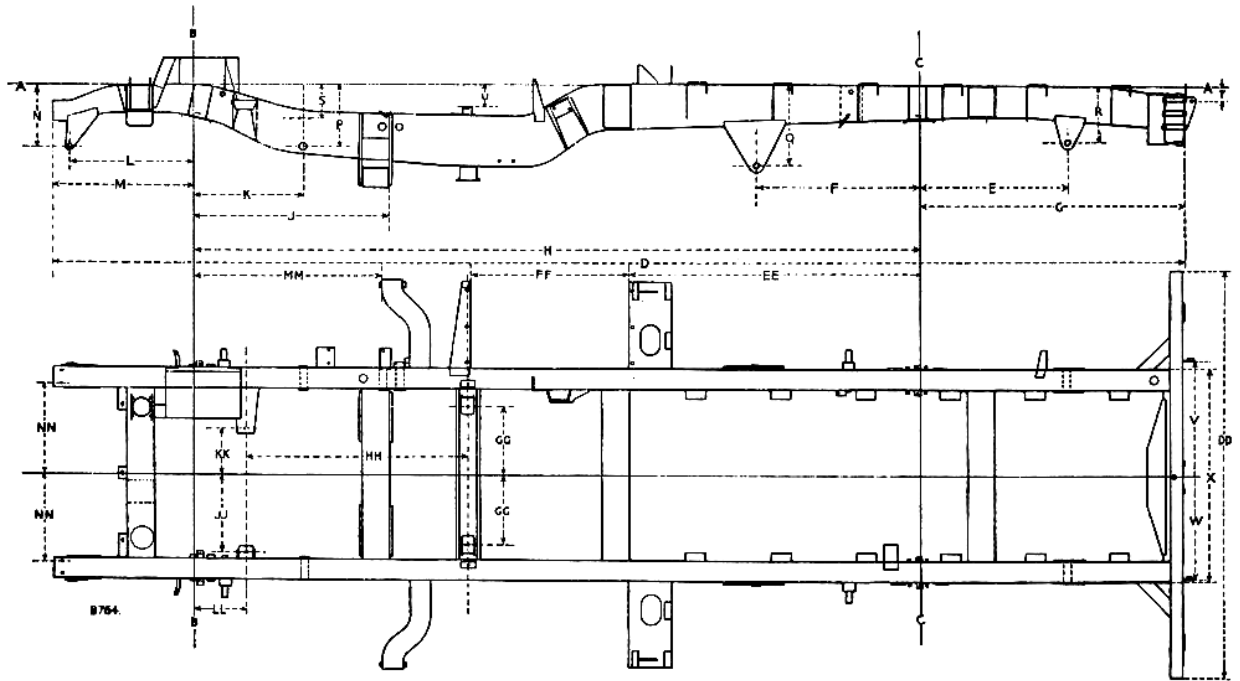


Fig. K-4—Chassis frame dimensions (Land-Rovers 107 and 109).

AA—Datum line	R— $8\frac{1}{8}$ in. (205 mm)
BB—Centre line of front axle	S— $4\frac{1}{2}$ in. (121 mm)
CC—Centre line of rear axle	T— $2\frac{1}{8}$ in. (52 mm)
D— $166\frac{1}{4}$ in. (4,24 m)	U— $3\frac{1}{4}$ in. (80,5 mm)
E— $21\frac{1}{4}$ in. (540 mm)	V— $16\frac{1}{8}$ in. (430 mm)
F—24 in. (610 mm)	W— $15\frac{1}{4}$ in. (387 mm)
G— $39\frac{1}{8}$ in. (1,00 m)	X—31 in. (787 mm)
H—107 in. (2,717 m)—107 Models 109 in. (2,768 m)—109 Models	DD— $60\frac{1}{2}$ in. (1,53 m)
J— $29\frac{1}{4}$ in. (743 mm)—107 Models $31\frac{1}{4}$ in. (793,8 mm)—109 Models	EE— $42\frac{1}{2}$ in. (1,086 m)
K— $15\frac{1}{2}$ in. (422 mm)—107 Models $18\frac{1}{2}$ in. (473,1 mm)—109 Models	FF— $23\frac{1}{2}$ in. (587 mm)
L—18 in. (457 mm)—107 Models 17 in. (431,8 mm)—109 Models	GG— $10\frac{1}{2}$ in. $\pm \frac{1}{8}$ (257 mm $\pm$ 0,8)
M— $20\frac{3}{4}$ in. (523 mm)—107 Models $18\frac{3}{4}$ in. (472,2 mm)—109 Models	HH— $32\frac{1}{2}$ in. $\pm \frac{1}{8}$ (835 mm $\pm$ 0,8)
N—9 in. (229 mm)	JJ— $11\frac{1}{8}$ in. (294 mm)
P—9 in. (229 mm)	KK— $6\frac{1}{8}$ in. (167 mm)
Q— $11\frac{1}{2}$ in. (297 mm)	LL—8 in. (203 mm)—107 Models 10 in. (228,6 mm)—109 Models
	MM— $28\frac{1}{4}$ in. (718 mm)—107 Models $30\frac{1}{4}$ in. (768 mm)—109 Models
	NN— $13\frac{1}{8}$ in. $\pm \frac{1}{8}$ (332 mm $\pm$ 0,50)

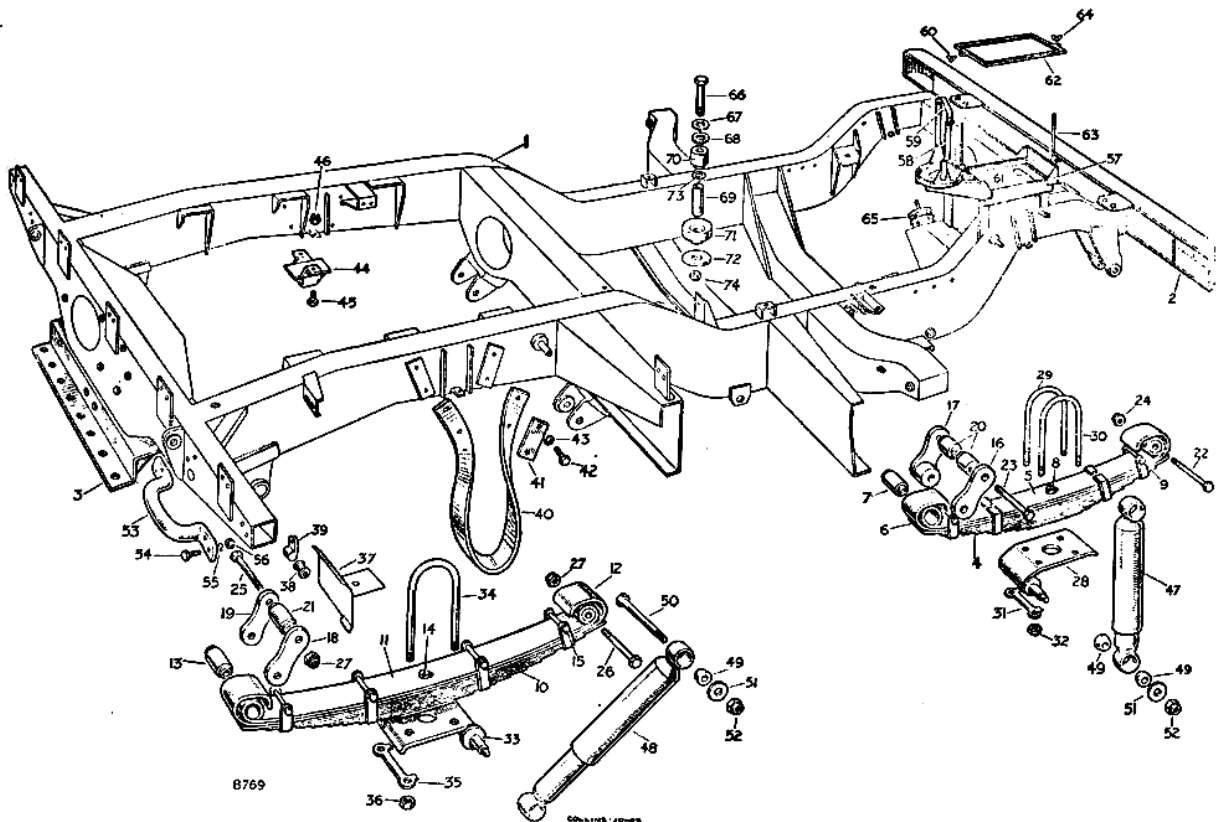


Fig. K-5—Layout of chassis frame.

- |       |                                       |       |   |
|-------|---------------------------------------|-------|---|
| 1     | Chassis frame                         | 37    | Shield for brake pipe, R.H.                     |
| 2     | Front bumper                          | 38    | Rubber grommet for brake pipe                   |
| 3     | Rear draw bar                         | 39    | Clip for grommet                                |
| 4     | Road spring complete, front, driver's | 40    | Check strap for rear axle                       |
| 5     | Main leaf } For front                 | 41    | Plate for check strap                           |
| 6     | 2nd leaf } spring                     | 42-43 | Fixings for check strap                         |
| 7     | Bush for front spring                 | 44    | Rubber buffer for axles, front and rear         |
| 8     | Dowel for front spring                | 45-46 | Fixings for buffers                             |
| 9     | Bolt } For spring                     | 47    | Shock absorber, front                           |
|       | Nut } clip                            | 48    | Shock absorber, rear                            |
| 10    | Road spring complete, rear, driver's  | 49    | Rubber bush for shock absorbers                 |
| 11    | Main leaf } For rear                  | 50-52 | Fixings for shock absorbers                     |
| 12    | 2nd leaf } spring                     | 53    | Lifting handle, rear                            |
| 13    | Bush for rear spring                  | 54-56 | Fixings for handles                             |
| 14    | Dowel for rear spring                 | 57    | Battery casing and air cleaner support complete |
| 15    | Bolt } For                            | 58    | Air cleaner clamp, side                         |
|       | Nut } spring clip                     | 59    | Air cleaner clamp, top                          |
| 16    | Shackle plate, tapped                 | 60    | Wing nut for clamp                              |
| 17    | Shackle plate, plain                  | 61    | Rubber strip for battery                        |
| 18    | Shackle plate, tapped                 | 62    | Battery cover                                   |
| 19    | Shackle plate, plain                  | 63    | Battery fixing rod                              |
| 20    | Bush in chassis frame, front spring   | 64    | Wing nut fixing battery                         |
| 21    | Bush in chassis frame, rear           | 65    | Suspension rubber for engine, front             |
| 22    | Shackle pin, front                    | 66    | Bolt, rear                                      |
| 23    | Shackle pin, springs to frame, front  | 67    | Plain washer, top                               |
| 24    | Self-locking nut, front               | 68    | Rubber washer                                   |
| 25    | Shackle pin, rear                     | 69    | Distance tube                                   |
| 26    | Shackle pin, springs to frame, rear   | 70    | Top rubber                                      |
| 27    | Self-locking nut, rear                | 71    | Bottom rubber                                   |
| 28    | Bottom plate for front spring, R.H.   | 72    | Plain washer, bottom                            |
| 29-32 | Fixings for front springs             | 73    | Shim  |
| 33    | Bottom plate for rear spring, R.H.    | 74    | Special nut                                     |
| 34-36 | Fixings for rear springs              |       |   |

Fixing engine unit to chassis frame at front and rear



# Section L — COOLING SYSTEM — ALL MODELS

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### Water pump—Petrol models

#### To remove Operation L/2

The following procedure for removing the water pump will be modified if an engine governor or heater unit is fitted. See Section T for details of these items of optional equipment.

1. Partially drain off the coolant.
2. Slacken the dynamo mounting bolts and adjusting link bolts and push the dynamo inwards.
3. Slacken the lower clip on the top hose and the clip securing the inlet manifold hose to the inlet elbow on the thermostat housing.
4. Remove the thermostat housing from the cylinder head complete with thermostat, outlet pipe, inlet elbow and joint washer.
5. Remove the copper tube and rubber joint ring from either the bottom face of the thermostat housing or the top face of the water pump casing.
6. Remove the fan blade, pulley (and distance piece if fitted).
7. Slacken the clip securing the bottom hose to the water pump inlet pipe and remove the bolt securing the pipe to the front cover.
8. Remove the water pump complete with joint washer and inlet pipe; as the pump casing is spigoted in the block, it will be necessary to oscillate it slightly as it is removed.
9. Remove the inlet pipe from the water pump.
10. The water pump may now be overhauled, Operation L/6, or exchanged for a Service Pump Assembly, obtainable from our Spares Department.

The Service Assembly comprises only the following parts:

- Water pump casing
  - Spindle, fan hub and bearing complete
  - Carbon ring and seal
  - Impeller
  - Spring washer
  - Set bolt
- } Locating the spindle bearing

Pumps must be stripped to this condition before they are returned for exchange.

#### To strip Operation L/4

1. Remove the bearing location bolt, place the pump in a vice and drift out the impeller bearing and spindle as an assembly from the pump body and from hub.
2. Cut through the seal and remove from spindle, insert the spindle into the water pump body, so that the impeller is in the position of the fan pulley. The spindle and bearing may now be drifted out of the impeller.

#### To assemble Operation L/6

1. Examine the spindle and bearing assembly; it need not be renewed if the bearing is satisfactory and the spindle is free from excessive corrosion. Clean any corroded portion of the spindle and paint with chlorinated rubber primer to prevent further action. (Part No. 261483 for half-pint tin). As an alternative, good quality aluminium paint or other anti-corrosive paint can be used in place of a rubber primer.
2. Insert a few drops of thick oil in the location hole in the bearing.

3. Press the spindle and bearing assembly into the front of the pump body with the longer end of the spindle leading. Locate it with the set bolt and spring washer.
  4. If the fan pulley hub has been removed, it must be pressed on to the spindle to a set dimension between the front face of the pulley hub and the mounting face of the water pump casing. This dimension must be: 4.140 in. (105 mm) on 1954-58 models or 4.215 in. (107 mm) on 1948-53 models.  
Care must be taken to set the hub to the correct dimension. When pressing on the hub, the spindle must be supported, to prevent pressure falling on the location set bolt.
  5. On 1954-58 models, fit the carbon ring and seal into the bore of the pump body with the carbon ring to the rear, and fit the rubber water deflector washer.
- On 1948-53 models fit the carbon ring and seal into the bore of the impeller with the carbon ring to the front.

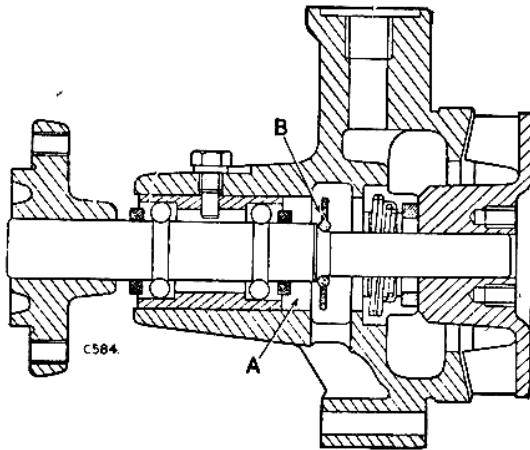


Fig. L-1. Cross-section of water pump,  
Petrol Models.

A—Through bore housing.  
B—Water deflector washer

6. Press the impeller on to the spindle until there is .020 in. (0.5 mm) clearance between the vanes and the pump body face (check with a feeler gauge). The impeller must be a *press fit* on the spindle. If the impeller is loose on the spindle, replace either part as necessary.
7. Refit the inlet pipe to the water pump.

#### To refit Operation L/8

To refit the water pump to the engine, reverse the removal procedure, noting the following points:—

1. Renew both joint washers.
2. When fitting the fan pulley, first engage the fan belt in the pulley groove.

3. On completion, run the engine and check and rectify any leaks.

#### Thermostat, Petrol models

If the thermostat becomes faulty in operation, overheating of the engine will usually result. To check the thermostat, remove it from its housing and run the engine; if the overheating is eliminated, the unit is faulty and must be renewed. Further tests may be made by immersing the thermostat in hot water, whereon expansion of the bellows should commence between 162°F (72°C) and 171°F (77°C) and be completed at 191°F (88°C).

#### To renew Operation L/10

1. Partially drain off the coolant and remove the top hose.
2. Remove the water outlet pipe from the top of the thermostat housing.
3. Lift out the thermostat from the housing, together with a fibre joint washer, above and below its flange.
4. Fit the new thermostat, together with two new joint washers.
5. Replace the water outlet pipe and top hose.
6. Refill the coolant system to the bottom of the radiator filler neck and check for leaks.

#### Water pump, Diesel models

#### To remove Operation L/12

1. Partially drain off coolant.
2. Slacken the dynamo mounting bolts and adjusting link bolts and push the dynamo inwards.
3. Disconnect the hoses from pump.
4. Remove the fan blade, pulley and distance piece.
5. Remove the water pump complete with joint washer.
6. The water pump may now be overhauled or exchanged for a Service Pump Assembly, obtainable from our Spares Department.

The Service Assembly comprises only the following parts:

Water pump casing	
Spindle, fan hub and bearing complete	
Carbon ring and seal	
Impeller	
Spring washer	} Locating the spindle bearing
Set bolt	

Pumps must be stripped to this condition before they are returned for exchange.



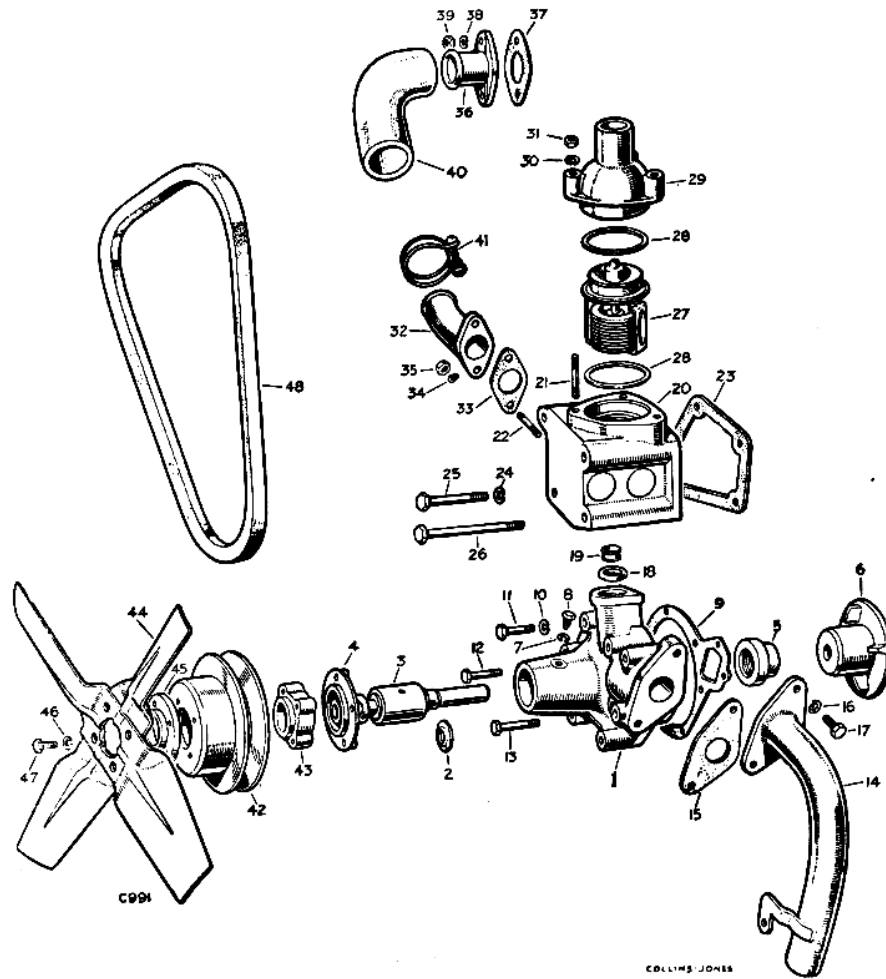


Fig. L-2—Layout of water pump, thermostat and coolant pipes, Petrol Models.

- |       |                                     |       |   |
|-------|-------------------------------------|-------|---|
| 1     | Water pump casing                   | 24-26 | Fixings for thermostat housing            |
| 2     | Water deflector washer              | 27    | Thermostat                                |
| 3     | Pump spindle and bearing            | 28    | Fibre washer for thermostat               |
| 4     | Hub for fan                         | 29    | Water outlet pipe, thermostat to radiator |
| 5     | Carbon ring and seal unit           | 30-31 | Fixings for outlet pipe                   |
| 6     | Impeller for pump                   | 32    | Water inlet elbow to thermostat           |
| 7     | Spring washer                       | 33    | Joint washer for inlet elbow              |
| 8     | Set bolt                            | 34-35 | Fixings for elbow                         |
| 9     | Joint washer for water pump         | 36    | Water outlet pipe from manifold           |
| 10-13 | Fixings for water pump              | 37    | Joint washer for outlet pipe              |
| 14    | Inlet pipe for water pump           | 38-39 | Fixings for water outlet pipe             |
| 15    | Joint washer for inlet pipe         | 40    | Rubber hose                               |
| 16-17 | Fixings for pipe                    | 41    | Clip for hose                             |
| 18    | Rubber joint ring                   | 42    | Fan pulley                                |
| 19    | Copper tube                         | 43    | Distance piece for fan pulley             |
| 20    | Thermostat housing assembly         | 44    | Fan blade                                 |
| 21    | Stud for outlet pipe                | 45    | Reinforcing plate for fan blade           |
| 22    | Stud for inlet pipe                 | 46-47 | Fixings for fan blade and pulley          |
| 23    | Joint washer for thermostat housing | 48    | Fan and dynamo belt                       |

**To strip****Operation L/14**

1. Remove the bearing location bolt, place the pump in a vice and drift out the impeller bearing and spindle as an assembly from the pump body and from hub.
2. Cut through the seal and remove from spindle, insert the spindle into the water pump body, so that the impeller is in the position of the fan pulley. The spindle and bearing may now be drifted out of the impeller.

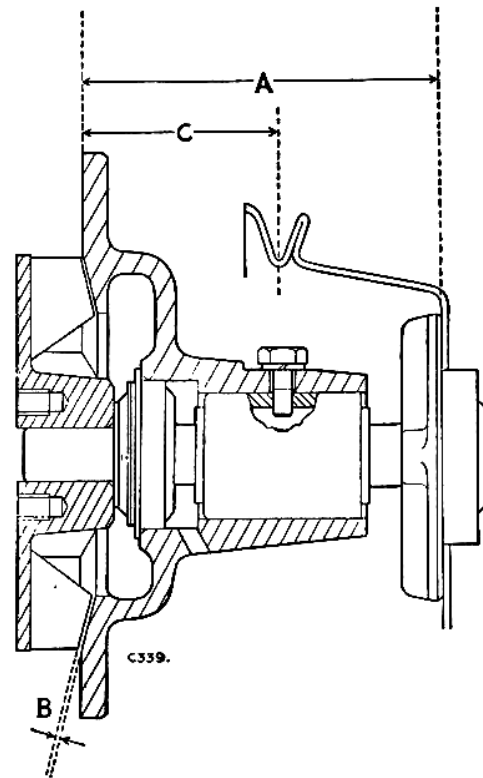
**To assemble****Operation L/16**

1. Examine the spindle and bearing assembly; it need not be renewed if the bearing is satisfactory and the spindle is free from excessive corrosion. Clean any corroded portion of the spindle and paint with chlorinated rubber primer to prevent further action. (Part No. 261483 for half-pint tin.) As an alternative, good quality aluminium paint or other anti-corrosive paint can be used in place of a rubber primer.
2. Insert a few drops of thick oil in the location hole in the bearing.
3. Press the spindle and bearing assembly into the front of the pump body with the longer end of the spindle leading. Locate it with the set bolt and spring washer.
4. If the fan pulley hub has been removed, it must be pressed on to the spindle to a set dimension between the front face of the pulley hub and the mounting face of the water pump casing. This dimension must be: 3.453 in. (86,36 mm). Care must be taken to set the hub to the correct dimensions. When pressing on the hub, the spindle must be supported, to prevent pressure falling on the location set bolt.
5. Fit the carbon ring and seal into the bore of the pump body with the carbon ring to the rear.
6. Press the impeller on to the spindle until there is .020 in. (0,5 mm) clearance between the vanes and the pump body face (check with a feeler gauge). The impeller must be a *press fit* on the spindle. If the impeller is loose on the spindle, replace either part as necessary.
7. Refit the inlet pipe to the water pump.

**To refit****Operation L/18**

To refit the water pump to the engine, reverse the removal procedure, noting the following points:—

1. Renew joint washer.
2. When fitting the fan pulley, first engage the fan belt in the pulley groove.
3. On completion, run the engine and check and rectify any leaks.



**Fig. L-3—Cross-section of water pump,  
Diesel Models**

A—3.453 in. (86 mm)    B—.020 in. (0,508 mm)  
C—1.875 in. (47,625 mm)

**Thermostat, Diesel models**

If the thermostat becomes faulty in operation, overheating or overcooling of the engine may result. To check the thermostat, remove it from its housing and run the engine; if the coolant temperature remains unchanged, the unit is faulty and should be renewed. See important note on page L-8.

Further tests may be made by immersing the thermostat in hot water, whereon expansion of the bellows should commence between 164°F (73°C) and 173°F (78°C) and be complete at 193°F (89°C).

**To renew****Operation L/20**

1. Partially drain off the coolant, disconnect the top and by-pass hoses from the thermostat cover —also the heater hose if fitted—and remove the cover.
2. Lift out the thermostat from its housing and fit the new one.
3. Replace the top cover and re-connect the hoses.
4. Refill the coolant system to the bottom of filler neck and check for leaks.

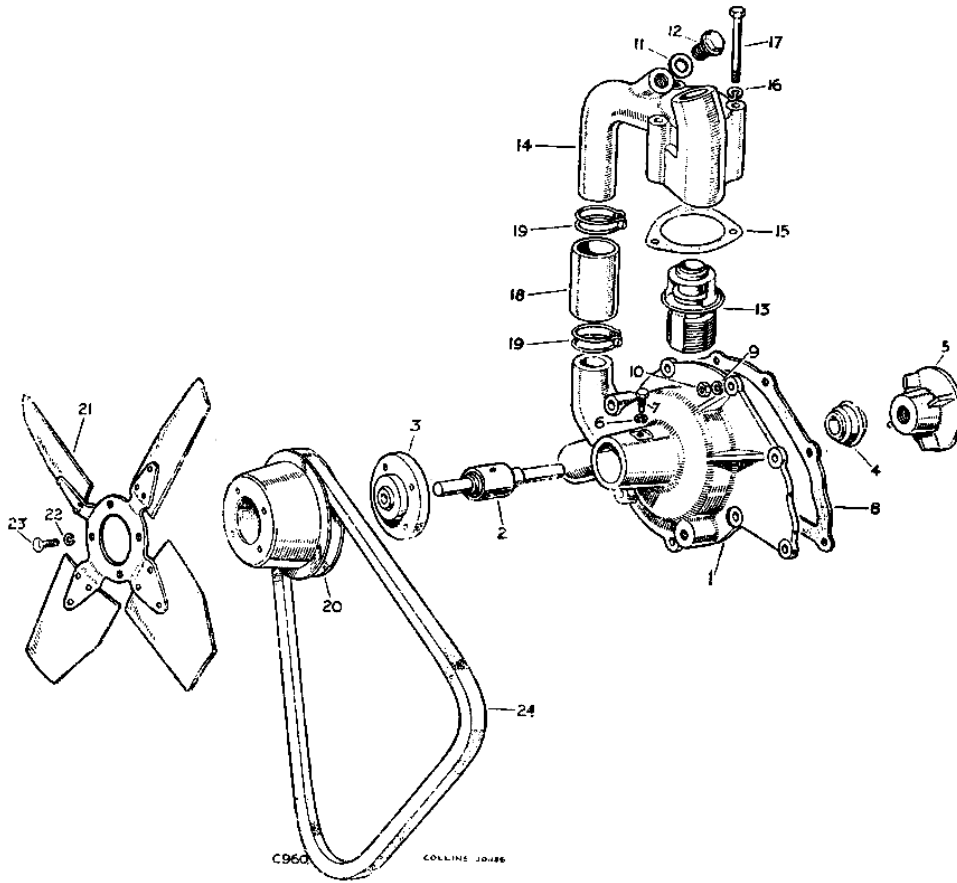


Fig. L-4—Layout of pump, thermostat and fan, Diesel Models.

- |    |  |    |                         |
|----|--|----|-------------------------|
| 1  | Water pump casing                            | 13 | Thermostat              |
| 2  | Spindle and bearing assembly                 | 14 | Outlet pipes and cover  |
| 3  | Pulley hub                                   | 15 | Joint washer for cover  |
| 4  | Seal   | 16 | Spring washer } for     |
| 5  | Impeller                                     | 17 | Set bolt } casing       |
| 6  | Spring washer } locating spindle             | 18 | By-pass hose            |
| 7  | Set bolt } and bearing                       | 19 | Clip                    |
| 8  | Joint washer                                 | 20 | Pulley                  |
| 9  | Spring washer } for                          | 21 | Fan blades              |
| 10 | Nut } casing                                 | 22 | Spring washer } for fan |
| 11 | Joint washer for plug } for heater return in | 23 | Set bolt } blades       |
| 12 | Plug } water outlet pipe                     | 24 | Driving belt            |

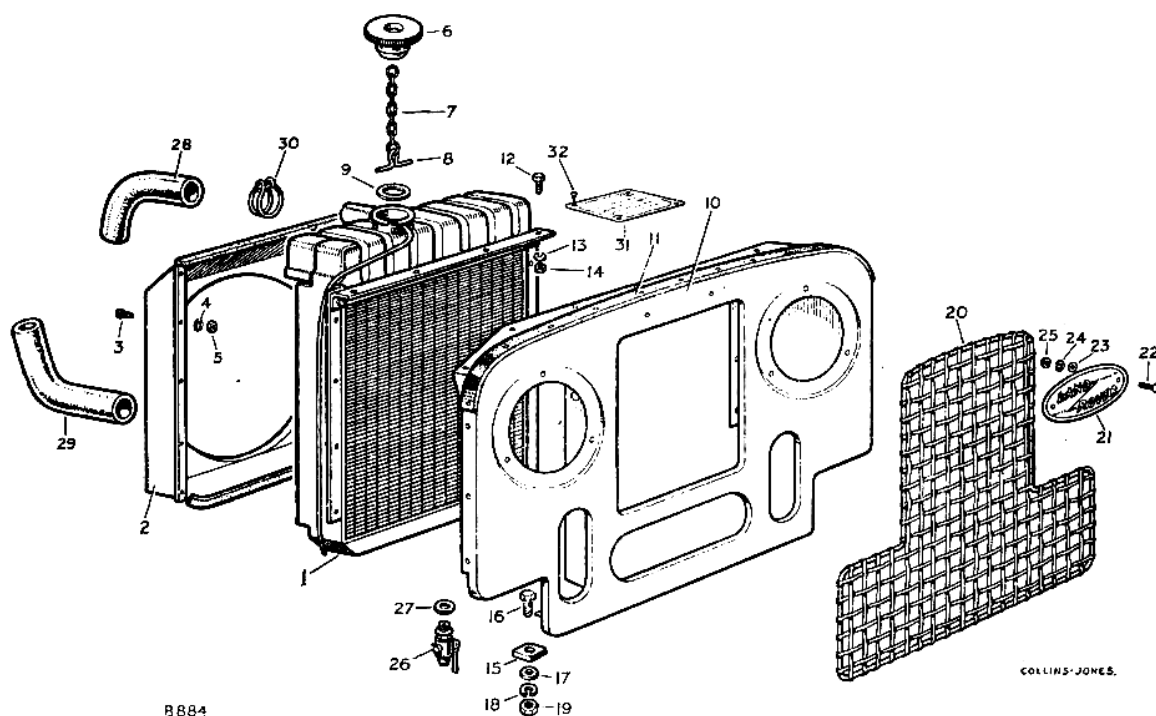


Fig. L-5—Layout of radiator and grille panel.

- |       |                                |       |                                   |
|-------|--------------------------------|-------|-----------------------------------|
| 1     | Radiator block assembly        | 15-19 | Fixings for grille panel          |
| 2     | Cowl for fan                   | 20    | Grille for radiator               |
| 3-5   | Fixings for cowl               | 21    | "Land-Rover" name plate           |
| 6     | Filler cap for radiator        | 22-25 | Fixings for grille and name plate |
| 7     | Chain for filler cap           | 26    | Drain tap for radiator            |
| 8     | Retainer for chain             | 27    | Joint washer for drain tap        |
| 9     | Joint washer for filler cap    | 28    | Hose for radiator, top            |
| 10    | Radiator grille panel assembly | 29    | Hose for radiator, bottom         |
| 11    | Bonnet rest strip              | 30    | Clip for radiator hoses           |
|       | Bifurcated rivet fixing strip  | 31    | Oil recommendation plate          |
| 12-14 | Fixings for radiator block     | 32    | Drive screw fixing plate          |

### Visual inspection

It is a good plan to inspect the cooling system at the same time as the engine oil level is checked; such care would largely prevent the possibility of a sudden and costly delay due to coolant loss and consequent engine damage. Attention should be paid to the following points:—

1. Water level in radiator—to the bottom of the filler neck.
2. Condition of all hoses—freedom from cracks and hose clips tight.
3. Any water leaks.
4. Check that the drain taps are fully closed.

As the cooling system is pressurised, the vehicle must not be run without the radiator cap in position. When removing cap follow instructions on top.

### Tests and adjustments

#### Fan belt

The fan belt is of the "V" type, drive is on the sides of the belt and it is not therefore necessary to adjust it tightly and so put an excessive load on the water pump and dynamo bearings; the tension is correct when the belt can be depressed  $\frac{7}{16}$  to  $\frac{7}{8}$  in. (8 to 11 mm)—Diesel models, and  $\frac{1}{2}$  to  $\frac{3}{4}$  in. (12 to 19 mm)—Petrol models by thumb pressure between the fan and crankshaft pulleys. The procedure for adjustment is as follows:—

Slacken the dynamo pivot bolts and the bolt securing the dynamo to the adjusting link. Move the dynamo outwards until the tension is correct and re-tighten the bolts.

#### Thermostat

See pages L-2 and L-4 of this section.

#### Draining the cooling system

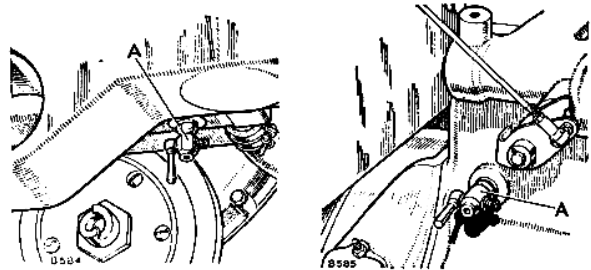
The cooling system should be drained and flushed out at least twice each year in the following manner:

1. Remove the radiator filler cap.
2. Open the water drain taps at the bottom of the radiator and on the left-hand side of the cylinder block.
3. When the water flow has ceased, insert a piece of wire in each tap to make sure that a blockage has not been caused by rust or scale.
4. Place a hose in the radiator filler neck and fill the system; adjust the flow of water to equal that draining from the taps.
5. Run the engine for a short time to ensure thorough cleaning of the whole system.
6. Stop the engine, remove the hose and close the taps. Refill the system with clean water to the bottom of the filler neck and replace the filler cap.

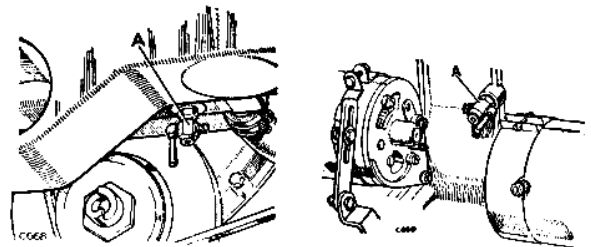
The total capacity of the cooling system is: Petrol and Diesel models—17 Imperial pints (9,7 litres).

*Note:* Use soft water wherever possible; if the local water supply is hard, clean rain or distilled water should be used.

7. Run the engine until working temperature is reached and top the water level as necessary.



A—Drain taps—Petrol Models.



A—Drain taps—Diesel Models.

Fig. L-6—Radiator drain taps.

#### Cleaning radiator—externally

In the event of the cooling gills of the radiator becoming blocked with dirt, straw, etc., they should be cleaned by means of compressed air or water pressure applied from the rear, so forcing the foreign matter out through the front of the radiator. Never use a metal implement for this purpose or serious damage may result to the radiator core.

#### Frost precautions

In cold weather, when the temperature may drop to or below freezing point, precautions must be taken to prevent freezing of the water in the cooling system.

A thermostat is fitted in the system and it is therefore possible for the radiator block to freeze in cold weather even though the engine running temperature is quite high; for this reason the use of an anti-freeze mixture is essential.

Only high quality inhibited glycol-based solutions should be used.

When the temperature is between 32° F and 0° F (0° C and minus 17° C) use one part of anti-freeze to four parts of water.

Proceed as follows:—

1. Ensure that the cooling system is leak-proof; anti-freeze solutions are far more "searching" at joints than water.
2. Drain and flush the system. See "Draining the cooling system"
3. Mix the solution to the required strength in a separate container and refill the system.

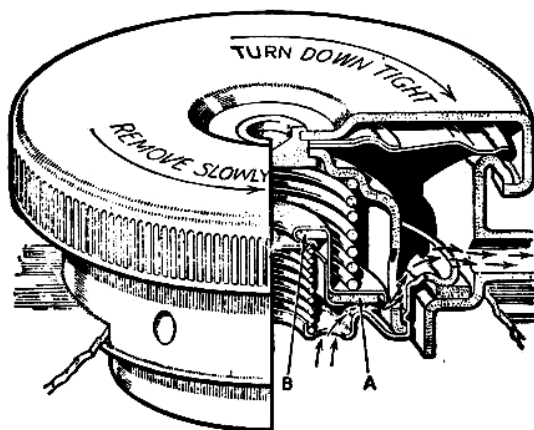


Fig. L-7—Radiator filler cap.

A—Pressure relief valve (steam escape).  
B—Depression relief valve.

4. Run the engine to ensure good circulation of the mixture.

If the vehicle is to be stored in cold weather, unless it is kept in a well-heated garage or anti-freeze solution has been used, the cooling system must be completely drained.

#### Radiator

To remove Operation L/22

1. Drain off the coolant.  
*Note:* Diesel models only—Disconnect the lead coupling the two batteries.
2. Disconnect the top and bottom hoses from the radiator.
3. On 1954-58 models disconnect the side lamp leads at snap connectors at each side of the grille panel assembly and the front lamp harness from the junction box at right-hand side of scuttle, then pull the wiring clear to front of engine.

On 1948-53 models disconnect the headlamp and horn wiring from the junction box on the dash panel and pull the wiring clear to the front of the engine.

4. Remove the radiator grille and chaff guard (if fitted) from the grille panel complete with the name plate.
5. Remove the fan blades.
6. Remove the bolts securing the front apron and remove panel. Remove the bolts securing the grille panel to the front cross-member and front wings.
7. Lift the radiator, grille panel and headlamps assembly upward, then forward to clear the vehicle.
8. Remove the rubber buffers from beneath the grille panel.
9. Remove the radiator block from the grille panel.
10. Remove the drain tap and joint washer from the bottom of the radiator block.
11. Remove the filler cap, complete with the joint washer, retainer and chain.

To refit

Operation L/24

1. Reverse the removal procedure, replacing the rubber buffers, if necessary, and connecting the wiring in accordance with the appropriate wiring diagram—Section P.

It is important to fully tighten the radiator cap. As the cooling system is pressurised, the radiator cap must be fully tightened, not left loose or just turned to the first stop, but tightened right down by turning clockwise as far as possible.

Failure to do so will result in the water rapidly boiling away with possible seizure and damage to the engine due to overheating.

It is equally important to take great care when removing the radiator filler cap, especially when the engine is hot, to avoid steam which may be blown out with considerable force.

When removing the filler cap, first turn it anti-clockwise to the stop and allow all pressure to escape before pressing it down and turning further in the same direction to lift it off.

#### Important

On no account must Diesel engines be run without water circulating through the cylinder block and cylinder head even for a few seconds, since lacquer formation would quickly render the injectors useless.

When water is drained a label must be attached to the steering column stating: "No water in cooling system—on no account must the engine be started until the cooling system is refilled."

**DEFECT LOCATION**

**Symptom, Cause and Remedy**

**A—EXTERNAL LEAKAGE**

1. Loose hose clips—*Tighten.*
2. Defective rubber hose—*Renew.*
3. Damaged radiator seams—*Rectify.*
4. Excessive wear in the water pump—*Renew.*
5. Loose core plugs—*Renew.*
6. Damaged gaskets—*Renew.*
7. Leak at the heater connections or plugs—*Rectify.*
8. Leak at the water temperature gauge plug—*Tighten.*
9. Diesel only—leak from either of the four small holes in L.H. side of cylinder block—*Fit new sealing rings to liner Section A.*

**B—INTERNAL LEAKAGE**

1. Defective cylinder head gasket—*Renew, check engine oil for contamination and refill as necessary.*
2. Cracked cylinder bore or liner—*Renew cylinder block (or Diesel) liner.*
3. Loose cylinder head bolts—*Tighten. Check engine oil for contamination and refill as necessary.*

**C—WATER LOSS**

1. Overfilling—*See Instruction Manual for filling instructions.*
2. Boiling—*Ascertain the cause of engine overheating and correct as necessary.*
3. Internal or external leakage—*See items A and B.*
4. Restricted radiator or inoperative thermostat—*Flush radiator and renew the thermostat as necessary.*

**D—POOR CIRCULATION**

1. Restriction in system—*Check hoses for crimps, and flush the radiator.*
2. Insufficient coolant—*Replenish.*
3. Inoperative water pump—*Renew.*
4. Loose fan belt—*Adjust.*
5. Inoperative thermostat—*Renew.*

**E—CORROSION**

1. Excessive impurity in the water—*Use only soft, clean water (rainwater is satisfactory).*
2. Infrequent flushing and draining of system—*The cooling system should be drained and flushed thoroughly at least twice a year.*
3. Incorrect anti-freeze mixtures—*Certain anti-freeze solutions have a corrosive effect on parts of the cooling system. Only good glycol-base solutions should be used.*

**F—OVERHEATING**

1. Poor circulation—*See item D.*
2. Dirty oil and sludge in engine—*Flush and refill.*
3. Radiator fins choked with chaff, mud, etc.—*Use air pressure from the engine side of the radiator and clean out passages thoroughly.*
4. Incorrect injection pump or ignition timing—*Section A.*
5. Incorrect valve timing—*Section A.*
6. Low oil level—*Replenish.*
7. Tight engine—*New engines are very tight during the "running-in" period and moderate speeds should be maintained for the first 1,000 miles (1,500 km).*
8. Choked or damaged exhaust pipe or silencer—*Rectify or renew.*
9. Dragging brakes—*Check cause—Section H.*
10. Overloading vehicle—*In the hands of the operator.*
11. Driving in heavy sand or mud—*In the hands of the operator.*
12. Engine labouring on grades—*In the hands of the operator.*
13. Low gear work—*In the hands of the operator.*
14. Excessive engine idling—*In the hands of the operator.*

**G—OVERCOOLING**

1. Defective thermostat—*Renew.*

**DATA**

**Capacity of cooling system—**

**Petrol and Diesel models**

17 Imperial pints (9,75 litres)

**Radiator**

Filler cap pressure valve opens at:

Petrol models .... 3.25 to 4.25 lb/sq. in.  
(0,22 to 0,29 Kg/cm<sup>2</sup>)

Diesel models .... 10 lb/sq.in. (0,703 Kg/cm<sup>2</sup>)

Filler cap vacuum valve

opens at .... 1 lb/sq.in. (0,07 Kg/cm<sup>2</sup>)

**Thermostat**

Type .... Bellows

**Opening temperature—**

Petrol models

Commences at .... 162° to 171°F (72°-77°C)

Fully open at .... 191°F (88°C)

**Opening temperature—**

Diesel models

Commences at .... 164° to 173°F (73°-78°C)

Fully open at .... 193°F (89°C)

**Water pump**

Type .... Centrifugal impeller

Dimensions between front face of pulley and mounting face of pump body:

1948-53 Petrol models 4.215 in. (107 mm)

1954-58 Petrol models 4.140 in. (105 mm)

Diesel models .... 3.453 in. (86 mm)

Clearance between

impeller vanes and

pump body .... .020 in. (0,5 mm)





## Section M — FUEL SYSTEM — ALL MODELS

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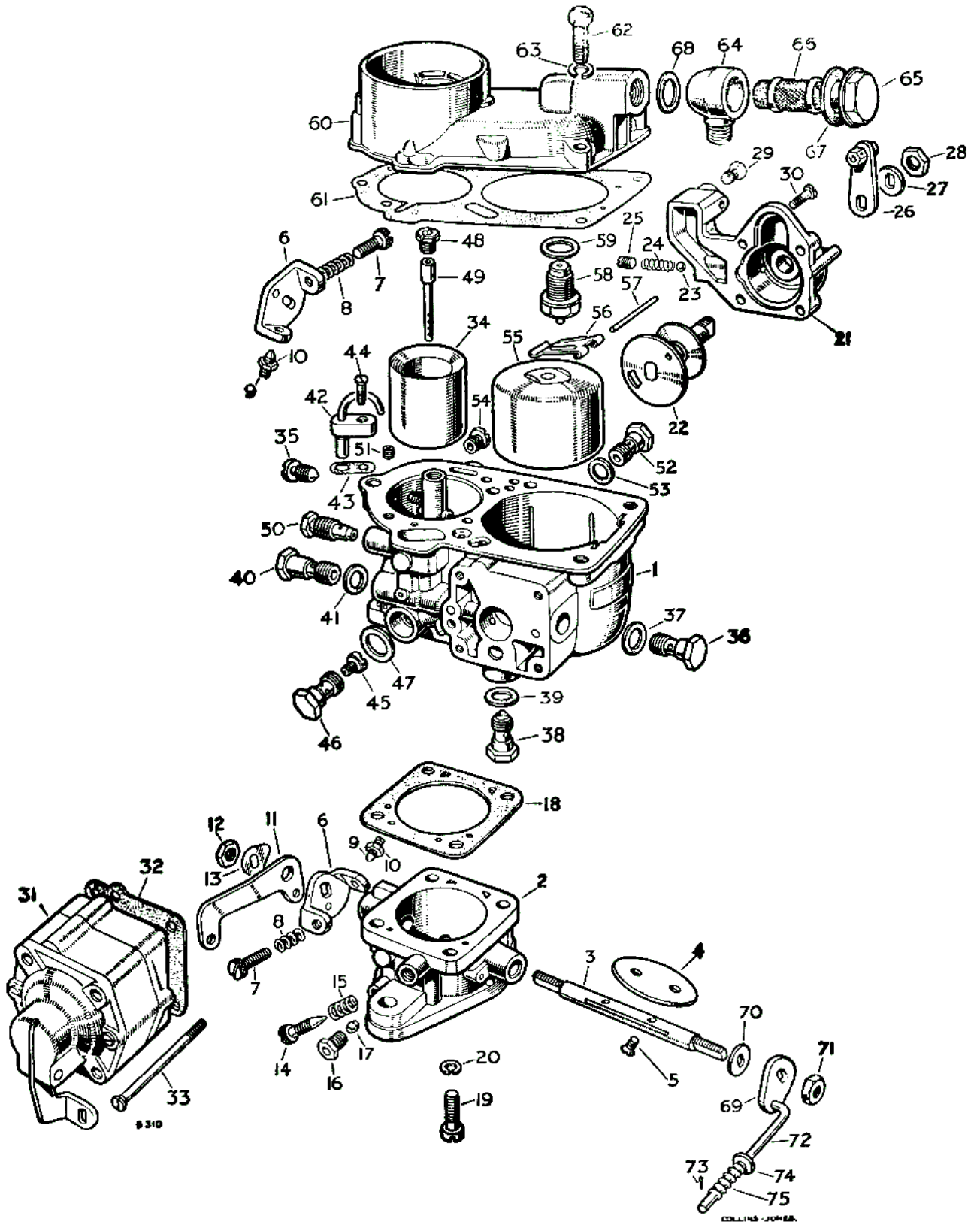


Fig M-1—Layout of carburetor, Petrol Models

Key to Fig. M-1

- |       |                                     |                                  |                                  |                            |
|-------|-------------------------------------|----------------------------------|----------------------------------|----------------------------|
| 1     | Carburetter body                    | 39                               | Fibre washer for valve           |                            |
| 2     | Throttle chamber                    | 40                               | Jet (75) accelerator pump        |                            |
| 3     | Spindle for throttle                | 41                               | Fibre washer for jet             |                            |
| 4     | Butterfly for throttle              | 42                               | Pump injector                    |                            |
| 5     | Special screw fixing butterfly      | 43                               | Joint washer for pump injector   |                            |
| 6     | Plate, throttle abutment            | 44                               | Special screw fixing injector    |                            |
| 7     | Special screw                       | } For slow running<br>adjustment | 45                               | Main jet (115)             |
| 8     | Spring                              |                                  | 46                               | Bolt, main jet carrier     |
| 9     | Special screw                       | } For throttle<br>stop           | 47                               | Fibre washer for bolt      |
| 10    | Locknut                             |                                  | 48                               | Correction jet (170)       |
| 11    | Throttle lever                      | 49                               | Emulsion tube                    |                            |
| 12    | Nut fixing throttle lever           | 50                               | Pilot jet (55)                   |                            |
| 13    | Lockwasher for nut                  | 51                               | Jet air bleed (1.5)              |                            |
| 14    | Special screw                       | } For mixture<br>control         | 52                               | Starter jet, petrol (135)  |
| 15    | Spring                              |                                  | 53                               | Fibre washer for jet       |
| 16    | Screwed union                       | } For suction<br>pipe            | 54                               | Starter jet, air (5.5)     |
| 17    | Olive                               |                                  | 55                               | Float                      |
| 18    | Joint washer for throttle chamber   | 56                               | Toggle for float                 |                            |
| 19-20 | Fixings for chamber                 | 57                               | Spindle for toggle               |                            |
| 21    | Starter body                        | 58                               | Needle valve complete            |                            |
| 22    | Starter valve complete              | 59                               | Fibre washer for valve           |                            |
| 23    | Ball                                | } For starter<br>valve           | 60                               | Top cover for carburetter  |
| 24    | Spring                              |                                  | 61                               | Joint washer for top cover |
| 25    | Plug retaining starter valve spring | 62                               | Special screw fixing top cover   |                            |
| 26    | Lever for starter                   | 63                               | Spring washer for screw          |                            |
| 27    | Special washer for lever            | 64                               | Banjo union                      |                            |
| 28    | Nut fixing starter lever            | 65                               | Special bolt for union           |                            |
| 29    | Special bolt fixing starter cable   | 66                               | Filter gauze for union           |                            |
| 30    | Special screw fixing starter body   | 67                               | Fibre washer, large              | } For<br>union             |
| 31    | Accelerator pump complete           | 68                               | Fibre washer, small              |                            |
| 32    | Joint washer for pump               | 69                               | Lever for accelerator pump rod   |                            |
| 33    | Special screw fixing pump           | 70                               | Special washer for lever         |                            |
| 34    | Choke tube (25)                     | 71                               | Nut fixing lever to spindle      |                            |
| 35    | Special screw fixing choke tube     | 72                               | Control rod for accelerator pump |                            |
| 36    | Jet economy (50)                    | 73                               | Split pin                        | } For control<br>rod       |
| 37    | Fibre washer for jet                | 74                               | Plain washer                     |                            |
| 38    | Non-return valve                    | 75                               | Spring                           |                            |

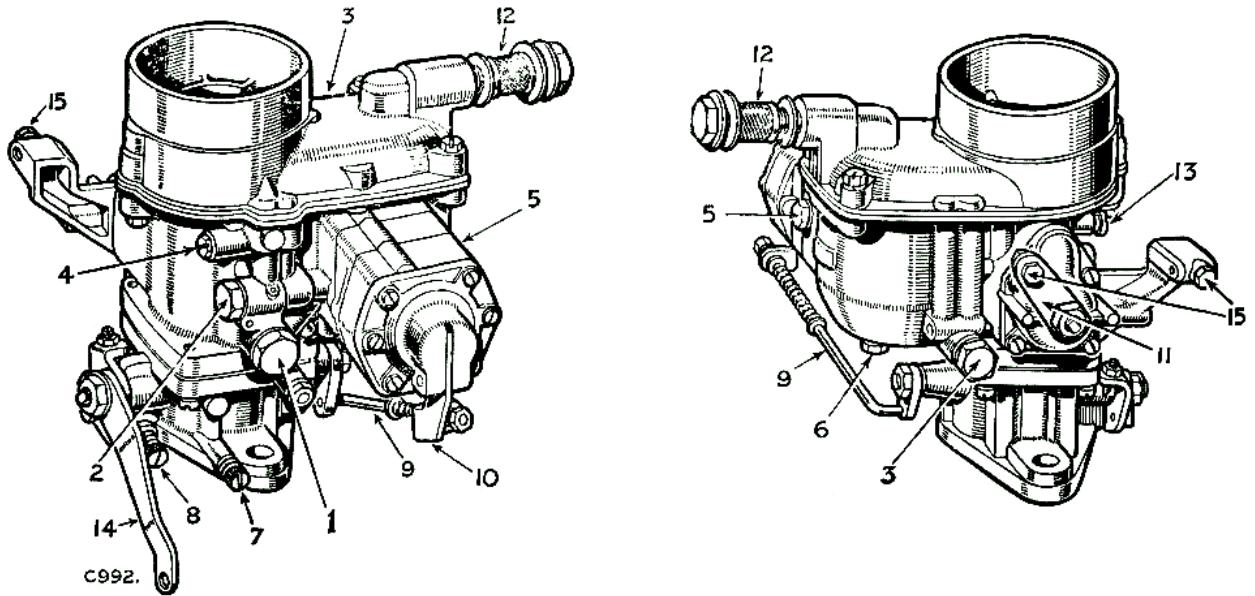


Fig. M-2—Carburettor jets and controls, Petrol models

- |                        |                           |                                    |
|------------------------|---------------------------|------------------------------------|
| 1 Main jet             | 6 Non-return valve        | 11 Lever for starter               |
| 2 Accelerator pump jet | 7 Mixture control         | 12 Banjo union                     |
| 3 Starter jet, petrol  | 8 Slow running adjustment | 13 Special screw fixing choke tube |
| 4 Pilot jet            | 9 Pump operating rod      | 14 Throttle lever                  |
| 5 Economy jet          | 10 Pump operating lever   | 15 Cold start cable clamping bolts |

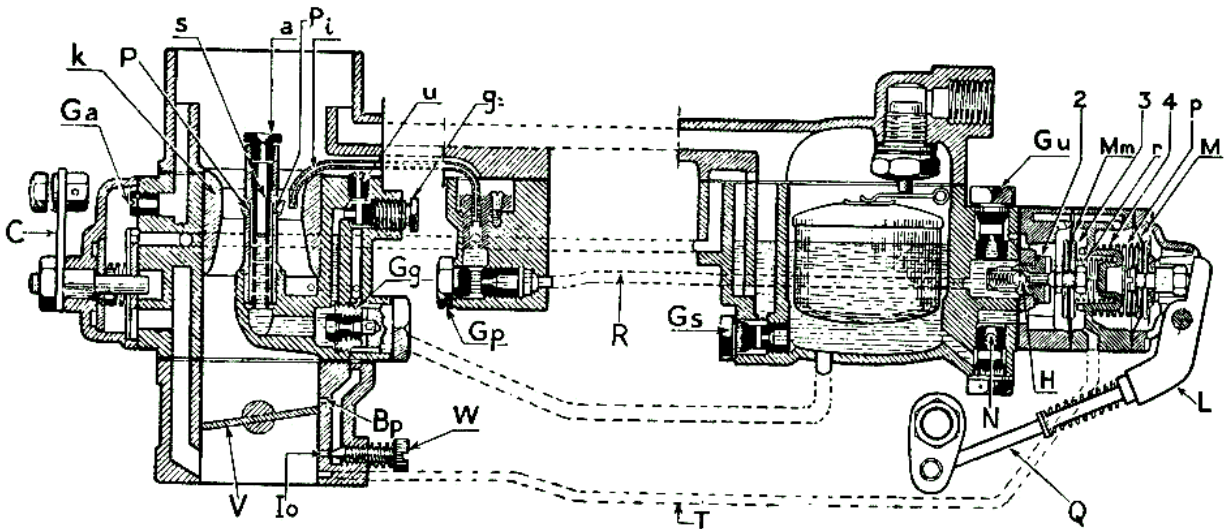


Fig. M-3—Diagrammatic section of carburettor.

- |                                  |                                    |
|----------------------------------|------------------------------------|
| a—Air correction jet             | L—Accelerator pump operating lever |
| A—Slow running adjustment screw  | M—Accelerator pump membrane        |
| Bp—Slow running duct             | Mm—Economy action membrane         |
| C—Bi-starter operating lever     | N—Non-return valve                 |
| D—Main jet carrier               | p—Spring for membrane M.           |
| g—Pilot jet                      | P—Emulsion tube orifices           |
| Ga—Starter air jet               | Q—Accelerator pump operating rod   |
| Gg—Main jet                      | r—Spring for membrane Mm           |
| Gp—Speed jet                     | R—Accelerator pump delivery        |
| Gs—Starter petrol jet            | s—Emulsion tube                    |
| Gu—Economy jet                   | T—Duct operating membrane Mm       |
| H—Ball valve                     | u—Pilot air bleed jet              |
| i—Injector nozzle                | V—Throttle butterfly               |
| Io—Slow running mixture delivery | W—Slow running mixture adjustment  |
| k—Choke tube                     |                                    |

**Carburetter**

**To remove** **Operation M/2**

1. Disconnect the air cleaner connection from the carburetter intake orifice.
2. Remove the air cleaner.
3. Disconnect the feed pipe from the carburetter inlet banjo.
4. Disconnect the distributor suction pipe from the carburetter and pull pipe clear.
5. Disconnect the accelerator connecting rod from the carburetter throttle lever, at a ball joint.
6. Release the cold start control cable from the cold start lever on the carburetter.
7. Remove the carburetter from the inlet manifold, together with two joint washers and a packing washer.

**To refit** **Operation M/4**

1. Reverse the removal procedure.
2. Renew the joint washers and packing washer.
3. Check the operation of the cold start control. (Three positions on the cold start lever.)

**Carburetter jets and controls**

**Fault location** **Operation M/6**

1. If acceleration is bad, make sure that the speed jet is not choked (such a condition, however, will seriously affect the general performance).
2. Failure of the accelerator pump membrane will be shown by weak mixture and spitting in the carburetter on rapid acceleration.  
It can be checked by pumping the throttle with the engine running and vehicle stationary, and noting the petrol delivery from the injector tube; if the delivery is small, renew the accelerator pump membrane. **Operation M/12.**
3. Failure of the speed jet membrane will cause a rich mixture at all times, particularly at small throttle openings, and result in excessive fuel consumption. To rectify, renew the speed jet membrane **Operation M/14.**
4. At all times when accelerator pump trouble is suspected, the non-return ball valves in the pump system should be inspected for correct seating. The valves are positioned as follows: one valve in the petrol inlet to pump, the second in the injector tube, and a third in the pump assembly outlet, visible when the pump is removed from the carburetter.

**To overhaul**

**Accelerator pump**

**To renew** **Operation M/8**

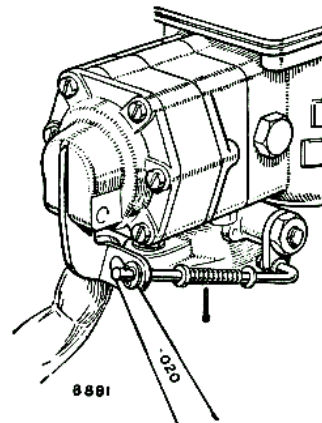
1. Disconnect the operating rod from the pump lever and remove the four set screws at the corners of the pump body and lift off the pump complete. Do not remove the other two set screws in the centre of the body.

2. Fit the new accelerator pump, entering the rod into the pump operating lever at the same time.
3. Adjust the pump operating rod. **Operation M/10.**

**Accelerator pump operating rod**

**To adjust** **Operation M/10**

1. Remove the split pin behind the spring and allow the spring to move back along the rod.
2. Slacken the slow running screw right off.



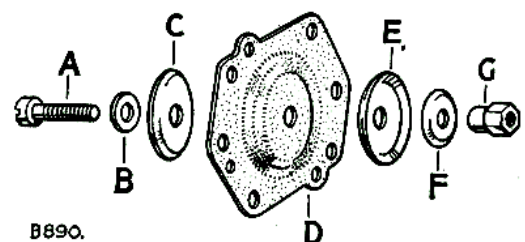
**Fig. M-4—**  
**Setting accelerator pump operating rod**

3. With the throttle fully closed and the operating lever just about to operate the pump diaphragm, add washer(s) on the end of the rod up to the nearest split pin hole, ensuring that there remains .20 in. (0,5 mm) clearance between the lever and the first washer when the outer split pin is fitted.  
This clearance ensures that there is no lost movement of the lever travel.
4. Compress the spring and replace the inner split pin.
5. Check that the spring is not coilbound when the throttle is fully open.

**Accelerator pump membrane**

**To renew** **Operation M/12**

1. Remove the outer split pin and washer(s) securing the operating rod to the pump lever (the washer(s) should be preserved).
2. Remove the four set screws at the corners of the pump body and lift off pump complete.



**Fig. M-5—Layout of accelerator pump membrane assembly,**

- |                  |                   |
|------------------|-------------------|
| A—Operating rod. | D—Membrane.       |
| B—Fibre washer.  | E—Dished washer   |
| C—Dished washer. | F—Distance washer |
|                  | G—Securing nut.   |

3. Remove the two set screws in the centre of the body and part the pump end cover, together with the membrane assembly, from the pump body; remove the spring from the recess in the pump body.
4. Part the membrane from the outer cover and remove the operating rod from its centre. Discard the membrane.
5. Fit the operating rod to the new membrane (Fig. M-5), taking care not to twist the membrane when tightening the securing nut. Secure the nut by staking.
6. Clean the pump body and end cover joint faces.
7. Replace the spring in the recess of the pump body. Place the end cover together with the membrane assembly in position on the pump body and insert the two set screws, which must not be tightened at this stage.
8. Depress the pump membrane by means of the operating lever and tighten the two screws fully.
9. Refit the accelerator pump unit to the carburettor, entering the rod into the pump operating lever at the same time; renew the neoprene joint washer if necessary.
10. Adjust the pump operating rod. Operation M/10.

### Speed jet membrane

#### To renew

#### Operation M/14

1. Remove the outer split pin and washer(s) securing the operating rod to the pump lever (the washer(s) should be preserved).
2. Remove the four screws at the corners of the pump body and lift off the pump complete.
3. Remove the two set screws in the centre of the body and separate the two halves of the pump body; remove the speed membrane assembly and the spring.
4. Remove the pump shaft from the centre of the membrane and discard the membrane.
5. Fit the pump shaft to the new membrane so that the small hole for the air duct tube (E) is on the left of the securing nut (G) (Fig. M-6). Care must be taken not to twist the membrane when tightening the securing nut. Secure the nut by staking.
6. Clean the joint faces of the two halves of the pump body.
7. Place the membrane assembly in position on the inner half of the pump body, locating it by means of the small air duct tube.
8. With the spring in its recess, place the outer half of the pump body in position on the inner half and secure with two set screws.
9. Refit the accelerator pump unit to the carburettor, entering the rod into the pump operating lever at the same time; renew the joint washer if necessary.
10. If necessary, adjust the pump operating rod, Operation M/10.

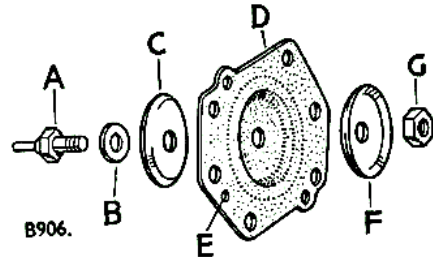


Fig. M-6—

Layout of speed jet membrane assembly.

- |                 |                       |
|-----------------|-----------------------|
| A—Pump shaft.   | D—Membrane.           |
| B—Fibre washer  | E—Air duct tube hole. |
| C—Dished washer | F—Dished washer.      |
|                 | G—Securing nut.       |

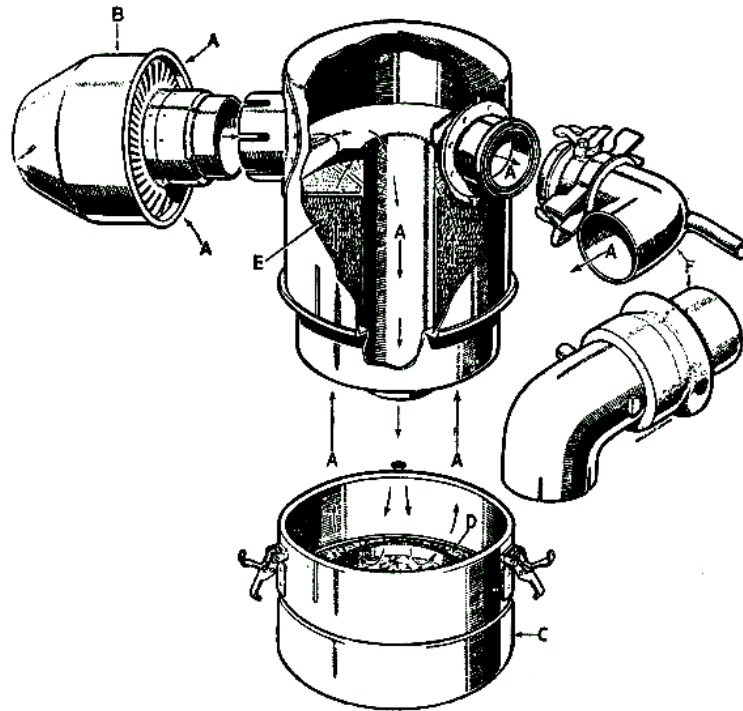


Fig. M-7—Air cleaner, 1948-53 models

A—Path of air shown → → →      C—Oil bath  
 B—Centrifugal pre-cleaner      D—Oil level  
 E—Woven steel packing  
 F—Outlet to carburetter

**Air cleaner—all models**

The air cleaner must be removed and cleaned at frequent intervals if an excessive rate of engine wear is to be avoided; the actual intervals will depend solely on operating conditions.

Under clean road conditions in a temperate climate, the oil bath need only be cleaned and refilled when engine oil changes are due, but when the vehicle is operated in a dust-laden atmosphere, desert, sub-tropical or tropical conditions—cleaning may be necessary twice daily.

**To remove (1955-58 models) Operation M/16**

1. Remove the clamping strap wing nut.
2. Disconnect the rubber connection at the carburetter.
3. Lift out the air cleaner complete with rubber connection and pre-cleaner when fitted.

**To refit      Operation M/18**

1. Reverse the removal procedure.

**To strip      Operation M/20**

1. Detach the rubber connection.
2. Remove the pre-cleaner when fitted.

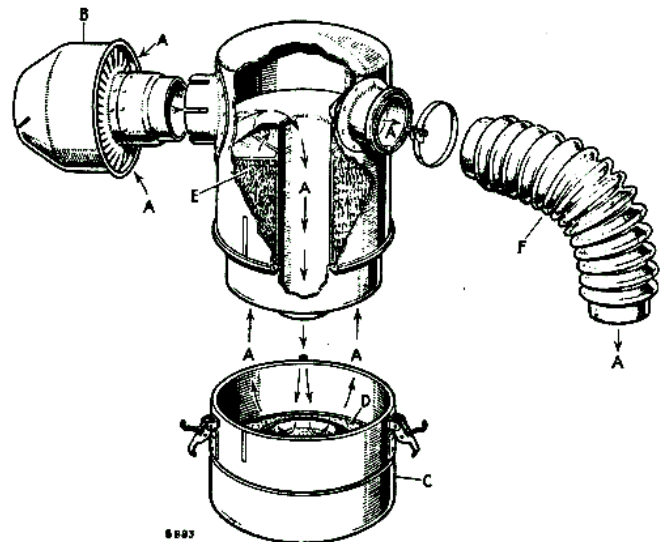


Fig. M-8—Sectioned view of air cleaner, 1954 models.

A—Path of air shown → → →      D—Oil level  
 B—Centrifugal pre-cleaner      E—Woven steel packing  
 C—Oil bath      F—Connection air cleaner to carburetter

3. Remove the oil bowl from the air cleaner body and empty.
4. If necessary, remove the cork washer from the air cleaner body.

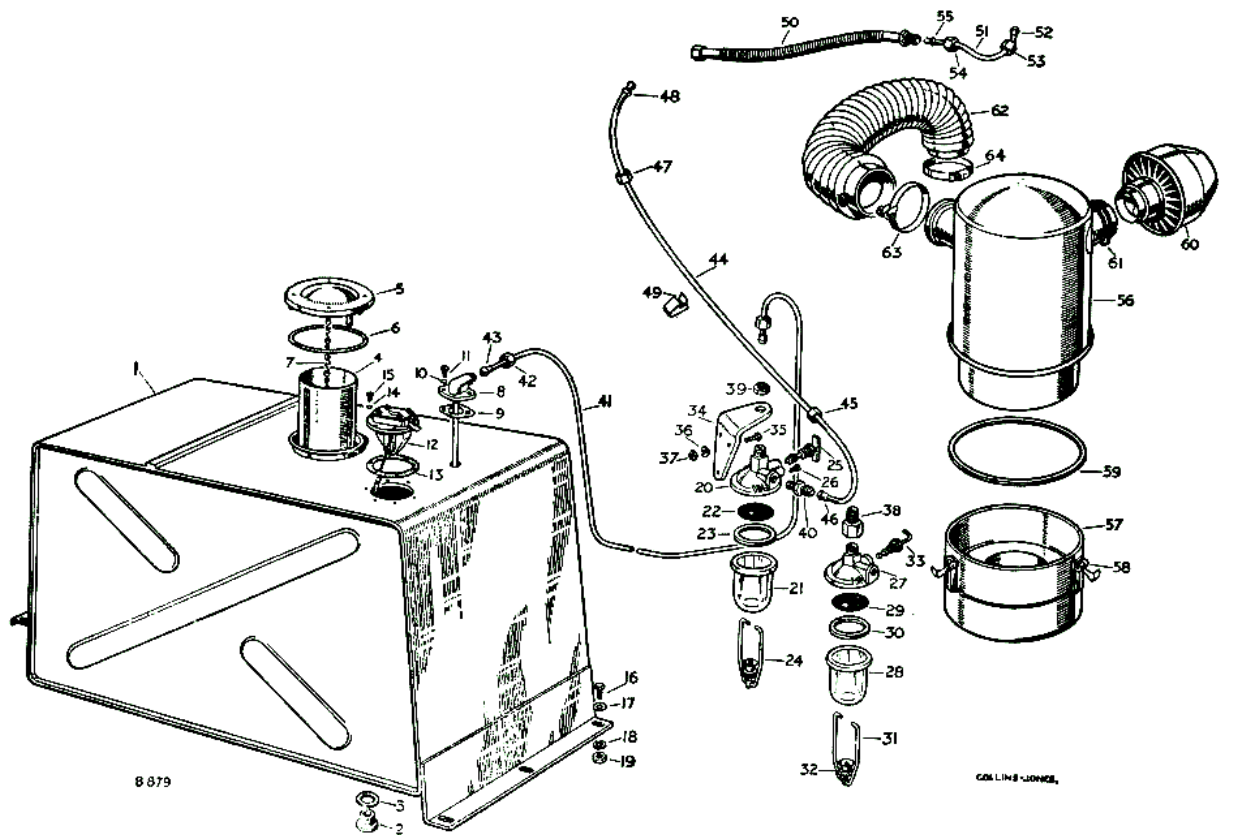


Fig. M-9—Layout of fuel system, Petrol models.

- |       |                                |       |  |
|-------|--------------------------------|-------|--|
| 1     | Petrol tank complete           | 31    | Retainer for bowl                              |
| 2     | Drain plug for petrol tank     | 32    | Screw cap for retainer                         |
| 3     | Joint washer for drain plug    | 33    | Tap and gland complete                         |
| 4     | Telescopic filler tube         | 34    | Bracket for sediment bowl                      |
| 5     | Filler cap                     | 35-37 | Fixings for bracket                            |
| 6     | Joint washer for cap           | 38    | Inlet adaptor for sediment bowl                |
| 7     | Chain for filler cap           | 39    | Special nut fixing adaptor and bowl to bracket |
| 8     | Outlet elbow complete for tank | 40    | Outlet union for sediment bowl                 |
| 9     | Joint washer for outlet elbow  | 41    | Petrol pipe complete, tank to bowl             |
| 10-11 | Fixings for elbow              | 42-43 | Fixings for pipe                               |
| 12    | Gauge unit for petrol tank     | 44    | Petrol pipe complete, bowl to pump             |
| 13    | Joint washer for gauge unit    | 45-48 | Fixings for pipe                               |
| 14-15 | Fixings for gauge unit         | 49    | Clip for petrol pipe                           |
| 16-19 | Fixings for petrol tank        | 50    | Flexible petrol pipe complete                  |
| 20    | Body only                      | 51    | Petrol pipe complete, flex to carburetter      |
| 21    | Bowl only                      | 52-55 | Fixings for pipe                               |
| 22    | Gauze for bowl                 | 56    | Filter and case                                |
| 23    | Joint washer for bowl          | 57    | Oil container                                  |
| 24    | Retainer for bowl              | 58    | Toggle clip for oil container                  |
| 25    | Tap and gland complete         | 59    | Cork washer for oil container                  |
| 26    | Special screw for tap          | 60    | Centrifugal air cleaner                        |
| 27    | Body only                      | 61    | Clip fixing cleaners together                  |
| 28    | Bowl only                      | 62    | Rubber connection, air cleaner to carburetter  |
| 29    | Gauze for bowl                 | 63-64 | Fixings for connection                         |
| 30    | Joint washer for bowl          |       |  |



**To assemble**

**Operation M/22**

1. Clean the filter gauze and oil bowl in petrol and refill oil bowl with clean oil.
2. Reverse the stripping procedure, renewing the cork washer if necessary.

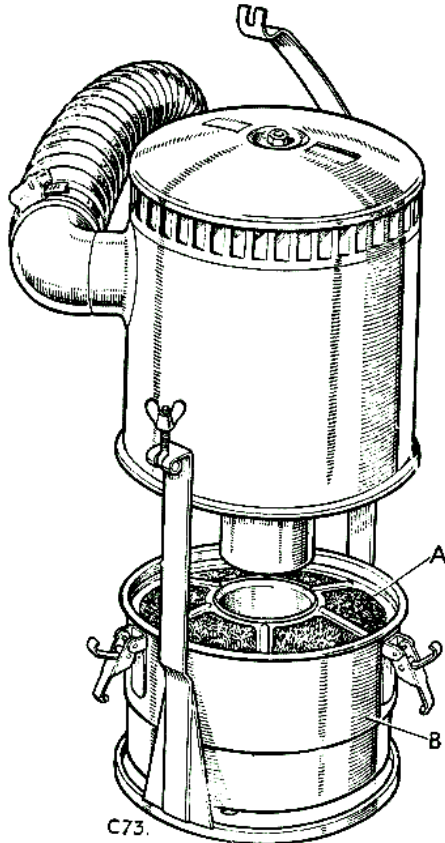


Fig. M-10—Air cleaner, 1955-58 models.

A—Removable filter gauze.  
B—Oil bowl.

*Note:*

At all times when the diesel engine is running, it is necessary to ensure that the oil bath air cleaner is fastened securely in the vertical position.

If adjustments are made with the engine running and the oil bath air cleaner balanced on top of the engine, it is possible, should the cleaner tip to one side, for oil to be drawn into the intake manifold and hence into the engine, where it will act as a fuel and cause the engine to overspeed out of control and serious damage may result.

Should it be necessary to run the engine with the air cleaner out of the normal position, the rubber hose should be disconnected from the inlet manifold and the whole oil bath removed from the vehicle.

**Fuel tank—all models**

**To renew**

**Operation M/24**

1. Disconnect the battery.

2. Remove the right-hand seat and raise the locker lid.
3. Detach the fuel feed pipe from the outlet union on the top of the tank.
4. Disconnect the wire from the level gauge unit.
5. Drain off the fuel.
6. Remove the fuel tank and undershield, if fitted, from below.
7. Remove the outlet elbow from the tank and fit together with a new joint washer, to the replacement tank.
8. Remove the gauge unit from the tank and fit together with a new joint washer, to the replacement tank.
9. Fit the replacement tank to the vehicle by reversing the removal procedure.

**Fuel gauge tank unit**

**To renew**

**Operation M/26**

1. Disconnect the battery.
2. Drain off the fuel.
3. Remove the right-hand seat and raise the locker lid.
4. Disconnect the wire from the tank unit.
5. Remove the gauge unit from the fuel tank complete with joint washer.
6. Fit the new unit by reversing the removal procedure.

**Fuel tank outlet union**

**To renew**

**Operation M/28**

1. Remove the right-hand seat and raise the locker lid.
2. Disconnect the union nut securing the fuel feed pipe to the outlet union.
3. Remove the outlet union and suction pipe from the fuel tank complete with joint washer.
4. Fit the new union by reversing the removal procedure.

**Sediment bowl, Petrol models**

**To remove**

**Operation M/30**

1. Disconnect the inlet and outlet pipes at the sediment bowl unions.
2. Remove the sediment bowl complete from the dash bracket.
3. If necessary, remove the bracket from the dash.

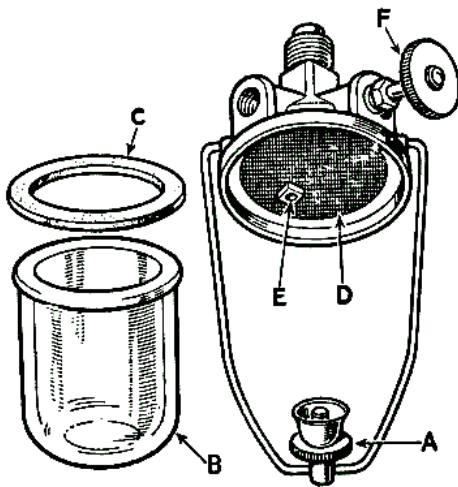


Fig. M-11—Fuel sediment bowl.

- |                 |                 |
|-----------------|-----------------|
| A—Thumbscrew    | D—Filter gauze. |
| B—Glass bowl.   | E—Fuel inlet.   |
| C—Joint washer. | F—Shut-off tap  |

**To refit** **Operation M/32**  
Reverse the removal procedure.

**Fuel pipe: tank to sediment bowl, Petrol models**

**To renew** **Operation M/34**

1. Disconnect the union nuts securing the pipe to the fuel tank outlet elbow and sediment bowl inlet union.
2. Withdraw the pipe from below the vehicle.
3. Replace the pipe by reversing the removal procedure.

**Fuel return pipe, Diesel models**

**To renew** **Operation M/36**

1. Remove the union nuts securing the flexible pipe to the fuel tank and leak-off pipe.
2. Remove the clips and withdraw the pipe from below the vehicle.

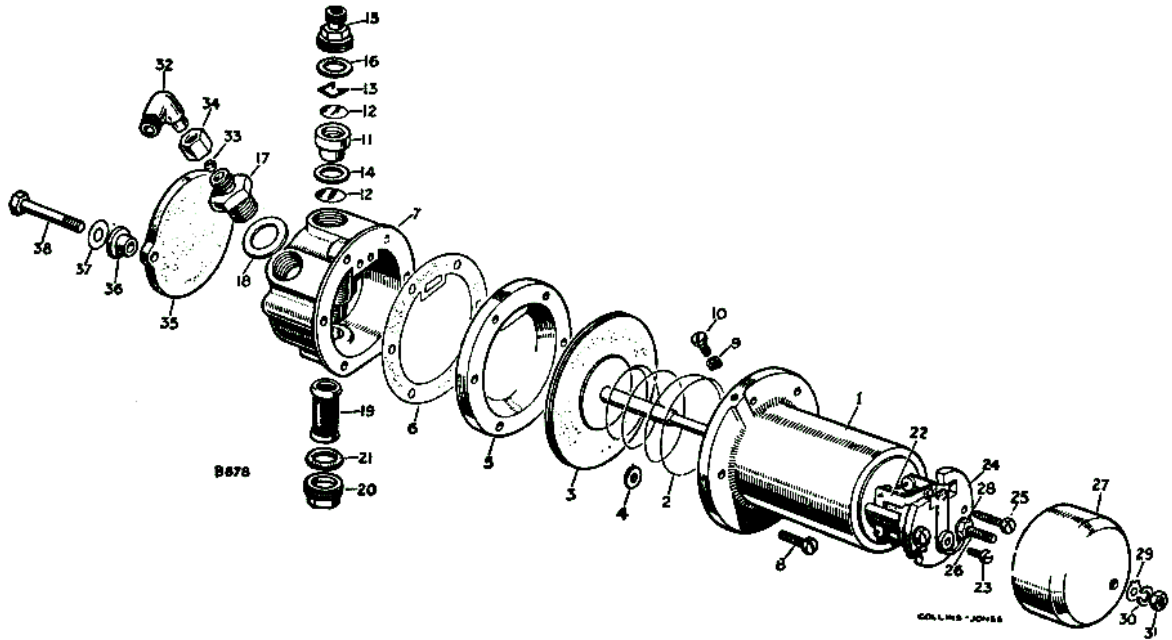


Fig. M-12—Exploded view of fuel pump, Petrol models.

- |    |                                   |                            |                                  |                     |
|----|-----------------------------------|----------------------------|----------------------------------|---------------------|
| 1  | Coil complete                     | 18                         | Washer for inlet union           |                     |
| 2  | Spring for armature               | 19                         | Filter                           |                     |
| 3  | Diaphragm complete                | 20                         | Plug for filter                  |                     |
| 4  | Roller for diaphragm              | 21                         | Washer for filter plug           |                     |
| 5  | Plate body                        | 22                         | Contact set complete             |                     |
| 6  | Joint washer for plate body       | 23                         | Special screw for contact blade  |                     |
| 7  | Body                              | 24                         | Moulding for end plate           |                     |
| 8  | Screw fixing coil housing to body | 25                         | Screw fixing moulding            |                     |
| 9  | Special spring washer             | } For earth terminal screw | 26                               | Terminal screw      |
| 10 | Special nut                       |                            | 27                               | Cover for end plate |
| 11 | Valve cage                        | 28                         | Terminal nut                     |                     |
| 12 | Disc for valve                    | 29                         | Tag for terminal                 |                     |
| 13 | Spring clip retaining valve disc  | 30                         | Spring washer                    |                     |
| 14 | Washer for valve cage             | 31                         | Nut                              |                     |
| 15 | Outlet union                      | 32                         | Elbow for pump                   |                     |
| 16 | Washer for outlet union           | 33-34                      | Fixings for elbow                |                     |
| 17 | Inlet union                       | 35-38                      | Fixings for electric petrol pump |                     |

**Fuel pump—Petrol models****To remove** **Operation M/38**

1. Disconnect the battery.
2. Detach the inlet and outlet pipes from the elbows on the fuel pump.
3. Disconnect the feed and earth wires from the pump terminals.
4. Remove the pump.

**To refit** **Operation M/40**

Reverse the removal procedure.

**To strip** **Operation M/42**

**Note: Under no circumstances should any attempt be made to move the core of the magnet.**

1. Remove the cast iron body from the aluminium body.
2. Unscrew the armature from the inner rocker and remove it complete with rollers, spring and impact washer.
3. If necessary, remove the impact washer (Fig. M-16) from the recess of the armature.
4. Remove the contact blade.
5. Disconnect the earth connection (held under one of the pedestal securing screws).
6. Withdraw the outer and inner rocker hinge pin and remove the rocker assembly complete from under the pedestal.
7. Separate the two halves of the aluminium body.
8. Remove the inlet union from the rear portion of the aluminium body.
9. Remove the outlet union and withdraw the thick fibre washer, the valve cage complete with delivery valve and retaining clip, the thin fibre washer and the suction valve.
10. Remove the filter plug, fibre washer and filter.

**To assemble** **Operation M/44**

1. Carefully clean all the component parts, renewing the diaphragm, contact breaker assembly and valves assembly as necessary.

**Valve cage** (See Fig. M-13)

2. The delivery valve (H) and suction valve (K) should both be fitted with the smooth side downwards.
3. Care should be taken that the valve retaining clip (I) in the valve cage (E) is located correctly in its groove.

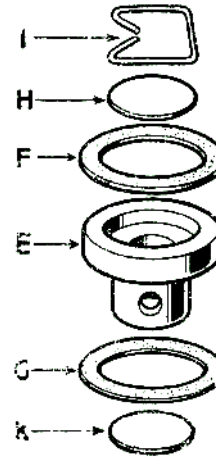


Fig. M-13—  
Layout of valve cage

E—Valve cage  
F—Thick fibre washer  
G—Thin hard fibre washer  
H—Delivery valve  
I—Valve retaining clip  
K—Suction valve

4. The thin fibre washer (G) should be fitted under the valve cage and the thick washer (F) above the cage.
5. Thick fibre washers are also fitted under the inlet union and the gauze filter.

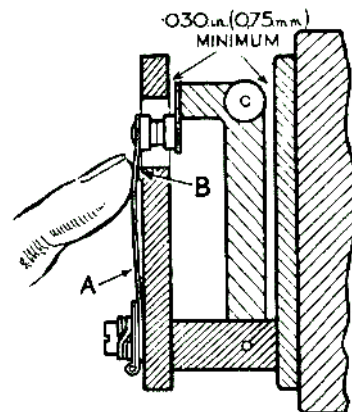
**Contact breaker** (See Fig. M-14)

6. The contact breaker should be assembled on its pedestal in such a way that the rockers are free in their mountings, without appreciable side play.

Any excessive side play on the outer rocker would permit the points to get out of line while excessive tightness would make the contact breaker sluggish in operation.

To obtain the correct freedom, it may be necessary to square the outer rocker with a pair of thin nosed pliers. The rocker hinge pin is case-hardened and must not be replaced by ordinary wire.

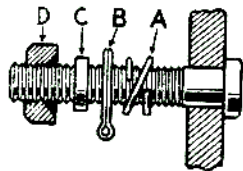
The contact blade (A) should be fitted next to the bakelite pedestal, that is, underneath the tags. It should rest against the ledge (B) on the pedestal when the points are apart. The points should just make contact when the rocker is in its midway position.



A—Contact blade  
B—Ledge

Fig. M-14—Contact breaker

7. Check the position by holding the blade in contact with the pedestal, being careful not to press on the overhanging portion (Fig. M-14); then ensure that a .30 in. (0,75 mm) feeler just slides between the white rollers and the cast iron body of the pump. If necessary the tip of the blade may be set in order to obtain the correct clearance.
8. The spring washer on the 2 B.A. screw to which the earth connection is made should be fitted between the tag and the pedestal, and the brass tag next to the head of the screw.
9. All four connections, that is, the two ends of the earthing tag and the two ends of the coil, should be soldered.



A—Spring washer  
B—Tag  
C—Lead washer  
D—Countersunk nut

Fig. M-15—Feed terminal assembly

10. In the case of the feed terminal screw, which holds the bakelite cover in position, the correct order for assembly is spring washer (Fig. M-15, A) next to the bakelite pedestal, then the tag (B), lead washer (C) and countersunk nut (D). Under no circumstances should this assembly be shortened by leaving out the spring washer, or in any other way, as this would probably result in distortion or breakage of the pedestal when the nut holding the cover in position is tightened.

**Magnet assembly**

11. Fit the armature return spring with its large diameter towards the coil. The spring must not be stretched or the action of the pump will be affected.
12. Swing the contact blade on the pedestal to one side.

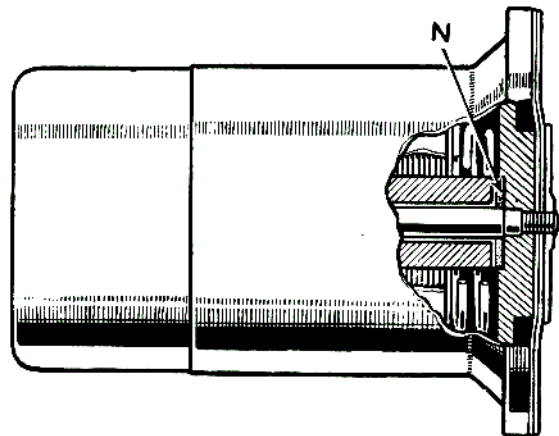


Fig. M-16—Armature impact washer  
N—Impact washer.

13. Fit the impact washer (N) in the recess of the armature.
14. Screw the armature into position.
15. Fit the eleven guide rollers in position round the armature.
16. Hold the magnet assembly in the left hand in an approximately horizontal position. Push the armature in firmly but steadily, with the thumb of the right hand (Fig. M-17).

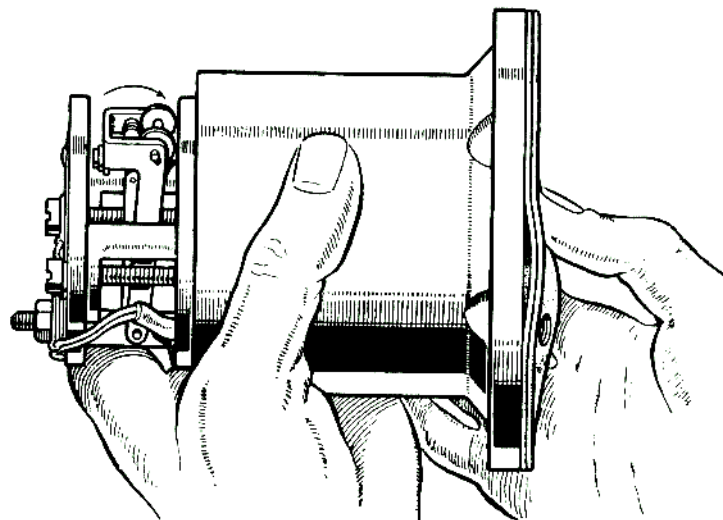


Fig. M-17—Armature adjustment

17. If the contact breaker throws over, the armature should be screwed in further until it ceases to do so. It should then be unscrewed one-sixth of a turn at a time until a position is found at which the contact breaker just throws over, care being taken to avoid jerking the armature. The armature should then be unscrewed for two-thirds of a turn, i.e. four holes; the setting is then correct.

*Note:* Do not forget that this setting must be carried out with the points out of contact.

When a new diaphragm is fitted, it is possible that considerable pressure will be required to push the armature right home. If there is any doubt about the point at which the contact breaker throws over, come back one-sixth of a turn.

18. Place the cast iron body in position on the aluminium body, with the drain hole in the cast iron member at the bottom in line with the filter plug in the aluminium body. Ensure that all the rollers are in their correct position. If one of the rollers falls out of position, it will get trapped between the two parts and cut a hole in the diaphragm.
19. Make sure that the cast iron body seats properly on the aluminium body, and insert the six screws. These screws must not be tightened up at this stage, as it is absolutely necessary to first stretch the diaphragm to its outermost position.
- This is best effected by using a special forked wedge to keep the armature in its extreme position (Fig. M-18); the wedge is inserted between the white rollers of the outer rocker and pressed in under the tips of the inner rocker,

until it lifts the trunnion in the centre of the inner rocker as far as it will go. Tighten the retaining screws fully, and remove the wedge.

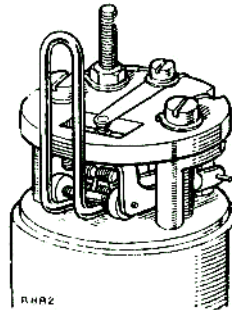


Fig. M-18—  
Use of forked wedge to  
keep the armature in  
position

*Note:* If a wedge is not available, the diaphragm may be stretched by holding the points in contact, by inserting a matchstick under one of the white fibre rollers and passing a current through the pump; this will excite the magnet, actuate the armature, and so stretch the diaphragm.

20. Test the fuel pump. It is best to use a cut-away cover while testing the pump, as this prevents the hinge pin from falling out, and, at the same time, makes it possible to observe the action of the contact breaker. The pump should be mounted three feet above the supply tank for testing; either paraffin or petrol may be used. When switched on, the pump should prime itself promptly, and fluid should flow from the outlet union. If the pump output is restricted, the pump should slow down gradually, and if completely cut off it should stop for at least 15 seconds.

### Fuel pump—Diesel

#### Testing fuel pump on vehicle

Ensure that there is sufficient fuel in the tank, then disconnect the fuel inlet pipe from the filter mounted on the front R.H. side of the engine. Turn the engine over by hand, with injection nozzles removed if necessary; there should be a well-defined spurt of fuel from the disconnected pipe every second revolution of the starting handle.

#### To remove Operation M/46

1. Disconnect the inlet and outlet pipes, remove the securing nuts and withdraw the pump complete.

#### To overhaul Operation M/48

1. Unscrew the nut at base of sediment bowl, move the retainer aside and withdraw the bowl, cork sealing gasket and gauze filter disc. Care must be taken to avoid damage to the filter disc.
2. Mark the upper and lower halves of pump casing to ensure correct alignment on re-assembly and note the position of diaphragm

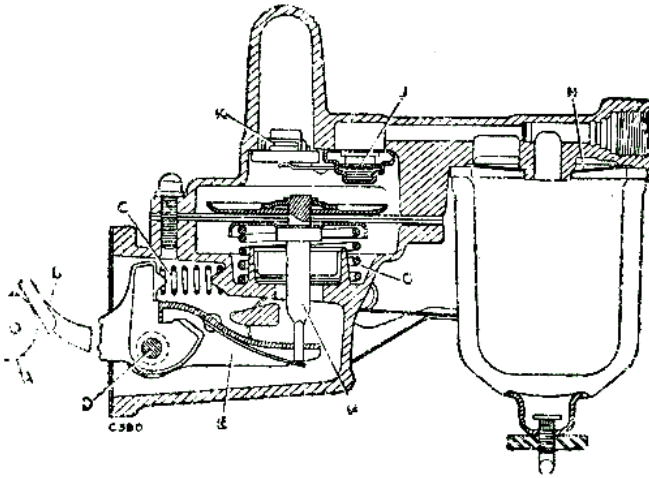


Fig. M-19—Sectioned view of fuel pump

**tab.** Remove the six screws securing the casings and, with the thumb pressing the diaphragm tab against the lower casing, lift the upper half clear.

3. Ease the diaphragm flexible material from the lower body joint face and holding the metal part of the diaphragm with the fingers, turn it 90° in either direction, whereon the diaphragm spring will push the diaphragm clear.
4. Remove the circlips (on late models the pivot pin is secured by two retainers), then drift the rocker arm pivot pin from the lower casing and withdraw the rocker arm, operating link, return spring and plain washers.

5. It is extremely unlikely that the hand priming mechanism will ever require replacement, but the hand lever, cork washers and hand rocker may be removed by filing the hexagon each side of the operating lever and springing the lever clear. Withdraw the cork washers and hand rocker.

*Note:* If removed, the hand operating mechanism must be replaced by new parts.

6. If necessary the oil seal and retainer may be removed by filing away the spread of metal caused by the four peening marks and then drift from below.
7. Remove the retaining plate and withdraw the valves and valve gasket from the upper casing.
8. Clean all parts thoroughly in paraffin and immediately before assembly, in Shell Fusus 'A' oil.
9. Examine all parts for wear and replace as necessary. Observe the following points:
  - (a) All gaskets to be renewed.
  - (b) Sediment bowl filter disc must be free of damage and fit tightly round the inlet neck of the upper casing.
  - (c) Renew the diaphragm assembly if any sign of hardening, cracking or porosity is present.
  - (d) Only very slight wear should be tolerated at the rocker arm contact face, pivot pin, link and pull-rod slots.
  - (e) Springs should be renewed, but ensure that the correct type are used.
  - (f) Valves to be tested for air tightness by suction.

#### Early models

10. Assembly of the components is a reversal of dismantling procedure, but the location of the rocker arm, washers and operating link on a piece of .240 in. (6.1 mm) diameter rod inserted in place of the pivot pin and then driven out by the pin will facilitate this part of the operation. Replace circlips.

#### Late models

If rocker arm pin and related parts have been detached from pump body, re-assemble rocker arm, link and spacing washers on to pin, and refit to body, after replacing return spring. Tap the retainers into their grooves, then holding the retainers firmly against the rocker pin, peen over the ends of the grooves to ensure that they cannot work loose.

Always use replacement retainers, as these are slightly shorter than the original to allow for satisfactory fixing in the body.

11. To refit the diaphragm assembly, hold the pump lower casing with the return spring in position and the rocker arm held outwards. Position the diaphragm over the spring with the

- 1 Upper casing
- 2 Securing screws
- 3 Spring washer
- 4 Valve gasket
- 5 Valves
- 6 Retainer for valves
- 7 Screw securing retainers
- 8 Gauze filter disc
- 9 Cork sealing gasket
- 10 Sediment bowl
- 11 Bowl retainer
- 12 Diaphragm assembly
- 13 Diaphragm spring
- 14 Oil seal retainer
- 15 Sealing washers
- 16 Lower casing
- 17 Hand priming lever
- 18 Return spring for hand lever
- 19 Hand rocker
- 20 Cork washers
- 21 Rocker arm pivot pin
- 22 Operating link
- 23 Plain washers
- 24 Rocker arm
- 25 Return spring
- 26 Joint washer

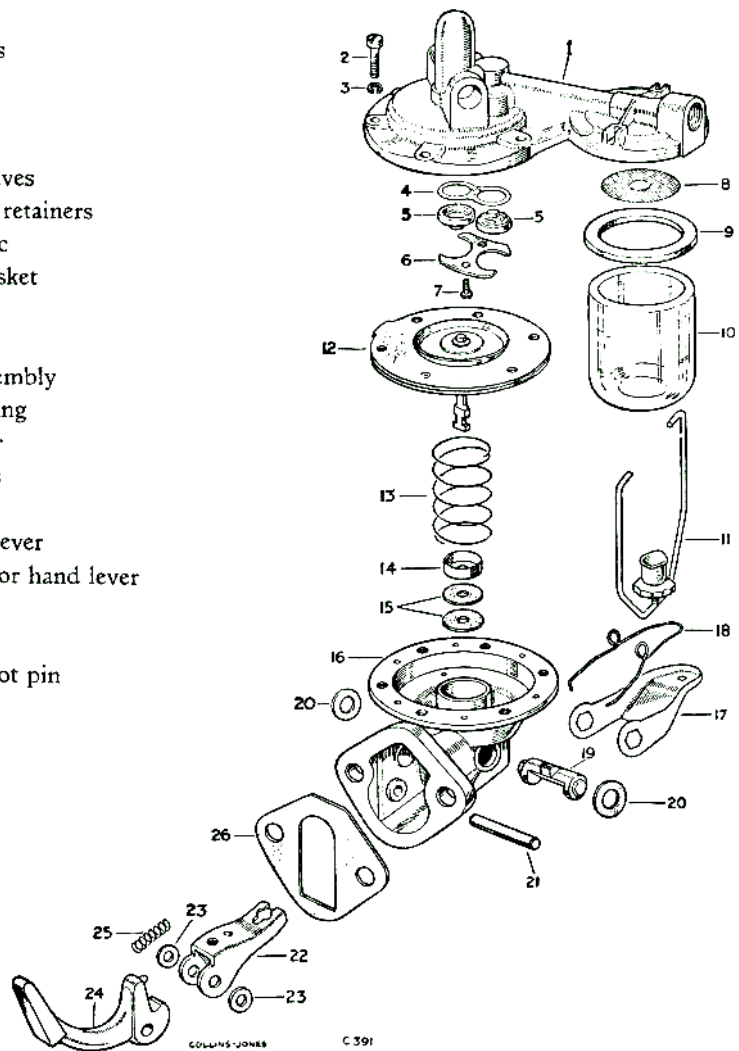


Fig. M-20—Exploded view of fuel pump, Diesel models.

flattened end of pull rod in line with the slot in operating link and the large tab on diaphragm 90° from original fitted position. Press the diaphragm assembly downward to engage the operating link slot and turn it 90° to the position noted whilst dismantling.

12. Push the rocker arm towards the pump until the diaphragm is level with the joint face, then place the upper casing assembly in position, aligning the marks made before dismantling. Fit the six securing screws and spring washers but tighten the screws just sufficiently for the heads to contact the spring washers. The rocker arm must now be pushed inward to the fullest extent before the screws are finally tightened.

*Note:* The diaphragm outer edges should be approximately flush with the outer edges of the pump joint faces when fitted.

Any appreciable protrusion of the diaphragm beyond the joint face edges, indicates improper fitment and necessitates the release of the six securing screws and refitment in accordance with item 12.

#### Fuel pump—to test without special equipment Operation M/50

1. Immerse the pump in a bath of fuel oil or Shell Fusus 'A' oil, and operate the rocker arm several times to flush.
2. Hold the pump clear of the bath and continue to operate the rocker arm until the pump is empty, then place a finger over the inlet port ('in') and work the rocker arm several times more. A distinct suction sound should be heard when the finger is removed from the inlet port, denoting that a reasonable degree of suction has been developed.



- Place a finger over the outlet port and again operate the rocker arm. Air pressure should be felt for two or three seconds after rocker movement has ceased. Build up the air pressure in the pump again, and with the finger held firmly over the outlet, submerge the pump completely in the paraffin or oil bath, then observe the joint face edges for signs of air leakage.

#### Fuel pump filter and sediment bowl

##### To remove and clean Operation M/52

- Unscrew the nut at base of sediment bowl, move the retainer aside and withdraw the bowl, cork sealing gasket and gauze filter disc. Care must be taken to prevent damage to the filter disc.
- Clean the bowl and filter disc in petrol or (Diesel) fuel oil, directing a compressed air jet on the gauze to remove any obstinate particles.
- Examine the cork gasket for filter bowl and renew if signs of deterioration are evident.

##### To replace Operation M/54

- Reverse the removal procedure ensuring that the gauze filter disc fits tightly round the inlet neck and is quite undamaged in any way.

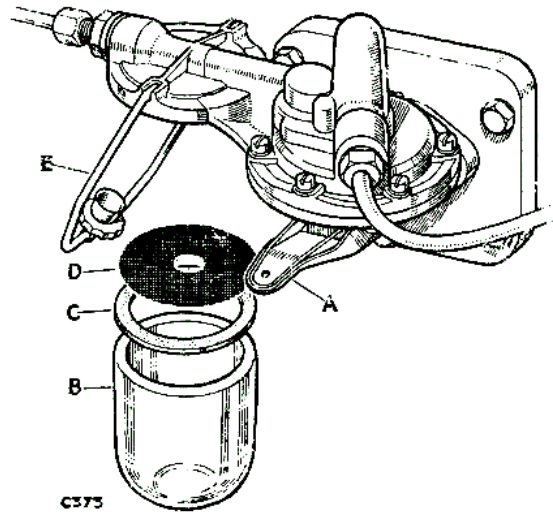


Fig. M-21—Removing sediment bowl—  
Diesel models

- |                      |                              |
|----------------------|------------------------------|
| A—Hand priming lever | D—Filter gauze               |
| B—Sediment bowl      | E—Retainer for sediment bowl |
| C—Cork gasket        |                              |

### Fuel system—Diesel models

*Note: Details of fuel lift pump will be found on Pages M-15 to M-17.*

If the injection pump is drained by disconnecting the drain pipe or by running the vehicle until all the fuel has been used, the injection pump must be primed before attempting to restart the engine. To minimise the possibility of inadvertently running out of fuel, a blue fuel level warning light is fitted to the instrument panel which glows when only two gallons of fuel remain in the tank and remains "on" until more fuel is added. This device is in addition to the usual fuel contents gauge.

Clean fuel is essential for the efficient operation of the fuel injection pump and injection nozzle assemblies, and for this reason four filters in all are fitted in the system. The first one is fitted in the fuel tank and requires no attention; the second—a sediment bowl and filter disc—is part of the fuel lift pump; the third is a large self-contained unit mounted on the R.H. front side of the engine, and lastly a small tubular gauze filter is fitted in the injection pump head.

An additional filter is fitted to all export Diesel Land-Rovers. This filter is dealt with in Operation M/60.

### Filters

Wear of injection pump, injection nozzle parts and the subsequent loss of power and efficiency is primarily due to the presence of dirt in the fuel.

Filters are situated in the Rover system in a manner calculated to minimise the possibility of foreign matter reaching the injection pump or injection nozzles, but the element in the main filter must be renewed, the sediment bowl and filter gauze on lift pump and the filter gauze in injection pump cleaned, at appropriate intervals. These intervals vary and are dependent on operating conditions, but reference to the Owner's Instruction Manual will provide a guide.

Complete sludging up of the main filter element in an unreasonably short operating period is usually due to an excessive quantity of wax in the fuel. Attention should be paid to the method of storage (where bulk storage is used) and the advice of supplier requested. Never draw fuel from the lowest point of a storage tank or barrel for refuelling purposes; the lowest point should only be used for draining off sludge and other impurities which accumulate at the bottom end.

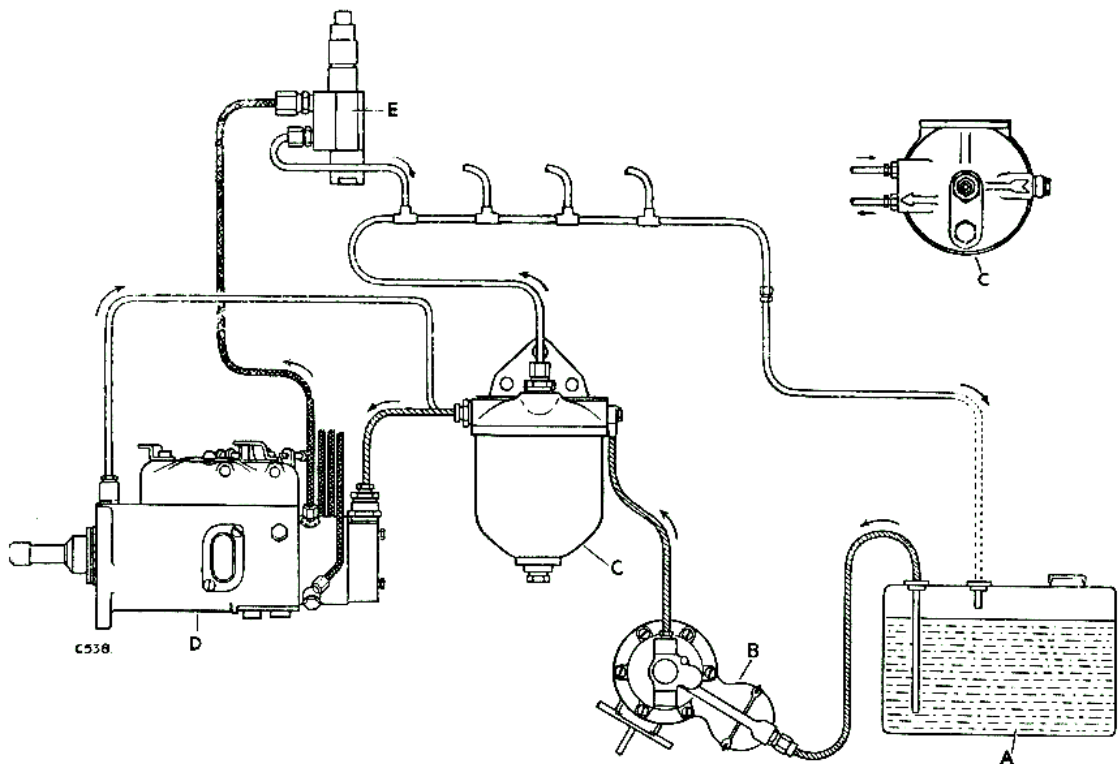


Fig. M-22—Diagram of fuel system.

A—Fuel tank  
B—Fuel pump  
C—Main filter  
D—Injection pump

E—Injection nozzle  
~~~~~—Low pressure delivery  
xxxxxxx—High pressure delivery  
—————Excess fuel spill back

**Main filter**

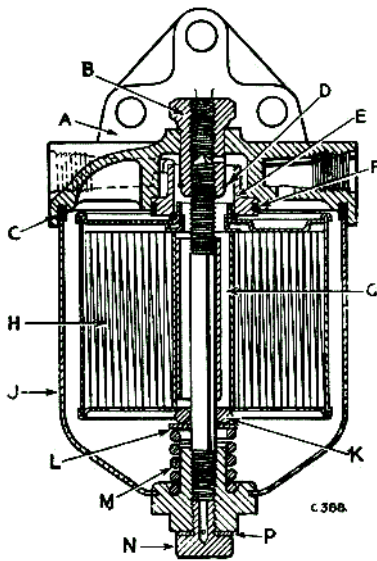
**To remove** **Operation M/56**

1. Slacken the drain plug at the base of filter container and allow fuel to flow into a suitable receptacle.
2. Disconnect the fuel inlet, outlet and bleed back pipes.
3. Remove the securing bolts and lift the assembly clear.

*Note:* A non-return valve is incorporated in the excess fuel spill back pipe. It can be removed by disconnecting the union at the top of the filter, and withdrawing the valve complete with holder.

**To refit** **Operation M/58**

1. Reverse the removal procedure and prime as in Operation M/64.



**Fig. M-23—Sectioned view of main fuel filter.**

- |                   |                |
|-------------------|----------------|
| A—Housing cover   | H—Element      |
| B—Cap nut         | J—Container    |
| C—Oil seal        | K—Seal         |
| D—Circlip         | L—Plain washer |
| E—Sealing ring    | M—Spring       |
| F—Oil seal        | N—Drain plug   |
| G—Location sleeve | P—Washer       |

**To remove element—filter in position on vehicle** **Operation M/60**

1. Slacken the plug at base of filter container and allow the fuel to flow into a suitable receptacle.
2. Disconnect the bleed back pipe from the top of filter unit.

3. Unscrew the centre cap nut at top of filter whilst supporting the container.
4. Withdraw the container complete with small sealing ring at top of element and remove the large sealing ring from the underside of filter cover.
5. Discard the filter element, then wash the container thoroughly in fuel oil. Clean the holes in drain plug and boss with a wire. Great care should be taken to ensure that the centre spindle above lower sealing ring is absolutely clean.
6. Renew the lower sealing ring if its serviceability is in any way doubtful—a new top sealing ring is supplied with each element and should always be used.
7. Examine the large sealing gasket for container and replace if necessary.
8. Fit the new element, top sealing rings, and refit container.
9. Reconnect pipes, tighten drain plug and prime. Operation M/64.

**Additional filter**

All Export Diesel models are fitted with an additional C.A.V. paper element type fuel filter mounted on the engine side of the dash, in the pipe line between the fuel tank and the mechanical fuel pump. See Fig. M-24.

This means that the bowl on the additional filter becomes the water trap, therefore when two C.A.V. filters are fitted, the sediment bowl on the mechanical fuel pump and second fuel filter ('F') mounted at the front right hand side of the engine will only need cleaning and the element changed, every 24,000 (40,000 km).

The bowl of the filter mounted on the dash should be emptied and cleaned every 3,000 miles (5,000 km) and the paper element replaced every 6,000 miles (10,000 km).

If the amount of dirt and water collected when cleaning the bowl at 3,000 miles (5,000 km) appears excessive the element should also be changed; it will also indicate that more frequent checking of the filter bowl is required.

**To renew additional filter element** **Operation M/62**

1. Unscrew the special bolt on the top of the filter, until the element holder can be removed.
2. Remove and discard the used element and the rubber washer.
3. Wash the container in petrol or fuel oil.

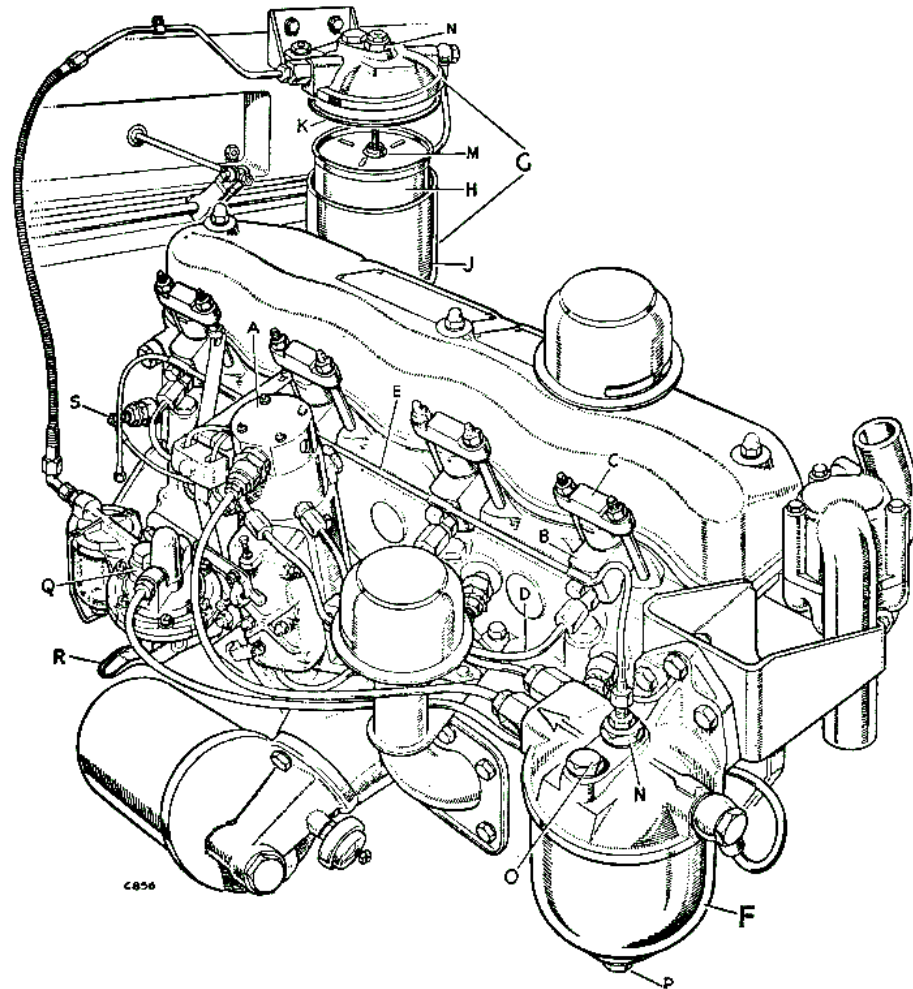


Fig. M-24—Layout of twin filters.

|                          |                        |                         |
|--------------------------|------------------------|-------------------------|
| A—Distributor pump.      | G—Fuel filter at dash. | O—Air vent plug.        |
| B—Injector               | H—Element.             | P—Drain plug.           |
| C—Clamp bar.             | J—Container.           | Q—Mechanical fuel pump. |
| D—Feed pipes.            | K—Large washer         | R—Hand priming lever.   |
| E—Spill pipes.           | M—Small washer.        | S—Heater plug.          |
| F—Fuel filter at engine. | N—Retainer nut.        |                         |

4. Renew the large rubber washer in the filter top, place a new element in the container, with the perforated holes to the bottom. Renew the small rubber washer on the top of the element.
5. Fit the container complete with element to the filter top and tighten the special bolt.
6. Prime the system. Operation M/64.

#### Priming the fuel system      Operation M/64

A—When the filter bowl has been cleaned or the paper element changed on either or both fuel filters, the system must be primed as follows:—

1. Do not attempt to start the engine hoping to draw the fuel through in this way, otherwise the full priming procedure will be necessary.
2. Slacken the air vent screw on the top of the engine filter.

3. Operate the hand priming lever in the mechanical pump until fuel free from bubbles emerges.
4. Tighten the bleed screw.
5. Operate the hand priming lever once or twice to clear the last bubbles of air into the filter bleed pipe.
6. Start the engine in the normal way and check for leaks.

B—When fuel system has been completely emptied proceed as follows:

7. Carry out operations above 1 to 5 inclusive.
8. Release air vent screw (A) on distributor pump. See Fig. M-25.
9. Operate the fuel pump hand priming lever until fuel free of air emerges. See Hand lever, Fig. M-24.

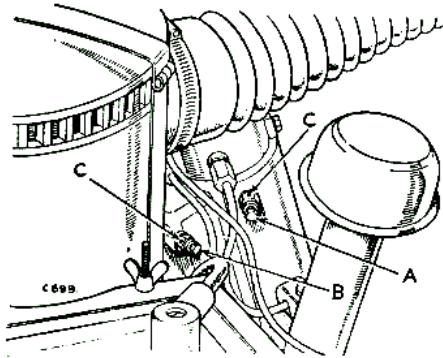


Fig. M-25—Priming the fuel system.

A—Air vent screw on distributor body.  
 B—Air vent screw on distributor control cover.  
 C—Fuel orifice.

10. Retighten the air vent screw.
11. To ensure that all air is exhausted from the pump it may also be necessary to slacken air vent screw 'B' in the distributor control cover and repeat items 9 and 10.
12. Start engine in normal way and check for leaks.

C When distributor pump only has been drained it is only necessary to carry out operations 8 to 12 inclusive.

*Note:* Ensure that fuel pump lever is on the bottom of the operating cam when priming the fuel system, otherwise maximum movement of the priming lever will not be obtained.

It should not be necessary to remove additional filter, but if removed, note that it is secured to the dash by three bolts and rivnuts.

**Injection pump filter**

**To remove and clean**      **Operation M/66**

1. Remove the pipe filter to injection pump.
2. Unscrew the pipe connection from injection pump head and withdraw the filter.
3. Wash the filter in fuel oil.

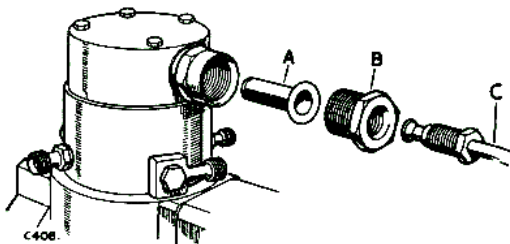


Fig. M-26—Injection pump filter.

A—Filter      B—Connection      C—Inlet pipe

**To refit**

**Operation M/68**

1. Replace the filter and pipe connection and reconnect the feed pipe at main filter end. Operate the lift pump by hand and couple the pipe to injection pump head whilst fuel flows from the pipe.

**Injection pump**

**To remove**

**Operation M/70**

1. Remove the air cleaner and flexible air intake pipe.
2. The fuel pipes, injection pump to injection nozzle, filter to injection pump and drain from injection pump should now be removed.
3. Disconnect the accelerator and cut-off controls.
4. Remove the securing nuts and washers then withdraw the pump.
5. Blank off all openings with special caps or adhesive tape if caps are not available.

**To refit**

**Operation M/72**

**1. Timing**

**A—Early engines**

On early engines the flywheel is marked SI.

(i) Early, unmodified engines.

In order to time these engines correctly, turn the crankshaft in the direction of rotation, until the timing pointer is exactly in line with the SI mark, with both valves on No. 1 cylinder closed.

(ii) Early engines with latest type pistons and early type hot plugs.

The injection pump timing for these engines must be altered to 17° B.T.D.C. Turn the crankshaft in the direction of rotation, until the timing pointer is 0.1 in. (2.5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

(iii) Early engines with latest type pistons and hot plugs.

The correct timing for these engines is 16° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is 0.2 in. (5 mm) past the SI mark on the flywheel, with both valves on No. 1 cylinder closed.

**B—Late engines**

On late engines the flywheel is marked 16° and 18°.

(i) Late engines with latest type pistons and early type hot plugs.

The correct timing for these engines is 17° B.T.D.C.

Turn the crankshaft in the direction of rotation, until the timing pointer is exactly between the 16° and 18° mark on the flywheel, with both valves on No. 1 cylinder closed.

- (ii) Late engines with latest type pistons and hot plugs.

This type of engine must be timed at 16° B.T.D.C.

Turn the crankshaft until the timing pointer is exactly in line with the 16° mark on the flywheel, with both valves on No. 1 cylinder closed.

*Note:* Engines fitted with late type hot plugs are identified by a splash of red paint on the cylinder head.

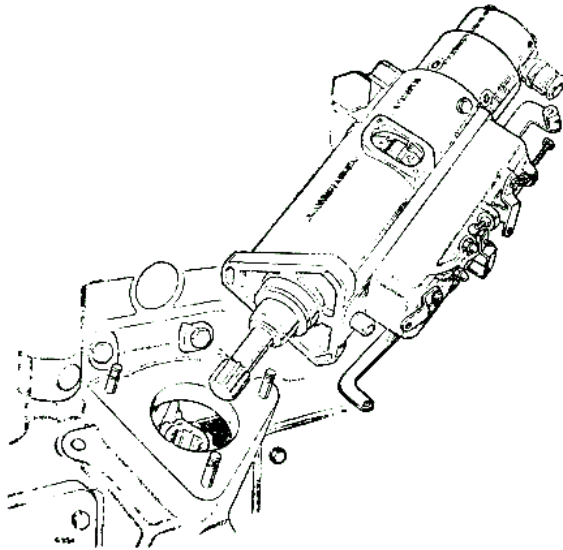


Fig. M-27—Fitting injection pump

- Remove the inspection cover from fuel injection pump and turn the rotor until the mark (A) on drive plate is in line with the arrow on timing circlip.
- Offer the pump to engine and fit the securing nuts and washers loosely. Observe the injection pump timing marks again and adjust if necessary by turning the pump body to align the marks.
- Tighten securing nuts, turn the flywheel against direction of rotation for approximately 90° and then in direction of rotation until the markings (see item 1) on flywheel are again in line with the timing pointer and check finally that the timing marks in injection pump are aligned.

It is very important that the injection pump is timed as accurately as possible. Two or three degrees retardation can cause excessive white smoke when starting from cold and running at light load. Two or three degrees advance can cause excessive black smoke at low speed full load.

The timing must be checked by turning the engine until the timing marks on the pump are dead in line and then checking the timing marks on the flywheel. In this way any slight error is magnified by the 2 : 1 ratio of camshaft to crankshaft and the large diameter of the flywheel. An error of a given width on the pump markings will be 12 times that width if transferred to the flywheel.

- Reconnect the pipes and controls; check the cut-off and throttle controls for full movement. Prime the system in accordance with Operation M/64, then refit the air cleaner and rubber connection.
- Run the engine and adjust the slow-running control if necessary. Turn the stop screw inward to increase idling speed and outward to decrease.

The upper maximum power output stop screw setting is sealed at the works and must not be altered.

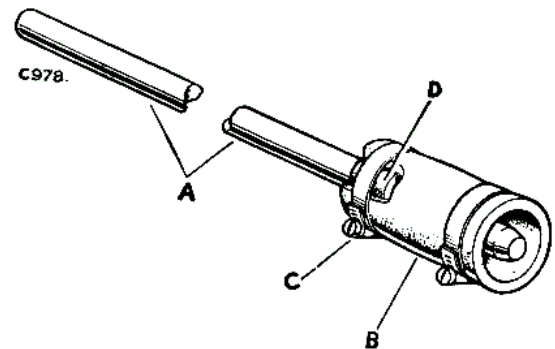


Fig. M-28—Extension shaft for revolution counter.

- A—Starting handle. 26 in. (660 mm) long x .687 in. (17 mm) diameter.  
 B—Rubber hose. 3 in. (75 mm) long x 1¼ in. (32 mm) internal diameter.  
 C—Hose clips, to suit external diameter of rubber hose.  
 D—Rubber packing between hose and starting handle.

When a new or reconditioned distributor pump is to be fitted, it will be found that the slow running control screw is wired to the distributor pump and that the maximum output control screw is not sealed.

It is necessary, therefore, after the distributor pump has been assembled to the engine, first to fit the slow running control screw and then adjust both screws as detailed below.

Finally the maximum output control screw should be wired up and sealed as shown at Fig. M-29.

The slow running engine speed should be set at 590 r.p.m.  $\pm$  20 r.p.m.

The maximum engine speed should be set at 3,650 r.p.m.  $\pm$  20 r.p.m.

Note that the maximum engine speed corresponds to 55 m.p.h. (84 k.p.h.) in top gear, 41 m.p.h. (66 k.p.h.) in third gear and 28 m.p.h. (45 k.p.h.) in second gear.

The engine speeds should be checked with a revolution counter from the starting dog. To do this some form of extension shaft is required; a starting handle cut down with driving pin removed and modified as shown at Fig. M-28 is one method of doing this.

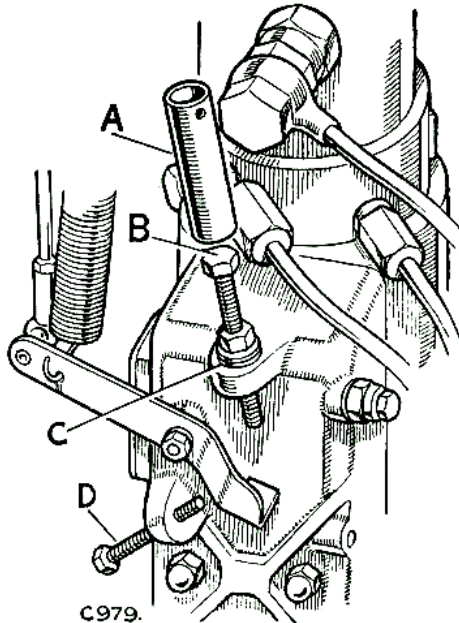


Fig. M-29—Distributor pump control screws.

- A—Screw collar.
- B—Maximum output control screw.
- C—Screw retainer for collar
- D—Slow running control screw.

To adjust the maximum output control screw, proceed as follows:—

- (a) Fit extension shaft to starting dog by sliding the rubber hose over the dog, tighten by means of the hose clip.
- (b) Check engine speed with revolution counter.
- (c) Remove adjusting screw collar. See Fig. M-29.
- (d) Slacken adjusting screw locknut; screw down to decrease engine speed and up to increase.
- (e) When maximum engine speed of 3,650 r.p.m.  $\pm$  20 has been obtained, tighten locknut, replace adjusting screw collar, wire and seal screw collar as shown at Fig. M-30.

To adjust the slow running control screw, proceed as follows:—

- (a) Check engine speed with revolution counter.
- (b) Slacken adjusting screw locknut and screw inwards to increase speed and outwards to decrease.
- (c) When a slow running speed of 590 r.p.m.  $\pm$  20 has been obtained, tighten locknut.
- (d) Remove extension shaft.

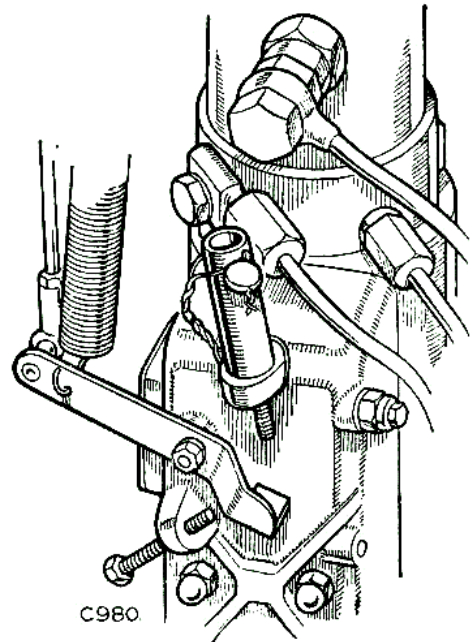


Fig. M-30—Control screws adjusted and sealed.

### Fuel injection nozzles

#### Checking nozzle assemblies on vehicle

##### Operation M/74

When carrying out the first service inspection at 750 miles (1,000 km) it is important that the injectors are removed, dismantled, thoroughly cleaned, re-assembled, checked and refitted. Thereafter this procedure should be carried out every 12,000 miles (20,000 km).

This thorough checking is necessary at the first service inspection to ensure any small particles of dirt or scale which may have become detached from the pipe lines, filters, etc., are removed.

Dirt in injectors not only has an effect on performance, but also on the noise level of a diesel engine and it is therefore most important to carry out this operation.

When an injection nozzle is considered to be the cause of irregular running and loss of power, a quick check may be made by loosening the fuel feed pipe union nut on each nozzle in turn, whilst the engine is idling and again at approximately 1,000 r.p.m.

If the injection nozzle assembly being checked has been operating properly, there will be a distinct reduction in r.p.m. accompanied by obvious roughness, but a faulty injection nozzle may make little or no difference to the engine note when its fuel feed pipe is loosened.

#### Testing nozzle assemblies on vehicle

##### Operation M/76

1. Remove the fuel spill gallery pipe complete, from the injection nozzles, then disconnect the fuel feed pipe (injection pump to nozzle) from the nozzle to be tested and from the injection pump.

2. Release the clamping strap and withdraw the suspected injection nozzle assembly; reconnect the pipe and nozzle assembly to the injection pump in a position whereby fuel ejection may be observed.
3. Loosen the union nuts securing the remaining fuel pipes to injection nozzles.
4. Whilst the starter turns the engine over, observe the manner in which fuel issues from the nozzle and compare the spray form with section "A" of Fig. M-43.

Very little fuel should issue from the main spray hole with the engine turning over at starter speed but a fine spray comparable to that illustrated in section "A" should be ejected from the auxiliary spray hole. If the ejected fuel is more in the form of a liquid jet or issues from the main pintle hole, then the nozzle and holder assembly should be removed for overhaul (Operation M/78) and a replacement unit fitted.

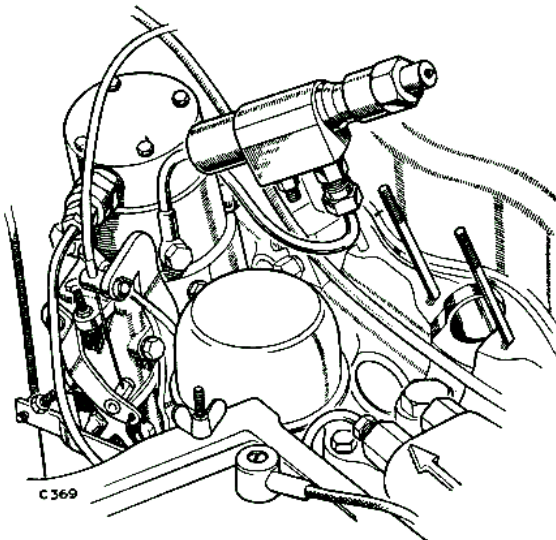


Fig. M-31—Testing nozzle assemblies on vehicle.

#### Bench testing of injection nozzle and holder assembly

To check a nozzle assembly and ensure that it is functioning correctly, a setting outfit as illustrated in Fig. M-33 is essential. A bench covered with linoleum or non-ferrous sheet metal is most suitable for mounting the outfit; such a surface facilitates the cleanliness essential when checking nozzle parts. Between the bench and setting outfit, a tray, also of non-ferrous metal, should be positioned to prevent spilt fuel spreading. Small containers may be attached to the bench to isolate the component parts of each assembly; these parts are carefully mated by the manufacturers and must not be interchanged. Lastly, a small bath with cover, containing Shell Fusus "A" oil for washing components, should be kept conveniently near.

The efficient operation of the injection nozzle assembly is dependent on four main conditions, as follows:—

- (a) The nozzle valve must open at 135 Ats.
- (b) The rate of back leakage must be within 150 to 100 Ats.
- (c) Seat tightness must be sufficient to prevent leakage.
- (d) Spray form must compare favourably with the illustration Fig. M-43.

Pressure setting, back leakage and seat tightness tests may be made by coupling the injection nozzle and holder assembly direct to the pressure feed pipe on setting outfit, but an adaptor must be fitted between the pipe and injection nozzle and holder assembly when testing spray form. This adaptor, described in Operation M/72, increases the pressure of fuel to the injection nozzle and holder assembly sufficiently for the main and auxiliary spray form to be determined.

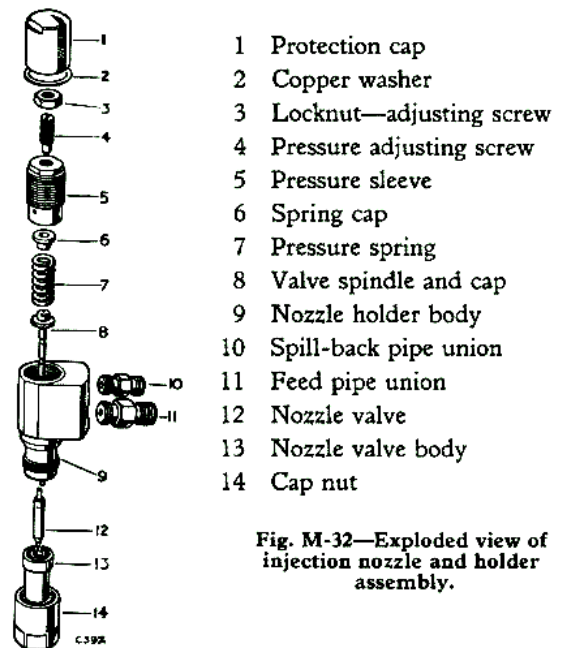


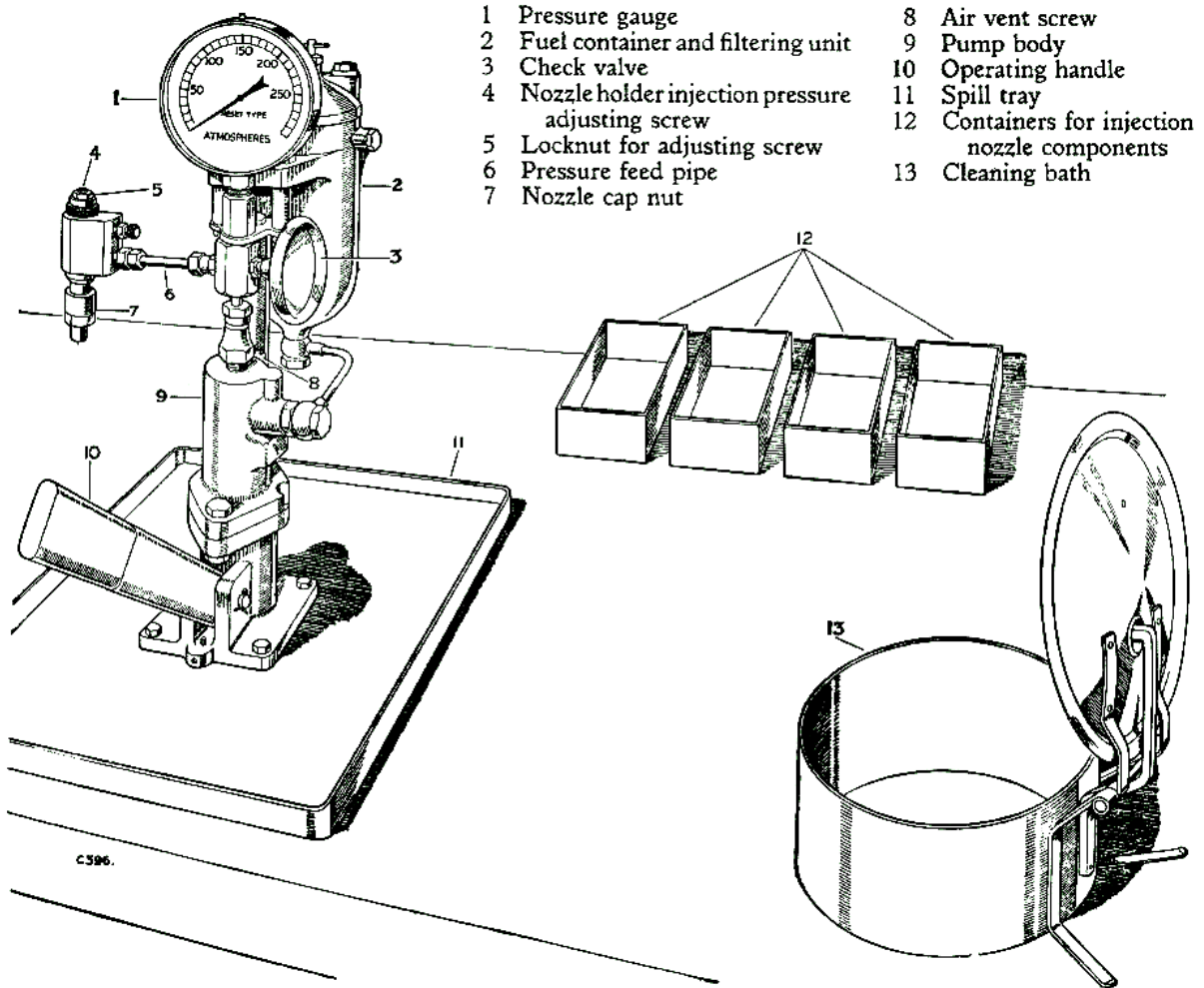
Fig. M-32—Exploded view of injection nozzle and holder assembly.

#### Dismantling and cleaning Operation M/78

A cleaning kit (Part No. 271484) is essential for removing carbon from the component parts of the injection nozzle and holder assembly. The use of special spanners (set Part No. 271482) is recommended.

1. Remove the nozzle holder protection cap and copper washer, unscrew the locknut, pressure adjusting screw and pressure sleeve, then withdraw the spring cap, spring and valve spindle. Unscrew the pipe unions and remove the copper washers.
2. Unscrew the cap nut, then remove the nozzle valve and body.





- |                                                    |                                               |
|----------------------------------------------------|-----------------------------------------------|
| 1 Pressure gauge                                   | 8 Air vent screw                              |
| 2 Fuel container and filtering unit                | 9 Pump body                                   |
| 3 Check valve                                      | 10 Operating handle                           |
| 4 Nozzle holder injection pressure adjusting screw | 11 Spill tray                                 |
| 5 Locknut for adjusting screw                      | 12 Containers for injection nozzle components |
| 6 Pressure feed pipe                               | 13 Cleaning bath                              |
| 7 Nozzle cap nut                                   |                                               |

Fig. M-33—Injection nozzle setting outfit.

3. Soak the component parts of the assembly in Shell Fusus "A" oil to loosen carbon deposits but do not allow parts of any one assembly to be interchanged with those of another.
4. Brush away all external carbon deposits from component parts with a brass wire brush (Part No. ET.068) and replace them in the oil bath. Particular care must be exercised when cleaning the pintle and seat of nozzle valve to avoid scratching or scoring, which may result in spray distortion.
5. Clean the three oil feed passages in the nozzle body with a wire or drill of  $\frac{1}{16}$  in. diameter. Remove the carbon from the annular recess with tool (Part No. ET.071) and from the valve seat, using tool (Part No. ET.070), with a rotary motion.
6. Select the appropriate size probe from the pocket of cleaning kit and secure it in the pintle hole cleaner (Part No. ET.069). Insert the probe into the bore of nozzle valve body and allow the end to extend through the main fuel outlet, then turn in a rotary manner to remove carbon.

7. Carbon may be removed from the nozzle valve cone by inserting the valve into tool (Part No. ET.072) and then rotating it alternatively in a clockwise then anti-clockwise manner whilst pressing the valve inward.



Fig. M-34—Cleaning nozzle body oil feed passages.

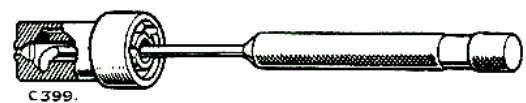


Fig. M-35—Scraping nozzle body annular recess.

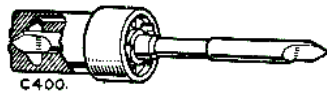


Fig. M-36—Removing carbon from valve seat.



Fig. M-37—Cleaning Pintaux nozzle hole.

If the nozzle is blued or the seating has a dull circumferential ring indicating pitting or wear, the nozzle body and valve should be returned to a C.A.V. Service Agent and replacement parts fitted. See "Defect Location".

Do not attempt to lap the nozzle valve to body. This process requires special equipment and training.



Fig. M-38—Removing carbon from nozzle valve cone.

- Clean the auxiliary spray hole using tool (Part No. ET.120) fitted with probing wire (.008 in (0,20 mm) diameter). Allow  $\frac{1}{16}$  in. (2,0 mm) only to extend from the chuck and thus minimise the possibility of the wire bending or breaking while probing. Great care must be taken to prevent breakage of the wire in the hole.

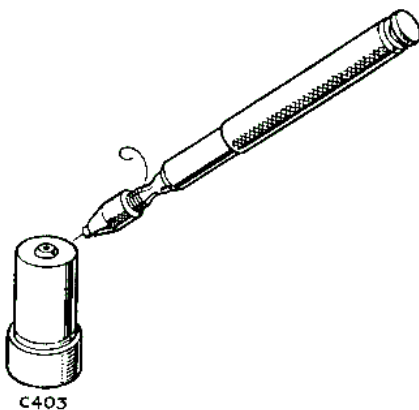
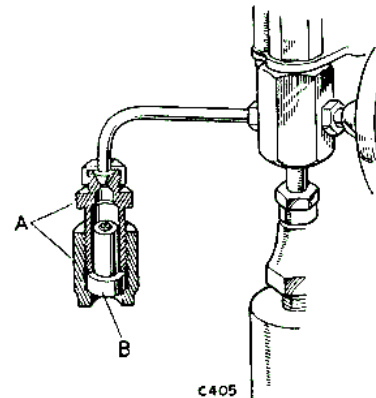


Fig. M-39—Cleaning auxiliary spray hole.

- With flushing tool ET.427 secured to the nozzle testing outfit, fit the nozzle body (spray holes uppermost) to the flushing tool and pump test oil through vigorously. This flushing process is necessary for the removal of any tiny carbon particles which may have become lodged in the body after scraping and probing.

Fig. M-40—Flushing nozzle body.  
A—Flushing tool. B—Nozzle body.

- Examine the pressure faces of nozzle body and nozzle holder to ascertain their freedom from scoring and scratches. These surfaces must be perfectly smooth. Fit the nozzle to nozzle body and check for freedom of movement.

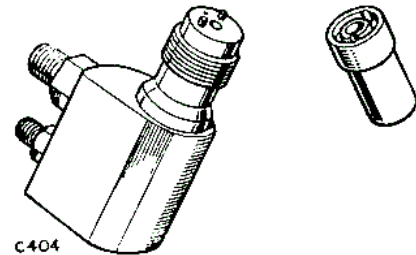


Fig. M-41—Injection nozzle assembly lapped pressure faces.

- Immerse the nozzle body and valve in the oil bath and assemble whilst submerged. Wash the remaining components thoroughly and reverse dismantling procedure.
- Test injection nozzle assembly in accordance with Operation M/80.

To test (Fig. M-32) Operation M/80

**WARNING:** The injection nozzle must not be allowed to point towards the operator when spraying and the hands must never be allowed to contact the spray, which has great penetrating force.

- Remove the cap from oil container (2) and fill with  $1\frac{1}{2}$  pints (0,852 litre) of Shell Fusus 'A' oil.
- Air vent the system by removing the vent screw (8), allow oil to flow freely for a few seconds and replace the screw whilst the flow continues. Operate the pump handle until oil flows from pipe (6).
- Connect the injector and holder assembly to the pressure feed pipe with the nozzle pointing downwards. The length and bore of this pipe is important and replacement pipes must be approximately 75 mm (2.8 in.) between the union nuts and of 3 mm (.118 in.) bore.

- Close the check valve (6) to keep the pressure gauge out of circuit and smartly operate the hand lever (10) several times to expel all air from the system.

#### Back leakage

- Open the check valve (3), move the operating handle slowly downward and note the highest pressure at which the gauge needle "flicks". This "flick" indicates the opening of the needle valve and should occur for this test at 160 to 170 atmospheres. Adjustment is made by removing the cap nut from the nozzle holder, loosening locknut (5) and turning the adjusting screw (4) clockwise to increase and anti-clockwise to decrease the opening pressure.
- Raise the pressure in the system to just less than valve opening pressure, release the operating lever and time the pressure drop from 150-100 atmospheres. This should be not less than 5 seconds for the original nozzle and not less than 7 seconds, if a new one is to be fitted, and not more than 36 seconds for either.
- Check externally the top and bottom of nozzle cap nut (7) and pressure pipe union nuts for signs of oil leakage. If leakage occurs at the nozzle cap nut, remove the nut and examine the pressure faces of nozzle holders and nozzle body for presence of foreign matter or surface scoring, before tightening further.

A leakproof nozzle assembly with an excessive rate of pressure drop, indicates a worn nozzle valve; the nozzle valve and nozzle body should be renewed.

#### Pressure setting

- The selected operational opening pressure of the nozzle valve is 135 atmospheres. Readjust to this setting in the manner described in item 5.

#### Seat tightness

- Wipe the bottom face of the injection nozzle dry and raise the pressure in the system to 125 atmospheres. A slight dampness on the bottom face is permissible, but blob formation or dripping indicates a badly seating valve in which case the assembly should be dismantled for further examination.

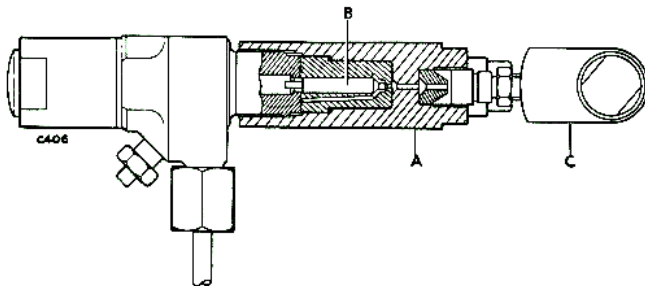


Fig. M-42—Sectioned view of adaptor (C.A.V.-E.T. 872).

A—Modified cap nut. B—Nozzle valve (less pintle).  
C—Nozzle under test.

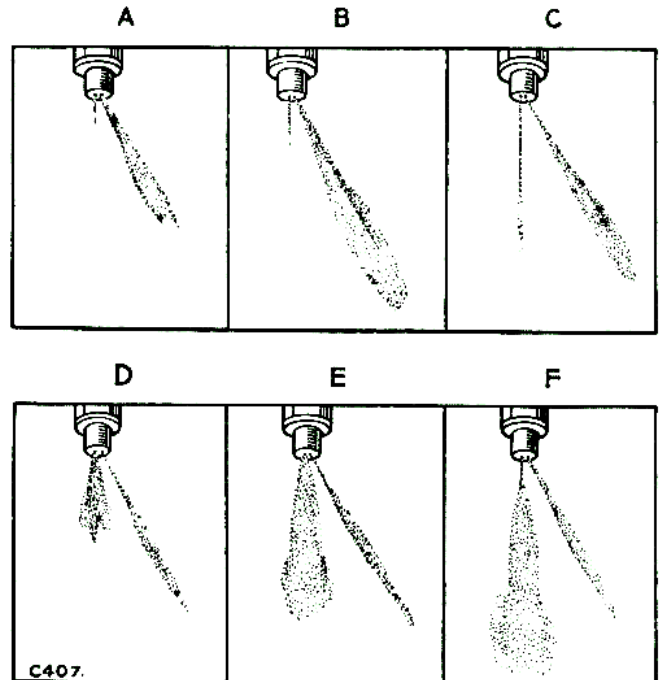


Fig. M-43—Injection nozzle spray form development —starting to running conditions

#### Spray form

- Fuel delivery to the injection nozzle assembly when testing spray form, must be characteristically similar to fuel delivery under normal operating conditions and to effect these conditions an adaptor (CAV Y7044872) must be fitted between the injection nozzle assembly and the pressure pipe.

The adaptor differs mainly in the cap nut and nozzle valve, from the ordinary type of injection nozzle and holder assembly as fitted to the engine; the nozzle valve has no pintle and the cap nut is extended, bored and threaded, to receive nozzles for testing.

- Connect the adaptor assembly to the pressure pipe and adjust the opening pressure of the nozzle valve to 220 atmospheres. (See items 4 and 5.) Screw the injection nozzle and holder assembly to be tested, into the adaptor and with the check valve closed, operate the handle smartly to expel air from the system.

The auxiliary spray form may be tested at 60 strokes per minute and the main spray at 140. Spray development from starting to running speeds is illustrated in Fig. M-43; this illustration should be referred to and compared with the spray form of nozzles under test.

## DEFECT LOCATION

### Symptom, Cause and Remedy

#### PETROL ENGINES

##### A—NO PETROL SUPPLY TO CARBURETTER

1. Blocked pump or bowl filter—*Clean.*
2. Stoppage in pipe lines—*Clear.*
3. Sticking needle valve—*Replace.*
4. Pump inoperative—*See item B below.*

##### B—INOPERATIVE FUEL PUMP (ELECTRIC)

1. Broken wiring or poor connections—*Rectify.*
2. Dirty contact points—*Clean.*
3. Foreign matter in pump—*Overhaul.*
4. Faulty pump—*Renew.*

##### C—ELECTRIC FUEL PUMP NOISY

1. Air leak between pump and tank—*Rectify.*
2. Dirt under pump valves—*Clean.*

##### D—LACK OF ENGINE POWER

1. Badly adjusted carburetter—*Adjust.*
2. Blocked jets—*Clear.*
3. Needle valve sticking—*Replace.*
4. Blocked filters or pipes—*Clean.*
5. Pump inoperative—*See items B or F.*
6. Engine fault—*See Section A.*
7. Accelerator linkage stiff—*Lubricate*
8. Water in petrol—*Drain and clear system.*

##### E—HEAVY PETROL CONSUMPTION

1. Badly adjusted or worn carburetter—*Adjust or replace.*
2. Float chamber flooding—*Replace needle valve*
3. Petrol leaks—*Rectify.*
4. Wrong main jet—*Check and rectify as necessary.*

#### DIESEL ENGINES

Note. Various defects may be caused by replacing any of the injection equipment on this engine with equipment of the incorrect type.

#### LIFT PUMP

##### F—INOPERATIVE FUEL PUMP (MECHANICAL)

1. Fuel tank empty—*Refuel.*
2. Cork sealing gasket for sediment bowl hardened or cracked—*Renew.*
3. Sediment bowl loosely fitted—*Tighten.*
4. Filter disc clogged—*Remove and clean.*
5. Diaphragm cracked or porous—*Renew—Operation M/48.*
6. Screws securing upper and lower casings loose—*Re-set diaphragm and tighten in accordance with Operation M/48, item 12.*
7. Rocker arm excessively worn—*Renew.*
8. Springs fatigued—*Renew.*
9. Valve seating gasket or valves damaged—*Renew.*
10. Dirt on valve or valve seats—*Clean and refit.*
11. Valve retainer screws loose—*Tighten.*
12. Pipe union—tank to pump—loose—*Tighten.*

##### G—FUEL LEAKING FROM BASE OF PUMP

1. Diaphragm porous or cracked—*Renew.*

#### INJECTION NOZZLES

##### A—NOZZLE BLUEING

1. Nozzle holder not tightened properly—*Renew nozzle body and valve—tighten fully.*
2. Inefficient cooling—*Check cooling system—renew nozzle body and valve.*
3. Small corrugated sealing washer not fitted or damaged—*Renew nozzle and valve, fit new washer.*

##### B—EXCESSIVE LEAK-BACK

1. Cap nut loose—*Tighten.*
2. Pressure seats scored—*Renew nozzle and holder assembly.*
3. Nozzle valve worn—*Renew nozzle and holder assembly.*

##### C—VALVE LIFTING PRESSURE TOO HIGH.

1. Compression screw incorrectly adjusted—*Re-adjust.*
2. Nozzle valve sticking—*Renew nozzle valve and nozzle body.*

##### D—VALVE LIFTING PRESSURE TOO LOW

1. Compression screw incorrectly adjusted—*Re-adjust.*
2. Spring fatigued or broken—*Renew.*

##### E—SPRAY FORM DISTORTED

1. Carbon on valve seat—*Remove.*
2. Nozzle tip distorted—*Renew nozzle valve and nozzle body.*
3. Spray holes distorted—*Renew nozzle valve and nozzle body.*
4. Injection holes partially blocked with carbon—*Remove deposit.*

##### F—NOZZLE DRIP

1. Valve seat scored—*Renew nozzle valve and nozzle body.*
2. Spring pressure incorrectly adjusted—*Re-adjust.*
3. Carbon deposit on valve or seating—*Remove.*
4. Nozzle valve sticking—*Clean and re-check, renew nozzle valve and body if trouble is not corrected.*

#### MAIN FILTER

##### A—LEAKAGE AT CONTAINER JOINT

1. Gasket unserviceable—*Renew.*
2. Container loose—*Tighten.*

##### B—FUEL PUMPED TO FILTER AT NORMAL PRESSURE BUT EMERGES AT MUCH REDUCED RATE

1. Element waxed up—*Renew element.*
2. Foreign body lodged in inlet connection—*Remove and examine.*

#### INJECTION PUMP

##### A—INJECTION PUMP DEFECTIVE

1. For any reason—*Return to CAV Agent—fit a replacement unit.*

DATA — ALL MODELS

**Air cleaner** .... A.C. Centrifugal—oil bath

Capacity:  
 1948-53 models .... 2 Imperial pints (1 litre)  
 1954-58 models .... 1.5 Imperial pints (0,85 litre)

**Carburettor**

Type .... Solex  
 Details .... Petrol models

Choke size:  
 1948-51 models .... 23  
 1952-58 models .... 25

Main jet:  
 1948-51 models .... 107,5  
 1952-58 models .... 115

Correction jet:  
 1948-51 models .... 160  
 1952-58 models .... 170

Pilot jet:  
 1948-51 models .... 45  
 1952-58 models .... 55

Pump jet:  
 1948-51 models .... 50  
 1952-58 models .... 75

Economy jet .... 50  
 Air bleed jet .... 1.5  
 Starter air jet .... 5.5

Starter petrol jet .... 135

**High speed circuit**

Petrol jet ....  
 Air bleed ....

Petrol level ....  $\frac{5}{8}$  in.  $\pm \frac{1}{8}$  (16 mm  $\pm 3$ ) below float chamber joint face

Exceptions to standard settings to suit various altitudes:

|                                           | 1948-51 models | 1952-58 models |
|-------------------------------------------|----------------|----------------|
| 3,000 to 6,000 feet (900 to 1800 m):      |                |                |
| Main jet                                  | 100            | 110            |
| Air bleed jet                             | 2.0            | 2.0            |
| 6,000 to 10,000 feet (1.800 to 3.000 m):  |                |                |
| Main jet                                  | 95             | 107,5          |
| Air bleed jet                             | 2.0            | 2.0            |
| 10,000 to 14,000 feet (3.000 to 4.200 m): |                |                |
| Choke size                                | 24 or 25       | 26             |
| Main jet                                  | 95             | 107,5          |
| Correction jet                            | 170            | 180            |
| Air bleed jet                             | 2.0            | 2.0            |

Main jet

Air bleed jet

6,000 to 10,000 feet (1.800 to 3.000 m):

Main jet

Air bleed jet

10,000 to 14,000 feet (3.000 to 4.200 m):

Choke size

Main jet

Correction jet

Air bleed jet

Exception to standard settings to suit tropical conditions:

Main jet:  
 1948-51 models 100  
 1952-58 models 110

**Filters**

Petrol models .... Sediment bowl, full flow  
 Diesel models, main.... C.A.V. Replaceable element, full flow

**Fuel pump**

Petrol models .... S.U. Electric  
 Diesel models .... A.C. mechanical  
 Pressure, Diesel models 5 to 8 lb./sq.in. (0,351 to 0,562 Kg/cm<sup>2</sup>)

**Fuel tank**

Capacity .... 10 Imperial gallons (45 litres). No reserve

**Injection pump, Diesel models**

Type .... C.A.V. Mechanically governed distributor

**Injection nozzle assemblies**

.... C.A.V. Pintaux  
 Nozzle size .... B.D.N.O./SP6209  
 Opening pressure of nozzle valve .... 135 Ats.

Back leakage rate, 150 to 100 Ats.:

New nozzle .... 7 seconds

Original nozzle .... 5 seconds



# Section N — EXHAUST SYSTEM

## INDEX

|                                     | Page |                                              | Page |
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| Exhaust silencer, early 1954        | N-1  | Front exhaust pipe, late 1954 onwards        | N-4  |
| Exhaust silencer, late 1954 onwards | N-4  | Intermediate exhaust pipe, late 1954 onwards | N-4  |
| Front exhaust pipe, early 1954      | N-1  |                                              |      |

## LIST OF ILLUSTRATIONS

| Fig. | Page | Fig.                                        | Page |
|------|------|---------------------------------------------|------|
| N-1  | N-2  | N-2                                         | N-3  |
|      |      | Layout of exhaust system, late 1954 onwards |      |

### Exhaust system, early 1954

#### Front exhaust pipe

##### To remove Operation N/10

1. Remove the clamping flange between the front exhaust pipe and the silencer.
2. Remove four nuts and spring washers securing the exhaust pipe to the exhaust manifold.
3. Withdraw the exhaust pipe complete with joint washer.

##### To refit Operation N/12

1. Replace the exhaust pipe by reversing the removal procedure.

#### Exhaust silencer (R.H.D. models only)

##### To remove Operation N/14

1. Jack up the rear of the vehicle and place jacking stands under the rear axle casing.
2. Remove both rear wheels.
3. Disconnect front exhaust pipe from silencer.
4. Remove the clips securing the front end of silencer unit to the support plate.
5. Remove the saddle securing the tail pipe to the tail pipe support bracket.
6. Withdraw the silencer unit complete by manoeuvring it past the right-hand road spring.

##### To refit Operation N/16

1. Replace the exhaust silencer by reversing the removal procedure.

#### Exhaust silencer (L.H.D. models only)

##### To remove Operation N/18

1. Jack up the rear of the vehicle and place jacking stands under the axle casing.
2. Remove the rear left-hand wheel.
3. Disconnect the front exhaust pipe from silencer.
4. Remove the clips securing the front end of the silencer unit to the support plate.
5. Remove the two bolts and self-locking nuts securing the silencer to the rubber support strip.
6. Remove the saddle securing the tail pipe to the tail pipe support bracket.

##### Land-Rover 107 only—

7. Remove the saddle securing the silencer to the chassis frame.
8. Remove two bolts securing one of the extremities of the rear axle check strap to the chassis side member. Remove the shock absorber top fixing bolt and slacken the lower one. Swing the shock absorber downwards.
9. Withdraw the silencer unit complete.

##### To refit Operation N/20

1. Replace the exhaust silencer by reversing the removal procedure, taking care to tighten the shock absorber securing bolts with the vehicle resting on the ground.

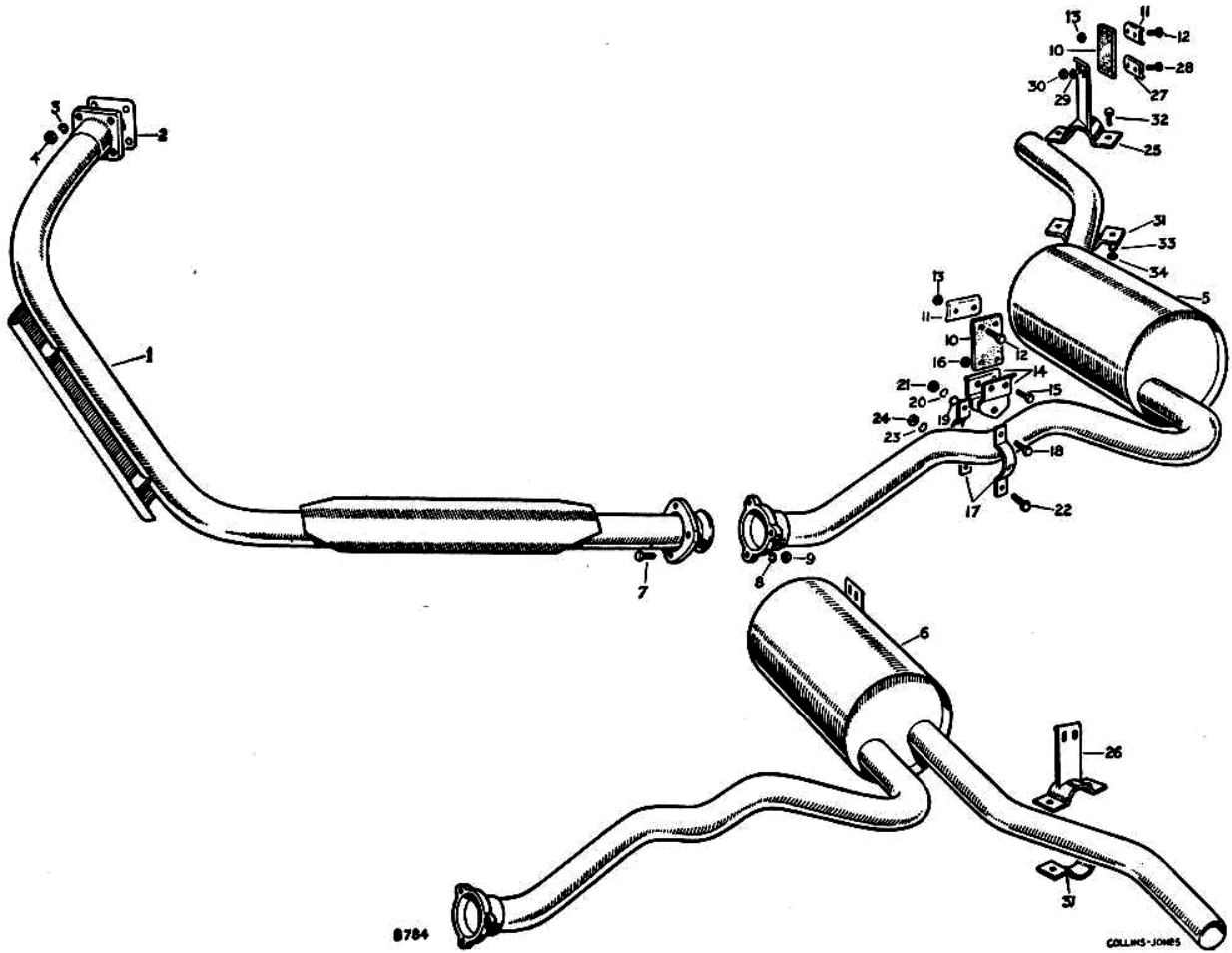


Fig. N-1—Layout of exhaust system, early 1954.

- |       |                                    |       |                                |
|-------|------------------------------------|-------|--------------------------------|
| 1     | Front exhaust pipe complete        | 15-16 | Fixings for plate              |
| 2     | Joint washer for exhaust pipe      | 17    | Pipe clamp                     |
| 3-4   | Fixings for exhaust pipe           | 18-21 | Fixings for pipe clamp         |
| 5     | Exhaust silencer complete          | 22-24 | Fixings for pipe clamp         |
| 6     | Exhaust silencer complete          | 25    | Clamp bracket for exhaust pipe |
| 7-9   | Fixings for silencer               | 26    | Clamp bracket for exhaust pipe |
| 10    | Flexible mounting for exhaust pipe | 27-30 | Fixings for clamp bracket      |
| 11-13 | Fixings for flexible mounting      | 31    | Saddle for clamp bracket       |
| 14    | Plate for flexible mounting        | 32-34 | Fixings for saddle             |



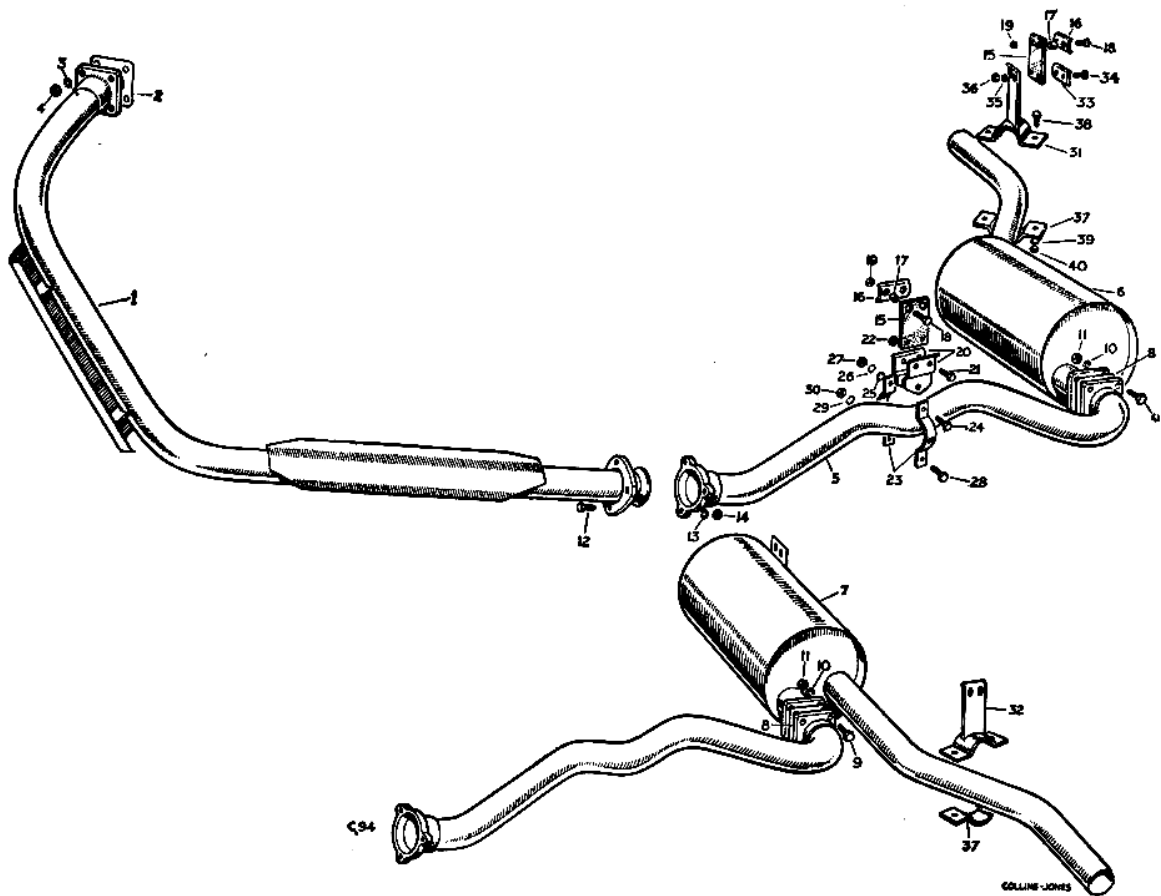


Fig. N-2—Layout of exhaust system, late 1954 onwards, Petrol and Diesel models.

- |    |                             |                                      |  |
|----|-----------------------------|--------------------------------------|--|
| 1  | Front exhaust pipe          |                                      |  |
| 2  | Joint washer for front pipe |                                      |  |
| 3  | Spring washer               | } Exhaust pipe to manifold           |  |
| 4  | Nut                         |                                      |  |
| 5  | Intermediate exhaust pipe   |                                      |  |
| 6  | Silencer complete—R.H.D.    |                                      |  |
| 7  | Silencer complete—L.H.D.    |                                      |  |
| 8  | Joint washer                |                                      |  |
| 9  | Bolt                        | } Intermediate pipe to silencer      |  |
| 10 | Spring washer               |                                      |  |
| 11 | Nut                         |                                      |  |
| 12 | Bolt                        | } Front pipe to intermediate pipe    |  |
| 13 | Spring washer               |                                      |  |
| 14 | Nut                         |                                      |  |
| 15 | Flexible mounting           | } Flexible mounting to chassis frame |  |
| 16 | Clamp plate                 |                                      |  |
| 17 | Distance piece              |                                      |  |
| 18 | Bolt                        |                                      |  |
| 19 | Self-locking nut            | } Plate to flexible mounting         |  |
| 20 | Plate for flexible mounting |                                      |  |
| 21 | Bolt                        | } Plate to flexible mounting         |  |
| 22 | Self-locking nut            |                                      |  |
| 23 | Pipe clamp                  | } Pipe clamp to flexible mounting    |  |
| 24 | Bolt                        |                                      |  |
| 25 | Shakeproof washer           |                                      |  |
| 26 | Spring washer               | } Pipe clamp to exhaust pipe         |  |
| 27 | Nut                         |                                      |  |
| 28 | Bolt                        | } Pipe clamp to exhaust pipe         |  |
| 29 | Spring washer               |                                      |  |
| 30 | Nut                         |                                      |  |
| 31 | Clamp bracket—R.H.D.        | } Clamp bracket to flexible mounting |  |
| 32 | Clamp bracket—L.H.D.        |                                      |  |
| 33 | Clamp plate                 | } Clamp bracket to flexible mounting |  |
| 34 | Bolt                        |                                      |  |
| 35 | Plain washer                |                                      |  |
| 36 | Self-locking nut            | } Saddle to clamp bracket            |  |
| 37 | Saddle for clamp bracket    |                                      |  |
| 38 | Bolt                        | } Saddle to clamp bracket            |  |
| 39 | Spring washer               |                                      |  |
| 40 | Nut                         |                                      |  |

## Exhaust system late 1954 onwards

**Front exhaust pipe****To remove** **Operation N/22**

1. Remove securing bolts at front exhaust pipe and intermediate pipe joint.
2. Remove nuts and spring washers securing pipe at exhaust manifold.
3. Withdraw the exhaust pipe and joint washer.

**To refit** **Operation N/24**

Reverse the removal procedure.

**Intermediate exhaust pipe****To remove** **Operation N/26**

1. Remove securing bolts at front exhaust pipe and silencer.
2. Remove supporting clamp and withdraw intermediate exhaust pipe.

**To refit** **Operation N/28**

1. Reverse the removal procedure, leaving the supporting clamps loose until the pipe has been secured firmly to front exhaust pipe and silencer.

**Exhaust silencer (R.H.D. models only)****To remove** **Operation N/30**

1. Remove the bolts securing intermediate pipe to silencer and release support saddle from silencer tail pipe, keeping silencer supported by hand.
2. Withdraw silencer assembly.

**To refit** **Operation N/32**

Reverse removal procedure, ensuring that the bolts securing intermediate pipe to silencer are fully tightened before finally clamping the tail pipe support.

**Exhaust silencer (L.H.D. models only)****To remove** **Operation N/34**

1. Remove bolts securing intermediate pipe to silencer.
2. Keeping the silencer supported, release the supporting strap for silencer right-hand side and saddle clamp on tail pipe, then withdraw silencer assembly.

**To refit** **Operation N/36**

1. Fit the silencer in position and loosely support by means of supporting strap and saddle clamp.
2. Secure the intermediate pipe to silencer.
3. Finally tighten bolts securing support strap and saddle clamp.

# Section P

## ELECTRICAL EQUIPMENT — ALL MODELS

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#### Batteries

*Note:* Two batteries fitted to Diesel models—see Data section.

#### To remove Operation P/2

1. Remove the air cleaner, disconnect the leads, remove the securing frame and lift battery clear (when removing one battery only—Diesel models—always remove the interconnecting battery lead completely from both batteries).

#### To refit Operation P/4

1. Reverse removal procedure, taking care to smear the battery terminals with petroleum jelly.

*Note:* The drive screws securing the battery leads are manufactured from a special

non-corrosive metal and must never be replaced with ordinary drive screws, which may cause serious corrosion of the battery terminals.

#### Starter motor

#### To remove Operation P/6

1. Petrol models—disconnect the positive lead from the battery.  
Diesel models—disconnect the negative L.H. battery lead from the battery and the leads from the starter solenoid.
2. Diesel models—remove the inlet and exhaust manifolds, and the dipstick and tube.

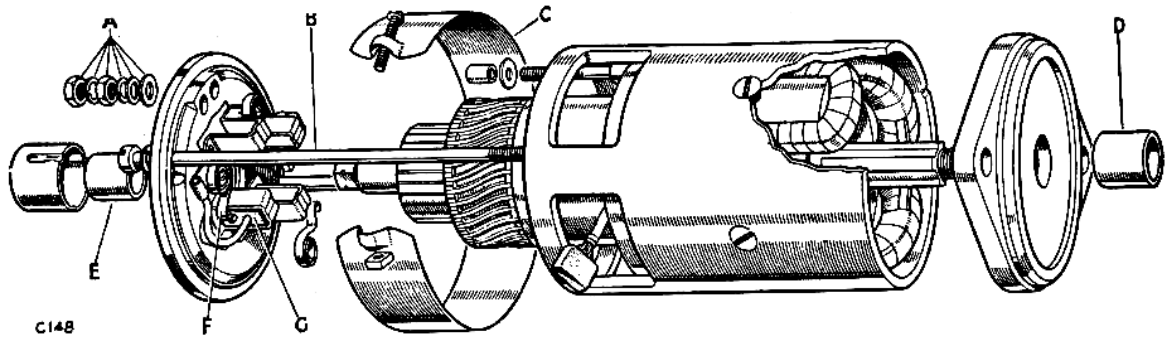


Fig. P-1—Exploded view of starter motor, Petrol models.

A—Terminal nuts and washer      C—Cover band      E—Bearing bush      G—Brush  
 B—Through bolt                      D—Bearing bush      F—Brush spring

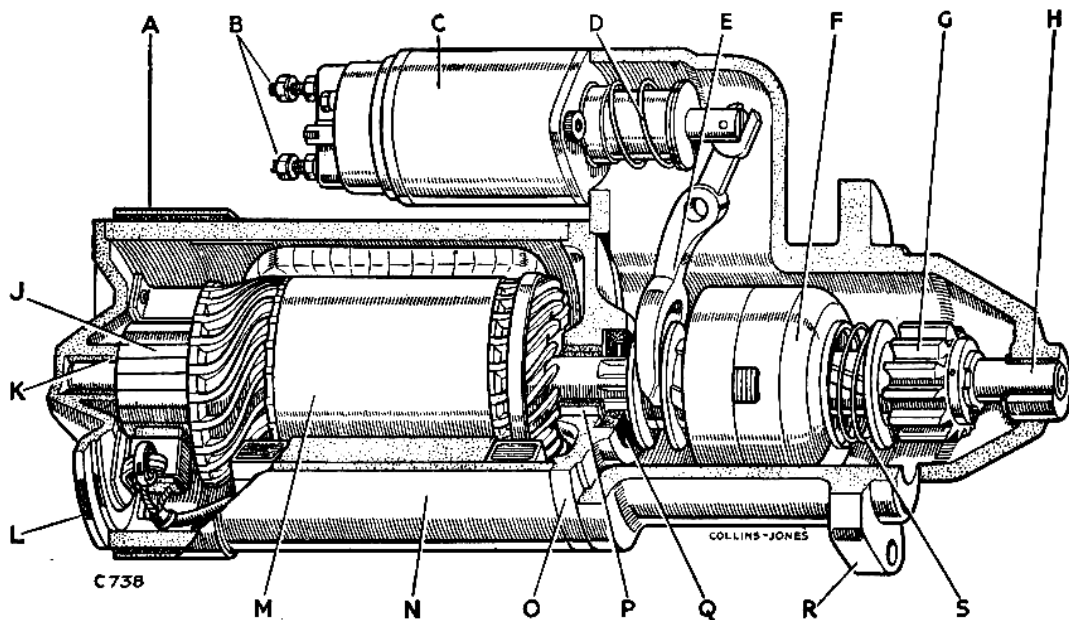


Fig. P-2—Sectioned view of starter motor, Diesel models.

A—Commutator cover band      G—Driving pinion      N—Yoke  
 B—Solenoid terminals          H—Porous bronze bush      O—Intermediate bracket  
 C—Solenoid                          J—Commutator                  P—Impregnated brass bush  
 D—Solenoid return spring      K—Porous bronze bush      Q—Brake ring  
 E—Engagement lever              L—Commutator-end bracket      R—Drive-end bracket  
 F—Clutch assembly                  M—Armature                      S—Cushion spring

3. 1954 models. Remove the oil filter and brackets from the cylinder block. Section A.
4. 1954 models. Detach the filter outlet pipe from the cylinder block.
5. Petrol models—disconnect the cable from starter.

#### Early models

Detach the outlet pipe from the cylinder block. Disconnect the wire to the oil pressure switch. Remove the oil pressure switch and oil pipe to the cylinder head by withdrawing two union

bolts. Remove the three nuts and spring washers securing the starter housing to the flywheel housing and lift out the starter motor and housing. (If necessary, remove the large bolt locating the starter motor in the housing through the access hole in the dash panel.)

6. Remove the securing bolts and withdraw starter.

#### To refit

1. Reverse the removal procedure.
2. Check the operation of the starter motor.

#### Operation P/8

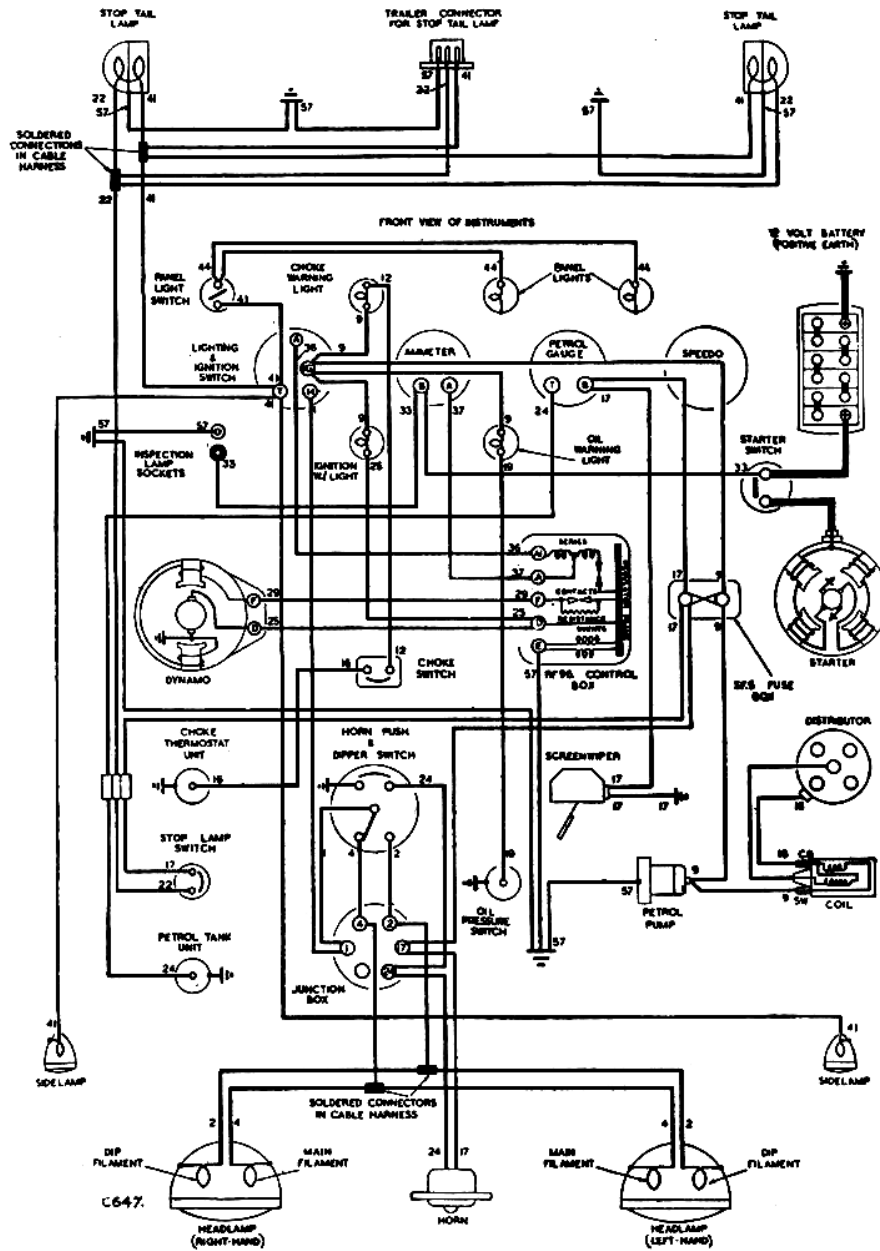


Fig. P-3—Wiring diagram, 1948-50 models

KEY TO CABLE COLOURS

|                      |                       |                      |                       |
|----------------------|-----------------------|----------------------|-----------------------|
| 1 BLUE               | 17 GREEN              | 33 BROWN             | 49 PURPLE             |
| 2 BLUE with RED      | 18 GREEN with RED     | 34 BROWN with RED    | 50 PURPLE with RED    |
| 3 BLUE with YELLOW   | 19 GREEN with YELLOW  | 35 BROWN with YELLOW | 51 PURPLE with YELLOW |
| 4 BLUE with WHITE    | 20 GREEN with BLUE    | 36 BROWN with BLUE   | 52 PURPLE with BLUE   |
| 5 BLUE with GREEN    | 21 GREEN with WHITE   | 37 BROWN with WHITE  | 53 PURPLE with WHITE  |
| 6 BLUE with PURPLE   | 22 GREEN with PURPLE  | 38 BROWN with GREEN  | 54 PURPLE with GREEN  |
| 7 BLUE with BROWN    | 23 GREEN with BROWN   | 39 BROWN with PURPLE | 55 PURPLE with BROWN  |
| 8 BLUE with BLACK    | 24 GREEN with BLACK   | 40 BROWN with BLACK  | 56 PURPLE with BLACK  |
| 9 WHITE              | 25 YELLOW             | 41 RED               | 57 BLACK              |
| 10 WHITE with RED    | 26 YELLOW with RED    | 42 RED with YELLOW   | 58 BLACK with RED     |
| 11 WHITE with YELLOW | 27 YELLOW with BLUE   | 43 RED with BLUE     | 59 BLACK with YELLOW  |
| 12 WHITE with BLUE   | 28 YELLOW with WHITE  | 44 RED with WHITE    | 60 BLACK with BLUE    |
| 13 WHITE with GREEN  | 29 YELLOW with GREEN  | 45 RED with GREEN    | 61 BLACK with WHITE   |
| 14 WHITE with PURPLE | 30 YELLOW with PURPLE | 46 RED with PURPLE   | 62 BLACK with GREEN   |
| 15 WHITE with BROWN  | 31 YELLOW with BROWN  | 47 RED with BROWN    | 63 BLACK with PURPLE  |
| 16 WHITE with BLACK  | 32 YELLOW with BLACK  | 48 RED with BLACK    | 64 BLACK with BROWN   |

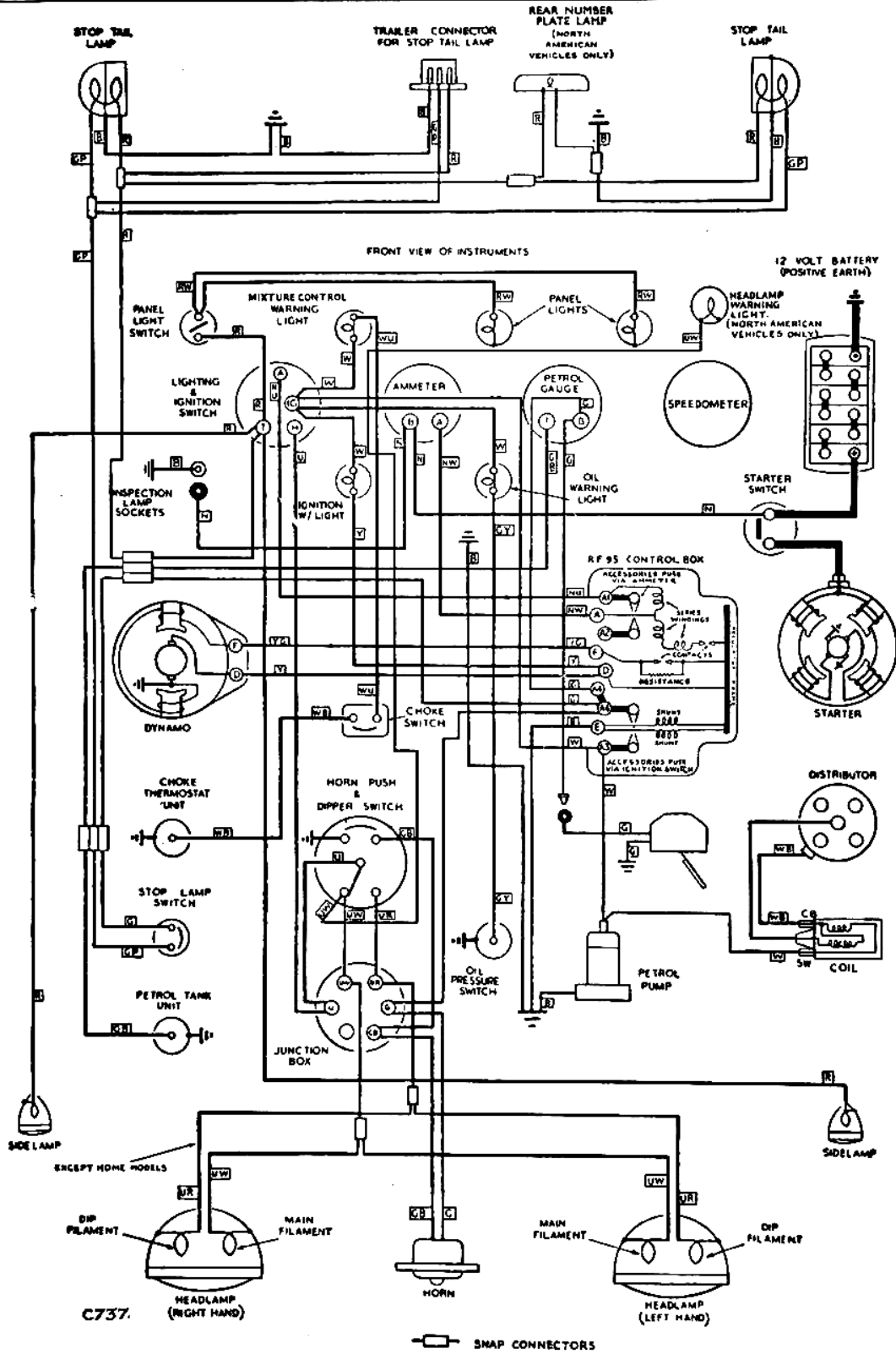


Fig. P-4—Wiring diagram, majority of 1951 models

KEY TO CABLE COLOURS

- |         |                               |        |          |
|---------|-------------------------------|--------|----------|
| B—BLACK | N—BROWN                       | R—RED  | W—WHITE  |
| G—GREEN | P—PURPLE                      | U—BLUE | Y—YELLOW |
|         | NU—BROWN with BLUE and so on. |        |          |

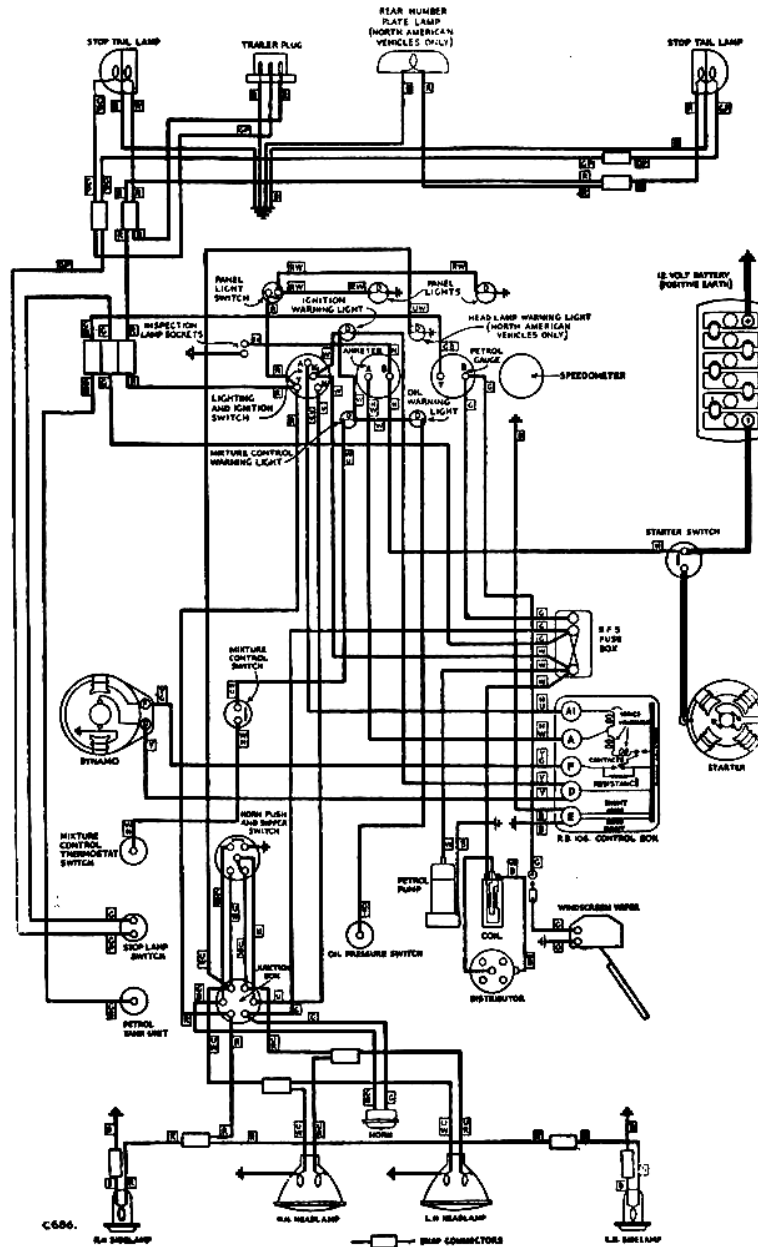


Fig. P-5—Wiring diagram, late 1951, 1952 and 1953 models

KEY TO CABLE COLOURS

B—BLACK  
G—GREEN

N—BROWN  
P—PURPLE  
R—RED  
U—BLUE  
NU—BROWN with BLUE and so on.

W—WHITE  
Y—YELLOW

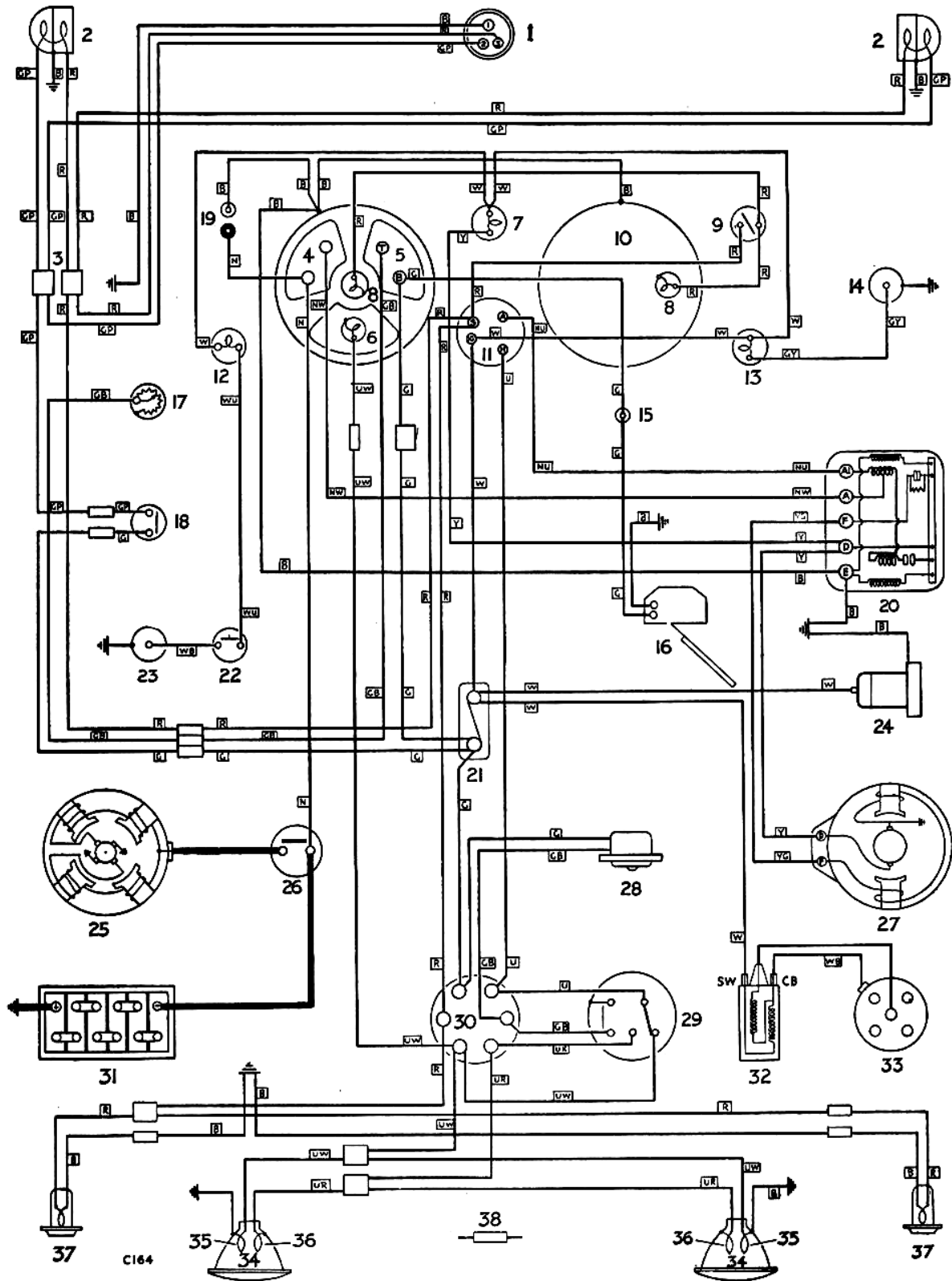


Fig. P-6—Wiring diagram 86 and 107—1956-58 models  
See Page P-9 for key to wiring diagram



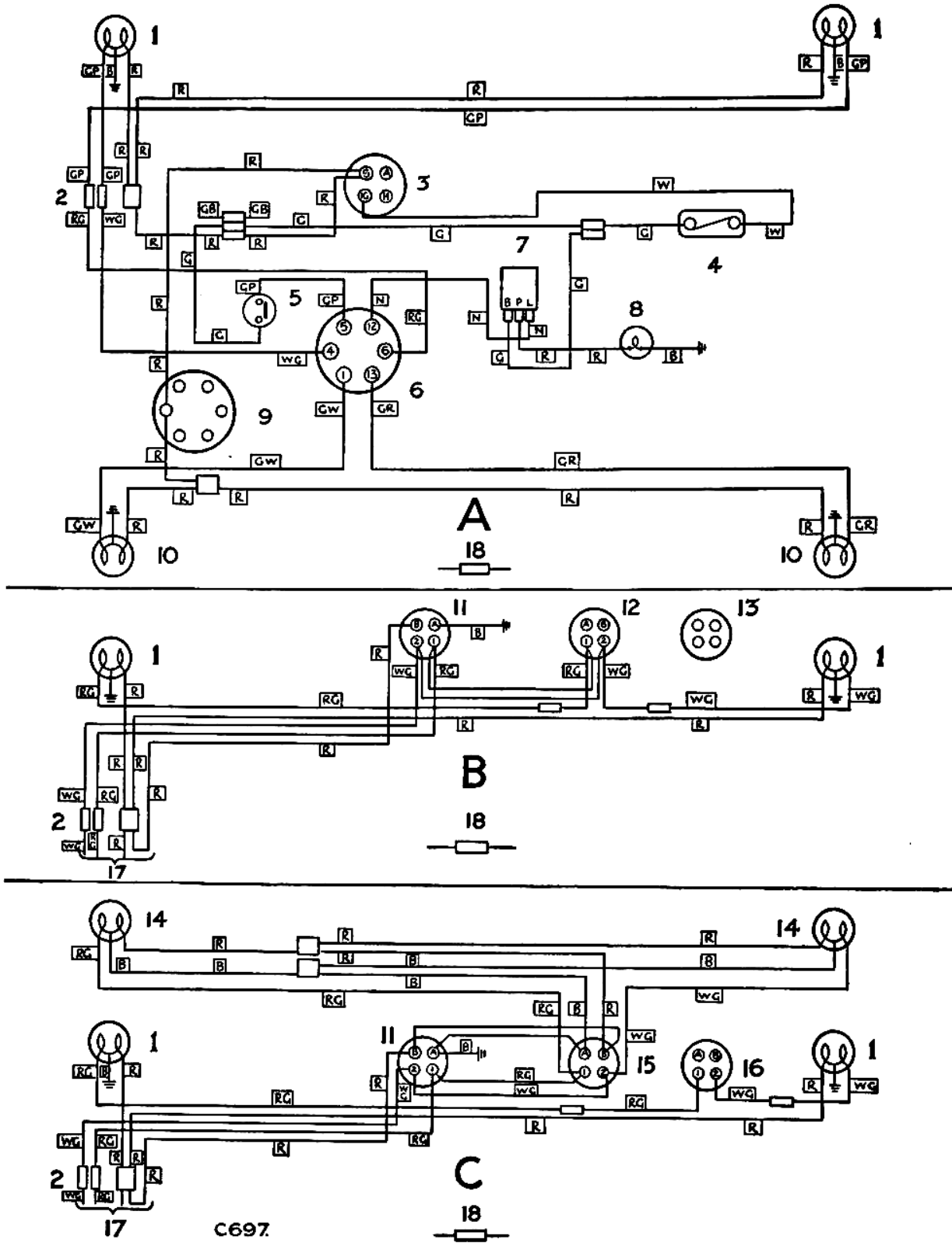


Fig. P-7—Flasher wiring diagram—1954-58 models  
See Page P-9 for key to wiring diagram

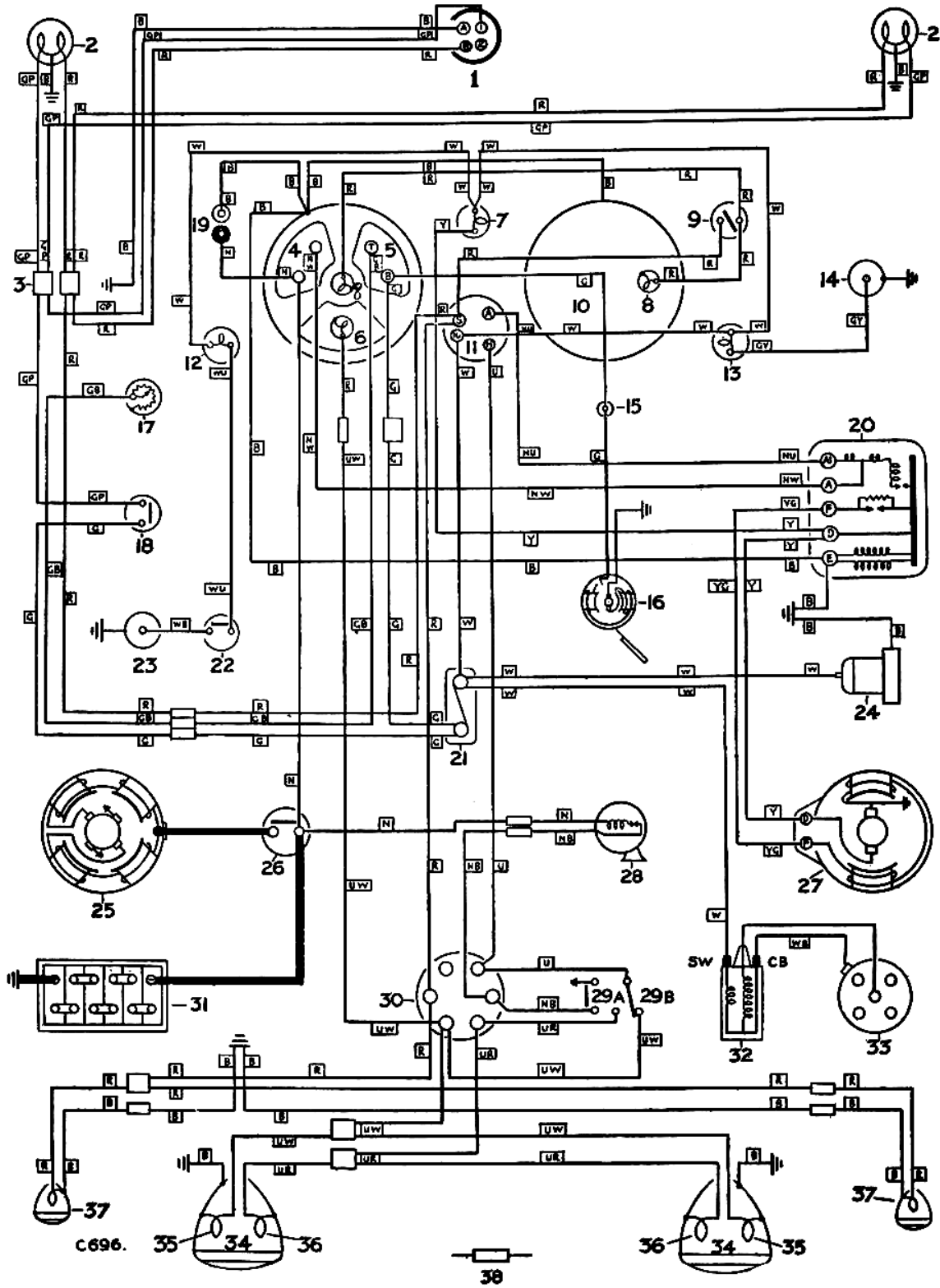



Fig. P-8—Wiring diagram 88 and 109—1954-58 models

See Page P-9 for key to wiring diagram

## Key to main wiring diagrams, Figs. P-6 and P-8

|                                          |                                                            |                                                                                                                   |
|------------------------------------------|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| 1 Trailer light socket (extra equipment) | 15 Windscreen wiper plug and socket                        | 28 Horn                                                                                                           |
| 2 Stop, tail lamps                       | 16 Windscreen wiper                                        | 29 Horn push and headlamp dipper switch,<br>86 and 107                                                            |
| 3 Snap connectors for trailer light      | 17 Petrol tank level unit                                  | 29A Horn push                                                                                                     |
| 4 Ammeter                                | 18 Stop lamp switch                                        | 29B Headlamp dipper switch                                                                                        |
| 5 Petrol level gauge                     | 19 Inspection lamp sockets                                 | 30 Junction box                                                                                                   |
| 6 Headlamp main beam warning light       | 20 R.B.106 voltage control box                             | 31 12 volt battery (positive earth)                                                                               |
| 7 Ignition warning light                 | 21 S.F.5 fuse box (35 amp. fuse)                           | 32 Ignition coil                                                                                                  |
| 8 Panel lights                           | 22 Mixture control switch (at control)                     | 33 Distributor                                                                                                    |
| 9 Panel light switch                     | 23 Mixture control thermostat switch<br>(at cylinder head) | 34 Headlamps                                                                                                      |
| 10 Speedometer                           | 24 Petrol pump                                             | 35 Main beam                                                                                                      |
| 11 Ignition and lighting switch          | 25 Starter                                                 | 36 Dip beam                                                                                                       |
| 12 Mixture control warning light         | 26 Starter solenoid switch                                 | 37 Side lamps                                                                                                     |
| 13 Oil pressure warning light            | 27 Dynamo                                                  | 38 Snap connectors shown thus  |
| 14 Oil pressure switch                   |                                                            |                                                                                                                   |

*Note:* On vehicles to the North American specification, the connections at the ignition and lighting switch are such that the sidelamps are extinguished when the headlamps are in use.


## Key to flasher wiring diagram, Fig. P-7

To be used in conjunction with main wiring diagrams on Pages P-6 and P-8.

A—Wiring diagram for flashers only.

B—Wiring diagram using flashers and trailer socket. In this diagram the rear flashers are shown connected via the trailer socket and vehicle flasher plug; the plug must be in this position when trailer is not in use.

C—Wiring diagram using flashers and trailer. In this diagram vehicle flashers are disconnected and trailer plug in use, giving flashers on trailer.

|                             |                                |                                                                                                                     |
|-----------------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1 Stop, tail lamp           | 7 Flasher unit                 | 13 Dummy trailer socket                                                                                             |
| 2 Snap connectors           | 8 Flasher warning light        | 14 Trailer stop, tail lamp                                                                                          |
| 3 Ignition and light switch | 9 Junction box                 | 15 Trailer plug                                                                                                     |
| 4 Fuse box                  | 10 Front flasher and side lamp | 16 Vehicle flasher plug in dummy trailer<br>socket                                                                  |
| 5 Stop lamp switch          | 11 Trailer socket              | 17 Wiring as diagram 'A' from this point                                                                            |
| 6 Flasher switch            | 12 Vehicle flasher plug        | 18 Snap connectors shown thus  |

## Key to cable colours

|                              |          |        |          |
|------------------------------|----------|--------|----------|
| B—BLACK                      | N—BROWN  | R—RED  | W—WHITE  |
| G—GREEN                      | P—PURPLE | U—BLUE | Y—YELLOW |
| RN—RED WITH BROWN, AND SO ON |          |        |          |

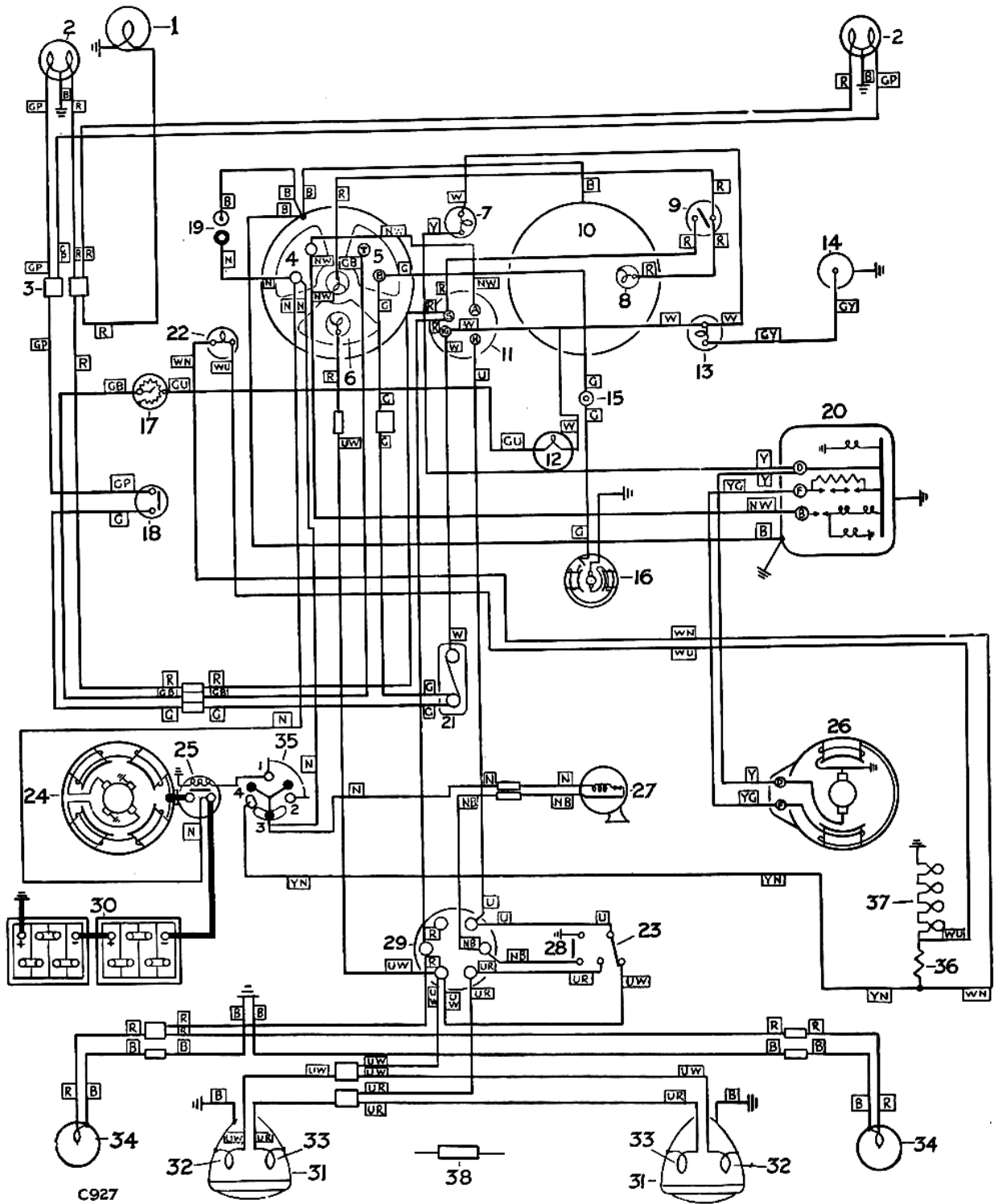


Fig. P-9—Wiring diagram, Diesel models.


**Wiring diagrams**

*Note:* On vehicles to the North American specification, the connections at the lighting switch are such that the sidelamps are extinguished when the headlamps are in use.

**Key to cable colours**

B—Black    N—Brown    R—Red    W—White  
 G—Green    P—Purple    U—Blue    Y—Yellow  
 RN—Red with brown and so on.

**Key to Fig. P-9**

- |                                            |                                                                                                                     |
|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1 Rear number plate light                  | 20 Current control box                                                                                              |
| 2 Stop, tail lamps                         | 21 Fuse box (35 amp. fuse)                                                                                          |
| 3 Snap connectors for number plate light   | 22 Heater plug warning light                                                                                        |
| 4 Ammeter                                  | 23 Headlamp dipper switch                                                                                           |
| 5 Fuel level gauge                         | 24 Starter                                                                                                          |
| 6 Headlamp main beam warning light         | 25 Starter solenoid switch                                                                                          |
| 7 Dynamo warning light                     | 26 Dynamo                                                                                                           |
| 8 Panel lights                             | 27 Horn                                                                                                             |
| 9 Panel light switch                       | 28 Horn push                                                                                                        |
| 10 Speedometer                             | 29 Junction box                                                                                                     |
| 11 Electrical services and lighting switch | 30 6-volt batteries (positive earth)                                                                                |
| 12 Fuel level warning light                | 31 Headlamps                                                                                                        |
| 13 Oil pressure warning light              | 32 Main beam                                                                                                        |
| 14 Oil pressure switch                     | 33 Dip beam                                                                                                         |
| 15 Windscreen wiper plug and socket        | 34 Side lamps                                                                                                       |
| 16 Windscreen wiper                        | 35 Starter and heater plug switch                                                                                   |
| 17 Fuel tank level unit                    | 36 Resistance for heater plug                                                                                       |
| 18 Stop lamp switch                        | 37 Heater plugs                                                                                                     |
| 19 Inspection lamp sockets                 | 38 Snap connectors shown thus  |

**To dismantle**                      **Operation P/10**

1. Remove the cover band, hold back the brush springs and lift the brushes from their holders.

**Petrol models**

2. Remove the starter drive, by withdrawing split pin from retaining nut on end of driving shaft and unscrewing the nut.
3. Remove the driving-end bracket, by unscrewing the two through bolts.
4. Withdraw the armature from the starter yoke.

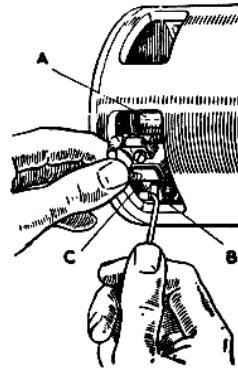
**Diesel models**

5. Disconnect the copper link between the lower solenoid terminal and the starter motor casing.
6. Remove the solenoid securing bolts. Withdraw the solenoid from the drive-end bracket casting, carefully making sure that the solenoid plunger is free from the starter drive engagement lever.
7. Unscrew and withdraw the two through bolts from the commutator-end bracket, and remove bracket from the starter motor yoke.
8. Remove the rubber seal from the drive-end bracket.
9. Remove the nut securing the eccentric pin, on which the drive engagement lever pivots, and withdraw pin.
10. Split the armature and intermediate bracket assembly from the drive-end bracket.
11. Slide the drive assembly and engagement lever off the shaft, first removing the washer from the end of the armature shaft extension.
12. Slide the intermediate bracket and brake assembly off the shaft, first removing the retaining ring from the armature shaft extension.

**To overhaul**                      **Operation P/12****Brushes**

1. Check that the brushes move freely in their holders by holding back the brush spring and pulling gently on the flexible connectors. Any tendency to stick should be corrected by cleaning with a petrol-moistened cloth, or in extreme cases by the light use of a smooth file. If a brush is damaged or worn so that it does not make good contact on the commutator, all the brushes must be renewed.
2. Check the tension of the brush springs with a spring balance. The correct tension is 30 to 40 oz. (850 to 1134 grammes) and new springs must be fitted if the tension is low.
3. The flexible connectors are soldered to terminal tags; two are connected to brush boxes, and two are connected to the free ends of the field coils. These flexible connectors must be removed by unsoldering, and the flexible connectors of the new brushes secured in their places by soldering.

The new brushes being pre-formed, "bedding" to the commutator is unnecessary.

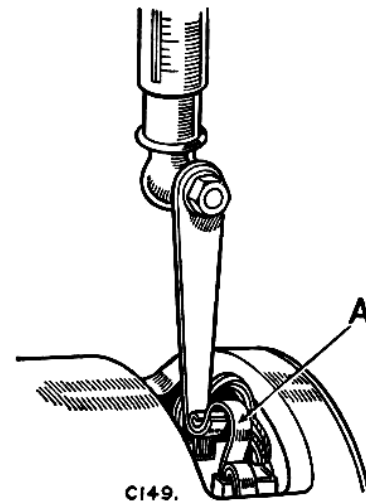


**Fig. P-10—**  
Checking brushes.

A—Commutator.  
B—Brush spring.  
C—Brush.

**Commutator**

4. Clean the commutator with a petrol-moistened cloth. If necessary, rotate the armature and, using fine glass-cloth, remove pits and burned spots from commutator; remove abrasive dust with a dry air blast. If the commutator is badly worn, mount in a lathe, and, using a very sharp tool, take a light cut, taking care not to remove any more metal than necessary. The insulators between the commutator segments must not be undercut.



**Fig. P-11—**Testing brush spring tension.  
A—Brush spring

**Armature**

5. If the armature is damaged, i.e. "lifted" conductors, or distorted shaft, it must be replaced. Never attempt to machine the armature core, or true a distorted armature shaft.

**To assemble**                      **Operation P/14**

1. Reverse the removal procedure.



**Starter drive—1955-58 Petrol models**

**To strip** **Operation P/20**

1. Withdraw split pin from nut on end of driving shaft and unscrew nut.
2. Remove main spring, washer, pinion and sleeve assembly, collar, push-off spring and spring restraining sleeve.

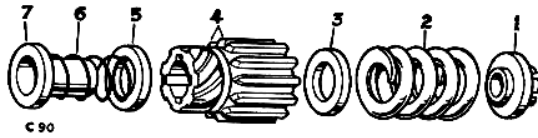


Fig. P-14—Layout of starter drive, 1955-58 Petrol models.

- |                               |                               |
|-------------------------------|-------------------------------|
| 1. Shaft nut.                 | 5. Collar.                    |
| 2. Main spring.               | 6. Pinion restraining spring. |
| 3. Washer.                    | 7. Spring retaining sleeve.   |
| 4. Screwed sleeve and pinion. |                               |

**To assemble** **Operation P/22**

1. Examine parts for excessive wear and replace as necessary. Assemble by reversing the removal procedure.

**Starter drive—Diesel models**

**To strip** **Operation P/24**

1. Remove the drive assembly from the armature shaft.
2. Remove the lock ring from the driving sleeve.
3. Lift the two halves of the engagement bush off the driving sleeve.
4. Using a suitable circlip extractor, remove the clutch retaining circlip from the barrel unit and withdraw the driving sleeve and clutch unit.
5. The clutch assembly can now be dismantled by removing all the parts from the driving sleeve—excepting the two pressure plates which are

held in position by the ring nut. To remove the ring nut, slide the driving sleeve on to the splined armature shaft and, using soft metal jaw plates, clamp the armature in a vice, file away the peened rims and remove ring nut. This locknut should only be removed if absolutely necessary. If removed, fit a new nut and peen the rim over the notch in the driving sleeve.

6. To remove the pinion from the helically splined sleeve, knock out the pinion retaining ring securing rivet. The retaining ring, pinion, cushion spring with cup washers and sleeve can now be separated.

**To assemble** **Operation P/26**

1. Reverse the stripping procedure.

*Note:* The correct cushion spring tension is 11 lb. (4,9 Kg.) measured with the spring compressed to  $\frac{3}{8}$  in. (22,2 mm) length and 16 lb. (7,26 Kg.) with the spring compressed to  $\frac{1}{2}$  in. (12,7 mm) length.

2. Check the slipping torque of the clutch as follows; fit the drive assembly on the splined armature shaft and clamp the armature between soft metal jaw plates in a vice.

Apply an anti-clockwise torque to the pinion with a suitable "torque wrench" fastened to the pinion teeth. The clutch should slip between 800-950 lb/in. (142,86 to 169,33 Kg/cm).

If the clutch slips at too low a torque figure, dismantle again, and add shims one at a time until the correct figure is obtained.

If the clutch does not slip between the torque limits given, again remove the circlip—dismantle and remove shims one at a time until the torque test gives correct figures.

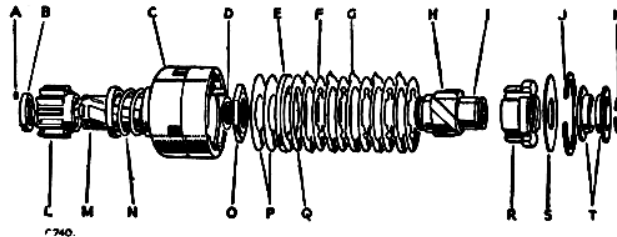


Fig. P-15—Exploded view of starter drive assembly, Diesel models.

- |                           |                          |
|---------------------------|--------------------------|
| A—Rivet                   | K—Lock ring              |
| B—Pinion retaining spring | L—Pinion                 |
| C—Barrel unit             | M—Helical splined sleeve |
| D—Thrust washer           | N—Cushion spring         |
| E—Backing ring            | O—Ring nut               |
| F—Clutch inner plate      | P—Pressure plates        |
| G—Clutch outer plate      | Q—Shim                   |
| H—Helical splines         | R—Moving member          |
| I—Driving sleeve          | S—Retaining washer       |
| J—Circlip                 | T—Engagement bush        |



3. The assembled clutch unit and lever mechanism must be capable of being pushed to the full extent of the set travel. The assembly must move along the armature shaft extension smoothly and freely, but without slackness.
4. Before fitting the drive assembly to the armature shaft, lightly smear the shaft and pack the space between the indented bearings inside the pinion sleeve, with a bentonite-based grease.

**Solenoid (Diesel models)—to test**

The solenoid is composed of two coils, namely, a closing coil, by-passed when the plunger is fully home, and a hold-on coil to retain the plunger in the fully home position.

To test individually, remove existing connections and with the use of a 4-volt DC supply (constant voltage), proceed as below:

**Closing coil**

Connect the supply between the solenoid terminal marked 'S T A' and the smaller centre terminal. This should cause a current of 14.8 amps. to 17.4 amps. to pass.

**Hold-on coil**

Connect the supply between the solenoid body and the small centre terminal. This should cause a current of 4.5-5.6 amps. to pass.

*Note:* These tests should not be carried out while the solenoid is hot. Do not attempt to repair a faulty solenoid, it should always be replaced.

**Starter switch—Petrol models****To remove** **Operation P/28**

1. Disconnect the battery.
2. Disconnect the three leads from the switch.
3. Screw off the switch knob and the locking nut from the switch spindle.
4. Remove the switch from the dash panel.

**To refit** **Operation P/30**

Reverse the removal procedure, connecting the wires in accordance with the appropriate wiring diagram.

**Starter switch—Diesel models**

See Operation P/144.

**Dynamo****To remove** **Operation P/32**

1. Disconnect the positive lead from the battery. Remove the air cleaner.
- Diesel only:** Completely detach the lead connecting both batteries, disconnect the negative lead from the L.H. battery and remove L.H. battery.

2. Disconnect the leads from dynamo.
3. Remove the bolts securing the dynamo to adjusting and anchor brackets.
4. Remove the belt from pulley and withdraw dynamo.

**To refit** **Operation P/34**

1. Reverse the removal procedure.
2. Adjust the driving belt tension: Petrol models,  $\frac{1}{8}$  to  $\frac{3}{8}$  in. (12-19 mm); and Diesel models,  $\frac{3}{16}$  to  $\frac{1}{4}$  in. (4-6 mm).

**To strip** **Operation P/36**

1. Take off the driving pulley.
2. Unscrew and withdraw the two through bolts.
3. The commutator-end bracket can now be withdrawn from the dynamo yoke. Do not lose the fibre thrust washer.
4. The driving-end bracket together with the armature can now be lifted out of the yoke.

**To overhaul** **Operation P/38****Brushes**

1. Lift the brushes up into the brush boxes and secure them there by positioning the brush spring at the side of the brush.
2. Fit the commutator-end bracket over the commutator and release the brushes.
3. Check that the brushes move freely in their holders by holding back the brush spring and pulling gently on the flexible connectors. Any tendency to stick should be corrected by cleaning with a petrol-moistened cloth, or in extreme cases by the light use of a smooth file. If a brush is damaged or worn so that it does not make good contact on the commutator, all the brushes must be renewed.
4. Check the tension of the brush springs with a spring balance. The correct tension is 22 to 25 oz. (624 to 709 grammes). In service it is permissible for this value to fall to 15 oz. (425 grammes). New springs must be fitted if the tension is low.
5. The new brushes being pre-formed, "bedding" to the commutator is unnecessary.

**Commutator**

6. Clean the commutator with a petrol-moistened cloth. If necessary, rotate the armature and, using fine glass-cloth, remove pits and burned spots from the commutator; remove abrasive dust with a dry air blast. If the commutator is badly worn, mount in a lathe, and, using a very sharp tool, take a light cut, taking care not to remove any more metal than necessary. Under-cut the insulators between the segments to a depth of  $\frac{1}{32}$  in. (0.8 mm) with a hacksaw blade ground to the thickness of the insulator.

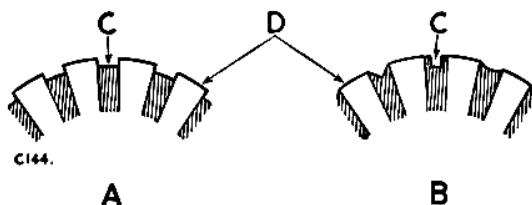


Fig. P-16—Undercutting commutator insulators.  
A—Right. B—Wrong.

#### To assemble

#### Operation P/40

1. Lift the brushes up into the brush boxes and secure them in that position by positioning the brush spring at the side of the brush.
2. Fit the commutator-end bracket on the armature shaft until the brush boxes are partly over the commutator. Place a thin screwdriver on top of each brush in turn and press the brush down on the commutator. The brush springs should then position themselves on top of the brushes.
3. Fit the commutator-end bracket to the yoke so that the projection on the bracket locates in the yoke.
4. Refit the two through bolts.
5. Inject a few drops of any high quality medium viscosity (SAE 30) engine oil into the hole marked "Oil" at the end of the commutator bearing housing.

#### To check

#### Operation P/42

1. Check the driving belt tension, ensure that it is neither too tight nor too loose; Operation P/34. Adjust if necessary by slackening the pivot and adjusting link bolts, then move the dynamo outwards from the engine to tighten belt or inwards to loosen. Re-tighten the securing bolts.
2. Disconnect the cables from terminals of dynamo and connect the two terminals with a short length of wire.
3. Start the engine and run at normal idling speed. Clip the negative lead of a moving coil voltmeter, calibrated 0-20 volts, to one dynamo terminal and the other lead to a good earthing point on the yoke.
4. Gradually increase the engine speed; the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts nor race the engine in an attempt to increase the voltage output. An engine speed of 1,000 r.p.m. should not be exceeded.
5. If there is no reading, check the brush gear as described in Operation P/38. A low reading of approximately  $\frac{1}{2}$ -1 volt indicates a possible faulty field winding. Readings of 4 to 5 volts are probably attributable to faulty armature windings.

*Note:* If a radio suppression capacitor is fitted between the output terminal and earth, disconnect this capacitor and re-test the dynamo before dismantling. If a reading is now given on the voltmeter, the capacitor is defective and must be replaced.

6. The dynamo being found serviceable, remove the link connecting the terminals and fit them to the respective connections. Ensure that the larger terminal is connected to control box terminal marked "D" and the smaller dynamo terminal to the control box terminal marked "F".

#### Voltage regulator—Petrol engines

#### To remove

#### Operation P/44

1. Disconnect the battery.
2. Disconnect all wires from the control box.
3. Remove the control box complete from the mounting plate.

#### To refit

#### Operation P/46

1. Reverse the removal procedure, connecting the wiring in accordance with the appropriate wiring diagram.

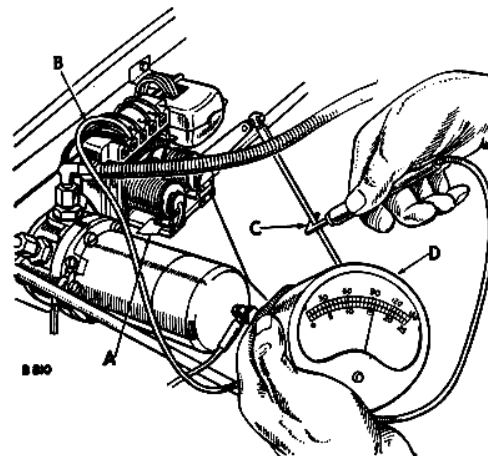


Fig. P-17— Checking voltage regulator, Petrol models.

A—Piece of paper. C—Earth.  
B—D connection. D—Voltmeter.

#### To check

#### Operation P/48

1. Place a piece of paper between the cut-out contacts and connect a moving-coil voltmeter to the "D" terminal on the regulator and to a good earth (not the one on the regulator box). Start the engine and increase r.p.m. until the voltage remains constant, i.e., the regulator is controlling; the voltmeter reading should be 15.8 to 16.4 volts. If the regulating voltage is not correct, the vehicle should be examined by a qualified electrician. Should the regulator be reading correctly at the commencement of this test, the earth lead of the voltmeter should be transferred to the "E" connection on the

regulator box; the reading should be the same as that obtained with the previous earth. If there is any difference, i.e., the "E" connection on the regulator gives a lower reading, it will indicate a bad earth on the regulator box.

#### Current voltage regulator—Diesel models Locating faults on charging circuit

Ensure that the dynamo is functioning correctly and that the battery is in order, then proceed as follows:—

- Ensure that the wiring between battery and control box is in order by disconnecting the wire from control box terminal B and connecting the end of the wire removed to the negative terminal of a voltmeter. Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is observed, the wiring is in order and the control box must be examined.
- If there is no reading, examine the wiring between battery and control box for defective cables or loose connections.
- Re-connect the wire to terminal B.

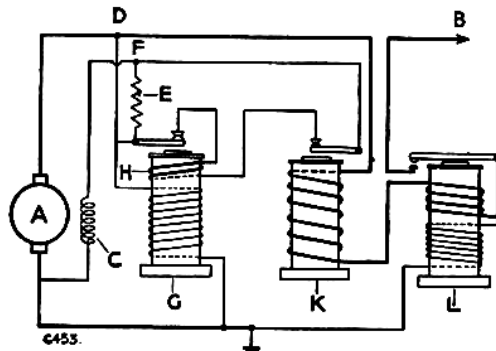


Fig. P-18—The charging circuit.

- |                                                       |                            |
|-------------------------------------------------------|----------------------------|
| A—Armature.                                           | F—Terminal on control box. |
| B—Terminal on control box—<br>to ammeter and battery. | G—Voltage regulator.       |
| C—Field windings.                                     | H—Bucking coil.            |
| D—Terminal on control box.                            | K—Current regulator.       |
| E—Resistor.                                           | L—Cut-out relay.           |

#### Regulator adjustments

The regulators are carefully set during manufacture to suit the normal requirements of standard equipment and, in general, further adjustments should not be necessary. However, if the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, it may be advisable to check the settings and re-adjust if necessary.

Before disturbing any settings, it is important to check that a fault in the charging system is not due to a slipping dynamo belt or to a defective battery.

#### Electrical setting of voltage regulator

##### Operation P/50

- Disconnect control box terminal B. Connect a first-grade moving coil 0-20 voltmeter between terminal D and earth.

- Slowly increase the speed of the engine until the voltmeter needle flicks and steadies. This should occur at a reading between 14.2 and 14.8 volt. If it does not, stop the engine and remove the control box cover.
- Slacken the adjustment screw locking nut (see Fig. P-20) and turn the screw in a clockwise direction to raise the voltage setting, or anti-clockwise to lower the setting. Turn the screw a fraction of a turn only at a time and re-tighten the locknut.
- Repeat this open-circuit voltage test until the correct setting is obtained.

Re-make the original connections.

*Note:* When the dynamo is run at a high speed on open circuit, it builds up a high voltage. Therefore, when adjusting the regulator, do not run the engine up to more than half throttle or a false voltmeter reading will be obtained. The adjustment should be completed within 30 seconds, otherwise heating of the regulator winding may cause an inaccurate setting to be made.

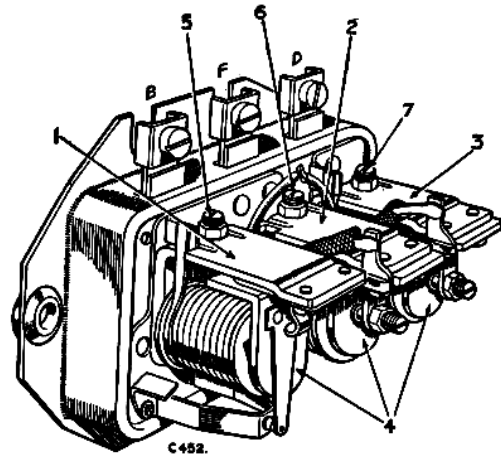


Fig. P-19—Current voltage regulator.

- |                            |                            |
|----------------------------|----------------------------|
| 1 Cut-out.                 | 6 Current adjusting screw. |
| 2 Current regulator.       | 7 Voltage adjusting screw. |
| 3 Voltage regulator.       | B—Terminal.                |
| 4 Armature.                | F—Terminal.                |
| 5 Cut-out adjusting screw. | D—Terminal.                |

#### Electrical setting of current regulator on vehicle

##### Operation P/52

- When setting the current regulator on the vehicle, the dynamo must be made to develop its maximum rated output, whatever the state of charge of the battery might be at the time of setting. The voltage regulator must therefore be rendered inoperative. To do this, the voltage regulator contacts should be short-circuited with a clip large enough to bridge the outer armature assembly securing screw and the insulated fixed contact bracket, as shown in Fig. P-20.

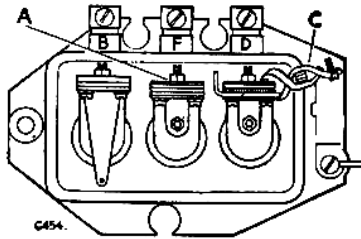


Fig. P-20—Short-circuiting voltage regulator contacts.

A—Current regulator adjusting screw. D—Terminal.  
B—Terminal. F—Terminal.  
C—Clip—short-circuiting.

2. Disconnect the cable from control box terminal B and connect a first-grade moving coil 0-40 ammeter between this cable and terminal B. Switch on all lamps and accessories. This will prevent the voltage of the system rising when the engine is started.
3. With the dynamo running at approximately 4,000 r.p.m., the ammeter needle should be steady and indicate a current of 22 amp. If it does not, the unit must be adjusted in a manner similar to that described for the voltage regulator.

Re-make the original connections.

#### Electrical setting of cut-out relay

##### Operation P/54

1. Connect a first-grade moving coil 0-20 voltmeter between control box terminal D and earth. Switch on the headlamps and slowly increase the engine speed from zero. Closure of the contacts, indicated by a slight drop in the voltmeter reading, should occur between 12.7 and 13.3 volts. If it does not, the unit must be adjusted in a manner similar to that described for the voltage regulator.

*Note:* When setting the cut-in voltage at a test bench, a suitable load resistor passing about 6 amperes should be connected between control box terminal B and earth. This will cause the voltmeter needle to flicker at the instant of contact closure.

2. Disconnect the cable from control box terminal B. Connect a first-grade moving coil 0-20 voltmeter between this terminal and earth. Run the engine up to speed and then slowly decelerate, noting the instant when the voltmeter reading drops to zero. This should occur between 9.5 and 10.5 volts. If it does not, adjust by carefully bowing the legs of the fixed contact post. Repeat the test and, if necessary, re-adjust until the armature releases at the voltage specified.

#### Cleaning contacts

##### Operation P/56

When cleaning the voltage or current regulator contacts, use fine carborundum stone or silicon carbide paper, followed by methylated spirits (denatured alcohol).

When cleaning the cut-out contacts, use a strip of fine glass paper—never carborundum stone or emery cloth.

#### Mechanical setting of air gaps—Voltage and current regulators

##### Operation P/58

All air-gap settings are accurately adjusted before the units leave the factory, and should require no further attention. If, however, an armature is removed for any reason, care must be taken to obtain the correct air-gap settings on re-assembly.

1. Slacken the two armature assembly securing screws so that the armature is loosely attached to the regulator frame.
2. Slacken the fixed contact locking nut and unscrew the fixed contact adjustment screw until it is well clear of the armature moving contact.
3. Slacken the voltage (or current) adjustment screw locking nut and unscrew the adjustment screw until it is well clear of the armature tension spring.
4. Using a 0.015 in. thick flat steel gauge, wide enough to cover completely the core face, insert the gauge between the underside of the armature and the copper disc. Take care not to turn up or damage the edge of this disc.
5. Press the armature squarely down against the gauge and re-tighten the two armature assembly securing screws.
6. With the gauge still in position, screw in the fixed contact adjustment screw until it just touches the armature moving contact. Re-tighten the locking nut.
7. Carry out the electrical settings, Operation P/52 or 54 as applicable.

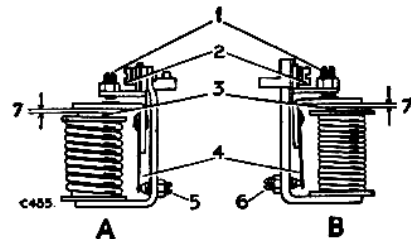


Fig. P-21—Voltage and current regulators.

A—Voltage regulator. B—Current regulator.  
1—Fixed contact adjustment screws. 4—Armature tension springs  
2—Armature assembly securing screws. 5—Voltage adjustment screws.  
3—Cores. 6—Current adjustment screws.  
7—.015 in. (0,381 mm).

#### Setting cut-out relay air gap

##### Operation P/60

1. Slacken the two armature assembly securing screws so that the armature is loosely attached to the cut-out frame.
2. Slacken the adjustment screw locking nut and unscrew the adjustment screw until it is well clear of the armature tension spring.

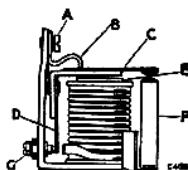


Fig. P-22—Cut-out relay.

A—Armature assembly securing screw.  
 B—Armature back stop.  
 C—Contact blade.  
 D—Armature tension spring.  
 E—Core.  
 F—Fixed contact post.  
 G—Adjustment screw.

3. Press the armature squarely down against the copper-sprayed core face and re-tighten the two armature assembly securing screws. No gauge is necessary.
4. Press the armature down against the core face and adjust the armature back stop so that a 0.018 in. (0,45 mm) gap is obtained between the tip of the back stop and the contact blade.
5. Insert a 0.010 in. (0,25 mm) thick flat steel gauge between the underside of the armature and the copper-sprayed core face. The gauge should be inserted from the side of the core nearest the fixed contact post. The leading edge of the gauge should not be inserted beyond the centre line of the core face. Press the armature down against the gauge and check the cut-out contacts. These should be just touching. If necessary adjust the height of the fixed contact by carefully bowing the legs of the fixed contact post.
6. Reset the cut-in voltage (Operation P/54) and lock the adjustment screw.

#### To remove Operation P/62

1. Disconnect the positive lead of R.H. battery and the leads to regulator box.
2. Remove the securing bolts and withdraw the regulator unit.

#### To refit Operation P/64

1. Reverse removal procedure, connecting wiring in accordance with the appropriate wiring diagram.

#### Headlamp, early models

##### To remove Operation P/66

1. Remove the two bolts and clamps securing the radiator grille and lift out the grille from its sockets.
2. Slacken the fixing screw at the top of the lamp and swing it upwards. Remove the front from the top of the lamp first.
3. The reflector is secured to the lamp by means of a rubber bead and can now be withdrawn.

4. Withdraw the two screws securing the wiring and detach the wires.
5. Remove the large nut and shakeproof washer securing the headlamp to its bracket and remove the lamp.

#### Headlamp, late models

##### To remove Operation P/68

1. Remove the securing screw from the lower side of rim and ease the rim off from the bottom.
2. Remove the dust-excluding rubber.

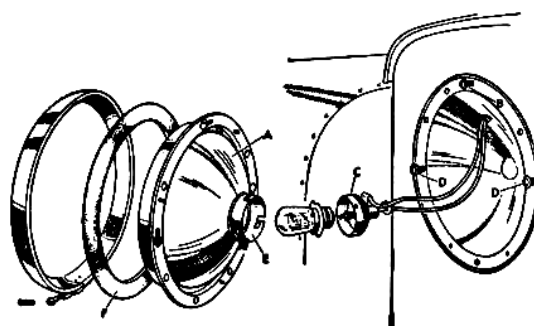


Fig. P-23—Headlamp.

A—Light unit.  
 B—Vertical setting adjusting screw.  
 C—Back shell.  
 D—Horizontal setting adjusting screws.  
 E—Bulb holder.  
 F—Dust-excluding rubber.

3. Press in the light unit against the tension of the screw springs and turn in an anti-clockwise direction until the heads of the screws can be disengaged through the slotted holes in the light unit rim.
4. Disconnect the wiring from the bulb socket assembly.
5. Remove the headlamp body complete with grommet from the radiator grille panel.

#### NOTE:

##### Non-split type headlamp rim

##### To remove Operation P/70

Where fitted, the non-split type rim is removed by removing the set screw, located at the bottom of the rim, and then springing the rim off. The unit is then removed as in Operation P/68.

##### To refit Operation P/72

Spring the rim back into position, having first replaced the dirt excluder rubber, and replace set screw and tighten.

## Replacement bulbs, 1948-53

| Position                                                                | Make and Type | Voltage | Wattage                              |                                             |
|-------------------------------------------------------------------------|---------------|---------|--------------------------------------|---------------------------------------------|
| Headlamps R.H. (Home models) ....                                       | Lucas No. 162 | 12      | 36 Single filament                   | } Vertical<br>fluted glass<br>in light unit |
| Headlamps L.H. (Home models) ....                                       | Lucas No. 300 | 12      | 36/36 Double filament (dip to left)  |                                             |
| Headlamps (R.H.D. Export models) ....                                   | Lucas No. 300 | 12      | 36/36 Double filament (dip to left)  |                                             |
| Headlamps (L.H.D. Export models except<br>North American vehicles) .... | Lucas No. 301 | 12      | 36/36 Double filament (dip to right) | } Block glass<br>in<br>light unit           |
| Headlamps (R.H.D. models) ....                                          | Lucas No. 354 | 12      | 42/36 Double filament (dip to left)  |                                             |
| Headlamps (L.H.D. models except Europe)                                 | Lucas No. 355 | 12      | 42/36 Double filament (dip to right) |                                             |
| Headlamps (Europe except France) ....                                   | Lucas No. 360 | 12      | 45/35 Double filament (Duplo)        |                                             |
| Sidelamps (dash fixing) ....                                            | Lucas No. 207 | 12      | 6 Single pole                        |                                             |
| Sidelamps (wing fixing) ....                                            | Lucas No. 989 | 12      | 6 Single pole                        |                                             |
| Stop/tail lamps (except North American<br>vehicles) ....                | Lucas No. 207 | 12      | 6 Single pole                        |                                             |
| Stop/tail lamps (North American vehicles) ....                          | Lucas No. 361 | 12      | 18/6 Double filament                 |                                             |
| Instrument panel lights ....                                            | Lucas No. 207 | 12      | 6 Single pole                        |                                             |
| Ignition and mixture control warning lights ....                        | Lucas No. 970 | 2.5     | .5 M.E.S.                            | } Alternatives, check<br>before ordering    |
|                                                                         | Lucas No. 987 | 12      | 2.2 M.E.S.                           |                                             |
|                                                                         | Lucas No. 987 | 12      | 2.2 M.E.S.                           |                                             |
| Oil pressure and headlamp warning lights ....                           | Lucas No. 987 | 12      | 2.2 M.E.S.                           |                                             |
| Rear number plate lamp ....                                             | Lucas No. 989 | 12      | 6 Single pole                        |                                             |

## Replacement bulbs, 1954

| Position                                                          | Make and Type | Voltage | Wattage                                      |
|-------------------------------------------------------------------|---------------|---------|----------------------------------------------|
| Headlamps (R.H.D. models) ....                                    | Lucas No. 354 | 12      | 42/36 Double filament (dip to left)          |
| Headlamps (L.H.D. models except North<br>America and Europe) .... | Lucas No. 301 | 12      | 36/36 Double filament (dip to right)         |
| Headlamps (Europe except France) ....                             | Lucas No. 360 | 12      | 45/35 Double filament (Duplo) (vertical dip) |
| Headlamps (France and North America) ....                         | Special       | 12      | —                                            |
| Sidelamps ....                                                    | Lucas No. 222 | 12      | 4                                            |
| Stop/tail lamps (except North American<br>vehicles) ....          | Lucas No. 207 | 12      | 6                                            |
| Stop/tail lamps (North American vehicles) ....                    | Lucas No. 361 | 12      | 18/6 Double filament                         |
| Rear number plate lamp ....                                       | Lucas No. 222 | 12      | 4                                            |
| Instrument panel lights ....                                      | Lucas No. 987 | 12      | 2.2 M.E.S.                                   |
| Warning lights ....                                               | Lucas No. 987 | 12      | 2.2 M.E.S.                                   |

## Replacement bulbs, 1955-58

| Position                                                          | Make and Type | Voltage | Wattage                                      |
|-------------------------------------------------------------------|---------------|---------|----------------------------------------------|
| Headlamps (R.H.D. models) ....                                    | Lucas No. 354 | 12      | 42/36 Double filament (dip to left)          |
| Headlamps (L.H.D. models except North<br>America and Europe) .... | Lucas No. 355 | 12      | 42/36 Double filament (dip to right)         |
| Headlamps (Europe except France) ....                             | Lucas No. 370 | 12      | 45/40 Double filament (Duplo) (vertical dip) |
| Headlamps (France and North America) ....                         | Special       | 12      | —                                            |
| Sidelamps ....                                                    | Lucas No. 222 | 12      | 4                                            |
| Stop/tail lamps ....                                              | Lucas No. 380 | 12      | 21/6 Double filament                         |
| Rear number plate lamps (North American<br>vehicles) ....         | Lucas No. 222 | 12      | 4                                            |
| Instrument panel lights ....                                      | Lucas No. 987 | 12      | 2.2 M.E.S.                                   |
| Warning lights ....                                               | Lucas No. 987 | 12      | 2.2 M.E.S.                                   |

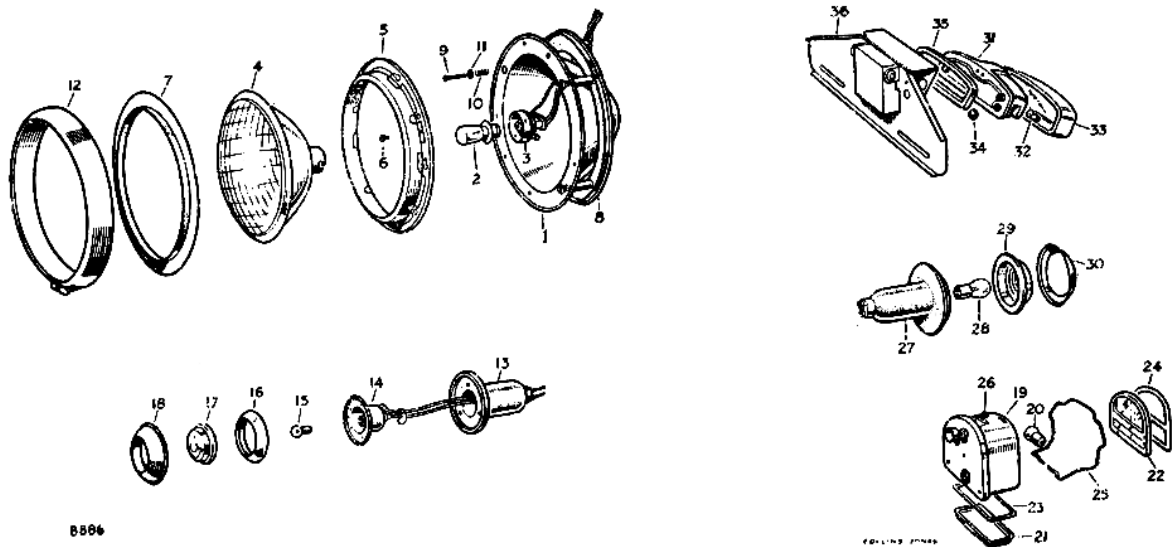


Fig. P-24—Layout of lamps.

- |    |                                  |    |                                            |
|----|----------------------------------|----|--------------------------------------------|
| 1  | Body for headlamp                | 19 | Stop tail lamp complete                    |
| 2  | Bulb for headlamp                | 20 | Bulb (12v. 6w.) for stop tail lamp         |
| 3  | Adaptor for bulb, double contact | 21 | Glass for number plate illumination, white |
| 4  | Light unit, "block-pattern" lens | 22 | Glass for stop and tail lights, red        |
| 5  | Rim complete for light unit      | 23 | Gasket for number plate illumination glass |
| 6  | Special screw for light unit rim | 24 | Gasket for stop tail glass                 |
| 7  | Rubber gasket for headlamp rim   | 25 | Spring retaining glasses                   |
| 8  | Gasket for body                  | 26 | Screw fixing body                          |
| 9  | Special screw                    | 27 | Rubber body                                |
| 10 | Spring for screw                 | 28 | Bulb for stop tail lamp                    |
| 11 | Cup washer for screw             | 29 | Glass                                      |
| 12 | Rim for headlamp, vehicle colour | 30 | Rim for glass                              |
| 13 | Body                             | 31 | Number plate lamp                          |
| 14 | Bulb interior                    | 32 | Bulb for number plate lamp                 |
| 15 | Bulb for side lamp               | 33 | Glass                                      |
| 16 | Gasket for body                  | 34 | Rubber grommet for wire                    |
| 17 | Glass                            | 35 | Rubber gasket for lamp                     |
| 18 | Rim complete                     | 36 | Support for lamp                           |

**To refit, adjust and re-focus, early models****Operation P/74**

1. Replace the headlamps by reversing the sequence of operations detailed for removal.
2. The setting of the headlamps should be checked by placing the vehicle in front of a blank wall at the greatest possible distance, taking care that the surface on which the vehicle is standing

is not sloping relative to the wall. The lamps are fitted with dual filament bulbs and must be set so that the main beams of light are parallel with the road and with each other.

3. Slacken the fixing nut at the top of the lamp and move the lamp on its adjustable mounting to the required position. Tighten the locking nut. The mounting is accessible when the bonnet top panel is raised.

- If Lucas Genuine Spare Bulbs are fitted it should be unnecessary to alter the setting of the lamp when a bulb is renewed. If, however, an ordinary bulb has to be fitted, it may be necessary to re-focus. If the lamp does not give a uniform long range beam without a dark centre, the bulb needs adjusting; when focusing it is an advantage to cover one lamp while testing the other.

To re-focus, slacken off the screw on the clip and move the bulb backwards and forwards until the best lighting is obtained.

Tighten the clamping clip after the best position for the bulb has been found.

#### To refit and adjust, late models

##### Operation P/76

- Reverse the removal procedure.
- Adjustment in a vertical plane is effected by turning the spring-loaded screw at the top of the lamp body.
- Adjustment in a horizontal plane is made by means of the screw at each side of the unit.

#### To adjust headlamps, using beam setting board

##### Operation P/78

- Mark on a board the dimensions given in Fig. P-25 and position the vehicle, unladen, on level ground.
- Place the board 12 ft. (365 cm) in front of the headlamps, ensuring that it is at right angles to the vehicle centre line and that the centre line on board is in the same plane as vehicle centre line.

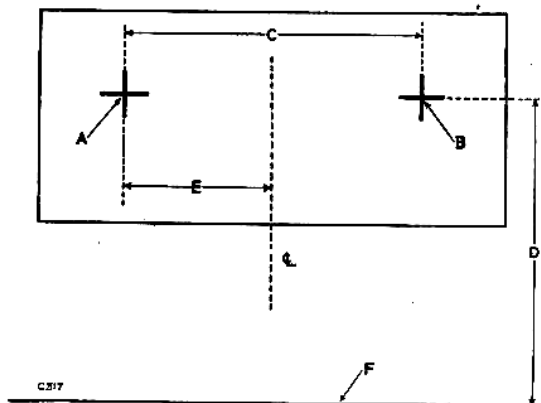


Fig. P-25—Headlamp beam setting board, 1954-58 models

- A—Concentrated area of light—L.H. headlamp.
- B—Concentrated area of light—R. H. headlamp.
- C—20 in. (508 mm).
- D—(86 and 88 models) 35½ in. (902 mm).  
(107 and 109 models) 37¼ in. (946 mm).
- E—10 in. (254 mm).
- F—Ground level.

- Adjust the beam by turning the screws indicated in Fig. P-23 until the area of concentrated light corresponds with the marks on beam setting board.

#### Side lamp, dash fixing type

##### To remove Operation P/80

- Slacken the screw at the top of the lamp locating it in the dash panel.
- Turn the lamp in a clockwise direction until the tongue at the bottom is disengaged from the dash and withdraw the lamp front and reflector.
- Disconnect the feed wire and remove the side lamp complete.

##### To refit Operation P/82

- Reverse the removal procedure.

#### Side lamp, wing fixing type

##### To remove Operation P/84

- Disconnect the leads at the snap connectors, alongside the radiator cowl.
- Lever the rubber bead away from the lamp and remove the rim and glass from the bottom of the rim lamp.
- If required, remove the bulb.
- Remove the lamp and grommet from the wing.

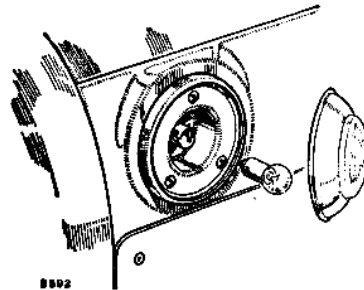


Fig. P-26—  
Side lamp

##### To refit Operation P/86

Reverse the removal procedure.

#### Stop and tail lamp—1954 models

(Except North American vehicles)

##### To remove Operation P/88

- Slacken the securing screw and swing open the stop and tail lamp cover; disconnect the wiring from the connectors.
- Remove the lamp complete from the rear of the body.

##### To refit Operation P/90

Reverse the removal procedure, reconnecting the wiring in accordance with the wiring diagram.



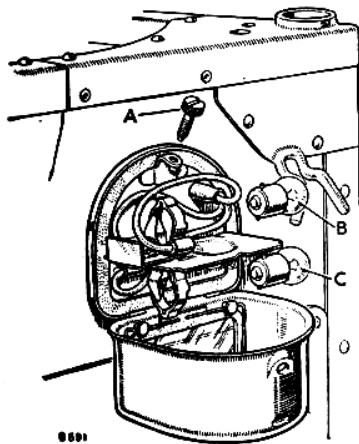


Fig. P-27—  
Stop, tail lamp—  
1954 models  
A—Securing screw.  
B—Stop bulb.  
C—Tail lamp bulb.

#### Stop and tail lamp—1955-57 models

##### To remove Operation P/92

1. Disconnect the three snap connectors securing the tail lamp harness to the main wiring harness, beneath the wheel box, adjacent to the chassis frame side member.

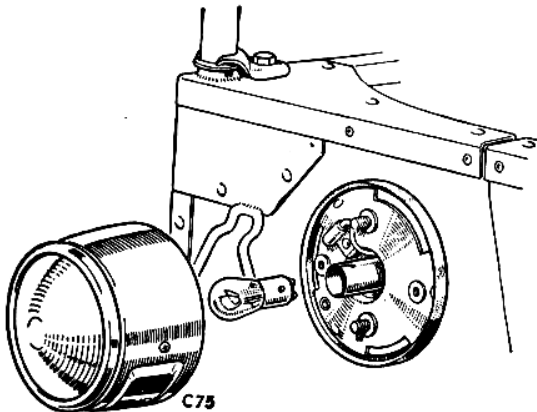


Fig. P-28—Stop, tail lamp—1955-58 models.

A—Securing bolt.  
B—Double filament bulb.  
C—Cover.

2. Withdraw the tail lamp harness through rubber grommet in wheel box.
3. Remove the two securing bolts and locking washers on the inside of body rear panel, then withdraw the lamp and harness complete.

##### To refit Operation P/94

1. Reverse the removal procedure. Reconnect harness in accordance with wiring diagram.

#### Stop and tail lamp—1954 models (North American vehicles)

##### To remove and refit Operation P/96

See Operations P/88 and P/90.

#### Rear number plate lamp (North American vehicles only)

##### To remove Operation P/98

1. Remove the small screw in the centre of the lamp and remove the cover.
2. Disconnect the wiring.
3. Remove the lamp from the rear number plate support.

##### To refit Operation P/100

1. Reverse the removal procedure.

#### Horn

The horn is adjusted on initial assembly and should not require attention for some considerable time.

Ascertain that horn failure or faulty note is not due to some outside source, such as a discharged battery, loose connections or loose horn mounting, before carrying out any adjustment.

#### Horn—80, 86 and 107 models

##### To remove Operation P/102

1. R.H.D. models. Remove the radiator grille.
2. With the ignition switched off, disconnect the wires from the horn.
3. Remove the horn complete from the front chassis cross-member.

##### To refit Operation P/104

Reverse the removal procedure.

#### Horn—88 and 109 models

##### To remove Operation P/106

1. Lift bonnet.
2. With the ignition switched off, disconnect the wires from the horn.
3. Remove horn from bonnet hinge position.

##### To refit Operation P/108

Reverse the removal procedure.

#### Adjustment of windtone horn

##### Operation P/110

#### Lucas

1. Disconnect the leads at the snap connectors adjacent to the horn, then remove the securing bolts and withdraw the unit.
2. Remove the dome and dome securing clip, clean the points and adjust them until they are almost touching, then turn the adjusting screw half a turn to increase the gap.

- If adjustment of the horn does not produce satisfactory results, the horn should be returned to the makers.

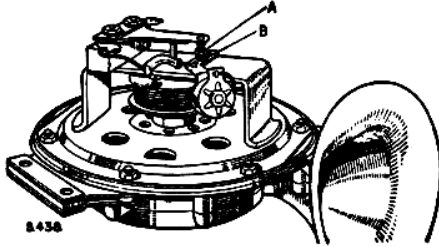


Fig. P-29—Horn adjustment. Lucas.  
A—Adjustable contact. B—Locknut.

#### Clear Hooters

- Remove the horn—Operation P/106, then remove the dome and dome clip.
- Connect the horn leads to a 12-volt battery and adjust nut (A) until maximum volume is obtained, then lock in position with nut (B). See Fig. P-30.

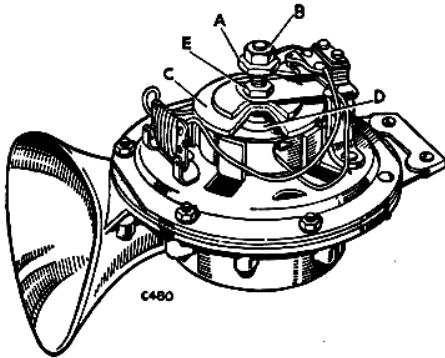


Fig. P-30—Horn adjustment. Clear Hooters.  
A—Adjusting nut. C—Armature.  
B—Locknut. D—Magnet core.  
E—Locknut—armature.

- Adjust the air gap between armature (C) and the magnet core face (D) to .045-.050 in. (1,1-1,3 mm) by slackening nut (E) and turn the armature (C) clockwise or anti-clockwise until the recommended distance is obtained, then tighten nut (E). The current consumption with horn correctly adjusted is 9 amperes.

#### Dip switch and horn button

##### To remove (86 and 107 models)

##### Operation P/112

- Disconnect the wires protruding from the bottom of the steering column by withdrawing the wires from the junction box on the dash.
- Slacken the clamp bolt holding the stator tube at the bottom of the steering column.
- Withdraw the stator tube, horn button and dipper switch complete.

- Remove the horn button and dipper switch from the stator tube.

##### To refit (86 and 107 models) Operation P/114

Reverse the removal procedure, spacing the rubber and felt bushes on the stator tube before insertion in the control column, as these eliminate vibration noises.

##### Dip switch, to remove (88 and 109 models)

##### Operation P/116

- Disconnect the dip switch leads at junction box.
- Remove the securing screws and withdraw the switch from toe board.

##### Dip switch, to refit (88 and 109 models)

##### Operation P/118

- Reverse removal procedure and reconnect the leads in accordance with wiring diagram.

##### Horn button, to remove (88 and 109 models)

##### Operation P/120

- Remove the securing screws and withdraw the horn button and leads.
- Disconnect the leads if necessary.

##### Horn button, to refit (88 and 109 models)

##### Operation P/122

- Reverse removal procedure.

#### Ignition—Petrol models

##### Distributor

##### To remove.

##### Operation P/124

- Pull off the sparking plug covers and detach the plug leads; disconnect the vacuum pipe, L.T. and H.T. leads.
- Remove the set bolt securing the distributor clamp to the distributor mounting plate.
- Remove the distributor complete with clamp.

##### To refit

##### Operation P/126

- Reverse the removal procedure; set the contact breaker gap to .014 to .016 in. (0,35 to 0,40 mm). The driving spigot on the distributor drive shaft is offset, so eliminating any possibility of mistiming the engine on replacement.

##### Coil

##### To remove

##### Operation P/128

- With the ignition switched off, disconnect the high and low tension leads from the coil.
- Remove the coil from the dash panel.

##### To refit

##### Operation P/130

- Reverse the removal procedure.

**Stop lamp switch****To remove**                      **Operation P/132**

1. With the ignition switched off, disconnect the two wires from the stop lamp switch.
2. Unhook the spring connecting the switch to the brake lever.
3. Remove the switch from the chassis bracket.

**To refit**                              **Operation P/134**

Reverse the removal procedure.

**Heater plugs—Diesel models**

The heater plugs do not require any maintenance. However, if at any time when the heater plugs are in use, the warning light glows very brightly, a short circuit in the system is indicated. No light will indicate an open circuit.

*Note:* Great care must be taken not to twist the centre terminal when removing heater plug leads.

**Fault location on heater plug circuit****Operation P/136**

- (a) Examine the fuse at terminal A3 and replace if "blown".
- (b) Failure of the warning light bulb will not affect the heater plug circuit, but the bulb should be replaced when conveniently possible—Section Q.
- (c) Connect one lead of the test lamp to the earth lead terminal on No. 1 heater plug and the other lead to the L.H. battery negative terminal, whereon the bulb should light. If the bulb remains unlit, a corroded, loose, or disconnected heater plug earth lead is indicated.

Move the test lamp lead from the earth terminal on No. 1 heater plug, to the terminal also on No. 1 plug, to which the inter-connecting lead is attached. If the plug is serviceable the bulb will light but a broken heater plug filament will be indicated by the lamp remaining unlit.

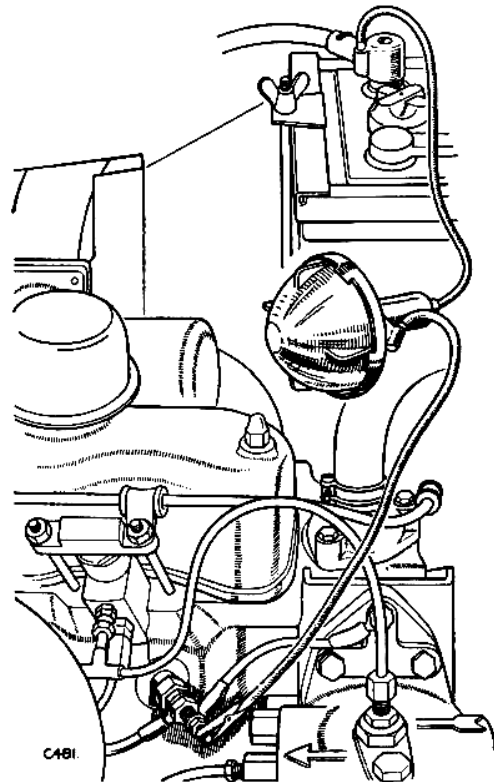
Check the remaining plugs in the same manner until the fault is located.

If the heater plugs are found serviceable check each terminal of the resistance unit in the same way.

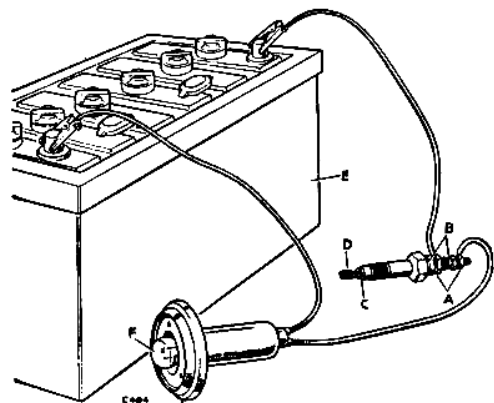
**Removal, cleaning and inspection of heater plugs****Operation P/138**

The shape of the heater plug element and its position in relation to the plug body is important and care must therefore be taken when fitting, removing or cleaning the plug, to avoid distortion or damage to the element.

1. Disconnect the leads from plugs, using two spanners at each terminal to prevent the central rod or insulating tube twisting.

**Fig. P-31—Checking heater plug circuit.**

2. Remove carbon from base of heater plug to avoid possible short circuiting of the element. Do not sandblast.
3. Examine the element for signs of fracture or severe heat attack and the seating for scores. Plugs with fractured element must be replaced. Where scoring of the seating is sufficient to allow gas leakage or erosion of the element such that a fracture is likely to occur, then a replacement plug must be fitted.

**Fig. P-32—Testing heater plug circuit.**

- |                  |                    |
|------------------|--------------------|
| A—Terminal nuts. | D—Element.         |
| B—Insulation.    | E—12 volt battery. |
| C—Seating.       | F—Bulb (12. v.)    |

4. Test the plug internal circuit for continuity, by connecting it and a 12 volt side-lamp bulb in circuit, to a 12 volt battery.

The inclusion of a bulb in circuit is **essential**.

5. Ensure that the terminal nuts and threads are clean and that the thread at base of plug is free of carbon, then refit the plugs and tighten.

*Note:* Make sure the shakeproof washers are fitted under the terminal in order to maintain good electrical contact.

Replace the leads in accordance with the wiring diagram and tighten the terminals, using two spanners to each terminal.

#### Resistance--heater plugs

**To remove** **Operation P/140**

1. Disconnect the leads from resistance.
2. Remove the securing screws and withdraw the unit.

**To refit** **Operation P/142**

1. Reverse removal procedure.

#### Starter and heater plug switch—Diesel models

**To remove** **Operation P/144**

1. Disconnect the positive lead from the right-hand battery.
2. Disconnect the leads from the back of the starter switch.
3. Remove the large securing nut from fascia side of panel.
4. Withdraw switch.

**To refit** **Operation P/146**

1. Reverse removal procedure, connecting leads in accordance with the appropriate wiring diagram.

#### Fuel gauge tank unit

No adjustment or repair is permissible to the fuel contents gauge tank unit. If the gauge reads wrongly or—Diesel models—the fuel level warning light does not glow when two or less gallons only remain in the tank, the lead(s) at the tank unit should be checked for security. If the fault is not corrected by tightening the terminal(s), remove and test the warning light and check the tank unit by substitution.

**To renew** **Operation P/148**

1. Disconnect the battery.  
Diesel—disconnect the positive lead from R.H. battery.
2. Drain off the fuel.
3. Remove the right-hand seat and raise the locker.
4. Disconnect the wire from the tank unit.
5. Remove the gauge unit from the fuel tank complete with joint washer.
6. Fit the new unit and cork washer; complete

the assembly by reversing the removal procedure, connecting lead(s) in accordance with the appropriate wiring diagram.

#### Fuse and junction boxes

**To remove** **Operation P/150**

1. Disconnect the battery.  
Diesel—Disconnect the positive lead from the R.H. battery.
2. Remove the cover and disconnect the leads.
3. Remove the securing screws and withdraw the unit.

On certain early vehicles, the fuse is housed in a separate box mounted adjacent to the voltage control box. To remove, proceed as follows:—

1. Disconnect the battery.
2. Remove the fuse box cover, by springing aside the cover clip.
3. Disconnect all wires from the fuse box by loosening the grub screws.
4. Remove the two screws and nuts securing the fuse box to the mounting plate and remove the fuse box.

**To refit** **Operation P/152**

1. Reverse removal procedure and reconnect the leads in accordance with wiring diagram.

#### Windscreen wiper motor

**To remove** **Operation P/154**

1. Slacken the wiper arm fixing nut and tap sharply to release the clamp collet, then remove the wiper arm and blade.
2. With the key in lamp switch turned "off", disconnect the leads from wiper motor.
3. Remove the securing nuts, washers, grommets, wiper blade stop, rubber mounting block and brass brushes, then withdraw the motor.

**To refit** **Operation P/156**

1. Reverse removal procedure, but do not lock the wiper arm blade until the sweep is correctly adjusted.

#### Mixture control thermostat switch—Petrol engines

**To renew** **Operation P/158**

1. Disconnect the wire from the thermostat switch.
2. Remove the switch from the cylinder head rear end cover.
3. Check the switch: Contact is made at 51-54°C (124-129°F); contact is broken at 47-53°C (117-127°F).
4. Fit the new switch by reversing the removal procedure.

*Note:* Renewal of the second switch in the mixture control warning light circuit (at the manual control) is dealt with in Section Q.

## DEFECT LOCATION

## Symptom, Cause and Remedy

## A—BATTERY DISCHARGED

1. Battery unserviceable—*Renew.*
2. Battery leads corroded or loose—*Clean and tighten.*
3. Voltage or current voltage regulator faulty—*Rectify or renew.*
4. Dynamo faulty—*Rectify.*

## B—DYNAMO NOT CHARGING OR CHARGING AT REDUCED RATE

1. Slipping fan belt—*Tighten.*
2. Dynamo loose on mounting—*Tighten.*
3. Continuity of circuit broken—*See Page P-16.*
4. Brushes excessively worn—*Renew.*
5. Commutator burnt or worn unevenly—*Skim the surface in lathe.*
6. Commutator glazed—*Clean with fine glass paper.*
7. Voltage or current voltage regulator faulty—*Rectify or renew.*
8. Dynamo internal circuit faulty—*Dismantle and check.*

## C—LAMPS DIM WHEN ENGINE REVOLUTIONS ARE LOW.

1. Faulty earth—*Check earthing points of lamps affected.*
2. Battery in a low state of charge—*See Symptom A.*

## D—BULBS FAIL FREQUENTLY

1. Battery in a low state of charge—*See Symptom A.*
2. Voltage or current voltage regulator faulty—*Rectify or renew.*
3. Loose connections—*Tighten.*
4. Wrong type of bulb used—*See bulb chart.*

## E—HORN FAILURE.

1. Loose connections—*Tighten.*
2. Burnt or loose contact points—*Clean and adjust. See Page P-23.*

F—INSTRUMENT PANEL LIGHTS FAIL—*See Section Q.*

## Ga—STARTER FAILS TO OPERATE—PETROL MODELS.

1. Stiff engine, indicated by inability to turn by hand—*Locate and remedy.*  
If the engine can be turned by hand, the trouble may be due to:—
2. Battery discharged—*Start by hand. Charging the battery either by a long period of daylight running, or from independent electrical supply.*
3. Broken or loose connection in starter circuit—*Check and tighten all battery, starter and starter switch connections and check the cables connecting these units for damage.*
4. Greasy, charred or glazed commutator—*Clean.*
5. Brushes worn, not fitted correctly or wrong type—*Renew.*
6. Brushes sticking in holders or incorrectly tensioned—*Rectify.*
7. Starter pinion jammed in mesh with flywheel—*Rotate the squared end of the starter shaft with a spanner to free the pinion.*

## Gb—STARTER FAILS TO OPERATE—DIESEL MODELS

1. Battery discharged—*Re-charge.*
2. Starter/heater switch unserviceable—*Renew.*
3. Wiring at starter/heater switch loose—*Tighten.*
4. Solenoid unserviceable—*Renew.*
5. Wiring at solenoid loose—*Tighten.*
6. Brushes unduly worn—*Renew.*
7. Brush springs fatigued—*Renew.*
8. Commutator greasy or dirty—*Clean with petrol-moistened cloth.*
9. Commutator burnt or worn unevenly—*Remove armature, and skim.*
10. Fault in internal circuit—*Dismantle and check.*
11. Starter solenoid badly earthed—*Clean and tighten connections.*

## H—STARTER OPERATES BUT ENGINE IS NOT CRANKED

1. Petrol models: Starter drive pinion not engaging with the flywheel, due to dirt on the screwed sleeve—*Clean.*  
Diesel models: Plate clutch pinion faulty—*Remove starter and dismantle to ascertain cause.*

## J—STARTER PINION WILL NOT DISENGAGE FROM FLYWHEEL.

1. Petrol models: Starter pinion jammed in mesh with the flywheel—*Rotate squared end of starter shaft with a spanner until pinion flies off. On no account run the engine or serious damage to the starter will result.*  
Diesel models: Return spring in starter broken—*Dismantle starter and renew.*

## K—ENGINE WILL NOT FIRE—PETROL MODELS.

1. The starter will not turn the engine due to a discharged battery—*Start the engine by hand. The battery should be recharged by running the car for a long period during daylight or from an independent electrical supply.*
2. Sparking plugs faulty, dirty or incorrect plug gaps—*Rectify or renew.*
3. Defective coil or distributor—*Remove the lead from the centre distributor terminal and hold it approximately  $\frac{1}{4}$  in. from some metal part of the engine while the engine is being turned over. If the sparks jump the gap regularly, the coil and distributor are functioning correctly. Renew a defective coil or distributor.*
4. A fault in the low tension wiring is indicated by no ammeter reading when the engine is turned slowly with the ignition on, or no spark occurs between the contacts when separated quickly with the fingers with the ignition on—*Examine all the ignition cables and check that the battery terminals are secure and not corroded.*
5. Dirty or pitted contacts—*Clean.*
6. Contact breaker out of adjustment—*Adjust.*
7. Controls not set correctly or trouble other than ignition—*See Instruction Manual "STARTING PROCEDURE."*

## M—ENGINE MISFIRES—PETROL MODELS.

1. See items (2), (5) and (6) under "Engine will not fire" and refer to Section A.

## N—ENGINE FAILS TO START FROM COLD—DIESEL MODELS.

1. Heater plug circuit broken—*See Operation P/136.*

**P—IGNITION AND MIXTURE DEFECTS—PETROL MODELS—DEFECTIVE DISTRIBUTOR.**

1. Contact breaker gap incorrect or points burned and pitted—*Clean and adjust.*
2. Distributor cap cracked—*Renew.*
3. Condenser failure—*Renew.*
4. Weak or broken contact breaker spring—*Renew.*
5. Excessive wear in distributor shaft bushes, etc.—*Renew.*
6. Rotor arm pitted or burned—*Clean or renew.*

**Q—MIXTURE CONTROL WARNING LIGHT FAILS TO APPEAR WHEN ENGINE REACHES RUNNING TEMPERATURE.**

1. Mixture control already pushed in—*In the hands of the operator.*

2. Broken connection in warning light circuit—*Rectify.*
3. Faulty thermostat switch (at cylinder head)—*Renew.*
4. Faulty manual switch (at mixture control)—*Renew Section Q.*
5. Broken operating mechanism at manual switch—*Rectify.*

**R—MIXTURE CONTROL WARNING LIGHT REMAINS ON WITH ENGINE AT RUNNING TEMPERATURE.**

1. Mixture control out—*Push control right in.*
2. Faulty manual switch—*Renew. Section Q.*
3. Broken operating mechanism at manual switch—*Rectify.*

**DATA****Batteries**

**Petrol models** .... Single 12 volt, positive earth  
Capacity .... 51 A.H.

**Diesel models** .... Two 6 volt, series connected, positive earth  
Capacity .... 120 A.H.

**Starter Motor**

**Petrol models**  
Nominal voltage .... 12  
Starting shaft end-float .... Zero

**Diesel models**  
Nominal voltage .... 12  
Starting shaft end-float .... Zero  
Lock torque .... 32.5 lb./ft. (4,49 Kg/m)  
Torque at 1,000 r.p.m. .... 15 lb./ft. (2,14 Kg/m)

**Starter motor drive**

**Petrol models** .... Spring-loaded pinion and sleeve  
**Diesel models** .... Multi-plate clutch  
Slip load .... 800 to 950 lb./in. (142,86 to 169,5 Kg/cm)

**Dynamo**

**Petrol models**  
Maximum output .... 19 amps

**Diesel models**  
Maximum output .... 22 amps

**Control box**

**Petrol models** .... Compensated voltage control

**Diesel models** .... Compensated current/voltage control

Voltage regulator—open circuit setting 20°C (68°F) at 2,000 r.p.m. .... 14.2 to 14.8 volts

Current regulator—Contact opening amperage .... 19

Cut-in voltage .... 12.7 to 13.3 volts

**Distributor**

Contact breaker gap .... .014 to .016 in. (0,35 to 0,40 mm)

Distributor rotation .... Clockwise, at drive end

Advance mechanism .... Centrifugal/vacuum

**Fuse**

.... Protects the horn, wind-screen wiper, and on early models also fuel tank level unit and stop lights.

Amperage .... 35

**Heater plugs**

Type .... K.L.G. B.R.Q.1 coil element—1.7 volts 36/40 amps.

**Stop lamp switch**

Type .... Mechanical

**Mixture control thermostat switch**

Contact made at .... 51-54°C (124-129°F)  
Contact broken at .... 47-53°C (117-127°F)

# Section R

## BODY — ALL MODELS

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| R-4  | Layout of tailboard, doors and side-screens, 1954-58 models               | R-8  | R-12 | Layout of rear body unit—86 and 88 models    | R-23 |
| R-5  | Layout of dash panel, windscreen and ventilators, 1948-53 models          | R-10 | R-13 | Layout of rear body unit—107 and 109 models  | R-24 |
| R-6  | Layout of dash panel, windscreen and ventilators, 1954-58 models          | R-12 | R-14 | Rear door, seals and rear step               | R-25 |
| R-7  | Door gusset plate                                                         | R-13 | R-15 | Layout of Station Wagon roof and sides       | R-26 |
| R-8  | Layout of cab and tropical roof                                           | R-17 | R-16 | Layout of Station Wagon De Luxe trim         | R-27 |

#### General body repairs

With the exception of the dash panel, which is steel, the body panels are constructed through out from Birmabright, with steel cappings and corner brackets; all steel parts are galvanised.

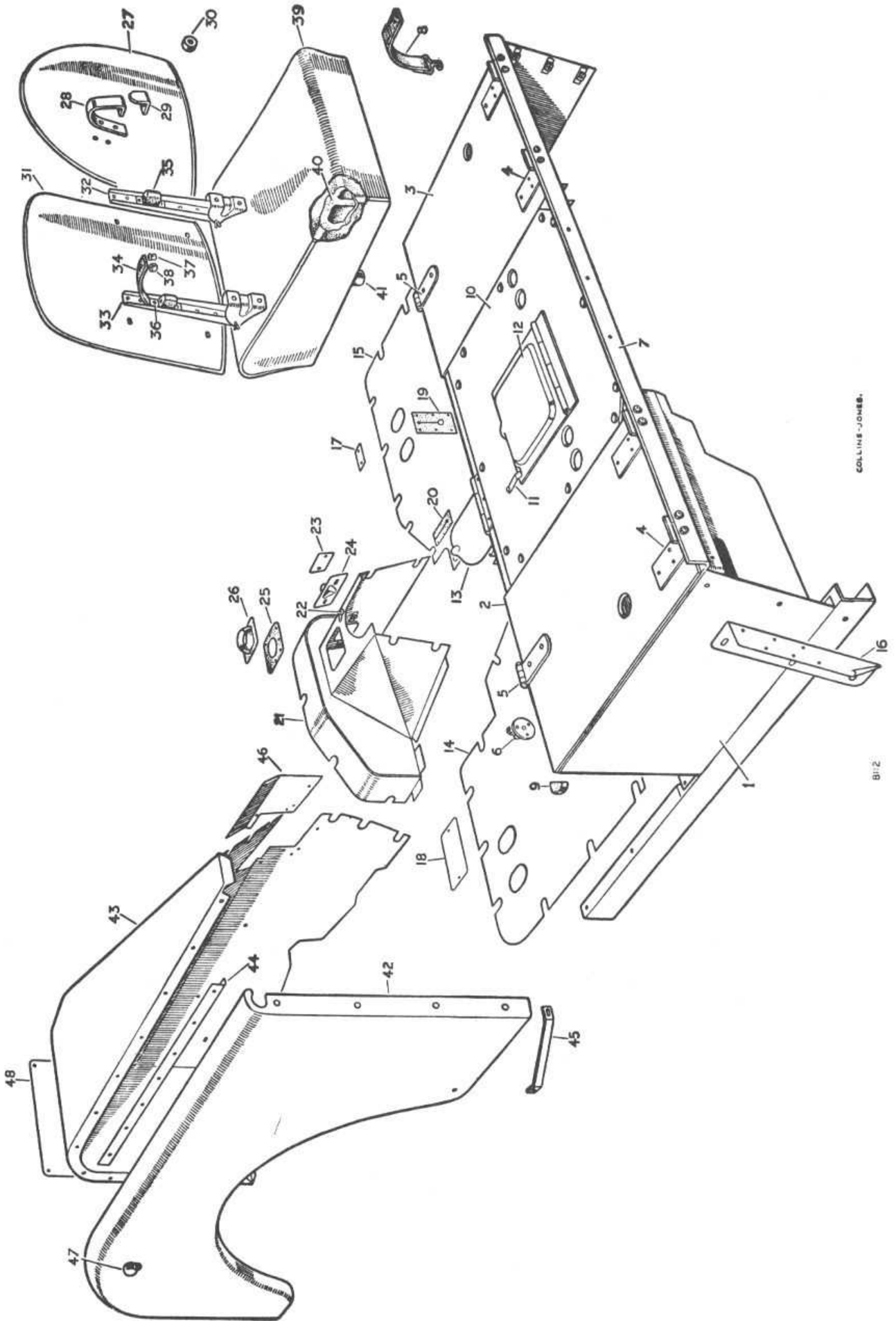
#### Riveting

Three types of rivet are used on the body:—

1. Aluminium pop or "blind" rivets are used only on box sections or where it is difficult or impossible to use any other type because of limited working space; these rivets are "snapped-up" from one side only. The setting is controlled by the breaking of a headed steel mandrel which passes through the tubular rivet; the mandrel break occurs only when the thicknesses being riveted have been pulled together tightly and the rivet head on the blind side fully formed. The mandrels are either of the break stem or break head type, the latter being used in positions where

the mandrel head is free to fall away after the rivet head is set. Where it is required to retain the broken-off portion of the mandrel within the headed-up part of the rivet, as for example in box sections (where a loose mandrel head would rattle) or for sealing the rivet with filler or stopper, the break stem type is used. Either a mechanical or pneumatic hand tool can be used for fixing pop rivets.

2. Bifurcated or "split" rivets are used for securing rubber and canvas together or to metal. The rivet is passed through the materials to be joined, a boss cap is placed over the tongues of the rivet, and these tongues then spread with a suitable drift.
3. Various sizes and lengths of round head rivets are used, and for these a suitably indented dolly is needed for the rivet head, while the tail of the rivet is peened over with a hammer, operated manually, electrically, or by compressed air.



COLLINS-JONES.

B1:2

Fig. R-1—Layout of seat base, toe plates and front wings, 1948-53



Key to Fig. R-1

- |       |                                                 |   |   |
|-------|-------------------------------------------------|---|---|
| 1     | Seat base assembly                              |   |   |
| 2     | Lid for tool locker                             |   |   |
| 3     | Lid for petrol tank access                      |   |   |
| 4     | Hinges for lids                                 |   |   |
| 5     | Hasps for lids                                  |   |   |
| 6     | Turnbuckle for lid hasp                         |   |   |
| 7     | Angle plate, seat base to rear body             |   |   |
| 8     | Retaining strap for locker lid                  |   |   |
| 9     | Rubber corner piece for lid (extra equipment)   |   |   |
| 10    | Centre cover panel                              |   |   |
| 11    | Spring clip for power take-off access cover     |   |   |
| 12    | Access cover for power take-off                 |   |   |
| 13    | Inspection cover for gearbox                    |   |   |
| 14    | Toe plate, left hand                            |   |   |
| 15    | Toe plate, right hand                           |   |   |
| 16    | Corner fixing angle                             |   |   |
| 17    | Cover plate for pedal adjuster (early vehicles) |   |   |
| 18    | Cover plate for pedal holes                     |   |   |
| 19    | Rubber cover for handbrake slot                 |   |   |
| 20    | Rubber cover for transfer lever slot            |   |   |
| 21    | Gearbox cover                                   |   |   |
| 22    | Spring clip for gearbox cover                   |   |   |
| 23-24 | Cover plate for gearbox cover (alternatives)    |   |   |
| 25-26 | Rubber seal for gear lever (alternatives)       |   |   |
| 27    | Seat back rest                                  | } | * |
| 28    | Bracket for back rest                           |   |   |
| 29    | Reinforcing bracket for bracket                 | } | † |
| 30    | Rubber buffer for back rest                     |   |   |
| 31    | Seat back rest                                  |   |   |
| 32-33 | Hinges for back rest                            |   |   |
| 34    | Retaining strap for back rest                   |   |   |
| 35    | Rubber buffer                                   |   |   |
| 36    | Securing plate for buffer                       |   |   |
| 37-38 | Fixings for strap                               |   |   |
| 39    | Seat cushion                                    |   |   |
| 40    | Rubber interior for cushion                     |   |   |
| 41    | Rubber dowel locating seat                      |   |   |
| 42    | Front wing side                                 |   |   |
| 43    | Front wing top and valance                      |   |   |
| 44    | Seal for wing joint                             |   |   |
| 45    | Stay for wing                                   |   |   |
| 46    | Cover plate for wing valance                    |   |   |
| 47    | Rubber buffer (door stop)                       |   |   |
| 48    | Registration plate                              |   |   |

\* Vehicles numbered 06110305 and 06300031 onwards.

† Vehicles numbered prior to 06110305 and 06300031.

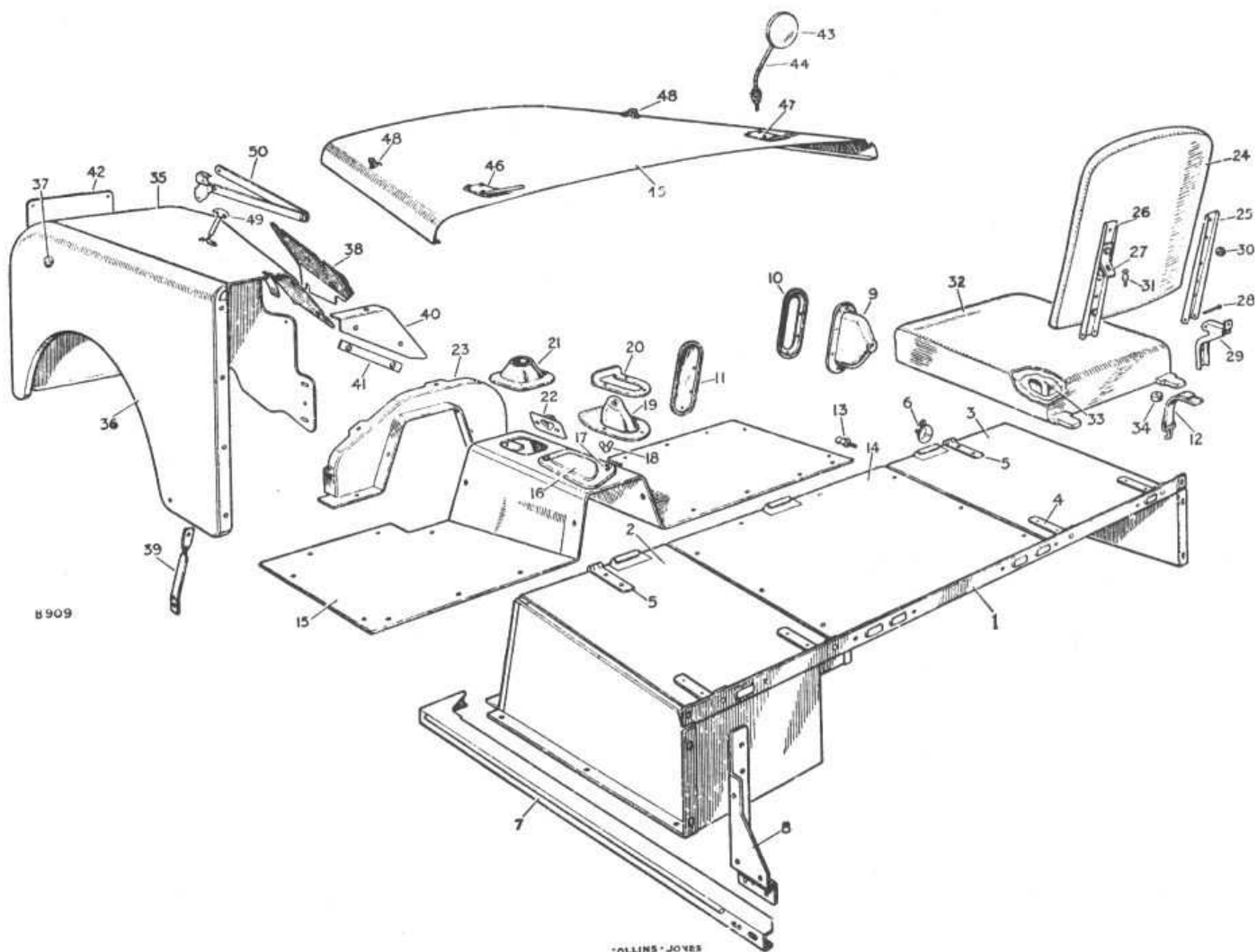


Fig. R-2—Layout of seat base, seats, front floor, wings and bonnet, 1954-58

- |    |                                          |    |                                           |
|----|------------------------------------------|----|-------------------------------------------|
| 1  | Seat base and floor assembly             | 27 | Retaining strap for seat back rest        |
| 2  | Lid for tool locker                      | 28 | Split pin                                 |
| 3  | Lid for petrol tank                      | 29 | Support bracket for front seat back rest  |
| 4  | Hinge for lids                           | 30 | Buffer for seat back rest                 |
| 5  | Hasp for locker lids                     | 31 | Stud for retaining strap                  |
| 6  | Turnbuckle for locker lids               | 32 | Seat cushion complete                     |
| 7  | Sill panel, L.H.                         | 33 | Rubber interior for seat                  |
| 8  | Corner bracket, L.H.                     | 34 | Rubber dowel locating seat                |
| 9  | Rubber cover for hand brake              | 35 | Front wing, top, L.H.                     |
| 10 | Retainer for rubber cover                |    | Front wing, side, R.H.                    |
| 11 | Cover plate for hand brake slot          | 36 | Front wing, side, L.H.                    |
| 12 | Access cover for P.T.O.                  | 37 | Rubber buffer in wing for door            |
| 13 | Stud for cushion retaining strap         | 38 | Cover plate for wing valance, L.H.        |
| 14 | Centre cover panel complete              | 39 | Stay for front wing                       |
| 15 | Front floor complete                     | 40 | Bracket, L.H.                             |
| 16 | Inspection cover for front floor         | 41 | Bolt plate                                |
| 17 | Stud plate for inspection cover wing nut | 42 | Number plate, L.H.                        |
| 18 | Wing nut                                 | 43 | Mirror only                               |
| 19 | Seal for transfer gear lever             | 44 | Arm for mirror                            |
| 20 | Retainer for transfer lever seal         | 45 | Bonnet top panel                          |
| 21 | Rubber seal for gear lever               | 46 | Hinge for bonnet, L.H.                    |
| 22 | Cover plate for operating rod            | 47 | Hinge for bonnet, R.H.                    |
| 23 | Gearbox cover complete                   | 48 | Staple for bonnet and windscreen fastener |
| 24 | Seat back rest, trimmed                  | 49 | Bonnet fastener                           |
| 25 | Hinge complete for seat back rest, R.H.  | 50 | Prop rod for bonnet                       |
| 26 | Hinge complete for seat back rest, L.H.  |    |                                           |

**Paint touching-up process for body panels**

Body panels are finished in stoving synthetic enamel and a special technique, detailed below, must be followed when touching up the paint finish after repair work.

**Preparatory work**

Thoroughly clean the damaged portion; all traces of wax polish, etc., should be removed with a suitable solvent such as White Spirit.

The surrounding edges of the paint film must be correctly feather edges, using a wooden block and suitable paper.

**Colour****(a) Small damaged areas:**

Prepare the correct colour finish by thinning to 40 parts finish to 60 parts thinner by volume.

Apply a built-up coat by spray and allow to air dry for four to six hours.

**(b) Large damaged areas (complete wings or panels):**

Prepare the correct colour finish by thinning 50/50 with thinner.

Apply one or two full spray coats; allow 15 to 30 minutes between coats and four to six hours (or preferably overnight) after the final application.

Half-hour air drying colour finish and thinners are obtainable from our Spares Department.

**Polishing**

After the recommended drying period, lightly polish with any good smooth polishing compound and finally clear, if necessary, with any good quality wax polish.

**Notes**

1. When spraying in small areas and in order to minimise dry spray, it is recommended that the air pressure for spraying be reduced to 30-40 lb/sq.in. (2,1-2,8 kg/cm<sup>2</sup>).
2. When touching up stoved synthetic finishes, no advantage is to be gained by mist-coating the patch. Instead, the edges of the patch should be faded out during application and any resultant dry spray removed during polishing with any good polishing compound.
3. It is not always easy to blend a patch or touch-up; to do so successfully and lose the edges requires practice by a skilled operator. In cases where the damage is on a conspicuous part of the vehicle, it is recommended that the operator sprays out the entire damaged part, e.g., door panel, wing, etc.
4. In certain instances, the materials listed are available locally. We can furnish additional information in this respect on demand, providing the serial numbers of vehicles concerned are quoted.

**Bonnet****To remove****Operation R/2**

1. If fitted, remove the spare wheel from the bonnet.
2. Unhook the bonnet fasteners, disconnect the bonnet prop rod, if fitted, lift the bonnet to its highest position and slide it out to the left, from its hinges.
3. Remove the hinges from the bonnet panel.
4. Remove the bonnet fasteners and the staples.
5. Place the new bonnet panel in position on the vehicle and the hinges in position in the brackets on the dash.
6. Using the hinges as templates, drill the eight holes in the panel, and secure the panel to the hinges.
7. Complete the assembly by reversing the removal procedure.

**Radiator grille panel****To renew****Operation R/4**

1. Lift off the grille and nameplate and, if fitted, the chaff guard. Remove the cover from the junction box on the dash panel and disconnect the horn and headlamp harness; unclip the harness from the wing.
2. Remove the bolts, spring washers, nuts, rubber packing pieces and plain washers securing the grille panel to the second chassis cross-member.
3. Remove the bolts, spring washers and nuts securing the radiator block to the grille panel and to the wings; disconnect the wiring from the horn and lift off the grille panel complete with headlamps and wiring.
4. Remove the headlamps.
5. Remove the bonnet rest strip from the grille panel.
6. Remove the headlamp and horn harness from the panel, together with the rubber grommets and cable clips.
7. Assemble and replace the new grille panel by reversing the sequence of Items 1-6.

**Front wings****To remove****Operation R/6**

1. Remove the bonnet.
2. Disconnect the side lamp harness at the snap connectors in the engine compartment.
3. On R.H.D. vehicles, remove the valance cover plate near the exhaust pipe.
4. Remove the wing stay from the dash.

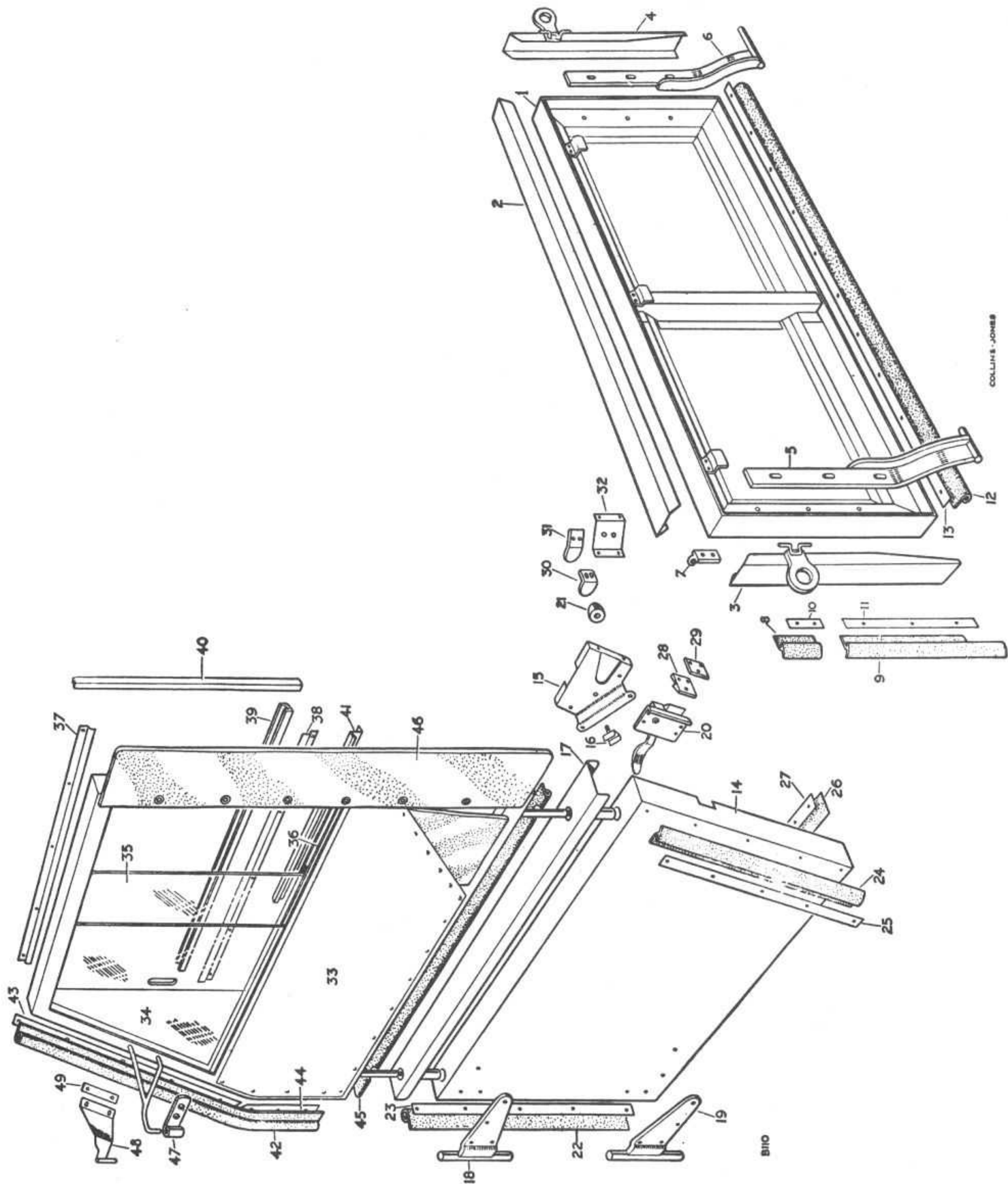


Fig. R-3—Layout of tailboard, doors and sidescreens, 1948-53

Key to Fig. R-3

- |       |                                     |       |                                      |
|-------|-------------------------------------|-------|--------------------------------------|
| 1     | Tailboard                           | 27    | Retainer for weather strip           |
| 2     | Top capping for tailboard           | 28    | Striking plate for door              |
| 3-4   | Side cappings for tailboard         | 29    | Tapped plate fixing plate            |
| 5-6   | Hinges for tailboard                | 30-31 | Stops for door buffer (alternatives) |
| 7     | Hook for tailboard chain            | 32    | Reinforcement for stop               |
| 8-9   | Weather strips for tailboard, sides | 33    | Side screen                          |
| 10-11 | Retainers for weather strips        | 34    | Fixed window                         |
| 12    | Weather strip for tailboard, bottom | 35    | Sliding window                       |
| 13    | Retainer for weather strip          | 36    | Channel for windows }*               |
| 14    | Front door                          | 37-38 | Retainers for channel }              |
| 15    | Gusset plate for door               | 39    | Channel for windows, bottom }        |
| 16    | Bolt and plate for gusset plate     | 40    | Channel for windows, rear }†         |
| 17    | Top capping for door                | 41    | Filler for fixed window }            |
| 18-19 | Hinges for door                     | 42    | Rubber draught strip at front edge   |
| 20    | Door lock                           | 43-44 | Retainers for draught strip          |
| 21    | Rubber buffer for door              | 45    | Rubber draught strip at lower edge   |
| 22    | Weather strip for door, front       | 46    | Rear flap                            |
| 23    | Retainer for weather strip          | 47    | Hinge for sidescreen                 |
| 24    | Weather strip for door, rear        | 48    | Hinge plate } Service modification   |
| 25    | Retainer for weather strip          | 49    | Back plate } for sidescreen hinge    |
| 26    | Weather strip for door, bottom      |       |                                      |

\*—Vehicles numbered prior to 8666250.

†—Vehicles numbered 8666250 onwards

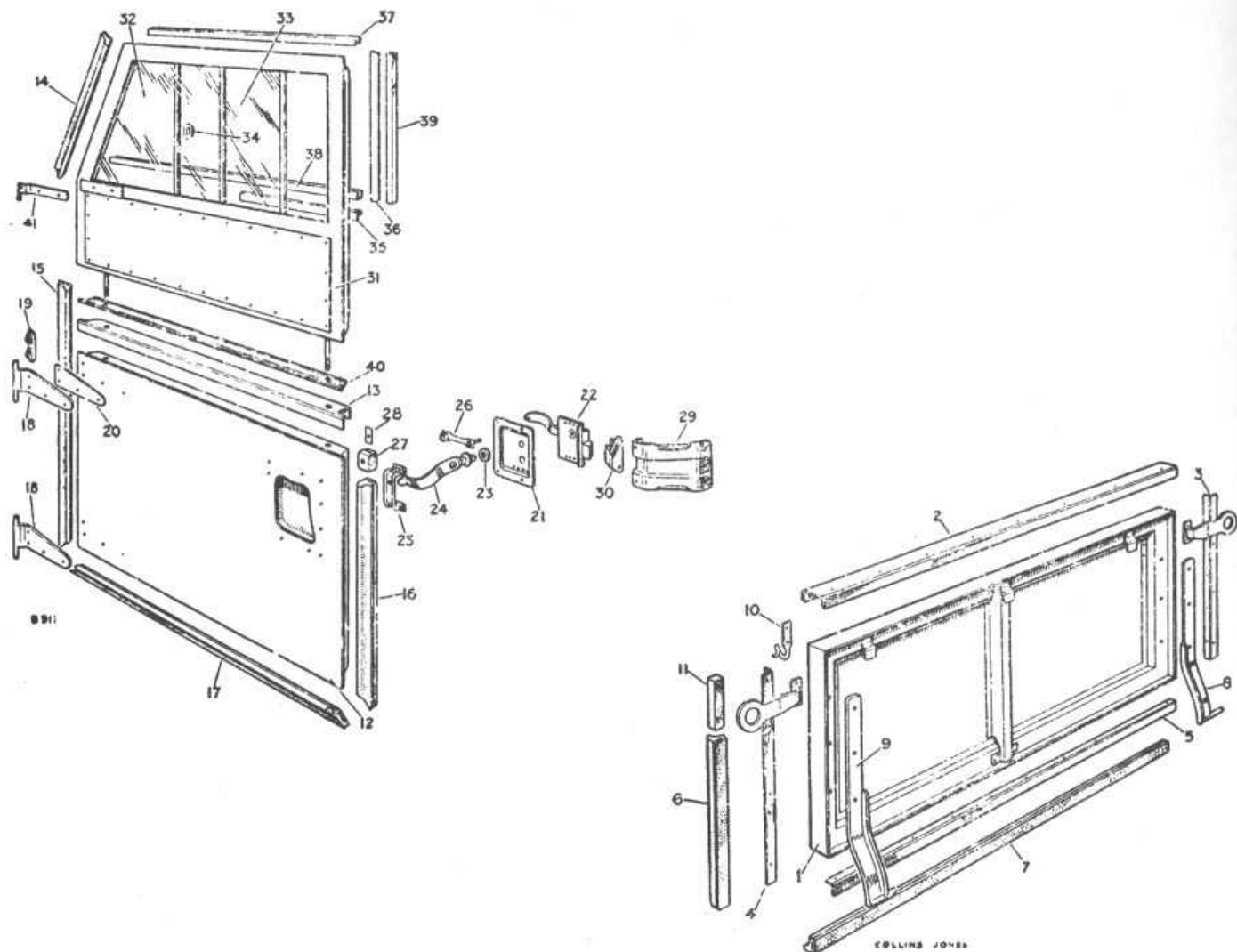


Fig. R-4—Layout of tailboard, doors and sidescreens, 1954-58

- |    |                                  |    |                                         |               |
|----|----------------------------------|----|-----------------------------------------|---------------|
| 1  | Tailboard assembly               | 22 | Door lock, L.H.                         |               |
| 2  | Top capping for tailboard        | 23 | Washer, handle to cover                 |               |
| 3  | Angle for rubber seal, R.H. side | 24 | Handle, L.H.                            |               |
| 4  | Angle for rubber seal, L.H. side | 25 | Bracket for door handle                 |               |
| 5  | Angle for rubber seal, bottom    | 26 | Captive plate                           |               |
| 6  | Sealing rubber, side             | 27 | Rubber buffer for doors                 |               |
| 7  | Sealing rubber, bottom           | 28 | Fixing plate                            |               |
| 8  | Hinge for tailboard, R.H.        | 29 | Support bracket for door striking plate |               |
| 9  | Hinge for tailboard, L.H.        | 30 | Striking plate for door lock            |               |
| 10 | Hook for tailboard chain, L.H.   | 31 | Sidescreen assembly, L.H.               |               |
| 11 | Rubber buffer for tailboard      | 32 | Fixed window, front                     |               |
| 12 | Front door assembly, L.H.        | 33 | Sliding window, rear                    |               |
| 13 | Top capping for door             | 34 | Knob for sliding window                 |               |
| 14 | Seal for door, front upper, L.H. | 35 | Filler, top and bottom                  | } For windows |
| 15 | Seal for door, rear lower, body  | 36 | Filler, rear                            |               |
| 16 | Seal for door, front lower, dash | 37 | Channel, top                            |               |
| 17 | Seal for door, bottom, sill      | 38 | Channel, bottom                         |               |
| 18 | Hinge complete, L.H.             | 39 | Channel, rear                           |               |
| 19 | Nut plate for hinge              | 40 | Sealing strip for sidescreen            |               |
| 20 | Packing plate for hinge          | 41 | Hinge plate, L.H.                       |               |
| 21 | Mounting plate for door lock     |    |                                         |               |

5. Withdraw the bolt, spring and plain washers and nuts securing the wing to the dash pillar, to the dash and radiator grille frame; lift off the wing complete.
6. If necessary:—
  - (a) Remove the driving mirror.
  - (b) Remove the sidelamp, harness and grommet from the wing.
  - (c) Remove the bonnet fastener.
  - (d) L.H. wing only. Remove the bonnet prop rod.
  - (e) Remove the R.H. wing valance plate.
  - (f) Remove the wing stay.
  - (g) Remove the registration plate.
  - (h) Separate the wing top and valance from the wing side.

**To refit**

**Operation R/8**

1. Reverse the removal procedure.

**Sidescreen windows**

**Sliding window**

**To renew**

**Operation R/10**

1. Move the sliding window to allow access to the screws securing glass run channel—top and bottom—then remove the screws from inside channel.
2. Withdraw the top run channel and sliding window.
3. Renew the bottom run channel if necessary.
4. Fit new parts as necessary and assemble by reversing the removal procedure.

**Fixed window**

**To renew**

**Operation R/12**

1. See Operation R/10, items 1-3 inclusive.
2. Ease the fixed glass clear of frame, after removing the screws securing front retainer on 1954-58 models.
3. Apply new Prestik sealing strip to window frame, renewing parts as necessary and assemble by reversing the removal procedure.

*Note:* Two-piece door only—if necessary, the complete assembly can be removed by removing the nuts, plain washers and spring washers securing the assembly to the door.

**Sidescreen hinge, to modify, 1948-53**

1. A special hinge plate has been designed as a Service replacement in cases where the fabricated wire hinge on the sidescreen has fractured.
2. The hinge plates and fittings are available from our Parts Department under the following part numbers:—

| Description                                    | Qty.                               | Part Number |
|------------------------------------------------|------------------------------------|-------------|
| Hinge plate, right hand                        | .... 1                             | 301916      |
| Hinge plate, left hand                         | .... 1                             | 301917      |
| Backing plate for hinge                        | .... 2                             | 301918      |
| Bolt ( $\frac{1}{4}$ in. x $1\frac{3}{4}$ in.) | } Fixing hinge plate to sidescreen | 4 250518    |
| Spring washer                                  |                                    | 4 3074      |
| Nut ( $\frac{1}{4}$ in.)                       |                                    | 4 2823      |

3. Remove the door complete with sidescreen from the vehicle.
4. Mark off and drill the two  $\frac{1}{4}$  in. (6,5 mm) clearance fixing holes for the new hinge plate in the sidescreen frame. The plate, which has slotted fixing holes, must be so positioned that its hinge pin is accurately in line with the two door hinge pins; the use of a straight edge is essential for this operation.
5. Secure the hinge plate on the outer side of the sidescreen, with a backing plate on the inside, by means of the two bolts, spring washers and nuts.
6. Replace the door and sidescreen and adjust the hinge bracket on the windscreen so that there is no strain on the new hinge.

**Front door**

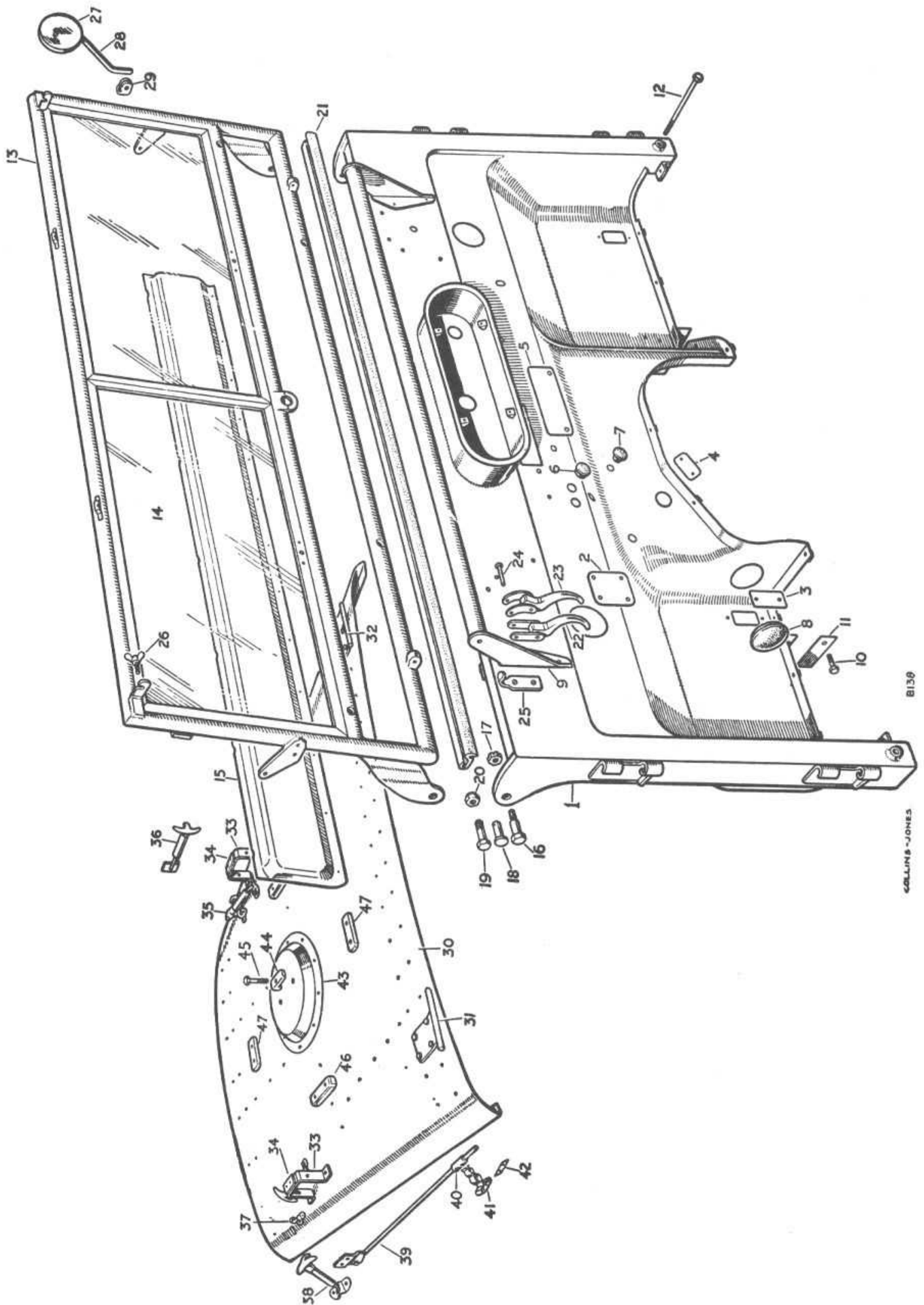
**To remove and refit**

**Operation R/14**

1. Remove the sidescreen.
2. Swing the door panel forward until parallel with the front wing and lift from its hinges.
3. If necessary, remove the door hinges.
4. Replace the door by reversing the removal procedure, renewing the sealing rubbers as necessary.

**Door gusset plate, to fit, 1948-53**

1. On early vehicles it may be found that the upper rear corner of the door panel is fractured, owing to vibration of the rear edge of the sidescreen placing an excessive strain on the door capping. A gusset plate is now fitted to strengthen the door.
2. If required, these plates can be obtained from our Parts Department under Part Numbers 302335—left hand and 302334—right hand.
3. Remove the sidescreen.
4. Remove the door from the vehicle.
5. Remove the upper buffer from the door.
6. Shear the two rearmost rivets securing the top capping.
7. Secure the free end of the clip to the gusset plate by means of the bolt and plate, spring and plain washers and nut provided.
8. Fit the gusset plate in position as shown at Fig. R-7.



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COLLINS-JONES

Fig. R-5—Layout of dash panel, 1948-53



Key to Fig R-5

- |       |                                              |       |                                        |
|-------|----------------------------------------------|-------|----------------------------------------|
| 1     | Dash panel                                   | 27    | Driving mirror                         |
| 2     | Cover panel for steering cut-out             | 28    | Arm for mirror                         |
| 3     | Cover plate for accelerator pedal hole       | 29    | Clip for arm                           |
| 4     | Access plate for exhaust rocker shaft        | 30    | Bonnet panel                           |
| 5     | Cover plate for governor quadrant hole       | 31-32 | Hinges for bonnet                      |
| 6-7   | Rubber blanking plugs for heater holes       | 33    | Support for windscreen                 |
| 8     | Rubber blanking plug for starter access hole | 34    | Tape for support                       |
| 9     | Hand rail                                    | 35-36 | Clamps for windscreen (alternatives)   |
| 10-12 | Fixings, dash to chassis                     | 37    | Staple for bonnet and windscreen clamp |
| 13    | Windscreen                                   | 38    | Bonnet fastener                        |
| 14    | Glass for windscreen                         | 39    | Prop rod for bonnet                    |
| 15    | Bottom panel for windscreen                  | 40    | Rubber tube for rod                    |
| 16-20 | Pivot bolts for windscreen (alternatives)    | 41    | Spring clip for rod                    |
| 21    | Rubber sealing strip for windscreen          | 42    | Tapped plate fixing clip               |
| 22-23 | Fasteners for windscreen (alternatives)      | 43    | Support for spare wheel                |
| 24    | Joint pin fixing fastener                    | 44    | Clamp for spare wheel                  |
| 25    | Catch for fastener                           | 45    | Bolt for clamp                         |
| 26    | Wing bolt in windscreen for hood             | 46-47 | Rubber support blocks for wheel        |
- } Extra equipment

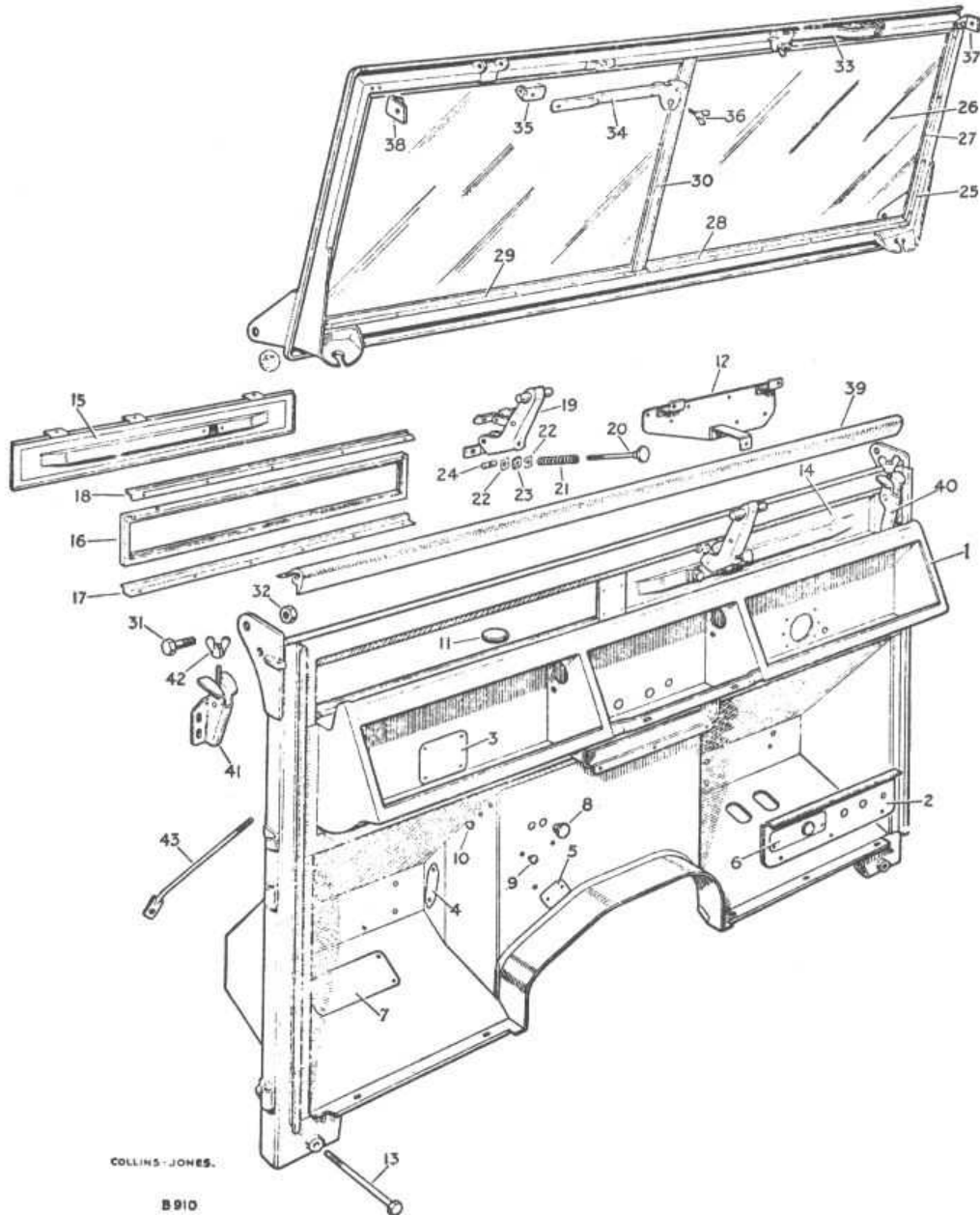


Fig. R-6—Layout of dash panel, windscreen and ventilators, 1954-58

- |                                            |                                            |                                         |
|--------------------------------------------|--------------------------------------------|-----------------------------------------|
| 1 Dash complete                            | 21 Spring                                  | } For adjusting screw                   |
| 2 Panel for controls                       | 22 Square washer                           |                                         |
| 3 Cover panel for steering column          | 23 Rubber washer                           |                                         |
| 4 Cover plate for accelerator pedal hole   | 24 Trunnion pin                            |                                         |
| 5 Access plate for bottom rocker shaft     | 25 Windscreen complete assembly            |                                         |
| 6 Cover panel for governor cutout in dash  | 26 Glass for windscreen                    |                                         |
| 7 Cover plate for pedal holes              | 27 Retainer for windscreen glass, vertical |                                         |
| 8 Rubber plugs, large, heater pipe holes   | 28 Retainer for windscreen glass, R.H.     | } Upper and lower                       |
| 9 Rubber plug, medium, heater wiring holes | 29 Retainer for windscreen glass, L.H.     |                                         |
| 10 Rubber plug, small, heater bolt holes   | 30 Cover for centre strip                  |                                         |
| 11 Rubber grommet for demister holes       | 31-32 Fixings for windscreen               |                                         |
| 12 Mounting plate for sump                 | 33 Pivot arm, R.H.                         |                                         |
| 13 Tie bolt                                | 34 Pivot arm, L.H.                         |                                         |
| 14 Ventilator lid for dash, R.H.           | 35 Pivot bracket, pivot arm to windscreen  |                                         |
| 15 Ventilator lid for dash, L.H.           | 36 Winged screw                            |                                         |
| 16 Seating rubber for ventilator lids      | 37 Bracket, R.H.                           | } For hood, cab and hard top attachment |
| 17 Retainer, bottom                        | 38 Bracket, L.H.                           |                                         |
| 18 Retainer, top                           | 39 Rubber sealing strip for windscreen     |                                         |
| 19 Operating lever assembly for ventilator | 40 Fastener for windscreen, R.H.           |                                         |
| 20 Adjusting screw for ventilator          | 41 Fastener for windscreen, L.H.           |                                         |
|                                            | 42 Wing nut for fastener                   |                                         |
|                                            | 43 Tie bar for dash support                |                                         |