

MAINTENANCE MANUAL  
AND  
INSTRUCTION BOOK  
**CAR, 2-SEATER**

4 x 2

*Austin*  
MODEL G/YG.

LIGHT UTILITY  
10 H.P.

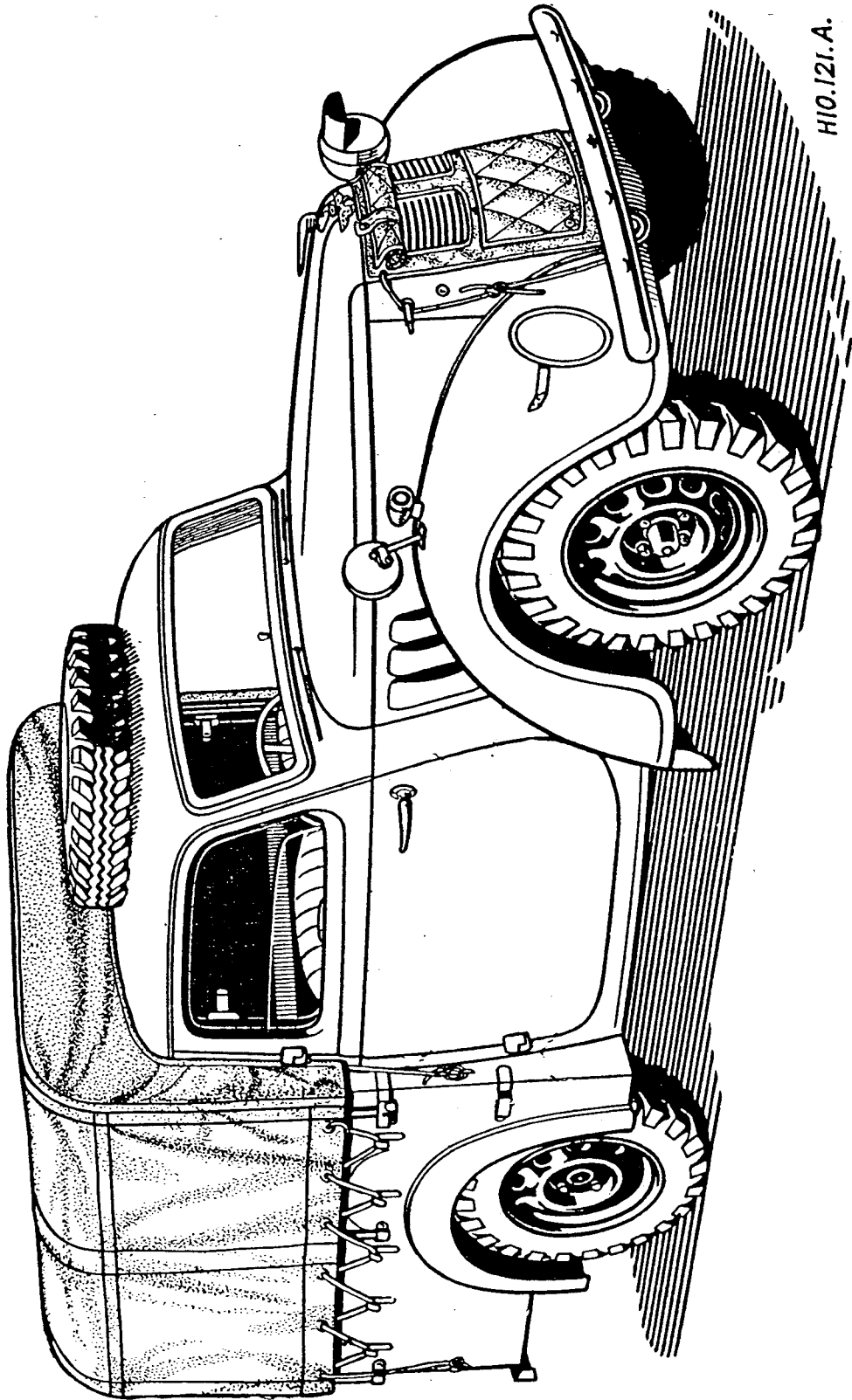
Austin Motor Co.'s  
Publication No. 2194.  
March, 1944.

**This Manual specifically covers all vehicles off Contracts V.4809, V.5015, V.5193, 23/1361, 23/3072, 23/4177, 23/14444 and 23/6567.**

**The Manual can also be followed for earlier contracts, such as V.4374, V.4181, V.4143, V.4112, V.4091, V.4065, V.4014, V.3928 and V.3887, with the exception of variations in Electrical Equipment—The C.A.V. Control Board and Fuse Box have superseded the Lucas Cut-out, Negative Earth has taken the place of Positive Earth, and hand-operated trafficators now take the place of Electric Trafficators.**

**The earliest models were not fitted with a Water Pump, but included a Thermostat in the top water hose.**

# THE AUSTIN LIGHT UTILITY



H10.121.A.

4 X 2. 10 H.P.

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## CHASSIS SPECIFICATION

## AND GENERAL DATA.

**ENGINE.**

Four cylinders, water-cooled, with side valves; detach-  
able head.  
Bore, 2.62-ins. (66.65 mm.).  
Stroke, 3.5-ins. (89 mm.).  
Cubic Capacity, 75.488 cu. ins. (1,237 c.c.).  
Brake h.p., 28.7 at 3,600 r.p.m.  
There are three main bearings. Oil circulation is by  
positive gear-wheel pump. Cooling by radiator, pump  
and fan, with thermostat control.

**Compression Ratio :** 6.52—1.

**Oil Pressure** at 30 m.p.h. in Top Gear with engine hot.  
30—35 lbs.

**Tappet Clearance** (engine cold). .015-in.

**Engine Sump Capacity :** 7 pints.

**ELECTRICAL.**

12-volt ignition and electrical equipment.  
Coil ignition controlled by automatic advance and retard  
mechanism incorporated in the distributor, and also  
vacuum control.  
Suppression equipment fitted.

**Contact Breaker Points :** .010—.012-in. opening.

**Sparkling Plug Points :** .018—.020-in.

**GEAR BOX.**

**Number of gears forward :** Four (Three Synchromesh).

**Number of gears reverse :** One.

**Oil Capacity :** 1½ pints.

**GEAR RATIOS.**

| Gearbox.  |             | Overall.  |             |
|-----------|-------------|-----------|-------------|
| 1st Speed | 4.5 to 1.   | 1st Speed | 27.6 to 1.  |
| 2nd Speed | 2.72 to 1.  | 2nd Speed | 16.7 to 1.  |
| 3rd Speed | 1.715 to 1. | 3rd Speed | 10.53 to 1. |
| 4th Speed | Direct.     | 4th Speed | 6.143 to 1. |
| Reverse   | 5.78 to 1.  | Reverse   | 35.5 to 1.  |

**SPRINGS.** Semi-elliptic front and rear.

**SHOCK ABSORBERS.** LUVAX Piston Type front and rear.

**CONTROLS.** The hand-brake lever is mounted at the left of the driver and the ball change gear lever is conveniently placed.  
Horn button mounted on steering column top.

**REAR AXLE.**

|                                 |                                                          |
|---------------------------------|----------------------------------------------------------|
| Type                            | Threequarter floating.                                   |
| Crown Wheel and Pinion Backlash | .008-in.—.012-in.                                        |
| Crown Wheel and Pinion          | Spiral Bevel.                                            |
| Oil Capacity                    | 2½ pints (approximately).                                |
| Axle Tooth Ratio.               | 6.143 to 1 (Bevel Pinion 7 teeth. Crown Wheel 43 teeth). |

**CHASSIS.**

|             |                                                  |
|-------------|--------------------------------------------------|
| Wheel Track | Front, 4 ft. Rear, 4 ft. 3 ins.                  |
| Wheel size  | 16-in. diameter, 4.00 D rim. 4-stud hub fitting. |
| Tyre size   | 16—6.00 E.L.P.                                   |

**BRAKES.**

|                                  |                                                   |
|----------------------------------|---------------------------------------------------|
| Type                             | Girling hand and foot control to all four wheels. |
| Length of linings before bending | Front and Rear Wheel Shoes, 7½-in.                |
| Width of linings                 | Front and Rear, 1½-in.                            |
| Thickness                        | Front and Rear, ⅜-in.                             |
| Number of linings per vehicle    | Eight.                                            |
| Lining Material                  | Chekko. W.G.2., or equivalent.                    |

**GENERAL DIMENSIONS.**

|                        |               |                                    |                                |
|------------------------|---------------|------------------------------------|--------------------------------|
| Wheelbase              | 7-ft. 9¾-ins. | Height Overall                     | 6-ft. 2½-ins.                  |
| Length Overall         | 13-ft.        | Width Overall                      | 5-ft. 3-ins.                   |
| Turning Circle Right : | 35-ft. 2-ins. | Cut-down Height (for shipment)     | 5-ft. 5¾-in. (latest Contract) |
| Left :                 | 36-ft.        | Ground Clearance (rear axle)       | 8½-ins.                        |
|                        |               | Unladen Weight (without equipment) | 19½ cwt.                       |

**Valve Timing :** Inlet valve opens 10° before T.D.C. (1/4 T.D.C. mark on flywheel).

**Ignition Timing :** Fire 5° to 6° before T.D.C.

**Firing Order :** 1, 3, 4, 2.

**Piston Clearance :** .012-in. at top land; .004-in.—.0045-in. at skirt.

**Piston Ring Gap :** .006—.010-in.

**Oversize Pistons available :** + ⅛-in., + ⅙-in.

**Crankshaft End Float :** .002-in.—.003-in.

**Valve Seat Angle :** 45°.

**COOLING SYSTEM.**

**Total capacity of system :** 2½ gallons.

**Capacity of Radiator :** 1½ gallons.

**Circulation by Pump.**

**Drain Taps :** One in Radiator.

**FUEL SYSTEM.**

**Petrol Tank Capacity :** 8½ gallons.

Level checked by electric gauge on Instrument Panel.

**Fuel Delivery** by Mechanical Pump.

**Pump Type.** A.C. Sphinx, T type.

**Carburettor Type.** Zenith 30 V.M.4 with A.C. oil bath air cleaner.

**FRONT AXLE.**

|                        |         |
|------------------------|---------|
| Camber                 | 1°      |
| Caster                 | 3°      |
| Swivel Pin inclination | 6½°     |
| Toe-in                 | 0—⅛-in. |

**STEERING.**

**Type :** Austin Worm and Sector.

## PERIODICAL ATTENTIONS

VII.

### DAILY.

**Engine.** Check level of oil sump and top up if necessary to full mark on dipstick. Use 30.H.D. oil. Oil filler tube is on offside of engine. Capacity 7 pints. Engine dipstick is on offside of engine.

**Radiator.** Check level of water in radiator and top up if necessary. Fill to within one inch of top of filler. To prevent the gradual formation of deposits in the cooling system, with consequent impeding of the circulation, the use of hard water should be avoided. Soft rain water, syphoned from the top of the barrel where it is clean, or, failing that soft water or water that has been boiled, should be used.

Occasionally flush out the cooling system by opening the draincock and allowing water to run through it until it comes out clear.

**Fuel Tank.** Check quantity of fuel in each tank and fill up (capacity 8½ gallons).

**Tyre Pressures.** Check tyre pressures, using tyre gauge, and inflate if necessary.

It is not sufficient to make a visual examination of the tyres for correct inflation. They must be checked each day before the vehicle is used, (i.e., when the tyres are cold) with the gauge provided, and maintained at the recommended pressure. See that all valves are fitted with valve caps. Inspect tyres for injury in either tread or side walls; if found, it must be reported immediately.

### FORTNIGHTLY.

Attention should be given to the vehicle once a fortnight as detailed in the Driver's Handbook.

### OTHER INTERVALS.

#### New and Reconditioned Engines.

When the engine is new or a reconditioned unit has been fitted, or following a major overhaul, the sump should be drained and refilled with new oil, 30.H.D., after the first 250 and 1,250 miles. At the same time as these changes are made the cylinder head nuts should be tested and tightened if necessary. (See Engine section).

#### Every 2,000 Miles.

**Engine Sump.** Every 2,000 miles drain sump and refill with new oil, 30. H.D.

**Oil Bath Air Cleaner.** Drain clean and refill. See Section D.

#### Every 5,000 Miles.

**1. Road Wheel Hubs.** Dismantle hubs, clean races, repack with fresh Grease No. 2. Early vehicles were fitted with an oil nipple at front hub but this is not to be used for lubrication. See Axle Sections.

#### Distributor Unit (Section G).

**1. Cam.** Remove the distributor moulding. Give the cam a light smear of clean machine oil.

**2. Cam Bearing.** Lift the rotor arm off the top of the spindle and add a few drops of thin machine oil. Do not remove the screw exposed to view.

**3. Cam Drive Shafting Bearing.** Lubrication is effected in the same way as lubrication of the cam bearing.

**4. Centrifugally Operated Automatic Advance and Retard.** Remove the distributor moulding and lift off the rotor arm. Undo the screws fitted at the edge of the contact breaker base and lift them out together with the spring washers.

The contact breaker base can then be removed from the body of the distributor.

Oil the springs and hinge pins and see that all working parts are free.

When replacing the contact breaker base, take care to fit it in its original position and to secure it firmly by means of the screws and spring washers.

**5. Contact Breaker Arm Pivot.** Test free opening of contact points with finger pressure. If the movement is at all "sticky" the breaker spring must be released from the screw at side of base plate, and the contact lifted off its pivot. Clean pivot, lightly oil and replace.

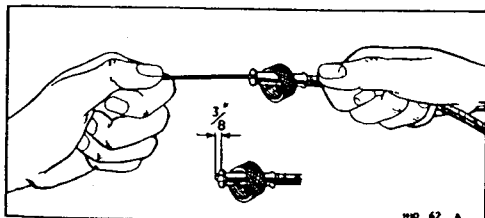
**6. Gearbox.** Drain when oil is warm (after a run) and refill to the level of the filler plug with new oil, 50.H.D.

**7. Rear Axle.** Drain when oil is warm (after a run) and refill to the level of the filler plug with new oil, C.600.

**8. Springs.** Springs should be thoroughly cleaned and painted or sprayed with engine oil, jacking under the frame in order to open the leaves.

**9. Speedometer Drive.** Disconnect at speedometer end and pull the inner flexible drive out of the casing and immerse in oil.

To re-assemble, thread the oily shafting into the casing, and while threading it give it a turning movement, which helps it to go down easily, and also helps to pick up connection with the square hole in the driving end. When this engagement is felt the shaft can be pushed right home so that the top square end stands out from the casing  $\frac{3}{8}$ -in.



Re-connect the cable to speedometer at back of instrument panel.

**10. Shock Absorbers :** Check fluid level and top up if necessary. Use Fluid Brake Hydraulic No. 3. (See Section Q). Shock Absorber link bearings are of rubber and should never be lubricated.

Tighten anchor bolts if necessary.

**Every 10,000 Miles.**

1. Adjust distributor contacts.
2. Inspect dynamo and starter motor b and clean commutator.
3. Test fuel flow at carburettor union.
4. Check and if necessary adjust carbure
5. Adjust tappets.
6. Check ignition timing.
7. Clean and adjust plugs.
8. Check front and rear hub bearings.
9. Check clutch pedal clearance.
10. Check fan belt and water circulation.
11. Inspect propeller shaft universal joint flange bolts. Except where lubricated fitted to the actual universals—which for periodical attention with the oil completely dismantle and repack roller bearings with lubricant.

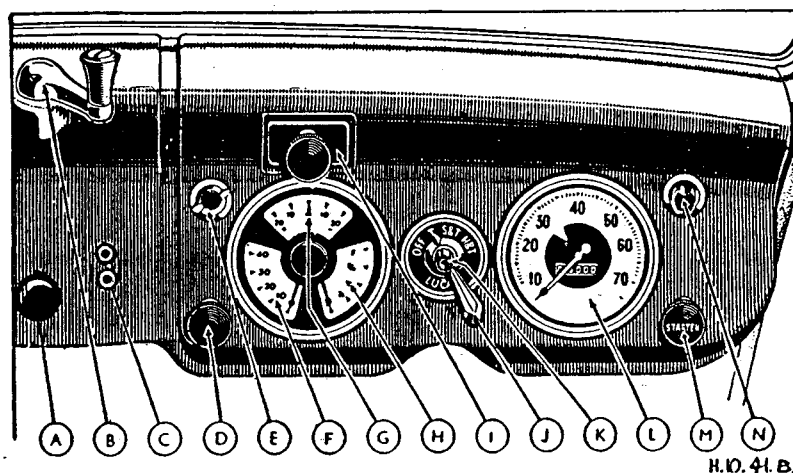


Fig. 1. Controls.

- |                          |                        |
|--------------------------|------------------------|
| A Trafficator Control    | H Petrol Gauge.        |
| B Windscreen Winder.     | I Screenwiper Control. |
| C Two-pin Socket.        | J Lighting Switch.     |
| D Carburettor Air Choke. | K Ignition Switch.     |
| E Ignition Warning Lamp. | L Speedometer.         |
| F Oil Pressure Gauge.    | M Starter Switch Knob. |
| G Ammeter.               | N Panel Light Switch.  |

(Some models have an additional control knob for switching a second headlamp).

#### Foot Controls.

- (a) **Accelerator.** The right-hand pedal which operates the carburettor throttle.
- (b) **Brake.** The centre pedal which operates brakes on all four wheels.
- (c) **Clutch.** The left-hand pedal.

#### Hand Controls.

- (a) **Brake.** Operates on all four wheels.

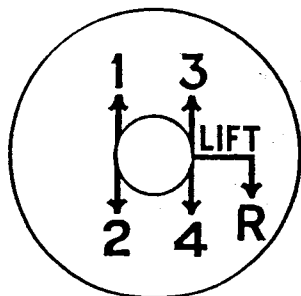


Fig. 2. Gear Positions.

- (b) **Gear Lever.** It should always be in neutral when starting the engine. Lift the lever to engage reverse gear.
- (c) **Carburettor air choke control.** For starting from cold, pull out air choke to limit until engine fires. As soon as the engine is running, push knob about half way back and turn it left to lock in warming-up position.
- (d) **Ignition Switch.** Centre of Instrument Panel. Turn clockwise to switch on.
- (e) **Lighting Switch.** Centre of panel, on same mounting as ignition switch. There are four positions :—

- (1) Off.

- (2) "T". Tail lamp or rear axle flood lamp only.

- (3) "S. & T." Side lamps and tail lamp or rear axle flood lamp.

- (4) "H. & T." All lamps.

Rear axle floodlamp switch : Fitted on rear chassis cross member. A changeover switch for tail lamp or rear axle floodlamp.

- (f) **Trafficator.** A manually-operated trafficator is provided for giving a nearside signal. The knob is conveniently placed to driver's left hand.

- (g) **Windscreen Wipers.** The windscreen wiper on the driver's side is started by pushing in the knob and turning it to the left. After this blade is in operation, the second blade may be started by pushing in its knob and turning to the right. The second blade should be stopped first by pushing in the knob and turning to the left ; to stop the first blade, push in the knob and turn to the right. The wipers operate only when the ignition switch is "On."

- (h) **Radiator Muff.** The radiator muff provides for various degrees of blanking off during cold weather ; adjust the flaps by means of the press fasteners.

**Instruments.**

- (a) **Speedometer.** Registers vehicle speed and total mileage.
- (b) **Oil Pressure Gauge.** Indicates the oil pressure in the engine. It does not show the quantity of oil in the sump.
- (c) **Ammeter.** Indicates the flow of current into or out of the battery. With the automatic voltage control system, little or no charge is shown when battery is in a well-charged condition.
- (d) **Ignition Warning Light.** On instrument panel. Glows red when the ignition is switched on and fades out when the dynamo is charging the battery.
- (e) **Petrol Gauge.** The petrol gauge indicates the contents of the tank when the ignition control is switched on.

When the tank is being filled, switch off and stop the engine and then switch on again, and the needle will record the amount of fuel entering the tank. The capacity of the tank is  $8\frac{1}{2}$  gallons.

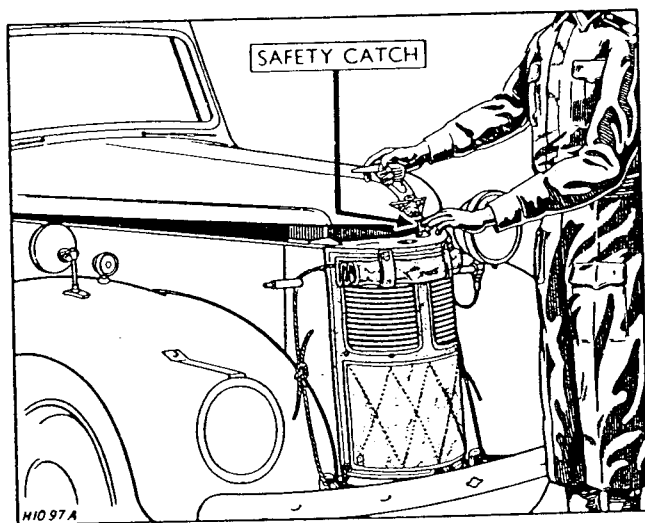
**Bonnet Safety Catch.**

Fig. 3.

This safety catch is designed to hold bonnet down while driving even if the bonnet has not been properly locked.

To open bonnet, turn handle towards offside of car and lift, but the safety catch has to be pushed back by the other hand.

**The Oil Gun.** The gun as supplied is used for forcing Oil C.600 through the nipples. Charge the gun by unscrewing the end cap and fill to three-quarters of its capacity. Replace end cap. Connect adapter to nipple and push gun body hard towards nipple. Repeat strokes according to

the amount of lubricant required in the bearing. Always clean nipples carefully before applying the gun.

**Starting the Engine.**

Before starting the engine check the oil level in the sump and the water level in the radiator.

- (a) Make sure there is sufficient petrol in the tank.
- (b) See that the gear lever is in neutral position. If the engine is cold pull out the air choke (see "Controls"). Turn ignition switch "on." Also push down clutch pedal, which takes the gearbox load off the engine.
- (c) Pull starter knob firmly (in cold weather the engine should first be rotated several times with the starting handle and the radiator should be completely blanked off by fastening muff flap in position). Never pull out the starter knob unless the engine is stationary.
- (d) As soon as the engine starts, release the knob, depress the accelerator slightly and slowly push in starting air choke.
- (e) When the vehicle has been parked for some time the petrol in the carburettor may have evaporated or leaked away. Before attempting to start the engine, refill the carburettor by operating the priming lever (A) on the petrol pump, which is on near side crankcase.

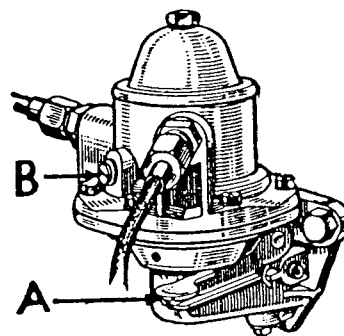


Fig. 4.

**Petrol Pump.**

- A. Priming Lever.
- B. Drain Plug.

- (f) The pumping action can be distinctly felt when the carburettor bowl is full. If this pumping action cannot be felt, turn the engine with the starting handle about one full turn, when the priming lever should be free to pump.
- (g) Do not allow engine to race when first started up, as time must be allowed for oil to circulate and lubricate the engine bearings. Let the engine idle fairly fast for a few minutes before moving off, or get into top gear as soon as possible after having started. Blanking off the radiator will assist to warm up quickly.

**Driving.****MAXIMUM PERMISSIBLE ROAD SPEEDS IN GEARS.**

|                                        | Miles per hour. |      |      |      |
|----------------------------------------|-----------------|------|------|------|
|                                        | 1st.            | 2nd. | 3rd. | Top. |
| New Engine ... ..                      | 6½              | 11   | 17½  | 30   |
| Engine Run-in (after 500 miles) ... .. | 12              | 20   | 32   | 55   |

Restricted by current A.C.I.

The gearbox has four forward speeds and a reverse.

- (a) To engage first gear, press down clutch pedal (i.e., declutch) and move the gear lever into the first speed position.
- (b) It may happen that when the clutch is let in, there is no apparent drive from the engine. That is because there has been no proper engagement of the gear. Therefore, declutch again, and it will certainly be found that the lever can then be moved so as to give the proper gear engagement. Do not use force, but always move gear lever as far as it will go.
- (c) Start on first speed, accelerate to about 8 m.p.h.,\* release the accelerator, declutch, move the lever to neutral, and continue the movement of the lever steadily to the second speed position and let in the clutch gently.
- (d) In moving from second to third speed, a similar action takes place. Accelerate to about 12 m.p.h.,\* release the accelerator, declutch, move the lever to neutral and continue the movement of the lever steadily into the third speed.
- (e) To move from third to top, declutch, and move the lever steadily into the position desired. It assists the change down from top to third, and third to second if the accelerator is kept slightly depressed while the change is made.
- (f) Gear changing may be slightly stiff in a new vehicle until the moving parts have eased in use. Changing should be done deliberately, but not hurriedly.
- (g) Always change gear early on a hill. Never allow the engine to labour in any gear and expect it to pick up speed on changing into a lower one when the vehicle has nearly

\*Figures given are those for an engine that has been run in.

stopped. Do not persist in attempting to drive the vehicle uphill in top gear when the speed falls below 20 m.p.h.—change down early.

- (h) If the vehicle has been driven back in reverse gear, wait until it is stationary before engaging a forward speed, and do not engage the reverse gear when the vehicle is travelling forward, or serious damage to the gears will result.
- (i) Keep the foot off the clutch pedal, except in heavy traffic. Even then do not allow the weight of the foot to be taken by the pedal. The slipping of the clutch caused by this practice heats and wears it badly.
- (j) When descending a long hill, or before commencing a steep descent, engage one of the lower gears, and do not accelerate. The engine will then help to retard the speed of the vehicle. When using the brake, keep the clutch in, disengaging it at the last moment if stopping.
- (k) **What Not to do.**  
Please do not make the following mistakes :—  
**Do not** forget the ignition switch when starting up.  
**Do not** forget to release the air choke control after starting the engine.  
**Do not** make a fast run with the radiator covered.  
**Do not** continue pulling out the starter knob if the engine will not fire.  
**Do not** pull the starter knob while a gear is engaged.  
**Do not** leave the vehicle in gear with hand-brake off.  
**Do not** coast with a gear engaged and the clutch held out.  
**Do not** fill the radiator with cold water when the engine is hot.  
**Do not** leave the ignition switched on when the engine is not running.  
**Do not** allow the engine to run at high speeds for the first 500 miles.  
**On no account run the engine in a closed garage. The exhaust gases are highly toxic and a very small amount in a restricted atmosphere will produce grave, if not fatal results**



# COOLING SYSTEM

## Description.

**T**HE cooling of the engine is maintained by pump circulation in conjunction with a fan-cooled radiator and a thermostat. The system should be filled with rain water, if available, or clean soft water.

Previous models had no cold-filling pipe, no by-pass pipe nor thermostat.

## THE "COLD-FILLING" RADIATOR.

The diagram, Fig. 1, shows the water circulation in the "Cold-Filling" system, which is a special circuit used on latest models. The arrows indicate the circuit before the thermostat opens and the white arrows the isolated portion of the system while warming up.

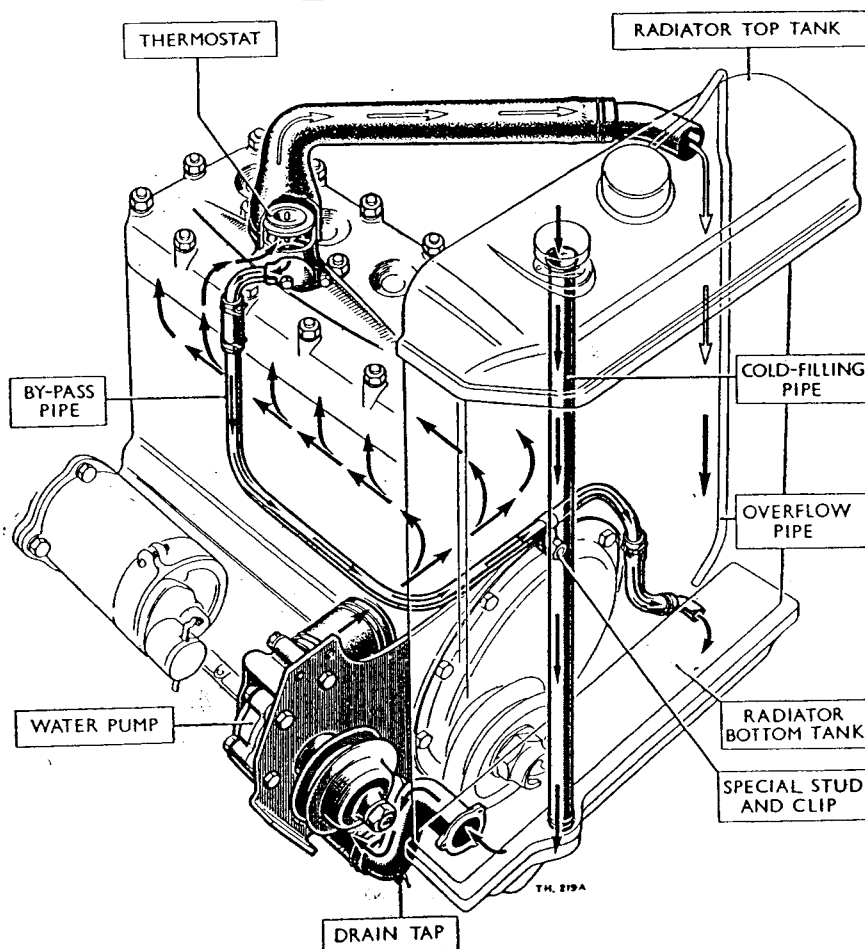


Fig. 1. Cold-Filling Diagram.

## The "Cold-Filling" Circuit.

In very low temperatures, when the radiator has been drained, the engine should be started immediately before re-filling with water.

With this "Cold-Filling" system the majority of the water poured into the empty radiator goes direct to the bottom tank, then across the tank to the outlet pipe and is circulated by the pump on the closed thermostat system while the radiator is still filling. The water entering the radiator via the direct filling pipe is warmed in contact with the bottom tank before rising into the radiator, this preventing freezing of the block. Thus the radiator can be filled in very low

temperatures, which may not be possible the ordinary circulation system as the block freeze as the system is being filled.

It will be seen that the "cold-filling" obviates the necessity for the water being pumped down the cooling tubes of the radiator. As the majority of the water rises through the radiator block, and carries with it some warmth from circulation taking place in the bottom tank.

In short, when engine is first started system immediately allows warm water to be by-passed across the bottom tank and into radiator block. There is no disadvantage to using this radiator in other climates.

**Capacity.**

The capacity of the radiator, pipes, and cylinder jacket is about 21 pints, and there are specially flexible water connections to allow of engine movement without strain on radiator.

**Overheating.**

Overheating may be caused by a slack fan belt, excessive carbon deposit in the cylinders, running with the ignition too far retarded, improper carburettor adjustment, failure of the water to circulate, or loss of water.

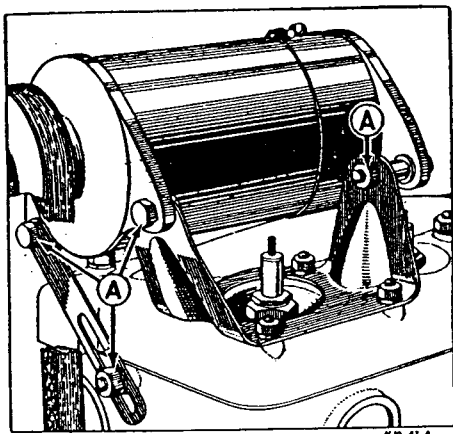
**Belt Adjustment.**

Fig. 2.

The Bolts "A" are for dynamo and fan belt adjustment.

The belt should be just sufficiently tight to prevent slip, yet it should be possible to move the belt laterally about one inch each way. To make the adjustment, slacken the bolts (A) indicated in Fig. 2, which hold the dynamo in position, and raise or lower the dynamo until the desired tension of the belt is obtained. Then securely lock the dynamo in position again.

**Frost Precautions.**

Care should be taken to see that the water is drained off completely, for in case of freezing it will do harm by lodging in small places and fracture of the cylinder block may result. THERE IS A DRAIN TAP IN THE BASE OF THE RADIATOR BLOCK. SEE THAT VEHICLE IS ON LEVEL GROUND WHILE DRAINING.

Freezing may occur first at the bottom of the radiator or in the lower hose connection. Ice in the hose will stop water circulation and may cause boiling.

A muff can be used to advantage, but care must be taken not to run with the muff fully closed, or boiling will result.

The fan blades may be removed in very severe weather.

**Protection by use of Antifreeze Mixture.**

Vehicles with antifreeze mixture in the cooling system have an identification mark on the header tank of the radiator, under the bonnet in the form of a disc painted in a specified colour.

The following precautions are necessary on vehicles so marked :—

1. When frost is expected or when the vehicles are to be used in very low temperatures, make sure that the strength of the solution is, in fact up to the strength ordered by its manufacturers.
2. The strength of the solution must be maintained by topping up with Antifreeze solution as necessary. Topping with water reduces the degree of protection afforded. Solution must be made up in accordance with instructions supplied with container.
3. TOP UP WHEN SYSTEM IS HOT.
4. If the cooling system has to be emptied, run the mixture into a clean container and use again.
5. If for any reason the mixture is lost and the system is filled with water only, REMOVE THE PAINTED DISC ON THE HEADER TANK.

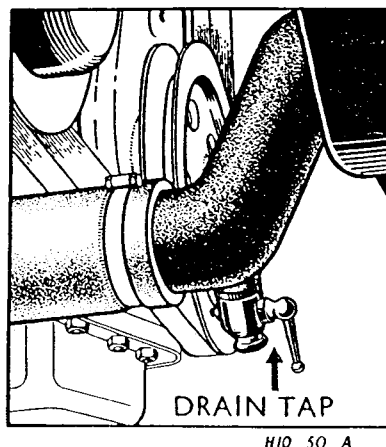
**Protection by Draining.**

Fig. 3.  
The tap is closed when the lever hangs down.

H10 50 A

**Protection by Draining—continued.**

On vehicles where antifreeze is not used, the following precautions must be taken during frosty weather to obviate any damage due to the freezing of the cooling system

1. Whenever frost precautions are ordered the cooling system must be completely drained. It is not sufficient merely to close radiator shutters or to cover the cooling system with muffs.
2. The cooling system is fitted with one drain cock, which must be opened to drain the system completely. It is essential that vehicle stands on level ground while draining.
3. Drain cock is positioned at radiator lower elbow.
4. Drain cock must be tested at frequent intervals by inserting a piece of wire to ensure that it is clear. This should be done immediately the drain cock is opened, so that any obstructions freed by the wire may be flushed out by the water.
5. When draining in very cold weather, do so when the engine is hot and do not leave the vehicle until the water is properly drained.
6. When completely drained, the engine should be run for a timed minute.
7. Place a notice on the radiator to the effect that it is empty.

**TO FLUSH RADIATOR.**

If there is antifreeze in the cooling system obtain a receptacle large enough to hold the contents of radiator and engine and place under drain tap.

Remove radiator filler cap and open drain tap at bottom offside of radiator. (Turn tap lever UP to open and DOWN to close).

As soon as a tap is opened, and again when water has stopped running insert a few inches of wire into tap outlet to ensure there is no clogging before the system is empty.

Remove antifreeze container and proceed to flush radiator from a hose or other supply of clean water.

**FAN BLADES.****Instructions for Fitting.**

It is not generally understood that there is a right and a wrong way round for the fitting of fan blades to vehicle engines.

The blades are not flat, but shaped, and the concave or hollow side should be the leading one, thus, when fitting to the dynamo pulley the convex

or arched side must always face the radiator. This convex side is further easily identified as stiffeners are pressed into the blades ; they project on this convex face.

In cases of overheating, the position of the fan blades should be at once examined ; sometimes after dismantling, the fan is, by mistake, re-assembled the wrong way round.

## WATER PUMP.

### To Remove.

1. Slacken dynamo belt (see page B/2).
2. Disconnect hoses from radiator and cylinder block flange on off-side.
3. Remove nut from front end of spindle, withdraw the pulley and take out the key. Remove oil nipple.
4. Remove pump unit from engine support by taking the nuts and spring washers from the six studs and separate the pump body from water pump cover.

### To Dismantle. (Fig. 4).

1. While holding the pump body (5), the spindle (7) can be tapped out toward the rear, carrying with it the impeller, spring and washers (2 and 3).

2. The two ball bearings, distance piece, steel and felt washers (8, 9 and 10) have next to be removed from the casing. First prise out the spring ring and remove the oil retaining ring, then, using a soft punch, tap out the first ball bearing, which will be followed by the tubular distance piece.

The second ball bearing will require to be centralised in the casing before it can be tapped out in a similar manner to the first bearing. It will be followed by the oil retaining assembly—two dished steel washers and a felt washer.

3. Removing the split cotter on the rear end of the spindle will enable the impeller and key to be withdrawn, followed by the spring, metal cup washer, rubber washer, and the carbon sealing ring which registers with a peg through the spindle.

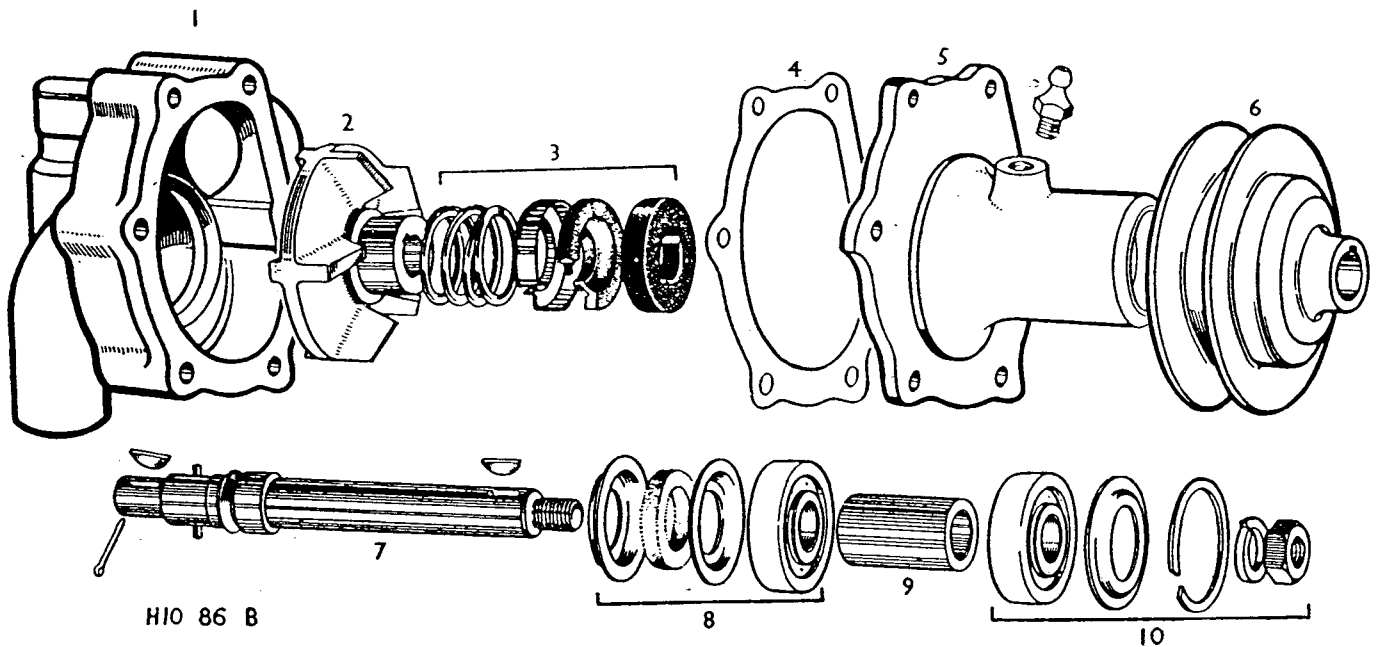


Fig. 4. Order of Assembly for Water Pump.

1 Water Pump Cover.

2 Water Impeller.

3 Sealing Ring Assembly.

4 Joint Washer.

5 Pump Body.

6 Belt Pulley.

10 Front Bearing Assembly and Pulley Nut.

7 Spindle, Keys, Peg and Impeller Cotter.

8 Rear Oil Retainer and Bearing Assembly.

9 Distance Piece.

### Early Type.

Early vehicles were fitted with a pump having a porous bronze bush instead of two ball races. The bush is oil-impregnated after manufacture, but an annular groove in the casting surrounding the bush, with which an oil hole communicates, enables the pores of the bush to be replenished with lubricant.

When reassembling pumps of this type, the bush will not be removed unless for renewal,

but the casting containing it should be totally immersed for 15 minutes in oil, maintained at 100°—120°C., and then allowed to cool in a bath of cold oil. Note that for heating the oil, a solution consisting of 6 ozs. of salt per pint of water boils at approximately 108°C. After assembly, the oil reservoir formed in the body should be refilled via the oil hole provided.

If, on dismantling the pump, the spindle and bush are found to be excessively worn, they

**WATER PUMP**—continued.

should be replaced with parts of later design, i.e., case hardened spindle, bush and improved rubber washer.

The pump spindle on these early models is located in position by a small spring ring which can be seen in the opening of the casting between the fan bearing and the oil-less bush when viewed from above. The pump should be turned by hand until the ends of the spring ring can be seen, and it is then a simple matter with the aid of two small screwdrivers, to push the ring into the small pit below, from which it can be retrieved later. The fan and pump spindle can now be driven out of the pump body and the sealing ring removed for replacement.

**To Re-assemble.**

1. In re-assembling, it is essential that the bearings, distance piece, and the various washers and other parts be positioned correctly. Fig. 4 shows the correct order.

2. The new rubber seal and the circlip can be used together for replacement of the old rubber seal complete with garter spring. The new rubber seal is of a modified shape and for identification purposes has two ridges 3/16-in. in length on the diaphragm portion diametrically opposite each other in place of the three pips which appeared on the superseded washer.

The circlip which now encircles the boss of the rubber seal is of solid wire (14 S.W.G.) instead of the coil (or garter) spring as hitherto and may be used with advantage in place of the garter spring on any existing rubber seals which have expanded where they pass over the spindle and are allowing leakage. The circlip must be fitted when the rubber seal is off the shaft. The new locating cup for the gland spring is of modified design, now locating on the outside of the carbon seal and can be used in replacement of the old one with either new or old rubber seals.

**To Refit.**

1. When fitting it is most important that the gland spring is holding the carbon seal against the pump body at a correct pressure.

With the double bearing pump this can be done by making sure that the gland spring is just holding the carbon seal up against the shoulder on the spindle before inserting the spindle into the pump. With the one ball bearing pump it must be left to the discretion of the fitter.

The latest gland spring is stronger than the earlier types and can be used for replacement of its predecessor.

The new gland spring has 2 coils of 10 S.W.G (.128-in.) phosphor bronze wire instead of 2½ coils of 13 S.W.G. (.092-in.) as hitherto. This modification effects an increased pressure on the carbon seal of the water pump.

2. It must be remembered that the pump has to be bolted into position on engine plate before the belt pulley is fitted. The lubricating nipple is re-fitted last.

3. Lubricate with C.600, using oil gun on nipple.

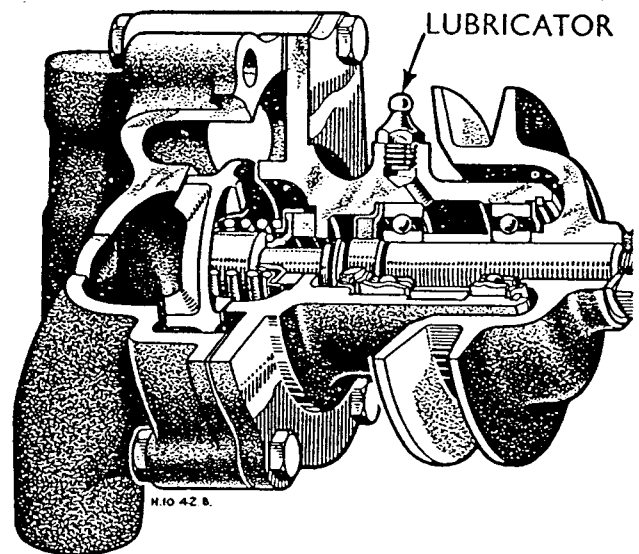


Fig. 5.

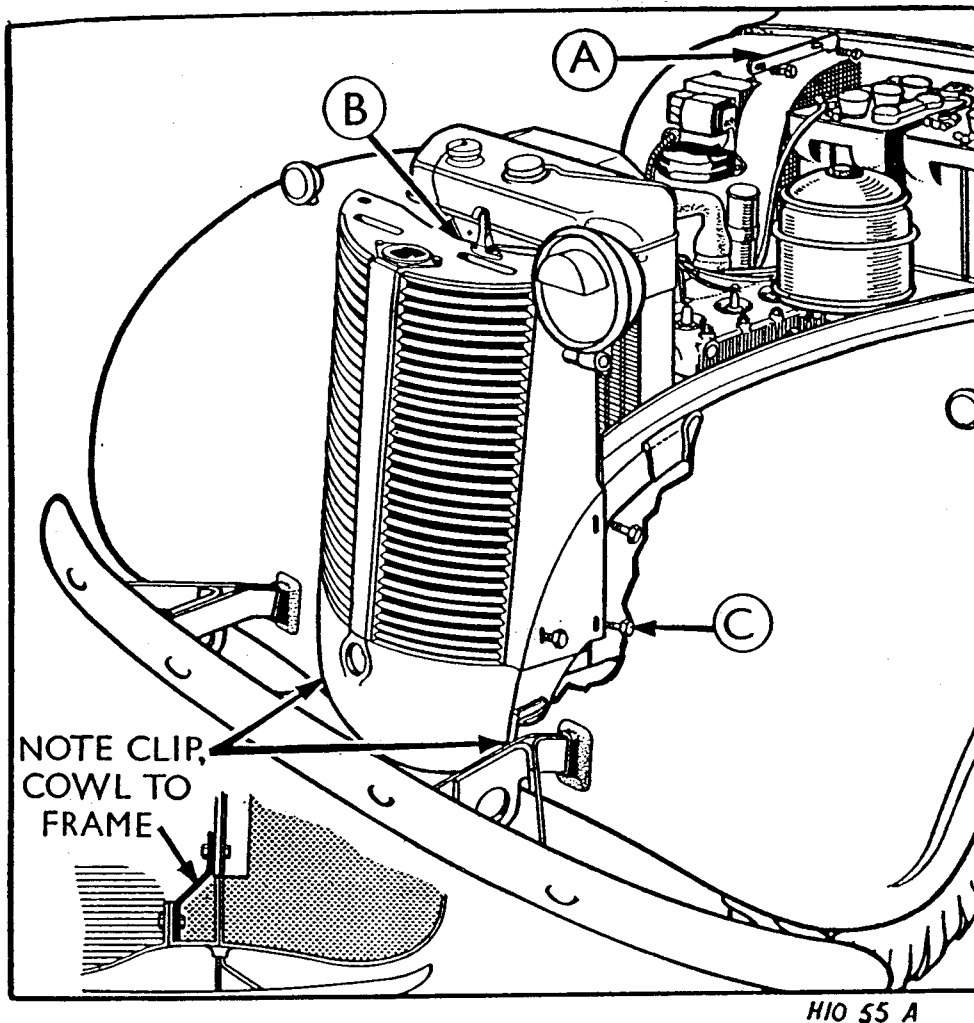


Fig. 6.

A. Bonnet Hinge.

B. Bolt securing cowl to radiator tank.

C. Bolts through mudwing.

### Radiator Removal.

Drain radiator by means of tap in bottom elbow, and remove dynamo from bracket on cylinder head. (See page B/2). The dynamo wiring is sufficiently long to allow the unit to rest on mudwing and fitch plate.

Take off radiator tank filler cap.

Disconnect water hose at top and bottom connections to radiator. Remove the nuts from the two mounting bolts which extend from the bottom of radiator, and which pass through the rubber mounting blocks. See illustration on following page for order of assembly of this mounting.

Remove nut and rubber washer from stud which forms the securing point of radiator and cowl at the top. Note that this stud also provides the anchor for the captive filler cap.

Radiator block may now be lifted from inside the cowl, taking care not to damage the fins as it clears the engine. (It is to give more access here that the dynamo and fan removal is suggested).

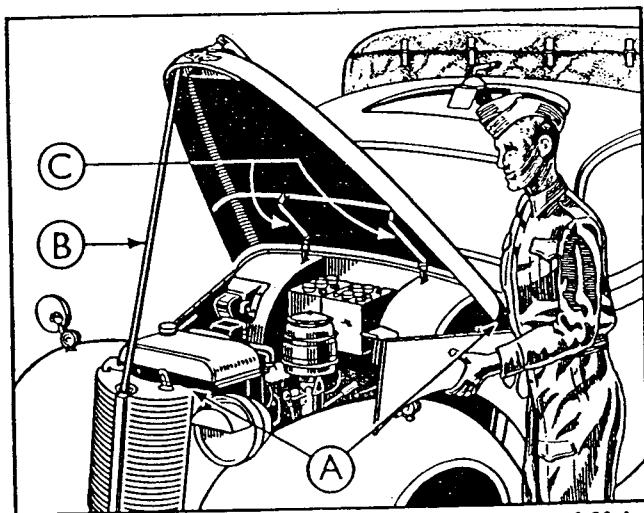
### Re-fitting.

Carefully place radiator in position and see that the support assemblies (Fig. 8) are properly in position before attempting to secure with the nuts at the bottom. When securing at the top do not finally tighten till dynamo and fan is in position and adjusted, in order to ensure proper fan blade clearance of radiator.

Note that the Cold Filling type radiator is not interchangeable with its predecessor unless the engine or cylinder head has also been changed for latest type at time of overhaul. If cylinder head only is changed to link up with the by-pass circuit provision will have to be made for securing the by-pass pipe at front of crankcase (see Fig. 1).

### The Cowl.

It is advisable to remove the bonnet, while the bonnet side plates must also be taken away. Illustration shows bolts to be removed. While working on such jobs it is usual to dispense with the bonnet prop rod, using a length of wood to raise the bonnet a few inches higher to



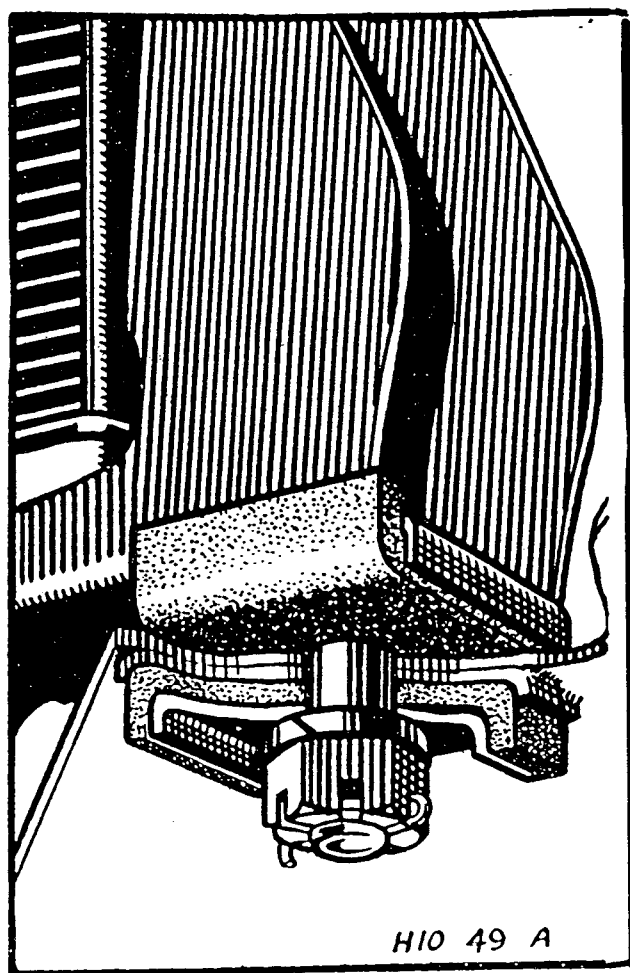
H10.99.A.

Fig. 7.

- A. Bonnet side bolt positions.
- B. Wooden support prop in place of fitted prop to give more working room.
- C. Bonnet Hinge Arm Bolts.

obtain better access. In this case the bonnet will need to be firmly held by an assistant while the bolts are taken from the hinge arms. The bonnet sides are held by one bolt through the scuttle and one through the top of the cowl. On the nearside the bolt through the cowl also secures the bonnet prop rod bracket.

To remove the cowl first disconnect the headlamp wiring at snap connection at each side. Although only one headlamp may be fitted, the wiring for the second headlamp is completed as far as the lamp bracket and then taped up.



H10 49 A

Fig. 8.

This illustration shows the assembly of one of the two radiator supporting points.

There are three bolts through each side of the cowl and into the mudguard and bodywork. Upon removal of these the cowl is free to be lifted from the vehicle. Leather packing will be found between the cowl and the mudguard; see that this is replaced when rebuilding the radiator unit. Replacement is a reversal of these instructions taking care to line up radiator to ensure register of bonnet lock.

## FUEL SYSTEM

C/1

**Description.**

An 8½ gallon petrol tank, which is fitted with a special filler cap incorporating a vent hole and electrically operated petrol gauge tank unit, is supported directly on the chassis side members at the rear of the chassis (see page C/2). On early models the tank incorporated an overflow and vent pipe as shown in Fig. 1.

An A.C. petrol pump, operated by the engine camshaft, draws petrol from the tank and lifts it at low pressure to the Zenith Carburetter, Type 30-VM4 (See Page D/1). An Oil Bath Cleaner is fitted. (See page D/3).

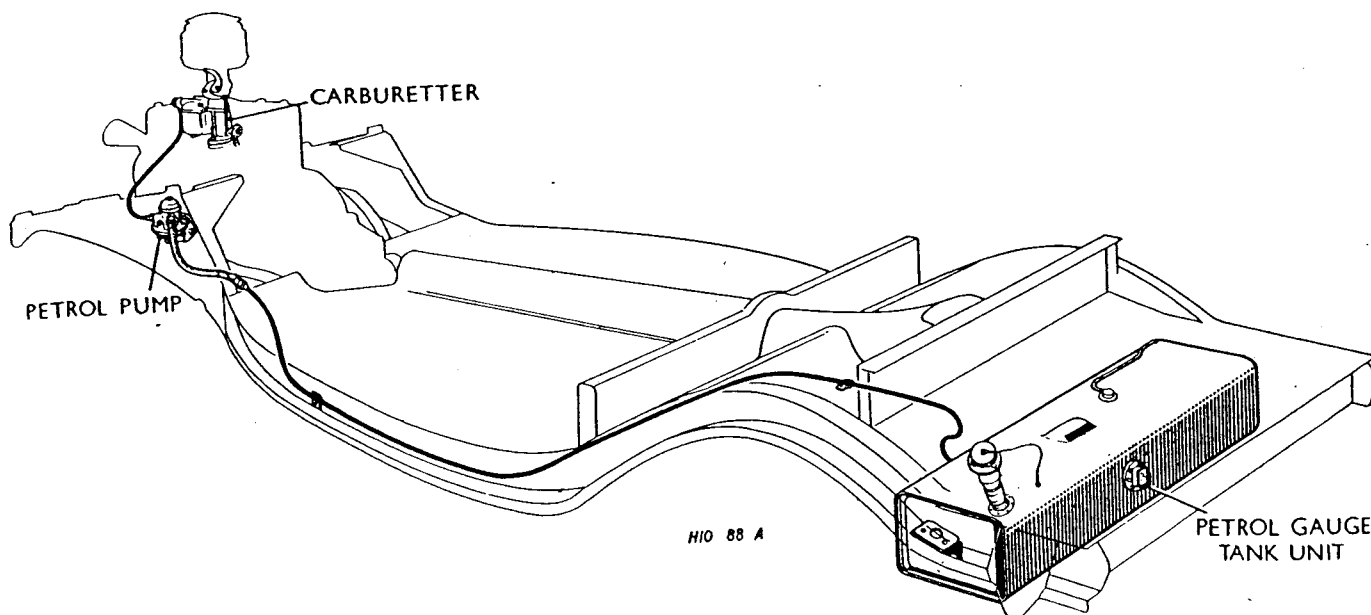


Fig. 1.

Layout of Fuel Feed System, showing tank, gauge unit, piping, carburetter and petrol pump positions.

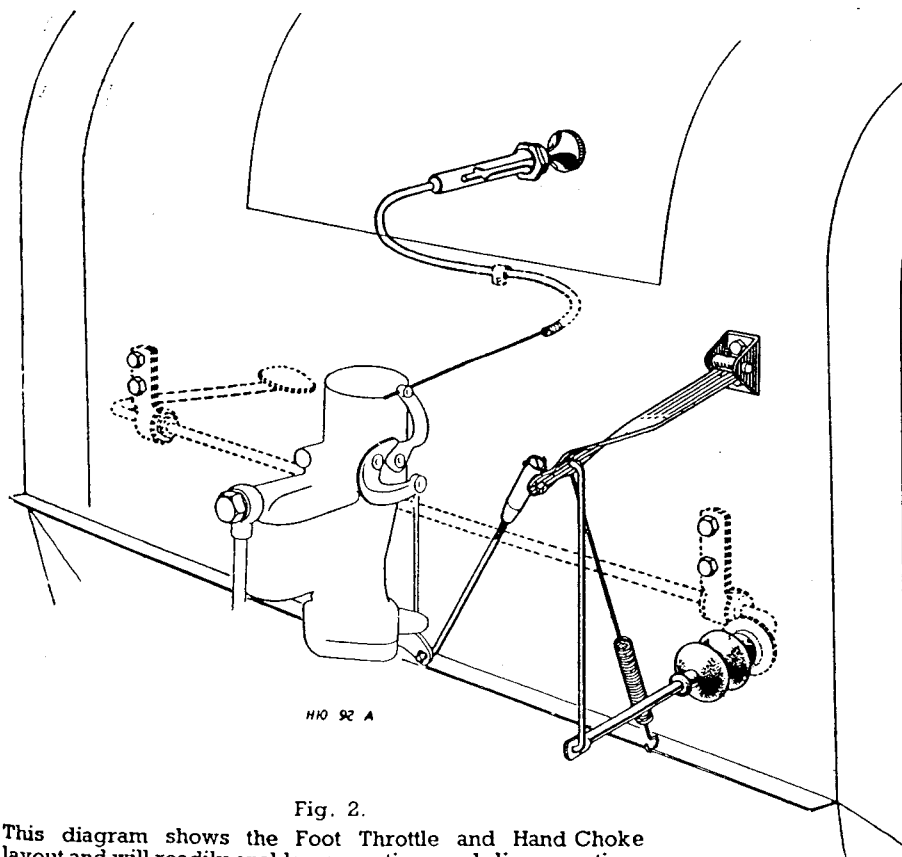
**THROTTLE LINKAGE.**

Fig. 2.

This diagram shows the Foot Throttle and Hand Choke layout and will readily enable connections and disconnections to be correctly made.

**PETROL TANK.****To Drain.**

The drain plug is positioned centrally in the bottom of the tank and is completely removed for draining.

**To Remove.**  
(See Fig. 3).

1. Drain as above.
2. Disconnect petrol delivery pipe from union in front of tank as shown in illustration.
3. Disconnect insulated lead from electrical unit terminal in rear of tank.
4. Remove filler hose clips accessible from inside vehicle on nearside and cover filler pipe opening.



5. Release nuts on the "U" bolt through frame and tank at each side (See Fig. 3), and gently lower tank free. Manoeuvre past springs and shackles, lowering offside first in order to clear filler tube through floor.

#### To Replace.

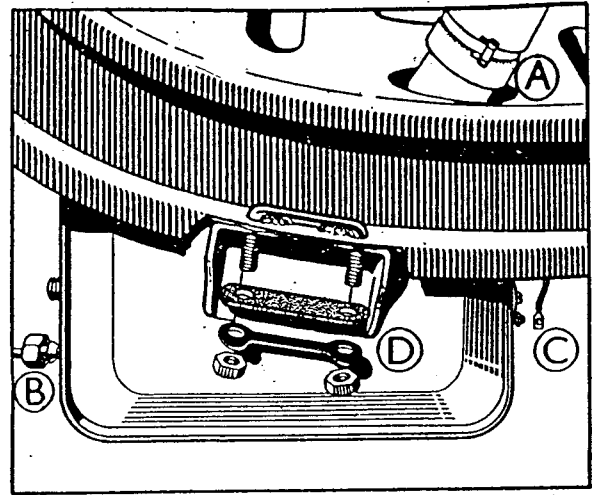
Reverse above order to replace tank, but ensuring that a rubber pad is between the tank bracket and the frame before the "U" bolt is threaded through the bracket.

Cover the tank filler tube outlet during re-fitting to ensure no foreign matter enters the tank from the underside of the chassis while it is being offered up in position.

#### Petrol Gauge Tank Unit.

This can be removed from the tank complete by the withdrawal of the six securing screws, but care must be taken not to bend the float lever or the subsequent gauge reading may be seriously affected.

Ensure that the joint washer is in place when refitting a tank unit, as this joint has to be petrol-tight.



H10 83 A.

The Tank Mounting.

Fig. 3.

Inset shows one of the two frame mountings for the petrol tank; A is the petrol filler connection; B the petrol pipe union. C is cable to electric fuel gauge unit in tank; D shows assembly of nuts and washers for securing tank to frame. The rubber pad, shown separate in drawing, must be fitted between tank bracket and frame.

#### The Manifolds.

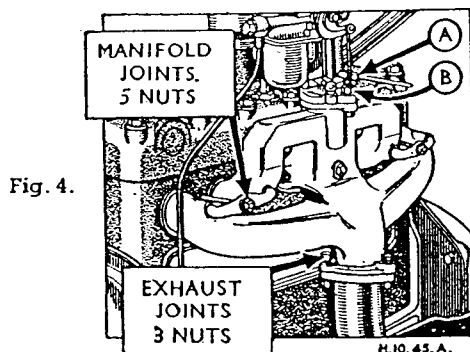


Fig. 4.

A. Suction Timing Union.  
B. Carburettor Flange Joint.

To remove inlet and exhaust manifolds it is necessary to disconnect the carburettor controls, petrol pipe and exhaust pipe.

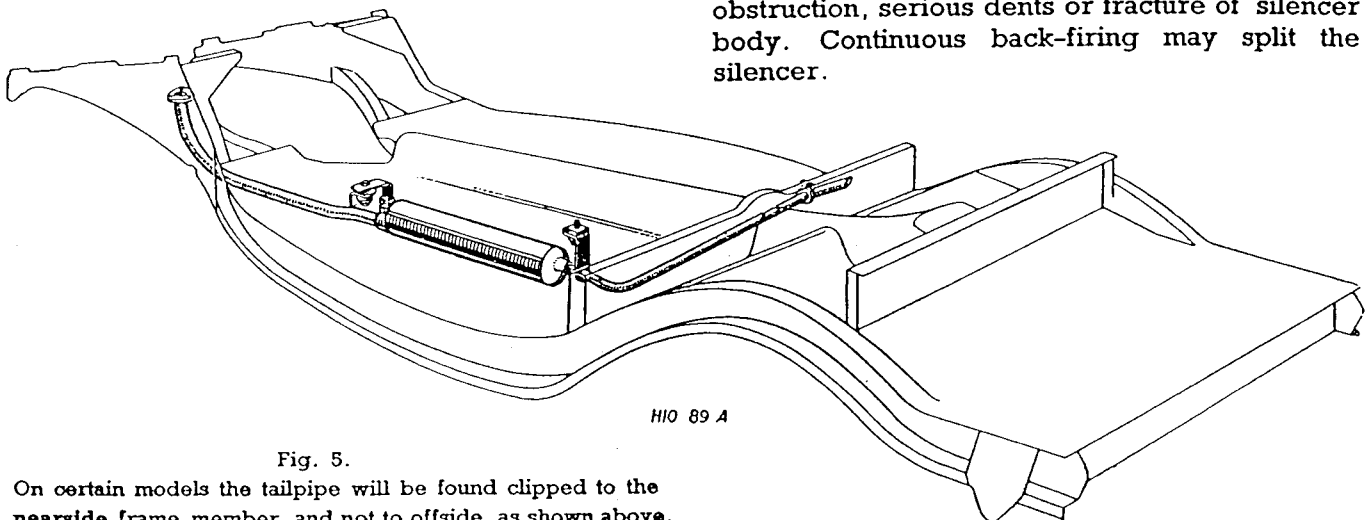
Inlet and exhaust manifolds are removed as one unit after releasing nuts at five points, two of these bearing on steel clamps, the remaining three on studs which pass through the flange, one on each end of the manifold and one in the centre.

Detach manifold joint washers.

#### 2. Pipes and Silencer.

The tail pipe is secured in a clip on frame member and is welded to silencer.

Two clips to the frame carry the silencer, the front clip also securing the exhaust pipe from the manifold on engine. Check pipes for obstruction, serious dents or fracture of silencer body. Continuous back-firing may split the silencer.



H10 89 A

Fig. 5.

On certain models the tailpipe will be found clipped to the nearside frame member, and not to offside, as shown above.

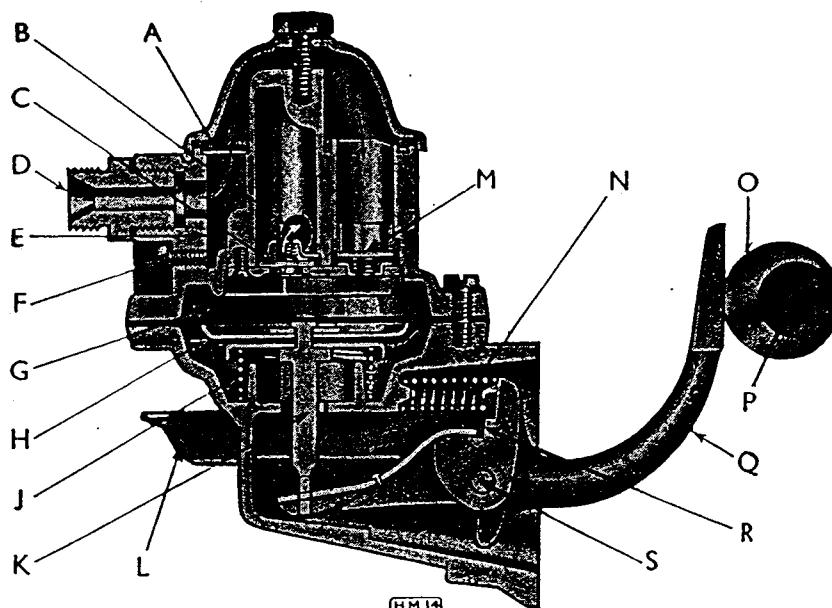
**A.C FUEL PUMP.**

Fig. 6.

F. Drain Plug.

The A.C. Petrol Pump.

L. Priming Lever.

**Type and Description**

The A.C.-Sphinx Fuel Pump, Type "T," is operated mechanically from an eccentric on the engine camshaft. Figure (6) gives a sectional view of the pump, the method of operation being as follows :—

As the engine camshaft (P) revolves, the eccentric (O) lifts pump rocker arm (Q) pivoted at (S) which pulls the pull rod (K) together with the diaphragm (H) downward against spring pressure (J) thus creating a vacuum in the pump chamber (G).

Petrol is drawn from the tank and enters at (D) into sediment chamber (E) through filter gauze (A), suction valve (M) into the pump chamber (G). On the return stroke the spring pressure (J) pushes the diaphragm (H) upwards, forcing petrol from chamber (G) through the delivery valve (C) and opening (B) into the carburetter.

When the carburetter bowl is full the float will shut the needle valve, thus preventing any flow of petrol from the pump chamber (G). This will hold diaphragm (H) downward against spring pressure (J) and it will remain in this position until the carburetter requires further petrol and the needle valve opens. The rocker arm (Q) operates the connecting link by making contact at (R) and this construction allows idling movement of the rocker arm when there is no movement of the fuel pump diaphragm.

Spring (N) keeps the rocker arm (Q) in constant contact with eccentric (O) to eliminate noise.

**Cleaning Filter. (See Fig. 7).**

The filter should be examined every 1,000 miles and cleaned if necessary. Under extreme conditions of dust laden atmosphere this mileage interval should be reduced as conditions dictate.

Access to the filter is gained by removing the dome cover, after unscrewing the retaining screw, when the filter gauze itself may be lifted off its seating. Remove the drain plug and clean out the sediment chamber. Clean filter gauze in air jet or petrol.

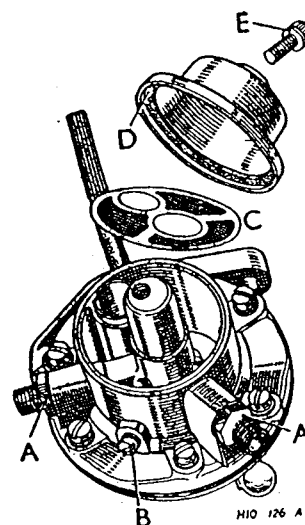


Fig. 7.

A. Pipe Unions. B. Drain Plug.  
C. Filter Gauze. D. Cork Washer.  
E. Cover Screw and Washer.

**A.C. FUEL PUMP—continued.**

The cork gasket under the filter cover should be renewed if broken or if it has hardened.

When refitting the cover, make certain that the fibre washer is replaced under the head of the screw. Tighten the filter cover retaining screw just sufficient to make a petrol-tight joint. Over-tightening will either destroy the cork washer, crack the cover, or fracture the main casting.

Check pump crankcase mounting bolts for tightness, and petrol pipe unions.

**Testing while on Engine.**

With the engine stopped and switched off, the pipe to the carburetter should be disconnected at the carburetter end, leaving a free outlet from the pump. The engine can then be turned over by hand, when there should be a well defined spurt of petrol at every working stroke of the pump, namely, once every two revolutions of the engine.

**Removing from Engine.**

Firstly, the pipe unions should be disconnected, the two nuts fixing the fuel pump to the engine crankcase should then be unscrewed after which the fuel pump and its protecting screen will come away readily.

**Dismantling Fuel Pump.**

Before commencing dismantling, clean the exterior of the pump and make a file mark across the two flanges for guidance in re-assembling in the correct relative positions. After separating the two main castings, the further dismantling of the components associated with each is quite straightforward. The diaphragm and pull rod assembly can be withdrawn by first of all turning it through 90 degrees. See Fig. 9. No attempt should be made to separate the four diaphragm layers from their protected washers and pull rod, as this is at all times serviced as a complete assembly, being permanently rivetted together.

**Inspection of Parts.** (Reference numbers apply to Fig. 8).

Firstly all parts must be thoroughly cleaned to ascertain their condition. Wash all parts in the locality of the valves in a clean paraffin bath separate from that employed for the other and dirtier components.

Diaphragm and pull rod assemblies should normally be renewed unless in entirely sound condition without any signs of cracks or hardening.

Upper and lower castings should be examined for cracks or damage, and if diaphragm or engine mounting flanges are distorted these should be lapped to restore their flatness. Where hand priming lever (10) incorporated in lower casting is broken, the parts should be replaced, the outer end of the spindle being rivetted over by hand tools after correctly locating the various components.

All badly worn parts should be replaced, and very little wear should be tolerated on rocker arm pins (13), the holes and engagement slot in links (9), holes in rocker arms (12). On the working surface of the rocker arm which engage with the engine eccentric, slight wear is permissible but not exceeding .010-in. depth. The valve seat incorporated in valve plate (24) should be examined and if at all roughened should be carefully lapped flat on a smooth carborundum stone; similarly, the corresponding outlet valve seat incorporated in the upper casting (22) should be examined and if worn unevenly to the slightest degree, both the upper casting and valve seat assembly must be replaced. It is not practicable to refit new valve seats into the castings as this calls for special equipment.

Fuel pump valves (23) should be renewed if all worn, although in an emergency they can be turned over to provide a fresh surface to the valve seat. Valve springs (21) should preferably be renewed, although they can be refitted providing they do not bear undue evidence of rubbing away on the outside diameter. In no circumstances should valve springs be stretched in an endeavour to increase their strength. Diaphragm springs (18) seldom call for replacement but where necessary, ensure that the replacement spring has the same identification colour and consequently the same strength as the original. Rocker arm springs (19) are occasionally found to be broken after service. All gaskets and joint washers should be renewed as a matter of routine.

**To Re-assemble Fuel Pump.**

The following procedure should be adopted dealing with the upper portion of the pump first.

Place outlet valve spring retainer (27) in position in upper casting (this retainer is the small three-legged pressing which retains the outlet valve spring), taking care not to distort the legs.

Place valve plate gasket (25) in position.

## A.C. FUEL PUMP—continued.

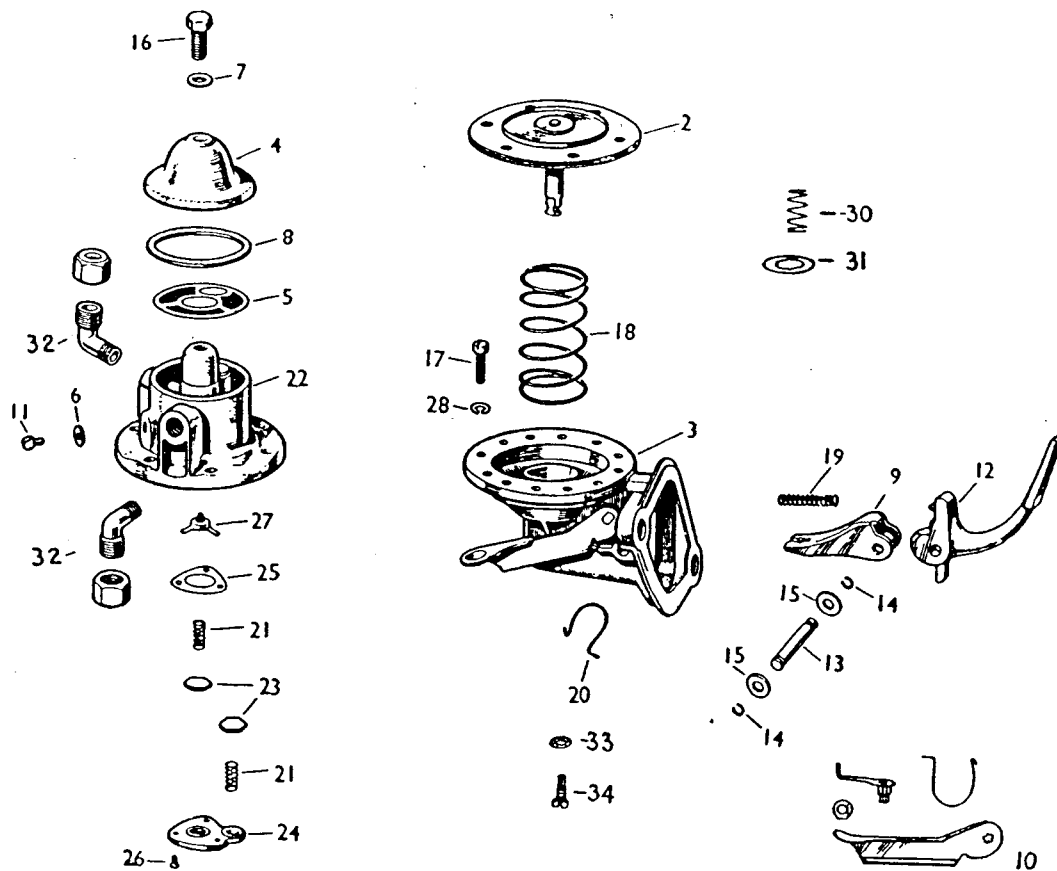


Fig. 8.

- 2. Diaphragm and Pull Rod.
- 3. Lower Casting.
- 4. Pump Top Cover.
- 5. Filter Gauze.
- 6. Drain Plug Gasket.
- 7. Cover Screw Washer.
- 8. Cover Cork Gasket.
- 9. Rocker Link.
- 10. Priming Lever Assembly.
- 11. Drain Plug.
- 12. Rocker Arm.

- 13. Rocker Arm Pin.
- 14. Rocker Arm Pin Clips.
- 15. Rocker Pin Washers.
- 16. Top Cover Screw.
- 17. Diaphragm Cover Screws.
- 18. Diaphragm Spring.
- 19. Rocker Lever Spring.
- 20. Priming Lever Spring.
- 21. Valve Spring.
- 22. Upper Chamber.
- 23. Valves.

- 24. Valve Retainer Plate.
- 25. Valve Plate Gasket.
- 26. Valve Plate Screw.
- 27. Spring Retainer.
- 28. Cover Screw Washers.
- 30. Oil Seal Washer Spring.
- 31. Oil Seal Washer.
- 32. Petrol Pipe Unions.
- 33. Stop Screw Washer.
- 34. Rocker Arm Stop Screw.

Valves should be swilled in clean paraffin before re-assembly. Apart from the cleaning effect this improves the sealing between the valve and seat.

Place outlet valve (23) on spring.

Place inlet valve (23) on valve seat located in upper casting.

Place valve spring (21) on centre of inlet valve.

Place valve plate (24) in position and secure with the three screws (26). (The inlet valve spring must be centred properly in the spring seat formed in the valve plate).

Place filter gauze (5) in position on top of casting, making certain that it fits snugly.

Fit cork gasket, cover, fibre washer, and retaining screw as previously detailed under "Cleaning Filter" and detailed on page C/3.

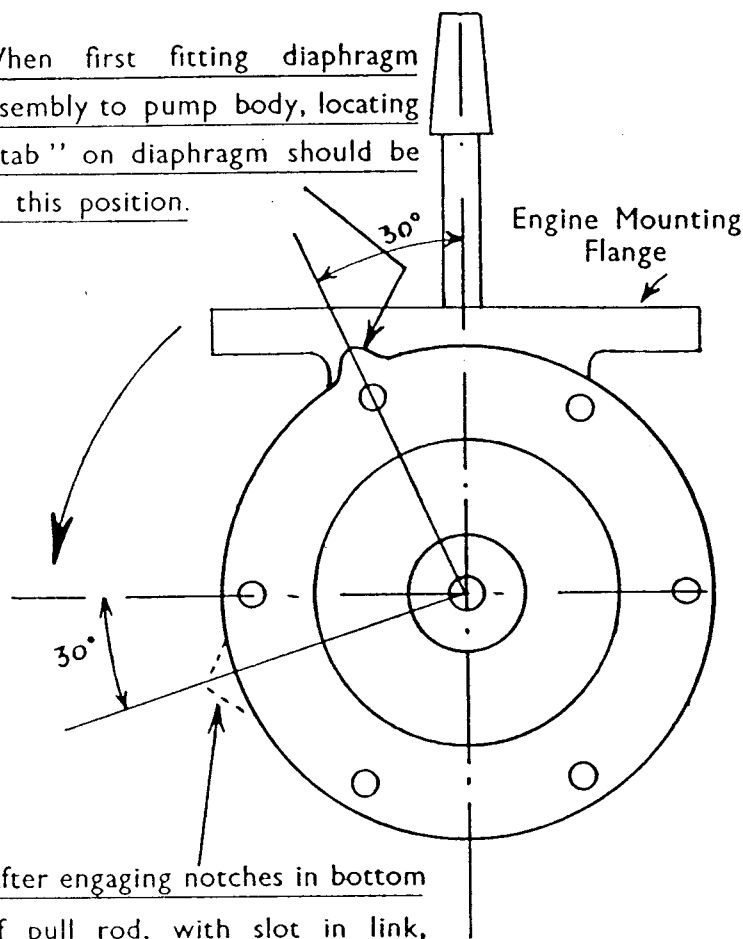
To assemble the lower half, proceed as follows :—

Assemble link (9), packing washers (15), rocker arm (12) and rocker arm spring (19) in the body (3).

Insert rocker arm pin (13) through hole in the body, at the same time engaging the packing washers, link, and the rocker arm, then spring the retaining clips into the grooves on each end of the rocker arm pin

**A.C. FUEL PUMP**—continued.

When first fitting diaphragm assembly to pump body, locating "tab" on diaphragm should be in this position.



After engaging notches in bottom of pull rod, with slot in link, and turning quarter turn to the left tab on diaphragm should be in this position.

Fig. 9.

The rocker arm pin should be a tap fit in the body, and if due to wear it is freer than this, the ends of the holes in the body should be burred over slightly.

NOTE.—The fitting of the rocker arm pin can be simplified by first inserting a piece of .240-in. diameter rod through the pin hole in one side of the body far enough to engage the rocker arm washers and link, and then pushing the rocker arm pin in from the opposite side, removing the temporary rod as the pin takes up its proper position.

To fit the diaphragm assembly to the pump body :—

On pumps where they are fitted, thread oil seal washer spring (30) and oil seal washer (31)

on to pull rod and turn washer 90 degrees to keep it in position.

Place the diaphragm spring (18) in position in the pump body.

Place the diaphragm assembly (2) over the spring, the pull rod being downwards, and centre the upper end of the spring in the lower protector washer.

Press downwards on the diaphragm at the same time turning the assembly to the left in such a manner that the slots on the pull rod will engage the fork in the link, ultimately turning the assembly a complete quarter turn to the left, which will place the pull rod in the proper working position in the link, and at the same time permit the matching up of the holes in the diaphragm with those on the pump body flanges.

**A.C. FUEL PUMP—continued.**

When first inserting the diaphragm assembly into the pump body, the locating "tab" on the outside of the diaphragm should be at the 11 o'clock position. After turning the diaphragm assembly a quarter turn to the left the "tab" should be at the 8 o'clock position. These positions are shown in Fig. 9.

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

Push the rocker arm (12) towards the pump until the diaphragm is level with the body flanges.

Place the upper half of the pump into the proper position as shown by the mark made on the flanges before dismantling.

Install the cover screws (17) and lock washers (28) and tighten only until the heads of the screws just engage the washers.

Release and push the rocker arm away from the pump so as to hold the diaphragm at the top of the stroke, and while so held tighten the cover screws diagonally and securely. On pumps fitted with rocker arm stop screws (34) and washer (33) these should be removed for the operation and afterwards refitted.

The best method is by using an A.C.-Sphinx bench test stand, on which the suction side of the pump is piped to a tin of paraffin at floor level and the outlet side of the pump connected to a stop tap and pressure gauge.

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

With the same apparatus a second test can be made by working the pump with the tap on the delivery side closed, pressure then being recorded on the gauge. After ceasing to work the pump it should take several seconds for this pressure to return to zero, thus denoting that the valves are seating properly. Also, while there is

pressure, the outer edge of the diaphragm—visible between the two clamping flanges—should be carefully examined for leakage and the retaining screws tightened if necessary. When working a pump by hand a somewhat longer stroke is obtained and the pressure developed is apt to be higher than when fitted to the engine.

When the above apparatus is not available the pumps should be tested, using a pan of clean paraffin, as follows :—

Firstly, flush the pump by immersing it in the paraffin and working the rocker arm half a dozen times, then empty the pump by continuing to operate it while held above the bath. Then with the pump clear of the paraffin bath place the finger over the inlet union (marked "in") and work the rocker arm several times. Upon removing the finger a distinct suction noise should be heard, denoting that the pump had developed a reasonable degree of suction. Afterwards the finger should be placed over the outlet union and after pressing the rocker arm inwards the air drawn into the pump chamber should be held under compression for two or three seconds; this should also be done with the pump immersed in paraffin and the clamping flanges of the diaphragm watched for any signs of air leakages.

**Refitting to Engine.**

Reverse the procedure outlined for removal from engine. Ensure that the rocker arm is correctly positioned against the eccentric on the camshaft, as particularly when pumps are inaccessibly mounted there is a possibility of inadvertently getting the rocker arm under the eccentric or to one side, when damage will result after the pump bolts are tightened. The gasket between the pump and the crankcase should be renewed if unsound.

After refitting to the engine, the pump should be run for a short time and pipe unions and pump examined for the possibility of fuel leakage.

## CARBURETTER.

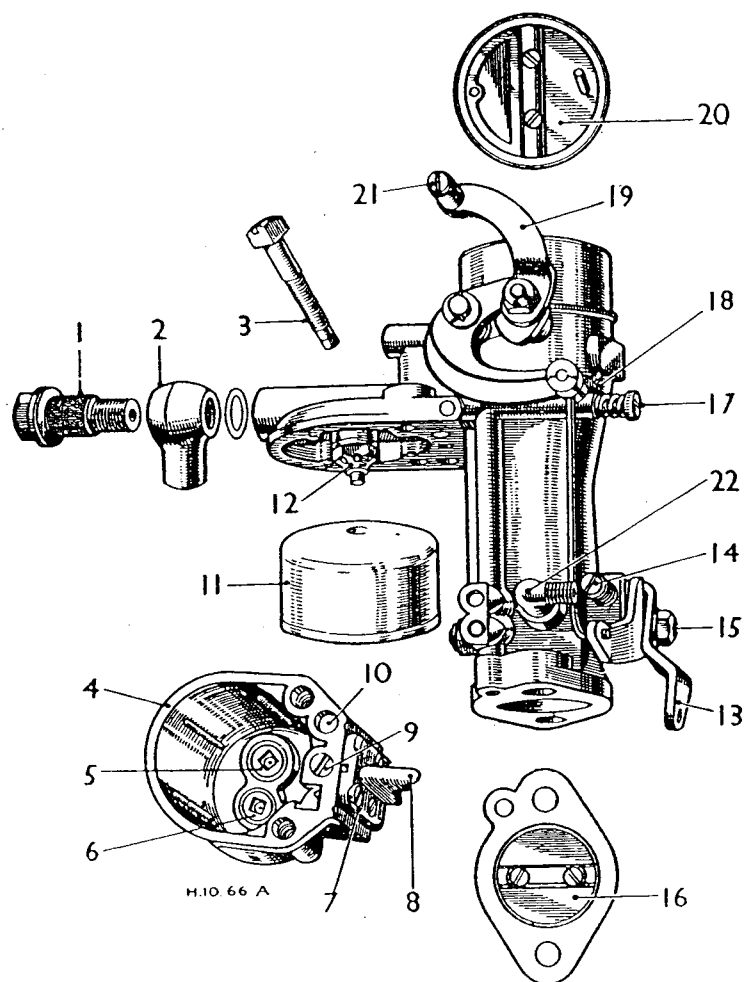


Fig. 1.

1. Union Nut carrying loose fibre washer and filter gauze.
2. Petrol Pipe Union.
3. A Float-chamber Retaining Bolt with squared end for use as jet key.
4. Carburettor bowl.
5. Compensating Jet.
6. Main Jet.
7. Emulsion Block.
8. Nozzle.

9. Slow Running Jet.
10. Compensating Well.
11. Float.
12. Needle Seating.
13. Throttle Lever.
14. Slow Running Adjuster Screw.
15. Throttle Spindle Nut.
16. Throttle "Butterfly."
17. Air Regulating Screw.

18. Choke-throttle Interconnecting Adjuster.
19. Choke Lever, with cam for throttle interconnection.
20. Choke Flap (with spring loaded release valve flap).
21. Choke Cable Anchorage.
22. Union for vacuum pipe to automatic ignition timing control at distributor.

## Description.

THE carburettor fitted is the Zenith down-draught type, 30-V.M.4., embodying the well known principles of main and compensating jets. Fuel from the pump passes through the union, the filter and the needle seating into the float chamber. As the float rises it will close the needle on its seating, thus regulating the flow of the fuel.

The float chamber contains the main jet, the compensating jet, the capacity well, and the slow running jet. Fuel flows through the main and compensating jets and also rises in the capacity well. From the jets it flows along two separate channels into a common channel in the emulsion block attached to the float chamber.

**CARBURETTER—continued.**

This main channel has its outlet in a nozzle which projects into the choke tube.

The capacity well is in direct communication with the atmosphere and the compensating channel in the emulsion block.

**Cold Engine.**

To obtain an easy start from cold the air choke control on the dashboard should be pulled to its fullest extent and the engine should be given, by hand, a few turns to free the moving parts. Then pull the self-starter knob. When the engine is running release the choke control to the second notch.

In cold weather it may be necessary to hold the choke control out for a few minutes while the engine warms up and to run the car for the first few minutes with the knob in the second notch position. As soon as the engine is warm, however, the control knob should be pushed right in, otherwise the mixture will be too rich.

**Air Choke.**

If difficulty in starting the engine is experienced, ascertain that the air choke flap is closing properly and if necessary adjust the wire.

Make sure also that the choke flap opens fully, for if this sticks in a partially closed position it will restrict the speed of the car and increase fuel consumption.

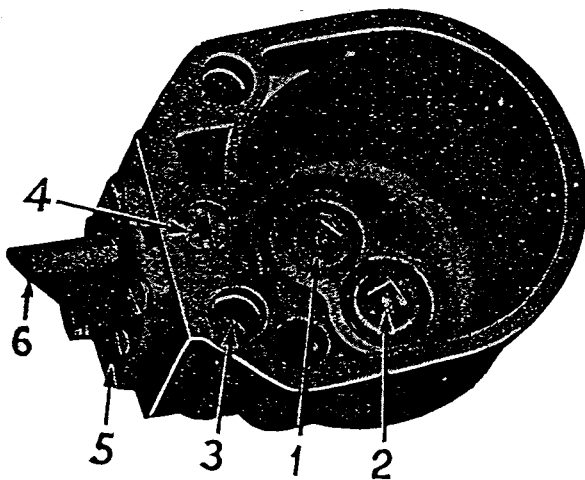


Fig. 2.

The Carburettor Bowl and Jets.

1 Main Jet.  
2 Compensating Jet.  
3 Capacity Well.

4 Slow-running Jet.  
5 Emulsion Block.  
6 Nozzle.

A choked slow running jet will also cause difficulty. Jets should be cleaned only by blowing through them, either with tyre pump or orally, or washing in petrol.

On no account may wire be used.

If the engine does not idle as slowly as desired, turn the screw (14) to the left to close the throttle slightly.

A weak mixture may cause difficulty in slow running and this may be adjusted by turning the air regulating screw (17) clockwise to enrich the mixture. Do not make the mixture too rich or the engine will "hunt" or will tend to choke when slow running while warm.

**Cleaning.**

The bowl of the carburettor should be removed occasionally for cleaning (See Fig. 2). Take out the two retaining bolts and the bowl will drop into the hand. On turning the bowl upside down the float will fall out and reveal the main and compensating jets at the bottom of the bowl.

The jets are removed by fitting into them the squared end of one of the retaining bolts and using a spanner on the other end.

The pipe connections from the petrol pump should be dismantled and the filter thoroughly cleaned in petrol. When re-assembling take care that the fibre washers on both sides of the union are correctly replaced and that the washer against which the bowl fits is not damaged.

**Standard Settings.**

Sizes of Zenith jets normally run in 5's—the higher the number the larger the jet.

The standard settings are :—

|                  |     |     |
|------------------|-----|-----|
| Choke Tube       | ... | 21  |
| Main Jet         | ... | 92  |
| Compensating Jet | ... | 50  |
| Slow Running Jet | ... | 45  |
| Progression Jet  | ... | 100 |
| Capacity Tube    | ... | 2   |
| Needle Seating   | ... | 1.5 |

Do not, however, alter the jets unless you are quite sure that other parts of the engine, including sparking plugs, ignition and valves are in order, and that the compression is good. There are no moving parts in the Zenith carburettor, so that nothing can get out of adjustment when once set.



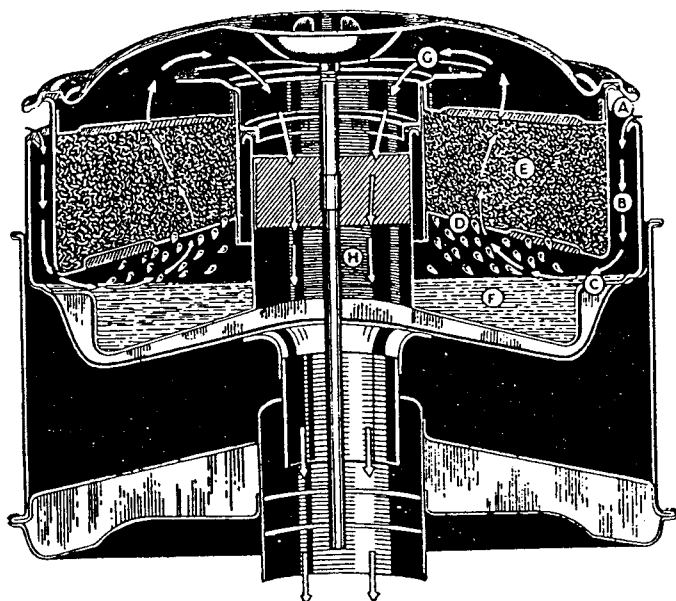
**OIL BATH AIR CLEANER.**

Fig. 3.

**Type and Description.**

An A.C. oil bath type Air Cleaner is fitted. Reference to Fig. 3 shows that air enters the cleaner through opening A between shell and top cover. It then passes downwards through annular passage B, strikes shelf C and reverses upwards into filter element through opening D.

The majority of the dust and dirt suspended in the ingoing air is precipitated into the oil in the bottom of the cleaner, when the air stream reverses above the shelf at C. Subsequently, a cleaning operation also takes place as the partly cleaned air is drawn upwards through the woven metallic mesh E.

The cleaned air passes out of the filter element through openings G and then to air intake through passage H.

The filter element is automatically oiled and washed by oil picked up from the shelf by the incoming air.

**To Inspect for Sludge.**

The air cleaner must be inspected every 1,000 miles, or more often under conditions of dust laden atmosphere.

Remove the knurled nut retaining the top cover and lift off the cover.

Lift out filter element assembly.

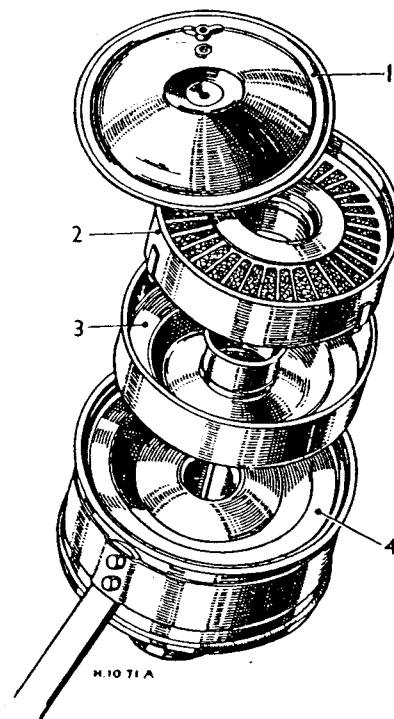


Fig. 4.

- 1 Securing Disc. 2 Gauze Filter.  
3 Oil Compartment. 4 Main Unit Housing

Examine oil container for sludge. If a depth of  $\frac{1}{4}$ -in. solid sludge is present, the cleaner must be completely serviced as described below.

If accumulation of sludge is slight, top up the oil container with engine oil to the level indicated on the instruction plate fitted just above the shelf. Replace the element, top cover and knurled nut, after making sure that the cover gasket is clean and in good condition.

It is important that the oil level in the cleaner is correct. Too high a level will result in oil being drawn into the combustion spaces, and too low a level will result in failure to keep the element saturated.

**Cleaning and Re-oiling.**

The cleaner should be periodically cleaned, and filled with new oil every 3,000 miles, or more frequently if inspection for sludge shows this to be necessary. Wash filter element thoroughly in a bowl of paraffin, and allow to drain and dry thoroughly.

Lift out the oil container, empty the oil, and scrape out the accumulated sludge. Wash entire oil container in paraffin and fill to indicated level with engine oil. It is not necessary to re-oil the filter element, as it is done automatically as soon as the engine starts up.

Make sure that the two cork gaskets are in good condition and re-assemble cleaner.

OIL CIRCULATION DIAGRAM.

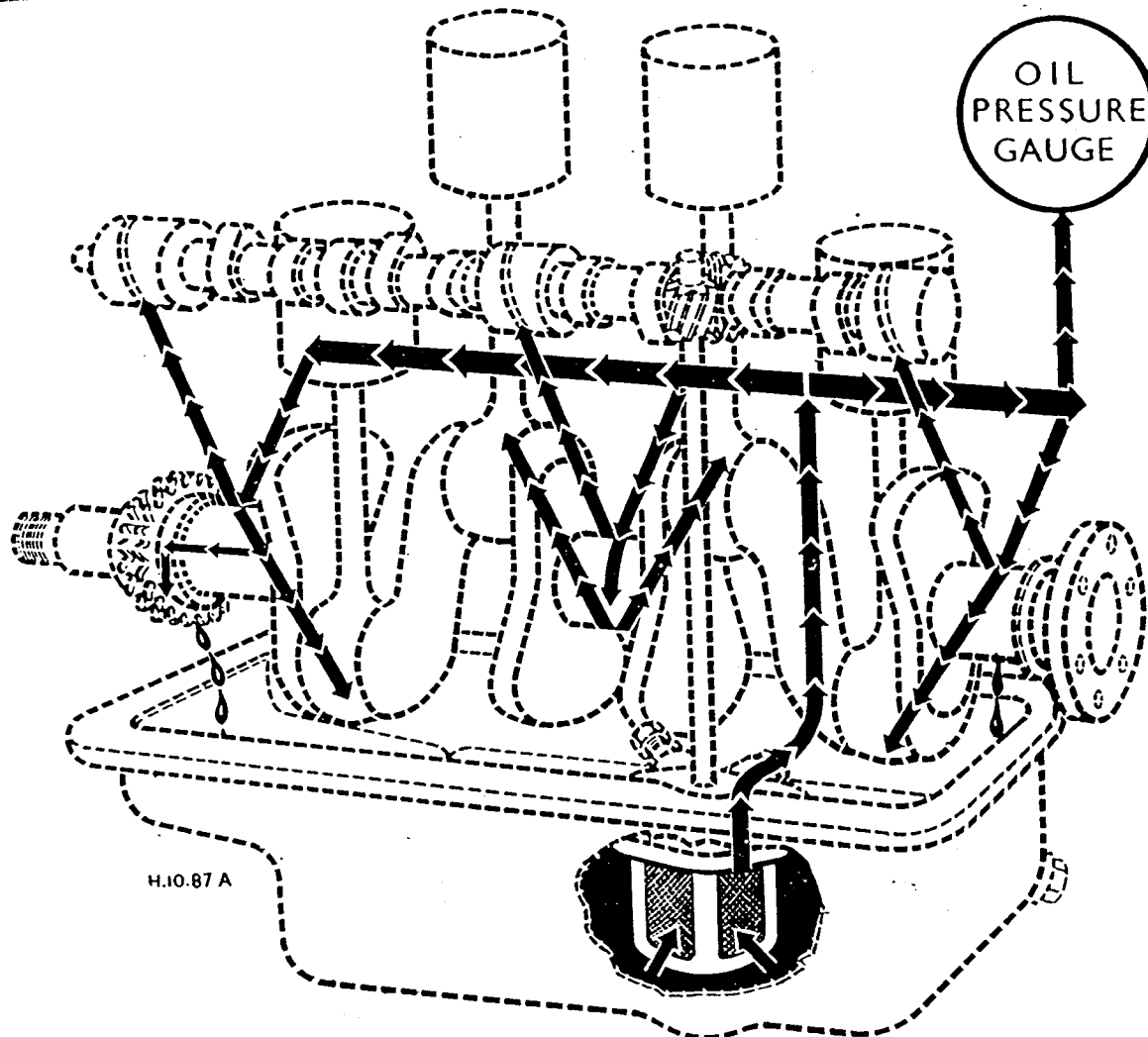


Fig. 1.

In this illustration the circulation system is clearly shown, from the pump then to gallery and bearings, timing gears and back to the sump.

**Capacity.**

1. **T**HERE is full pressure lubrication throughout the unit. The sump oil capacity is approximately 7 pints. The oil filler is on the off-side of engine and the oil level is checked by dipstick in off-side of crankcase.

**Draining.**

Every 2,000 miles the sump should be drained, and refilled with new oil (on new or reconditioned engines this should be done after the first 250 miles and then after 1,250 miles).

**Refilling.**

Under no circumstances should petrol or paraffin be poured through the oil filler to clean the engine.

After filling with fresh oil to the correct level, run the engine for a few moments to check that

the oil is circulating and that the oil pressure gauge reading is correct. The oil level should not be allowed to go below 1 inch on the bottom of the dipper rod. Wipe the rod before taking the reading of the level, and the reading should only be taken when the engine has been standing and the vehicle is on level ground.

2. **Pressure Gauge.** The oil pressure gauge indicates whether the oiling system is working properly and it should be looked at frequently while the engine is running. Should the gauge fail to register a normal pressure, it may be due to lack of oil in the crankcase. Should the gauge register no pressure although oil is present, stop the engine immediately and look for a broken pipe or other cause. Test gauge by replacement; clamped direct to instrument panel.

When the engine is started in cold weather the pressure may rise to over 40 lbs., but after the oil has circulated the pressure will gradually drop to 30-35 lbs. When the vehicle is standing and the engine is running slowly pressure may drop very low.

**3. Circulation.** The oil circulation is clearly shown in the accompanying illustration. Starting at the gauze strainer and pick-up in the sump, oil is drawn into the pump, which has a spring-loaded release valve overflowing back into the sump. The main oil delivery is along the oil gallery which runs the length of the engine on the offside. From this main oil gallery oil is delivered to the main bearings and through drilled passages in the crankshaft to the big end bearings; there are also passages in the block to the three camshaft bearings.

At the front end of the crankshaft there is a bleed hole to feed oil to the camshaft driving chain, while separate lubrication for the cylinder bores and tappets is carried out by a small jet hole in the top half of each connecting rod big end bearing.

#### 4. The Gauze Strainer and Pick-up.

The oil strainer is attached to the pump body by two bolts through the flange. The strainer is detached for interior cleaning.

#### 5. Check for Pressure Loss.

First check oil level in sump; use dipstick. If the oil level is well up, check oil gauge pipe from crankcase to instrument panel for fracture or leak.

If pipe is in order, remove sump and examine gauze in filter; this may be clogged. Also remove release valve and spring and inspect for foreign matter.

If these tests fail to show the cause of loss of pressure or oil circulation, crankshaft and other bearings will have to be closely examined, and stripped down if necessary.

#### 6. Remove Oil Sump.

First drain off oil by taking out the drain plug fitted to rear of sump, the oil capacity is approximately 7 pints.

The sump is secured in position with 18 set screws, washers and spring washers. Support sump while removing these screws, and then carefully lower clear of the oil pump gauze strainer.

Remove sump joint washer; if broken it will have to be replaced by a new one on re-assembly.

#### 7. The Oil Pump.

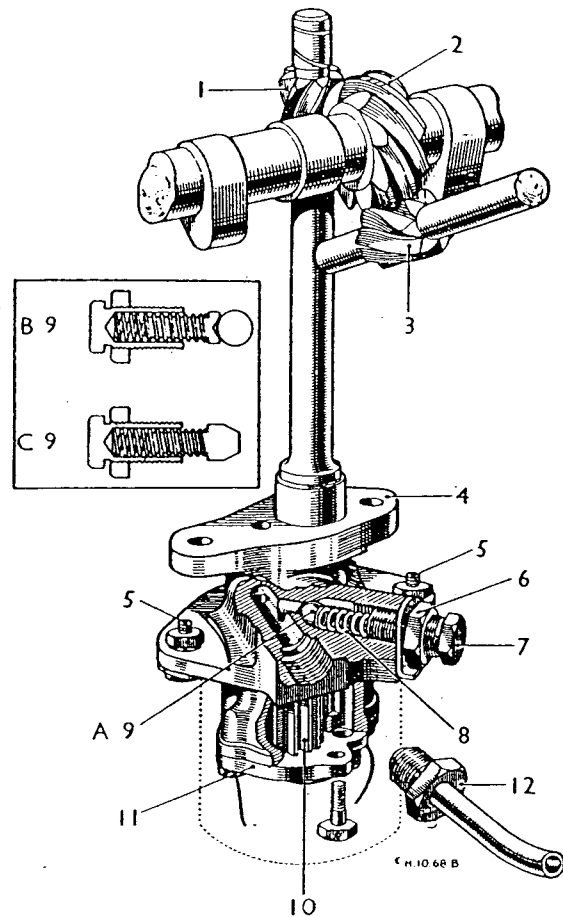


Fig. 2.

1. Pump Spindle Driving Gear.
2. Camshaft Gear.
3. Ignition Distributor Gear.
4. Oil Pump Body.
5. Gauze Strainer Retaining Screws.
6. Release Valve Locknut and Lock Washer.
7. Release Valve Retaining Bolt.
8. Release Valve Spring.
- 9a. Release Valve Ball (original type).
- 9b. Later type Release Valve.
- 9c. Current type of Release Valve.
10. Pump Gears.
11. Bottom Cover.
12. Gland Nut and Delivery Pipe.

The gauze strainer is secured by two retaining bolts to the pump casing. Detach strainer for cleaning.

To remove pump, first take away main oil feed pipe to crankcase, and take off the two nuts holding the top flange to crankcase. The pump can then be lowered from engine, complete with driving shaft and camshaft meshing gear.

**THE OIL PUMP—continued.**

To dismantle the pump, remove the four bolts in the bottom cover, when the gears will be accessible. The driving gear is keyed to the driving shaft, but the driven gear will slide out. Tap out driving shaft and inspect the key and keyway.

In re-assembling the bottom cover, ensure that all four bolts are wired together for security.

**8. Release Valve.**

The release valve lock-nut is secured with a tab washer. After dismantling and cleaning, the valve should be finally adjusted on test after the engine has been run. The normal setting is to give

30—35 lbs. pressure at the equivalent of a road speed of 30 m.p.h.

On the latest models, pumps are fitted with longer gears than before, and it will be found that a centre piece is included between the release valve ball and the spring on some recent types. The latest valve has no ball valve but a conical seating to the spring loaded plunger. On these models the Works setting is to give 10 lbs. per square inch minimum at 400 r.p.m.

Spares for the early type pumps—driving shaft, gears, casing and relief valve—are not interchangeable with the current type, but the pumps are interchangeable as complete assemblies.

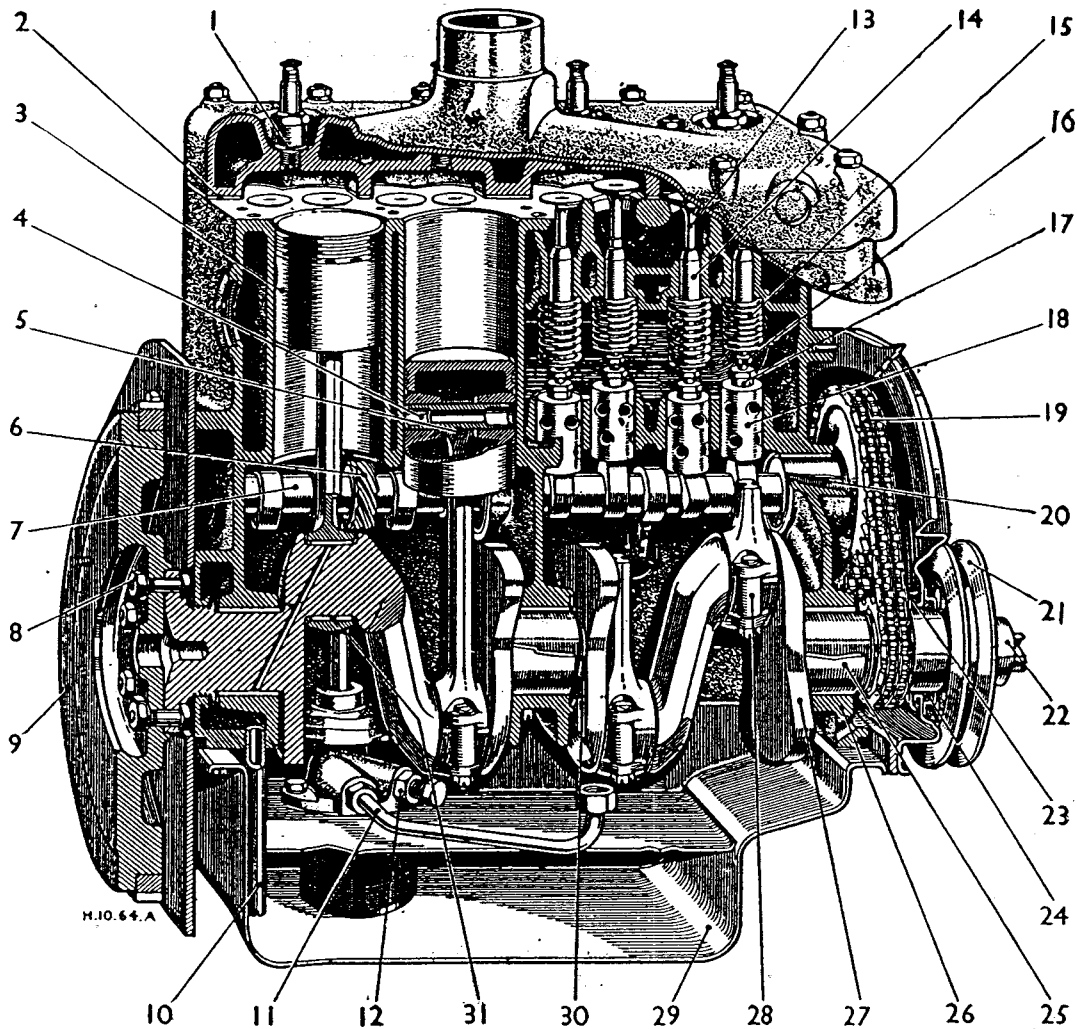


Fig. 1.

Engine with Counterbalanced Crankshaft.

- |                                                 |                                        |
|-------------------------------------------------|----------------------------------------|
| 1. Sparking Plug Washer.                        | 17. Flat to accommodate locking plate. |
| 2. Cylinder Head Gasket.                        | 18. Barrel Tappet.                     |
| 3. Piston.                                      | 19. Camshaft Timing Chain.             |
| 4. Gudgeon Pin.                                 | 20. Camshaft Front Bearing.            |
| 5. Gudgeon Pin Clamping Bolt.                   | 21. Crankshaft Pulley.                 |
| 6. Drive Gear for oil pump and ignition timing. | 22. Starting Handle Dog and Nut.       |
| 7. Camshaft.                                    | 23. Oil Thrower.                       |
| 8. Flywheel Flange Bolt.                        | 24. Felt Oil Retainer.                 |
| 9. Flywheel.                                    | 25. Crankshaft Front Bearing.          |
| 10. Oil Return Pipe to sump.                    | 26. Bearing Cap.                       |
| 11. Oil Pump Delivery Pipe.                     | 27. Crankshaft.                        |
| 12. Oil Pressure Valve Lock Nut.                | 28. Connecting Rod Big End.            |
| 13. Valve Stem.                                 | 29. Oil Sump.                          |
| 14. Valve Guide.                                | 30. Crankshaft Thrust Washers.         |
| 15. Valve Spring.                               | 31. Big End Bearing.                   |
| 16. Tappet Adjustment Screw.                    |                                        |

# ENGINE RECOMMENDED CLEARANCES AND GENERAL DATA.

|                                               |     |     |     |     |                                                    |
|-----------------------------------------------|-----|-----|-----|-----|----------------------------------------------------|
| Crankshaft and Bearings                       | ... | ... | ... | ... | .002—.003-in.                                      |
| Crankpins and Big Ends                        | ... | ... | ... | ... | .001—.002-in.                                      |
| Gudgeon Pin to Piston                         | ... | ... | ... | ... | Thumb fit at 70°F.                                 |
| Camshaft and Bearings                         | ... | ... | ... | ... | .001—.0025-in.                                     |
| Crankshaft End Clearance or Float             | ... | ... | ... | ... | .002—.003-in.                                      |
| Thrust                                        | ... | ... | ... | ... | Taken by washers on centre main bearing.           |
| Side Clearance, Connecting Rod and Crankshaft | ... | ... | ... | ... | .008—.012-in.                                      |
| Crankshaft Diameter of Journals               | ... | ... | ... | ... | 1.8745—1.8750-in.                                  |
| Diameter of Crank Pins                        | ... | ... | ... | ... | 1.7495—1.7500-in.                                  |
| Valve Tappet Clearance                        | ... | ... | ... | ... | .015-in. with engine cold.                         |
| Piston Fit.                                   | ... | ... | ... | ... | .012-in. at top land; .004-in.—.0045-in. at skirt. |
| Piston Ring Gap                               | ... | ... | ... | ... | .006-in. to .010-in.                               |

By official request undersize bearings of .010-in., .020-in., .030-in., .040-in. and .060-in. are now listed.

The crankshaft re-grinding sizes for undersize bearings are tabulated below :—

| Undersize of Bearing. | RE-GROUNDING SIZES. |           |            |           |
|-----------------------|---------------------|-----------|------------|-----------|
|                       | CRANK-PINS.         |           | JOURNALS.  |           |
|                       | Minimum.            | Maximum.  | Minimum.   | Maximum.  |
| .010-in.              | 1.739½-in.          | 1.740-in. | 1.864½-in. | 1.865-in. |
| .020-in.              | 1.729½-in.          | 1.730-in. | 1.854½-in. | 1.855-in. |
| .030-in.              | 1.719½-in.          | 1.720-in. | 1.844½-in. | 1.845-in. |
| .040-in.              | 1.709½-in.          | 1.710-in. | 1.834½-in. | 1.835-in. |
| .060-in.              | 1.689½-in.          | 1.690-in. | 1.814½-in. | 1.815-in. |

## CYLINDERS AND CRANKCASE.

Cast Iron Monobloc, crankcase integral with cylinder block. Pressed steel sump. Cylinder bore, plain dia., 2.621-in. + .001-in. — .0005-in. Max. permissible rebore, diameter + ⅛-in.

## CYLINDER HEAD.

Cast iron, secured by 17 H.T. ⅜-in. steel studs. C. and A. gasket .045-in. thick compressed. Specially hardened exhaust valve seat inserts are fitted.

**CLEARANCES AND DATA—continued.****CRANKSHAFT.**

Steel stamping, 3 bearings.

**MAIN BEARINGS.**

Steel shells white metal lined. Retained by feathered projections.

Thrust washers each side of centre bearing, for end thrust.

**CONNECTING RODS.**

Steel stamping "H" section. Detachable bearings. Caps secured by two H.T. steel bolts, with heads recessed for locating dowel pin. Small end fitted with clamping bolt securing gudgeon pin.

**PISTON AND RINGS.**

Pistons, aluminium alloy, solid skirt. Lower ring groove drilled for oil return. Also supplied in oversizes of  $+\frac{1}{32}$ -in. and  $+\frac{1}{16}$ -in.

**GUDGEON PIN.**

Tubular, grooved for clamping bolt. Thumb push fit in piston boss at 70°F. Length  $2\frac{1}{2}$ -in., dia. .5623/.5625.

**RINGS.**

Two compression, one oil control, all above gudgeon pin. Ring gap .006/.010-in. Groove widths: Compression .0950/.0955-in. Oil Control, .1577/.1582-ins. Groove clearance, .002-in. to .0025-in.

**CAMSHAFT.**

One piece stamping fitted nearside of crankcase, chain driven from crankshaft. Three bearing, steel white-metal lined. Spiral gear

for oil pump and distributor shaft drive. Eccentric cam for operating fuel pump. End float, .002-in. Timing chain, Duplex roller .375-in. pitch 54 pitches.

**VALVES.**

Inlet, Silicon Chrome Steel; Exhaust, Silicon Chrome or X.B. Steel; Single Coil spring retained by cup and split cone wedges.

Valve seat angle, inlet and exhaust 45°. Seal width,  $\frac{1}{16}$ -in. to  $\frac{5}{64}$ -in. Valve guides fitted. Stem clearance, .0025/.00375-in.

**VALVE TIMING.**

Inlet. Opens 10° B.T.D.C.

**FLYWHEEL.**

11  $\frac{5}{16}$ -in. dia., bolted to crankshaft flange.

Starter ring A.S. 17 steel, 94 teeth, shrunk on flywheel.

**LUBRICATION SYSTEM.**

Spur gear type pump in sump, driven by vertical shaft from camshaft. Oil is drawn through a strainer in sump and forced under pressure to main, big end and camshaft bearings.

**OIL PRESSURE INDICATOR.**

Smith's pressure gauge, type X.53483.

Oil filler on offside of crankcase. Oil level indicated by dipstick offside of crankcase. Crankcase vented to atmosphere via tappet side cover. Normal pressure 30/35 lbs./per sq. in. Sump capacity 7 pints.

**Expansion Plugs (or Welch Plugs).**

Four expansion plugs are fitted in the cylinder block and four in the cylinder head. To remove a plug, drill a hole in the centre and lever out the plug with a screwdriver or other suitable tool.

It is usual in fitting a new plug to coat the edge with a jointing compound before inserting (the

"bulge" must of course be on the outside when a plug is put in position). A carefully aimed tap at the centre with a small hammer direct or with a blunt punch will expand the plug sufficiently to make a water-tight joint. If too heavy a blow is used the plug will be useless and must be replaced by another new one.

**1. Remove Cylinder Head.**

Detach air cleaner by releasing clip at carburettor intake and also freeing stay from under two cylinder head nuts.

Remove dynamo leads from the two terminals at rear, and then remove dynamo complete by releasing adjusting bolts illustrated on page B/2.

Remove carburettor after releasing throttle link, vacuum ignition pipe union and choke cable.

Disconnect H.T. leads and Suppressors from sparking plugs, and detach top water connection.

Remove cylinder head nuts, take away dynamo bracket, and then lift head.

The head gasket should be examined for damage such as burning between the cylinder bores or cracks. If faulty it will need to be replaced by a new one when re-assembling.

**2. Decarbonizing.**

All carbon deposit should be removed by carefully scraping with a suitable tool, care being taken not to damage the piston crowns and cylinder head and not to allow dirt to enter the cylinder barrels or the valve chambers.

When cleaning the top of a piston, do not scrape right to the edge, as a little carbon left on the chamfered edge assists in keeping down oil consumption; with pistons cleaned right to the edge, or with new pistons, oil consumption is often slightly, though temporarily, increased.

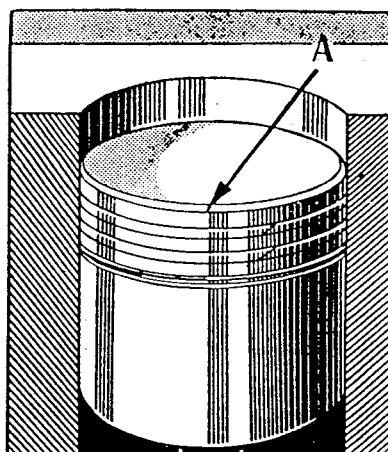


Fig. 2.  
"A" is chamfered edge of Piston on which a thin ring of carbon may be left.

**3. Bonnet Side.**

In order to gain access to the valves (on near-side of engine) it is necessary to first remove the bonnet side, held by one bolt at radiator cowl and one into the scuttle.

**4. Manifold.**

The exhaust and inlet manifold will need to be removed. This casting is held in position by five studs; remove these, also the three nuts to the exhaust pipe flange. (See page C/2).

Carefully remove the manifold gasket, which may be in a condition to be used again. When refitting manifolds ensure good joints.

**5. Valve Cover.**

The valve cover is held in position by two set screws, while the breather pipe attached is secured under a clip to crankcase. This pipe must be detached at the same time as the valve cover.



## 6. Valve Grinding.

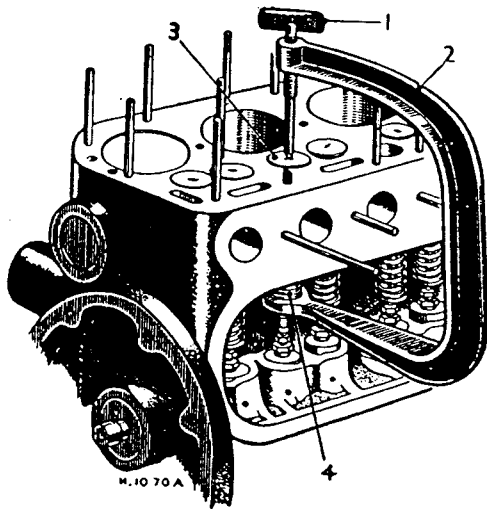
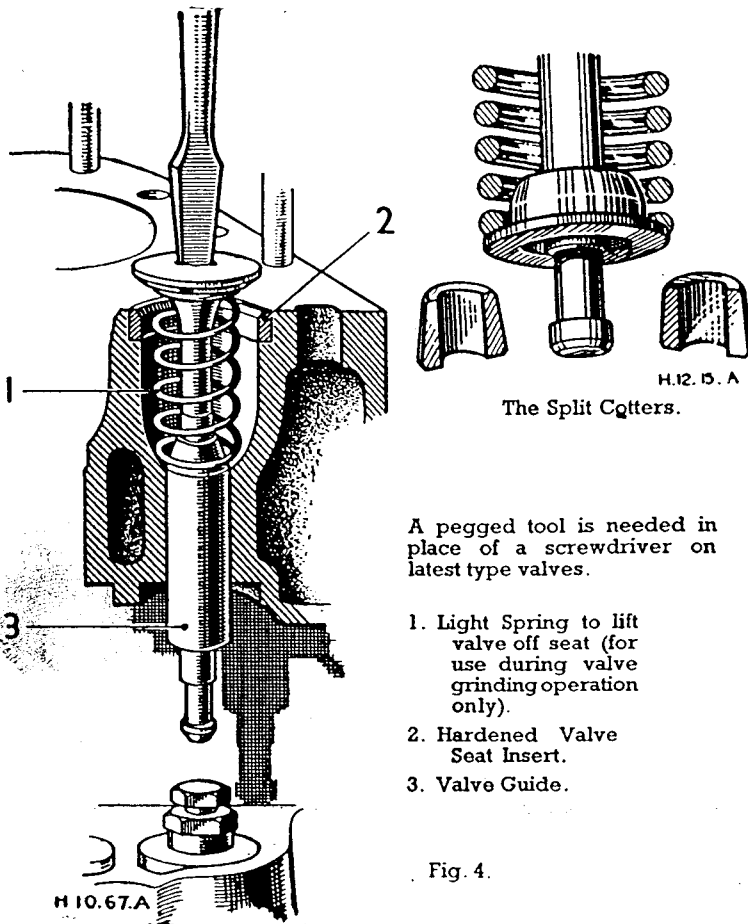


Fig. 3. 1 and 2. Valve Lifter in use. 3. Valve Head.  
4. Spring compressed.

Before grinding-in the valves each valve spring must be compressed to allow the split cotters and the cotter cup to be removed. Also slack back tappet adjustment to ensure there is sufficient clearance for grinding.

The valve is then free to be rotated on its seat.



A pegged tool is needed in place of a screwdriver on latest type valves.

1. Light Spring to lift valve off seat (for use during valve grinding operation only).
2. Hardened Valve Seat Insert.
3. Valve Guide.

Fig. 4.

It will be noted that the tappet has been screwed well down to clear valve during the grinding operation.

After it is cleaned, a little grinding compound should be smeared evenly on the valve face and the valve rotated backwards and forwards by means of a screwdriver, or a pegged tool in the case of valves with two holes in place of a slot, advancing it a step at short intervals, until the pitting is removed. Lift each valve a little from its seating at the end of each step to allow some of the grinding compound to enter between the two faces and facilitate cutting action. The use of a light spring as illustrated will automatically raise valve off seat when pressure is released.

Care should be taken that none of the compound enters the cylinders or the valve chambers. The valve seating should be wiped clean after the operation. It is essential for each valve to be ground-in and refitted on its own seating as indicated by the number on the valve head. The valves are numbered from 1 to 8 starting from the front.

It is also desirable to clean the valve guides. This can be done by dipping the valve stem in petrol or paraffin and moving it up and down and round in the guide until it is free. Then the valve should be cleaned and the stem smeared with graphite grease and reinserted in the guide, the valve spring, cup and cotters being fitted round it.

Adjust tappets to .015-in. with engine cold, and replace valve cover and breather pipe. (See page F/8).

## 7. Exhaust Seatings.

The exhaust valves have specially hardened inserted seatings. If these are renewed they should be pressed into position with special tools.

## 8. The Gasket.

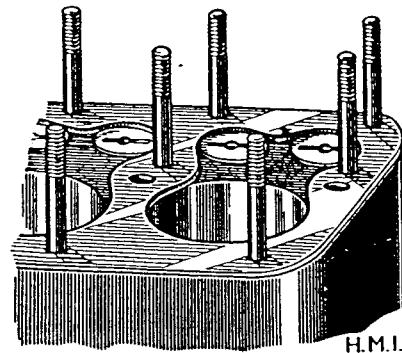


Fig. 5. Replace the Gasket Beaded Edges Downwards.

The cylinder head gasket should be replaced with the beaded edge facing down and a little grease should be smeared over each side to make a good joint and prevent sticking when the head is next to be lifted.

## ENGINE (Offside View)

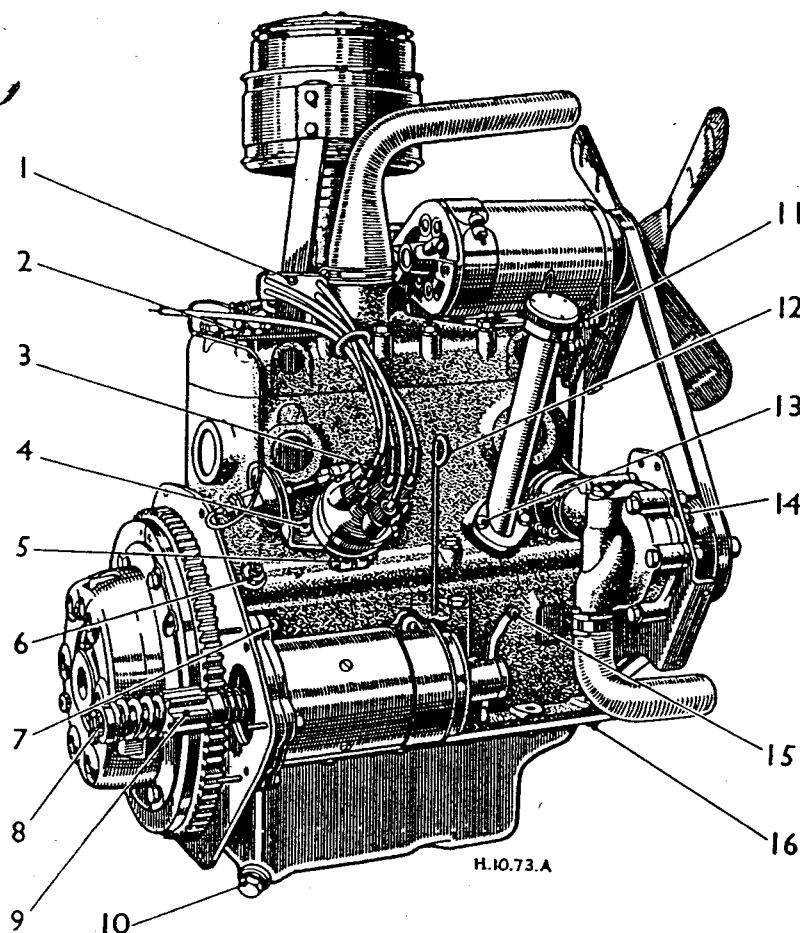


Fig. 6.

- |                                     |                                    |
|-------------------------------------|------------------------------------|
| 1. H.T. Cable Insulator.            | 9. Starter Pinion and Sleeve.      |
| 2. Air Cleaner Stay.                | 10. Oil Sump Drain Plug.           |
| 3. H.T. Interference Suppressors.   | 11. Dynamo Adjusting Bolt.         |
| 4. Distributor Clip Securing Screw. | 12. Oil Level Dipstick.            |
| 5. Distributor Clamp Bolt.          | 13. Oil Filler Tube Flange Screws. |
| 6. Oil Pipe Union.                  | 14. Water Pump Lubricator.         |
| 7. Starter Motor Bolts.             | 15. Starter Motor Switch Lever.    |
| 8. Starter Motor Shaft Nut.         | 16. Oil Sump Studs.                |

The water by-pass elbow on latest models is bolted to water outlet on cylinder head joint below top water connection.

### 9. Cylinder Head Nuts.

When replacing the head take care to tighten the nuts evenly commencing at the centre and working to the outside. Do not tighten any one right home while the others are loose and make sure the centre nuts are tight first.

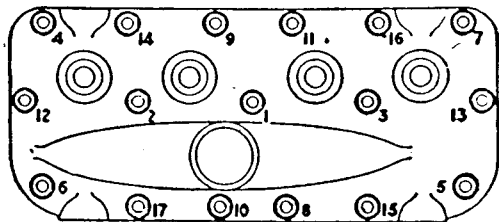


Fig. 7. Tighten Cylinder Head Nuts from the Centre and work outwards.

Cylinder head nuts need to be checked again when the engine has been run to ensure the gasket is bedded down properly.

### 10. Re-assembly.

Replace dynamo and flex leads (the terminals are of special size to ensure correct replacement). Adjust fan belt (see page B/2), and refit carburettor, air cleaner and plug leads.

Connect up top water hose and by-pass pipe (where fitted) and refill the radiator.

### 11. To Renew Valve Guide.

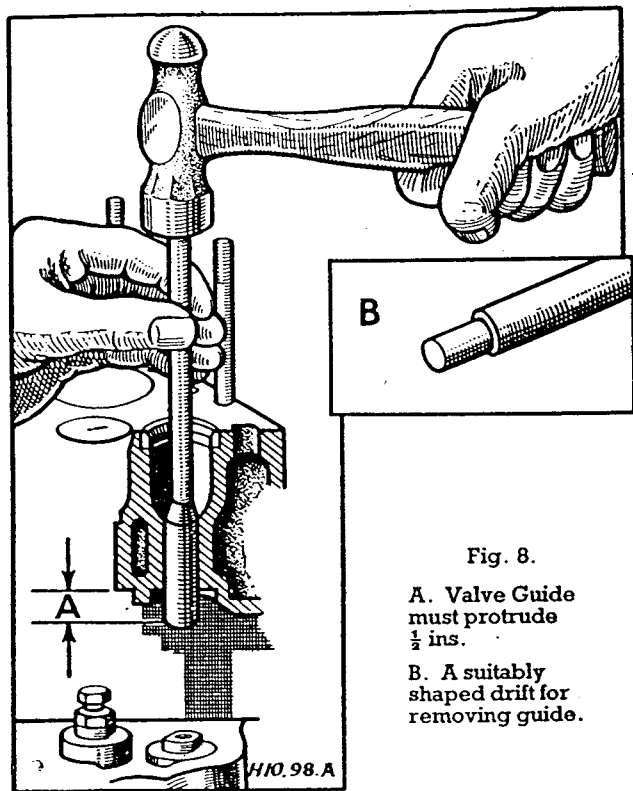


Fig. 8.

A. Valve Guide must protrude  $\frac{1}{2}$  ins.  
B. A suitably shaped drift for removing guide.

After removal of valve, the valve guide may be driven out with a drift, as shown in Fig. 8; the drift is shown "stepped" in order to ensure location and obviate drift slipping off guide and possibly damaging the port. The guide should be knocked out in the direction shown, but the tappet screw must first be withdrawn.

A new guide should be forced in position in the same direction—that is, inserting through the valve seating. The final correct position of the guide is as shown in Fig. 8—the guide should stand  $\frac{1}{2}$ -in. clear.

### 12. Renewing Valve Spring.

It is always advisable to remove the cylinder head to renew a valve spring. It takes less time than attempting to hold a valve through a plug aperture while a spring is placed in position.

### 13. Remove Tappet.

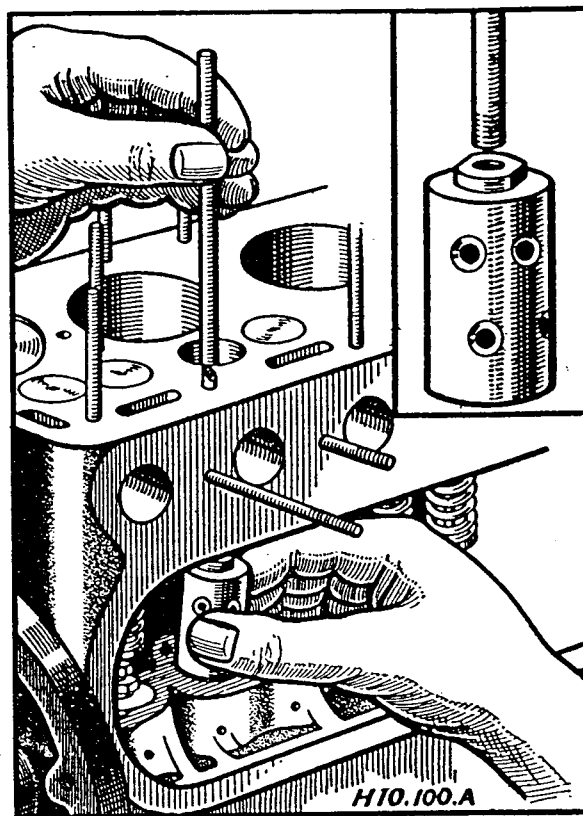


Fig. 9.

The Tappet can be withdrawn with the fingers or with the aid of a piece of screwed rod which will screw into the top of the tappet and enable it to be pulled up.

The tappet can only be removed if the tappet screw is first withdrawn, when the tappet can be lifted out without fouling the valve guide.

ENGINE (Nearside View).

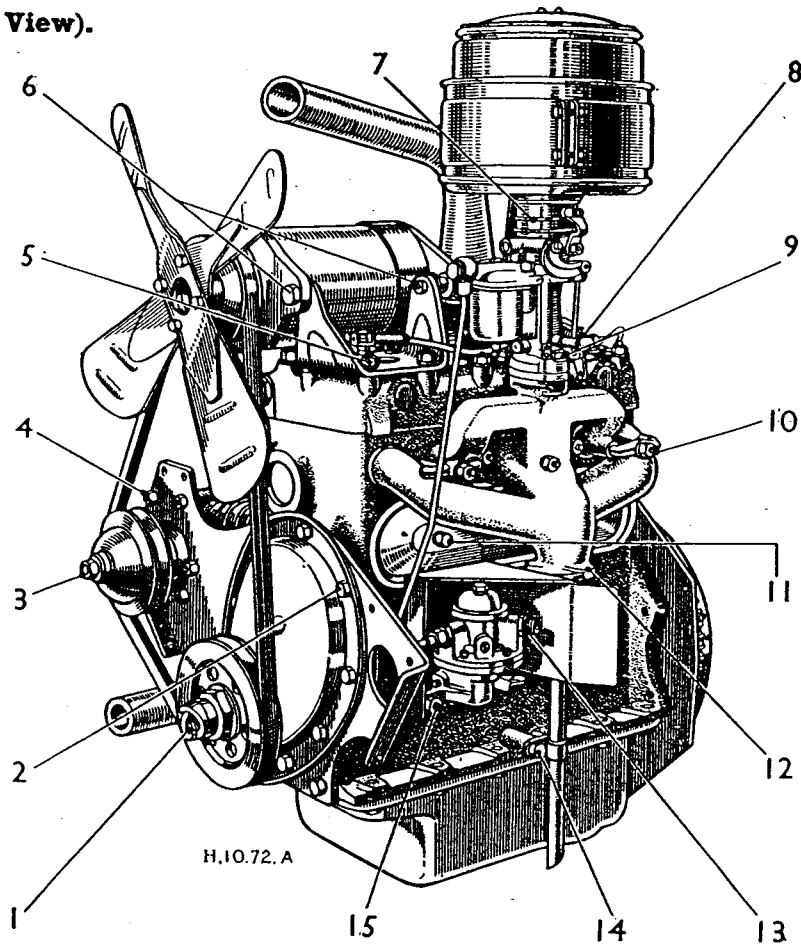


Fig. 10.

1. Starting Handle Dog.
2. Front Cover Screws.
3. Water Pump Pulley Nut.
4. Water Pump Mounting Bolts.
5. Dynamo Bracket Mounting.
6. Dynamo Adjusting Bolts.
7. Air Cleaner Clip.
8. Vacuum Control Pipe Union.

9. Carburettor Flange Studs.
10. Manifold Studs.
11. Valve Cover Screws.
12. Exhaust Pipe Flange.
13. Petrol Pump Inlet Union.
14. Breather Pipe Clip.
15. Petrol Pump Mounting Stud which also carries the pump shield.

14. Tappet Adjustment.

The adjustment must be made or checked with the engine cold. To make this adjustment, remove the valve cover and have the engine slowly turned with the hand starting crank. Watch each valve open in turn and note the point at which it stops rising.

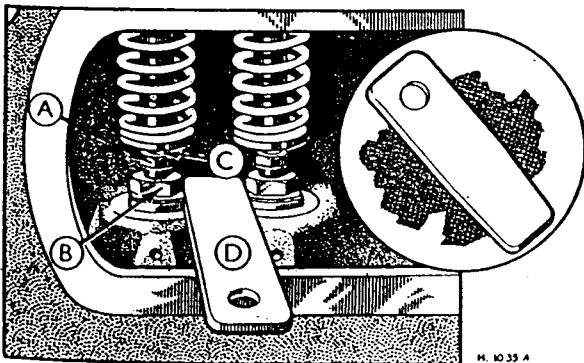


Fig. 11. A. Tappet Screw. B. Locknut. C. Clearance. D. Locking Plate to keep tappet from turning while adjusting.

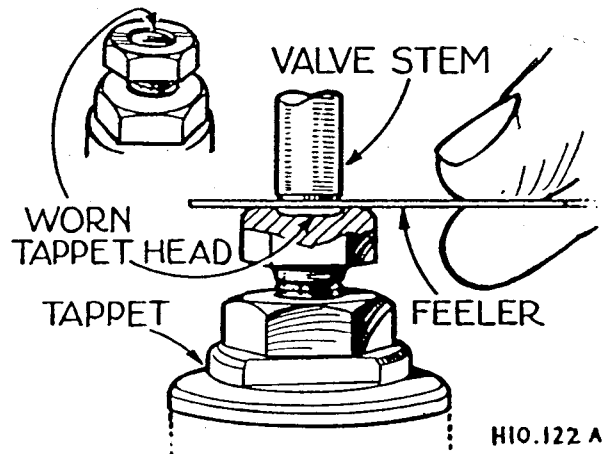


Fig. 12.

This illustration shows how a worn tappet head can allow a greater clearance than is shown by the use of a feeler gauge. Always check tappet head for wear and renew if necessary.

From that point until the valve begins to lift again there should be between the valve stem and the tappet a clearance of .015-in. If the clearance is other than this it can be adjusted by loosening the locknut and raising or lowering the screw, being careful to tighten the locknut when the adjustment is completed.

When replacing the valve cover carefully re-fit joint washer; renew the washer if it is damaged.

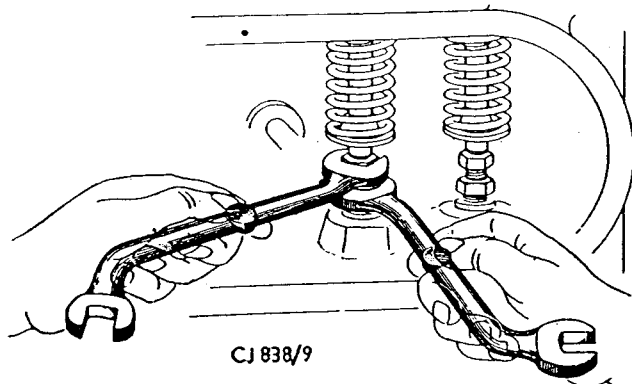


Fig. 13.

Showing Service Tools in use when adjusting tappets.

Check the tappet adjustment again after the vehicle has run about 100 miles as the valves have a tendency to "bed down."

#### 15. Petrol Pump.

Release the two nuts on petrol pump flange and the complete pump unit can then be taken away after giving it an upward tilt to bring the operating arm through the crankcase. The joint is made with a paper washer. (See page C/4 for pump overhaul).

#### 16. Remove Oil Sump. (See page E/2).

#### 17. Remove Distributor. (See page G/4).

#### 18. Bearings.

Big end and main bearings can often be dealt with while the engine is in the chassis, but for major overhauls it is preferred to take out the engine unit complete.

When fitting bearings ensure that all bearing caps are replaced the right way round as shown by the stamp markings, which face the camshaft and that connecting rod caps are retained for the same connecting rods, and that they are refitted the same way round as found.

On late models the crankshaft is counter-balanced, but the bearings are of the same diameter and interchangeable with those of the plain crankshaft. To enable these pistons to be drawn past the webs of the counter-balanced crankshaft, the crankcase clearance has been

increased; these newer engines can be identified by the "bulges" in the lower portion of the casting. The later crankshaft must not be used in the earlier type of engine.

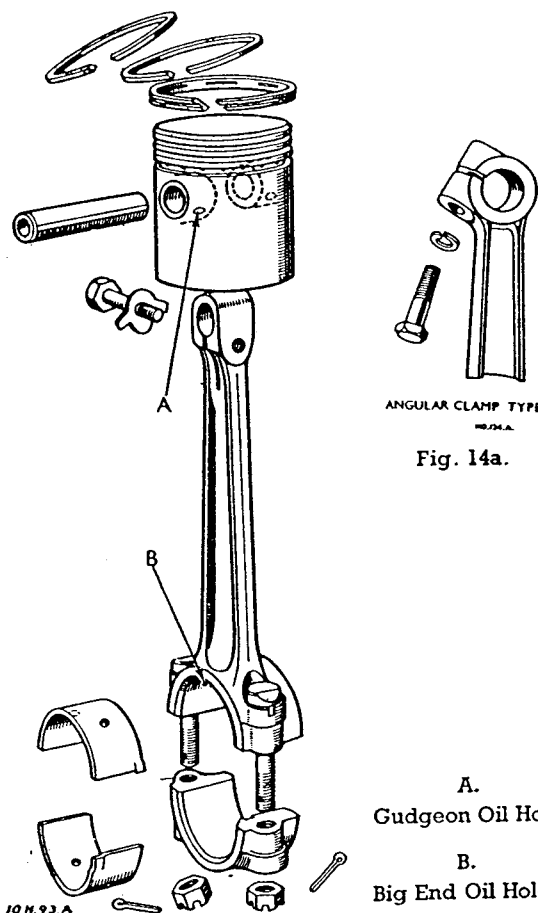


Fig. 14.

The main bearings, like those of the big ends, are of the detachable type. See page 31 for undersize bearings available. Fig. 14a shows the angular clamping for gudgeon on current models.

#### 19. Connecting Rods.

There are two types of connecting rods in use.

In the early models the gudgeon pin clamping bolt passes through the rod horizontally and is locked with a tab washer, which has to be hammered over. There is an oil squirt hole in the top half of the big end bearing, and in these rods this should face the camshaft side of the engine.

Later model connecting rods have the gudgeon pin clamping bolt set at an angle and use a spring washer. As will be seen from illustration on page F/12, these rods should be fitted facing alternately.

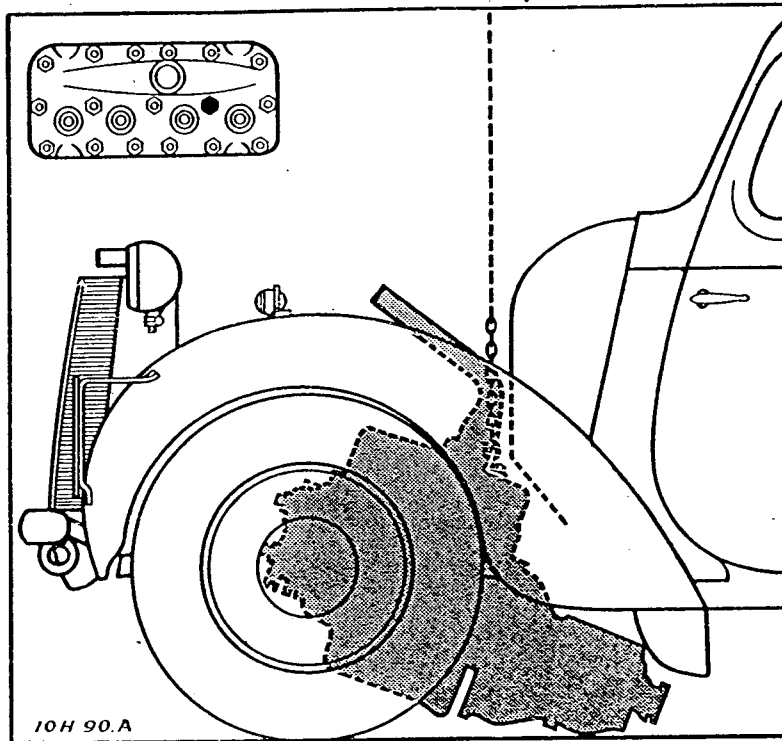
Either type of connecting rod can be used, but must only be fitted in sets.

When replacing the split cotters in the big end and main bearing nuts after tightening up, the ends should be bent back with pliers; hammering back the cotters is not approved.

(Continued on page F/12).

**TO REMOVE AND REFIT ENGINE.**

Fig. 15.



**STAGE 1.**

Showing position of engine when first lowered from mountings. On the Cylinder Head plan above is indicated the correct nut under which to clamp the lifting bracket.

For subsequent operations it is advisable to remove the engine and gearbox unit from the frame. First drain all oil from engine and gearbox.

**Bonnet.**

1. Disconnect bonnet top hinge and bonnet sides. (See illustration in Radiator Section, page B/6).

**Battery.**

2. Disconnect the earth lead from the battery and from flywheel housing bolt.

**Radiator Block.**

3. Remove water hose connection at top and bottom of radiator and also remove radiator block itself. (See page B/6). This is secured at two points at the bottom and one point at the top. Split pins are used on all nuts, and it should be noted that the top nut and bolt also anchors the radiator filler security wire. Dynamo must be removed before radiator can be lifted free. (See page B/2).

**Pipes and Cables**

4. Disconnect exhaust pipe at manifold. (See page C/2).

5. Remove accelerator linkage at carburettor end and also choke wire connection and petrol pipe. (See page C/1).

6. Pull out starter lever from front end bracket of starter motor (see page T/7) and then remove the motor itself ; it is held to the flywheel housing by three bolts. Also take away packing plate for starter, noting position of locating dowels for guidance when replacing.

7. Disconnect flexible oil pipe from side of crankcase.

8. Disconnect H.T. lead from the centre of distributor, and also take away the L.T. lead connected to side of distributor housing. The two leads to the electric horn (mounted on top of water pump) should also be disconnected.

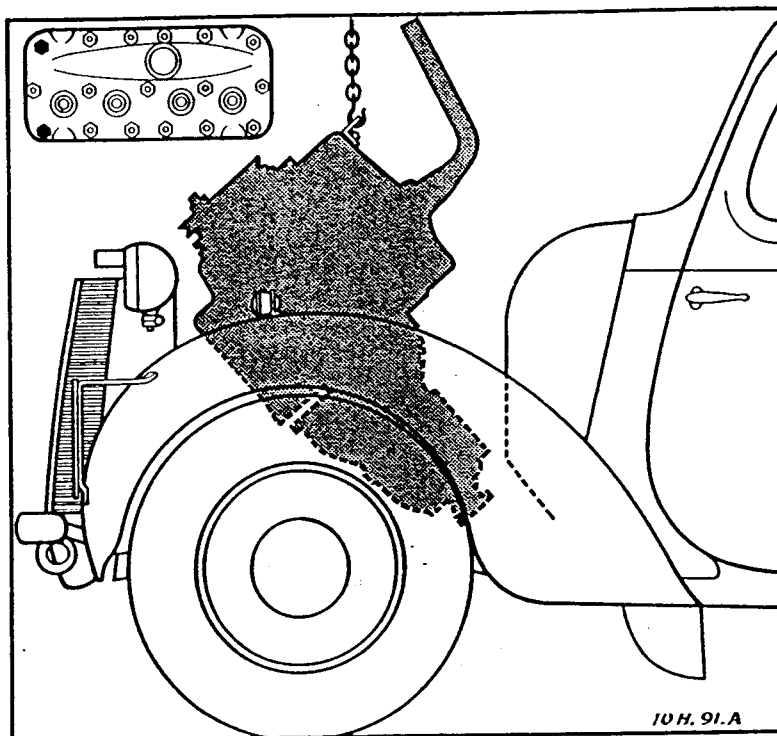
**TO REMOVE AND REFIT ENGINE**—continued.

Fig. 16.

**STAGE 2.**

The Cylinder Head plan indicates the correct nuts to use to clamp the lifting brackets for raising engine clear. This is the correct angle for lifting.

**Gearbox Top Cover.**

9. Remove rubber or felt cover from gearbox top, and then take away the gearbox top and lever complete by withdrawing the six small bolts in the top face. Cover the open box with rag to keep out any foreign matter.

**Clutch Pedal and Propeller Shaft.**

10. Working from below, disconnect clutch pedal stalk from lever, and also take out the four bolts from the propeller shaft flange to gearbox flange; the splines will allow the propeller shaft flange to be moved back free from the gearbox to enable it to be lowered.

**Lifting Points.**

11. Before attempting to remove engine, pulley blocks must be in position to take the weight. The unit will be approximately in balance if the weight is taken from a bracket mounted on the cylinder head where shown. (If the head is not in position it should be temporarily replaced without the gasket and secured by the nuts).

**Front Engine Mountings**

12. While the weight is taken, remove the nuts from the top of the two rubber mounting blocks at the front end of engine.

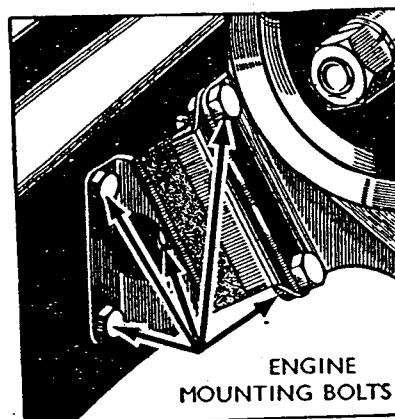
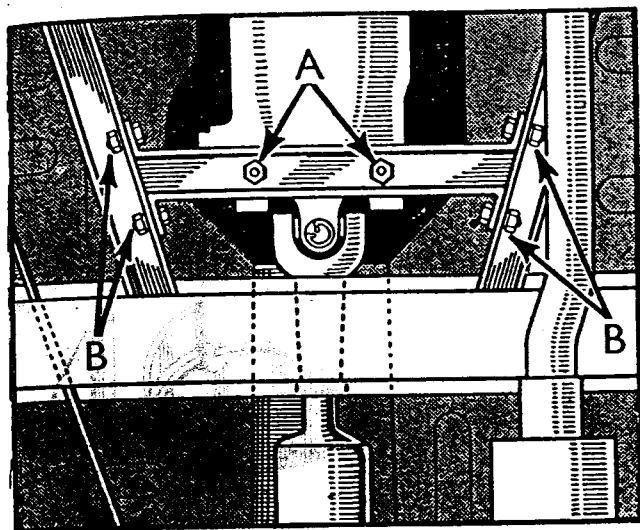


Fig. 17.

There is a live rubber mounting at each side of the engine at the front. The rubber is held between two plates which are bolted to chassis and engine front plate.

## TO REMOVE AND REFIT ENGINE—continued.



H10.96.A

Fig. 18.

- A. Gearbox Mounting.  
 B. Cross Member Mounting.  
 (As seen from under the vehicle).

(Continued from page F/9).

## 20. Assembling Conn. Rods.

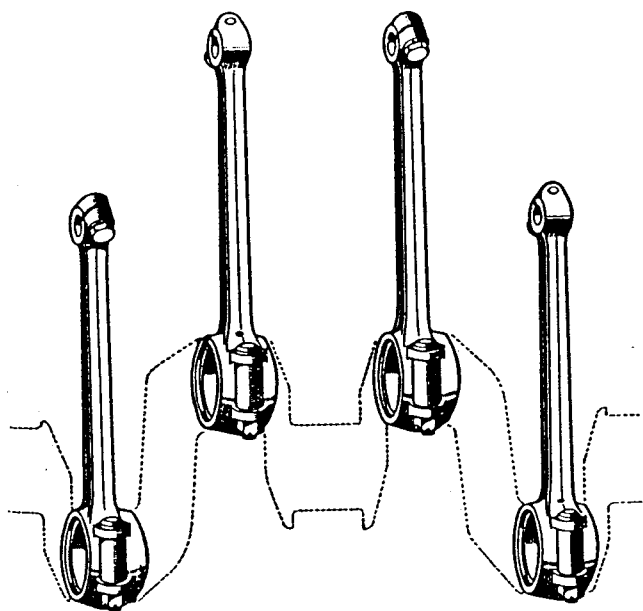


Fig. 19.

Order of assembling the latest type connecting rods. These connecting rods may be used with earlier crankshafts, as shown in illustration above, but must only be used in sets.

## 21. Starting Nut and Fan Driving Pulley.

For access to the valve timing gear, unscrew starting nut after knocking back lock washer. The spanner will probably have to be hammered

13. To disconnect the rear mounting point (below gearbox), take out the two bolts through each end of the gearbox mounting cross member. When this bar is free, disconnect it from the gearbox itself by removing the two nuts to the rubber mounting block. Unless this cross member is removed here will be difficulty in bringing the unit through the front of the chassis.

## Lifting Angle.

14. At this stage the engine should be lowered by means of the pulley block and chain; the unit will tilt rearward and the gearbox will finally rest on the ground. Bring it to rest gently or the rear mounting may receive damage.

15. Attach two clips to the front cylinder head studs as illustrated, and transfer the pulley block chain to these. The engine can now be lifted out, maintaining the same angle till finally free.

## To Refit Engine.

Reverse above operations to refit engine.

in order to "start" this nut, but a few fairly sharp blows should be sufficient. With the nut and its washer removed, the fan belt pulley can be withdrawn from the shaft by using light leverage behind it; the pulley is keyed to the shaft, but there is no taper, the fitting being parallel. Tool CJ.1535 is a special extractor for this pulley.

## 22. Valve Timing Cover.

The timing gear cover is held to the engine front plate by nine set-screws. One setscrew is longer than the others as it also has to carry the clip for the thermostat by-pass pipe on latest type (See Fig. 1, Section B).

The timing cover and paper washer can now be removed, and at the same time the oil thrower should be taken from front of crankshaft, noting the correct fitting for keeping oil from creeping to the fan pulley.—the concave or hollow side must face the front, toward the pulley.

## 23. Withdrawing Camshaft.

Remove tappets as described in page F/7, and camshaft, complete with sprocket and chain can be withdrawn providing the crankshaft sprocket is also withdrawn at the same time. Crankshaft sprocket is keyed to the crankshaft but has a parallel fit and will slide fairly easily. (Also see page F/14 for separating camshaft from sprocket).

## 24. Front Suspension Plate.

Engine front suspension plate can be removed by taking out the remaining set screws.



## 25. Remove Flywheel.

After taking away Clutch (see page J/1), the flywheel can be removed upon releasing the six set screws to crankshaft flange.

In replacing flywheel, see that the 1/4 timing mark is in line with the first and fourth throws of the crankshaft.

## 26. Rear Suspension Plate.

Engine rear suspension plate may be removed after the flywheel by taking out the remaining set screws into crankcase.

## 27. Bearing Caps.

The front and rear main bearing caps have cork oil sealing strips fitting into a groove (See Fig. 21). In rebuilding see that these strips are in place and in good condition.

## 28. Centre Bearing.

There are thrust washers fitted each side of the centre bearing. See that the peg formed on each pair fits into the bearing cap. (See Fig. 21). The end float permissible is from .002 to .003-in.

## 29. Pistons and Bores.

There should be a clearance of .004-in.—.0045-in. at the piston skirt, and .012-in. at top land, measurement being taken at right angles to the gudgeon pin and in the working part of the cylinder bore. (See Fig. 20). Replace piston upside down to test skirt clearance. Piston ring gaps should be .006-in. to .010-in. when tested in the cylinder bores.

Piston Ring Guide FJ5531/1 will facilitate the replacement of piston assembly.

## PISTON CLEARANCE

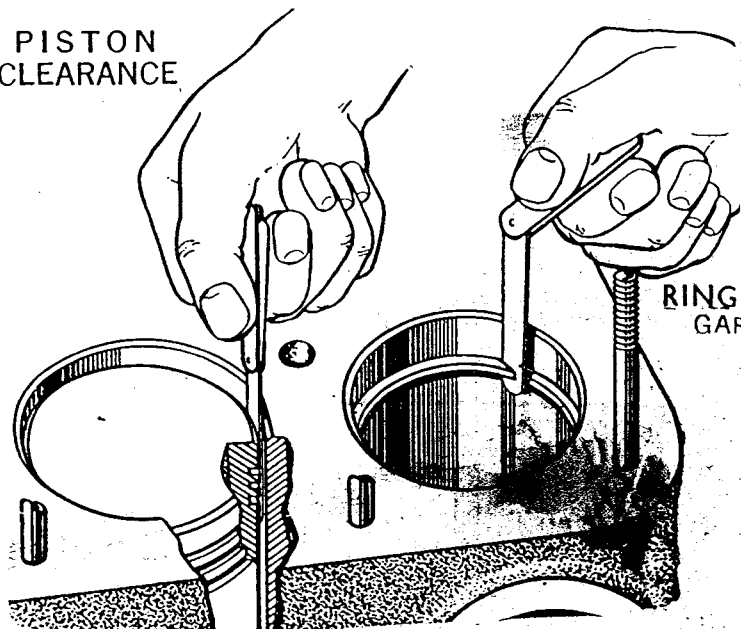


Fig. 20.

Piston and Rings are available in oversizes of  $+\frac{.01}{16}$ -in. and  $+\frac{.02}{16}$ -in.

Also Test for loss of Flexibility by Pressing Rings Outward on to Cylinder Wall and again Checking Gap. Replace piston upside down to test skirt clearance.

## 30. Main Bearings and Oil Pump.

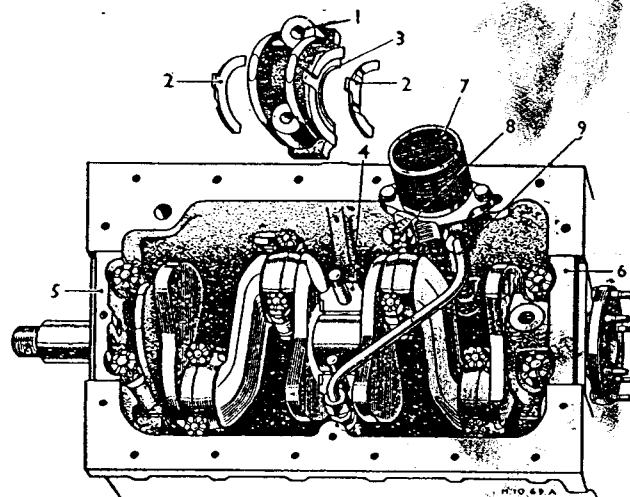


Fig. 21.

- |                                                      |                                                    |
|------------------------------------------------------|----------------------------------------------------|
| 1. Main Bearing Cap.                                 | 6. Rear Bearing Cap (note recess for cork insert). |
| 2. Thrust Washer Halves.                             | 7. Oil Pump Gauze.                                 |
| 3. Groove in cap to accommodate washer.              | 8. Release Valve Assembly.                         |
| 4. Centre Bearing Housing.                           | 9. Delivery Pipe.                                  |
| 5. Front Bearing Cap. (Note recess for cork insert). |                                                    |

## VALVE TIMING.

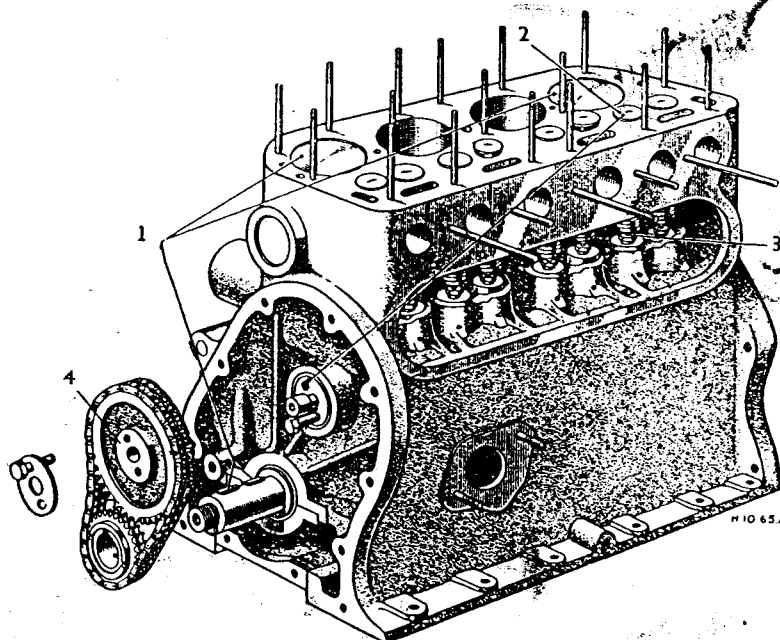


Fig. 22.

1. Pistons 1 and 4 at T.D.C., also showing position of crankshaft keys.
2. Inlet Valve about to open, also showing position for camshaft gear bolts.
3. Tappet set with .015-in. clearance.
4. Camshaft and Crankshaft Sprocket correctly in position in chain.

**31. Valve Timing.**

It should be noted that the chain sprockets are jig assembled and are therefore NOT marked in any way for re-timing purposes.

If the chain is to be removed the sprockets should first be marked in some manner and probably the most convenient method is to paint the opposing teeth. The sprockets have close working centres and teeth are then easily identified on re-assembly. If a chain sprocket is to be renewed the painted timing marks can be copied on to the new sprocket, identifying the teeth to be marked in relation to the position of keyway or bolt holes.

32. Inlet valve must be timed to open 10 degrees before Top Dead Centre. To accomplish this, re-fit camshaft and tappets and assemble valves and springs. Assemble sprockets and chain as illustrated.

It is more convenient to time from No. 4 cylinder, and it is important that the inlet valve used should be adjusted to .015-in. before timing.

**33. Ignition Timing.**

For details of ignition timing see page G/4.

**IGNITION**

The coil ignition equipment is provided with an automatic advance mechanism, which relieves the driver of the necessity of adjusting the timing. Its advantages are particularly evident when accelerating and during hill climbing, the danger of pre-ignition, knocking or pinking being very much reduced.

The device is housed in the distributor unit, and it consists of a centrifugally operated mechanism by means of which the ignition is advanced in proportion to engine speed.

In addition the distributor is also fitted with vacuum operated mechanism, which gives very accurate timing control, as it provides for variations to suit special conditions of engine load and throttle opening. It is connected by copper pipe from carburetter.

**1. Distributor Type.**

The distributor is a Lucas Model DK4A, Service No. 405601. These identification marks are stamped on the side of the distributor. When ordering replacements, always quote these numbers.

**2. Ignition Coil Type.**

The coil is a Lucas Model Q12, Service No. 401612. These identification marks are stamped on the base of the ignition coil. When ordering, always quote these numbers.

**3. Testing in Position to locate cause of Uneven Firing.**

- (a) Start the engine and set it to run at a fairly fast idling speed.
- (b) Short circuit each plug in turn by placing a hammer head or blade of a wooden handled screwdriver between the terminal and the cylinder head. No difference in the engine performance will be noted when short circuiting the plug in the defective cylinder. Shorting the other plugs will make uneven running more pronounced.
- (c) Having located the cylinder which is at fault, stop the engine and remove the cable from the terminal of the sparking plug. Re-start the engine and, holding the rubber, keep the end of the cable about 3/16-in. from the cylinder head.
- (d) If the sparking is strong and regular, the fault probably lies in the sparking plug. Remove the plug, clean, and adjust gap to the correct setting or alternatively fit a replacement plug. (See page G/3).

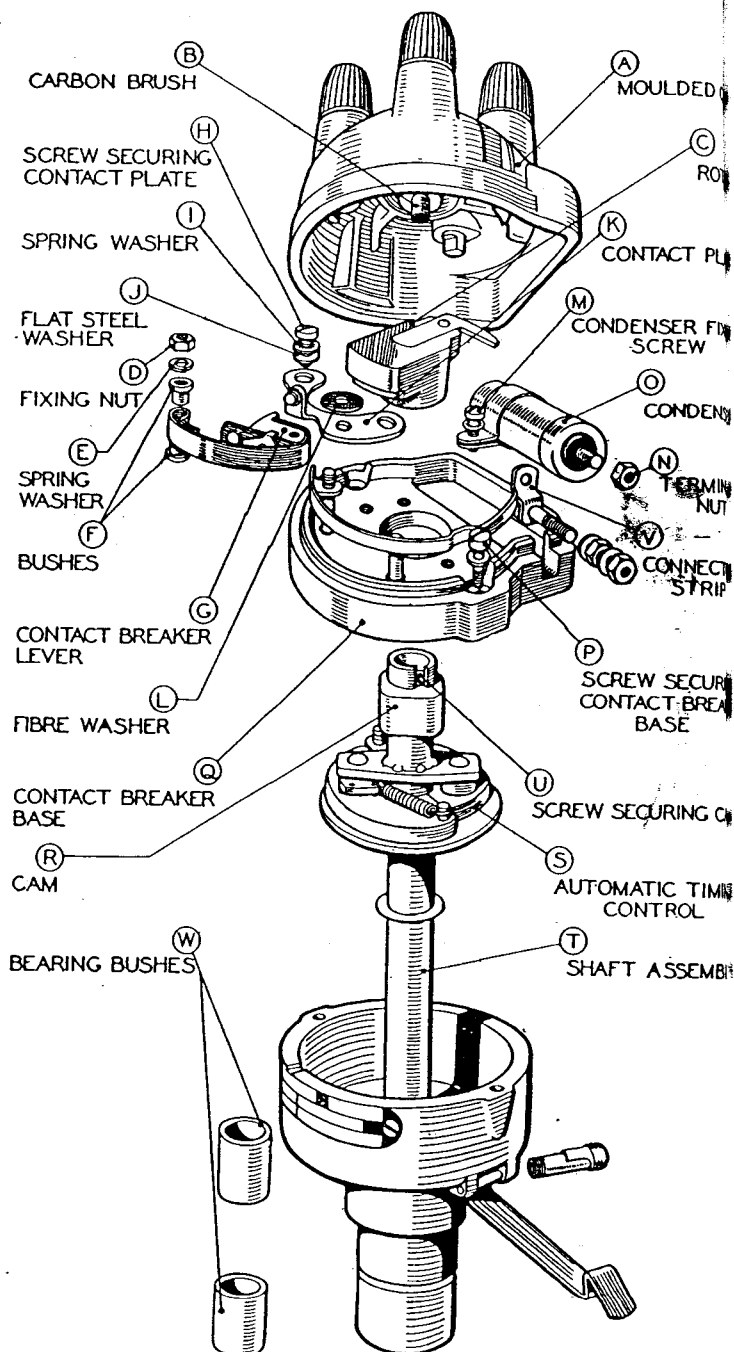


Fig. 1.  
Exploded View of Distributor.

- (e) If there is no spark or if it is weak and irregular, examine the cable from the sparking plug to the distributor. After a long period of service, the rubber insulation may be cracked or perished and the cable should be replaced. Finally, examine the moulded distributor cap, wipe the inside and outside with a clean dry cloth, see that the carbon

**IGNITION—continued.**

brush moves freely in its holder and examine the moulding closely for sign of breakdown. After long service, it may have become tracked, that is a conducting path may have formed between two or more of the electrodes or between one of the electrodes and some part of the distributor in contact with the cap. Evidence of a tracked cap is shown by the presence of a thin black line in the places indicated. A replacement moulded distributor cap must be fitted in place of one that has tracked.

**4. Testing in Position. Low Tension Circuit.**

- (a) Spring back the securing clips on the distributor and remove the moulded cap and rotor. If the rotor is a tight fit, it can be carefully levered off with a screwdriver.
- (b) Check that the contacts are clean and free from pits, burns, oil or grease. Turn engine and check that the contacts are opening and closing correctly and that the clearance when the contacts are fully opened is .010-in. — .012-in. Correct as necessary.
- (c) Switch on the ignition, turn the engine with the starting handle and observe the ammeter reading, which should rise and fall with the closing and opening of the contacts. If the reading fluctuates in this way, the low tension circuit is in order.
- (d) If the ammeter reading remains steady, locate the fault in the low tension circuit.
- (e) Another method of testing is to disconnect the cable at the "CB" terminal of the coil and at the low tension terminal of the distributor and connect a test lamp between these terminals. If the lamp lights when the contacts close and goes out when the contacts open, the low tension circuit is in order.

**5. Low Tension Circuit. To locate Fault.**

- (a) Having determined, by testing as described in paragraph 4, that the fault lies in the low tension circuit, switch on the ignition, and turn the engine until the contact breaker points are fully opened.
- (b) Refer to the wiring diagram (see page T/1) and check the circuit with a volt-meter (0-20 volts) as follows:—

NOTE.—If the circuit is in order, the reading on the voltmeter should be approximately 12.

- (c) Battery to ammeter. Black and yellow cable. Connect voltmeter between ammeter terminal "B" and a good earthing point. No reading indicates damaged cable or loose connections.

- (d) Ammeter. Connect voltmeter to ammeter terminal "A" and earth. No reading indicates fault in ammeter which must be replaced.
- (e) Ammeter to lighting and ignition switch. Purple and white cable. Connect voltmeter to switch terminal "A" and earth. No reading indicates damaged cable or loose connections.
- (f) Ignition switch. Connect voltmeter to ignition switch terminal "IG" and earth. No reading indicates fault in ignition switch.
- (g) Switch box terminal to ignition coil terminal "SW." White cable. Connect voltmeter to ignition coil terminal "SW" and earth. No reading indicates damaged cable or loose connections.
- (h) Ignition coil. Disconnect the cable from the ignition coil terminal "CB" and connect voltmeter to this terminal and earth. No reading indicates fault in primary winding of the coil. If the correct reading is given replace the original connection to the "CB" terminal.
- (j) Ignition coil to distributor. White and brown cable. Disconnect the cable from the low tension terminal on the distributor and connect the volt meter to the end of this cable and earth. No reading indicates damaged cable or loose connections. If the correct reading is given replace the connection to the distributor low tension terminal.
- (k) Contact breaker and condenser. Connect the voltmeter across the contact breaker points. No reading indicates fault in the condenser.

**6. High Tension Cables.**

- (a) The high tension cables must be carefully examined and any which have the insulation cracked, perished or damaged in any way, must be replaced.

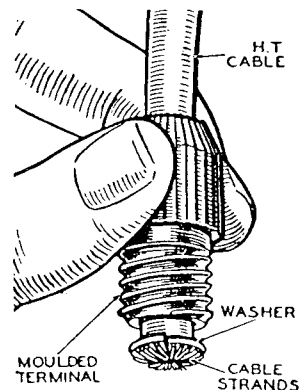


Fig. 2.

**IGNITION**—continued.

- (b) To fit the cables to the terminals, thread the knurled moulded terminal nut over the lead, bare the end of the cable for about  $\frac{1}{4}$ -in., thread the wire through the brass washer removed from the original cable and bend back the strands. Finally screw the nut into its terminal.
- (c) The cables from the distributor to the sparking plugs must be connected up in the correct firing order, which is 1, 3, 4, 2.

**7. Suppressors.**

A complete set of radio interference suppressors is fitted; there is a 15,000 ohm resistor at each sparking plug, a 5,000 ohm resistor in each of the five H.T. leads at distributor end of cables, and condenser to earth from the yellow lead of the dynamo, one from S.W. terminal of coil and another from the screenwiper motor. All condenser earth contacts must be clean, tight, and kept slightly greased to avoid corrosion.

**8. Sparking Plugs.**

The sparking plugs fitted are the Lodge C.14S, or alternatively Champion L.10.

The gaps of these plugs should be maintained between .018-in. and .020-in. If the gap is allowed to become too wide, misfiring at high speeds is liable to occur, and if too small, bad slow running and idling will be the results.

The removal or fitting of the Lodge plugs for Nos. 2 and 3 cylinders must be effected with the standard  $\frac{7}{16}$ -in. open-ended spanner; the special box spanner provided is for use with plugs for Nos. 1 and 4 cylinders.

When replacing the sparking plug after cleaning, make sure that the sparking plug washer is not defective in any way, and if it looks flat and worn, fit a new one to be sure of obtaining a gas-tight joint.

When fitting be careful not to damage the top insulation of the plug, for a heavy knock might damage the insulation and misfiring will occur.

Improper carburettor adjustment and excessive use of the choke will have the effect of causing the internal insulation to become foul and dirty, and if the high tension leads are old and the rubber has become hard and cracked, electrical leakage may occur, with the result that the plugs will misfire. If the distributor points are out of adjustment fouling of the plugs is very liable to happen.

It is recommended that plugs be renewed every 10,000 miles, for old plugs are wasteful and give bad and sluggish running.

When replacing the lead on a plug, see that the suppressor is securely attached and clear of any obstruction which may cause a short circuit.

**9. Contact Breaker Mechanism.**

- (a) Turn the engine until the contact breaker points are fully opened, and check the gap with a gauge having a thickness of .010-in.—.012-in. If the gap is correct, the gauge should be a sliding fit. Do not alter the setting unless the gap varies considerably from the gauge. To adjust the setting, keep the engine in the position to give maximum opening of the contacts and then slacken the two screws

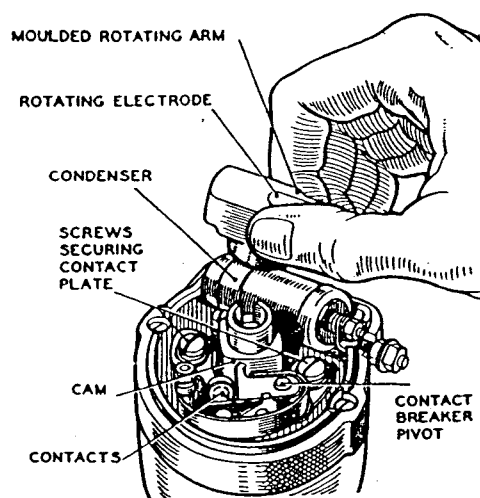


Fig. 3.

Contact Breaker Assembly.

securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and then tighten the two locking screws.

- (b) If the contacts are dirty or pitted, they must be cleaned by polishing with a fine carborundum stone, and afterwards wiped with a petrol moistened cloth. The moving contact can be removed from its mounting in order to assist cleaning. Check and adjust the contact breaker setting after cleaning the contacts. (See paragraph 14).
- (c) Check that the moving arm moves freely on its pivot. If it is sluggish, remove the moving arm and polish the pivot pin with a strip of fine emery cloth. Afterwards apply a light smear of thin lubricating oil to the pin.

**IGNITION**—continued.

**10. Distributor Lubrication.**

To be carried out after servicing the distributor and at intervals of about 5,000 miles.

- (a) Give the cam a light smear of clean engine oil and apply a slight trace of oil to the top of the pivot pin on which the contact breaker lever works.
- (b) Lift the rotor arm off the top of the spindle and add a few drops of thin machine oil through the lubricator hole provided in the spindle. (Do not remove the screw in the top of the spindle as there is an oil way provided). Refit the rotor correctly and push it on to the shaft as far as it will go.
- (c) Add a few drops of thin machine oil through the hole in the contact breaker base through which the cam passes in order to lubricate the automatic timing control.
- (d) Add a few drops of thin machine oil to the lubricator on the distributor shank.

**11. Distributor. To Remove and Replace.**

Remove distributor cap with H.T. leads, disconnect the thin L.T. wire from the side of the base, remove the vacuum pipe union and then take out the distributor clip securing screw and slacken the clamping bolt.

Using a slightly turning motion, pull distributor from crankcase; it will come away upward, bringing with it the driving shaft and camshaft meshing gear.

**12. Ignition Timing.**

- (a) As it is essential that a spark should occur at the plug points as each piston reaches the top of its compression stroke, re-timing after dismantling needs care but should present no difficulty.
- (b) In order to re-set the ignition timing remove all sparking plugs except No. 1 and, using the starting handle, turn the crankshaft until No. 1 piston is at top dead centre before a firing stroke.
- (c) The compression felt at the handle will denote the correct stroke. Top dead centre of No. 1 piston is marked on the flywheel (1/4), which can be seen after removing the clutch cover. For correct timing move flywheel backward  $1\frac{1}{2}$  teeth on starter ring (equals 5 to 6 degrees advance). Remove the distributor cover, slacken the screw in the clip of the distributor casing and turn the casing until the contact breaker points just begin to open, with the rotating centre arm pointing to the position of No. 1 electrode in the distributor cover. The spark is then

correctly timed for No. 1 cylinder, and of course for Nos. 2, 3 and 4.

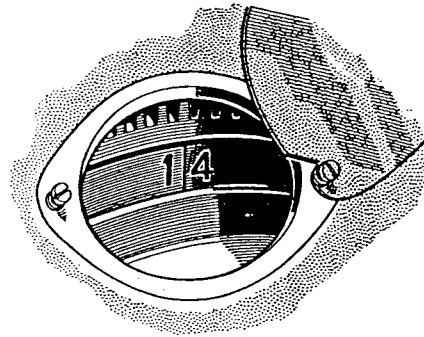


Fig. 4.

- (d) As the distributor cover carries the electrodes for the four cylinders it will be realised that it is imperative the rotating arm can pass the spark to the correct sparking plug lead at each firing stroke.
- (e) Finally tighten the adjusting screw, refit the distributor cover and test the car on the road when, if necessary, the timing can be re-adjusted at the distributor. There is a considerable amount of latitude for adjustment but only extremely small movement should be made at one time.
- (f) If the leads from the distributor to the sparking plugs have been disconnected they must be replaced in the firing sequence 1, 3, 4, 2.

**14. Distributor. To Dismantle.**

- (a) Spring back the securing clips and remove the moulded cap "A" (Fig. 1).
- (b) Lift the rotor "C" off the top of the spindle. If it is a tight fit, it should be carefully levered off with a screwdriver.
- (c) To remove the moving contact, unscrew the nut "D" securing the end of the spring, lift off the spring washer "E" and bush "F" and remove the contact breaker lever "G". Take out the two screws "H" complete with spring washers "I" and flat steel washers "J" from the plate "K" carrying the fixed contact and remove the plate.
- (d) Undo the two screws "P" fitted at the edge of the contact breaker base "L" and lift them out together with the spring washers. The contact breaker base can then be removed from the body of the distributor.
- (e) Take out the screw "M" from the condenser band clip. Unscrew the terminal nut "N," lift off the spring washer and remove the condenser "O."
- (f) Remove the driving gear from the shaft by tapping out the peg. In re-assembling, the peg must be rivetted over to secure the gear.

**IGNITION**—continued.

- (g) Lift the cam "R," automatic timing control "S" and shaft assembly "T" from the distributor. Before dismantling, carefully note the positions in which the various components are fitted in order that they can be replaced correctly. Take out the screw "U" from inside the top of the cam spindle and lift the cam off. The automatic timing control is then accessible.

**15. Procedure for the Replacement of Bearing Bushes.**

- (a) In order to ensure easy running of the distributor shaft when the shank has been rebushed, the new bushes must be fitted so that they are in correct alignment. The bushes must be fitted by means of a vertical drilling machine or hand press using a mandrel and a packing block of the type illustrated.

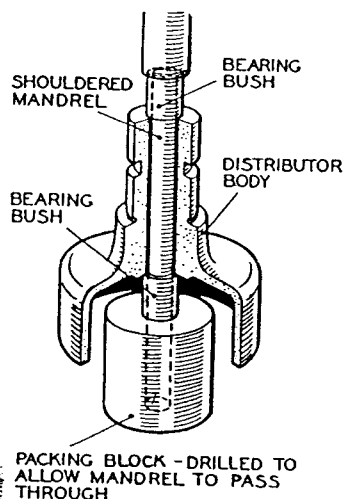


Fig. 8.

- (b) Fit the mandrel in the drilling machine or hand press and place the distributor body in an inverted position on the table below it.
- (c) To remove the bushes, a sleeve must be fitted over the mandrel to build it up to the required size. With this sleeve fitted in position, force the old bushes out of the shank by applying a steady pressure.
- (d) Take the sleeve off the mandrel. Place one of the longer bushes on the mandrel, then the distributor body in an inverted position and finally one of the smaller bushes.
- (e) Locate the end of the mandrel through the packing piece and press the mandrel downwards, taking care that both bushes enter the distributor shank squarely. Continue forcing the bushes into the shank until the mandrel reaches the end of its travel.

- (f) After fitting, the bushes must not be opened out by roaming or any other means as this would tend to impair the porosity of the bushes, and so prevent effective lubrication.

**16. Distributor. To re-assemble.**

- (a) Assemble the automatic timing control "S" taking care that the parts are fitted in their original positions and that the control springs are not stretched. Place the cam "R" on its spindle, locate the pins on its base plate in the holes in the toggles of the timing control mechanism and secure by tightening the locking screw "U."
- (b) Fit the shaft in its bearings and replace the driving member. (See page G/4).
- (c) Place the contact breaker base "Q" in position on the distributor body and secure by replacing the two screws "P." A spring washer must be fitted under each of the screw heads, and the screws must be fully tightened.
- (d) Insert the terminal post of the condenser through the hole in the connector. Replace the spring washer and tighten the nut "N." Secure the band clip by replacing and tightening the fixing screw "M."
- (e) Position the plate "K" carrying the fixed contact on the contact breaker base and secure it by replacing and lightly tightening the two screws "H," first placing a spring washer "I" and flat steel washer "J" under the heads of each of the screws. Place the insulating washer "L" over the contact breaker pivot and position the contact breaker lever over the pivot pin. Place a bush "F" over the spring fixing post and locate the end of the contact breaker spring over the fixing post and replace the second bush "F" and spring washer "E" and secure by tightening the nut "D." Adjust the contact breaker setting to give a gap of .010-in. — .012-in. when contacts are fully opened.

**NOTE.**—If it becomes necessary to renew the contacts a replacement set comprising fixed and moving contacts must be fitted.

- (f) Place the rotor "C" on the top of the spindle, locating the register correctly and push it fully home.
- (g) Fit the moulded distributor cap "A" and secure by means of the spring clips.

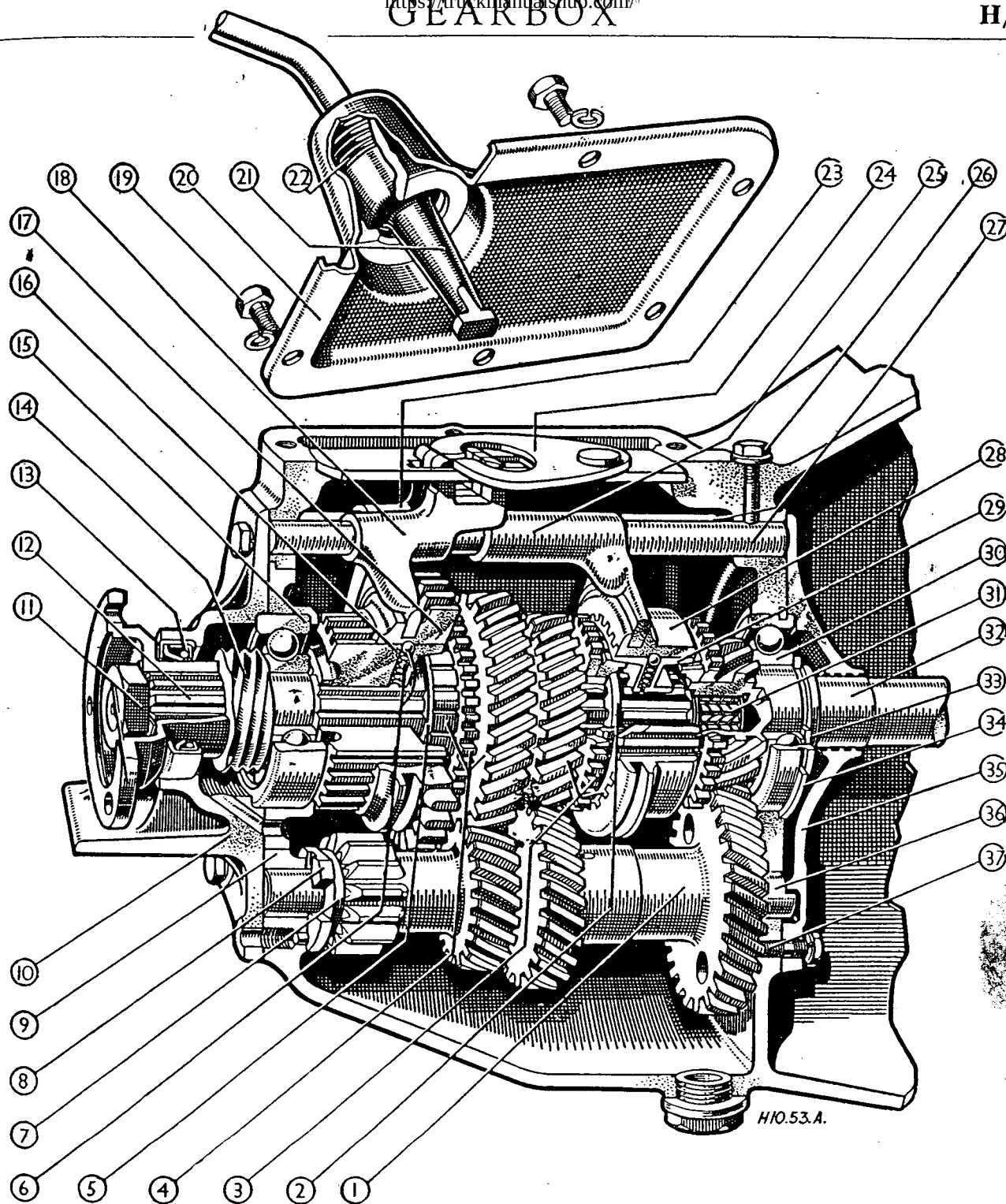


Fig. 1.

- |                                                                                |                                         |                                           |                                             |
|--------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------------|---------------------------------------------|
| 1. Laygear.                                                                    | 7. Layshaft Steel Thrust Washer (rear). | 18. First and Second Speed Fork.          | 28. Third and Fourth Speed Coupling Sleeve. |
| 2. Front Thrust Washer.                                                        | 8. Layshaft Thrust Washer (bronze).     | 19. Top Cover Set Screws.                 | 29. Third and Fourth Speed Synchroniser.    |
| 3. Third Speed Wheel, Synchronising Cone and Coupling Sleeve, mounted on bush. | 9. Gearbox Case.                        | 20. Top Cover.                            | 30. Front Ball Bearing.                     |
| 4. Second Speed Wheel, Synchronising Cone and Coupling, mounted on bush.       | 10. Gearbox Rear Cover.                 | 21. Change Speed Lever.                   | 31. Front Roller Bearing.                   |
| 5. Rear Thrust Washer (steel).                                                 | 11. Third Motion Shaft Nut.             | 22. Change Speed Lever Spring.            | 32. First Motion Shaft.                     |
| 6. Synchronising Springs and Balls.                                            | 12. Third Motion Shaft.                 | 23. Reverse Fork.                         | 33. Spring Ring for First Motion Shaft.     |
|                                                                                | 13. Rear Oil Seal.                      | 24. Change Speed Gate with interlock arm. | 34. Spring Ring for Front Ball Bearing.     |
|                                                                                | 14. Speedometer Wheel.                  | 25. Third and Fourth Speed Fork.          | 35. Front Cover.                            |
|                                                                                | 15. Rear Ball Bearing.                  | 26. Fork Rod Locking Pin.                 | 36. Layshaft.                               |
|                                                                                | 16. Second Speed Synchroniser.          | 27. Forward Speeds Fork Rod.              | 37. Front Cover Screw.                      |
|                                                                                | 17. First Speed Wheel.                  |                                           |                                             |



**REMOVING THE GEARBOX.****Disconnect.**

1. If the engine is still in the frame disconnect the propeller shaft at gearbox end and take off speedometer drive cable at the union in end cover. Also take out clutch pedal stalk by removing the clamp pin.

2. Drain the box of all oil by removing the plug from the bottom. The oil capacity is  $1\frac{7}{8}$  pints.

**Top Cover and Gate Lock.**

3. Remove top cover carrying gear lever, by taking out the six set screws. Also lift out change speed gate lock.

**Starter and Leads.**

4. Take off starter motor by removing the three setscrews through mounting plate and gearbox (also disconnecting battery lead and starter cable if the engine is still in the frame).

**Housing Bolts and Clutch Fork.**

5. Take out the remainder of the bolts from the housing, when the gearbox can be withdrawn, carrying with it the clutch operating linkage and withdrawal operating rod, fork and release bearing with cup assembly.

**Shaft Flange.**

6. To withdraw propeller shaft flange knock back lock washer, and remove nut. The flange may need an extractor tool, but as it fits on splines it should be possible to tap it off without necessitating such heavy blows as to cause damage.

**OPERATIONS WITH BOX REMOVED.****Rear End Cover and Oil Seal.**

1. Remove flexible rear mounting block by taking the nuts from the two studs; this will provide better accessibility to the lower setscrews in the cover.

2. Take out the speedometer pinion and then remove all six setscrews (with spring washers) in end cover.

3. Prise off cover, which will bring with it the rear oil seal.

4. Do not extract oil seal from cover unless it is intended to replace with a new one, as it will be necessary to force it out of the housing, possibly causing distortion of the sealing ring. In fitting a new seal, press or lightly tap into position, taking care to ensure the "lip" faces the inside of the gearbox, and that it lies flat.

5. There is a paper washer between rear cover and gearbox, and also a locating peg for bearing housing and end cover. Ensure proper location when refitting cover and bearing.

**Clutch Withdrawal Fork and Bearing.**

1. The withdrawal fork is secured in position on the operating shaft by a cycle-type cotter (see Fig. 1, page J/1), and it is best to remove this before dismantling any of the other clutch linkage as the operating rod holds the fork in the best position.

2. Remove the cotter nut and washer, and lightly tap the cotter upward. The release bearing can be detached from the fork at the same time taking care not to scratch or chip it when bringing it over the splined end of the first motion shaft.

3. Disconnect the clutch rod from pedal and take lever from operating shaft by removing the pinch bolt from the top. (See Fig. 6, Section J). The operating shaft may now be tapped out of the clutch housing, leaving the withdrawal fork behind. Remove pedal return spring.

4. Examine the two bushes in the housing and replace if these are worn. The shaft should be a perfectly free fit, but there should be no actual slackness. In all but the earliest models, oil nipples are fitted into the operating shaft housing. Only light lubrication is needed or oil will find its way on to the release bearing, which is intended to run perfectly dry. Stiffness in the shaft, however, will cause damage to the clutch and bearing.

5. Next remove clutch pedal, which is secured by a spring ring. Remove the ring with a screwdriver, take off washer and pedal.

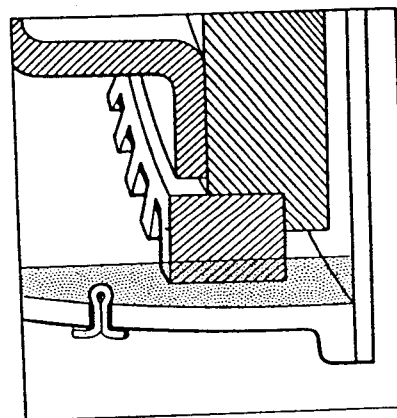
**Clutch Drain Hole.**

Fig. 2.

6. There is a drain hole in the clutch housing, but in order to ensure this is kept clear of mud or other stoppage, a split cotter is loosely fitted through it; see that this is still loose and free (Fig. 2).

## Front Cover.

1. There are six studs through the front end cover; remove the nuts and spring washers and lift cover, with paper joint washer. There is no oil seal washer here, but an oil-return thread is included in the cover bearing.

Use a new joint washer when replacing.

## Change Speed Fork Rods.

1. With both end covers removed, tap out each of the fork rods, taking care to retrieve each of the spring-loaded steel balls as the rods pass through each rod housing. The small springs will remain in the fork.

2. Lift out each fork, making note of its actual position to assist in re-assembling.

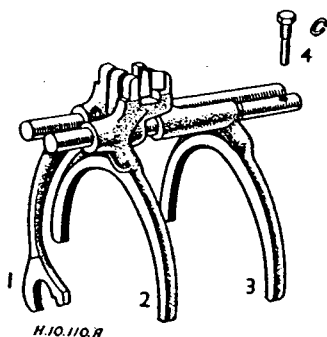


Fig. 3.

1. Reverse Gear Fork.
2. 1st and 2nd Speed Fork.
3. Fig. 3 shows the relative position of all forks and rods when assembled in the box.
4. Fork Rod Locating Set Screw.

## Spring Loaded Forks.

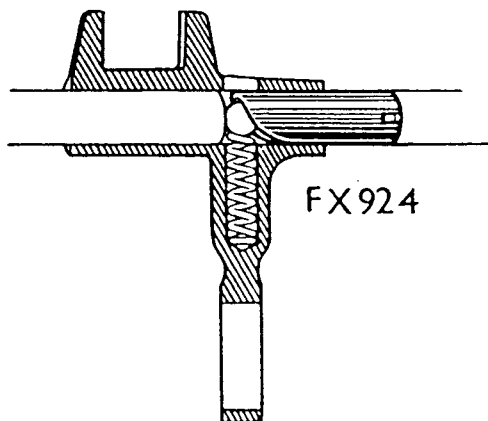


Fig. 4.

1. This drift facilitates the replacement of the change speed rods through the gear striking forks after the locking ball and spring have been replaced in their housings.

2. The spring and ball are placed in the housing and then held down in position when the tool is passed into the fork. The fork rod is then pushed in from the opposite end and the ball is trapped in position before the tool is withdrawn.

The fork rod on early models had grooves for 3rd and 4th speed location, but this type rod has been replaced by one with slots instead of grooves. The rods are interchangeable.

## FIRST MOTION SHAFT.

1. First Motion Shaft can be withdrawn from the front after removal of the front cover. If the bearing is tight in the housing it will need to be tapped out with a hammer and soft punch from inside the box.

2. In replacing a First Motion Shaft, the bearing must be tapped into position to ensure the bearing is flush with the case before the front cover is replaced.

3. There is a spring ring in a groove on the outer race of the bearing, provided for location purposes in the box. The bearing must be tapped into the box till the spring ring is properly home.

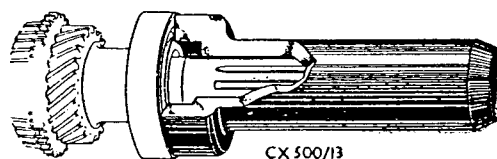


Fig. 5.

Using a First Motion Shaft Drift to place bearing in position on shaft. The bearing has also to be tapped into the box housing.

## Securing First Motion Shaft Retaining Ring.

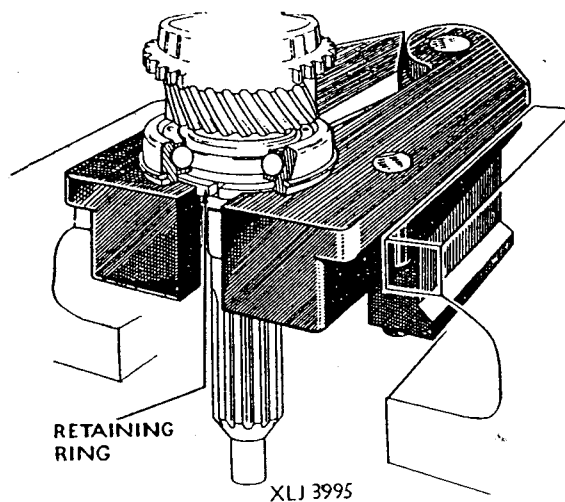


Fig. 6.

1. Fig. 6 shows the special vice jaws for closing the First Motion Shaft bearing retaining ring. This is not a spring ring and such a tool is essential to ensure that the ring is properly closed up in the groove.

**THIRD MOTION SHAFT AND LAYGEAR.**

1. To remove Third Motion Shaft it will first be necessary to free it from the Laygear. (Fig. 7).

2. The laygear must be lowered in the box for disengagement, and in order not to displace the thrust washers fitted to each end a wire or thin rod should follow as the layshaft is driven through the box.

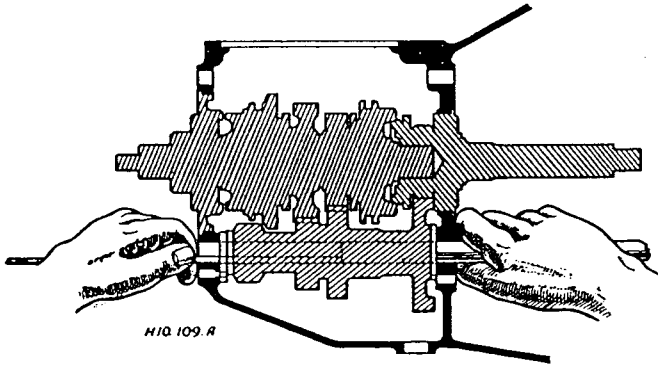


Fig. 7.

Lowering Laygear to free the Third Motion Shaft.

3. The laygear will then drop sufficiently for the gears to come out of mesh, and the Third Motion Shaft Assembly complete can be moved rearward and lifted from the box. (See Figs. 11 and 12 and accompanying text for detail of assembly of gears and shaft).

4. The assembly of the laygear and the thrust washers will then be clearly seen. The purpose of the thin rod is to enable the gear to be readily re-assembled if it is not desired to take it out of the box. (See Fig. 8).

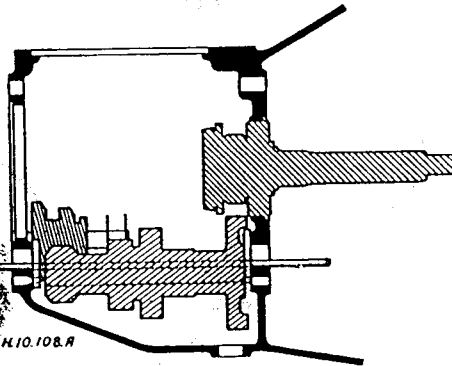


Fig. 8.

Lowering Laygear in order to clear the First Motion Shaft.

5. By removing the rod, however, the gear and thrust washers can be lifted out of the box complete (although the reverse gear will need to be manipulated by hand to clear).

**Re-bush Laygear.**

1. If the laygear needs new bushes, the old ones can be tapped out and the new ones fitted without special tools, but it is essential that the bushes are driven in till they are slightly below the surface.

**Reverse Gear.**

1. Note that the short reverse gear shaft is secured in position by a set screw from the outside of the box (nearside, towards the rear). Remove the set pin, and tap out shaft to remove gear.

2. Examine gear bush for wear. If a new bush is fitted, ensure it is reamed if necessary to provide a sliding fit on shaft.

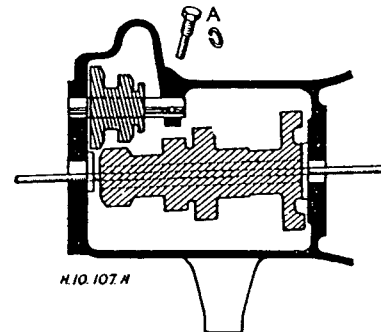


Fig. 9.

A Reverse Shaft Locating Screw.

Laygear moved out of line to enable reverse gear to be positioned.

**Laygear Thrust Washers.**

1. Note that the front thrust washer has a slot which registers with one of the front cover studs (this stud is longer than the others, and is at the bottom). The rear thrust washer has a peg which registers with a drilled hole. There is a hardened floating steel washer between this thrust and the laygear. The accompanying illustrations make this assembly clear, and will show how the thin rod keeps the gear and thrust washers in place while building or dismantling the box.

The front Thrust Washer fitting.

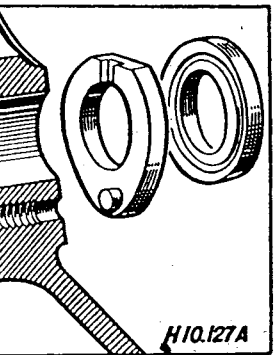
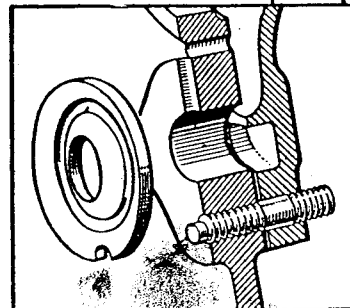


Fig. 10.

The rear Thrust Washer assembly.

### THIRD MOTION SHAFT THRUST WASHER.

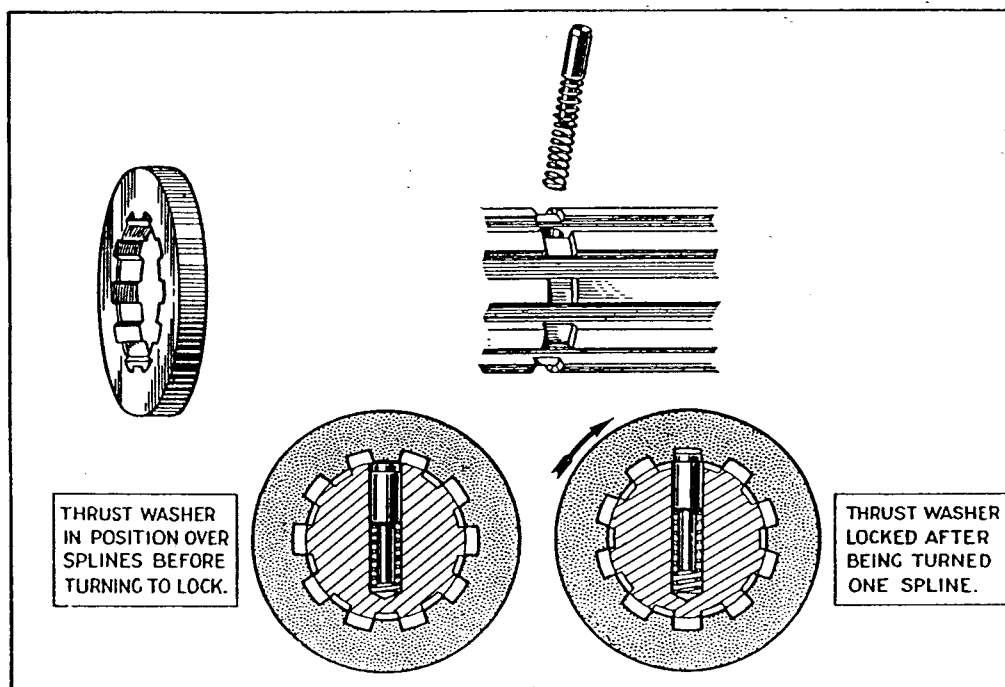


Fig. 11.

This thrust washer is locked by a spring loaded peg situated in a blind hole drilled in the shaft and is positioned between the 3rd speed wheel and the synchroniser which operates for both 3rd and 4th speeds.

When assembling, the peg is held down level with the bottom of the groove and the washer slid along the shaft until it comes into position over it. The washer is then turned one spline when the

peg will spring up into one of the slots in the washer and thus lock it in position.

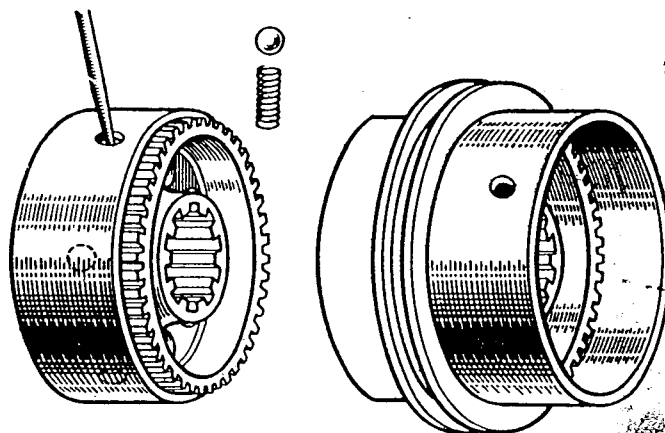
When dismantling the peg is held down by a tool having a flat end such as a small screwdriver, and the thrust washer turned one spline when it can be slid along the shaft and removed. Care must be taken that as the peg is uncovered, it does not fly out and become lost.

### Synchromesh Sub-assembly Guide.

1. Special guides are available to facilitate re-assembling the six balls and springs into the speed synchroniser and speed gear coupling sleeve in the synchromesh gearboxes. The guide is a sleeve the same width as the coupling sleeve. (See Fig. 12).

2. It will be seen that the machined portion of the guide bore is slipped over the synchroniser and turned until the hole coincides with one of the six sockets in the synchroniser. A spring and ball are then placed in position, the ball depressed and the guide rotated to hold it in this position. This procedure is repeated for each spring and ball in turn until they are all held in a depressed position.

3. The guide is then pushed further along the synchroniser splines, and followed up by the gear coupling sleeve.



USING TOOL NO. CJ 345-1

Fig. 12.

4. The splined portion of the guide fully depresses the balls against their springs and then, as the coupling sleeve replaces the guide, the balls find their location in the coupling sleeve groove.

**FITTING GEAR SYNCHRONISING CONES.**

The Synchronising Cones on the second, third and fourth speed gears are "shrunk on" to the gear itself, which is normally supplied as a complete assembly for spares purposes. Where facilities exist for shrinking on and final machining, however, cones can be supplied separately, but care must be exercised in fitting if the gear is to operate satisfactorily. The internal broaching of the cone is calculated to allow for a shrinkage fit on to the gear serrations, and the cone must be heat-expanded before it can be fitted. When heated to approximately 250 degrees Fahrenheit expansion will be sufficient to allow the cone to be pressed home on to the gear without damaging the broaching and will be sufficiently close fitting to resist displacement in gear changing.

This can best be done by immersion in oil heated to 250 degrees Fahrenheit and then fitting by means of a hand-operated press. After shrinking on, the unit should be immediately quenched in water to prevent the heat softening the gear itself.

On each gear the appropriate speed coupling adaptor must be fitted before the cone, but there is no need to pre-heat this adaptor—it can be pressed home cold. There is a shoulder on one side of the adaptor, and this must face gear and not cone.

When the cone is in position the final machining can be done in accordance with the dimensions given below. The taper of the cone must be true and concentric with the bore to .001-in.

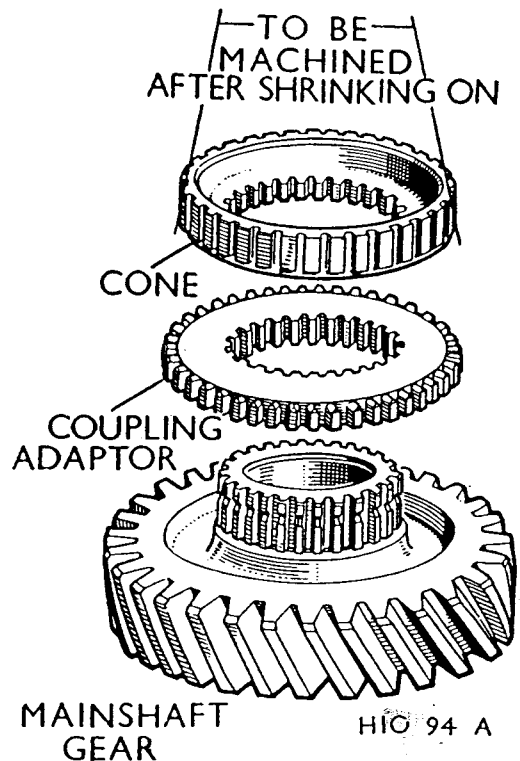


Fig. 13.  
Order of Assembly.

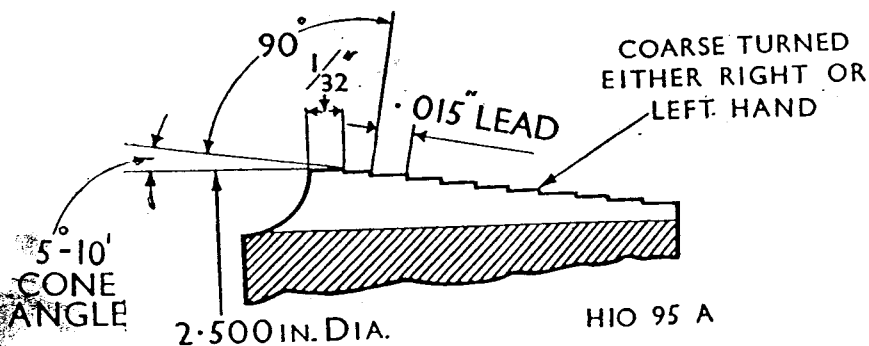


Fig. 14.

**THE THIRD MOTION SHAFT.**

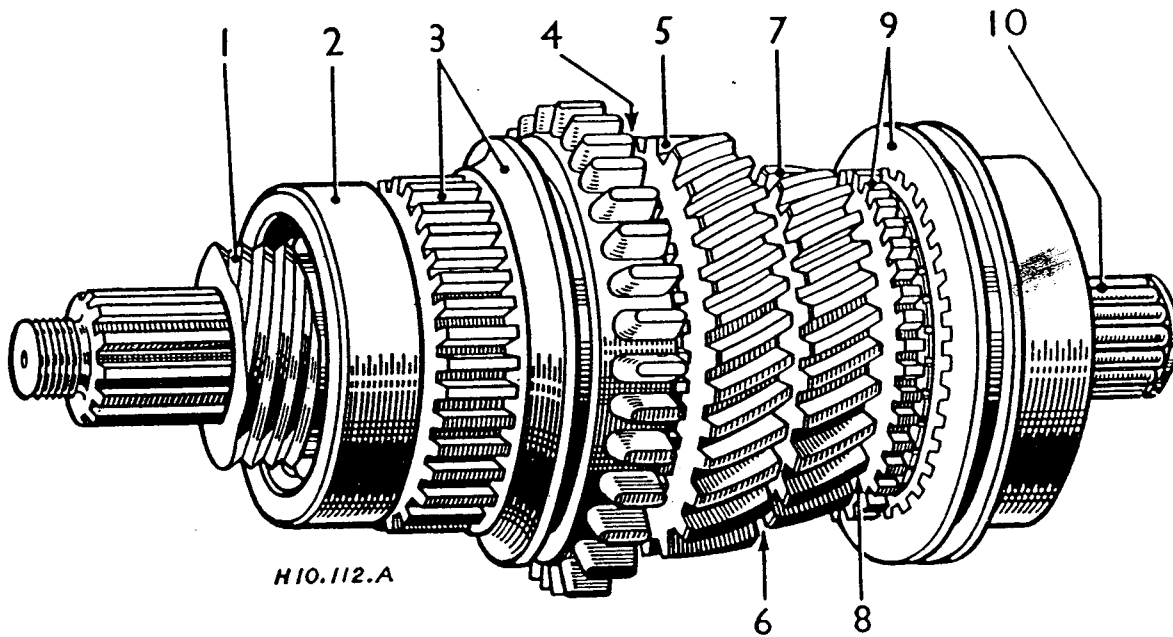


Fig. 15.

**Order of Assembly.**

1. Speedometer Wheel.
2. Ball Bearing.
3. 2nd Speed Synchroniser complete with 1st Speed Wheel.
4. Steel Thrust Washer.
5. 2nd Speed Wheel complete.
6. Bronze Thrust Washer.

7. 3rd Speed Wheel complete.
8. Steel Thrust Washer complete with spring loaded locking peg.
9. 3rd and 4th Speed Synchronisers complete with sleeve.
10. Roller Bearing. On latest models a bronze bush is replacing this roller bearing, and may be used as a replacement on early vehicles.

Fig. 15 shows the correct running assembly of the Third Motion Shaft, but actually the speedometer wheel (1) and the ball bearing (2) are not assembled till the shaft and gears are positioned in the box. The rear ball bearing is

then pressed into the bearing housing, the speedometer wheel follows, and the rear cover and its joint washer complete the assembly at this end of the box.

# CLUTCH

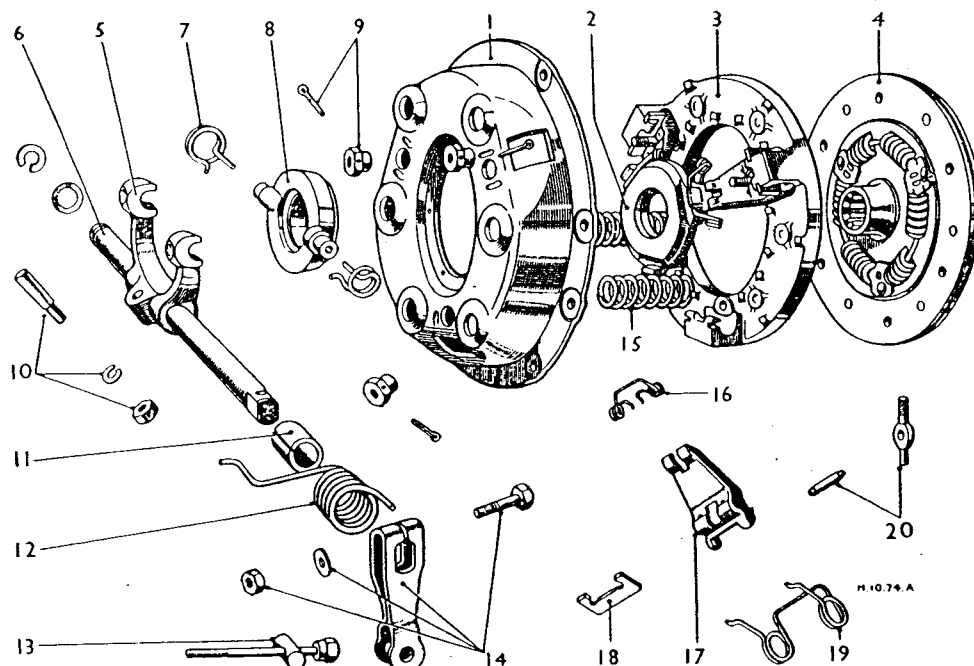


Fig. 1.

- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| 1. Cover for clutch.                  | 11. Clutch Shaft Bushes.             |
| 2. Release Lever Plate.               | 12. Pedal Return Spring.             |
| 3. Pressure Plate.                    | 13. Trunnion for lever.              |
| 4. Clutch Plate and Linings.          | 14. Shaft Lever and Clamp Bolt.      |
| 5. Withdrawal Fork.                   | 15. Thrust Springs.                  |
| 6. Clutch Operating Shaft.            | 16. Spring Retainers.                |
| 7. Release Bearing Retaining Springs. | 17. Release Levers.                  |
| 8. Release Bearing.                   | 18. Struts for release levers.       |
| 9. Nuts and Cotters for eyebolts.     | 19. Anti-Rattle Springs.             |
| 10. Withdrawal Fork Cotter.           | 20. Eyebolts and Release Lever Pins. |

## Remove Clutch Unit.

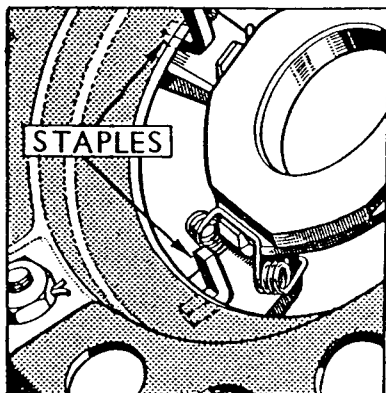


Fig. 2.

1. To remove the clutch six set pins have to be withdrawn from the flywheel. Three staples should be placed in position as shown in sketch. When the set pins have been released a turn or two the staples will be tightly held between the case and the levers. Similarly, when re-assembling, staples must be taken out as the set

pins are tightened, or they may fall into the clutch, which may necessitate complete dismantling to retrieve them. The clutch must be held steady while the last two bolts are removed.

## Clean Faces.

2. Before a new clutch plate is fitted it is essential that the flywheel face and also the face of the clutch pressure plate be thoroughly cleaned with petrol and polished dry, and an examination made for any scoring which might damage the new clutch plate if allowed to remain on the faces. If the pressure plate or flywheel is badly scored a re-conditioned replacement must be used.

## Re-assemble on Flywheel.

3. Re-assembly is exactly a reversal of the above operations, again taking care to ensure no staple drops into the clutch.

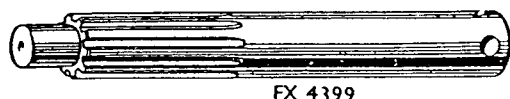
**Plate Alignment.**

Fig. 3.

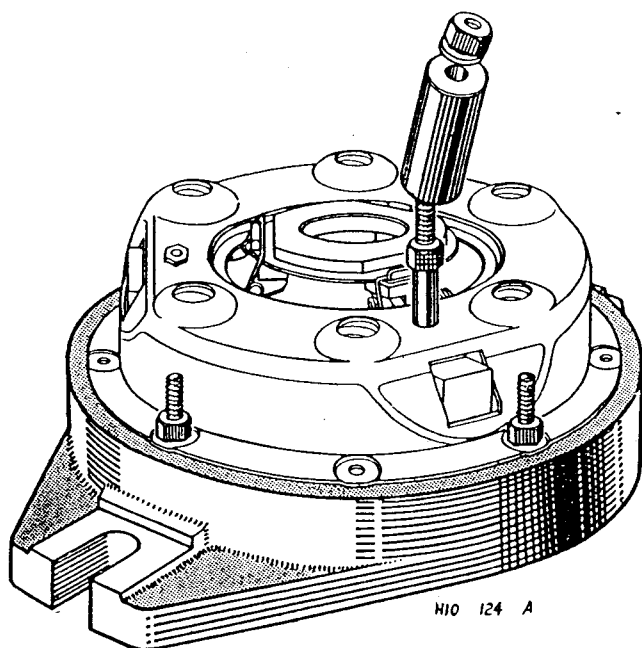
Service First Motion Shaft for Aligning Clutch with Flywheel.

**Plate Alignment.**

4. The alignment of the clutch unit, loose clutch plate and flywheel is much simplified by the use of the special Austin Tool ; this is a dummy first-motion shaft and enters the flywheel centre bearing or bush. A spare first-motion shaft can be used if no tool is available.

**Clutch Springs.**

5. Where the clutch plate is found to have been badly burned and worn, and the pressure plate shows signs of overheating, there has probable been sufficient clutch-slip to somewhat weaken the operating springs. It is therefore strongly advised that the springs be renewed.

**6. To Dismantle Clutch.**

FJ6131

Fig. 4.

The Clutch Assembly Fixture illustrated here greatly facilitates dismantling and re-assembly of the complete unit.

With the clutch mounted on this fixture the three clutch spring tension nuts can be removed ; they are replaced by the adapters, with the nuts lightly screwed down. As the clutch is released from the base the adapters take the spring pressure and can afterwards be slacked back in turn till the springs are released.

**7. To re-assemble Clutch.**

The tool is used in reverse for re-assembling the clutch.

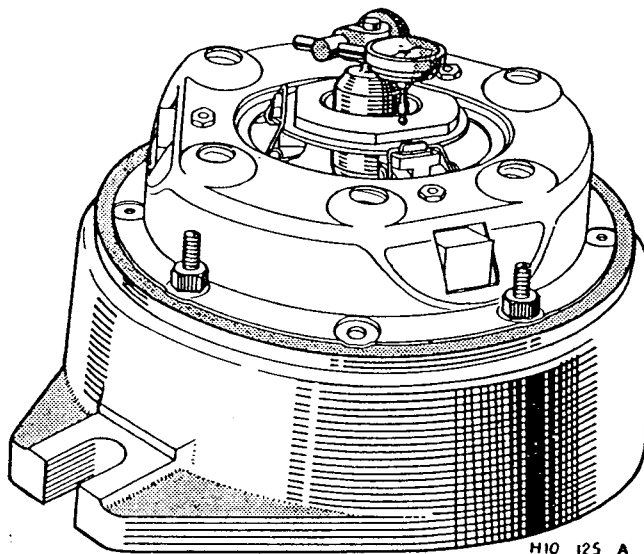
**8. Clutch Setting.**

Fig. 5.

The tool also enables the clutch plate to be accurately aligned, without which clutch drag is almost sure to be present when the unit is in use.

The assembled clutch is mounted on the base, complete with clutch plate and dummy first motion shaft.

A dial gauge is mounted on the dummy first motion shaft, and when moved round the clutch release ring will immediately show which of the three tension nuts requires adjusting to make the clutch run true. There should be  $\frac{3}{16}$ -in. space between levers and clutch case.

**9. Improvised Jig.**

Where special tools are not available, the flywheel is detached and using three extra long studs screwed the whole length in place of set pins, this would make a useful jig. With the clutch mounted tightly on the flywheel the three clutch case nuts can be removed. The clutch springs are slowly expanded as the three holding-down nuts are screwed back up the long studs.



**10. Make Identity Marks.**

At the outset it is advisable to mark the four clutch nuts and the studs to which they belong. The nuts are drilled and cottered on their studs and if replaced in their original position the setting will be more easily accomplished.

**11. Correct Tension.**

Replace with new springs and then re-assemble. With everything in position—including the clutch plate—press down the cover till sufficient thread shows on the four studs to start the nuts. Using the correct nut for each stud, screw down till it is possible to push the split-pin through the nut and stud; incorrect assembly will cause clutch plate to spin and make the gears difficult to engage.

**Release Bearing.**

12. When erecting clutch unit, carefully examine clutch release bearing and the release lever plate and replace if at all worn or scored. It should be noted that the carbon release bearing is of very brittle material; care should be taken not to damage this when refitting the gearbox. (See Section H). This bearing ring and plate are designed to run without lubrication and will only fail if continually misused or through wrong adjustment of the clutch pedal which in themselves are usually the original cause of the clutch plate needing renewal.

**"Free" Movement.**

13. When finally assembled, there should be approximately  $\frac{1}{2}$ -in. to 1-in. "free" movement of the clutch pedal before actual engagement with the clutch springs is felt. If there is not this free movement the clutch may not engage fully and

will accordingly again create clutch slip. The pedal position is easily adjusted by altering the effective length of the rod between the pedal and the clutch operating lever on the shaft end.

**Clutch Pedal Adjustment.**

14. The adjustment must be such as to allow this free movement of the clutch pedal with one finger. After depressing the pedal to this extent the stronger resistance of the clutch springs will be obvious, so that it is easy to ascertain the amount of movement.

The pedal should be tested from time to time, otherwise damage may be done to the clutch owing to the slipping of the plates.

The adjustment is obtained by first slackening the locking nut and screwing back the adjusting nut until the pedal has sufficient free movement.

Finally, tighten the locking nut.

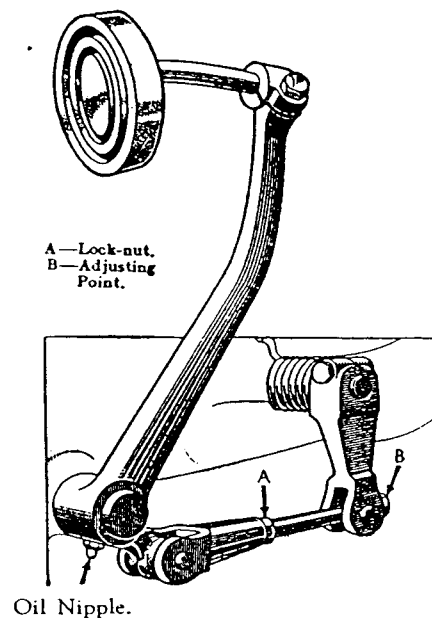


Fig. 6.

The Clutch Pedal Adjustment.

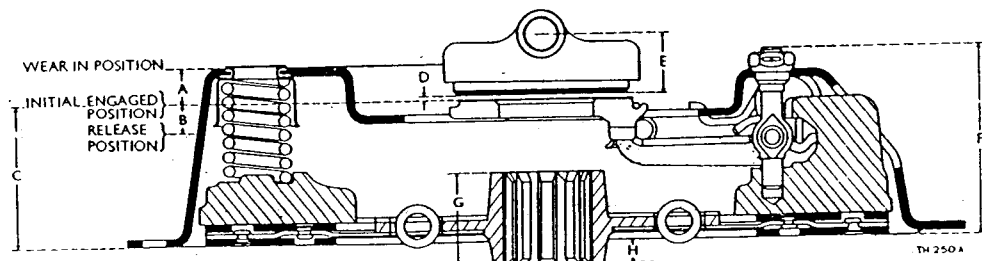
**Essential Dimensions.**

Fig. 7.

# PROPELLER SHAFTS AND UNIVERSAL JOINTS L/1

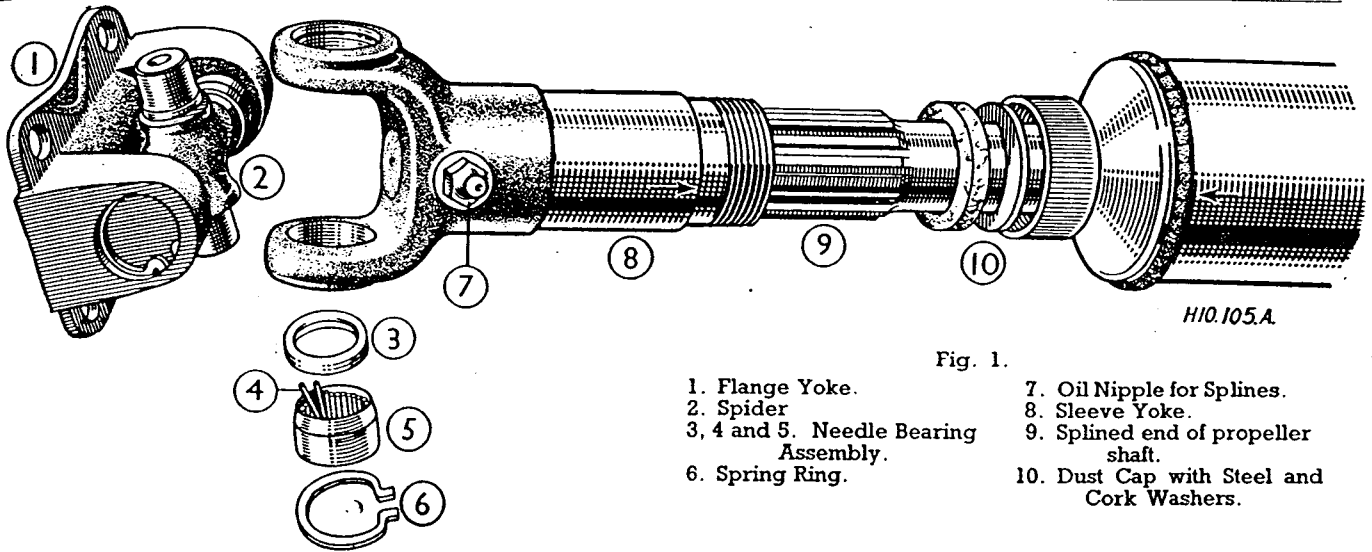


Fig. 1.

- |                                      |                                           |
|--------------------------------------|-------------------------------------------|
| 1. Flange Yoke.                      | 7. Oil Nipple for Splines.                |
| 2. Spider                            | 8. Sleeve Yoke.                           |
| 3, 4 and 5. Needle Bearing Assembly. | 9. Splined end of propeller shaft.        |
| 6. Spring Ring.                      | 10. Dust Cap with Steel and Cork Washers. |

## 1. Type and Description.

Propeller Shaft and Universal Joints are Hardy Spicer Series (Fig. 1).

To accommodate fore and aft movement of the axles and other components, the forward end of each shaft is provided with a splined sliding joint. Each joint consists of a centre spider, four needle roller bearings and two yokes. Reference to Lubrication Chart shows location of joints.

## 2. Lubrication.

On latest models a lubricator may be found fitted to the centre spider for lubrication of the bearings. Grease must not be used, oil C.600 being the correct lubricant. Reference to Fig. 2 shows that the central oil chamber is connected to the four oil reservoirs and the needle roller bearing assemblies.

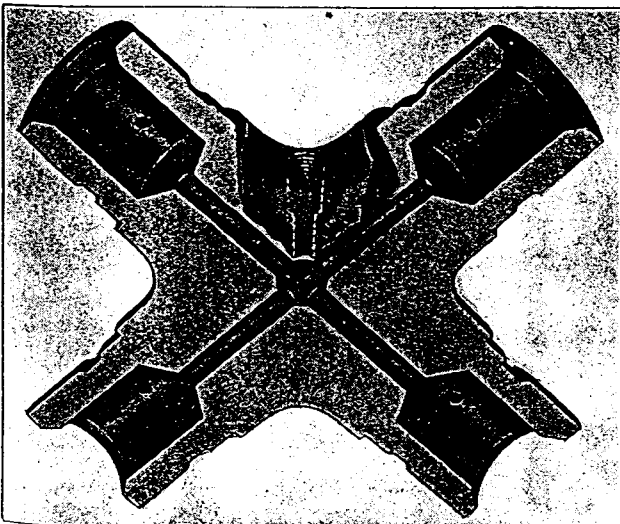


Fig. 2.

The needle roller bearings are packed on assembly with Oil C.600. Where no lubricator

is fitted for lubrication attention in service, the Universal Joints should be completely dismantled every 10,000 miles and repacked with lubricant. A lubricator is provided on the sleeve yoke of the sliding spline joint on all types.

If a large amount of oil exudes from the oil seals the joint should be dismantled and new oil seals fitted.

After dismantling, and before re-assembly the inside splines of the sleeve yoke should be liberally smeared with grease.

## 3. Tests for Wear.

Wear on the thrust faces is located by testing the lift in the joint, either by hand, or by using a length of wood suitably supported.

Any circumferential movement of shaft relative to the flange yokes indicates wear in the needle roller bearings, or the sliding spline.

## 4. Removal of Complete Assembly.

Support the propeller shaft near the sliding joint by wood blocks or sling from chassis.

Remove all nuts and bolts from companion flange at sliding spline joint end.

Unscrew by hand, the dust cap at rear of sliding joint. Slide splined sleeve yoke about half an inch towards the propeller shaft.

This disengages the pilot flanges and allows front end of shaft to be lowered carefully on to support.

Remove all nuts and bolts from companion flange at fixed joint end and lower carefully to ground.

Remove front end support and lower to ground.

## L/2 PROPELLER SHAFTS AND UNIVERSAL JOINTS

### 5. To Dismantle.

Having unscrewed the dust cap, pull sliding joint off shaft. Clean enamel from snap rings and top of bearing races. Remove all snap rings by pinching ears together with a pair of pliers,

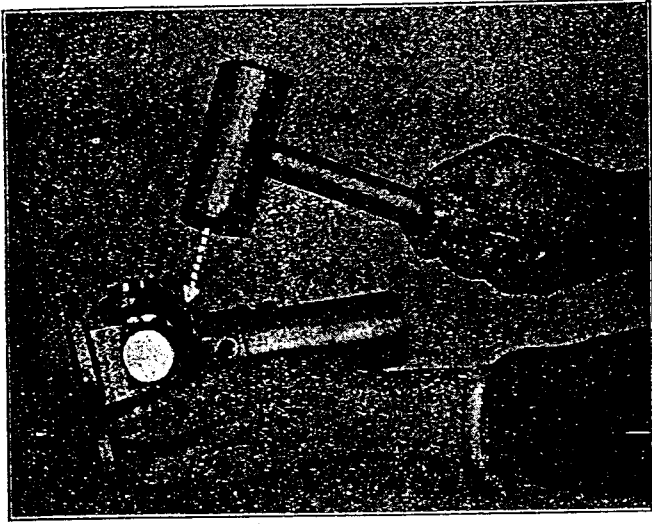


Fig. 3.

and prising with a screwdriver. If ring does not snap out of groove readily, tap end of bearing race lightly to relieve the pressure against ring. Holding joint in left hand with splined sleeve yoke lug on top, tap radius of yoke lightly with copper hammer (see Fig. 3). Top bearing should begin to emerge; turn joint over and finally remove with fingers (see Fig. 4). If necessary tap bear-

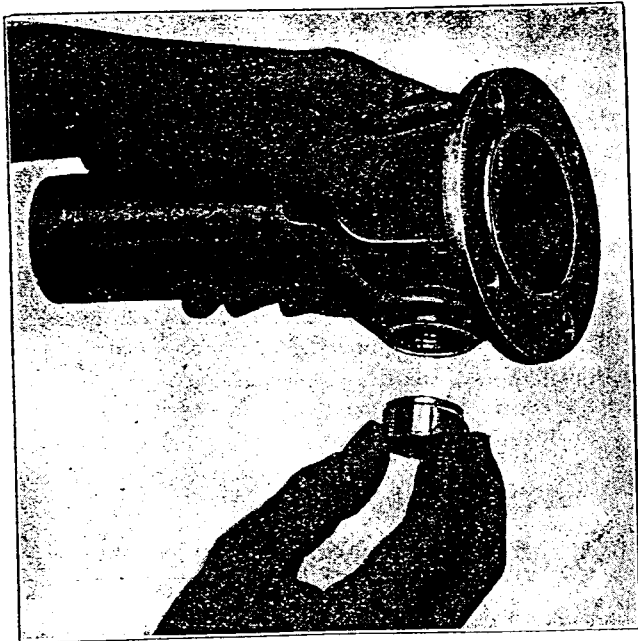


Fig. 4.

ing race from inside with small diameter bar, taking care not to damage bearing race. Keep joint in this position to avoid dropping the needle rollers. Repeat this operation for opposite bearing. Splined sleeve yoke can now be removed (see Fig. 5). Rest exposed trunnions on wood or lead blocks, and remove two remaining bearing races.

### 6. To examine and check for wear.

The parts most likely to show signs of wear after long usage are the bearing races and spider journals. Should looseness in the fit of these parts, load markings or distortion be observed,

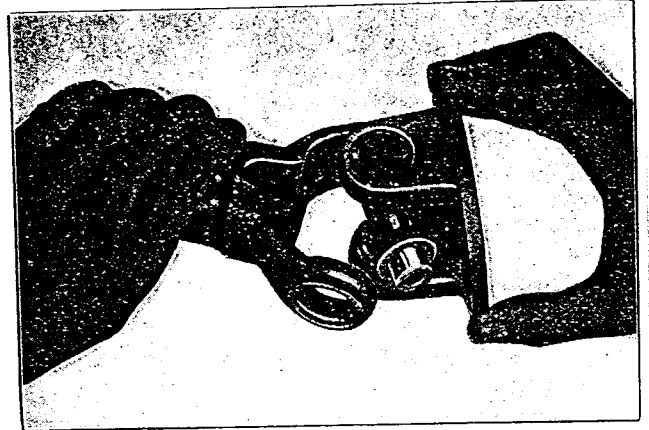


Fig. 5.

they must be renewed complete, as no oversize journals or bearing races are provided. It is essential that bearing races are a light drive fit in the yoke trunnion. In the rare event of wear having taken place in the yoke cross hole, the holes will most certainly be oval, and the yokes must be renewed.

With reference to wear of the cross holes in a fixed yoke, which is part of the tubular shaft assembly, only in cases of emergency should this be replaced. It should normally be replaced by a complete tubular shaft assembly. The other parts likely to show signs of wear are the splined sleeve yoke, or splined stub shaft. A total of .004-in. circumferential movement, measured on the outside diameter of the spline should not be exceeded. Should the splined stub shaft require renewing, this must be dealt with in the same way as the fixed yoke, i.e., a replacement tubular shaft assembly fitted.

### 7. To Re-assemble.

See that all drilled holes in journals are cleaned out and filled with oil (Fig. 2). Assemble needle rollers in bearing races and fill with oil. Should difficulty be experienced in assembly, smear the

# PROPELLER SHAFTS AND UNIVERSAL JOINTS L/3

walls of the races with vaseline to retain the needle rollers in place.

Insert spider in flange yoke. Using soft nosed drift about  $\frac{1}{8}$ -in. smaller in diameter than the hole in the yoke, tap the bearing in position. It is essential that bearing races are a light drive fit in the yoke trunnions. Repeat this operation for the other three bearings. The spider journal shoulders should be coated with shellac prior to fitting retainers to ensure a good oil seal.

If joint appears to bind, tap lightly with a wooden mallet, which will relieve any pressure of the bearings on the end of the journals. When replacing sliding joint on shaft, be sure that trunnions in sliding and fixed yoke are in line. This can be checked by observing that arrows marked on splined sleeve yoke and splined stub shaft are in line. It is advisable to replace cork gaskets and gasket retainers on spider journals, using the tubular drift shown in Fig. 6.

## 8. To Replace Shaft Assembly.

Wipe companion flange and flange yoke faces clean, to ensure the pilot flange registering properly and joint faces bedding evenly all round. Insert bolts, and see that the nuts are evenly tightened all round and are securely locked. Dust cap to be screwed up by hand as far as possible. Sliding joint is always placed towards front of vehicle.

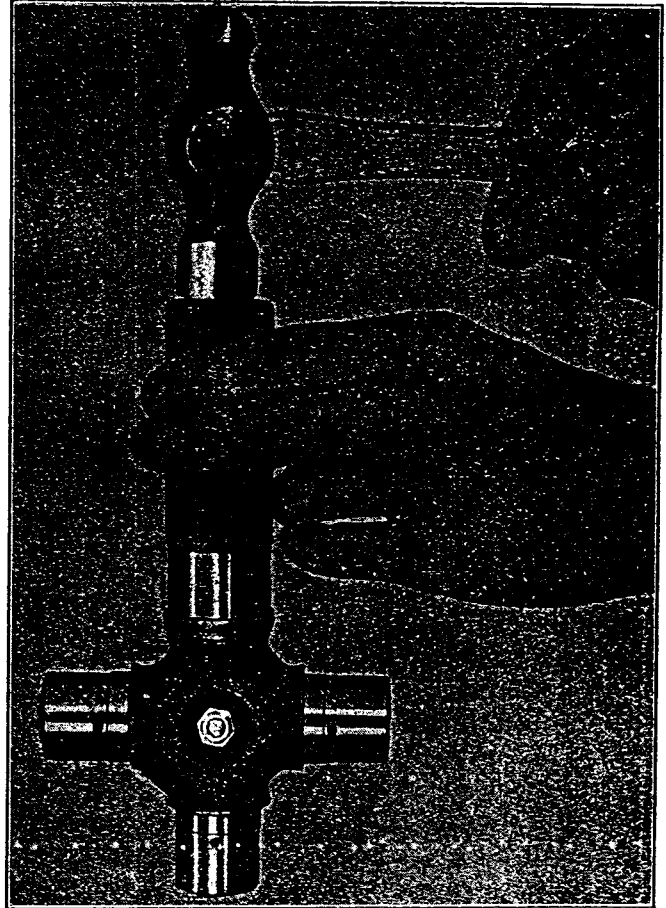


Fig. 6.

Tapping an oil seal into position. Care must be used to see it is well home yet undamaged. A tubular drift must be used.

## COLUMN AND BOX.

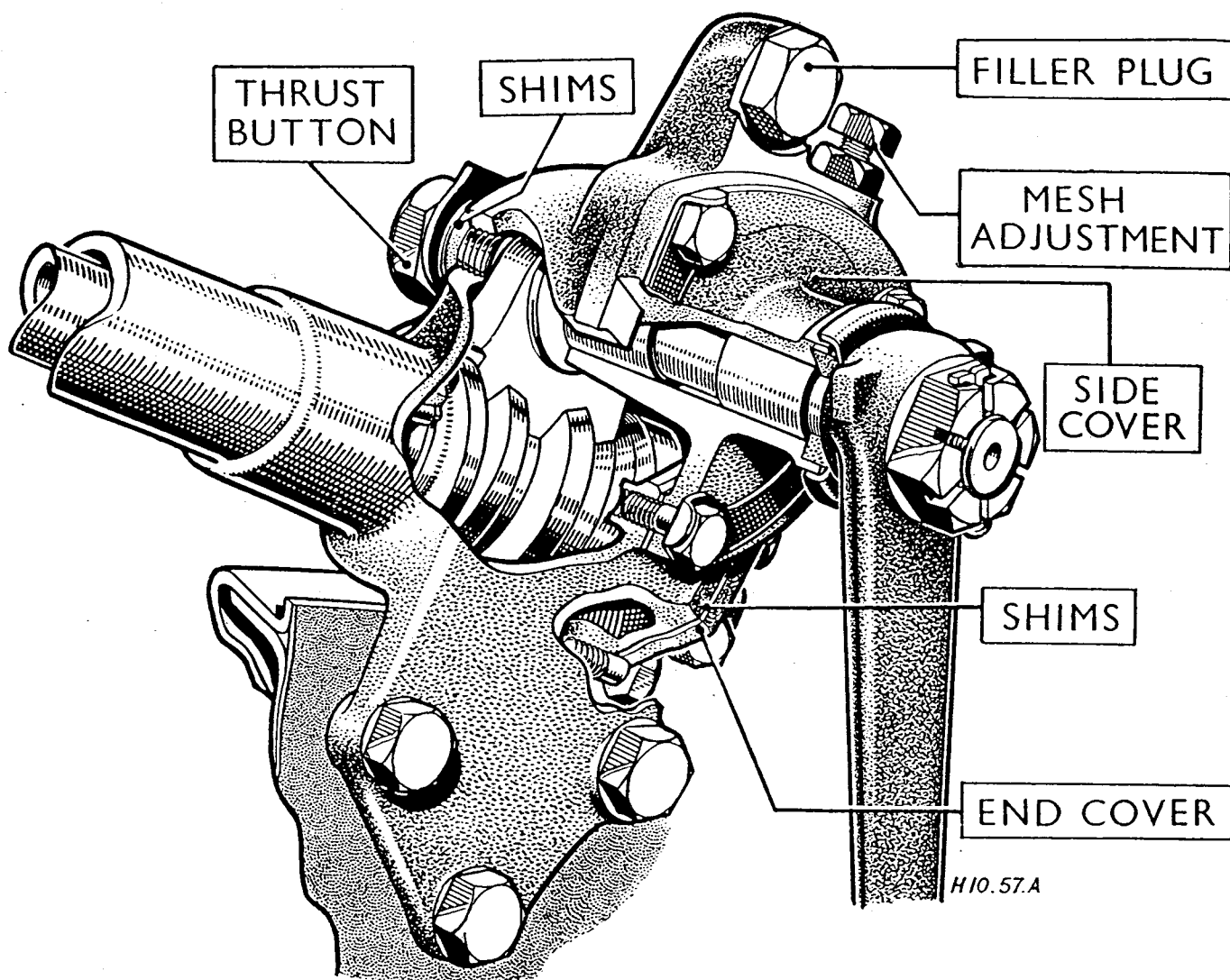


Fig. 1.  
A Sectional View of Steering Box.

### Steering Type.

This steering box is of the Worm and Sector type, and is mounted well to the front of the chassis frame.

Facilities are provided to adjust end play at the worm, end play in the sector, and also the mesh of the worm and sector.

All working parts are immersed in oil. A felt bush is fitted in the top of the steering column outer tube and serves as a third steady bearing for the inner column. The steering arm is attached to the rocker shaft by a fine tapered spline.

Connection to the swivel arm is by means of the side rod with ball and socket joints.

To remove the steering it is advisable to first remove offside front mudwing (see page U/2) and road wheel.

### Maintenance.

An oil filler plug is provided at the top of the steering box casing. C.600 oil should be used. Grease should not be used under any circumstances.

The top bush in the steering column outer tube is impregnated with graphite and no lubrication should be necessary, but if after long periods a dry squeak develops, this may be cured by a small application of oil.

Check that the steering arm and ball ends are tight and that the bolts securing the steering box to the frame are tight.

### To Remove Horn Button and Trafficator Switch.

1. Slacken nut of clamp bolt in end cover (Fig. 6) of steering box and release snap connector of

horn cable (which passes through centre of steering column).

2. From inside the cab, the trafficator switch plate carrying the horn button can be pulled away from the steering wheel centre and the full length tube removed through the back of the cab.

To replace the trafficator and horn button tube, give it a turning movement as it goes down the column to help it past the felt pad near the top and also the cork oil seal in the end cover. If the column has been removed from the vehicle, it can be held vertically, which will help in threading the horn cable through the end cover. This cable should be cleaned of any oil which it may have collected when dismantling. When the tube is in position it will protrude through the end cover, and the clamp bolt should then be tightened to secure it in position.

If electric trafficators are in use, as on early models, the locating plate under steering wheel nut must be adjusted for cancelling operation at each lock.

#### To Remove and Refit Steering Wheel.

1. After removal of the central tube and trafficator switch, the steering wheel nut is accessible. Remove nut with box spanner and also take out the trafficator operating arm if it is of the type clamped under the central nut. Some models, however, have a projection cast on the inside of the wheel hub for locating purposes.

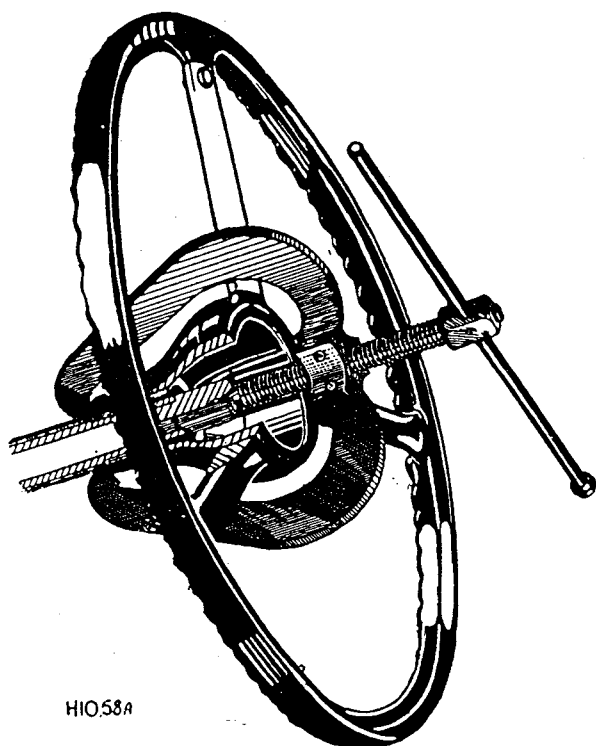


Fig. 2. Removing Steering Wheel.

2. Remove Steering Wheel by use of an extractor shown in Fig. 2.

3. Replacement is a reversal of the above order of operations, tapping the centre of the wheel on to the splines and securing with the nut.

#### To Remove and Refit Outer Tube Top Bush.

1. Remove steering wheel.

2. Open spring retaining ring and slide upwards clear of shaft.

3. Pick out old felt bush.

4. Insert new felt by rolling to form a bush and inserting the corner of the felt into the shaft and outer tube. The remainder of the bush can then be inserted gradually with the aid of a screw-driver. Graphite should be applied to the side of the felt strip which makes contact with the steering shaft.

5. Replace spring ring.

6. Refit steering wheel.

#### To Remove Steering Arm.

1. Turn the steering wheel to the equivalent of full offside lock. The sector inside will then be up against the box itself.

2. Remove the split pin from the steering arm securing nut and then unscrew the nut itself; as the sector is up against the casing there will be no damage to the worm when pressure is applied to the nut.

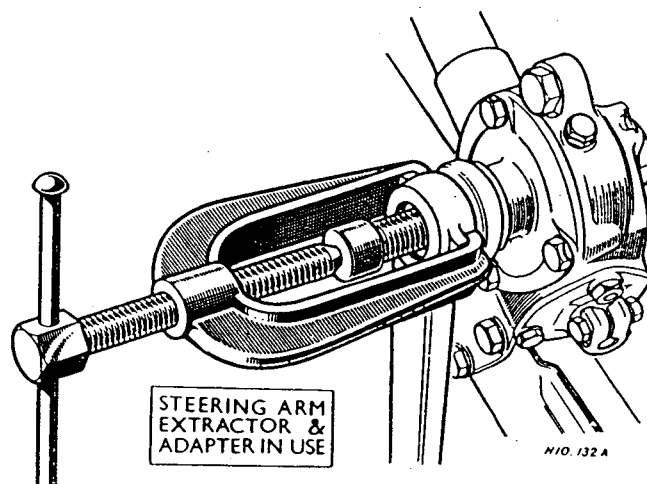


Fig. 3.

A typical Extractor in use. Steering arm may be withdrawn without disturbing Box Mounting if required.

3. Withdraw steering arm with an extractor as illustrated.

**To Replace Steering Arm.**

1. When replacing the steering arm on steering cross shaft it is essential that it is fitted to the correct spline in order to secure full steering lock to both left and right. The arm and the shaft end are marked as shown at "A" in illustration and the arm must be fitted so that the marks are in line.

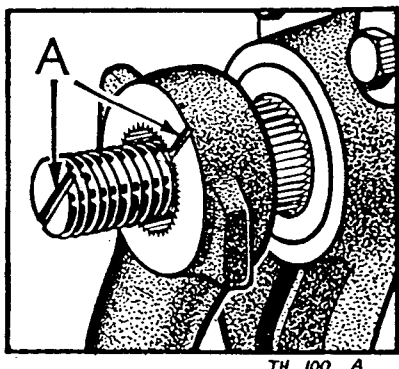


Fig. 4.

Lining up Arm and Shaft.

**Removal of Box and Column.**

1. Remove steering column clip under instrument panel and also the two draught excluder plates where the column passes through front of cab.
2. Take away off-side bonnet panel.
3. Remove front off-side road wheel.
4. Disconnect steering side rod from the bottom of steering arm.
5. Remove the three bolts which hold the box to chassis side member, when the box and column complete can be lifted from the chassis and withdrawn forward.

**Refitting.**

Refit box and column to vehicle before replacing steering wheel.

**End Play Adjustment.**

To take out end play or stiffness in the movement of the sector itself, take out the thrust button from the back of the box ; it is locked in position with a tab washer. Take out or add shims under this thrust button until the required adjustment is secured, then securely lock up with the special tab washer, which also locates on projections in the casting.

**To Remove the Sector.**

1. Mount the steering column in a vice for convenience of working, but take care not to hold it sufficiently tight to damage the tubular column. Mount near the box end and support the other end of the column.
2. To remove sector knock back lock washers take out the three setscrews and lift side cover and paper washer, followed by shims. The sector can then be lifted out.
3. Examine the side cover for damage, such as a distorted face where it bolts to the box. Also check fit of sector in the bushes, and examine the inside thrust washers and the felt washer on the outside of this bearing. Any damage must be made good by replacement, as ill-fitting parts here may lead to loss of oil as well as possible inaccurate meshing of gears.

**Replace Sector and Side Cover.**

1. Screw the adjusting bolt well out of the way and replace sector and end cover assembly, noting that thrust washer is fitted with chamfer facing sector. Take particular care to note that the oil hole, drilled through the bearing boss and down to the shaft bearing, faces the steering wheel end of the box.
2. Screw down the nuts on side cover and, with steering wheel again temporarily refitted, turn to full nearside lock and replace steering arm, noting the correct spline fitting (see Fig. 4). Tighten nut and refit split cotter.
3. Turn steering wheel till the steering arm is approximately in the centre of its travel—equivalent to road wheels in straight ahead position. In this position there should be no lost motion between wheel and arm but there should be no binding.

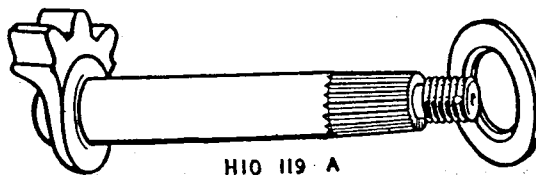


Fig. 5.

Make certain that Thrust Washer is fitted with chamfered side against sector gear.

### Mesh Adjustment.

1. Slack off the side cover screws and tighten or slacken mesh adjustment bolt until there is no lost movement between the sector and the worm with the steering arm in the central position. There will be a certain amount of slackness on both full locks; this is in order. Lock up cover screws, and screw down mesh lock nut.

### The End Cover.

1. To remove End Cover take out two studs and remove the remaining nut. NOTE: There is a paper washer and also shims under this cover. The cover itself also contains a cork oil seal held in position with a steel retaining washer. See this seal is in position and that it is a good fit over the horn button tube which it normally houses.

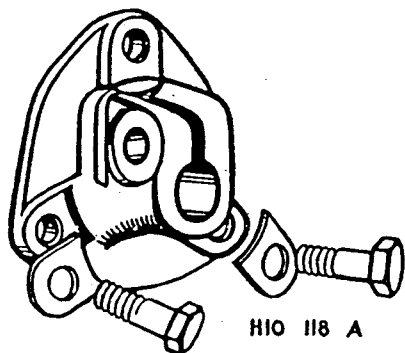


Fig. 6.

Replace End Cover with clamp bolt uppermost.

### To Remove Inner Column and Bearings.

Remove steering wheel.

Remove side cover and sector.

Remove end cover.

A light tap with a hide hammer on the end of the steering column will drive out the worm, bringing with it the bottom end roller bearing race and its outer ring. Examine the race for signs of damage. The outer ring of the top race will remain in the box unless deliberately prised out, but the roller cage should follow the worm and shaft when these are extracted from the bottom.

2. The worm should be closely examined for scores and indentations and should also be closely tested for end play on shaft. The worm is secured by a spring ring at the bottom, but if there is any noticeable end play—loose up-and-down movement—the worm and shaft complete must be replaced with a new one.

### To Replace the Column.

1. When replacing the inner column take care not to displace the felt ring and its steel retainer which is near the top of the outer column—manipulate the inner column past this "obstruction." There is also a similar felt seal inside the inner column—see this is in place before finally inserting the trafficator and horn tube after refitting the steering wheel.

2. Shims must be fitted under the end cover until there is no perceptible end play in the column although there must be no stiffness of movement—allowing of course for slight binding due to the felt insert in the column.



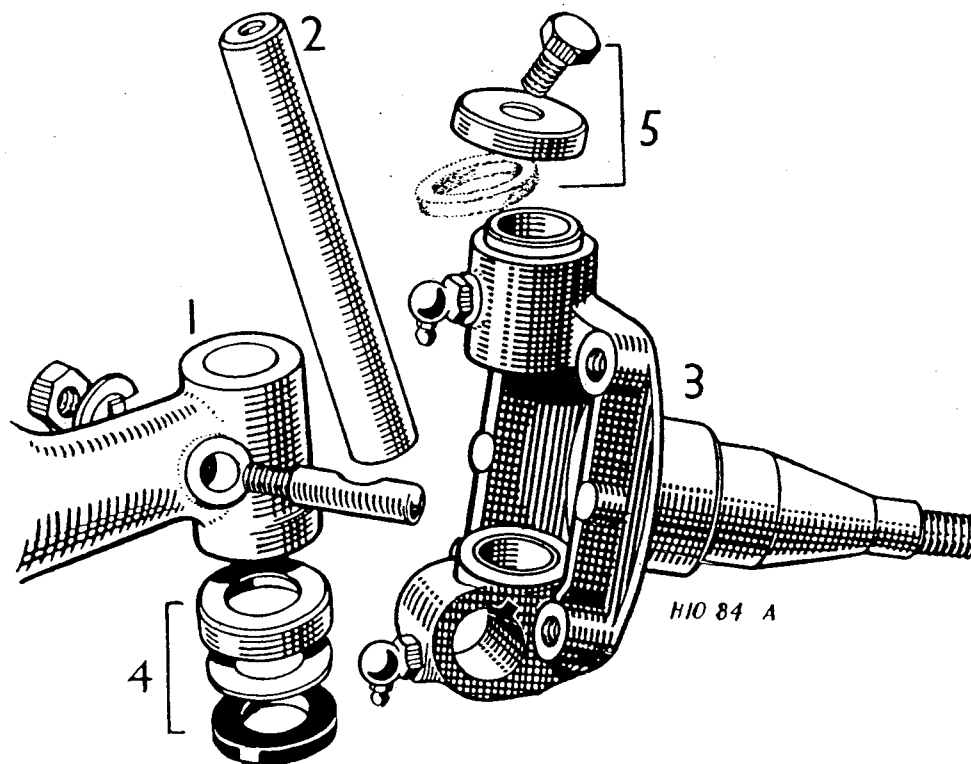
**THE SWIVEL AXLE.**

Fig. 1.

1. Swivel Pin Housing.  
2. Swivel Pin.

3. Swivel Axle.  
4. Lower Thrust Assembly.

5. Set Screw and  
Felt Washer Assembly.

The above illustration shows an exploded view of the Swivel Axle, and it should be noted that the design of the cotter securing the swivel axle pin is such that it cannot be driven out till the pin itself is withdrawn—it must only be slackened first.

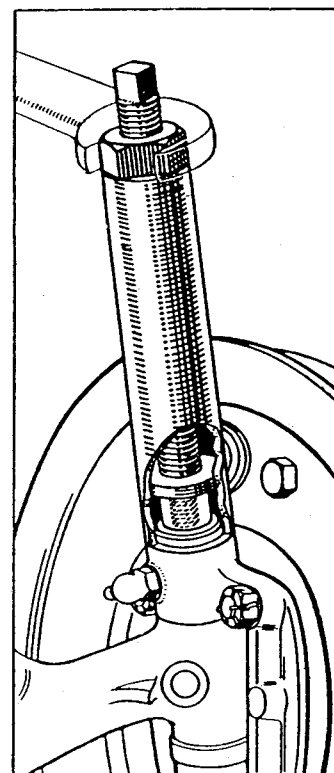
**Withdraw Swivel Pin.**

1. Jack up and remove wheel.
2. Take out set screw from top of swivel housing and remove cover and felt ring.
3. Slacken nut of cotter securing the swivel pin.
4. With an extractor which will screw into the internally threaded end of the swivel pin (as shown in illustration), screw up and withdraw the pin.
5. Retrieve the lower thrust washer, felt pad and cover.

Fig. 2.

Using a Swivel Pin  
Extractor.

If brakes are still in position, remove brake drum and screw in adjuster to clear swivel pin.



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## THE SWIVEL AXLE—continued.

### Re-assembling.

If new bushes are to be fitted the welch plug must be driven out of the bottom of the swivel axle, when the bottom bush can be tapped out. When new bushes are fitted they must be reamed in line with the special reamer included in the Service Tools List. Use a new welch plug and see

that it is expanded into the groove in the housing. It is essential to ensure that the Swivel Pin cotter through the axle is locked up tightly, otherwise the pin may turn in the axle beam when on the road, thus creating wear and consequent slackness in the axle beam which may necessitate scrapping the axle.

### Front Wheel Track.

When the steering rod and cross rod are connected up, test for front wheel alignment.

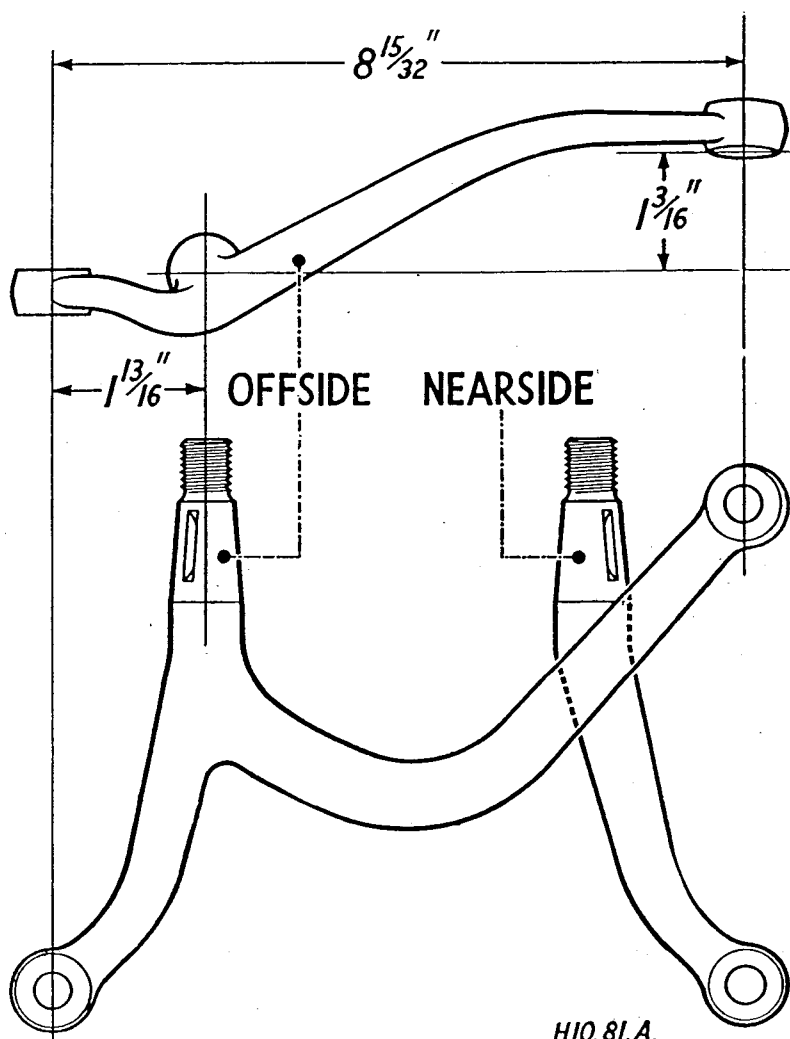
With the wheels in the straight ahead position, take measurements at the edge of the rim at axle height. The rims should be  $\frac{1}{8}$ -in. closer in front than at the rear. Any deviation from this can be corrected by slackening the lock nut at each end of the cross rod and rotating the cross rod; the ends are threaded right- and left-hand respectively, and by this means the wheels are re-set to the required position.

It should be understood, however, that should the wheels require more than slight adjustment it is possible damage to swivel arms has been sustained. In this case re-adjustment at the cross rod is not a cure, as the steering geometry will be upset, causing heavy tyre wear and inaccurate steering. In this case make a quick check as shown in Fig. 4, and if necessary then remove arm and make a fine check with dimensions shown in Fig. 3. Damaged arms must be renewed and not corrected by bending.

### THE SWIVEL ARMS.

The accompanying drawing shows the swivel arms with dimensions which will enable them to be checked up for damage.

Fig. 3.



### Steering Arms and Toe-in.

Before attempting to adjust faulty toe-in, a check should be made to find the cause of its having become deranged.

If the length of the track rod has not been altered, incorrect wheel alignment indicates that damage has occurred to some component.

If the forward placed track rod steering arms were parallel to one another the toe-in on full lock would be the same as toe-in in the straight ahead position. The swivel arms are set so that their projected centre lines would meet approximately on the centre line of the rear axle, so that on full lock the wheels toe-out. It will thus be seen that if either swivel arm is bent toe-out on full lock will be wrong in spite of the fact that toe-in at straight ahead position is correct. See Fig. 4 for easy check.

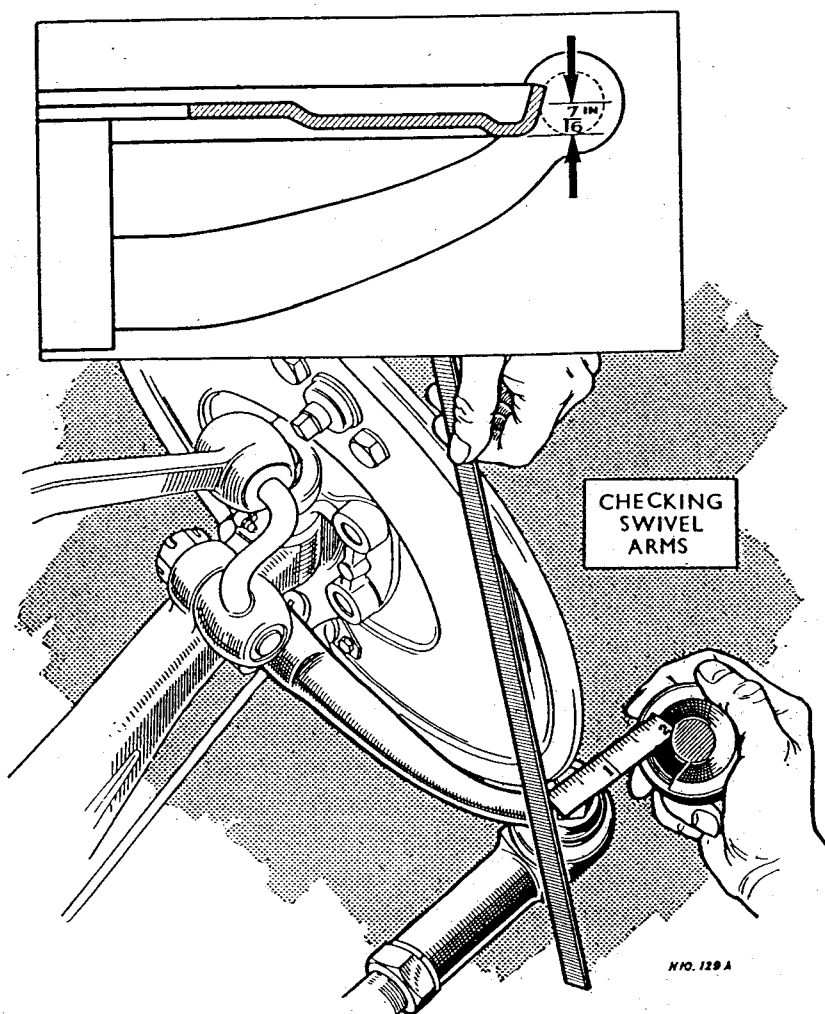


Fig. 4.  
Actual position of the swivel arm relative to the back plate.

**Front Wheel Camber.** This is the outward tilt of the front wheels and should be 1 degree from the vertical. A rough check can be made by measuring the distance from the outside wall of the tyre immediately below the stub axle, to a plumb line, hanging from the outside wall of the tyre immediately above the stub axle. This distance should be the same on both wheels. The correct method of checking is, of course, with a camber gauge. If this measurement is incorrect, either the stub axle or axle beam is bent. If subsequent inspection of the axle beam against the dimensions given in Fig. 3 show that it is in order, then the stub axle is bent or there is serious wear in the steering swivel pins.

**Swivel Pin Inclination.** This can only be checked with a special gauge, or after the axle has been removed. The inclination is shown in Fig. 5 and is  $6\frac{1}{2}$  degrees.

**Caster.** This is the tilt backwards of the axle beam and "set" during manufacture to be correct when the axle is mounted on the springs. Caster is 3 degrees from the vertical.

To check the swivel arm for damage, without dismantling, place a straight-edge across the backplate in such a position that a direct reading can be taken with a rule between the centre of the swivel arm eye and the straight-edge, representing the inside face of the backplate.

If the reading is other than that shown in the diagram the affected arm must be removed. A fine check can then be made with dimensions given in Fig. 3.

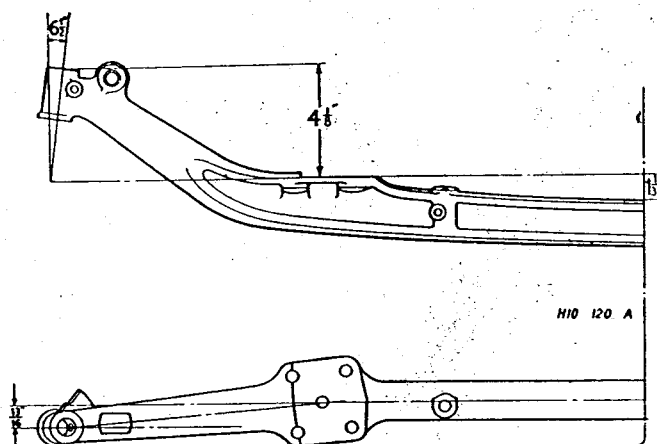
**THE AXLE BEAM AND SWIVEL ANGLE.**

Fig. 5.

The accompanying illustration shows the essential detail of the axle beam and will enable this unit to be checked for possible damage.

The offside half of the front axle is shown, and it will be seen that the axle is not straight, but has a

"set" which brings each swivel-end 13/16th of an inch forward.

The lug for brake compensating swivel and its securing cotter (which is on offside only) is also indicated on drawing.

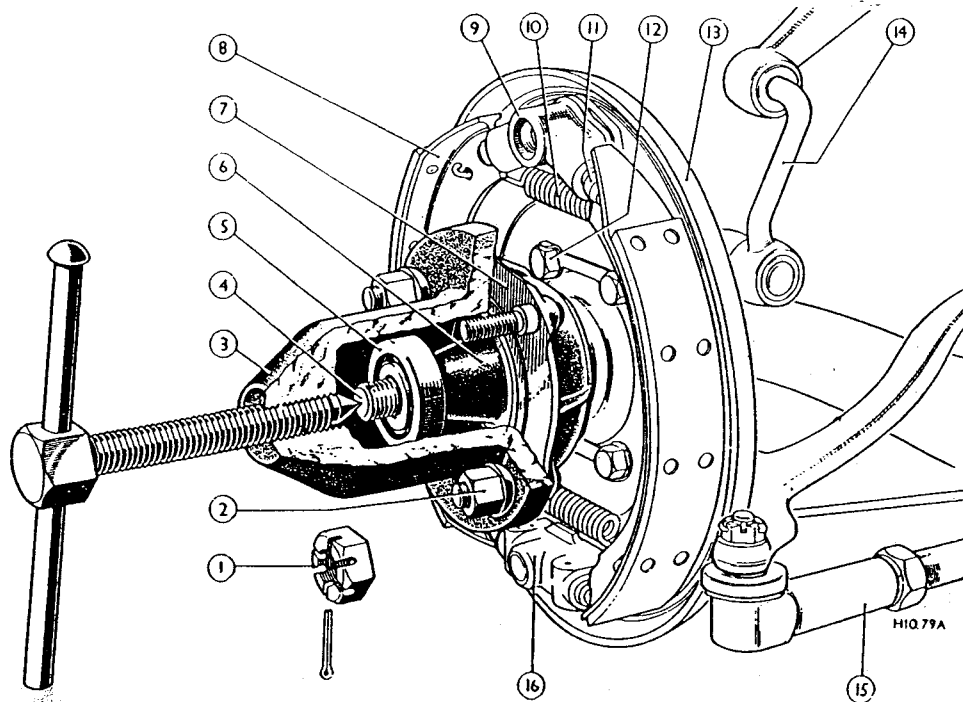
**WITHDRAWING A FRONT HUB.**

Fig. 6.  
Extractor in position.

- 1 Securing Nut and Cotter
- 2 Wheel Stud and Nut.
- 3 Hub Extractor in position.
- 4 Swivel Axle.
- 5 Hub Outer Bearing.
- 6 Distance Piece.
- 7 Hub with studs.
- 8 Brake Shoe.

- 9 Brake Adjuster Housing
- 10 Brake Shoe Spring.
- 11 Expander Plunger.
- 12 Back Plate Setscrews.
- 13 Back Plate.
- 14 Shock Absorber Link.
- 15 Cross Rod Socket Assembly.
- 16 Brake Expander Housing.

**Jacking Up.**

1. Chock all wheels not being operated upon.
2. Jack up axle beam immediately below spring mounting, and remove wheel. (Note that nearside wheel studs have left-hand threads, and offside right-hand threads).

**Brake Drum.**

3. With a screwdriver take out the two screws locating the brake drum; the drum can be tapped off the hub and brake linings provided the hand-brake is in the off position and definitely not adjusted so closely as to bind.
4. Should the linings hold the drum when the brake lever is fully off, it will be necessary to slack back the adjustment a few notches at the adjusting unit. (See page R/2, Fig. 3).

**End Cover.**

5. To remove hub end cover, it will be necessary to force a screwdriver between its joint with the hub.
6. There is a paper washer here, and when re-assembling it will be necessary to use a new washer.

7. The hub cover should be prised off a little at a time from each side.
8. Remove split cotter from hub nut exposed and then remove nut.

**Using the Extractor.**

9. The extractor is supplied complete with a loose adaptor; the adaptor is not required for the front hub.
10. Fit hub extractor over the wheel studs of the hub and replace the wheel nuts, seeing that the extractor bolt is well screwed back to allow the extractor to fit close up to the hub.
11. Applying a spanner or tommy bar, screw up the extractor bolt. The hub will be withdrawn complete with outer and inner bearings, distance piece and washers. Fig. 7 will make clear the actual order of these parts when assembled.
12. The inner bearing can be tapped out of the hub with the end of a drift such as Service Tool FJ5434 (See page V/3). The bearing is refitted with the same tool.
13. Hand pack bearings and hub with Grease No. 2.

**FRONT HUB—continued.**

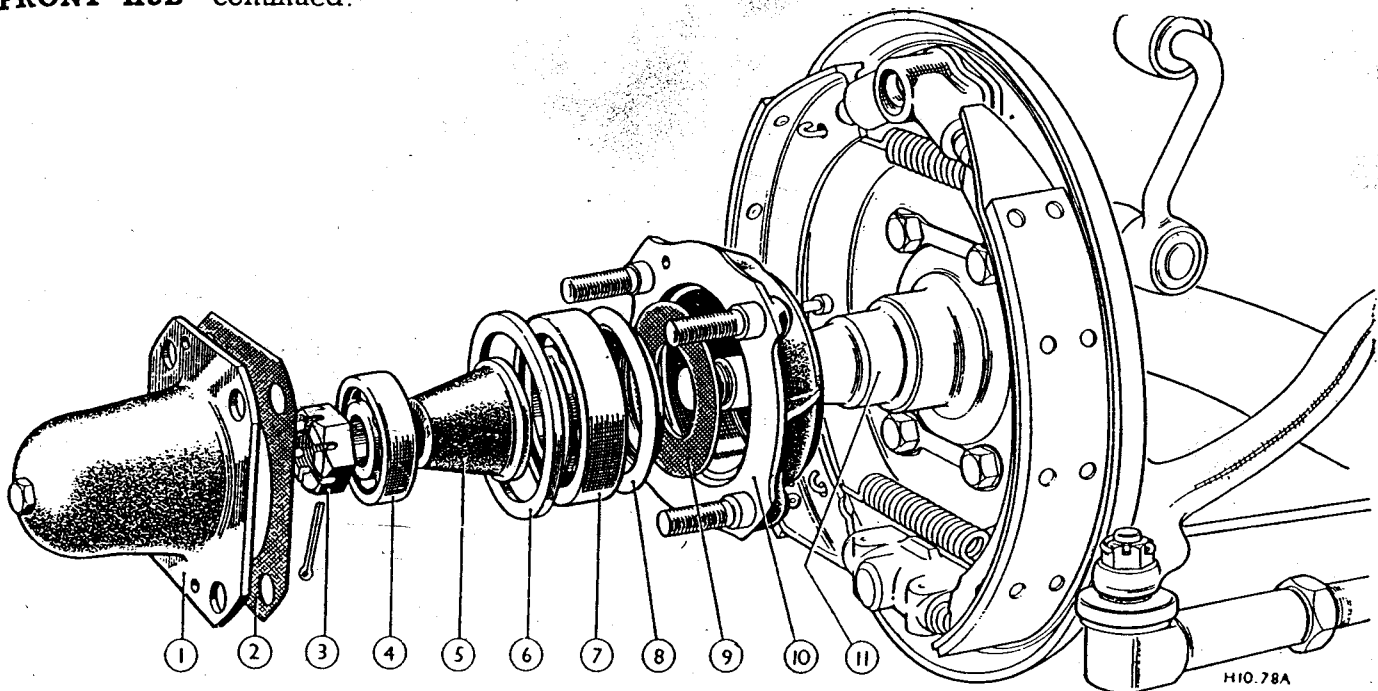


Fig. 7.

**Order of Assembly of Front Hub.**

- 1 Hub Cover
- 2 Joint Washer
- 3 Nut and Cotter
- 4 Outer Bearing

- 5 Distance Piece
- 6 Packing Washer for bearing
- 7 Inner Bearing
- 8 Distance Ring

- 9 Oil Retainer
- 10 Hub with studs
- 11 Swivel Axle

**Re-Assembly.**

1. The hub bearings are not adjustable; the inner races are locked tightly on the swivel axle by the outer nut, which is then split-pinned for security.

2. If bearings are in good condition there will be no noticeable slackness when assembled. If it is possible to rock the wheel, then the bearings must be renewed complete.

3. Replace washer, hub cover and brake drum, ensuring that the two small holes in each of these three components is in line for inserting the two small screws. Temporary use of the wheel nuts will assist in ensuring that the hub cover and drum are well home to enable the screws to be properly tightened.

4. Fit wheel and finally tighten nuts.

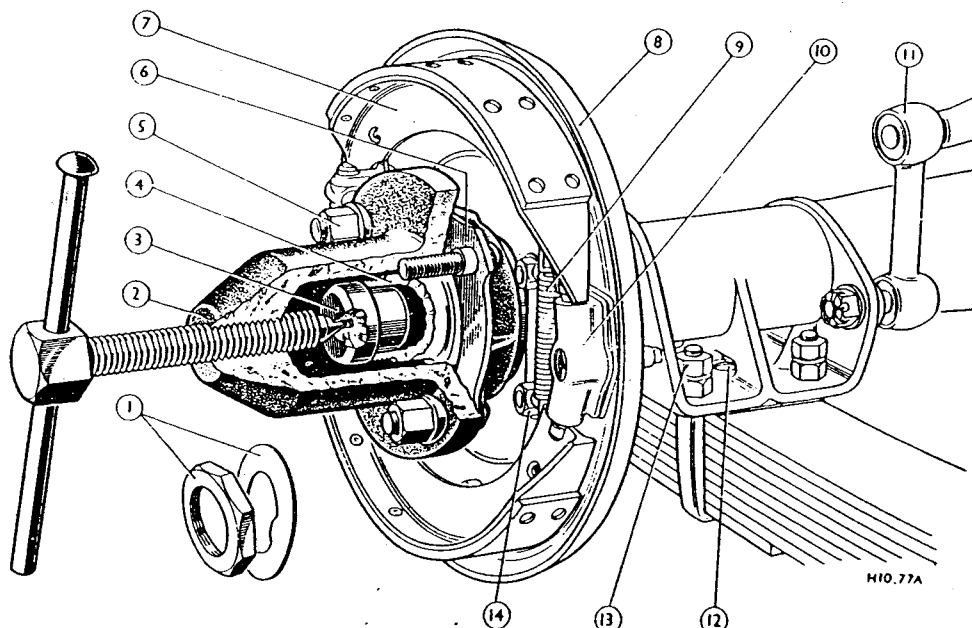


Fig. 1.

Extractor in position.

- 1 Hub Lock Nut and Washer.
- 2 Hub Extractor in position.
- 3 Extractor Adaptor in position.
- 4 Axle Tube End.
- 5 Wheel Stud and nut.
- 6 Hub with studs.
- 7 Brake shoe.

- 8 Brake Back Plate.
- 9 Brake Shoe Spring.
- 10 Brake Adjuster Housing.
- 11 Shock Absorber Link.
- 12 Hole to take spring centre bolt.
- 13 Spring Clip Lock Nut.
- 14 Back Plate Setscrew.

### Axle Shaft.—To Remove and Replace.

1. Chock all wheels not being operated upon.
2. Jack up under spring as closely as possible to axle.
3. Remove wheel (note there are left-hand threads on nearside studs, and right-hand threads on offside).
4. Take out the two drum locating screws, using a screwdriver. The drum can be tapped off the hub and brake linings provided the handbrake is in the off position and not adjusted so closely as to bind.
5. Should the linings hold the drum when the brake lever is fully off it will be necessary to slack back the adjustment a few notches at the adjusting unit. (See illustration of adjusting unit, Fig. 3, R/2).
6. Draw out axle shaft by gripping the flange outside hub; it should slide out easily, but should

it be tight on the studs it may need gently prising with a screwdriver inserted between the flange and the hub. Should the paper washer be damaged it will need to be replaced with a new one when re-assembling.

Replacement is a reversal of the above operations.

### Hubs.—To Withdraw and Replace.

Remove wheel and axle shaft as above.

7. With the shaft removed the hub retaining nut is accessible. This nut is locked in position by a keyed washer which is hammered down on to one of the flats of the nut. Knock back washer and remove nut with well-fitting spanner, such as Service Tool No. FX.4400.

8. Lockwasher can be removed by hand by tilting it so that the key disengages with the slot in the threaded portion of the axle case.

9. To use the extractor on the rear hub, the adaptor (3, Fig. 1) will be needed. It will be seen this piece fits into the end of the axle tube and provides a stop for the extractor bolt when this is screwed up.

10. The extractor is fitted over the wheel studs and the nuts should be screwed well down. By screwing up the central bolt of the extractor, using either a spanner or a tommy bar, the hub and double-row ball bearing, together with washers and oil seal, will be withdrawn. The actual order of assembly will be seen in Fig. 2.

The bearing can be tapped out of the hub with the aid of a drift such as Service Tool FJ5434 (See page V/3).

11. When assembling, bearings must be packed with Grease No. 2. Rear hubs receive some lubricant from the axle during normal running.

#### Re-assembly.

1. The hub bearing is not adjustable.

In latest models a Standard Double Row Ball Journal Bearing supersedes the Special Double Row Double Purpose Ball Bearing with split outer race.

2. With the early type the loose race is first pressed into the hub together with the distance piece and oil retainer in the order shown in the above illustration. The ball cage and second half of outer race complete follows into the hub, the

special drift listed in Service Tools being useful for this operation. The later type bearing is replaced in one operation.

It is essential that the face of the outer race protrudes .001-in. to .004-in. beyond the face of the hub plus paper washer when the bearing is pressed into place. This is to ensure that the bearing is definitely gripped between the abutment shoulder in the hub and the flange of the differential shaft. This is important.

3. Hub is then mounted on axle tube, followed by lock washer (which has a tongue to register with groove or hole) and finally the securing nut.

4. Tighten up nut till hub is fully home, and then secure by hammering down lock washer on one of the flats of the nut.

5. Replace axle shaft, carefully finding the spline fitting and also ensuring the flange and washer is threaded over the hub studs in the position in which the two small holes of the flange and hub coincide. Then re-fit the brake drum, taking the same precaution regarding the two small holes, and ensuring the drum is well home when inserting the screws. (Fig. 5, page R/3). Temporary use of the wheel nuts will assist.

6. Replace wheel and finally tighten nuts.

#### Lubrication.

Hubs should be dismantled and hand packed with fresh Grease No. 2 every 5,000 miles.

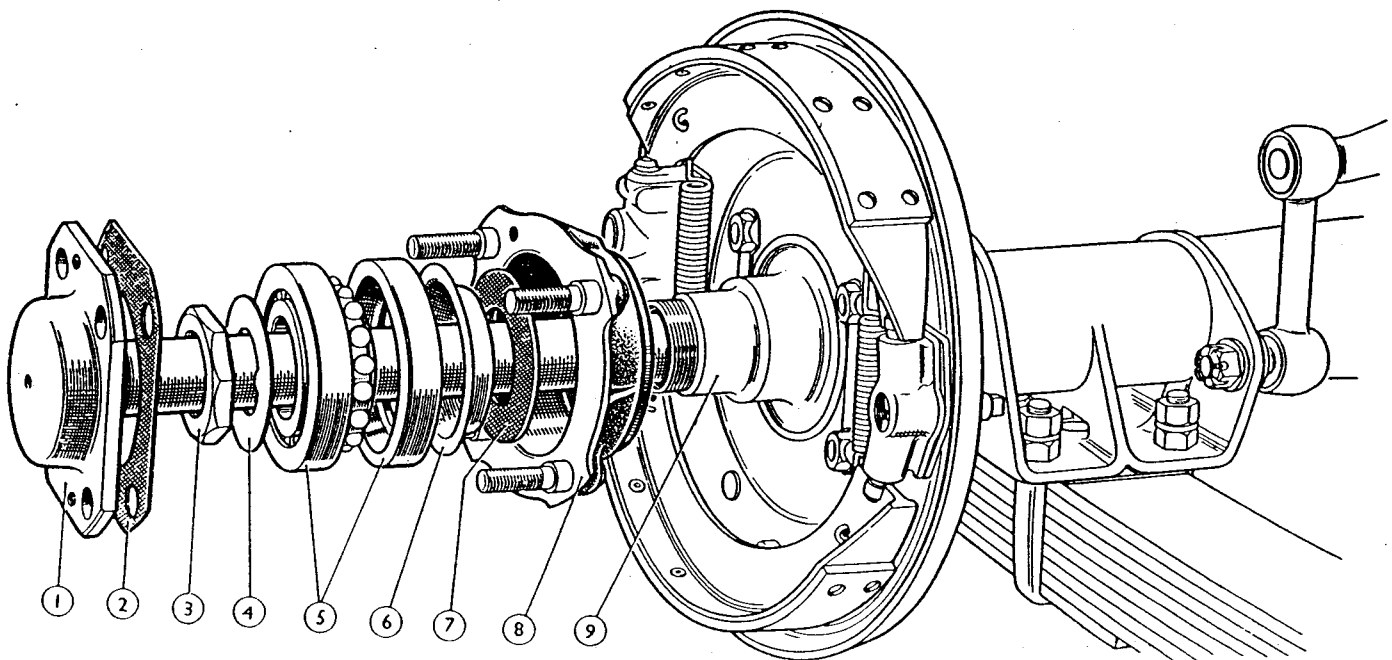


Fig. 2.

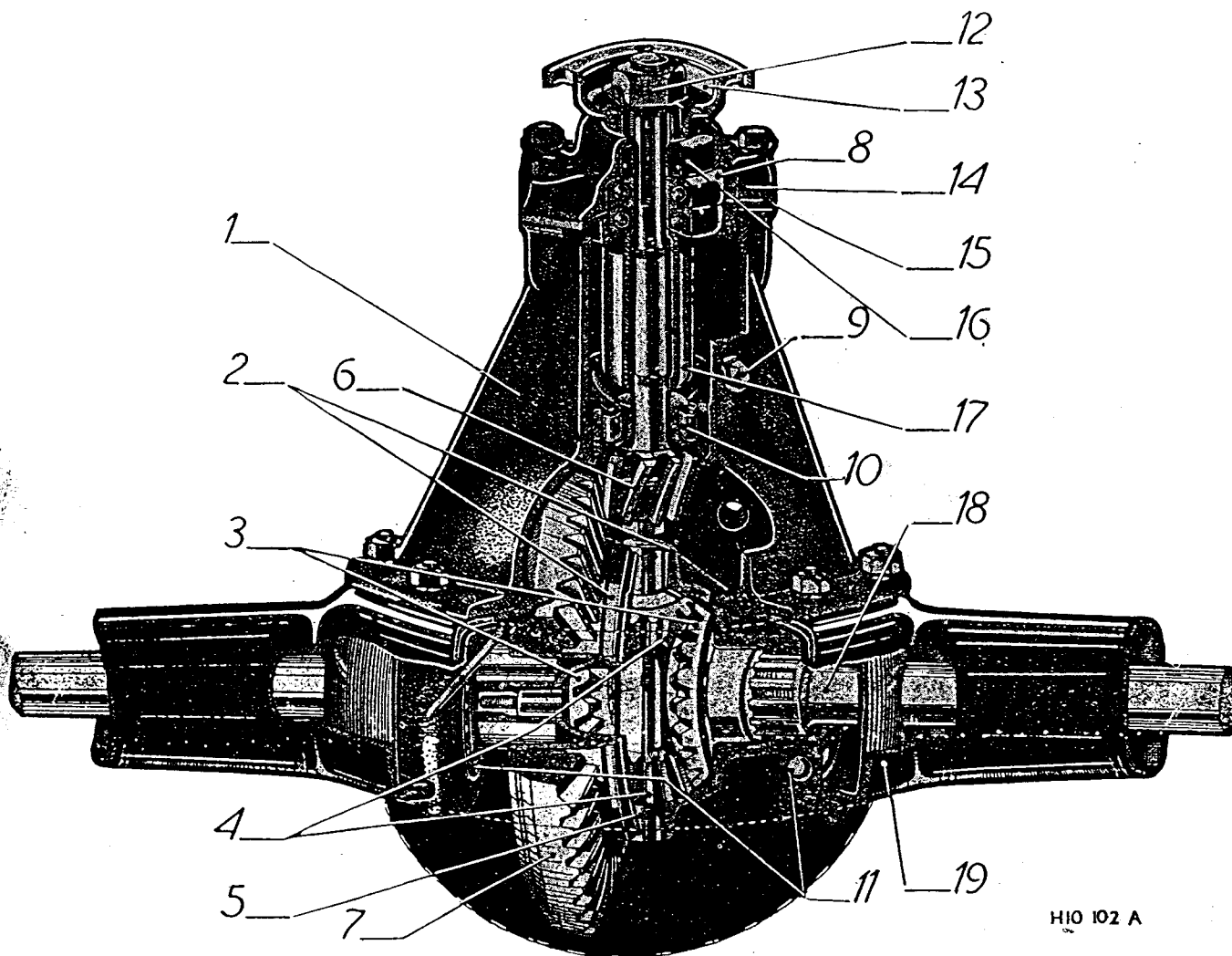
#### Order of Assembly of a Rear Hub.

- 1 Axle Shaft Flange.
- 2 Joint Washer.
- 3 Hub Lock Nut.
- 4 Lock Washer.
- 5 Split-Race Bearing.

- 6 Distance Ring.
- 7 Oil Retainer.
- 8 Hub with studs.
- 9 Axle Tube.



## THE DIFFERENTIAL.



H10 102 A

Fig. 3.

- 1. Gear Carrier.
- 2. Differential Case.
- 3. Differential Wheels.
- 4. Differential Pinions.
- 5. Differential Pinion Centre.
- 6. Bevel Pinion.
- 7. Crown Wheel.
- 8. Split Race Ball Bearing.
- 9. Bearing Retainer Screw.
- 10. Pinion Roller Bearing.

- 11. Ball Bearing.
- 12. Flange Nut.
- 13. Propeller Shaft Flange.
- 14. Bearing Cover.
- 15. Sleeve for bearing.
- 16. Oil Seal.
- 17. Pinion Sleeve.
- 18. Axle Driving Shaft.
- 19. Axle Case Stiffener.

## Bevel Pinion.—To Renew Oil Seal.

7. This oil seal can be renewed with the axle in position.

8. Jack up vehicle under chassis side members in front of spring mountings, and not under springs or axle. Raise vehicle till wheels are clear of the road and remove wheels.

9. Take out the four bolts of propeller shaft flange to axle pinion flange.

10. Remove large nut in centre of pinion flange after knocking back lock washer, and then withdraw the flange itself. A flange puller tool can be used, but it should be possible to tap the flange off the splined pinion shaft.

11. Remove the six set pins from pinion end cover after knocking back the tab washers; the end cover can now be withdrawn.

12. The oil seal is pressed into this end cover, but can be removed with a punch. Never remove an oil seal from the end cover unless it is intended to replace with a new one, as it is invariably distorted in removal.

13. The new oil seal must be carefully pressed home, with the edge of the rubber or leather sealing ring facing inwards.

14. Replace end cover, lock up the six set pins when thoroughly tightened, and replace the pinion flange, serrated washer, and nut. This nut must be fully tightened and finally locked in position by punching up the washer.

## Pinion and Bearings.

15. The pinion complete can be withdrawn while the end cover is removed as described above for oil seal replacement.

16. When the cover is detached, prise off the sleeve for pinion bearing and take away the shims found in this joint. Shims must be replaced as found.

17. Examine the double-purpose ball bearing housed in this sleeve; it is of the split outer race type and easily inspected. One of the races is a drive fit into the sleeve. If the bearing is to be replaced, this must be done complete with new races.

18. To withdraw the pinion itself, first remove the small retaining screw in the side of the differential case. It is locked in position with a small locating washer, and its purpose is to locate the roller bearing.

19. Before the pinion is withdrawn the loose collar or adjusting sleeve can be slid off.

20. The pinion bearing is a drive fit on the shaft, and its outer race is pressed into the gear carrier. The bearing can be driven off the pinion shaft and the race tapped out of the case for renewal or extracted by means of Tool F.J.5766. (See Service Tools Section). The race must be driven in far enough to just clear the retaining screw when being replaced.

## To Withdraw the Carrier.

1. The bevel gear carrier unit can be withdrawn with the axle in position. Withdrawing the bevel gear however first entails removing the propeller shaft and then the axle shafts (for which latter operation the road wheels and brake drums must also be removed. (See Fig. 1, O/1).

Also remove drain plug and run the oil into a suitable receptacle.

2. To withdraw the bevel gear unit, take out the ten set pins which hold the gear carrier to the axle case, and lift out the carrier complete.

## To Replace Carrier.

1. The differential carrier is refitted into the axle case and secured by replacing the ten set screws, but using a new paper joint washer.

2. When all bolts have been tightened the axle shafts (which are interchangeable) can be threaded through the hubs and secured on to the four wheel studs. If the splines do not engage at once thus preventing a shaft going right home, it should be given a half-turn while pressure is still applied. When connecting up propeller shaft use new lockwashers under the four nuts. Replace axle drain-plug and re-fill with oil.

## Crown Wheel.—To Remove.

3. Remove the four nuts and spring washers from the main bearing caps. Ease off the bearing caps, after which the crown wheel complete with differential carrier can be lifted out of the gear carrier.

4. To detach the crown wheel knock back lock-washers, remove the eight bolts.

5. The ball thrust races should be a tight fit on each end of the differential case, and if found to be loose a new case will be needed. They should be tight enough to need a withdrawal tool for removal.

### Shaft Pinions.—To Remove.

6. Knock back lockwashers and remove the eight set pins to part the differential case to give access to the differential wheels and axle shaft pinions.

7. The near side half of the differential case (to which the crown wheel is bolted) houses the pin upon which the two differential pinions revolve, and this pin is located in position at one end by a dowel pin protruding from the case. Prise off the pin to detach the pinions.

8. The unit is now fully dismantled and all parts should be checked for scoring and signs of wear.

## RE-BUILDING THE UNIT

### The Crown Wheel.

9. Replace the differential wheels on the pin and assemble the axle shaft pinions. Use new lockwashers when bolting up. To be sure the casing is bolted up in the position in which it was originally machined see that the identification marks are in line. Bolt the crown wheel to the differential case (but see next paragraph before using lockwashers). If new races are necessary take particular care to ensure they are fitted correctly. The word "thrust" which is stamped on one side of the race, should be on the outside.

10. At this stage the crown wheel should be checked for alignment. The crown wheel, differential case and bearings complete should be placed on a pair of vee blocks for this test and a sensitive meter or dial indicator used. The crown wheel should be slowly rotated and measurements taken on the face of the wheel. The crown wheel must not be more than .002-in. out of truth. Any greater irregularity must be corrected. First detach the crown wheel and examine for any slight particles of grit on the flange. When the parts are thoroughly cleaned it is rare to find they do not run true.

### The Pinion Assembly.

11. Build up pinion with bearing, distance piece, new oil seal in bearing cover and replace complete with shims, sleeve, flange, lockwasher and nut. Next place the pinion assembly into its housing in the gear carrier and bolt down pinion bearing cover, but do not knock over the lock washers.

### THE BEVEL PINION MESHING GAUGE.

#### Etched Figures.

1. The last process in the manufacture of bevels is the mating together and running-in of each pair of wheels on a special machine, part of the duty of which is to indicate the correct distance from the ground end of the pinion to the centre line of the axle shafts. As this distance varies from gear to gear a number is etched on the bolting-up face of every crown wheel and on the end face of every bevel pinion as a reference for gauging when fitting the mating pinion.

#### Using the Gauge.

2. With the eccentric gauge the bevel pinion can be quickly located in its correct position relative to the crown wheel.

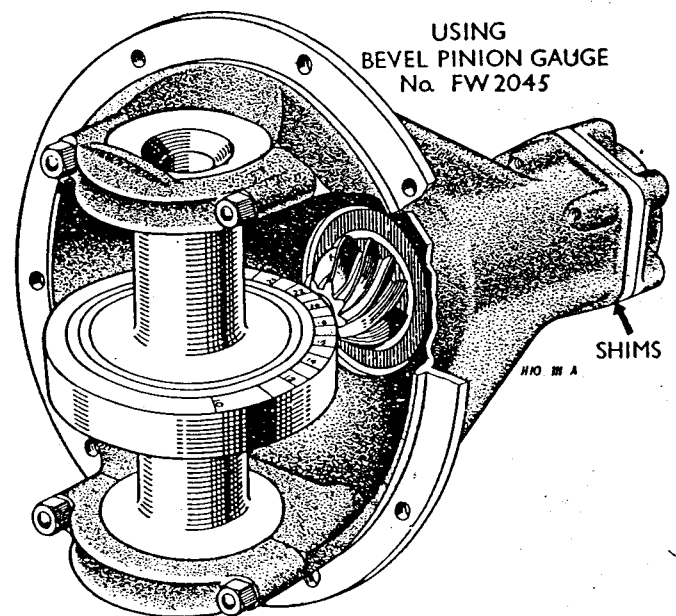


Fig. 4.

3. The gauge is placed in the axle casing bearing housing and rotated until the scale reading corresponds to the number etched on the bevel pinion. Shims are then inserted under the sleeve to secure the bevel pinion in position with the bevel pinion end face tight up against the gauge.

4. The end cover is then finally bolted in position and lockwashers knocked over. Remove bearing caps, take out eccentric gauge, replace differential complete into carrier and secure end caps with the four nuts and spring washers.

5. It must be clearly understood that the use of this gauge is essential when a new pair of Austin mated wheels has been obtained; the setting figure may vary from pair to pair.

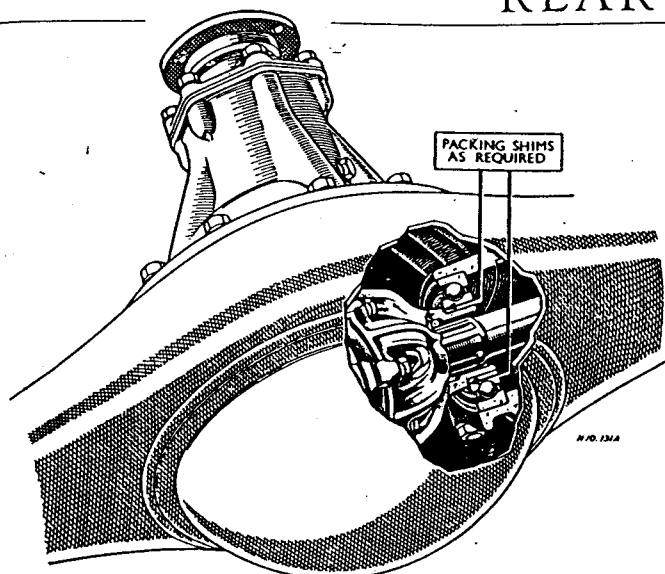
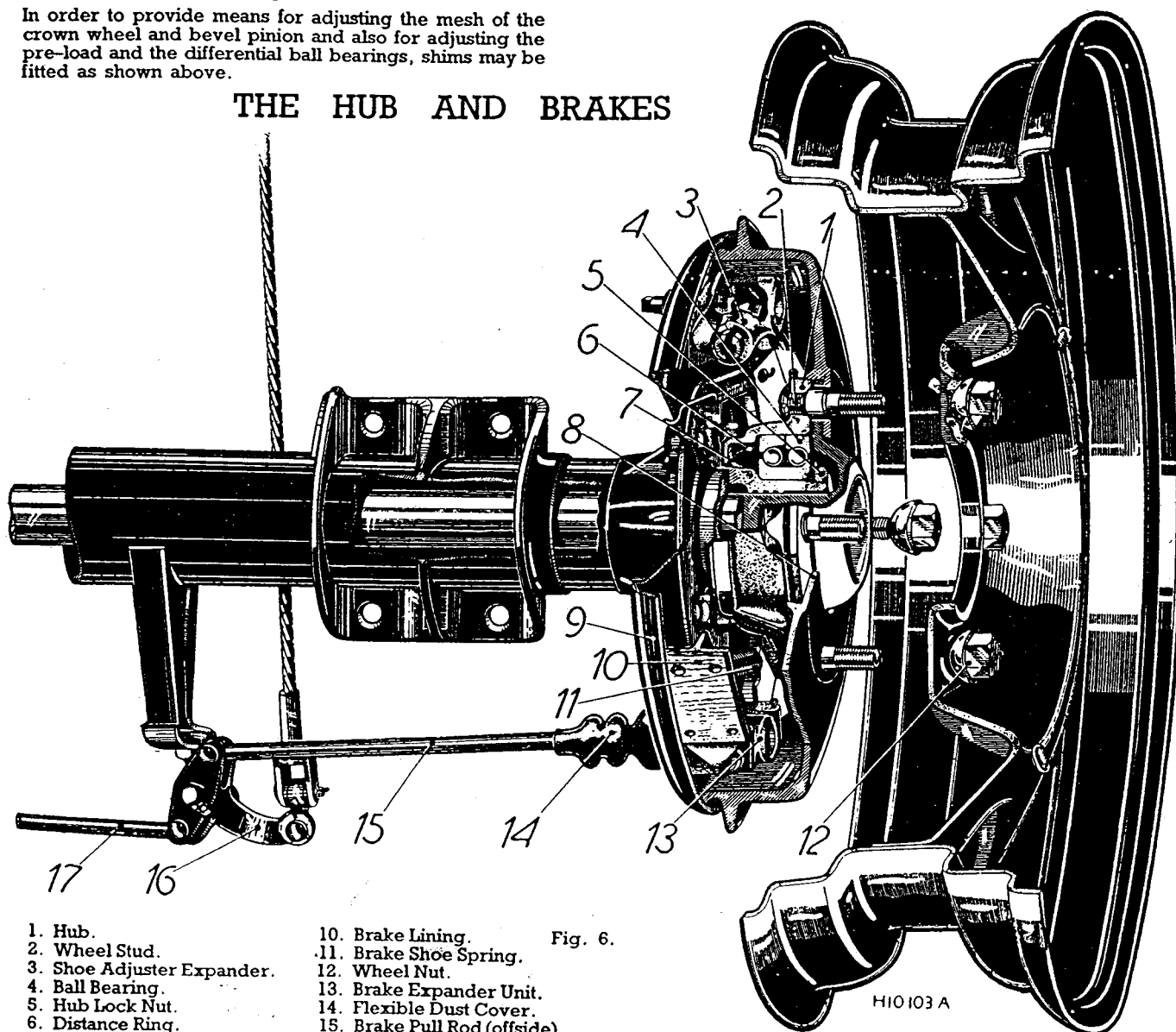


Fig. 5.

In order to provide means for adjusting the mesh of the crown wheel and bevel pinion and also for adjusting the pre-load and the differential ball bearings, shims may be fitted as shown above.

## THE HUB AND BRAKES



- |                            |                                |
|----------------------------|--------------------------------|
| 1. Hub.                    | 10. Brake Lining.              |
| 2. Wheel Stud.             | 11. Brake Shoe Spring.         |
| 3. Shoe Adjuster Expander. | 12. Wheel Nut.                 |
| 4. Ball Bearing.           | 13. Brake Expander Unit.       |
| 5. Hub Lock Nut.           | 14. Flexible Dust Cover.       |
| 6. Distance Ring.          | 15. Brake Pull Rod (offside).  |
| 7. Oil Retainer.           | 16. Brake Balance Lever.       |
| 8. Brake Drum.             | 17. Brake Pull Rod (nearside). |
| 9. Brake Back Plate.       |                                |

Fig. 6.

## TO REMOVE AXLE UNIT.

### Propeller Shaft and Springs.

1. Disconnect brake cable from brake balance lever, and also the shock absorber links to axle. Remove propeller shaft bolts at pinion flange.

2. Remove nuts and lock nuts from spring clips ("U" bolts). Raise chassis as detailed on Page Q/1 until both springs are well clear of axle; axle is then free and can be withdrawn for further dismantling. Carefully remove pad from between spring and axle spring bracket. It has a hole for location over spring centre bolt. In re-assembling, make sure this pad is properly located, in order that the spring pin can fit into the centre hole.

## SPRINGS.

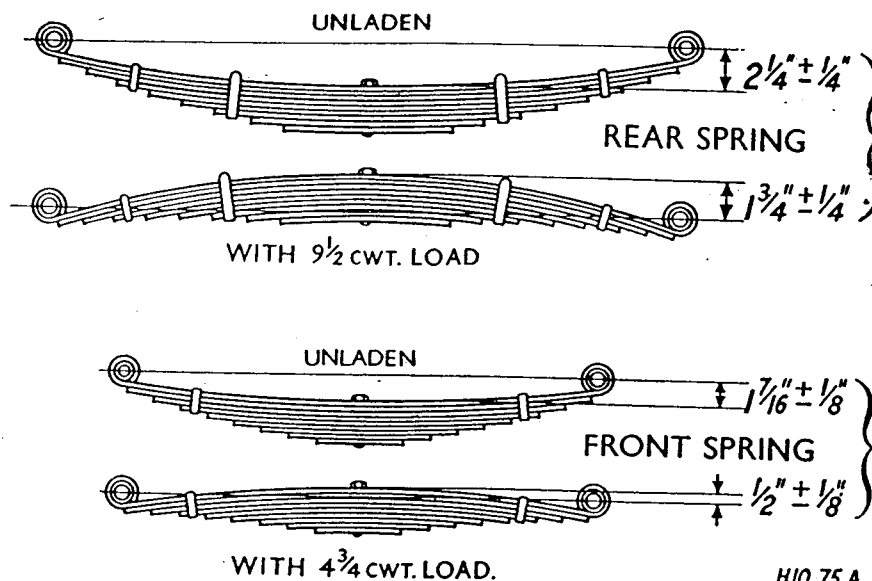


Fig. 1.

**Spring Detail :**

|                         | Front.    | Rear.     |
|-------------------------|-----------|-----------|
| Total Length            | 31-in.    | 43-in.    |
| Free Camber             | 1 7/8-in. | 2 1/4-in. |
| Camber, laden (reverse) | 1/2-in.   | 1 3/4-in. |

**Removing a Spring.**

1. Chock all wheels except the one at spring to be dealt with.
2. Jack up axle till wheel is just clear of ground, and then take weight of frame by packing up to side member with bricks or blocks of wood.
3. Remove wheel, then slightly lower jack to take the tension from spring.
4. Remove shock absorber arm.
5. Using a box spanner release locknuts from the spring clips ("U" bolts), remove spring washers and then holding-down nuts. The spring clips may now be taken away, also the clip pads which are fitted between spring axle. (See Fig. 1, page O/1). Front springs are mounted above the axle, and rear springs are underslung.

**To Dismantle and Re-assemble Road Springs.**

1. Grip spring in a vice, with the vice jaws against top and bottom leaves.
2. Free the leaf clips by tapping with a hammer.
3. Remove the nut on spring centre bolt.
4. Carefully open the vice when spring leaves will separate.
5. Clean leaves and examine for signs of failure such as cracks. Replace any defective leaves, thoroughly grease and re-assemble by clamping in vice and replace clamping bolt and nut.
6. While spring is still held in vice, refit leaf clips.

**To Renew Spring Eye Bushes.**

Bushes must be punched out of spring leaf eyes, and new bushes pressed into position. New bushes must be reamed out in position with Service Tool FX4277.

A special drift for removal and fitting of bushes is Tool No. CX585/30.

## SHACKLES.

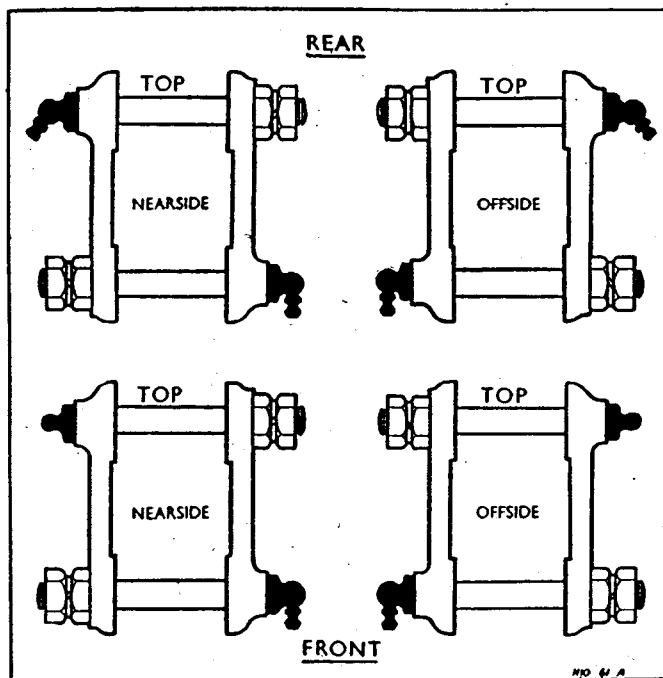


Fig. 2.

Diagram of Order of Assembly.

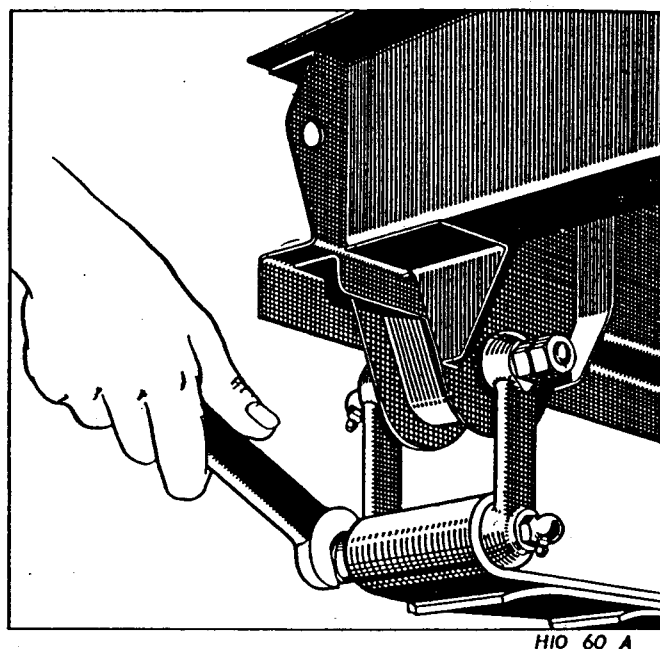


Fig. 3.

An Adjustable Shackle.

### Removing a Shackle.

1. To dismantle the shackle, take off the locknut, washer and adjusting nut at top and bottom, after which the shackle halves can be tapped apart, using a suitable punch.
2. Shackle bushes can also be tapped out for replacement.
3. The front anchor end of each spring is held by a shackle pin with nut, washer and locknut.
4. All shackles are adjustable for wear at both top and bottom. The nuts should be tightened till all perceptible side play is eliminated and then the lock nuts tightened up.

5. It will be noticed that each pin is integral with one of the side plates, and therefore both sets of nuts must be removed before the shackle can be removed from the spring or the frame.

6. The accompanying diagram shows the correct order of assembly for each of the four shackles, which is important, as this provides the most convenient position for carrying out adjustment and lubrication.

### To Renew Shackle Bush.

Bushes must be punched out of housing. Service Tool CX585/30 is a special drift for fitting new bushes. These must be reamed out in position with Tool No. FX4277.

**LUVAX PISTON TYPE HYDRAULIC SHOCK ABSORBERS.**

**Front.** Nearside and Offside — P5 — 13  
Double Acting.

**Rear.** Nearside and Offside — P5 — 5  
Double Acting.

The shock absorbers are double acting, equal resistance being offered to the compression as to the recoil of the road springs.

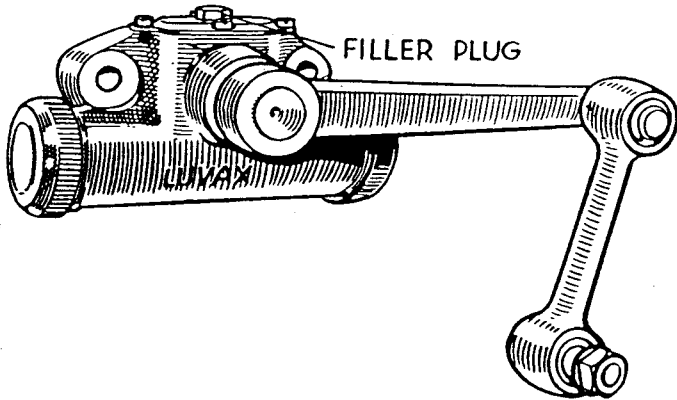


Fig. 4.

The maintenance of the shock absorbers in position on the vehicle is confined to the periodical examination of the anchorage to the chassis, the fixing bolts being tightened as required.

The occasional renewal of the bearings, and the topping up with fluid at about 5,000 miles require the removal of the shock absorbers from the chassis, and is carried out by Workshops.

No adjustment to the shock absorbers is required or provided for, and any attempt to dismantle the piston assembly by removing the end caps will seriously affect the performance of the shock absorber.

**Testing.**

When the question of vehicle suspension is under consideration, and there is any doubt that the springs are adequately damped, the condition of the chassis springs and the tyre pressures should also be borne in mind.

If the shock absorbers do not appear to function satisfactorily, an indication of their resistance can be obtained by carrying out the following check :

Remove the shock absorbers from chassis. Place in vice (held by fixing lugs to avoid distortion of cylinder body).

Move the lever arm up and down through its complete stroke. A moderate resistance throughout the full stroke should be felt.

If the resistance is erratic, and free movement of the lever arm is noted, it may indicate lack of fluid.

If the addition of fluid (added as described) gives no improvement, a new or reconditioned shock absorber should be fitted.

Too much resistance, when it is not possible to move the lever arm slowly by hand, possibly indicates a broken internal part, or a seized piston, in which case the shock absorber should be exchanged.

**Topping up with Fluid.**

Remove the shock absorbers from the chassis.

Before removing the filler cap (located in the tip cover) carefully wipe clean the exterior of the shock absorber, this is most important, as it is vital that dirt or foreign matter does not enter the shock absorber.

Use only thin piston type fluid, Hydraulic Brake Fluid No. 3.

While adding fluid the lever arm must be worked throughout its full stroke to expel any air that might be present in the working chamber.

**Fluid Level.**

Fluid should be added to the bottom of the filler plug hole.

**Refitting Shock Absorbers to Chassis.**

When handling shock absorbers that have been removed from the chassis for any purpose, it is important to keep the assemblies upright as far as possible, otherwise air may enter the working chamber, resulting in free movement.

**Bearing Replacement.**

Tight rubber bearings are used between the lever arm and connecting link and the link axle.

Special tools as shown in these instructions are necessary for fitting bearings, and a hand press or equivalent apparatus should be available.

Before dismantling the connecting link from the lever arm, or the pins from the link bearing, the position in which they are fitted must be noted, otherwise difficulty will be experienced when refitting the shock absorber to the chassis.

In this connection the following points should be taken into consideration.

**Front Assemblies.**

The shock absorber movements are "handed," owing to the position of the lever arm which is a permanent fixture to the rocker shaft.

The connecting links are also "handed"; nearside and offside are, therefore, not interchangeable.

In both cases the link is assembled into the lever arm bearing from the inside of the arm (nearest the shock absorber movement).

The pin fitted at the chassis end of the link; is also fitted from the inside of the lever arm.

## Rear Assemblies.

In this case the lever arm pin forms part of the arm.

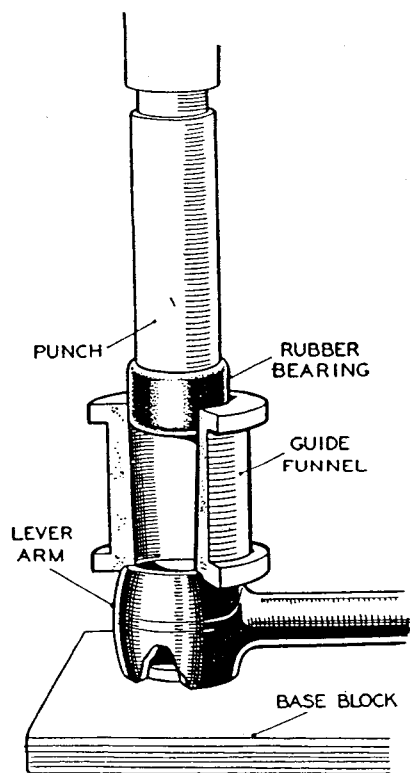
The link is fitted on the inside of the lever arm with the pin at the chassis end of the link assembled pointing inwards (fitted from the outside of the arm with the threaded end of the pin facing the shock absorber movement).

## To Dismantle.

Dismantle the front connecting links by pressing out the link from the lever arm bearing, and the pin from the link.

Remove the rubber bush from the lever arm and link boss ends.

The procedure for the rear shock absorbers is similar, except that the lever arm bearing is pressed out from the link.



ASSEMBLING BEARING TO BOSS END  
Fig. 5.

## To Fit New Bearings and Reassemble Front Shock Absorbers.

Wash out the boss end of the lever arm and connecting link to remove any dirt or grease.

Rest the boss end of the link in position as illustrated.

Place the guide funnel in position on the link.

Damp the outside of the rubber in benzine (if this is not available, petrol or paraffin can be used as a substitute) and insert in the end of the guide funnel.

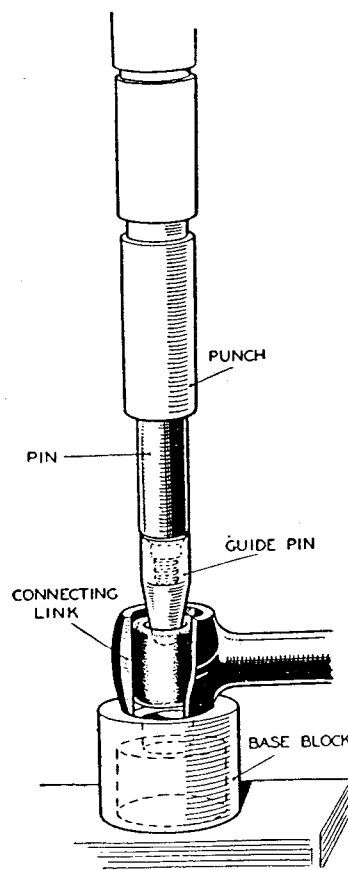
With a quick action force the bearing through the tapered bore of the guide into position in the boss end of the link, using the punch or pressure tool as shown.

## To Fit Pin to Assembled Rubber Connecting Link.

Place the boss end in position on the base block.

Smear the bore of the rubber with petroleum jelly.

Fit the screwed end of the pin into the tapered guide tool.



METHOD OF FITTING PIN  
Fig. 6.



With a quick action force the guide tool, together with the pin into the rubber.

The tapered guide can then be withdrawn through the base, leaving the pin assembled in the bearing.

#### To Assemble Link to Lever Arm.

As illustrated, this is assembled in the same manner as already detailed for fitting the pin to the link bearing.

#### To Fit New Bearings and Reassemble Rear Shock Absorbers.

##### Connecting Link.

Wash out the boss ends of the link.

Fit bearings at both ends as already described for the lever arm and link boss ends of the front shock absorbers (assembling bearing to boss end).

#### To Assemble Link to Lever Arm.

Assemble the lever arm pin to the connecting link boss end in the same manner as the front shock absorber link is fitted to the lever arm (method of fitting connecting link).

The pin is fitted to the chassis end of the link as illustrated and described for front shock absorbers (method of fitting pin).

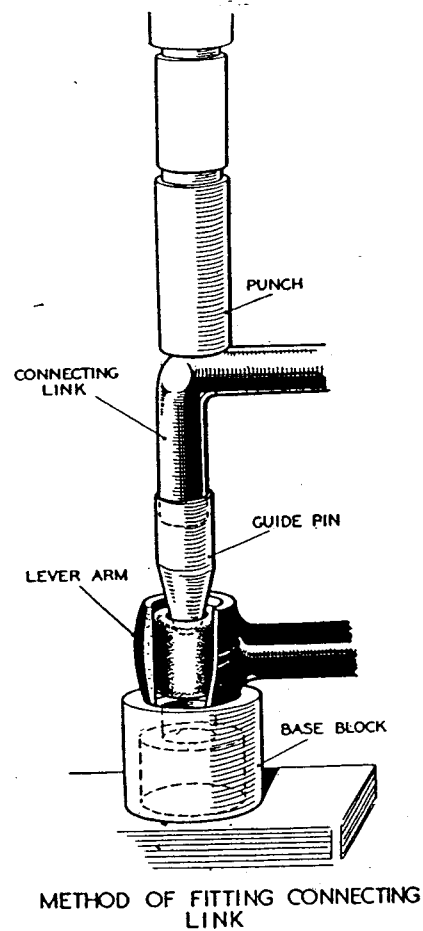


Fig. 7.

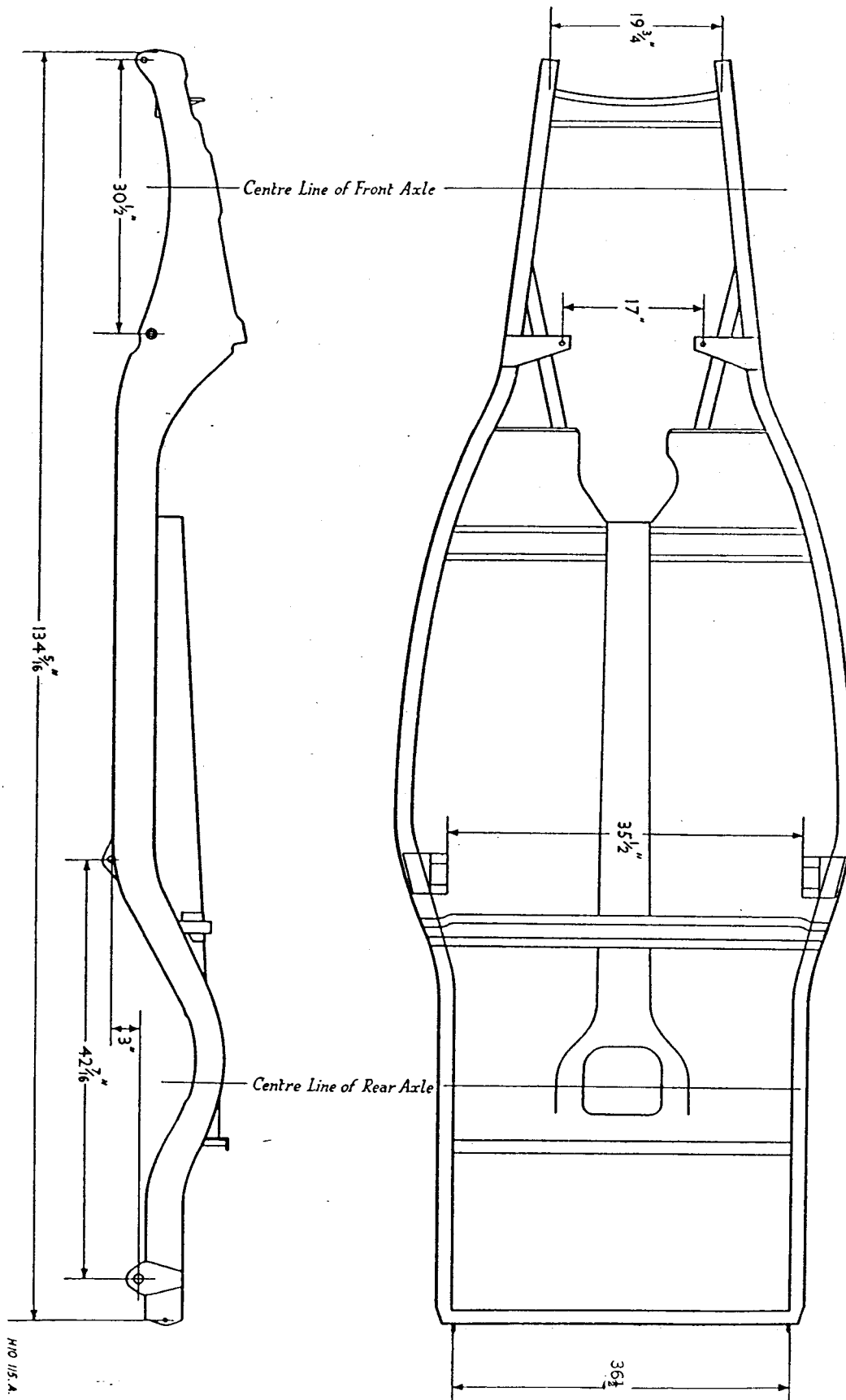


Fig. 8.

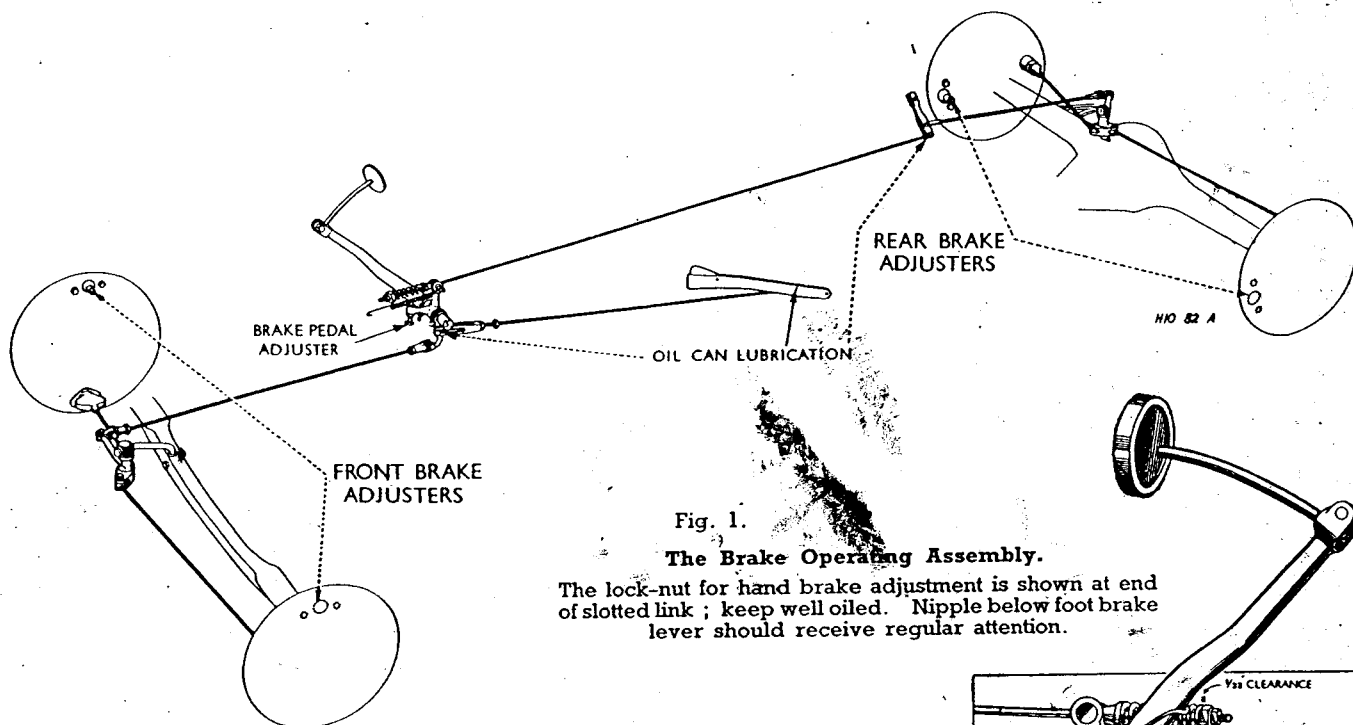


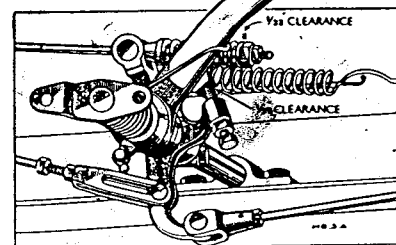
Fig. 1.

### The Brake Operating Assembly.

The lock-nut for hand brake adjustment is shown at end of slotted link ; keep well oiled. Nipple below foot brake lever should receive regular attention.

It is of the utmost importance that brakes are adjusted or serviced to give an equal distribution of braking on all wheels, so that maximum tyre life is obtained. Remember that adjustment will not always effect a cure ; oil may have reached the brake linings.

Brakes are automatically compensated, and any tendency to pull to one side can only be due to either seized joints through lack of lubrication or to oil from hubs reaching some of the brake linings. (with the possible exception of badly worn drums becoming distorted).



## 1. Description.

Girling wedge and roller type automatically compensated, and adjusted direct from brake back plate.

Each brake consists of :—

- The backplate.
- A pair of fabric faced shoes.
- The shoe expander.
- The shoe adjuster and
- A pair of "pull-off" springs.

The load is applied either by foot or hand, direct coupled to all wheels, through a front-rear compensating spring and balance levers.

## 2. The Expander Unit.

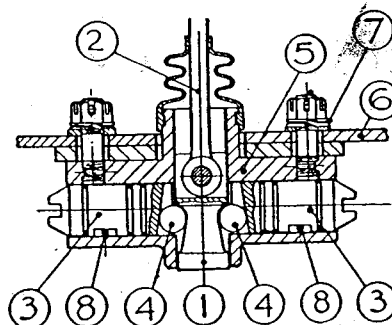


Fig. 2.  
Expander Unit.

The expander consists of :—

A die-cast housing in which are two studs (cast in and not removable).

A hardened and ground steel cone.

Two hardened and ground steel plungers.

Two hardened and ground steel rollers.

Two steel stop pins.

A pull rod or draw link.

Two double coil spring washers.

Two brass slotted nuts and two split pins (or on late models two Simmonds nuts).

It will be seen that any load applied to the draw-link is transmitted to the cone causing it to move between the rollers, which then climb the inclined faces of the cone and force the plungers apart. The plungers, of course, then push out the shoes until they contact the brake drum.

The expander is not rigidly attached to the back plate, but is held lightly under spring washer pressure. The securing bolts pass through slots in the back plate, and under the light spring washer pressure the expander can float or slide sufficiently to enable the shoes to be self-centring. The expander must never be bolted solid to the back plate ; the brass nuts over the spring washers should be first tightened and then slacked back one complete turn and split-pinned. (Simmonds nuts are just slacked back).

### 3. Operation of the Plunger Units.

The cone (1) when pulled by the rod (2) forces apart the plungers (3) by means of the rollers (4). The plungers engage with the webs of the brake shoes.

The housing (5) is lightly held on the back plate (6) by nuts and spring washers (7) so that it floats between the brake shoes, which are thus self-centring. When the brake shoes are removed the pins (8) hold the plungers (3) in the housing.

The adjuster unit, which is held firmly on the back plate by its housing (B) has two somewhat similar plungers (C) held apart by the adjuster (A), a conical ended screw, which provides adjustment to the shoes.

### 4. Adjustment.

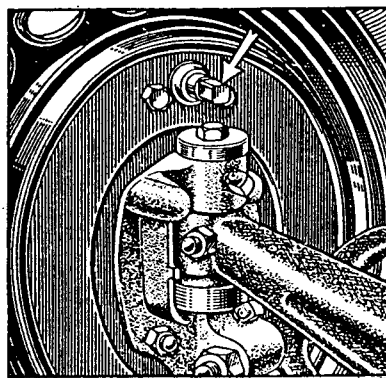


Fig. 3.

A Front Brake Adjuster.

In making adjustment to take up the wear of the brake linings there is only one operation necessary at each wheel to adjust the brake shoes.

This is as follows :—

On the opposite side of the drum whence the operating rod protrudes will be seen the square-ended brake shoe adjuster, indicated by the arrow in the illustration. This can be turned a notch at a time, which can be felt and heard and is the engagement of the four flat sides of the cone on the inner end of the adjuster engaging with the plungers which support the shoes. Turn the adjuster in a clockwise direction as far as it will go with reasonable pressure. The brake shoes are then hard on and the adjuster should be turned back one full notch to give the shoes the necessary clearance from the drum.

Each drum should be treated similarly, and it is not necessary to jack up the wheels.

After adjustment is completed press the brake pedal down as hard as possible once or twice in order to centralise the brake shoes in the drums.

It is important that no attempt should be made to adjust the brakes with the handbrake on.

The illustration shows the adjuster of the front brake ; on the rear brakes the adjuster will be found immediately in front of the axle.

## 5. The Adjuster Unit.

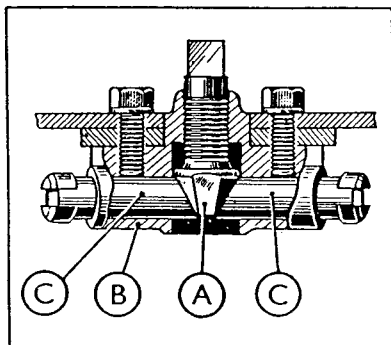


Fig. 2.

- A. Flats on Expander Screw.
- B. Expander Housing.
- C. Plungers.

The adjuster consists of:—

A steel housing.

A screwed steel spindle having a cone at one end, with machined flats.

Two hardened and ground plungers having inclined faces to engage with the cone, and grooves to accommodate the brake shoes at the outer ends.

The expander housing is bolted firmly to the back plate, and a spanner is used on the outer end of the spindle to enable it to be screwed in or out to adjust the position of the shoes.

Rotation of the spindle in a clockwise direction forces the plungers outward, pushing the shoes closer toward the brake drums, and as each "flat" is reached a "click" will be heard, due to the plungers dropping from the cone surface under the pressure of the shoe "pull-off" springs. All adjustments must be completed on one of these "clicks."

It is an essential part of the design of the Girling Braking System that adjustment for brake lining wear is **always** made at each brake drum and **never** by means of altering the length of brake rods. The two brakes on each axle are automatically compensated and hand or foot pressure brings all four brakes into operation.

## 6. Dismantling the Brakes.

First jack up the car and remove the road wheels. Slack back the adjuster anti-clockwise as far as it will go. The adjuster should turn quite freely in the housing.

The brake drum is mounted on the hub and held by two small countersunk screws. Mark the position of the drum on the hub, take out the screws and remove the drum.

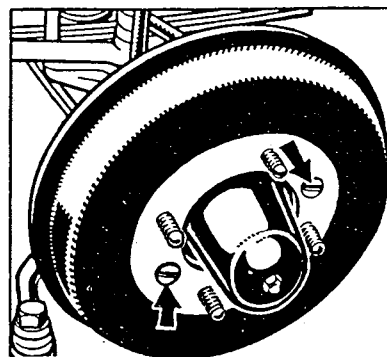


Fig. 5.  
Drum Mounting.

## 7. Remove Shoes.

To remove the shoes place a large screw-driver, or other lever, against one of the studs on the back plate behind the shoes and lift one shoe out of the groove in the plunger at the expander end. Both shoes and springs can now be removed leaving the expander and adjuster units in position on the back plate. Be careful not to overstretch the springs.

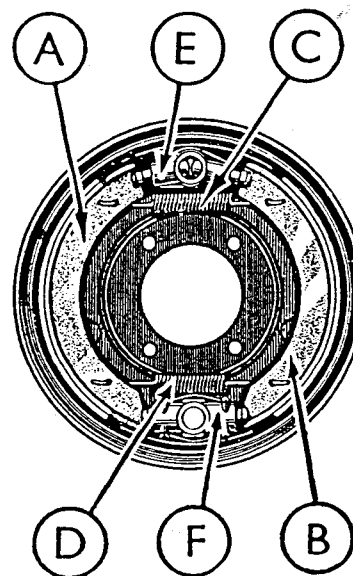


Fig. 6.

- A. and B. Brake Shoes.
- C. and D. Shoe Return Springs.
- E. Adjuster Expander.
- F. Brake Operating Expander.

Clean down the back plates, check the expander and adjuster units for free working. Inspect the shoe pull-off springs and replace if they are stretched or damaged.

When relining do the four shoes of one axle at the same time.

### 8. Refitting Shoes.

In refitting the shoes be sure that the springs are between the shoe webs and the back plate. Hook the shoes together with one spring at the adjuster ends and assemble on the adjuster unit first, crossing two shoes to do so. Place one shoe in position on the expander unit, replace the second spring and lever the other shoe into position. Refit the brake drum.

### 9. Brake Back Plate.

The brake back plate is secured to the axle by four nuts and bolts, and can be removed after taking off hubs (see page O/1). The bolts can be taken out after knocking back the tabs of the lock-washers and removing the nuts. Each brake rod from the expander unit must, of course, be disconnected from the balance lever on the rear of the axle casing.

There is no adjustment possible for these rods, but it will be noted that the offside rod is shorter than that on the nearside.

• Re-assembling is a reversal of these operations.

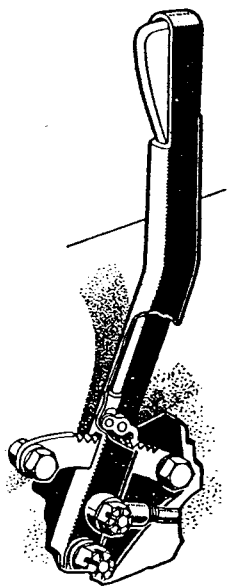


Fig. 7.

Handbrake Ratchet Mounting.

### 10. Rods and Linkages.

Should it be necessary at any time to adjust one of the rods, or fit a new one, the following precautions should be taken :—

The handbrake should have a little "free" movement and is adjusted by means of the connecting rod from bottom of lever to cross shaft. In tightening lock-nut be careful not to distort the slotted link.

### 11. "Free" Movement and Clearances.

When the brake pedal has from  $\frac{1}{4}$ -in. to  $\frac{1}{2}$ -in. free movement from the floorboard there should be  $\frac{1}{32}$ -in. clearance between the face of the forward adjusting screw and the lever on the pedal shaft. The front and rear brake rods should be adjusted to suit this position. (See illustration of pedal mounting, Fig. 1, R/1).

The front brakes are operated by direct pull and the rear brakes are operated through a special spring. There should be  $\frac{1}{32}$ -in. clearance between this spring and the locking nut.

### 12. Fit New Rods.

Should it be necessary to fit new transverse rods on either axle, remove the shoes as previously described. Next remove the expander unit by undoing the two nuts holding it to the back plate, drawing the rod attached to it through the rubber cover.

To remove the rod, the expander plungers must be withdrawn by removing the split pins which retain them. The rod and the expander cone can now be drawn out, taking care that the two small rollers are not lost. Knock out the pin attaching the short rod to the expander cone, and fit the new rod. Re-assemble the expander unit, making sure the rollers are properly in place.

If there is any difficulty in re-assembling the rollers, a little grease smeared on them and the slots in which they work will hold them in place while being assembled.

Now push the rod through the dust cover, and tighten up fully the two nuts holding the unit to the back plate, not forgetting the double spring washer underneath them. Slack back the nuts one complete turn, thus allowing the unit to float on the back plate in the manner it is intended. Re-assemble shoes and brake drum or hub assembly.

It is very important that at no time must the adjustable fork end on the rear brake rod, and on the front and rear longitudinal rod, be screwed off the rods further than the inspection holes provided.

This can be checked with the aid of a thin piece of wire. The fit of the pins in the fork ends must always be free as plenty of clearance has been provided purposely at these points.

Always fully tighten the lock-nut after adjustment.

### 13. Shoe Centralising.

To centralise the shoes and ensure correct clearance between the shoes and the drums, slack off the adjuster set pins that hold the unit to the back plate, and, by turning the adjuster screw in a clockwise direction as far as it will go, put the brake shoes hard on. Then screw up the pins holding the adjuster unit tightly and slack off the adjuster one full notch. When all drums have been treated in this manner press the brake pedal down as hard as possible once or twice, to ensure that the shoes are centralised. The shoes should now be quite free of the drums.

Check expander for free float. If tight, slack off the slotted brass nuts (or Simmonds nuts) one complete turn. In the case of brass nuts, split pins must always be used.

The unit will then float on the backplate and be self-centring.

### 14. Equalising Wear.

To equalise brake lining wear it is a good plan occasionally to reverse the brake shoes on each hub. In the case of rear wheels, this means putting the lower shoes on top ; and for front wheels, using front shoes at rear of hub, and vice versa. Thus, all linings share leading-shoe wear.

### 15. Lubrication.

The brake balance levers and the nipple on the brake pedal, and all joints should be oiled regularly.

Inattention to lubrication of the brake balance levers may cause the brakes to stick on.

### Inflation Pressures.

**T**HE most important feature of tyre maintenance is regular attention to pressures—to a great extent the life of a tyre depends upon it.

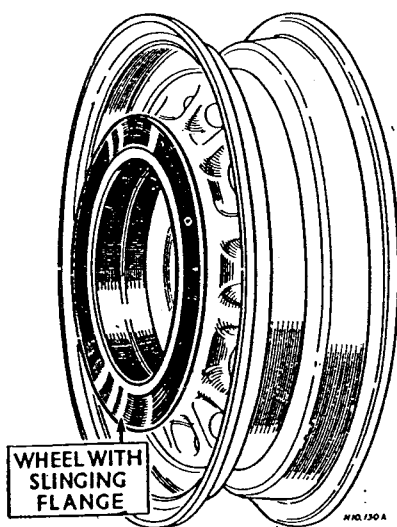
Failure to maintain correct pressures affects adversely both casing and tread.

Pressures should be tested and any loss restored as often as possible.

### Maintenance.

**Oil** (particularly paraffin) and **grease**, are injurious to rubber and should not be allowed to remain on tyres. To remove, petrol may be applied sparingly.

**Cuts** should receive attention ; major ones by vulcanisation and minor by the application of special compound.



Wheels on some models may be fitted with a slinging flange as shown.

**Damage.** Damage affecting only the rubber tread and walls may be plugged with a good tread cut filling. If this is done promptly an extension of the injury will be prevented.

It is important that the tyre should be removed immediately any serious damage is sustained.

**Misalignment** plays havoc with front tyres and an occasional check with an alignment gauge is recommended.

Front wheels should be set between parallel and  $\frac{1}{8}$ -in. toe-in ; rear wheels should be parallel.

**Wheel nuts** should be tightened frequently particularly when the vehicle is new or the wheels have been removed and refitted.

Nearside wheel nuts have left hand threads.

### Fitting Hints.

When fitting a tyre attention is called to the following points.

To avoid trapping the tube between the edge of the cover and the rim, always inflate the tube very slightly before placing it in the cover.

During the final inflation see that the edges of the cover are seated evenly round the edge of the rim. Check this by the moulded line on the cover, which should be about a quarter of an inch from the rim all the way round.

### Uneven Wear.

Because the front wheels are slightly "cambered" or lean outwards the outer side of the tyre tread wears more than the inner. To minimise the effect of such wear, change round the tyres periodically, say every 3,000 to 4,000 miles (5,000 to 6,000 km.) so that the more worn sides are next to the car.

Change the near and offside tyres so that unequal weight distribution and consequent wear caused by road camber are shared. The spare tyre should be used in turn with the others.

### Changing a Wheel.

**NOTE.**—The nearside wheel nuts and studs have left-hand threads and the nuts are marked with the letter "L."

Before removing a wheel see that the hand-brake is on firmly and if on a hill scotch one or two of the wheels. Check the spare tyre for correct pressure and adjust the jack nearly to the height required by turning the head before placing it under axle or spring.

In refitting the wheels, ensure that tyres with a chevron pattern tread are fitted so that the apex of the chevron in contact with the ground points forward. Ignore any instructional marking on the side walls of such tyres.

When changing a front wheel place the jack under the axle beam immediately below spring mounting. For a rear wheel, place jack under spring as close as possible to axle.

On fitting the spare wheel, tighten the nuts alternately and securely before removing the jack and test the nuts again when the wheel is on the ground.





### Fuse Box Colour Chart.

PURPLE AND BLACK : To Horn, to Fuel Gauge and to Stop Lamp (when fitted).  
PURPLE : Inspection Plug Sockets and Interior Light.

Stop Lamp is fitted  
to some models only.

Contact Breaker Unit  
is earthed at Crankcase.

### **Introduction.**

**T**HE lighting and starting units are arranged for wiring on the earth return system, one path for the current being provided by the frame instead of a second wire. It is essential that all units are in good metallic contact with the frame.

The electrical system is 12 volt and the negative pole of the battery is earthed.

If wiring has been removed for any purpose, when replacing see that the suppressors and condensers are in position.

In brief the electrical equipment can be described as comprising four independent electrical circuits as follows :—

- (1) Charging—consisting of dynamo, cut-out and regulator unit and battery.
- (2) Ignition—consisting of battery, ignition switch, coil, distributor and sparking plugs.
- (3) Starting—consisting of battery, starter switch and starter.
- (4) Lighting and Accessories.

The dynamo operates in conjunction with a regulator (mounted on engine side of dash) which causes the dynamo to give an output which varies according to the load on the battery and its state of charge. Also the regulator causes the dynamo to give a controlled boosting charge at the beginning of a run, which quickly restores the current taken during starting.

An ignition warning light is provided which gives an indication when the ignition is switched on and the engine is not running. The lamp will also light at low speeds when the engine is not running at sufficient speed to cause the dynamo to charge the battery. The failure of the warning light bulb will not affect the ignition, but it should be replaced at the first opportunity.

When operating the starter, observe the following points :—

- (1) See that there is sufficient petrol and that all conditions are correct for starting.
- (2) Operate the starter switch firmly and release it as soon as the engine fires.
- (3) Never operate the starter switch when the engine is running. If the engine will not fire at once, allow it to come to rest before operating the switch again.
- (4) Do not run down the battery by keeping the starter on when the engine will not start.

The electrical equipment is designed and manufactured to give long periods of service without any need for adjustment or cleaning. As long as it continues to work satisfactorily no attempt should be made to interfere with it in any way. Unnecessary "tinkering" will do more harm than good.

In the event of any trouble developing, always look for the more obvious causes before commencing to dismantle any of the units or to make any adjustments. For example, check that all connections to the terminals are tight and that cables are not damaged—some breakdowns in cables are by no means obvious, the rubber insulation may be intact, and the cable appear satisfactory, but the wire inside may be fractured—a bending test will usually enable the failure to be located. Should it finally be found necessary to make adjustments or replacements, these must be carried out by personnel having good electrical experience. The correct tools and instruments as described must be used.

Remember that dirt and moisture are the two greatest enemies of the electrical equipment, as they bring about the breakdown of insulating surfaces. Before replacing mouldings or other insulating parts, always wipe with a clean dry cloth.

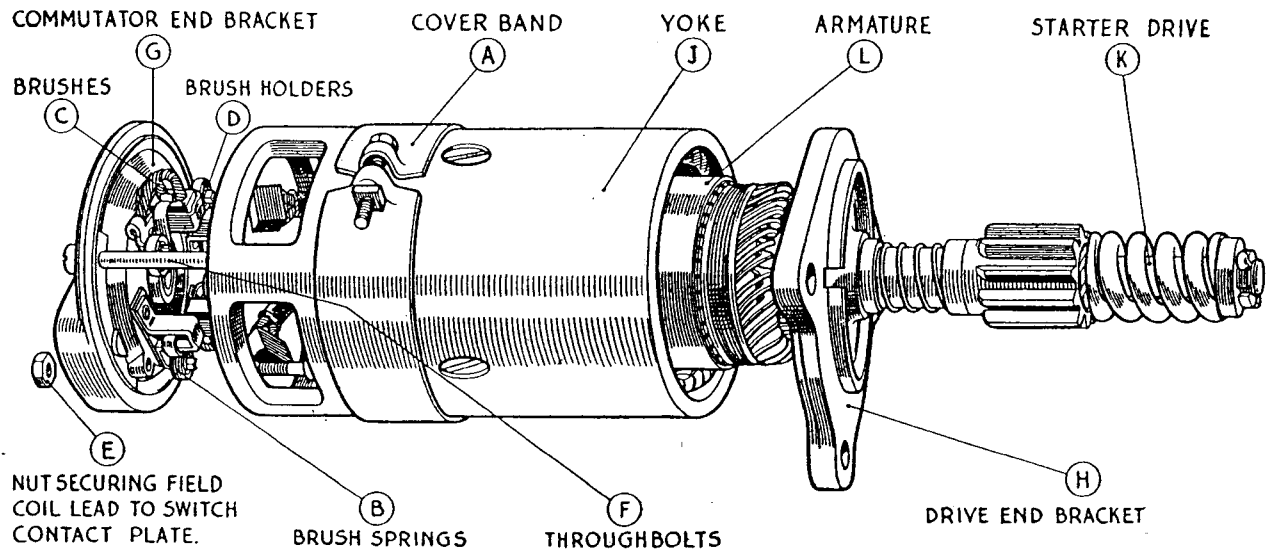
**STARTER.**

Fig. 2. Exploded view of Starter.

**1. Type.**

This starter is a Lucas Model M418G, Type L, Service No. 255,378. These identification marks are stamped on the yoke. When ordering replacements always quote the unit numbers.

**2. To Test on Vehicle.**

Switch on the lamps and operate the starter control. If the lights go dim, but the starter is not heard to operate an indication is given that current is flowing through the starter but that the starter pinion is meshed permanently with the geared ring on the flywheel. This has probably been caused by the starter being operated while the engine is still moving. In this case the starter must be removed from the engine for examination.

Should the lamps retain their full brilliance when the starter switch is operated, check that the switch is functioning (see page T/6, Fig. 10). Next, if the switch is in order, examine the connections at the battery and starter switch and also examine the wiring joining these units. Corroded battery terminals should be removed, scraped clean, refitted, and coated with mineral jelly. Continued failure of the starter to operate indicates an internal fault in the starter which must be removed for examination.

Sluggish or slow action of the starter is usually caused by a poor connection in the wiring which causes a high resistance in the starter circuit. Check the wiring as described above.

If the starter is heard to operate but does not crank the engine, the starter drive is either dirty or damaged.

**3. To Remove and Replace.**

Pull out starter lever from front end bracket of starter motor (see page T/7, Fig. 13) and then remove the motor itself; it is held to the flywheel housing by three bolts. Also take away packing plate for starter, noting position of locating dowels for guidance when replacing.

**4. Examination of Commutator and Brush-gear.**

Remove the starter cover band "A" (Fig. 3) and examine the brushes "B" and commutator "C". Hold back each of the brush springs "D" and move the brush by pulling gently on its flexible connector. If the movement is sluggish remove the brush from its holder "E" (Fig. 3) and ease the sides by lightly polishing on a smooth file.

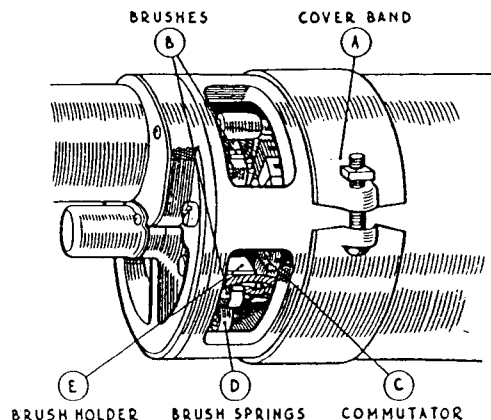


Fig. 3. Starter Brush Gear.

## STARTER—continued.

Always replace brushes in their original positions. If the brushes are worn so that they do not bear on the commutator or if the brush flex is exposed on the running face, they must be renewed.

If the commutator is blackened or dirty, clean it by holding a petrol moistened cloth against it while the armature is rotated.

Secure the body of the starter in a vice and test by connecting it with heavy gauge cables to a battery of correct voltage. Connect one cable to the starter terminal and hold the other against the yoke or end bracket while the switch is operated by hand. Under these light load conditions, the starter should run at a very high speed.

If the operation of the starter is still unsatisfactory, a replacement unit should be fitted and the defective starter dismantled for detailed inspection and testing.

## 5. Dismantling.

- Remove the cover band "A" (Fig. 2), hold back the brush springs "B" and lift brushes "C" from their holders "D."
- Remove the starter switch (see page T/7).
- Unscrew the nut "E" securing the field coil lead to the contact plate in the end bracket. Unscrew the two through bolts "F" and remove from the commutator end bracket and withdraw the end bracket "G". Remove the driving end bracket "H" complete with armature "L" and drive "K" from the starter yoke "J" (See Fig. 2).

## 6. Brushes.

- Test the brush springs with a spring scale.

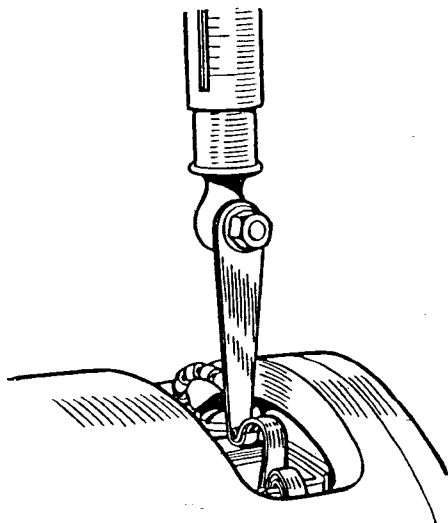


Fig. 4. Testing Brush Spring Tension.

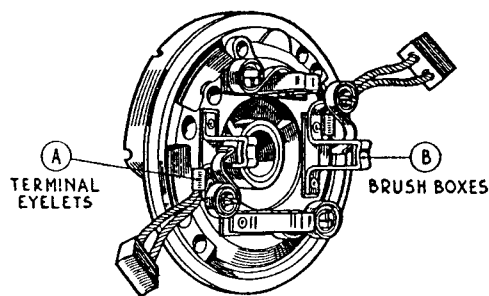


Fig. 5. Brush Connections.

The correct tension is 30-40 ozs. Fit a new spring if the tension is low.

- If the brushes are worn so that they do not bear properly on the commutator or the flexible connector is exposed on the running face they must be replaced. Two of the brushes are connected to terminal eyelets "A" (Fig. 5) attached to the brush boxes "B" on the commutator end bracket and two "A" (Fig. 6) are connected to tappings "B" on the field coils.

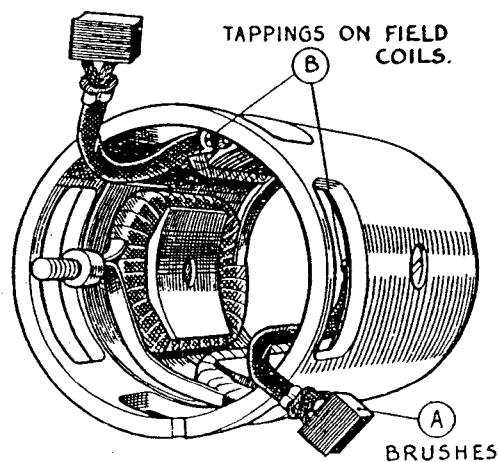


Fig. 6. Brush Connections.

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their place by soldering. The brushes are pre-formed so that bedding to the commutator is unnecessary.

## 7. Drive.

- If the pinion "A" (Fig. 7) is tight on the screwed sleeve "B" wash away any dirt with paraffin and afterwards give the sleeve the merest trace of thin machine oil.

**STARTER—continued.**

- (b) If any parts are worn or damaged they must be replaced. NOTE.—Pinions and sleeves are carefully matched and must be replaced as a pair, not separately.

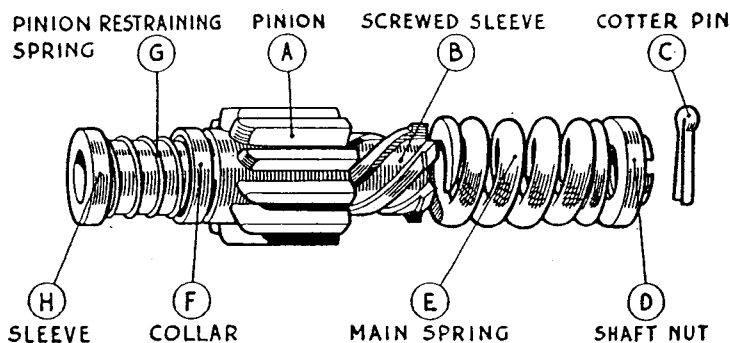


Fig. 17.

Components of Starter Drive.

Remove the cotter pin "C" from the shaft nut "D" at the end of the starter drive. Hold the squared end of the starter shaft at the commutator end by means of a spanner and unscrew the square shaft nut, (left-hand thread). Lift off the main spring "E," screwed sleeve with pinion, collar "F," pinion restraining spring "G" and the sleeve "H" on which the restraining spring fits.

The drive should be re-assembled with the new components by reversing the order of dismantling.

**8. Commutator.**

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a petrol moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive as described in paragraph 7 and remove the armature from the end bracket. Now mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is necessary and finally polish with a very fine glass paper.

**9. Field Coils.**

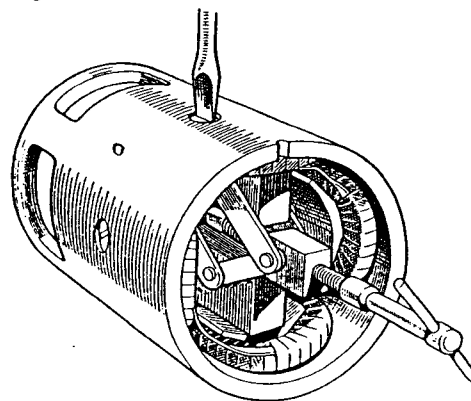
The field coils can be tested for an open circuit by connecting a 12-volt battery, having a bulb of the correct voltage in one of the test leads, to the tapping points on the field coils at which the brushes are connected. If the lamp does not light, there is an open circuit in the wiring of the field coils.

Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible

that one of them may be earthed to a pole shoe or to the yoke. This may be checked by removing one of the test leads from the brush connector and holding on to a clean part of the starter yoke. Should the bulb now light, it indicates that the field coils are earthed.

Should the above tests indicate that the fault lies in the field coils a replacement starter must be fitted. If, however, a pole shoe expander and wheel operated screwdriver are available, it is possible to replace the field coils. A pole shoe expander is necessary in order to ensure that there will not be any airgap between the pole shoes and the inner face of the yoke. (See Fig. 8).

Fig. 8.



Pole Shoe Expander.

Replace the field coils as follows:—

- Remove the two insulation pieces which are fitted beneath the field coils to prevent the intercoil connectors from contacting with the yoke.
- Mark the yoke and pole shoes in order that they can be fitted in their original positions.
- Unscrew the four pole shoe retaining screws by means of the wheel operated screwdriver. (See Fig. 17).
- Draw the pole shoes and field coils out of the starter yoke and lift off the field coils.
- Fit the new field coils over the pole shoes and place them in their original positions inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.
- Locate the pole shoes and field coils by lightly tightening the fixing screws.
- Insert the pole shoe expander, open it to its fullest extent and tighten the screws.
- Finally tighten the screws by means of the wheel operated screwdriver.
- Replace the insulation pieces between the field coil connections and the yoke.

**STARTER—continued.****10. Armature.**

Examination of the armature will in many cases reveal the cause of failure, e.g., conductors lifted from the commutator due to the starter being engaged while the engine is running and causing the armature to be driven at an excessive speed. A damaged armature must in all cases be replaced—no attempt should be made to machine the armature core or to true a distorted armature shaft.

**11. Bearings.**

Bearings which are worn to such an extent that they will allow approximately .015-in. total side play of the armature shaft must be replaced.

To replace the bearing bushes proceed as follows :—

- (a) Press the bearing bush out of the end bracket.
- (b) Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing. (See Fig. 9).

**NOTE.**—The bearing bushes are of the porous phosphor bronze type. Before fitting, the bushes

should be allowed to stand for 24 hours immersed for approximately seven-eighths of their length in thin engine oil in order to fill the pores of the bush with lubricant.

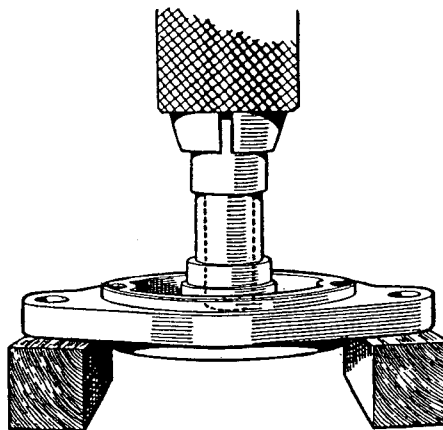


Fig. 9. Method of fitting Bearing Bush.

**12. Re-assembly.**

The re-assembly of the starter is a reversal of the operations described in paragraph 5, page T/4.

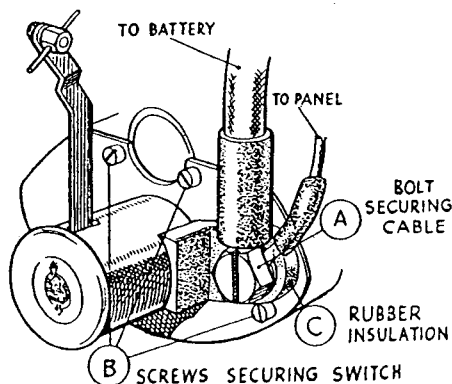
**STARTER SWITCH.****1. Hand Operated Switch Type ST10.**

Fig. 10. Switch fitted to Starter.

**2. Description.**

The switch is mounted on the commutator end bracket of the starter and is operated by a Bowden wire from a control mounted in the dash. Operate the control firmly to prevent burning of the switch contacts—pull smartly and release smartly.

**3. Testing in Position.**

Check that the switch control lever can move freely and that the wire control is undamaged. If the switch operates but does not complete the circuit to the starter it is probable that the contacts

are badly damaged and the switch must be removed for examination and if necessary replacement of the contacts.

**4. Removal.**

- (a) Disconnect the earthing cable from the battery terminal to avoid any danger of causing short circuits.
- (b) Unscrew the bolt "A" clamping the battery cable to the switch.
- (c) Take out the four screws "B" securing the switch to the starter end bracket. One screw is positioned under the rubber insulator "C" but is accessible when the insulator is held back.
- (d) Pull the complete switch away from the end bracket.

**5. Replacement of Contacts.**

If examination shows that the contacts are badly burned, they must be renewed.

The contacts must be replaced as a complete set comprising two fixed contact plates for fitting in the commutator end bracket and the moving contact disc for mounting on the switch plunger. The new components must be accurately fitted and the replacement must not be made unless the contacts can be set to the dimensional limits shown in Fig. 12.

**STARTER SWITCH**—continued.

To remove the old fixed contacts "A" (Fig. 11) from the starter end bracket, remove the nut "B" securing the connection from the starter field coil and withdraw the three screws "C" and insulating bushes "D". Fit the replacement contacts in position, taking care to place insulating plate "E" beneath the contacts and to place the insulating bushes "D" over the securing bolts before screwing them home.

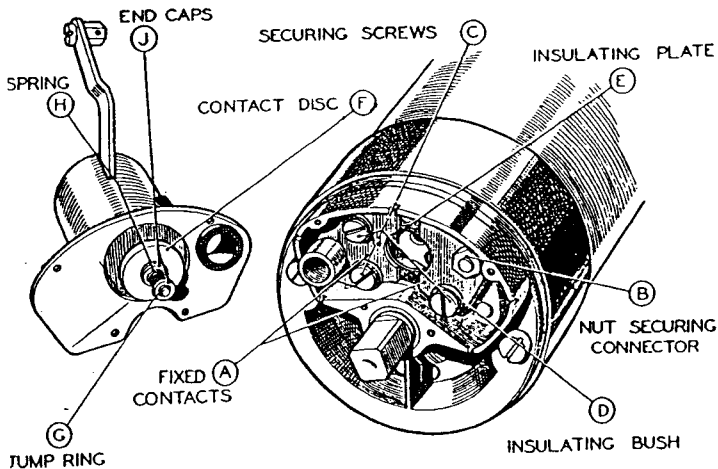


Fig. 11. Starter Switch Removed.

After fitting the two fixed contacts, the faces of the contacts must be machined in order to obtain a flat surface. The diameter of the machined portion must be 1 inch and the depth of the machined surface must be  $.245 \pm .005$  inches from the edge of the starter end bracket.

To remove the original contact disc "F", withdraw the jump ring "G" from the end of the spindle. The correct position of the contact disc relative to the switch fixing plate, as shown in Fig. 12, must be obtained by fitting shims behind the disc.

Replace the spring "H" with its end caps "J" on the spindle and secure by means of the jump ring "G."

Finally, fit the switch to the starter end bracket and re-connect the cable to the switch.

**Switch Lever.**

Starter switch lever is held in position by the spring pressure of the switch gear. Lever may be pulled out instead of disconnecting switch wire when removing starter motor.

To replace lever, insert at angle as shown to get behind the spring and then bring lever upright and push down till slots cut in the lever register with the end cap.

No tools are required for this operation.

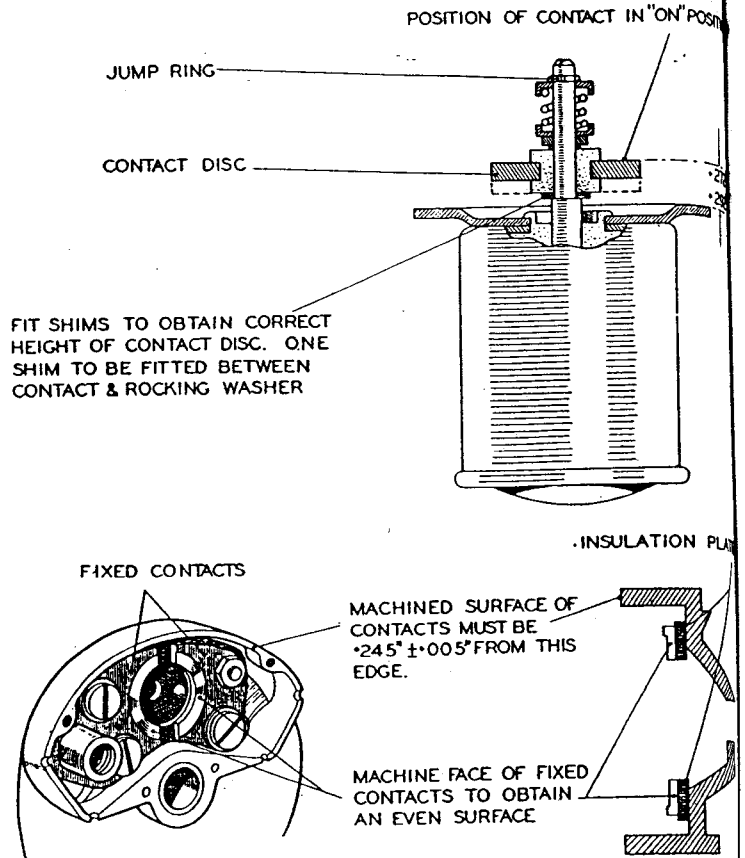
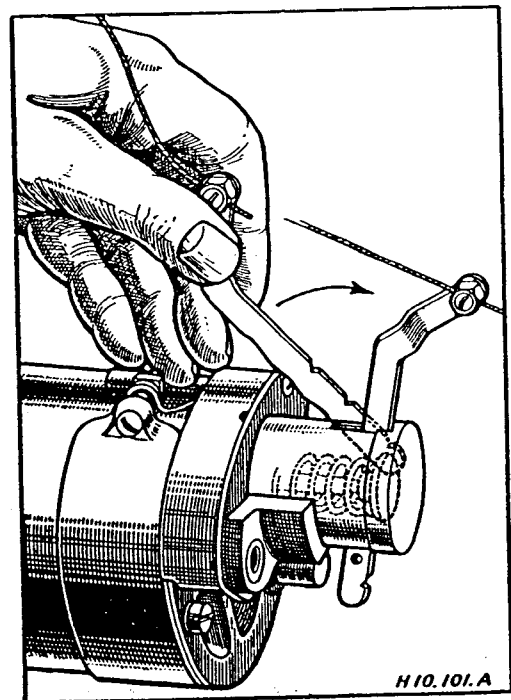
Fig. 12.  
Setting of Starter  
Switch Contacts.CROSS SECTION OF  
BRACKET SHOWING  
POSITION OF CONTACT

Fig. 13. Removing Switch Gear.

DYNAMO.

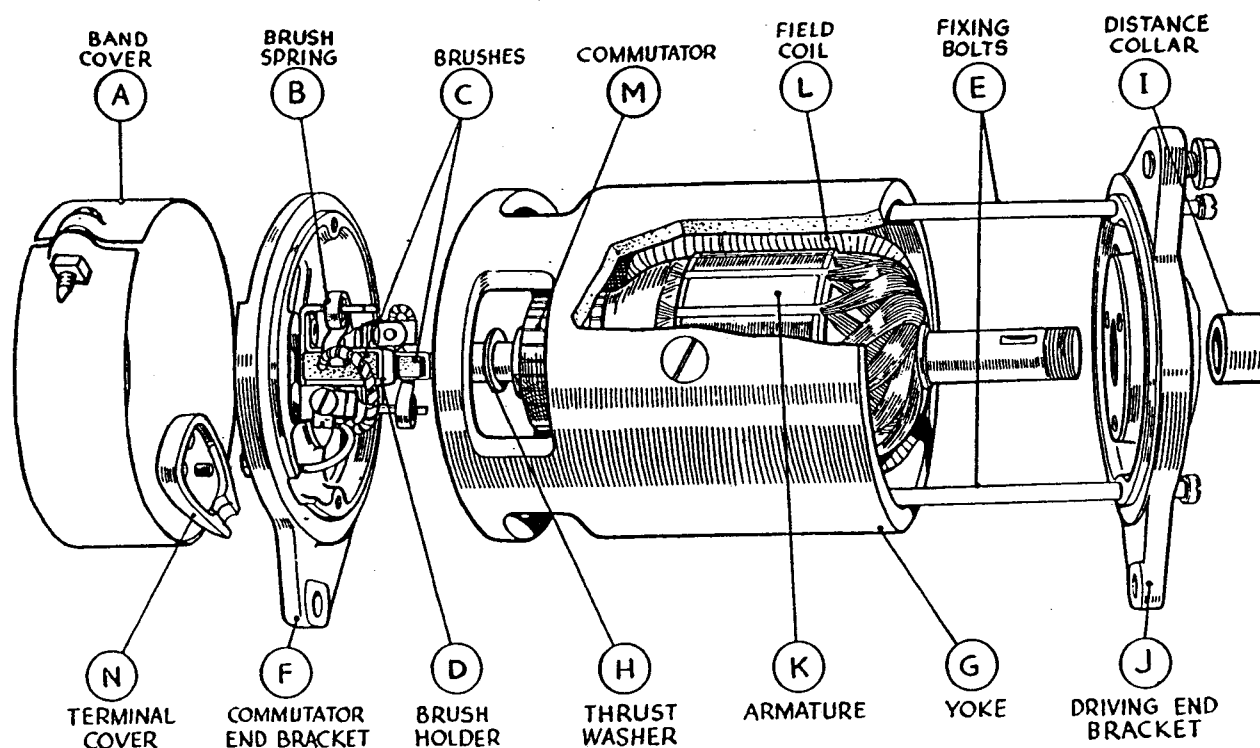


Fig. 14. Exploded and Partly Sectioned View of Dynamo.

1. Type

This dynamo is a Lucas model C45P, Type T45. Service No. 238464. These identification marks are stamped on the yoke. When ordering replacements always quote the unit numbers.

2. To Test on Vehicle.

- (a) Check for belt slip and adjust if necessary (see Section B).
- (b) Check that the dynamo and control box are connected correctly. The dynamo terminals are accessible after the removal of the moulded terminal cover shown in Fig. 14 secured to the commutator end cover by a counter-sunk head set screw. The dynamo terminal "D" should be connected to the control board terminal "+D" by a yellow lead and the dynamo terminal "F" connected to control board terminal "F" by a green lead.
- (c) After switching off all lights and accessories, disconnect the cables coloured "yellow" and "green" from terminals of dynamo marked "D" and "F" respectively.
- (d) Connect the two terminals with a short length of wire.

- (e) Start the engine and set to run at normal idling speed.
- (f) Clip the positive lead of a moving coil type voltmeter calibrated 0-20 volts to one dynamo terminal and the negative lead to a good earthing point on the dynamo yoke.
- (g) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts. Do not race the engine in an attempt to increase the voltage. It is sufficient to run the dynamo up to a speed of 1,000 r.p.m.

If there is no reading check brush gear.

If there is a low reading of approximately 1 volt, the field winding may be faulty.

If there is a reading of approximately 5 volts, the armature winding may be faulty.

- (h) Remove the dynamo cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace



**DYNAMO—continued.**

brushes in their original positions. If the brushes are worn so that they do not bear on the commutator, or if the brush flex is exposed on the running face, new brushes must be fitted. If the commutator is blackened or dirty, clean it by holding a petrol moistened cloth against it while the engine is turned slowly by hand cranking.

Re-test the dynamo; if there is still no reading on the voltmeter, there is an internal fault and the complete unit, if spare is obtainable, should be replaced.

- (j) If the dynamo is in good order, restore the original connections to the dynamo. Remove the yellow lead from the "D" terminal on the control box and connect the voltmeter between this cable and a good earthing point on the vehicle. Run the engine as before. The reading should be the same as that measured directly at the dynamo. No reading on the voltmeter indicates a break in the cable to the dynamo. If the reading is correct test the Control Box (see page T/12, paragraph 3).

**3. To Remove and Replace.**

See Section B (Fan and Dynamo).

**4. Drive Pulley.**

The pulley is keyed to the shaft and secured by a nut and spring washer.

To remove pulley first take off fan blades, grip the square extension flange in a vice and remove the nut with a box spanner.

The pulley is easily withdrawn as it has a parallel fitting and not a taper. Should the pulley be tight a suitable extractor should be used.

Replacement dynamos are supplied without pulley.

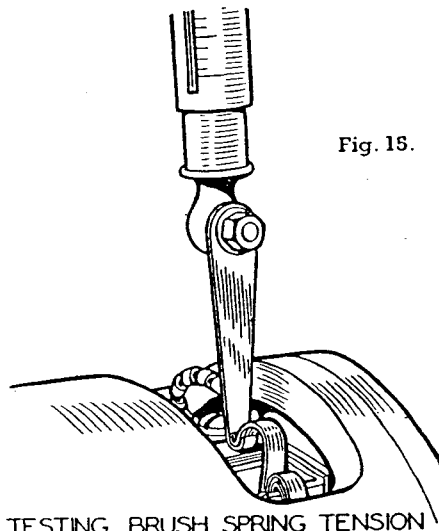
**5. Dismantling.**

- Remove the drive from armature shaft as detailed in paragraph 4.
- Remove key from armature shaft.
- Remove the cover band, hold back the brush springs "B" and remove the brushes "C" from their holders "D".
- Unscrew and remove, from the driving end bracket, the two through bolts "E" securing the commutator end bracket and driving end bracket to the yoke.

- Unsolder the connections to the "D" and "F" terminals on the commutator end bracket and draw the leads out of the terminals. Remove the commutator end bracket "F" from the yoke "G". If it is a tight fit it should be carefully levered off with a screwdriver. When free, slide the end bracket, which is fitted with a porous bronze bearing bush for the armature shaft, sufficiently clear to enable the screw securing the second field coil lead to the brush box terminal to be removed. Remove the thrust washer "H" from the commutator end of the armature shaft and the distance collar "I" from the driving end (see Fig. 14).
- The driving end bracket "J" together with the armature "K" can now be lifted out of the yoke.
- The driving end bracket, which, on removal from the yoke, has withdrawn with it the armature shaft ball bearing, need not be separated from the shaft unless the bearing is suspected and requires examination in which event the armature should be removed from the end bracket by means of a hand press.

**6. Brushes.**

Test if the brushes are sticking. Clean with petrol and if necessary ease the sides by lightly polishing with a smooth file. Replace brushes in original positions.



Test the brush springs with a spring scale if available. The correct tension is 30/40 ozs. Fit a new spring if the tension is low.

## DYNAMO—continued.

If the brushes are worn so that the flex is exposed on the running face, new brushes must be fitted. Brushes are pre-formed so that bedding to the commutator is unnecessary.

### 7. Dynamo-Commutator.

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a petrol moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper while rotating the armature. To remedy a badly worn commutator, mount the armature, with or without the drive end bracket in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very

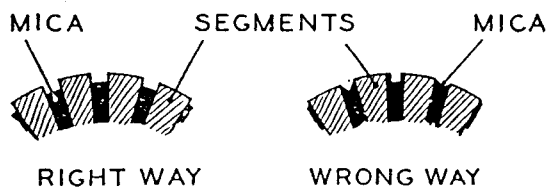


Fig. 16.

Method of Undercutting Commutator.

fine glass paper. Undercut the mica insulation between the segments to a depth of  $1/32$ -in. with a hack-saw blade ground down to the thickness of the mica (Fig. 15).

### 8. Field Coil.

Test the field coils, without removing from the dynamo yoke by connecting them in series with a 12-volt battery and a 12-volt 36-watt bulb. If the field coils are satisfactory, the bulb should light up, but its brilliance should be somewhat less than when it is connected directly to the battery. Failure of the bulb to light indicates an open circuit in the field coil windings, while if the bulb lights with full brilliance, the field coils are probably either shorted or earthed to the pole shoes or dynamo yoke. In either case, the complete dynamo assembly must be returned to the Depot and a replacement fitted. If, however, a pole shoe expander and wheel operated screwdriver are available, it is possible to replace the field coils (see Fig. 17). A pole shoe expander is necessary, in order to ensure that there will not be any airgap between the pole shoes and the inner face of the yoke.

Replace the field coils as follows :—

- (a) Remove the insulation piece which is provided to prevent the junction of the field coils from contacting with the yoke.
- (b) Mark the yoke and pole shoes in order that they can be fitted in their original positions.
- (c) Unscrew the two pole shoe retaining screws by means of the wheel operated screwdriver.

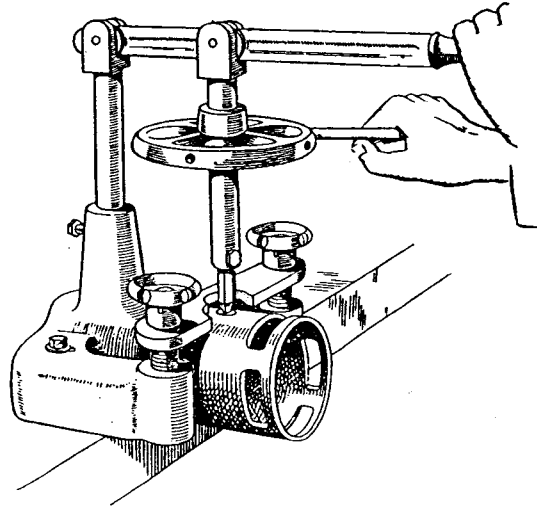


Fig. 17.

Using Wheel Operated Screwdriver.

- (d) Draw the pole shoes and coils out of the dynamo yoke and lift off the coils.
- (e) Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.
- (f) Locate the pole shoes and field coils by lightly tightening the fixing screw.
- (g) Insert the pole shoe expander, open it to the fullest extent and tighten the screws.

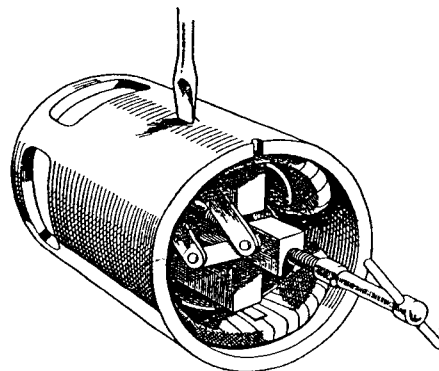


Fig. 18.

Pole Shoe Expander.

**DYNAMO—continued.**

- (h) Finally tighten the screws by means of the wheel operated screwdriver and lock them by caulking.
- (j) Replace the insulation piece between the field coil connections and the yoke.

**9. Armature.**

The testing of the armature winding requires the use of a volt-drop test or a growler. If these are not available, the armature should be checked by substitution. No attempt should be made to machine the armature core or to true a distorted armature shaft.

**10. Bearings.**

Bearings which are worn to such an extent that they will allow approximately .015-in. total side movement of the armature shaft, must be replaced.

To replace the bearing bush at the commutator end, proceed as follows :—

- (a) Press the bearing bush out of the commutator end bracket.
- (b) Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing.

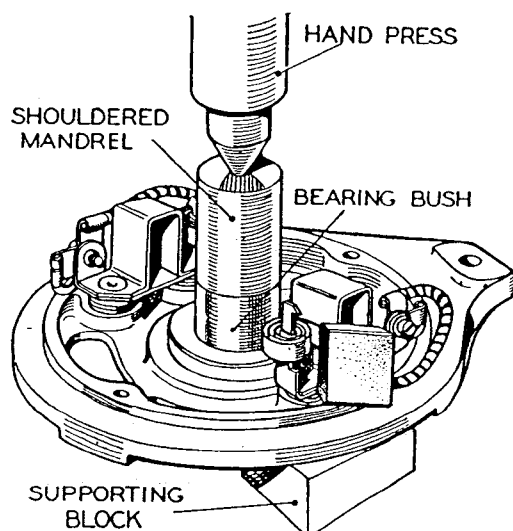


Fig. 19. Method of Fitting Bearing Bush.

**NOTE.**—Before fitting the new bearing bush it should be allowed to stand for 24 hours immersed for approximately seven-eighths of its length in thin engine oil.

The ball bearing at the driving end is replaced as follows :—

- (a) Knock out the three rivets which secure the bearing retaining plate to the end bracket and remove the plate.
- (b) Press the bearing out of the end bracket and remove the corrugated washer, felt washer and felt retaining washer.
- (c) Before fitting the replacement bearing see that it is clean and pack it with a high melting point grease.
- (d) Place the felt retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.
- (e) Locate the bearing in the housing and press it home by means of a hand press, using a tool locating on the outer journal.
- (f) Fit the bearing retaining plate. Insert three new rivets from the outside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

**11. Dynamo—Re-assembly.**

In the main the re-assembly of the dynamo is a reversal of the operations described in paragraph 5, page T/9, bearing in mind the following points :

- (a) The field coil lead provided with the eyelet must be connected to the terminal on the brush box which is in metallic contact with the end bracket.
- (b) The second field coil lead must be connected to the "F" terminal in the end bracket. The short length of cable from the terminal in the insulated brush box must be connected to the "D" terminal in the commutator end bracket.
- (c) Unscrew the lubricator from the commutator end bracket, lift out the felt wick and spring and refill the cap with lubricant. Replace spring and wick and screw the lubricator in position in the end bracket.

C.A.V. CONTROL BOARD

1. Type.

The Control Board is a C.A.V. Type 75BT-19X. Identification marks are stamped on the nameplates fixed to the base and the main cover.

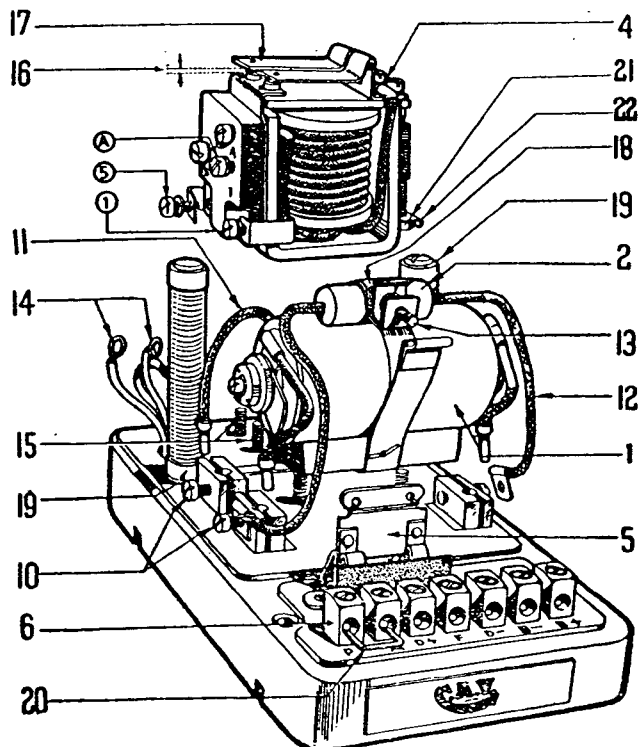


Fig. 20.

2. Description and Operation (Figs. 20 and 21.)

This Control Board houses the following items of electrical equipment :—

- (a) Voltage Regulator (1) with suppressor condenser (2) housed under Main Cover (3) which is sealed when the Control Board leaves the factory. The regulator operates on the compensated control principle which provides automatic adjustment of the charging current according to the state of charge of the battery. A high current reading indicates that the battery is in a low state of charge and as that state improves so the charge to the battery becomes less until a trickle charge of 2 or 3 amps is obtained.

- (b) Cut-out (4) under main cover functions as an automatic switch for connecting and disconnecting the battery with the dynamo, according to the speed of the latter.

This is necessary because the battery will discharge through the dynamo if it is at rest or if its speed is too low to generate a

sufficient pressure to overcome that of the battery.

- (c) Main Dynamo Fuse (5).
- (d) Distribution terminals (6) for dynamo and battery connections.
- (e) Points resistances (19). These are connected in series and by operation of the regulator points are connected in and out of the dynamo field circuit in order to vary the dynamo output according to the state of charge of the battery.

3. To Test whilst in position on the Vehicle.

Terminals are easily accessible if clip (7) is slid off and terminal cover (8) removed

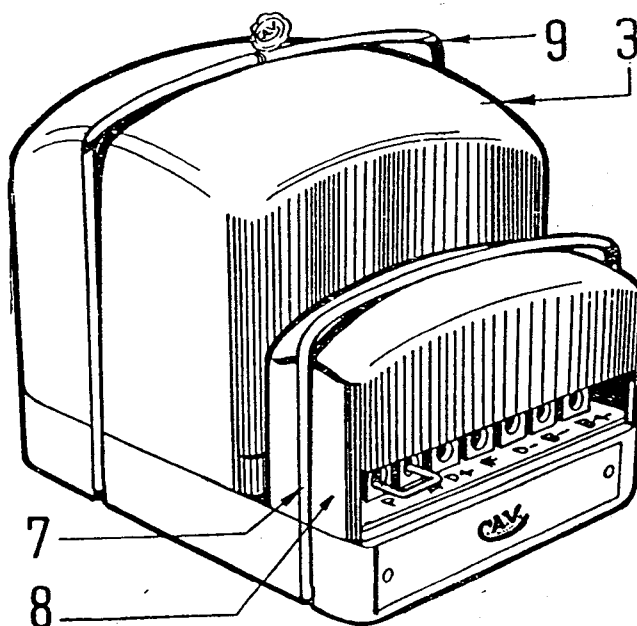


Fig. 21.

Voltage Regulator Type B2-CZ15 (1).

In the event of the battery not being kept in a fully charged state under normal running conditions of the vehicle and as indicated by bad starting and poor illumination from the driving lamps, it is necessary to test the open circuit regulator voltage in order to ascertain if it is within the limits of 15.9 to 16.5 volts.

Proceed as follows :—

- (a) Disconnect from terminals marked B— and B+, cables coloured black and purple and white respectively.
- (b) Switch off all lamps and accessories on the vehicle.

**CONTROL BOARD**—continued.

- (c) Connect the positive lead of a moving coil type voltmeter having a suitable range to terminal marked D+ and the second voltmeter lead to terminal marked D—. Run dynamo at a speed between 1,000 and 1,500 r.p.m. If the voltmeter reading does not fall between 15.9 and 16.5 volts then the regulator must either be re-set or renewed. (See paragraphs 6 and 7).

**Cut-out (4).**

- (d) Without disconnecting any cables from Control Board switch on all driving lamps and connect a moving coil voltmeter, having a suitable range, across terminals D+ and D— on the Control Board.
- (e) Speed up the dynamo gradually noting increase in voltage as recorded on the voltmeter until a peak figure is reached, at which point the voltmeter needle will flick back to a lower voltage. This peak voltage is the cutting-in voltage and should be between 13 and 13.5 volts. Should this not be correct then the cut-out must either be re-set or renewed. (See paragraphs 6 and 7).

**(f) Dynamo Fuse (5).**

See that this is intact ; if blown it should be re-wired, but first ascertain and rectify the cause of its failure, starting with the battery for defective cell or cells and then the regulator for excessive setting.

**(g) Distribution Terminals (6).**

See that the cables are firmly held in the terminals by the grub screws. Make sure that the correct coloured cables are connected to their respective terminals.

They should be as follows :—

Terminal marked B+ Cable coloured purple and white.

|   |   |    |                       |
|---|---|----|-----------------------|
| " | " | B— | Cable coloured black. |
| " | " | D— | " " black.            |
| " | " | D+ | " " yellow.           |
| " | " | F  | " " green.            |
| " | " | P  | " " yellow.           |
|   |   |    | and brown.            |
| " | " | A  | " " yellow            |
|   |   |    | and brown.            |

**(h) Condenser (2).**

A condenser .020 mfd. capacity, is connected across the regulator terminals as illustrated in Fig. 20 for the purpose of suppressing interference with radio receivers.

**4. Adjustments whilst in position on Vehicle.**

- (a) **Regulator (1).** In certain circumstances it should be possible to adjust the regulator without removing it from the control board on the vehicle. If this cannot be conveniently carried out, proceed as laid out in Para. 7.

**(b) Cut-out (4).**

Remarks given for regulator above apply equally to the cut-out.

**(c) Dynamo Fuse (5).**

Spare fuse wire is carried wound around the fuse bridge. This is number 29 S.W.G. tinned copper wire and it is essential the size and material of wire is not changed. When fitting a new fuse, remove all old pieces of the blown fuse and slip **one strand of wire** into the fuse bridge clips. Fig. 22.

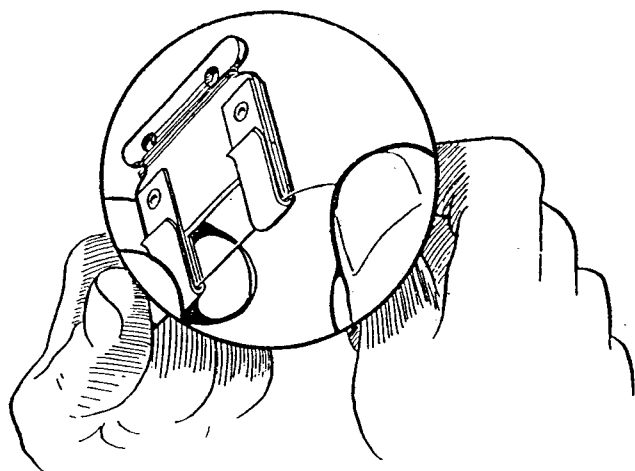


Fig. 22.

**5. To remove and replace complete Control Board.**

Disconnect battery leads, remove wires from terminals under cut-out fuse cover, and take out four bolts to scuttle.

**6. Dismantling and replacing Parts—with Control Board removed from Vehicle.**

It is necessary to first remove the main cover (3) by breaking the seal and slipping off clip (9). Also terminal cover (8) by slipping off clip (7).

**CONTROL BOARD—continued.****REGULATOR.****To replace Regulator complete (Fig. 20).**

- (a) Release all terminal screws (10).
- (b) Take out regulator leads (11).
- (c) Remove condenser leads (12).
- (d) Release cradle strap screw (13) and open strap.
- (e) Lift out regulator and fit replacement regulator.
- (f) Re-assemble according to a — e reversed.

**CUT-OUT.****To replace Cut-out complete.**

- (g) Remove 3 connections (14) from terminals marked A, 5 and 1.
- (h) From back of board take out 4 screws (15).
- (i) Remove cut-out and fit replacement unit.
- (k) Proceed as for a and b reversed.

**Suppression Condenser (2).**

To replace, first loosen terminal screws (10) and take off condenser leads (11). Loosen cradle strap and screws (13) and slide condenser (2) through clip (18).

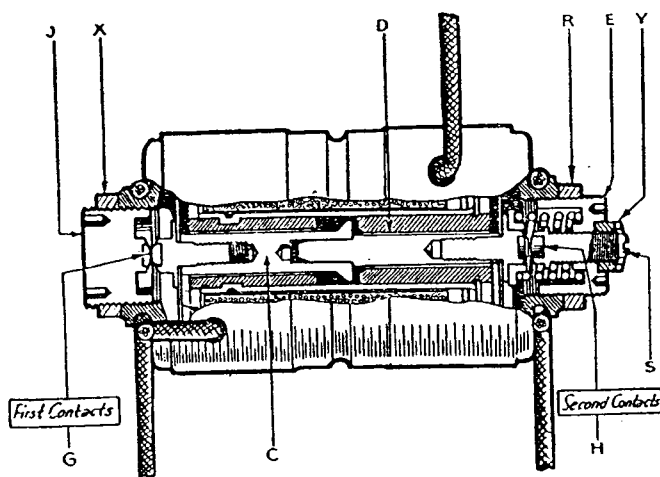
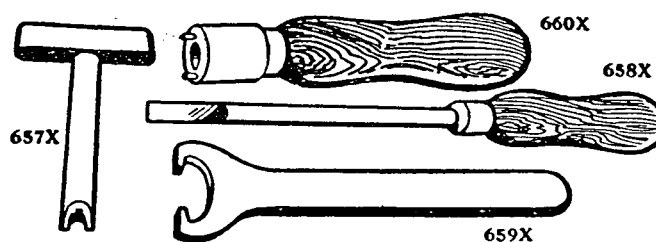
**7. Re-setting and Adjusting Regulator.****Re-setting Regulator (Fig. 23).**

Fig. 23.

It is advisable to have a set of tools available as illustrated in Fig. 24 before attempting the following sequence of operation.

- (a) See that dynamo cables are connected to their respective terminals:—  
 Cable coloured yellow to terminal D +  
 " " black " " D —  
 " " green " " F



Recommended Tools for Servicing. Fig. 24.

- (b) All other cables to the control board should be disconnected.
- (c) See that Link (20) is in position between terminals marked A and P.
- (d) Connect the positive lead of a moving coil type voltmeter, having a suitable range, to D + terminal and the second voltmeter lead to D — terminal.
- (e) Slacken back locknuts (X, R and Y)—tools 659X and 657X.
- (f) Screw back contact (J)—tool 660X.
- (g) Screw back second contact (S) as far as possible—tool 658X.
- (h) Screw back the sleeve (E)—tool 660X.
- (i) Screw in the first contact (J) as far as it will go i.e., until the armature (C) makes contact with the sleeve (D).
- (k) Screw back the first contact approximately one-and-a-half turns.
- (l) Lock the first contact screw (J) in this position by means of the locking nut (X).
- (m) Run the dynamo at approximately 1,000 r.p.m.
- (n) Screw in sleeve (E) until voltmeter reading is approximately 16.5 volts.
- (o) Run dynamo for one minute.
- (p) Adjust sleeve (E) until first contact setting lies between 15.9 and 16.2 volts.
- (q) Lock sleeve (E) in position by means of locknut (R).
- (r) **Stop Dynamo.** Screw in contact (S) as far as it will go. Turn contact (S) back one complete turn and lock in position by locknut (Y).
- (s) Run dynamo up to 2,000 r.p.m. Voltage setting on second contacts should be at least 0.1 volts above first contact setting, but within 15.9 to 16.5 volts.
- (t) If second contact voltage is above limit, stop dynamo and screw (J) in slightly. Re-check first contact setting and then proceed as in r.
- (u) If second voltage is below first contact, stop the dynamo and screw (J) out slightly. Re-check first contact setting and then proceed as in r.

**CONTROL BOARD—continued.**

**NOTE.**—The adjustment of contact (S) is only possible while the dynamo is stationary. If the contact is screwed up while the dynamo is running, a short circuit is set up on the dynamo resulting in a fusing or welding of the regulator contacts.

**8. Re-setting and Adjusting Cut-out.**

- (a) Connect all cables to the Control Board terminals as indicated in Paragraph 3G.
- (b) Connect a moving coil type voltmeter, having a suitable range, across terminals D + and D—.
- (c) Adjust cut-out gap (16) to 0.020-in.—0.025-in. by carefully bending the moving contact strip arms (17).
- (d) Run the dynamo and gradually increase its speed until a voltmeter reading of 13 to 13.5 volts is reached, when the needle should

flick back to a lower value. If this peak and cutting-in voltage is not recorded, stop the dynamo and adjust nut (21), afterwards speeding up the dynamo again. This procedure should be followed until the correct voltage of 13 to 13.5 volts is reached.

- (e) After having made the necessary adjustments see that adjusting nut (21) is located firmly in position against the curl of the tag (22) to prevent the nut from turning.

**Maintenance of Cut-out.**

- (f) The cut-out points can be cleaned with spirit or very fine carborundum paper, but do not use a file or any form of coarse grit.
- (g) If the contacts are in a burnt or pitted condition, they should be renewed or a complete replacement cut-out fitted.

**FUSE BOX.****Type C.A.V., SF4/L5.**

The fuse box fitted provides four separate fusing points for the various accessories. The four circuits are: Headlamps; Sidelamps; Horn and Fuel Gauge; Stop Lamp (when fitted), Inspection Plug Sockets and Interior Light.

A bank of interconnected terminals for negative feed is included with additional separate terminals for use as required.

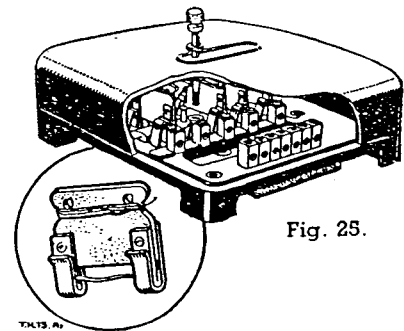


Fig. 25.

**WINDSCREEN WIPER.****Type S.W.4.**

The switch is combined with the knob on the driver's side. To start push in the knob to disengage from the parking stop. Release the knob and then rotate it until the driving dogs engage. To switch off, push in the knob and turn it until the arm lies on the scuttle. The drive to the blade on the passenger's side is engaged and disengaged in a similar manner.

**Replacement of Arm and Blade Assembly.**

To remove the arm and blade assembly, slacken the fixing nut and tap it sharply to release

the collet which clamps the arm on to the spindle. Then remove the complete assembly. When fitting the replacement arm and blade, slacken the securing nut and push the arm fixing bush over the end of the spindle as far as it will go. Secure by tightening the nut.

**Replacement of Blade.**

Take out the rubber bush securing the blade to the arm and remove the blade. Insert the tongue on the replacement blade through the slot in the arm, and secure it by fitting the rubber bush through the hole in the tongue. The bush can be fitted more easily if it is moistened.

**HEADLAMP.****Type L.WD.H.1.****Removing Lamp Front and Reflector.**

To remove the lamp front slacken the securing screw at the bottom of the rim and swing it downwards out of the slot. Remove the front from the bottom of the lamp first. When replacing locate the top of the rim first, then press on at the bottom and secure by means of the fixing screw.

The reflector is secured to the lamp body by means of a rubber bead and can be withdrawn when the bead is removed. When replacing, the projection on the reflector rim must be fitted into the location at the top of the lamp body and the reflector must be secured by refitting the rubber bead, the thicker lip of which must be located between the reflector rim and the lamp body.

**Cleaning.**

Care must be taken, when handling the reflector, to prevent it from becoming finger-marked. It can, however, be cleaned by polishing with a fine chamois leather. Metal polishes must not be used.

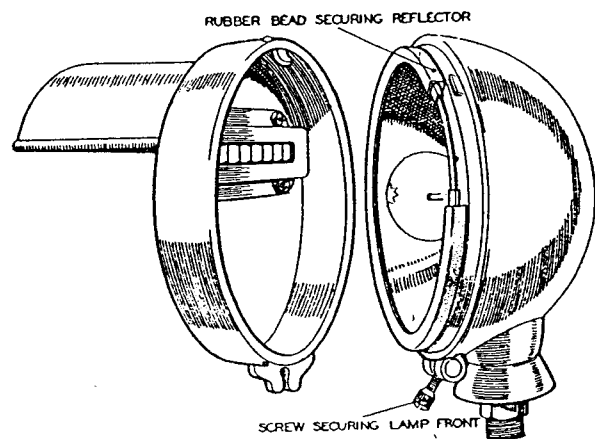


Fig. 26.

**Setting and Focusing.**

The lamp must be set to ensure that the beam is projected below the horizontal.

To obtain the best driving light, the bulb should be correctly focused in the reflector. To adjust the position of the bulb, remove the front and reflector and slacken the screw on the clamping clip at the back of the reflector. Slide the bulb holder backward or forward until the best lighting is obtained and finally tighten the clamping screw.



**SIDE LAMPS.****Type L-WD-S1.**

To remove the front and reflector, slacken the locking screw at the bottom of the lamp, and pull the front and reflector away from the lamp body. When replacing, locate the top first, then press on at the bottom, and secure by tightening the fixing screw. The bulb holder can be removed by unclipping it from the back of the reflector. If it is a tight fit, it can be removed by carefully levering off with a screwdriver.

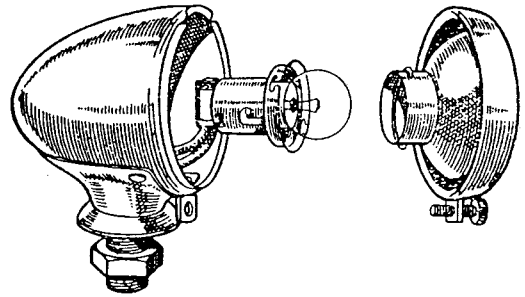


Fig. 27.

**TAIL LAMP.****Type L-WD-T1.**

To remove the cover carrying the red glass, twist and pull cover off its spring clips. When replacing, position the locations in the cover on the spring and push home.

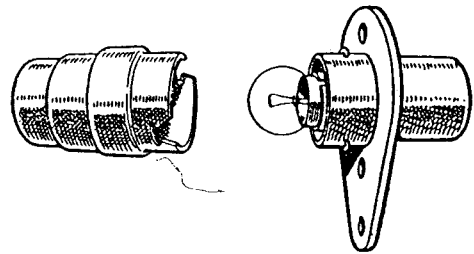


Fig. 28.

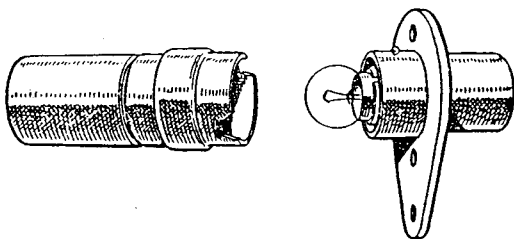
**AXLE FLOODLAMP.**

Fig. 29.

**Type L-WD-AF1.**

The body of axle floodlamp is removed and replaced in the same manner as the tail lamp.

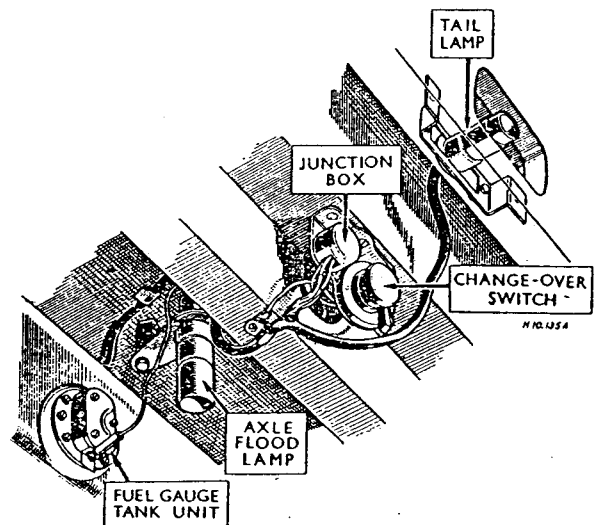


Fig. 30.

Layout of tail lamp, flood lamp, and change-over switch.

**IGNITION WARNING LAMP.****Type WL3-G.**

The warning lamp on the instrument panel will light when the ignition is switched on and the engine is not running. This lamp also lights when the engine is only idling.

Should the bulb of the warning lamp fail this will not affect the ignition, but it should be replaced as soon as possible to act as a safeguard to the battery, by reminding the driver not to leave the ignition switched on. It can be removed from its socket when the small cover plate holding the red glass is unscrewed. The replacement bulb should be a 2.5 volt, .5 watt screw cap type as originally fitted.

**BATTERY.****1. Type and Description.**

Two 6-volt 75-amp./hour Type L-WD-2 Lead-Acid Batteries are fitted under the bonnet.

The negative terminal is earthed to the fly-wheel housing.

Provided these batteries are properly maintained they will function satisfactorily throughout the temperature range—21°F. to 140°F.

**2. Maintenance.**

See page T/20 for special precautions necessary at temperatures below 32°F. (freezing point).

When atmospheric temperature exceeds 100°F. examine battery at intervals not exceeding 7 days, and at temperatures below this, every 14 days, as follows :—

(a) Brush dirt from top of battery and remove vent plugs. NEVER bring a naked light near a battery when the vent plugs have been removed, or when the battery is being charged as the gas given off by the electrolyte is highly inflammable.

(b) **The Specific Gravity of Electrolyte** indicates the state of charge of the battery. Table A shows what the specific gravity of the electrolyte should be, at various temperatures, when the battery is fully charged. Check the gravity by means of a hydrometer, and if it is below the figures shown for the appropriate temperature in Table B, the battery should be charged as soon as possible by the normal running of the vehicle. If this cannot be arranged the battery should be charged from an external source. If the level of the electrolyte is so low that a hydrometer reading cannot be taken, no attempt should be made to take a reading after adding distilled water until the battery has been on charge for at least 30 minutes. NEVER transfer the electrolyte from one cell to another.

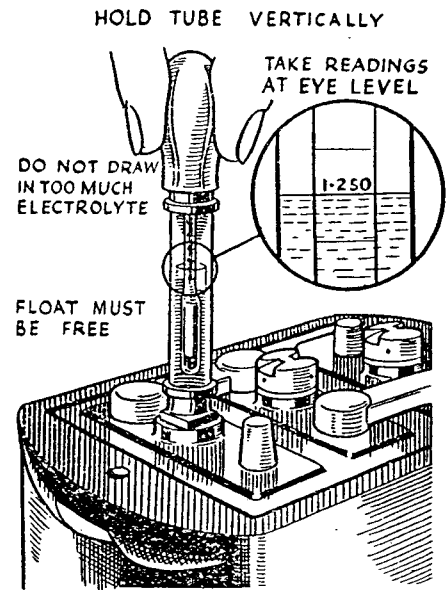
NEVER leave a battery in a discharged condition. It must be put on charge as soon as possible.

**TABLE "A"**

|                 |
|-----------------|
| 1.270 at 120°F. |
| 1.280 at 100°F. |
| 1.285 at 80°F.  |
| 1.295 at 60°F.  |
| 1.305 at 40°F.  |
| 1.310 at 20°F.  |
| 1.320 at 0°F.   |
| 1.325 at -21°F. |

**TABLE "B"**

|                 |
|-----------------|
| 1.220 at 120°F. |
| 1.230 at 100°F. |
| 1.235 at 80°F.  |
| 1.245 at 60°F.  |
| 1.255 at 40°F.  |
| 1.260 at 20°F.  |
| 1.270 at 0°F.   |
| 1.275 at -21°F. |

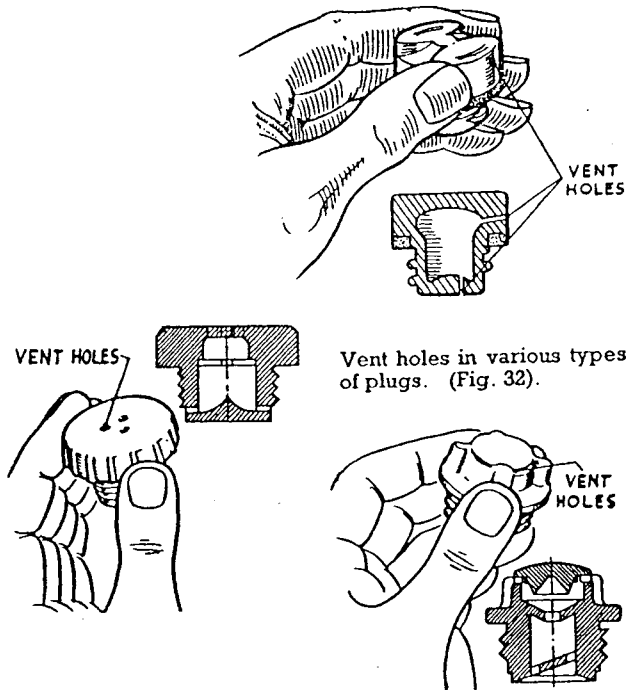


Taking Hydrometer reading. (Fig. 31).

(c) **Electrolyte Level.** Check if the level in each cell is  $\frac{1}{4}$ -in. above top of separators. Top up, if necessary, with distilled water. Do not allow distilled water to come in contact with metal—use only a glass or earthenware container and funnel.

Distilled water should always be used for topping up batteries if possible. As an alternative, in an emergency clean rain water may be used, and even river water as a last resort, if it is known that the battery is badly in need of topping up. Chlorinated water must NOT be used for topping up.

If a battery is found to need an excessive amount of topping up, steps should be taken to find out the reason. For example, the battery may be receiving an excessive charge, in which case the Regulator Setting should be checked, see page T/12. If one cell in particular needs topping up more than another it is likely the case or container is cracked, in which event the battery must be replaced and arrangements made to clean up the container in which the battery is housed. Metal parts should be well cleaned and if possible washed with a solution of ammonia or bicarbonate of soda in water. After cleaning, paint all surrounding parts, wood or metal with anti-sulphuric paint if available.

**BATTERY**—continued.

- (d) Vent Plugs should be kept clean and air passages free. Refix tightly after replacing the rubber washers.
- (e) **Cable Terminals** should be kept free from corrosion and bolted tightly on the terminal posts and coated with Vaseline or petroleum jelly—not grease. If corrosion has taken place, disconnect the terminal from the battery, scrape the corrosion away—taking care that none of it gets into the battery—and wipe with a rag moistened with weak ammonia or bicarbonate of soda solution if available.
- When removing the cable terminals from the battery terminal posts, do not use undue

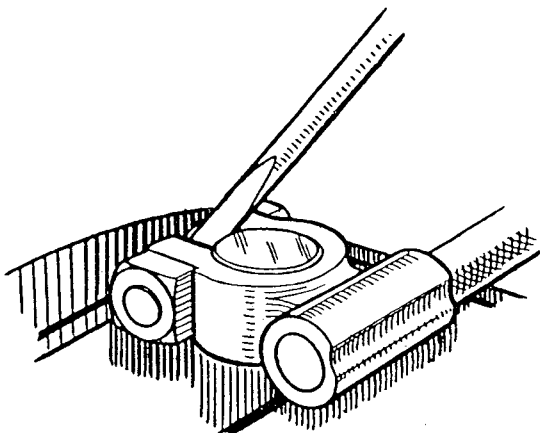


Fig. 33.

force. The split clamp type of terminal can be opened slightly with a screwdriver which should then enable it to be removed easily. Battery Electrolyte, which contains sulphuric acid in a diluted form is destructive to practically everything except rubber, lead, glass or earthenware, therefore rags used to clean battery tops, etc., should be thrown away afterwards, if they are put in the tool box, for example, they will cause the tools to rust.

It will destroy the outside covering of cables, and seat covers, clothes and boots, besides all the metal parts of the vehicle.

- (f) **Cleanliness.** Keep the battery and surrounding parts, particularly the tops of the cells, clean and dry. Brush away any sand, dust or road slush.
- (g) **Fixing.** The battery must be held firmly in its mounting. Fixing bolts, where used, must be kept tight without using undue force.

### NEVER EMPTY ELECTROLYTE FROM THE BATTERY.

#### 3. Charging from External Source.

Before starting the charge, the battery should be topped up with distilled water to  $\frac{1}{4}$ -in. above the top of the separators.

The charge should be at the rate of 11 amps. and continued until the specific gravity of the electrolyte in each cell shows no further rise during four hours continuous charging, and all cells gas freely. If the specific gravity of the electrolyte in any cell or cells fails to rise whilst on charge and gassing does not take place, these should be tested for internal short circuit.

The maximum permissible temperature of electrolyte during external charging is 120°F., and if this is reached the charge should be suspended to allow the temperature to fall. If charging from an external source has to be carried out at temperatures above 100°F., this should be done at half the re-charge rates given above to avoid exceeding the maximum permissible electrolyte temperature of 120°F. If at the end of the charge the specific gravity varies by more than 5 points, (i.e., .005), from the figures given in Table A, the gravity must be adjusted, either raised by the addition of electrolyte, the specific gravity of which at 60°F. would be 1.350, or lowered by the addition of distilled water.

**BATTERY**—continued.

When adjusting the density, care must be taken not to leave too much electrolyte in the cell or cells, any surplus over  $\frac{1}{4}$ -in. above the top of the separators must be removed.

To test a cell suspected of being short circuited, take the individual voltage of each cell of the battery, while it is on charge and also while not on charge, if possible also arrange to discharge the battery. If still fitted to the vehicle this can be done by operating the starter, without allowing the engine to start.

In every case the voltage of the bad cell will be much less than the others. If it is confirmed that the cell or cells are shorted internally, the battery must be renewed.

4. **Special Precautions in Cold Climates** where the temperature is frequently below 32°F. (freezing point), and not lower than — 20°F.

- (1) **Limit of Discharge.** The state of charge of the battery must not be allowed to fall below the condition indicated by the following specific gravities :—

1.200 sp. gr. at 0°F.

1.245 sp. gr. at — 21°F.

1.265 sp. gr. at — 30°F.

otherwise the electrolyte may freeze and the battery be damaged through cracking of the cell containers.

Never allow a battery to stand in a discharged condition.

- (2) **Electrolyte Level** in each cell should be  $\frac{1}{4}$ -in. above the top of the separators. When topping up use clean water, preferably distilled, or clean melted snow. This should be done only during charging and preferably whilst the cells are gassing, so that the water becomes mixed with the electrolyte before it has time to freeze. Under these conditions the temperature of the topping up water is immaterial, but not more than a dessert spoonful of water per cell must be added at a time.

---

## ELECTRIC HORN.

### Type HF.1235.

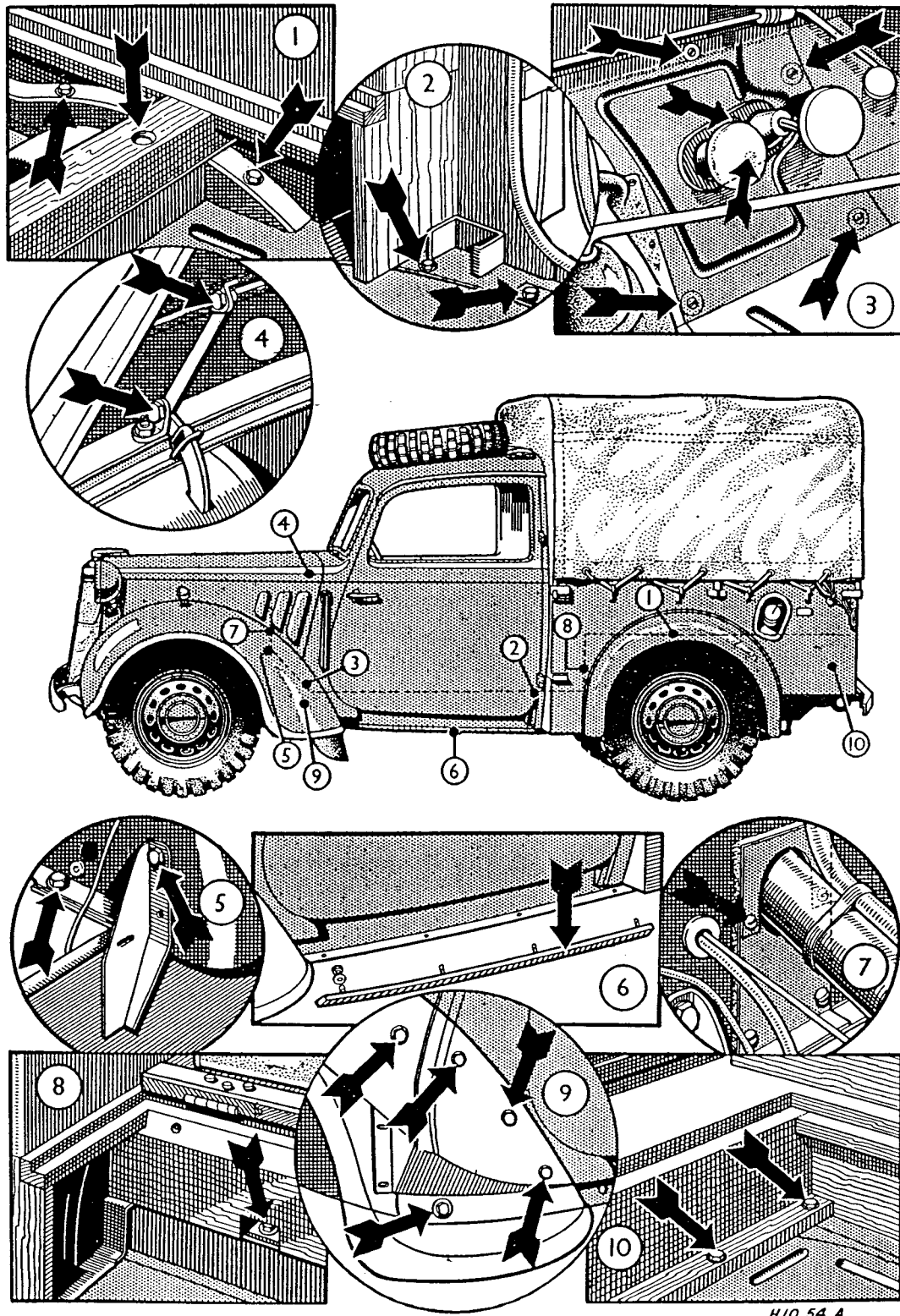
1. Electric Horns are adjusted to give their best performance before leaving the Works and will give a long period of service without any attention. No subsequent adjustment is required.

2. If the horn becomes uncertain in action, or does not vibrate, it has not necessarily broken down. The trouble may be due to a discharged battery or a loose connection or short circuit in the wiring of the horn. A short circuit in the wiring will cause the fuse protecting it to blow; fuse will be

found in the purple and black section of the Fuse Box.

3. The performance of the horn may be upset by the fixing bolt working loose, or by the vibration of some part adjacent to the horn. To check this, remove the horn from its mounting, hold it firmly in the hand by its bracket and press the push. If the note is still unsatisfactory, do not attempt to dismantle the horn, but return it to a depot for examination.

# BODY REMOVAL



H10.54.A

Fig. 1.

The actual positioning of all attachment points is shown in the centre illustration, with close-up detail in each of the associated inset drawings.

### To Remove Body.

1. Remove battery, separate all snap connections to lamps and horn and disconnect leads from ignition coil, dynamo, starter motor and throttle and choke levers on carburetter.
2. Place oil receptacle under steering box to catch lubricant, then slacken steering end cover, pinch bolt and withdraw horn switch and tube.
3. Withdraw steering wheel. (For operations 2 and 3 also see Steering Section).
4. Remove moulded cover over gearbox top.
5. Disconnect speedometer cable from drive at rear of gearbox.
6. Release steering column from clip under instrument panel.
7. Take out toe plates in floor-board near clutch and brake pedals.
8. Remove bonnet and side panels held by bolt at radiator cowl and a bolt into scuttle.
9. Take out the bolts as shown at position 9 in composite illustration, but if it is intended to remove the wings complete, the front bumper bar will first have to be detached. It is held each side

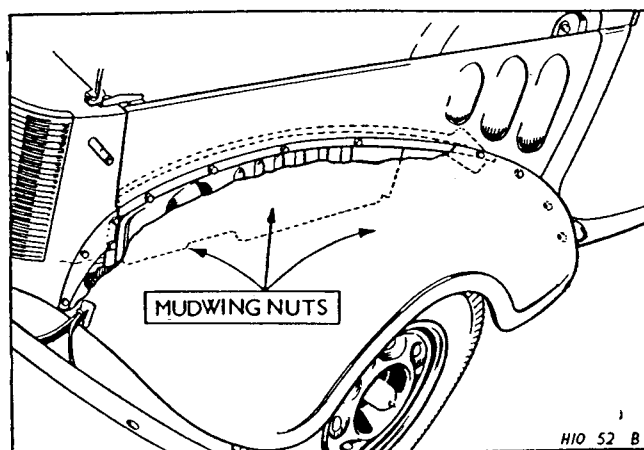


Fig. 2.

by two bolts through the frame. The mudwing bolts to body and fitch plates will be seen in accompanying illustration.

10. At this stage, take out the detachable rear floor boards and proceed to remove body set-screws at positions indicated at 1 and 10. Positions 8 and 2 are more quickly located, together with the bottom strip below the doors (four bolts each side). Positions 3, 9 and 5 are also easily located. Care should be taken to detach the petrol filler hose from tank inlet.

11. The body is then free to be lifted. If windows are wound down a sling can be passed through the cab and further support used near the tail-board.
12. The body should be drawn backwards as it is raised in order that the scuttle can follow the "rake" of the steering column.
13. It will be found the body is mounted with a felt strip between it and the frame ; similar strip should always be used in mounting.
14. Replacing the body is exactly a reversal of the above procedure, care being taken to "thread" the dash over the steering column.

### Removing Front Windscreen.

1. First disconnect winder chain from bottom of screen frame, as shown in accompanying illustration.
2. While the weight of the screen is supported by an assistant remove the bolt from each of the two hinge plates at the top of the screen as shown inset.

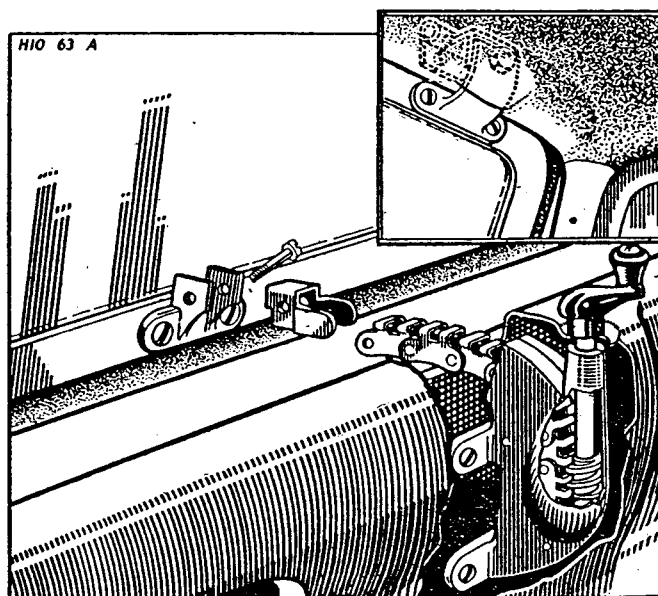


Fig. 3.

### Replace Screen.

1. When replacing screen winder chain after refitting screen frame, the chain bolt and clip is more easily located if the chain is wound out for a few inches and the screen kept partly open.
2. The illustration also shows the method of mounting of the winder mechanism, which can be removed complete for renewal in the event of damage.

## DOOR CASING AND FITTINGS.

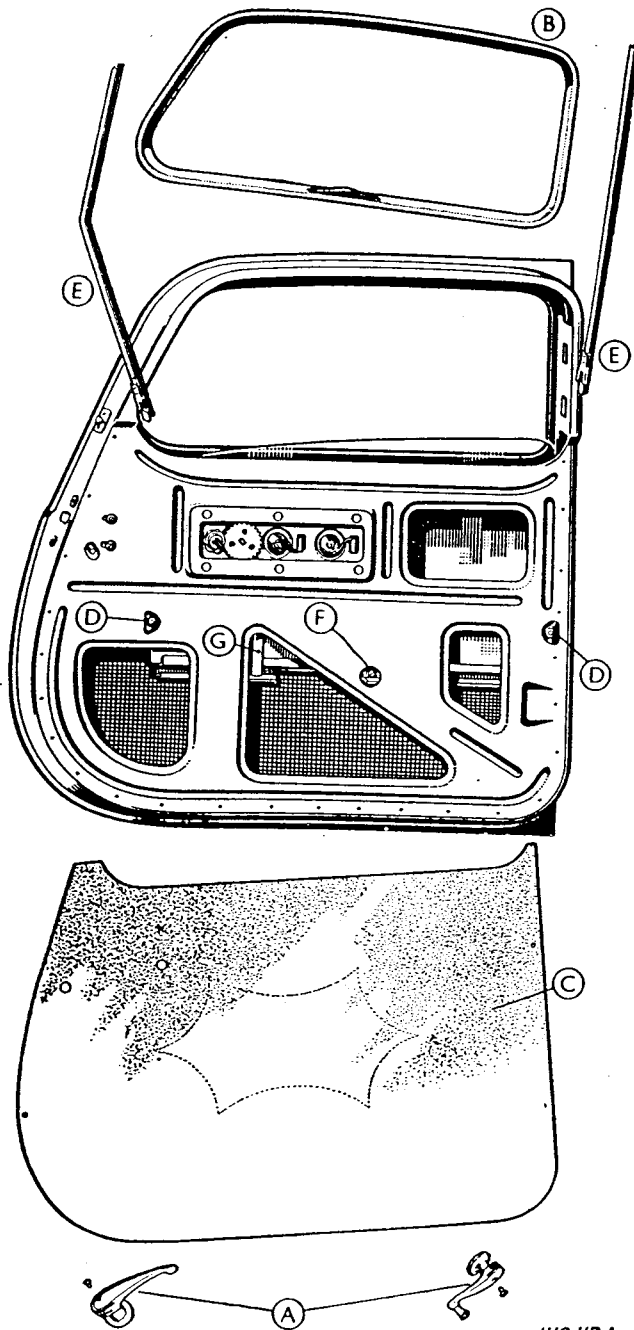


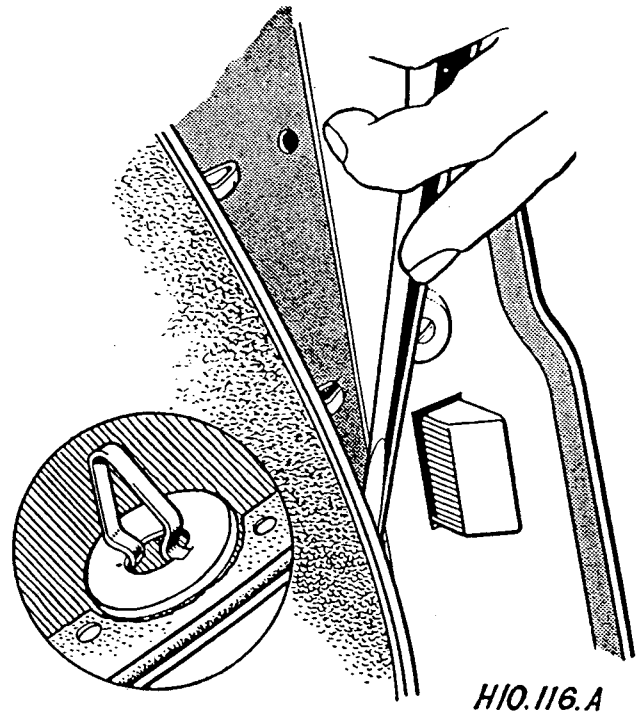
Fig. 4.

- A. Door and Winder Handles.
- B. Window Fillet.
- C. Door Casing.
- D. Locking Nuts for glass channels.
- E. Channels.
- F. Stop Screw for lifting arm.
- G. One of the Lifting Arms.

H10.117A

## Remove Glass.

1. Remove door check strap and take out hinge pins.
2. Take off interior handles—winder and lock handle— by taking out the central screw from each.
3. Take out window fillet by removing screws to door frame.
4. Remove door casing. It is usually held by three screws into the door frame as well as by the spring clips (illustrated separately on this page).



H10.116.A

Fig. 5.

5. Temporarily refit window winding handle and wind glass to its lowest position.
6. Take out the small screws in the upper half of glass channels, and then slacken the two nuts shown at "D" in large illustration.
7. Through aperture in door panel the two lifting arms can be seen up against the two stop screws in the slide. Take out these stop screws and draw the lifting arms towards the centre, when they will slide out of this bottom channel.

## CHANNEL FITTING.

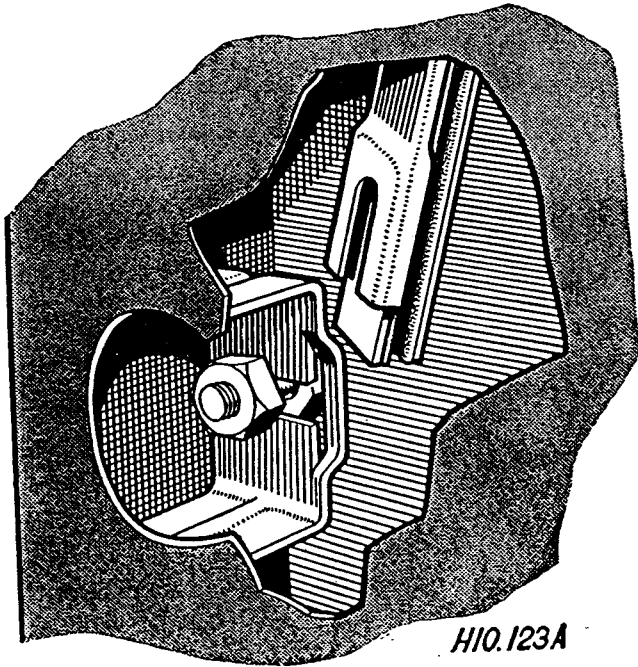


Fig. 6.

8. With the loose glass channels leaning inward the glass complete may be withdrawn upward by hand from the door.

9. In the illustration the glass channels are shown withdrawn, but there is no need to detach them. If they are detached, the accompanying drawing will show how they should be replaced in order to register with the locking plate and bolts "D."

## Mechanical Winder.

This is bolted in position but can easily be detached for renewal. If springs are to be renewed, note the direction of "wind," or the window weight may not be properly counter-balanced.



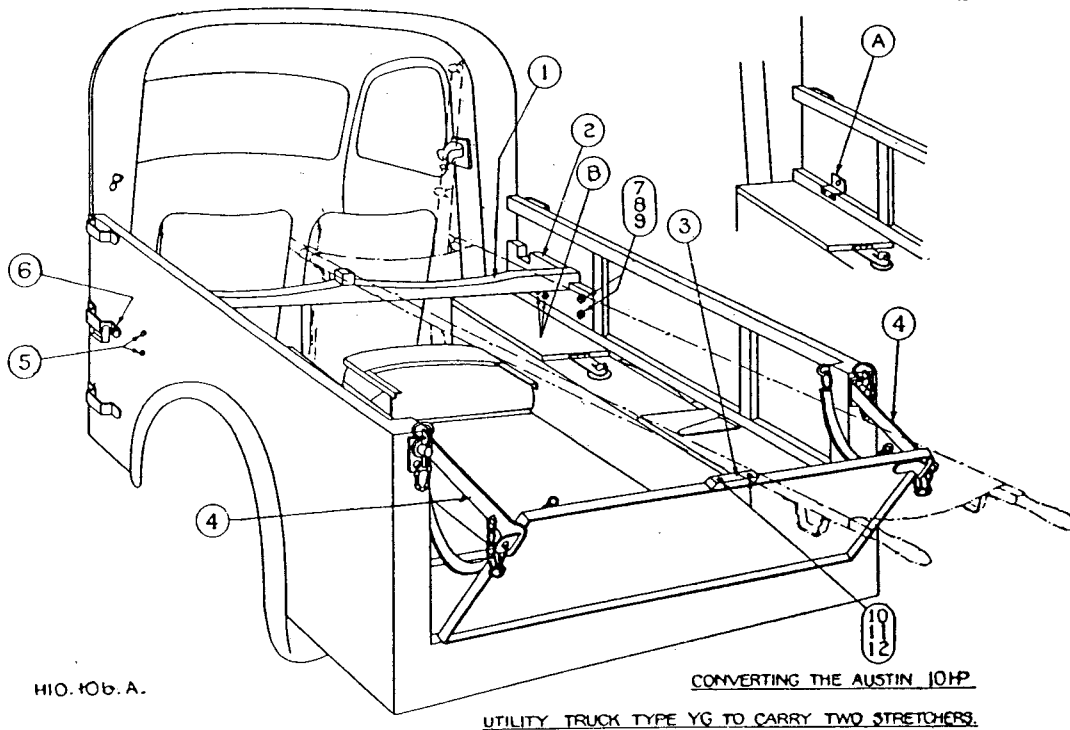


Fig. 7.

**CONVERSION DETAILS.**

1. This scheme was introduced to bring early models into line with regard to stretcher accommodation.

2. Remove two brackets A which, together with four woodscrews and two  $\frac{1}{4}$ -in. x  $\frac{5}{8}$ -in. B.S.F. bolts are discarded.

3. Place stretcher rail support block (item 2) in position shown and fix with one  $\frac{1}{4}$ -in. B.S.F. x  $1\frac{1}{8}$ -in. bolt (item 6) for each block, using whichever of the two holes marked B are found to register. (It will be found that the earlier trucks will require the use of the forward hole, the rearward hole suiting the later trucks). The nuts and washers of the discarded  $\frac{5}{8}$ -in. long bolts, together with two plain washers (item 7) are re-used for this fixing.

4. Fit  $\frac{1}{4}$ -in. B.S.F. x  $1\frac{3}{4}$ -in. bolts, nuts and washers items 5, 7, 8 and 9) after drilling holes in body panels, locating from block.

5. Stretcher bar assembly (item 1) can now be placed in block slots, the forward position for stowage, and the rear position for use with stretcher.

6. Tailboard block (item 3) is secured centrally in top rail of tailboard (after drilling suitable holes marked from block) with 2 B.A. x  $1\frac{1}{2}$ -in. metal threads, nuts and washers (items 10, 11 and 12).

7. Tailboard stay assembly (item 4) is fitted as illustrated. The round hole on the body peg, secured by the chained cotter, the slotted end engaged on the tailboard bracket and secured by the chained spring hook on the tailboard stay assembly.

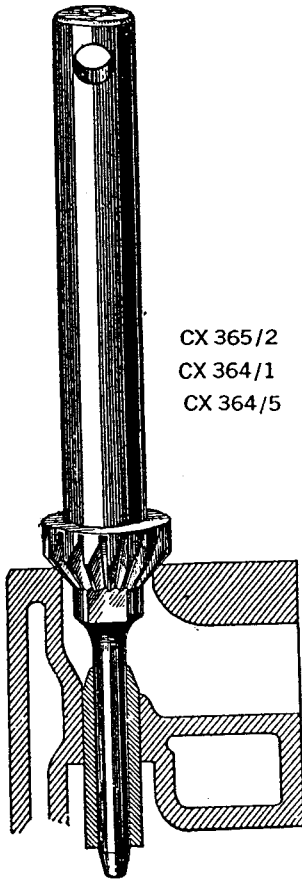
8. It should be noted that the rifle is reversed in the rifle clip on the off side body pillar to clear stretcher handle, and that it is necessary to hinge back the off side emergency seat with the back rest folded flat to clear the rifle in this position. Further the pick shaft on the near side body pillar must be removed from its clip and stored on the floor behind the front seats.

**PARTS REQUIRED.**

|                                                                                                                                  |                  |            |
|----------------------------------------------------------------------------------------------------------------------------------|------------------|------------|
| (1) Stretcher Bar Assembly                                                                                                       | .....            | 1 off      |
| (2) Stretcher Rail Support Block                                                                                                 | .....            | 2 off      |
| (3) Tailboard Block                                                                                                              | .....            | 1 off      |
| (4) Tailboard Stay Assembly                                                                                                      | ..... 1 off R.H. | 1 off L.H. |
| (5) Hex. Bolt $\frac{1}{4}$ -in. B.S.F. x $1\frac{3}{4}$ -in. for fixing item 2                                                  | .....            | 4 off      |
| (6) Hex. Bolt $\frac{1}{4}$ -in. B.S.F. x $1\frac{1}{2}$ -in. (replaces $\frac{1}{4}$ -in. x $\frac{5}{8}$ -in. bolt) for item 2 | .....            | 2 off      |
| (7) $\frac{1}{4}$ -in. Plain Washer Used with item 5                                                                             | .....            | 4 off      |
| Used with item 6                                                                                                                 | .....            | 2 off      |
| (8) $\frac{1}{4}$ -in. Spring Washer. Used with item 5                                                                           | .....            | 4 off      |
| (9) $\frac{1}{4}$ -in. B.S.F. Nut. Used with item 5                                                                              | .....            | 4 off      |
| (10) C/SK Metal Thread 2 B.A. x $1\frac{1}{2}$ -in for fixing item 3                                                             | .....            | 2 off      |
| (11) Spring Washer $\frac{3}{8}$ -in. Used with item 10                                                                          | .....            | 2 off      |
| (12) Nut 2 B.A. Used with item 10                                                                                                | .....            | 2 off      |

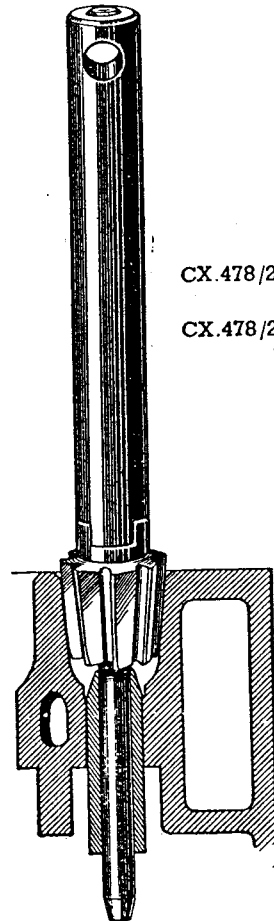
ENGINE.

Valve Seating Cutter.



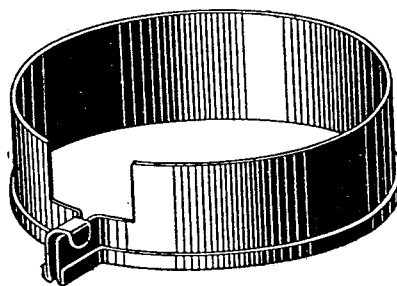
CX 365/2  
CX 364/1  
CX 364/5

Valve Port Reamers.



CX.478/2-CX.479/9 } (Inlet)  
CX.364/1. }  
CX.478/2, CX.479/2, } (Exhaust).  
CX.364/1. }

Piston Ring Guide.



FJ 5531/1

**Valve Lifter for Slotted Valve Head.**  
2H.1001/2320.

Tool illustrated on page F/5.

**Valve Lifter for Peg Type Valve Head.**  
FJ.5793.

**Tappet Wedge, FJ, 5404.**

Tool illustrated on page F/7.

**Tappet Adjustment Spanners, CJ838 and CJ839.**

Tools illustrated on page F/8.

**Fan Driving Pulley Extractor, CJ.1535.**

**Drift for Crankshaft Gear, KJ.3503.**

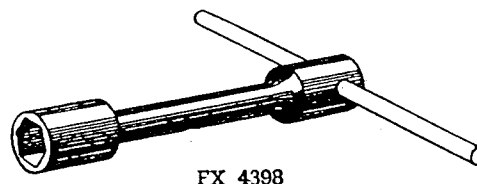
**Gudgeon Pin Setscrew Spanner.**

For use with early type connecting rod,  
XLX.763 (horizontal clamping).

For use with latest type connecting rod,  
2H3127 (angular clamping).



**Spanner for Main Bearing Cap Nut.**



#### GEARBOX AND CLUTCH.

**Service 1st Motion Shaft (for assembling clutch plate) FX.4399.**

Tool illustrated on page J/2.

**Drift for Assembling Gearbox Fork Rods and Springs. FX.924.**

Tool illustrated on page H/3.

**Drift for 1st Motion Shaft Bearing, XLJ.2668.**

**Drift for 1st Motion Shaft Bearing (into Housing) CX.500/13.**

**Vice Jaws for 1st Motion Shaft Retaining Ring. XLJ.3995.**

Tool illustrated on page H/3.

**Synchromesh Sub-assembly Guide. CJ.345/1.**  
Tool illustrated on page H/6.

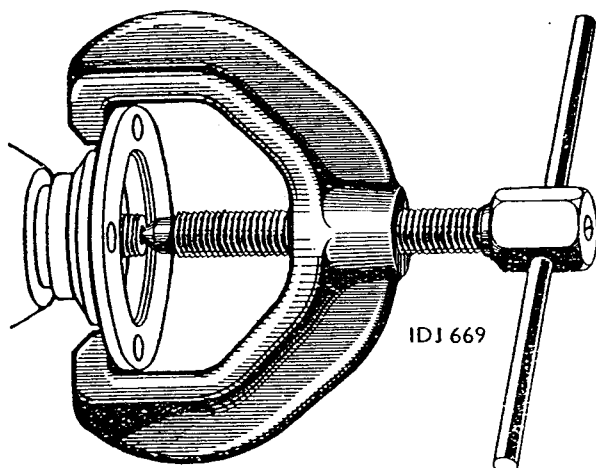
**Drift for 1st Motion Shaft Bearing (into Housing) CX.500/13.**  
Tool illustrated on page H/3.

**Clutch Setting and Assembly Fixture. FJ.6131.**  
(With or without Dial Gauge).  
Tool illustrated on page J/2.

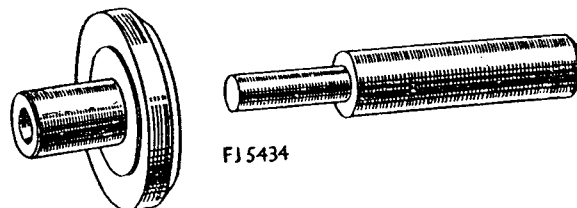
**Clutch Brace Spanner. FX.4524.**

## REAR AXLE.

**Extractor for Bevel Pinion and Third Motion Shaft Flanges.**

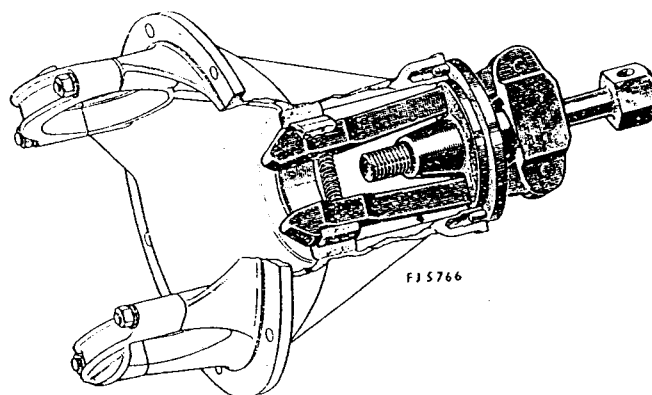


**Drift for Hub Assembly.**

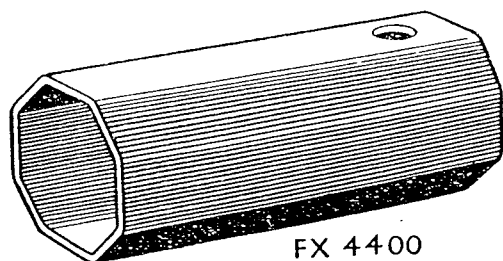


**Gauge for Fitting Bevel Pinion. FW.2045.**  
Tool illustrated on page O/5.

**Extractor for Pinion Bearing Outer Race. FJ. 5766.**



**Spanner for Rear Hub Retaining Nut.**



**Rear Hub Extractor. FJ.5441.**  
Tool illustrated on page O/1.

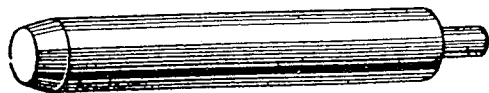
## FRONT AXLE.

**Reamers for Swivel Axle Bushes.**  
FX.3817/1 and FX.1923/2.

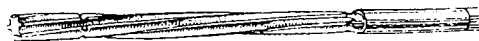


**Extractor for Front Hub. FJ.5441.**  
Tool illustrated on page N/5.

**Extractor for Swivel Pins. CJ.720.**  
Tool illustrated on page N/1.

**CHASSIS.****Drift for Shackle Bushes.**

CX 585/30

**Reamer for Shackle Bushes.**

FX 4277

**STEERING.****Extractor for Steering Arm. CJ.207.**

Tool illustrated on page M 2.

**Extractor for Steering Wheel. CJ.211.**

Tool illustrated on page M/2.

# TOOL KIT AND ACCESSORIES

W/1

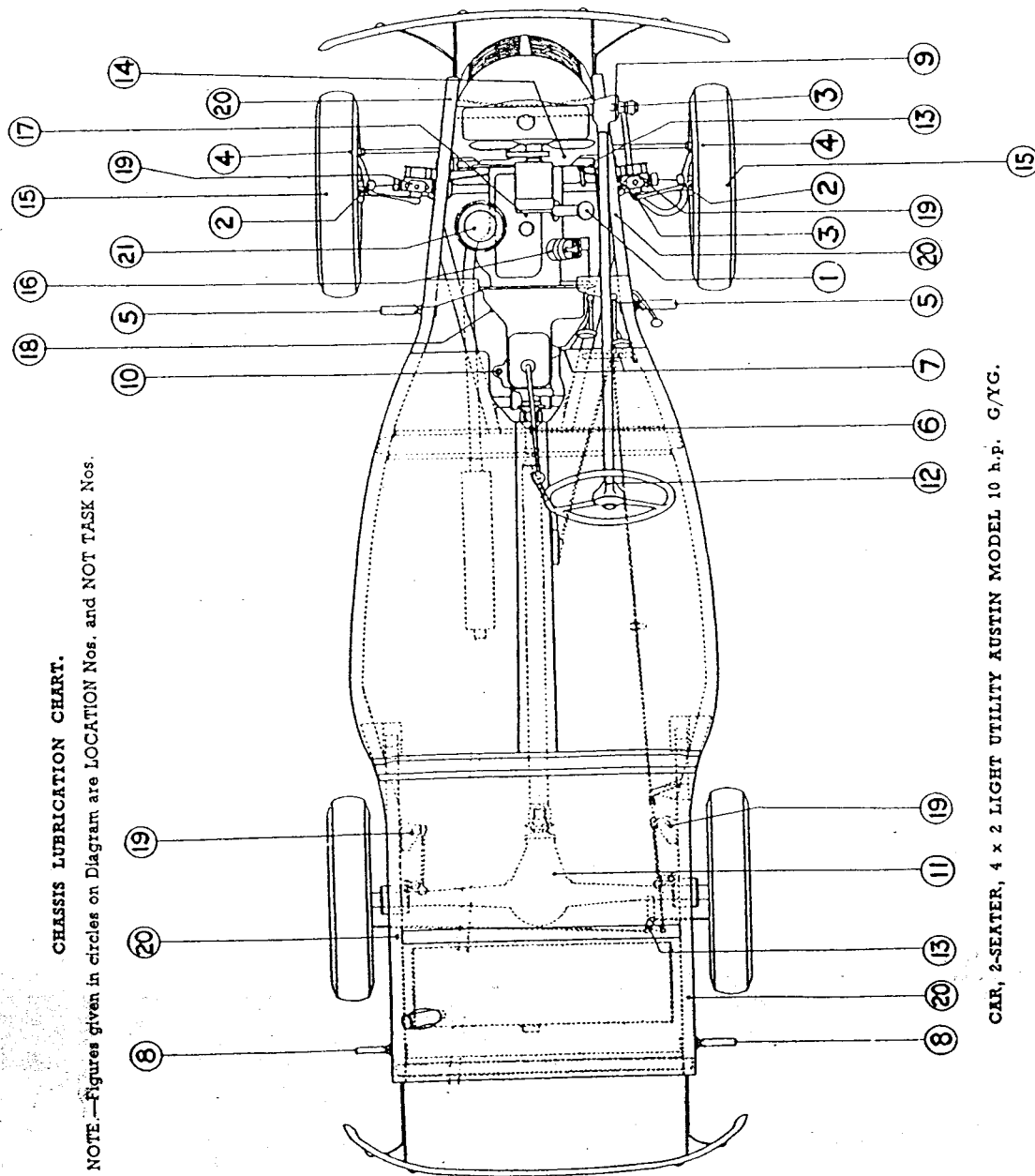
| Austin<br>Part Number | DESCRIPTION.                                                                                                                             | Proprietary or M.T.<br>Part Number.                |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| 2H 3436               | Bag for tools                                                                                                                            | MT2/284                                            |
| 2H 3454               | Bulbs for Head and Side Lamps (in box)<br>Head Lamp Bulb (12v. 36w. Lucas No. 58)<br>Side Lamp Bulb (12v. 6w. Lucas No. 209)<br>Box only | { Demand :—<br>MT3/12526<br>MT3/12516<br>MT3/39761 |
| 2H 3446               | Copper or Steel Wire (15 feet)                                                                                                           | VAOS/GB/1813                                       |
| 2H 1697               | Gauge and Screwdriver for ignition                                                                                                       | Not Serviced.                                      |
| 2H 2977               | Gauge for Sparking Plug clearance (also Tappet Clearance Gauge with early models)                                                        |                                                    |
| 2H 3435               | Gauge for Tyre Pressure                                                                                                                  | MT1/46293                                          |
| 2H 3735               | Grease Gun and Adaptor (Make—Tecalemit; Type Pom Pom 'CH'; Service No. 25732)                                                            | { MT1/TT/Type Pom<br>Pom B.                        |
| 2H 3444               | Hammer                                                                                                                                   | VAOS/FA/2139                                       |
| 2H 3958               | Inspection Lamp (Make—Lucas ; Type No. 98 ; Service No. 61400A)                                                                          | MT3/11637                                          |
| 2H 3445               | Insulating Tape (1 roll or tin) $\frac{1}{2}$ " wide                                                                                     | MT1/2250                                           |
| 2H 3509               | Lifting Jack                                                                                                                             | MT1/44001                                          |
| 2H 3612               | Shaft for jack—jack end                                                                                                                  | Local Manufacture                                  |
| 2H 3659               | Shaft for jack—handle end                                                                                                                | Local Manufacture                                  |
| 2H 3660               | Handle only                                                                                                                              | Local Manufacture                                  |
| 2H 3884               | Oil Can (Wesco No. 3320T)                                                                                                                | MT1/10128                                          |
| 2H 3453               | Oil Funnel                                                                                                                               | MT1/18744                                          |
| 2H 110                | Pliers (Combination)                                                                                                                     | MT2/12153                                          |
| 2H 3570               | Tyre Pump (foot)                                                                                                                         | MT1/12246                                          |
| 2H 84                 | Screwdriver                                                                                                                              | MT2/5249                                           |
| 2H 2647               | Adjustable Spanner                                                                                                                       | MT2/10994                                          |
| 2H 3127               | Box Spanner, $\frac{3}{8}$ -in. x $\frac{1}{4}$ -in.                                                                                     | MT2/7647                                           |
| 2H 3752               | Box Spanner for Sparking Plug                                                                                                            | MT2/46064                                          |
| 2H 88                 | Double Ended Spanner, $\frac{3}{8}$ -in. x $\frac{1}{4}$ -in.                                                                            |                                                    |
| 2H 89                 | Double Ended Spanner, $\frac{5}{8}$ -in. x $\frac{3}{8}$ -in.                                                                            |                                                    |
| 2H 83                 | Double Ended Spanner, $\frac{7}{8}$ -in. x $\frac{1}{2}$ -in.                                                                            |                                                    |
| 2H 1361               | Spanner for Tapper Screw                                                                                                                 |                                                    |
| 2H 3741               | Sparking Plug (Spare) Lodge C. 14S                                                                                                       | } alternatives                                     |
| 2H 1928               | Sparking Plug (Spare) Champion L.10                                                                                                      |                                                    |
| 2H 4152               | Carrier for spare sparking plug                                                                                                          |                                                    |
| 2H 86                 | Tommy Bar                                                                                                                                | MT2/44930                                          |
| 2H 2037               | Tool Wrap                                                                                                                                | Local Manufacture                                  |
| 2H 1683               | Tyre Valve Tool                                                                                                                          | MT2/19723                                          |
| 2H 918                | Wheel Brace                                                                                                                              | MT2/3650                                           |

(Some of the latest vehicles are fitted with 14-volt 7-watt bulbs in side, rear and inspection and axle-flood lamps).

|                     | Austin Part Name.  |     |     |     |     |     |     | Alternatives.                                                 |
|---------------------|--------------------|-----|-----|-----|-----|-----|-----|---------------------------------------------------------------|
| <b>ENGINE :</b>     | Gudgeon Pin        | ... | ... | ... | ... | ... | ... | { Piston Pin<br>Small End Pin<br>Wrist Pin                    |
|                     | Scraper Ring       | ... | ... | ... | ... | ... | ... | Oil Control Ring                                              |
|                     | Welch Plug         | ... | ... | ... | ... | ... | ... | { Expansion Plug<br>Core Plug<br>Sealing Disc                 |
|                     | Oil Sump           | ... | ... | ... | ... | ... | ... | { Oil Pan<br>Oil Reservoir                                    |
| <b>CONTROLS :</b>   | Choke              | ... | ... | ... | ... | ... | ... | { Strangler<br>Starter<br>Easy Starting Device                |
|                     |                    |     |     |     |     |     |     |                                                               |
| <b>GEARBOX :</b>    | Gear Lever         | ... | ... | ... | ... | ... | ... | Shift Lever                                                   |
|                     | Change Speed Fork  | ... | ... | ... | ... | ... | ... | { Shift Fork<br>Selector Fork                                 |
|                     | First Motion Shaft | ... | ... | ... | ... | ... | ... | { Clutch Shaft<br>First Reduction Pinion<br>Main Drive Pinion |
|                     | Layshaft           | ... | ... | ... | ... | ... | ... | Counter Shaft                                                 |
| <b>AXLE :</b>       | Crown Wheel        | ... | ... | ... | ... | ... | ... | { Ring Gear<br>Spiral Drive Gear                              |
|                     | Small Pinion       | ... | ... | ... | ... | ... | ... | { Bevel Pinion<br>Spiral Drive Pinion                         |
|                     | Spring Clips       | ... | ... | ... | ... | ... | ... | "U" Bolts.                                                    |
|                     | Axle Shaft         | ... | ... | ... | ... | ... | ... | { Half Shaft<br>Hub Driving Shaft<br>Jack Driving Shaft       |
| <b>STEERING :</b>   | Swivel Axle        | ... | ... | ... | ... | ... | ... | { Pivot Pin<br>Steering Pin<br>King Pin                       |
|                     | Cross Rod          | ... | ... | ... | ... | ... | ... | { Tie Rod<br>Track Rod                                        |
|                     | Side Rod           | ... | ... | ... | ... | ... | ... | { Drag Link<br>Steering Connecting Rod                        |
|                     | Steering Arm       | ... | ... | ... | ... | ... | ... | Drop Arm                                                      |
| <b>ELECTRICAL :</b> | Dynamo             | ... | ... | ... | ... | ... | ... | Generator                                                     |
|                     | Control Board      | ... | ... | ... | ... | ... | ... | { Voltage Regulator<br>Cut Out<br>Voltage Controller          |
| <b>EXHAUST :</b>    | Silencer           | ... | ... | ... | ... | ... | ... | Muffler                                                       |
| <b>BODY :</b>       | Bonnet             | ... | ... | ... | ... | ... | ... | Hood                                                          |
|                     | Mudguard           | ... | ... | ... | ... | ... | ... | Fender                                                        |

# CHASSIS LUBRICATION CHART.

NOTE.—Figures given in circles on Diagram are LOCATION Nos. and NOT TASK Nos.



CAR, 2-SEATER, 4 x 2 LIGHT UTILITY AUSTIN MODEL 10 h.p. G/YG.

| Location No. | PART.                                                                    | W.D. Lubricants.       | Task No.        |
|--------------|--------------------------------------------------------------------------|------------------------|-----------------|
| 1            | ENGINE (Sump capacity 7 pints)                                           | 30 H.D.                | 2               |
| 2            | STEERING SWIVEL PINS                                                     | C.600                  | 8               |
| 3            | STEERING SIDE ROD                                                        | C.600                  | 8               |
| 4            | CROSS ROD                                                                | C.600                  | 8               |
| 5            | FRONT SPRING REAR SHACKLE PINS                                           | C.600                  | 13              |
| 6            | UNIVERSAL JOINT SLIDING SPLINES                                          | C.600                  | 12              |
| 7            | BRAKE AND CLUTCH PEDAL LEVERS                                            | C.600                  | 11 & 15         |
| 8            | REAR SPRING REAR SHACKLE PINS                                            | C.600                  | 13              |
| 9            | STEERING BOX                                                             | C.600                  | 8               |
| 10           | GEAR BOX                                                                 | 50 H.D.                | 11              |
| 11           | REAR AXLE                                                                | C.600                  | 12              |
| 12           | TOP OF STEERING COLUMN                                                   | 30 H.D.                | 8               |
| 13           | BRAKE BALANCE LEVERS                                                     | C.600                  | 15              |
| 14           | WATER PUMP                                                               | C.600                  | 3               |
| 15           | ROAD WHEEL HUBS (FRONT)                                                  | Grease No. 2           | •               |
| 16           | DISTRIBUTOR                                                              | 30 H.D.                | •               |
| 17           | DYNAMO (WHEN LUBRICATOR IS FITTED)                                       | 30 H.D.                | 9               |
| 18           | CLUTCH OPERATING SHAFT                                                   | C.600                  | 11              |
| 19           | SHOCK ABSORBERS                                                          | Fluid Brake Hyd. No. 3 | •               |
| 20           | ROAD SPRINGS                                                             | 30 H.D.                | 13              |
| 21           | CARBURETTOR AIR CLEANER (OIL BATH)                                       | 30 H.D.                | 5               |
|              | OIL CAN LUBRICATION.<br>ALL THROTTLE, BRAKE ROD AND CLUTCH<br>ROD JOINTS | 30 H.D.                | 5, 11<br>and 15 |

•Periodic Attention as ordered.

T.L.C. 139A.