SERVICE LITERATURE

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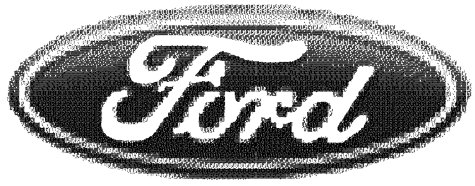

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CONTENTS

New ANGLIA & PREFECT (1959 onwards)

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SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 2: **BRAKES**
Subject: **THE BRAKING SYSTEM**
Effective on: New Anglia Cars (1959 onwards)

THE BRAKING SYSTEM

Description

The brakes are hydraulically operated by means of a pendant pedal, connected to the brake master cylinder via a short push-rod.

NOTE.—Cars produced prior to approximate Engine No. 13000 incorporated two eccentric bolts on the pedal bracket assembly between the master cylinder push rods and the pedals. Cars produced after this engine number incorporate a special concentric shouldered bolt. Dismantling and assembly procedures are not affected, but the pedal height cannot be adjusted.

The front brakes are of the two leading shoe type, with an independent cylinder for each shoe ; the rear brakes have, for each pair of shoes, a single cylinder which also incorporates a mechanical expander operated by the handbrake linkage.

The mechanical linkage, operated by the handbrake lever through a cable, is connected only to the rear wheels. As the cable is pre-packed with grease during manufacture, a grease nipple is not incorporated in the outer conduit.

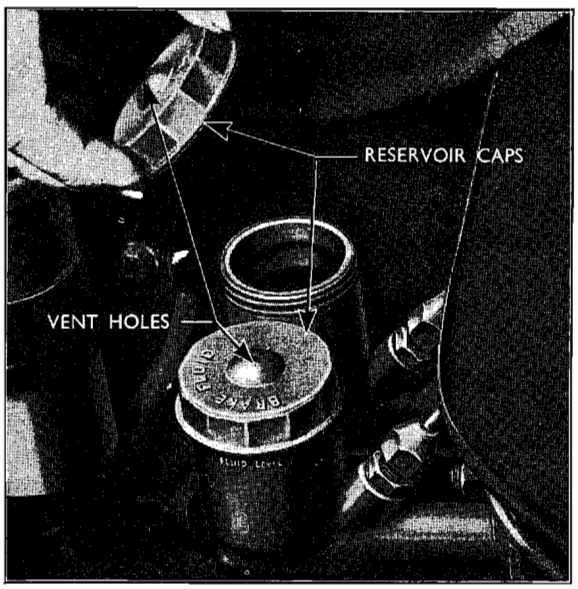

Fig. 1
Brake and Clutch Master Cylinders

The Hydraulic System

The brake master cylinder is connected to a five-way union to which are connected the stop light switch and distributing pipe lines to both front and rear brakes. A pipe is led to each front brake plate, connection being made by a flexible hose to the upper wheel cylinder on each brake plate. From the rear of the five-way union a single pipe is connected with a flexible hose to a three-way union mounted on the rear axle housing. Pipes run from this union to each rear brake plate wheel cylinder.

The brake fluid reservoir is part of the brake master cylinder and should be maintained topped up to the level mark (approximately $\frac{1}{2}$ in. (12.7 mm.) below the top face), which is indicated on the outside surface of the reservoir. It is essential that only approved hydraulic brake fluid be used. (Part No. ME-3833-E).

The Handbrake System

The handbrake linkage gives braking action to the rear wheels only. A cable runs from the handbrake lever to the equaliser mounted flexibly at the rear of the rear axle casing.

From the equaliser to which the rearmost end of the cable conduit is attached, the cable runs to the brake plate on one side of the car.

A separate rod runs from the equaliser to the brake plate on the other side of the car. Clevises complete the linkage to each operating lever, which are pivoted in the ends of their respective wheel cylinder expander housings.

Application of the handbrake lever places the cable in tension, directly applying the brakes on one rear wheel. At the same time, due to this action, the outer conduit is placed in compression thus pushing on the flexibly mounted slotted equaliser. The rod running between the equaliser and the other rear wheel brake is therefore subjected to the same tension thus applying the brakes on that rear wheel, giving an equal brake action on both sides of the car. Towards the rear of the drive shaft tunnel an abutment bracket is provided to anchor the forward end of the brake cable conduit to provide a means of adjustment for the linkage, see Fig. 4.

Continued overleaf

ADJUSTMENTS FOR BRAKE LINING WEAR

Front Brakes

Adjust each front brake shoe individually : there is one square-headed snail-cam adjuster for each brake shoe, i.e., two on each brake plate, which both turn clockwise (when viewing the brake plate) to expand the shoes. Refer to Fig. 2 when adjusting the brakes.

1. Raise the front wheels clear of the ground.

2. Turn the adjuster of one shoe anti-clockwise to bring the lining away from the drum. Turn the other shoe adjuster clockwise until the drum is locked, and slacken back until the wheel is just sufficiently free to rotate without binding.

3. Rotate the other adjuster clockwise until the drum is locked, and slacken back until the wheel is just sufficiently free to rotate without binding.

4. Adjust the shoes of the other front wheel in a similar manner.

NOTE.—This adjustment must be performed accurately to obtain a minimum clearance between the linings and the drums, with consequent minimum pedal travel.

Rear Brakes

A snail-cam adjuster is incorporated on each brake back plate, operating on the leading shoe only, in addition to the wedge type adjuster fitted diametrically opposite to the expander unit. The procedure for rear brake adjustment is as follows :—

1. Raise the rear wheels clear of the ground.

2. Turn the square-headed threaded wedge adjuster (positioned on the brake plate in front of and above the axle housing, see Fig. 3) clockwise until both shoes are held firmly against the drum.

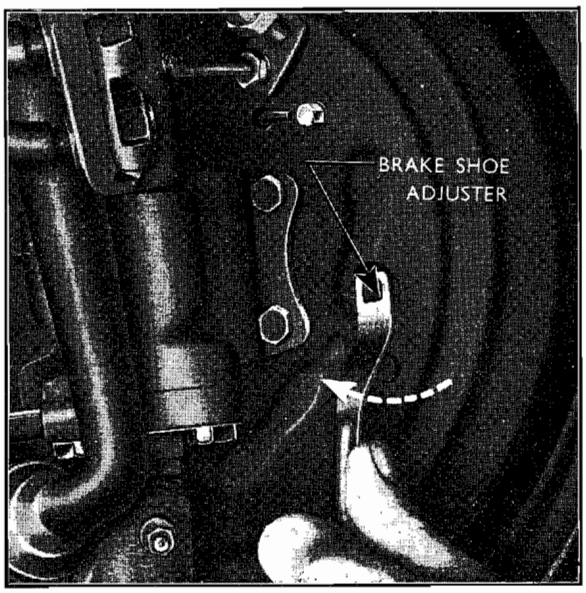

Fig. 2
Front Brake Adjustment

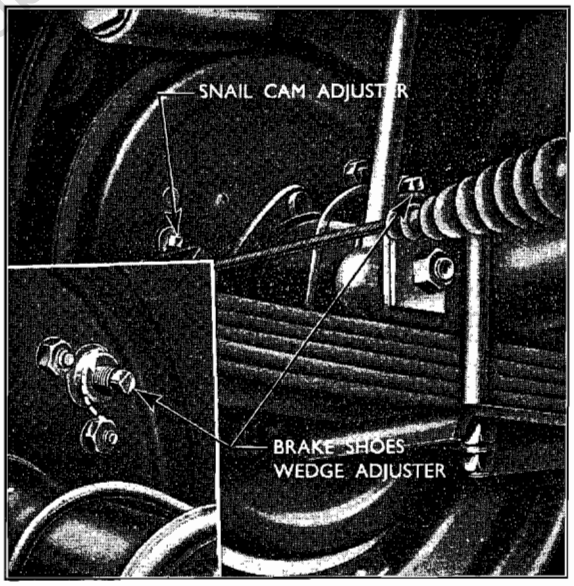

Fig. 3
Rear Brake Shoe Adjustment

3. Gently turn the square shank of the snail-cam adjuster clockwise until the cam can be felt to touch the leading shoe.

4. Slacken off the square-headed threaded wedge adjuster two " clicks " and then slacken back the snail-cam adjuster 1/12th of a turn, i.e., 2 in. (5 cm.) on a 4 in. (10 cm.) long spanner. Repeat on the other brake plate and rotate each wheel in turn when no binding should be perceptible.

If a shoe is binding, the snail-cam adjuster should be slackened back just sufficiently to free this shoe. If movement of the snail-cam adjuster has no effect on the binding shoe, return the snail-cam to its original position and slacken back the wedge adjuster until the shoe is free.

ADJUSTING THE HANDBRAKE LINKAGE

Preliminary

1. Before commencing the adjustment, check that no sharp bends exist in the handbrake cable.

2. Examine the handbrake operating levers on the rear brake plates for signs of stiffness.

3. Check that each rear wheel expander is free to slide in the brake plate slots.

4. Examine the clevis pins and renew where necessary.

5. Ensure that the flexible mounting for the equaliser is serviceable, and adjust the handbrake rod (connecting the equaliser to the right-hand rear brake) so that the distance between the centre of the right-hand clevis and the inside face of the equaliser (where the brake outer cable abuts) is between $31\frac{7}{8}$ in. to $32\frac{1}{32}$ in. (80.97 cm. to 81.36 cm.).

Adjustment

1. Fully release the handbrake lever.

2. Tighten the square-headed threaded adjuster on each brake plate (located above and forward of the rear axle housing) by turning clockwise to lock the rear drums. Repeat for the other rear brake, see Fig. 3.

3. Slacken the locknut on the adjuster sleeve provided on the brake outer conduit, located in the drive shaft tunnel (see Fig. 2). Tighten the adjusting nut on the threaded sleeve until all play is taken out of the handbrake cable. Tighten the locknut.

4. Slacken the square-headed threaded brake adjusters as for a normal brake adjustment to obtain a minimum running clearance for the shoes. (See continuation sheet 1.)

5. Apply the handbrake lever. This should move through four or five notches to lock the rear wheels.

6. Check all split pins and clevis pins for correct fitting.

NOTE.—With the handbrake applied, the flexible insulator mounting attached to the equaliser, should be parallel to the centre line of the car.

HANDBRAKE AND CABLE

To Remove

1. Disconnect the brake cable at the handbrake lever after removing the split pin and clevis pin.

2. Unscrew the locknut securing the brake cable conduit to the bracket in the drive shaft tunnel, see Fig. 4. Pull the conduit adjusting sleeve to the rear and slide the inner cable out of the bracket.

3. Remove the nut, washer and the bolt securing the equaliser to its flexible mounting on the rear of the rear axle casing.

4. Disconnect the brake inner cable or rod at the slotted hole on each brake plate clevis. Remove the cable.

5. If necessary, the handbrake lever can be removed after unscrewing the eight self-tapping screws securing the gaiter retainer, lifting the gaiter and unscrewing the two bolts locating the handbrake lever assembly to the floor pan.

To Replace

1. If removed, refit the handbrake lever assembly to the floor pan, securing it with two lockwashers and bolts. Position the rubber gaiter and secure it with the retainer and eight self-tapping screws.

2. Bolt the equaliser, complete with the cable assembly, to the flexible mounting on the rear axle using a bolt, washer and a nut.

3. Engage the cable or rod ends in the slotted clevis hole at each rear brake plate.

4. Pass the inner cable through the slot in the abutment bracket in the drive shaft tunnel. Locate the threaded adjusting sleeve in the bracket and screw up the locknut.

5. Reconnect the forward end of the brake cable to the handbrake lever by means of the clevis pin. Lock the clevis pin with a split pin.

6. Adjust the handbrake linkage as described previously.

BLEEDING THE HYDRAULIC SYSTEM

Preliminary

Before bleeding the hydraulic system, the following points should be observed :—

1. Examine the fluid reservoir cap and ensure that the vent holes in the top and underside are clear.

2. The fluid level in the reservoir should be level with the mark on the reservoir. If necessary, top up with an approved hydraulic brake fluid.

3. All unions and connections should be checked for tightness and freedom from leaks. Also check the condition of the flexible rubber hoses.

4. If the condition of the wheel and master cylinders is in doubt, check the rubber boots for signs of fluid leakage. If fluid is present on the outside of the cylinders, dismantle and check the rubber cups and seals, replacing them if the sealing lips are damaged.

5. If it is suspected that an incorrect brake fluid has been used, drain the system thoroughly and flush with methylated spirits or commercial alcohol. Do not use petrol. Renew the piston cup and rubber seals on all wheel cylinders, both brake and clutch master cylinders and the clutch operating cylinder.

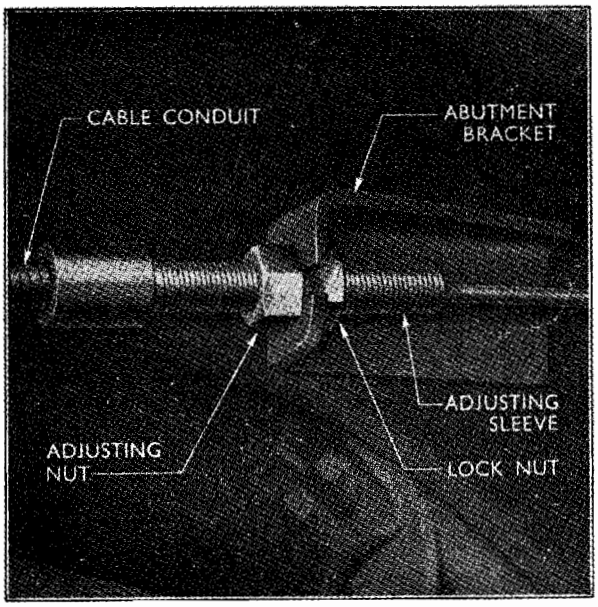

Fig. 4
Handbrake Cable Adjustment

Continued overleaf

Also, renew all flexible rubber hoses in the systems. Refill the systems with new fluid and bleed both brake and clutch systems.

Bleeding the System

1. Clean the area around the bleed valves on the wheel cylinders.

2. Bleed the front brakes first, commencing at the brake having the shortest pipe line. Remove the rubber cap on the bleed valve and fit a rubber tube on the valve. (A set of four bleed tubes is available under Tool No. P.2006).

3. Place the end of the bleed tube in a clean jar containing some brake fluid. Keep the end of the tube under the surface of the fluid during the bleeding operation.

4. Open the bleed valve and quickly depress the brake pedal fully to the floor pan, unimpeded by any undue thickness of floor covering. After slowly releasing the pedal, pause for an instant before the next depression to ensure full recuperation of the master cylinder. Check that the master cylinder piston returns fully after each stroke. If the piston is sticking, overhaul the master cylinder, see sheet 6. For each stroke of the brake pedal some fluid or air should come out of the tube, if neither fluid nor air is pumped out, the bleed valve has not been properly opened or there is a blockage in the pipe line.

5. Continue depressing the brake pedal, until no more air bubbles emerge from the tube.

NOTE.—It is important that the fluid level in the reservoir tank is maintained during the bleeding operation. Do not replenish the tank with fluid drained from the system as it may be contaminated or aerated. If the fluid in the system is dirty, it is advisable to drain it completely and refill with fresh fluid.

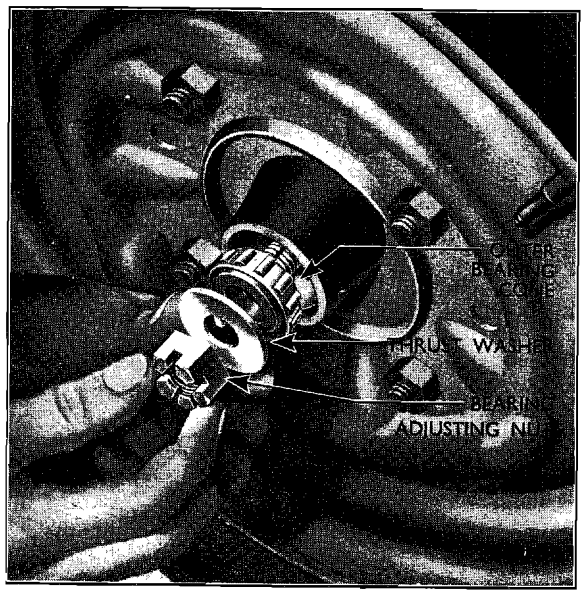

Fig. 5
Front Hub Bearing Adjustment

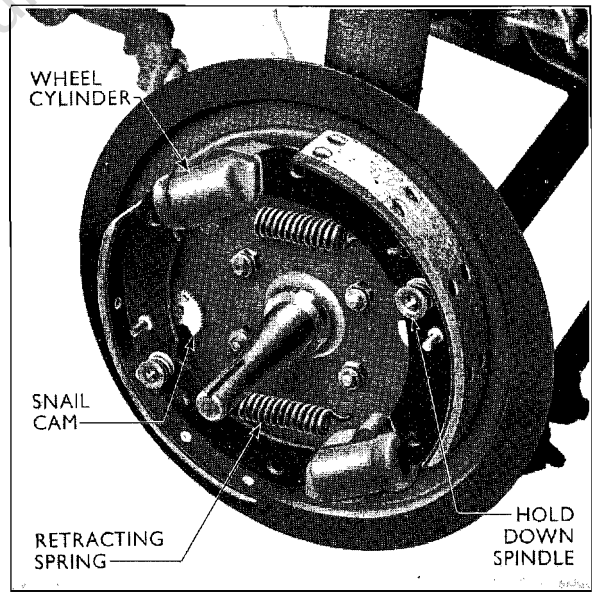

Fig. 6
Front Brake Plate

6. When, with each stroke of the brake pedal, fluid alone comes out of the bleed tube, close the valve with the master cylinder fully recuperated, i.e., with the pedal in the " off " position. Do not use excessive force when tightening the valve. Remove the tube and refit the rubber cap on the bleed valve.

7. Repeat the operation on the other front brake and then on the rear brakes, starting with the brake having the shorter pipe line.

8. Finally, again bleed from the front brake having the shortest line as described in Operation 2.

9. Refill the reservoir to the level shown on the filler neck and replace the vent cap.

10. Check the " feel " of the brake pedal from the driving seat to ensure that the bleeding has been effective.

NOTE.—If difficulty is experienced in expelling all air from the system, bleeding may be assisted by first expanding the rear brake shoes by means of the wedge adjusters and then backing off both shoes in each front brake by means of the snail cam adjusters. Re-adjust the front and rear brakes after a satisfactory bleed has been obtained.

FITTING NEW BRAKE SHOES

Each brake lining is secured by ten rivets to its brake shoe. The linings should be renewed when worn to within $\frac{1}{32}$ of an inch (0.79 mm.) of the rivet heads.

When new linings are fitted, there should be no clearance between the lining and the shoe, and the leading edge of the linings should be slightly chamfered.

Front Brake Shoes

1. Jack up the vehicle and carefully prise the hub and dust caps from their locations.

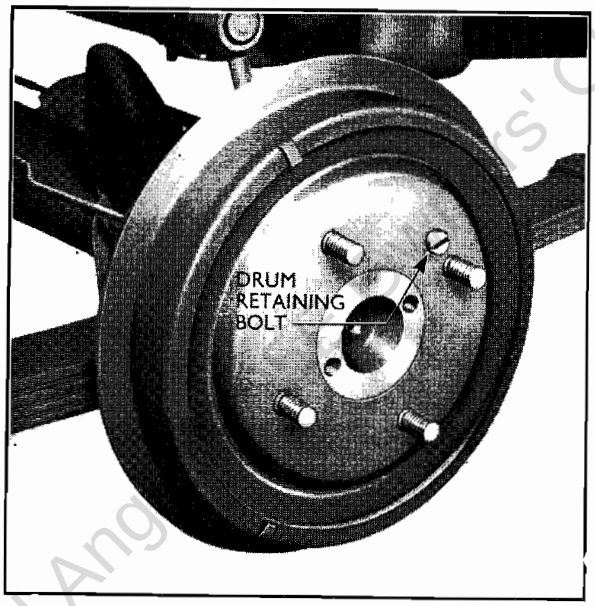

Fig. 7
Rear Brake Drum

2. Remove the split pin, unscrew the bearing adjusting nut, (use Tool No. CP.3018), and lift out the thrust washer. Pull the wheel and brake drum off the spindle, taking care not to drop the outer wheel bearing.

3. Remove the brake shoe holding down spindle, spring and the two dished retaining washers from each brake shoe, by depressing the upper washer and rotating this or the spindle through 90° when it can be withdrawn. Pull the tapered end of one shoe away from its piston and disengage the other end of the shoe from the slot in the back of the other wheel cylinder. Remove the retracting spring.

4. Remove the other shoe and spring in a similar manner.

5. When fitting new shoes, apply a suitable high melting point grease to the brake shoe contact pads on the brake plate, check that the lining ends are slightly chamfered, and locate the hooked end of the return spring in the hole in the brake shoe web, and the other end in the brake plate hole adjacent to the wheel cylinder.

6. Locate the wider end of the shoe web in the slot at the closed end of the opposite shoe wheel cylinder and pull out the other end of the shoe until the web engages on the plain face of the piston. Locate the shoe holding down spindle through the back plate and shoe web, and fit the first dished retaining washer, dish uppermost, spring and the other retaining washer, dish downwards, compress the spring and turn the upper retaining washer through 90° to lock it in position.

7. Replace the other shoe in a similar manner.

8. Refit the brake drum and wheel, outer bearing, thrust washer and bearing adjusting nut. Tighten the nut to 30 lbs. ft. (4.148 kg.m.) torque, rotating the hub whilst tightening, then back off the nut not less than 2 and not more than 2½ castellations.

NOTE.—Check that the front wheel bearings are adequately lubricated. The grease should be worked carefully into the rollers and cages of the inner and outer bearings. The hub itself should not be packed completely full but an appreciable air space should be left. The dust cap must be fitted dry.

Insert a new split pin, open out the ends and check that the hub rotates freely.

9. Refit the dust cap and hub cap, and adjust the brakes as described on sheet 2.

10. Lower the car to the ground.

Fitting Rear Brake Shoes

1. Remove the hub cap, slacken the wheel nuts, release the handbrake and jack the rear wheels off the ground.

2. Unscrew the wheel nuts, remove the road wheel, remove the screw retaining the brake drum and remove the drum.

3. Remove the brake shoe holding down spindle, spring and the two dished retaining washers from each brake shoe, by depressing the upper washer and rotating this or the spindle through 90° when it can be withdrawn. Withdraw the split pin from the handbrake line.

4. Detach the shoes and return springs. The return springs are of unequal length. The spring

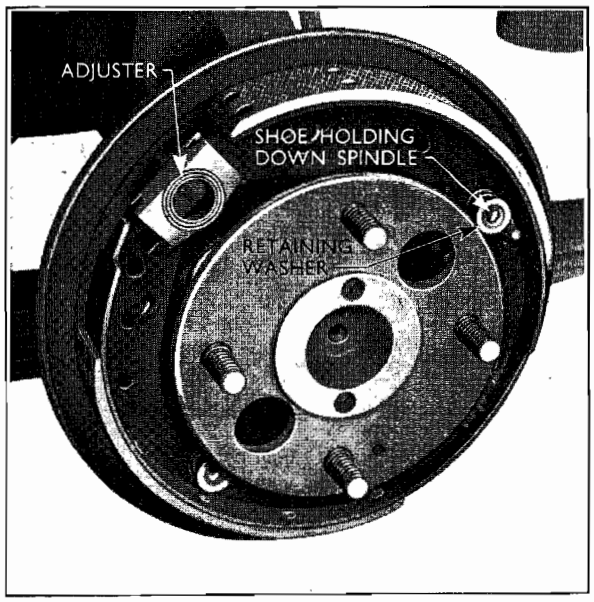

Fig. 8
Rear Brake Plate

with two sets of coils fits adjacent to the expander housing. The shorter spring fits adjacent to the adjuster housing.

5. Reassemble the shoes and springs with the springs fitted between the shoes as shown in Fig. 9.

NOTE.—Apply a suitable high melting point grease to the brake shoe contact pads on the brake plate.

Fit the leading edge of one shoe against the expander piston and the other end in the adjuster tappet slot. Expand the springs and fit the leading edge of the other shoe in the adjuster tappet slot and the trailing edge against the expander housing slot. Locate the shoe holding down spindle through the back plate and shoe web, and fit the first dished retaining washer, dish uppermost, spring and the other retaining washer, dish downwards, compress the spring and turn the upper retaining washer through 90° to lock it in position. Check that the handbrake link is correctly installed in the leading shoe web and fit a split pin to secure it in position.

6. Replace the brake drum and retaining screw, refit the road wheel and nuts.

7. Repeat these operations for the other rear brake, and adjust both brakes as described on continuation sheet 1.

8. Remove stands, tighten wheel nuts and replace hub caps.

FRONT BRAKE PLATE ASSEMBLY

Two wheel cylinders are mounted diametrically opposite each other on each front brake plate. Each cylinder piston operates a brake shoe and the other end of the shoe rests on a hardened steel contact in the base of the recessed end of the other wheel cylinder housing.

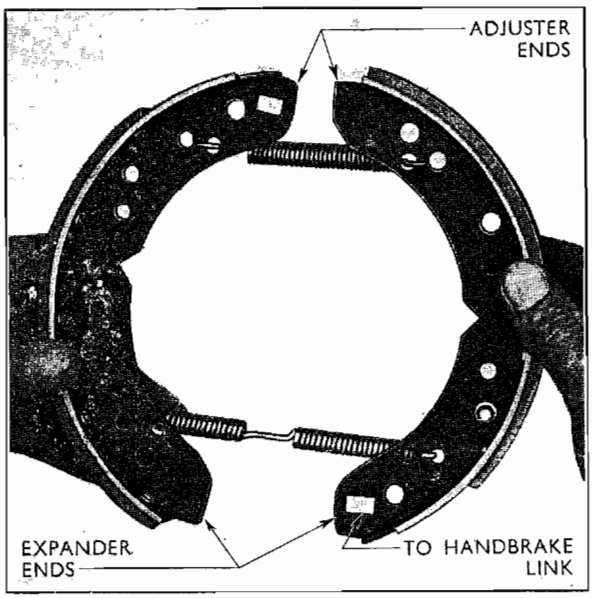

Fig. 9
Rear Shoes and Springs

The fluid pipe from the brake master cylinder is connected through the five-way union to the upper wheel cylinder on each front brake plate. A short pipe connects the two cylinders on each brake plate so that the hydraulic pressure applied to each shoe is equal. A bleed valve is fitted to each lower cylinder housing.

Two snail-cam adjusters are fitted on each brake plate : these engage with pegs fitted in the brake shoe webs. Clockwise rotation of each adjuster expands the shoes outwards against the drum to take up normal lining wear. Each shoe is held against the back plate by a holding down spring.

To Remove

1. Jack up the wheel and prise the hub and dust caps from their locations.

2. Remove the split pin, unscrew and remove the bearing adjusting nut, and detach the bearing thrust washer.

3. Pull the wheel and brake drum and bearing off the spindle slackening back the adjusters, if necessary.

4. Remove the brake shoes and springs as described on continuation sheet 2.

5. Disconnect the flexible fluid hose at the upper wheel cylinder, using a blanking plug, Tool No. A/ET.2000, in the end of the hose to prevent fluid loss.

6. Unscrew the four self-locking nuts retaining the brake plate to the suspension unit, and detach the brake plate.

To Dismantle

1. Disconnect and remove the short pipe at the rear of the brake plate, which connects the two wheel cylinders.

2. Unscrew the two bolts and spring washers securing each cylinder to the back plate, and detach the cylinders.

3. To dismantle a wheel cylinder, pull off the rubber boot and extract the piston and seal.

4. Extract the return spring from the cylinder.

5. Unscrew the bleed valve from the lower cylinder.

6. If it is necessary to dismantle the snail-cam adjusters, file off the peened-over end of the cam stud and detach the cam and spring. Remove the stud from the back of the brake plate.

Inspection

Do not use mineral oils, or cleaning fluid extracted from mineral oil, e.g. petrol, paraffin, carbon tetrachloride, etc., as they will cause the rubber seals to swell and become ineffective.

The slightest trace of mineral oil can soon render the brakes inoperative.

Methylated spirits or commercial alcohol must always be used for flushing out the system, washing

the brake housings, components and any container that comes into contact with brake fluid.

Any foreign matter should be washed off the housing and reservoir with methylated spirit or commercial alcohol. If foreign matter finds its way into the system it may score the pistons or damage the seals and render the brakes either wholly or partly inoperative.

Pistons and piston seals should be carefully stored away from grease or oil and handled carefully at all times. The seals should be inspected carefully before fitting, even if they have just been drawn from stock.

See that the sealing lips are perfectly formed, concentric with the bore of the seal, free from knife edges, surface blemishes or marks. Any seal that does not appear perfect, no matter how minute the blemish may appear to be, should be rejected.

Seals should not be turned inside out when inspecting them since this strains the surface skin and may eventually lead to failure in service.

All pistons and housings must be carefully inspected before assembly, any imperfections or scores on the piston or cylinder bore may provide a track for fluid leaks under pressure and any damaged parts must be discarded. Parts must be stored and handled very carefully to reduce any possibility of accidental scoring.

To Reassemble

1. Rebuild the wheel cylinders. Assemble the piston seal to the piston with the flat face of the seal adjacent to the piston rear shoulder.

2. Dip the piston and seal in brake fluid (Part No. ME–3833–E), locate the spring end in the piston seal, and carefully insert the spring, seal and piston in the cylinder. Take care not to damage the edge of the seal during insertion.

Refit the rubber boot.

3. Fit the wheel cylinders in their locating holes in the brake plate, and secure each cylinder with two bolts and spring washers.

4. Refit the short connecting pipe between the two wheel cylinders and tighten the union securely.

5. Replace the bleed valve in the lower cylinder but do not overtighten.

6. (*a*) To reassemble the snail-cam adjusters, if dismantled, pass the cam adjuster stud through the brake plate hole from the back, and place the cam spring on the stud.

(*b*) Locate the cam on the flat of the stud end so that the clockwise rotation of the stud head will move the brake shoe out into contact with the drum.

(*c*) Rivet over the stud end to lock the cam securely in position, and check for correct operation.

To Replace

1. Secure the brake plate to the suspension unit by means of four bolts and self-locking nuts. The bolts should be located so that a flat on one side of the hexagon head abuts the machined flat on the spindle body flange.

2. Reconnect the flexible fluid pipe to the upper wheel cylinder.

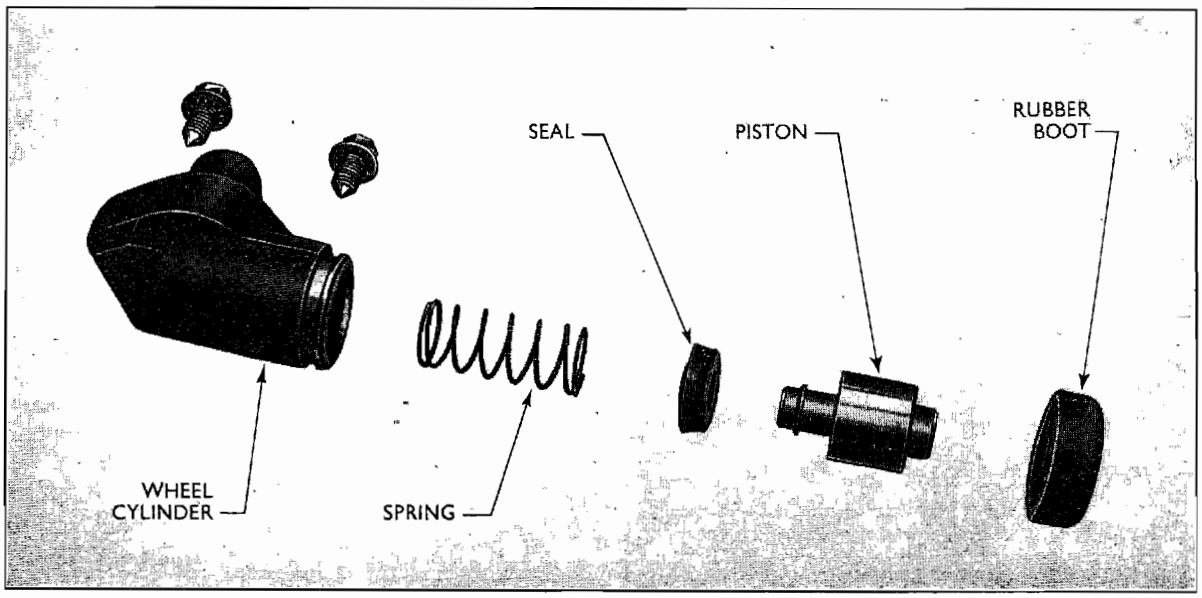

Fig. 10
Front Wheel Cylinder—Exploded

3. Lightly lubricate the brake shoe contact pads on the brake plate with a suitable high melting point grease, and refit the brake shoes and return springs as described on sheet 3.

4. Refit the brake drum and wheel assembly to the spindle, replacing the bearing thrust washer and castellated spindle nut.

5. To adjust the hub bearings, rotate the wheel carefully, tightening the bearing nut to a torque of 30 lbs. ft. (4.148 kg.m.).

NOTE.—Check that the front wheel bearings are adequately lubricated. The hub itself should not be completely packed with wheel bearing grease, but an appreciable air space should be left.

Slacken back the nut not less than 2 and not more than $2\frac{1}{2}$ castellations, and lock the nut with a new split pin.

6. Fit the hub dust cap and replace the hub cap.

7. Bleed the brakes and readjust them as described on continuation sheets 1 and 2.

8. Lower the car to the ground and check the action of the brakes on road test.

THE REAR BRAKE PLATE ASSEMBLY

The rear brake plate carries the brake shoes, expander housing, and adjuster unit. Each shoe is held in contact with three thrust pads on the brake plate by means of a single coiled spring. Return springs of unequal length connect the two shoes.

The brake plate is secured to the rear axle housing by four bolts and self-locking nuts.

To Remove

1. Jack up the rear end of the vehicle.

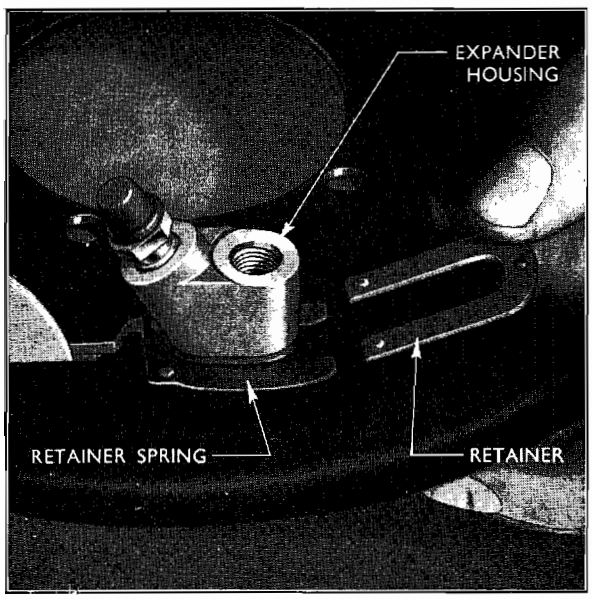

Fig. 11
Expander Housing Retainers

2. Remove the hub cap, and remove the four nuts securing the road wheel to the drum. Remove the road wheel, unscrew the drum retaining screw, then remove the brake drum.

3. Rotate the axle shaft flange so that the two holes in the flange are vertical to gain access to two of the retaining nuts securing the drive shaft retaining flange and back plate to the axle casing. Rotate the axle shaft flange through 90° and remove the other two nuts.

4. Remove the axle shaft, using adapter Tool No. P3072-2 and main tool PT3072 (see Rear Axle Bulletin.)

5. Disconnect the brake pipe from the expander housing, using a brake line plug, Tool No. A/ET.2000, to prevent fluid loss. Remove the split pin and clevis pin connecting the handbrake cable clevis to the operating link.

6. Remove the brake back plate and remove the brake shoes and return springs as described on sheet 3.

To Dismantle

1. Remove the adjuster unit which is secured to the brake plate assembly by two nuts and two lock-washers.

2. This unit can be further dismantled by extracting the tappets and screwing the adjuster wedge out of the housing.

3. Remove the expander housing rubber dust cover, the retainer and retainer spring. (See Fig. 11.) Unscrew the bleed valve and remove the valve.

4. Detach the expander housing and the handbrake operating link from the brake plate slot.

5. To dismantle the expander cylinder, detach the expander cylinder rubber boot, and remove the piston and seal as an assembly, from the housing interior. Air, from a tyre pump, applied at the housing fluid port, will facilitate removal of the piston and seal.

To Reassemble

All parts should be washed and inspected as described on continuation sheet 3 for the front wheel cylinders.

1. Dip the piston and seal in brake fluid to facilitate assembly in the cylinder. Reassemble the piston seal to the piston with the flat face of the seal adjacent to the piston rear shoulder.

2. Again dip the piston and seal in brake fluid to facilitate assembly and insert the piston in the expander housing, again taking care not to damage the seal during insertion. Locate the rubber boot on the housing and refit the boot retainer.

3. Insert the handbrake operating link and the bleed valve housing projection of the expander housing into the slot in the brake plate.

4. Fit the expander housing retainer spring from the handbrake lever end of the housing, with the dimples on the end of the spring away from the back plate. Ensure that it engages correctly in the slots formed in the housing.

5. Fit the retainer in the opposite end of the housing, ensuring that the dimples on the spring are locating those formed on the plate. (See Fig. 11.)

6. Refit the rubber dust cover.

7. Reassemble the conical type bleed valve to the expander housing.

8. To reassemble the adjuster unit, screw the adjuster wedge into the housing, and refit the tappets, lubricating them with zinc oxide grease. Ensure that the tappets are inserted to conform to the adjuster wedge profile, when the slots in which the shoe webs engage are vertical. Secure the adjuster unit to the brake plate with the two lock-washers and nuts.

To Replace

1. Grease the brake shoe support pads and refit the brake shoes to the back plate as outlined previously on continuation sheet 3.

2. Reconnect the handbrake cable clevis to the operating link, securing the clevis pin with a new split pin.

3. Reconnect the fluid pipe to the union on the back of the expander housing.

4. Replace the axle shaft and secure the axle shaft retainer and back plate to the rear axle using four self-locking nuts.

5. Replace the brake drum, retaining it with its slotted cheese-head screw, refit the road wheel and tighten the wheel nuts securely. Replace the hub cap.

6. Bleed the brake system, as detailed on sheet 2 and readjust the brakes as described on continuation sheet 1.

7. Lower the vehicle to the ground and road test to check the braking action.

THE PEDAL ASSEMBLY

The brake pedal is of the pendant type and is mounted with the clutch pedal in a bracket assembly bolted to the engine bulkhead beneath the instrument panel.

Brake Pedal Adjustment

On cars built prior to approximate Engine No. 13,000 adjustments are provided to vary the height of the brake and clutch pedals. Each master cylinder push rod is attached to its pedal lever by means of an eccentric adjuster bolt, which, when rotated, varies the effective length of the master cylinder push rod.

At all times, ensure that with the pedal fully returned, there is clearance between the push rod end and the piston in the master cylinder.

On cars built after this engine number a concentric bolt is fitted in place of the eccentric bolt and therefore no adjustment is provided.

To Remove

1. Unscrew the four nuts securing the bracket and master cylinders to the engine bulkhead.

2. Remove the accelerator pedal by unscrewing the clamp bolt, also remove the pedal return spring.

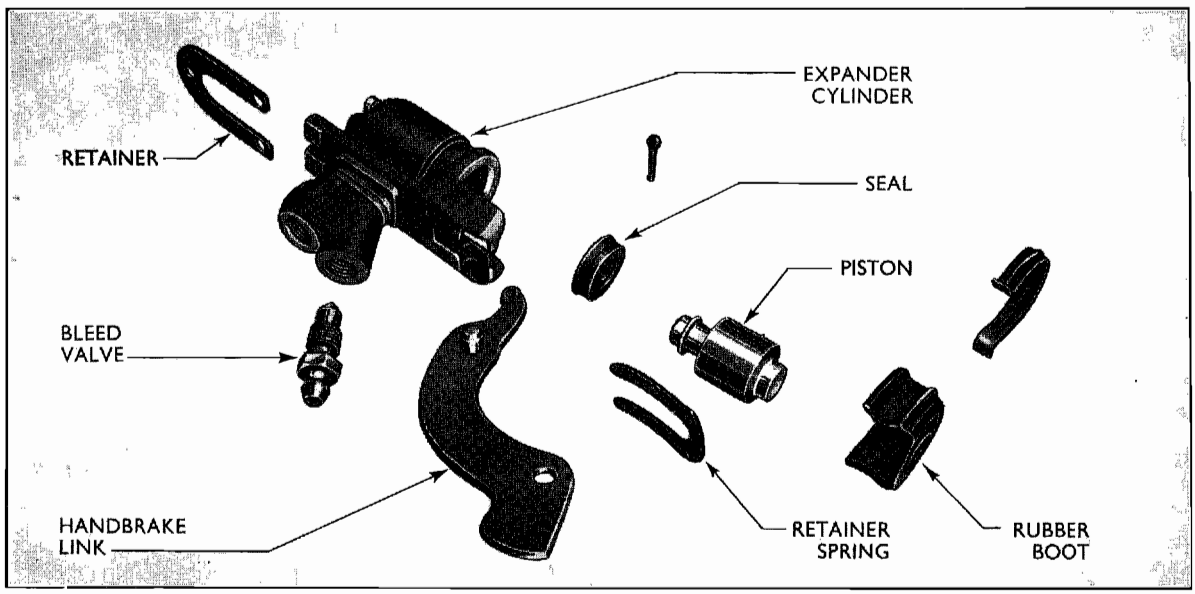

Fig. 12
Rear Brake Expander

Disconnect the linkage from the carburettor, and the engine bulkhead, so that it can be moved to the left out of engagement with the bush provided in the brake and clutch pedal bracket.

On L.H.D. vehicles disconnect the accelerator linkage at the carburettor and the engine bulkhead, and move the linkage to the right to disengage it from the bush in the pedal bracket.

3. Unscrew the nuts and remove the bolts securing the master cylinder push rods to the pedals.

4. Remove the bolt from each side of the upper face of the bracket assembly.

5. The assembly may now be manoeuvred downwards and removed from its location.

To Dismantle

1. Detach the pedal return spring from its location in the arm and remove.

2. Detach the circlip from one end of the pedal spindle and slide the spindle out of the assembly. Remove the pedals, noting that there is a sintered bronze washer between the two pedal bosses.

3. The pedal bearing is a bronze bush.

4. Wash the pedal bearings thoroughly and check for wear.

5. Check the condition of the spindle and also the pedal return spring.

To Reassemble

1. Lubricate the bushes, position the two pedals in the bracket and replace the washer in the position detailed in paragraph 2 of the dismantling instructions. Reinsert the spindle and replace the circlip previously removed.

2. Refit the pedal return spring.

To Replace

1. Position the assembly beneath the instrument panel, and replace the two upper mounting bolts and lockwashers.

Do not fully tighten the bolts at this stage.

2. Locate the accelerator linkage in the bush provided on the pedal bracket. Connect the linkage to the engine bulkhead and the carburettor. Refit the accelerator pedal return spring, the pedal and tighten the clamp bolt.

On L.H.D. vehicles slide the accelerator linkage to the left to engage with the bush provided on the pedal bracket. Connect up the linkage at the engine bulkhead and on the carburettor.

3. Replace the four nuts to retain the bracket and master cylinders to the front of the engine bulkhead and tighten these securely. Tighten the two upper mounting bolts.

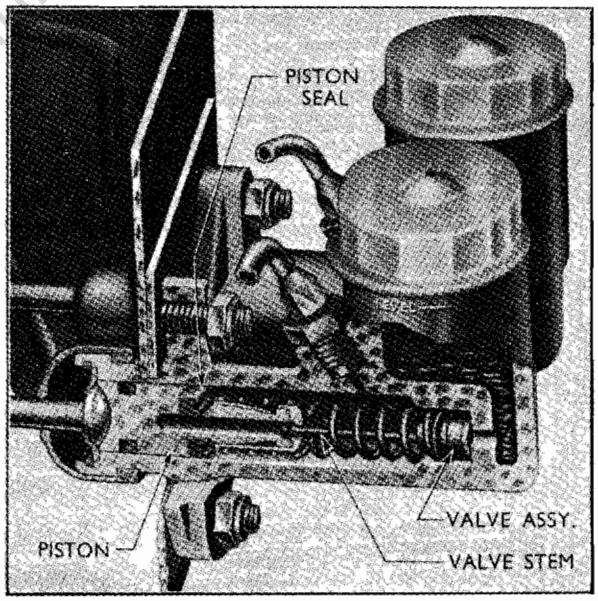

Fig. 13
Sectioned Master Cylinder

4. Locate the plastic washers in the push rod eyes and fit the eccentric bolts (or concentric bolts, see sheet 1), lockwashers and nuts. Adjust the height of the pedals, as described on sheet 5, and tighten the locknuts.

THE BRAKE MASTER CYLINDER

The brake master cylinder is mounted on the engine bulkhead immediately opposite the pedal assembly bracket. The front spigot end of the piston accommodates the valve stem and carries the spring retainer. The return spring (under compression) is fitted between the spring retainer and the valve spacer at the forward end of the cylinder.

The reservoir port drilled at the front of the cylinder chamber, permits fluid to flow from the reservoir to this chamber.

In the chamber above and behind the reservoir port, is the pipe line port. The pipe line supplies fluid to the front and rear wheel cylinders through the five-way union.

When the brake pedal is in the "off" position, fluid is free to flow from the reservoir and pipe line into the chamber.

On depressing the brake pedal the piston moves forward, advancing the valve which closes the reservoir port, thus preventing the fluid returning to the reservoir from the chamber.

As the piston moves further forward, fluid is forced through the pipe line port developing pressure in the wheel cylinders. When the brake pedal is released the return spring pushes back the piston, reducing the pressure in the chamber, fluid then returns from the wheel cylinders to the master cylinder by the action of the brake shoe retracting springs releasing the shoes. The valve uncovers the reservoir port and

communication between the reservoir and master cylinder chamber is restored.

The rubber boot over the push rod prevents water and dust entering the cylinder.

NOTE.—A replacement master cylinder drawn from stock has its working surfaces protected by a special preservative, it is therefore important that the seals be given adequate lubrication before use. It is not necessary to withdraw the piston from the cylinder if the following procedure is carried out. Remove the pipe line blanking plug or plugs, and the push rod end dust cap, when clean brake fluid can be injected at these locations, and the piston operated for several strokes.

To Remove

1. Detach the fluid line, using a blanking plug, Tool No. A/ET.2000 to avoid dirt entering the system.

2. Unscrew the nut, remove the spring washer and the eccentric (or concentric) bolt securing the master cylinder push rod to the pedal.

3. Withdraw the master cylinder after unscrewing the two nuts securing the master cylinder to the bulkhead.

4. Empty the contents of the fluid reservoir into a clean container.

To Dismantle

1. Remove the rubber boot. Withdraw the circlip and remove the push rod.

2. Pull the piston and valve assembly from the cylinder.

3. The piston is held in the spring retainer by a tab which engages under a shoulder on the front of the piston. Carefully lift this tab, and remove the piston as shown in Fig. 15.

4. Compress the spring and move the retainer to one side which will release the end of the valve stem from the retainer.

5. Slide the valve spacer and shim off the valve stem.

6. Remove the rubber valve seal and the piston seal, if necessary.

7. Wash all parts in methylated spirits or commercial alcohol. Inspect the piston and cylinder for scores

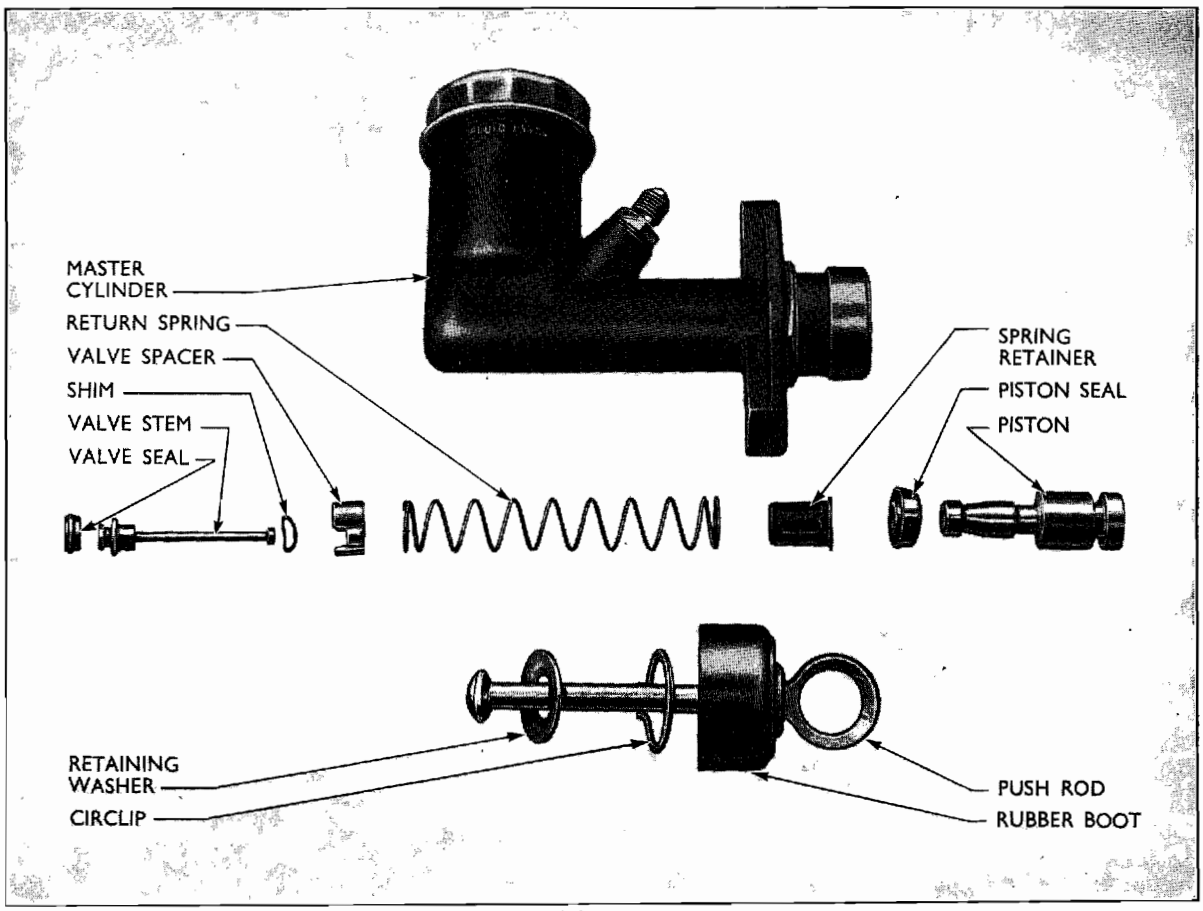

Fig. 14
Master Cylinder Exploded

Continued overleaf

and the rubber seals for damage to the sealing lips. Renew any parts that appear unsuitable for further service.

To Reassemble

1. Replace the piston seal with the lip towards the smaller diameter of the piston.

2. Fit the valve seal with the lip away from the spring.

3. Slide the shim, the valve spacer, with the legs over the valve seal, and the return spring, in this order, over the valve stem, see Fig. 14.

4. Insert the spring retainer in the rear end of the return spring, and compress the spring to permit the valve stem to be located in the spring retainer by means of the offset hole.

5. Insert the front of the piston in the spring retainer, and secure it by locating the spring retainer tab under the front shoulder of the piston.

6. Lubricate the piston and seal. Insert the piston assembly in the cylinder, valve seal end first. Ensure that the piston seal is not damaged as it enters the master cylinder.

7. Install the push rod in the master cylinder. Locate the washer and install the retaining circlip.

8. Replace the rubber boot.

To Replace

1. Refit the master cylinder to the engine bulkhead, replace the two securing nuts and tighten securely.

2. Reconnect the fluid pipe, tighten the union securely, but do not overtighten.

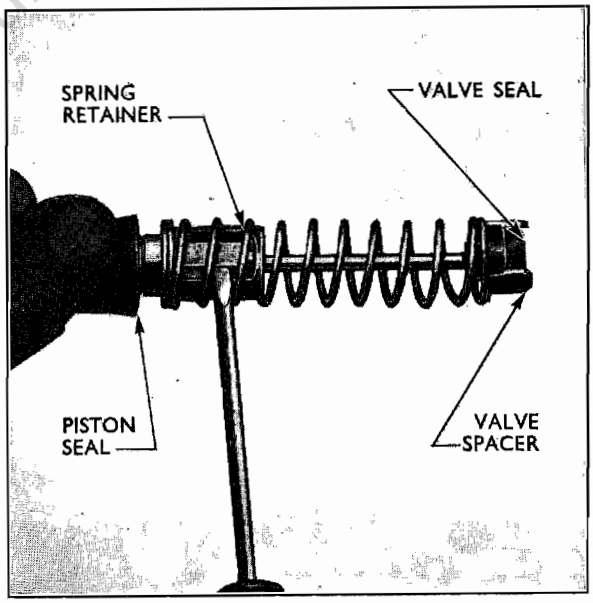

Fig. 15
Master Cylinder Piston Valve

3. Locate the plastic washers in the eye of the push rod and fit the eccentric bolt, lockwasher and nut.

4. Top up the master cylinder reservoir with clean approved fluid, and then bleed the braking system as described on sheet 2. If necessary, readjust the brake shoes. Check the action of the brakes on road test.

SPECIFICATION

Type—Hydraulic

Lining Area	76.8 sq. in. (495 sq. cm.)
Drum Dia.	8 in. (20.32 cm.)
Lining Length	7.68 in. (19.51 cm.)
Lining Width	1.25 in. (3.18 cm.)

Bolt Tightening Torques

Brake plate to spindle body	15 to 18 lbs. ft. (2.073 to 2.487 kg.m.)
Brake plate to axle casing	15 to 18 lbs. ft. (2.073 to 2.487 kg.m.)
Wheel cylinder bleed screw	6 to 7.5 lbs. ft. (0.829 to 1.036 kg.m.)

SERVICE BULLETIN **Passenger Cars**

Ford Motor Company Limited
Dagenham, England

Section 3: **FRONT AXLE-STEERING GEAR**

Subject: **Front Suspension Overhaul**

Effective on: New Anglia (1959 onwards)

THE FRONT SUSPENSION

Description

The front suspension assembly consists of two vertical shock absorber units, one on each side of the car, surrounded by coil springs. At the upper end of each suspension unit is a rubber-mounted thrust bearing which is secured to a reinforcement under each mudguard. The wheel spindle, carrying the brake plate and hub assembly, is forged integrally with each suspension unit foot.

A track control arm is connected to each suspension unit. The inner end of each control arm is mounted on rubber bushes in the front cross member, the outer ends being connected through ball joints to the steering arms bolted to the foot of each suspension unit.

A stabiliser bar is connected between the outer ends of each track control arm and is secured at the front to attachment feet mounted on the body side members.

Two adjustable track rods connect the steering arms to the drop arm to idler arm rod. The idler arm forms an idling link at one end of this rod and is parallel with the drop arm at all times.

The steering lock is determined by stops on the body side members which bear against the drop arm and steering idler arm under conditions of full lock.

The wheel bearings, toe-in, and toe-out on turns can be adjusted but the camber, castor and king pin inclination angles are set in production and cannot be altered.

When repairs are being carried out to any part of the front suspension system, it is essential that spring clips are fitted, otherwise extreme difficulty or personal injury may be experienced in dismantling and reassembling the parts. The wheel alignment should always be checked after carrying out repairs to a suspension unit or the linkage which could affect these settings.

FRONT WHEEL HUB BEARINGS

To Test

1. Jack up the front of the car.

2. Grasp the wheel at two diametrical points, preferably at the top and bottom of the wheel. If it is possible to rock the wheel and brake drum excessively on the spindle, the hub bearings require adjustment.

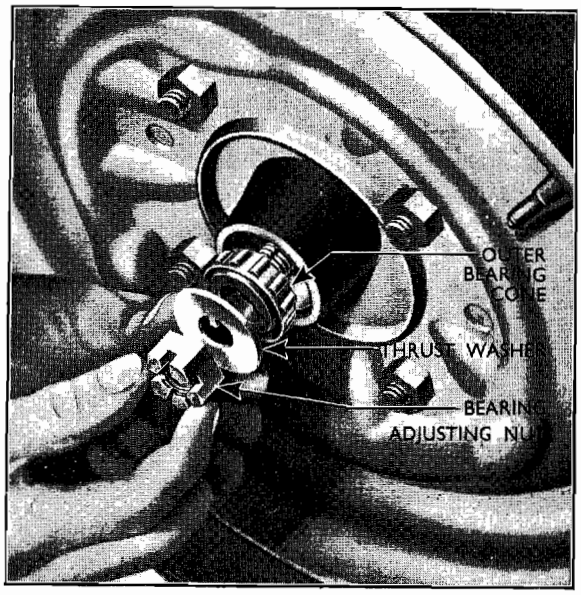

Fig. 1
Front Hub and Wheel Bearing Adjustment

To Adjust

Excessive play in the hub bearings can be removed by tightening the bearing nut as follows :—

1. Lever off the hub cap.

2. Remove the dust cap. This is a press fit in the hub and should be gently tapped to free it from its location.

3. Remove the split pin locking the adjusting nut (see Fig. 1).

4. Turn the wheel in its normal direction of rotation, at the same time tightening up the bearing adjusting nut until a slight drag can be felt, then turn back the nut one castellation at a time until the wheel is perfectly free with just perceptible end-float. (The spindle has two holes at 90° to each other to enable an accurate adjustment to be made.) This end-float is best tested at the periphery of the wheel.

When fitting new bearings the same degree of adjustment can be obtained without relying on "feel" by tightening the bearing adjusting nut to a torque of 30 lb. ft (4.14 kg.m.) (while turning the wheel in its normal direction of rotation), and then turning back the nut 2 to 2½ castellations.

5. Fit a new split pin.

6. Replace the dust cap by tapping it into its hub location.

NOTE.—This cap is provided to protect the hub bearings from dust and dirt and must not be packed with grease.

7. Replace the hub cap.

NOTE.—Never allow the car to be driven with the dust caps missing, otherwise dirt and grit can penetrate to the hub bearings and cause premature wear.

FRONT HUBS

To Remove

1. Lever off the hub cap and slacken the wheel nuts.

2. Jack up the front end of the car, placing supports beneath the body side members.

3. Remove the wheel nuts and detach the wheel.

4. To remove the hub, detach the dust cap, which is a press fit in the hub, by tapping lightly with a hammer. Slacken back the brake adjusters if necessary. Remove the split pin, bearing adjusting nut, thrust washer and outer bearing cone. The hub and brake drum assembly can now be pulled off the spindle.

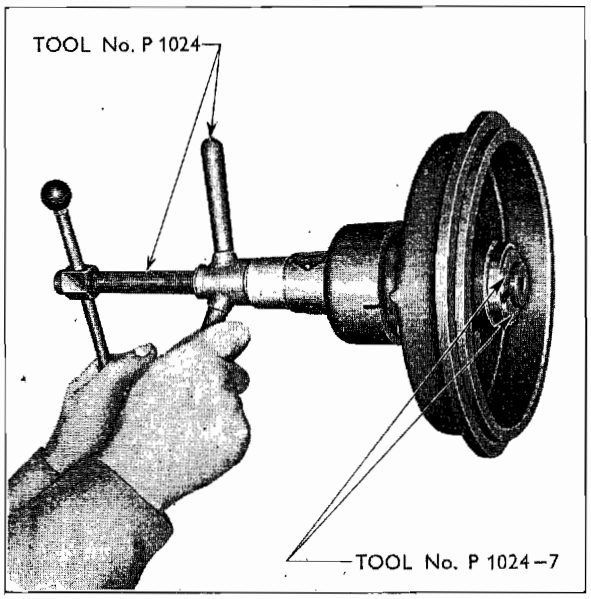

Fig. 2
Fitting a Hub Bearing Cup

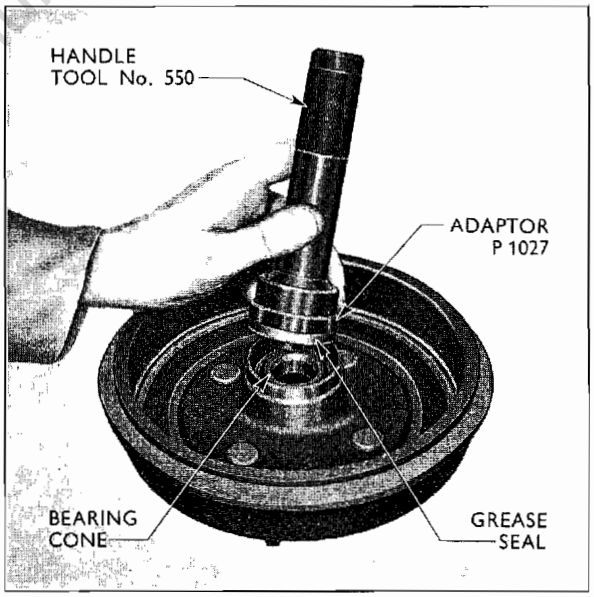

Fig. 3
Fitting a Front Hub Oil Seal

To Dismantle

1. Lever the grease retainer from the inner end of the hub.

2. Detach the inner bearing cone.

3. Examine the bearing cups and remove if necessary, using main tool P.1024 and adaptor set P.1024–X, consisting of two split adaptors and centraliser ring.

Remove one cup at a time, using the appropriate adaptor. Check that the adaptor is correctly fitted in the cup before tightening the wing nut.

Never use drifts to remove bearing cups, as damage may be caused to the hub which could prevent new cups seating correctly.

To Reassemble

1. If the bearing cups have been removed, they should be replaced, using tool No. P.1024 as shown in Fig. 2. Fit one cup at a time, screwing the appropriate adaptor onto the centre bolt to pull the cup into the hub.

The tapers of the inner and outer cups should be facing outwards at each end, i.e. the wider flanges should be towards each other.

2. Pack the space between the two cups with a suitable wheel bearing grease, leaving an appreciable air space to allow for expansion of the grease when warm.

3. If new bearing assemblies have been fitted, wash the new bearing cones in clean paraffin and pack the rollers and cages with grease, working the grease well into the roller cages.

4. Grease and fit the inner bearing cone and locate a new grease retainer on the inner end of the hub with the lip towards the bearing.

5. Press the grease retainer into position, using the driver P.1027 with the 550 handle as shown in Fig. 3.

To Replace

1. Position the hub and brake drum assembly on the spindle and locate the outer bearing cone in its cup. Ensure that adequate grease is packed in the bearing cage before positioning the bearing on the spindle.

2. Refit the thrust washer on the spindle end with the tongue engaging in the spindle slot. Replace the castellated nut adjusting, as described on sheet 1.

3. Replace the wheel on the brake drum and fit the wheel nuts, tightening them securely.

4. Adjust the hub bearings as described on sheet 1.

5. Refit the dust cap by tapping it into the end of the hub and, if the brake adjustment has been varied to enable the drum to be removed, readjust the front brake.

6. Lower the car to the ground, recheck the wheel nuts, and replace the hub cap.

THE SUSPENSION UNITS

Each front coil spring is located between a seat welded to the body of the suspension unit and another seat on the piston rod. There is a shroud inside the coil spring, which serves to protect the highly machined surface of the piston rod from road dirt.

The upper mounting assembly consists of a steel sleeve with a rubber bush bonded internally to it. Two ball thrust bearings are fitted in the mounting, the inner races being bonded to the rubber bush. The bearings may be renewed as necessary but of the mounting assembly it is only possible to replace the three studs in the flange or the complete assembly.

Operation of the Suspension Unit

The unit consists of an outer body or casing, inside which is a cylinder, located at the top by the lower guide seat and at the bottom by the compression valve assembly in the base of the unit.

A piston rod operates inside the cylinder and is fixed to the thrust bearing at its upper end. The piston and rebound valves are located in the bottom of the piston rod.

In operation, the piston rod remains stationary and the suspension unit body moves up and down on the rod.

The piston valve operates inside the piston and is mounted on the rebound valve assembly. The rebound valve seat is inside the piston valve body which seats on the piston valve screw.

The compression valve located in the base of the cylinder also incorporates a foot valve assembly. The seat for the compression valve is provided in the foot valve nut and the pressure of the compression valve spring is set during manufacture and should not be altered. The foot valve is located inside the cylinder and is held on to the face of the body by a compression spring. A leak path is cut across the face of the body under the foot valve.

When the car hits a bump in the road, the body of the suspension unit moves upwards, so forcing fluid past the compression valve which is lifted off its seat. The fluid then flows into the space between the cylinder and the suspension unit casing.

At the same time, the piston valve is forced upwards off its seat and fluid flows past the valve, through ports in the piston rod to fill the space above the piston inside the cylinder (see Fig. 4).

When the car moves over the bump, the body of the suspension unit moves downwards on the rebound stroke, thus creating a partial vacuum in the cylinder between the piston and the foot valve. The piston valve closes and fluid passes back through the ports in the piston rod into the cylinder via the rebound valve, which opens at a pre-determined setting.

The quantity of fluid flowing back into the cylinder through the rebound valve is not sufficient to fill the space, so the partial vacuum in the cylinder lifts the

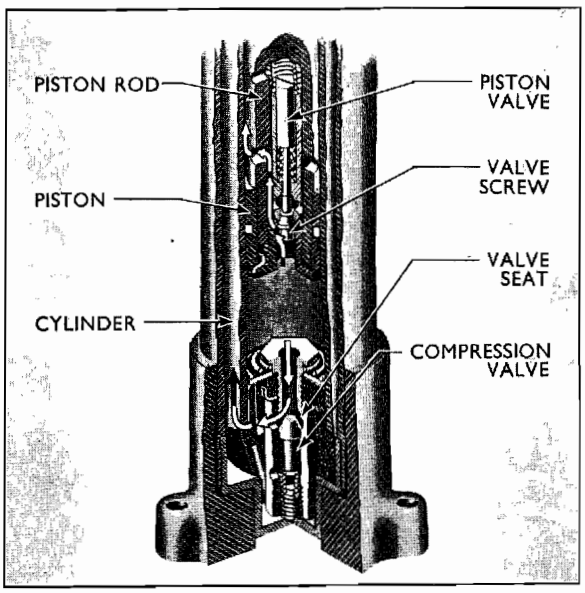

Fig. 4
Suspension Unit Operation (Compression)

Continued overleaf

foot valve off its seat against the pressure of its spring, so that fluid may flow back into the cylinder from the annular space between the cylinder and the suspension unit body (see Fig. 5).

The upper guide bearing is sealed by a rubber gland on the piston rod and the hydraulic fluid is sealed inside the unit.

Topping-up a Suspension Unit

Suspension units should be topped-up with the car standing unladen on level ground.

To top-up the front suspension units, remove the combined level and filler plugs (see Fig. 6), and add genuine shock absorber fluid part No. M–100502–E, until the fluid level reaches the bottom of the filler plug hole.

After topping-up, replace the filler plug securely. **On no account should fluid be added to the suspension unit under pressure, or with a wheel raised off the ground.**

To Remove a Suspension Unit

1. Fit spring clips P.5010 over as many coils of each spring as possible, connecting the safety strap.

2. Remove the hub and dust caps, withdraw the split pin, unscrew the castellated wheel bearing adjusting nut and withdraw the washer and bearing. Then remove the hub, brake drum and wheel from the spindle as an assembly.

3. To remove the brake plate assembly, unscrew the self-locking nuts and withdraw the brake plate from the studs. Support the brake plate so that the rubber brake hose is not stretched or distorted.

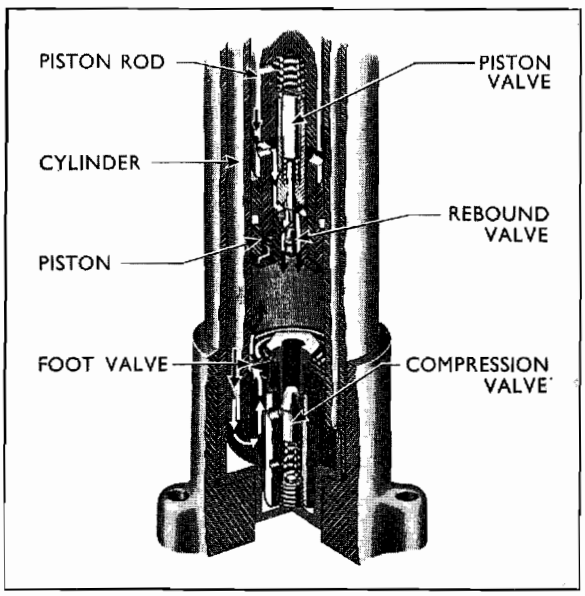

Fig. 5
Suspension Unit Operation (Rebound)

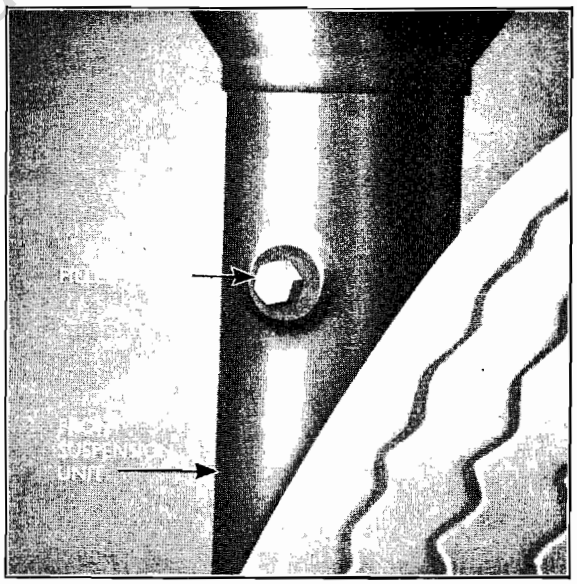

Fig. 6
Front Suspension Filler Plug

4. Bend back the tabs on the tab washer and unscrew the three bolts securing the steering arm to the suspension unit foot, see Fig. 7.

5. Lift the hood and unscrew the three self-locking nuts securing the suspension unit upper mounting to the mudguard reinforcement and lower the suspension unit from the car.

To Dismantle

1. Unscrew the self-locking nut, which retains the upper thrust bearing, using Tool No. P.5025, as shown in Fig. 10.

Withdraw the upper thrust bearing race and ball-bearing, storing them carefully to avoid damage. Remove the upper mounting assembly, lift the lower thrust bearing off the inner bearing race, and slide the race from the piston rod. Avoid damaging the piston rod or the bearing.

2. Lift off the upper spring seat and withdraw the piston rod shroud.

3. Draw the coil spring (still in the spring clips) over the end of the suspension unit.

4. Remove the filler plug from the outer casing and pump the fluid out of the unit by moving the piston rod up and down.

5. Unscrew the piston rod gland cap, using Tool No. P.5017.

NOTE.—The cylinder body is staked over in the slot of the piston rod gland cap, and this metal must be levered up clear of the slot before fitting the tool.

Position the tool so that the lugs locate in the piston rod gland cap slots and turn the tool in an

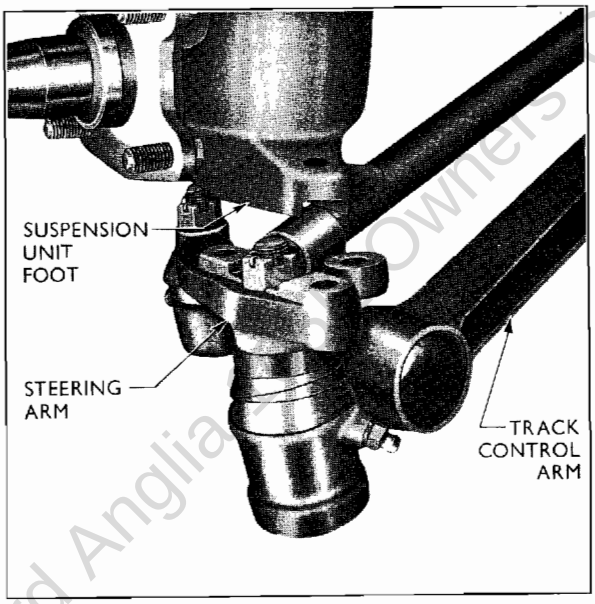

Fig. 7
Steering Arm Location on Unit Foot

anti-clockwise direction when the gland cap will be screwed out of the suspension unit.

6. Remove the rubber sealing ring, grasp the piston rod and pull the piston and cylinder out of the suspension unit.

7. Pull the compression and foot valve assembly out of the base of the cylinder. The hexagonal nut projecting from the assembly houses the compression valve.

In the end of the nut, a small screw is provided for adjusting the valve setting in production. Do not interfere with this adjusting screw.

8. Withdraw the piston rod from the cylinder. The upper guide and the piston rod gland will remain in the top of the cylinder. Take care not to lose the rubber gland or damage the upper guide when withdrawing the piston rod.

9. Straighten up the tabs of the lockwasher holding the piston valve nut in place, and remove the valve nut from the piston and rod assembly.

10. Extract the piston valve assembly and the piston valve spring from the piston rod. Note that the adjustment of the piston valve is sealed at the time of assembly, and should not be interfered with.

11. Withdraw the piston rod gland from the upper guide and lift out the gland cup or seat and the wave spring from the upper guide, see Fig. 8.

12. Remove the upper guide from the cylinder.

13. The rebound stop tube can be removed from the top of the cylinder, although this is not normally necessary.

To Reassemble

Inspect all parts for wear, the wheel spindle for possible damage, and the condition of the valves for seating.

The piston is not serviced separately from the piston rod, since it is machined after assembly to the piston rod, to ensure correct alignment, although the piston ring can be renewed if necessary.

Fluid ports are drilled through the piston rod, so that fluid can pass in and out as a normal part of the function of the shock absorber. A smaller bleed hole is provided to eliminate fluid pressure building up behind the piston valve. These holes must be free from dirt or foreign matter.

Ensure that the two leak path " V " grooves in the compression valve body are clear and inspect the piston rod for scores.

1. If the rebound stop has been removed, push it into the cylinder until it is flush with the top of the cylinder.

2. Replace the spring inside the end of the piston rod and fit the piston valve assembly with the rebound valve towards the piston end. Place a new lockwasher on the piston rod so that the tongue on the inside of the washer is located in the slot at the end of the rod. Refit the valve nut and tighten it fully. Turn over the tab of the lockwasher against a flat of the nut to prevent it loosening in service.

3. Enter the piston rod and piston into the cylinder.

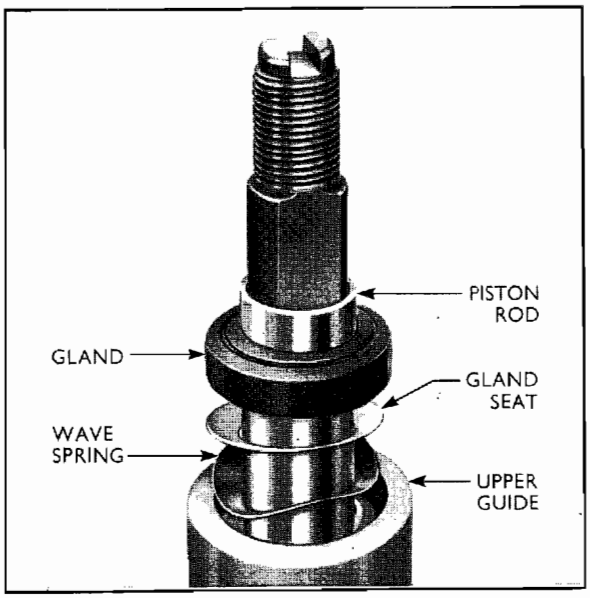

Fig. 8
The Upper Gland Seal Assembly

4. Refit the compression and foot valve assembly in the base of the cylinder. This will also serve to keep the piston in position. Carefully enter the valve assembly, foot valve first, into the cylinder so that the die-cast body of the valve assembly is not damaged. Push the valve assembly into the cylinder until the three lugs on the valve body come into contact with the base of the cylinder.

5. Enter both the piston rod and the cylinder into the suspension unit outer casing, taking care not to push down on the piston rod, otherwise the compression and foot valve may be dislodged from the bottom of the cylinder.

6. Place the wave spring in the upper guide and locate the gland cup or seat on top of it, with the dished face pointing towards the inside of the guide. Replace the gland in position on the gland seat with the words "This Side Down" towards the gland seat, or the grooved face uppermost.

7. Lift the cylinder from the outer casing, hold it firmly and fit the upper guide assembly on the piston rod, pushing the spigot end of the guide into the top of the cylinder. This will also establish the correct position of the rebound stop. Lower the cylinder back into the outer casing.

8. Locate a new sealing ring in the suspension unit casing around the edge of the upper guide, and replace the piston rod gland cap. Use Tool No. P.5017 to tighten the cap to a torque of 23 to 31 lbs. ft. (3.180 to 4.286 kg.m.).

Swage the outer casing of the unit into the tool slot in the gland cap to prevent the cap loosening in service.

9. Refill the suspension unit with approved hydraulic shock absorber fluid through the filler plug orifice. Place the unit vertically in a vice, with the piston rod in its lowest position. Refill with fluid through the filler plug hole, until it overflows. Move the piston rod up and down to the fullest extent at least six times, and again top up the unit with the piston rod at its lowest position.

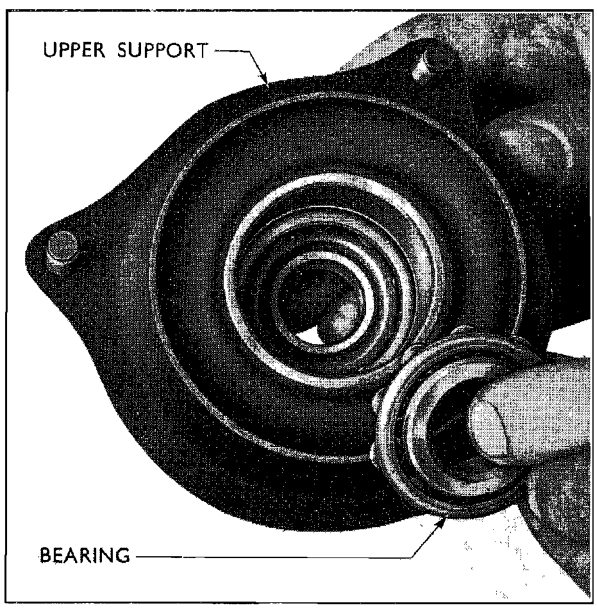

Fig. 9
A Suspension Unit Upper Mounting

10. Replace the filler plug.

11. Refit the coil spring.

NOTE.—Standard and heavy duty springs are available and it is important that springs of similar types are fitted to each side of the vehicle.

The spring grading is indicated by paint marks on the end coils as follows :

Standard spring — Brown.
Heavy duty spring — Red.

Fit each spring with the end coil located correctly in the lower spring seat.

12. The spring compressor, Tool No. P.5008 should be used to enable the spring clips, Tool No. P.5010 to be fitted, when a replacement spring is required.

13. Pull the piston rod up to the top of its stroke and refit the shroud ; note that the flat on the internal bore of the shroud cap engages with the corresponding flat on the piston rod.

14. Replace the spring upper seat, ensuring that the spring is seating correctly. Refit the upper mounting assembly.

The bearings and bearing races should be inspected carefully and new parts fitted if required. Prior to fitting, pack each bearing cage with grease to provide adequate lubrication.

Place the lower bearing race on the piston rod, together with the lower half of the thrust bearing.

15. Position the upper mounting over the piston rod so that the tapered rubber face is towards the spring upper seat, making sure that it locates correctly on the lower half of the thrust bearing. Keep the piston rod pulled to the top of its stroke and locate the top half of the upper thrust bearing inside the upper mounting assembly. Refit the upper bearing race.

16. Replace the thrust bearing retaining locknut, using Tool No. P.5025, as shown in Fig. 10.

The correct tightening torque for this locknut is 45 to 55 lb. ft. (6.221 to 7.604 kg.m.).

To Refit the Suspension Unit

1. Position a gasket on the upper mounting assembly and secure the top of the unit to the reinforced mudguard flange, tightening the nuts to a torque of 15 to 18 lb. ft. (2.074 to 2.489 kg.m.). Fit the dust cap to the upper mounting.

2. Locate the steering arm in the foot of the suspension unit, ensuring that the lugs on the arm are correctly located in the slot of the suspension unit foot. Fit the three bolts and tab washers, tightening them securely and lock the bolt heads with the tab washers.

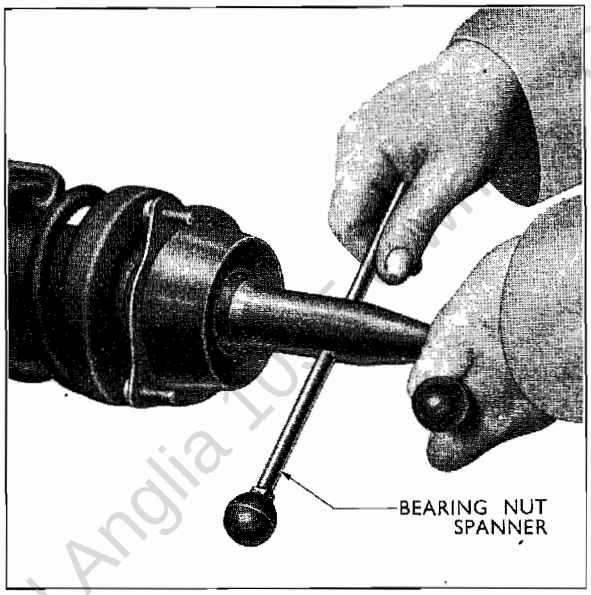

Fig. 10
Tightening a Thrust Bearing Locknut

3. Position the brake plate on the studs. Fit and tighten the self-locking nuts to a torque of 15 to 18 lb. ft. (2.074 to 2.489 kg.m.).

4. Replace the wheel and brake drum and adjust the wheel bearings and brakes.

5. Lower the car to the ground and remove the spring clips.

6. Check the fluid level in each suspension unit as described on continuation sheet 2.

Do not add fluid under pressure.

STABILISER BAR AND BUSHES

To Remove and Replace

1. Fit spring clips, jack up the car and place stands under the crossmember.

2. Remove the stabiliser bar " U " bolts.

3. Withdraw the split pins and unscrew the stabiliser bar nuts. Dismantle the conical rubber bushes from the track control arms.

4. Remove the stabiliser bar from the car.

5. Remove the attachment mounting foot pivot bolt, nut and flat washer and slide the attachment foot out of the side member.

When renewing the attachment mounting foot with the stabiliser bar in position it will be necessary to turn the mounting through 90° to clear the bar.

6. Position the mounting foot bushes in the mounting foot, lubricate the flanges of the bushes with soapy water and enter the mounting foot between the flanges of the side member. Fit the pivot bolt, flat washer and self-locking nut. Do not fully tighten the nut at this stage.

7. Place a rubber bush on each side of the stabiliser bar with the flanges towards the flange on the stabiliser bar.

8. Refit the stabiliser bar to the track control arms so that the sweep in the bar is upwards.

NOTE.—The bar when fitted must slope up from the track control arms towards the attachment mounting feet.

9. Push a rubber bush on to the stabiliser bar at the other side of the track control arm with the flange outwards, fit a flat washer and castellated nut to each end of the bar. Tighten the castellated nuts to a torque of 25 to 30 lb. ft. (3.46 to 4.148 kg.m.). Lock each nut with a new split pin.

10. Fit the stabiliser bar " U " bolts in the notches cut in the stabiliser bar. Refit the " U " bolt locking plates and retaining nuts. Tighten the nuts to a torque of 15 to 18 lb. ft. (2.074 to 2.489 kg.m.). Bend over the tabs of the locking plates to securely lock the nuts.

11. Lower the car to the ground and remove the spring clips. Tighten the stabiliser bar attachment foot pivot bolt nuts to a torque of 22 to 27 lb. ft. (3.04 to 3.73 kg.m.).

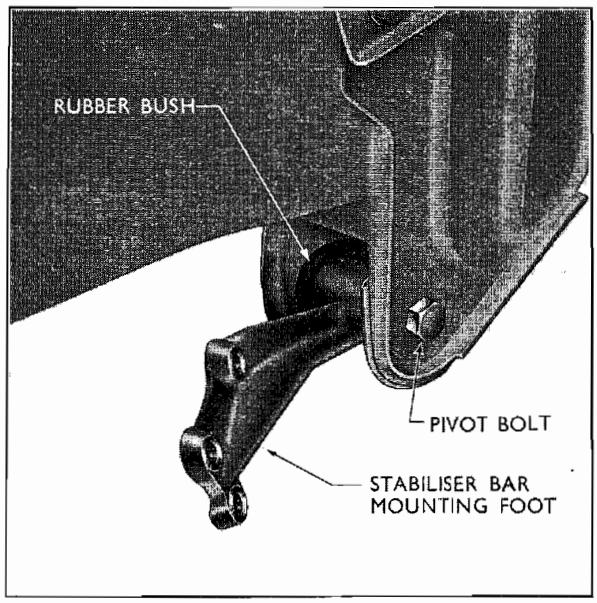

Fig. 11
A Stabiliser Bar Mounting Foot

Continued overleaf

TRACK CONTROL ARMS

To Remove

1. Fit spring clips, jack up the front end of the car and fit stands.

2. Unscrew the three bolts securing the steering arm to the suspension unit foot and detach the assembly from the suspension unit.

3. Withdraw the split pin, unscrew the castellated nut and separate the ball joint securing the track control arm to the steering arm with Tool No. P.3073–9. Remove the dust seal and cap from the ball joint.

4. Unscrew the self-locking nut from the track control arm pivot bolt, pull out the pivot bolt and withdraw the arm from the cross member.

5. Extract the split pin and unscrew the castellated nut from the end of the stabiliser bar, remove the flat washer and bush from the end of the bar and detach the track control arm.

The track control arm ball joint cannot be serviced separately, and if it is worn, the track control arm must be renewed.

NOTE.—The track control arms are " handed " due to the angular movement of the ball joint and can be identified by the lubricator, which must face towards the front of the car, see Fig. 12.

To Replace

1. Position the track control arm on the end of the stabiliser bar (grease nipple on ball joint to front), fit the rubber bush, flat washer and castellated nut to the stabiliser bar.

2. Locate the bushes in the inner end of the track control arm, lubricate the bushes with soapy water and enter the arm in the cross member. Fit the pivot bolt and self-locking nut. Do not tighten the nut at this stage.

3. Fit the dust caps and seal on the ball joint and enter the joint in the steering arm, fit and tighten the castellated nut, locking it with a split pin to a torque of 40 to 45 lbs. ft. (5.528 to 6.219 kgm.).

4. Enter the lugs on the steering arm in the notches on the foot of the unit, fit and tighten the three bolts to a torque of 30 to 35 lbs. ft. (4.15 to 4.84 kg.m.), locking them with the tab washers.

5. Tighten the nut on the end of the stabiliser bar to a torque of 25 to 30 lbs. ft. (3.460 to 4.148 kg.m.). Lock the nut with a new split pin.

6. Lower the car to the ground and remove the spring clips.

7. Tighten the self-locking nut on the track control arm pivot bolt to a torque of 22 to 27 lbs. ft. (3.04 to 3.73 kg.m.).

STEERING ARMS AND TRACK RODS

One steering arm is secured to the base of each suspension unit. The outer end of each track rod is attached to its respective steering arm.

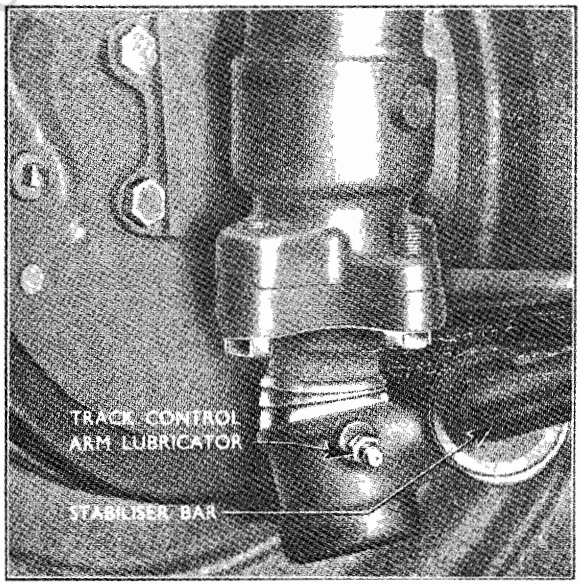

Fig. 12
A Track Control Arm Ball Joint

The inner end of each track rod is attached to the steering drop arm to idler arm rod. One end of the steering drop arm to idler arm rod is attached to the steering gear drop arm, and the other end is attached, through the steering idler arm, to the idler arm support bracket secured to the body sidemember.

The idler arm support consists of a bracket, stud and bush assembly, and is only serviced as a complete assembly, and should not therefore be dismantled.

To Remove a Track Rod

1. Disconnect the track rod from the steering arm at its outer end, after removing the split pin and castellated nut and separating the ball joint. Use Tool No. P.3073–9 to separate the joint, first fitting the thread protector over the threaded portion of the ball joint stud.

2. Separate the track rod at its inner end from the drop arm to idler arm rod. A similar ball joint connection is made at this end of the track rod to that at the outer end.

To Replace a Track Rod

1. Check that each track rod end and track rod is screwed onto the adjusting sleeve an equal amount and that two clamps are in position on the sleeve.

2. Place the inner and outer caps over the track rod inner ball joint stud ; the inner cap has the larger internal diameter.

3. Place the rubber dust cap over the stud and pass the stud through the drop arm to idler arm rod, engaging the tapers. Secure the stud with a castellated nut, tighten the nut to a torque of 18 to 22 lbs. ft. (2.489 to 3.042 kg.m.), then secure with a new split pin.

4. Fit the inner and outer caps, together with the rubber dust cap, to the track rod outer ball joint stud, then pass the stud through the steering arm, securing it with a castellated nut and split pin.

Ensure that the wheels are in the straight-ahead position, and that each track rod end ball joint is in the middle of its travel before locking the clamp bolts. Always tighten each clamp in the pendant position with the slots in line with the slots in the track rod and the clamp bolt located beneath the track rod.

5. Check toe-in and toe-out on turns where applicable, then traverse the steering between locks, ensuring that at the extremities of each lock the track rod can be rotated slightly, proving that the ball joint cannot bear against its housing at any point.

To Remove the Drop Arm to Idler Arm Rod

1. Disconnect each track rod at its inner location, as described above.

2. Withdraw the split pin and remove the castellated nut at each ball joint location on the drop arm to idler arm rod.

3. Use a suitable forked tool to separate the ball joint tapers, then detach the drop arm to idler arm rod.

To Replace the Drop Arm to Idler Arm Rod

1. Position a rubber dust cap over each ball joint stud then enter the appropriate studs through the idler arm and the steering drop arm.

Note that the ball joint having a lubricator in its base is fitted to the idler arm.

2. Secure each ball joint with a castellated nut and split pin.

3. Reconnect the two track rods, as described previously.

To Remove the Idler Arm and Bracket

1. Withdraw the split pin, unscrew the castellated nut then separate the idler arm at the ball joint on the idler arm to drop arm rod.

2. Remove the two bolts and self-locking nuts which locate the idler arm bracket to the body side member, and lift away the bracket and stud assembly.

3. Separate the idler arm from the stud assembly after removing the split pin and castellated nut.

To Replace the Idler Arm and Bracket

When fitting a tab washer, a new stud and bush assembly, or a new idler arm, the following sequence of operations must be observed.

1. Check that the bush is a good fit on the stud, renewing the stud and bush assembly if wear has occurred.

2. Screw the stud clockwise into the bush until tight, and then screw back one full turn. **Ensure that this setting is not altered.**

3. Secure the idler arm bracket to the body side-member, using two bolts and self-locking nuts. Tighten the nuts to a torque of 25 to 30 lbs. ft. (3.46 to 4.146 kgm.).

4. Fit a rubber dust seal to the stud and, with the steering in the **straight ahead position** fit the idler arm to the stud.

5. Loosely fit a tab washer and castellated nut to the stud. Turn the tab washer until the two longest and most widely spaced tabs lie on either side of the idler arm. Bend these down to grip the idler arm.

6. Tighten the nut securely. Check that the distance between the lower face of the idler arm and upper face of the steering drop arm to idler arm rod is approximately $\frac{35}{64}$ in. (13.9 mm.). This dimension should also exist between the upper face of the other end of the idler arm and the lower face of the idler arm support bracket.

7. Split pin the nut and turn up the two remaining tabs of the tab washer against a flat of the nut to prevent the stud and nut assembly from rotating.

8. Attach the other end of the idler arm to the drop arm to idler arm rod, ensuring that a rubber dust cap is fitted over the idler arm to drop arm rod ball joint stud. Secure the idler arm with a castellated nut and split pin.

FRONT WHEEL ALIGNMENT

Front wheel alignment is most important if correct steering and reasonable tyre wear are to be obtained.

Before attempting to check the wheel alignment, the following points should be investigated and, if necessary, corrected.

1. Tyres for correct inflation.
2. Wheels for true running.
3. Front wheel bearing adjustment.
4. Stabiliser bar " U "-bolt nuts for tightness.
5. All ball joints for looseness.
6. Front suspension coil springs for correct seating.

When the above points are all in order, the vehicle should be stood on a **perfectly level surface** in the wheel alignment bay.

NOTE.—When checking any wheel alignment figures, it is advisable to allow the vehicle to run straight into the wheel alignment bay, as a sudden turn may result in the wheels being out of the straight-ahead position, which could give misleading results.

Continued overleaf

If the vehicle has been 'jacked-up' prior to checking the wheel alignment, it is advisable to run it out of the bay and then straight back again to allow the wheels to settle into their normal position. If the vehicle cannot be run out of the bay before checking the wheel alignment, the front end of the vehicle should be bounced several times to ensure that the wheels are returned to their normal position.

Checking Toe-in

When checking the toe-in, make sure the measurements are taken at the same height at both front and rear of the wheels, with the wheels in the straight-ahead position.

The toe-in may be checked using the gauge No. 95B (part of the Churchill wheel alignment equipment) and must be between the limits given in the Specification.

Adjustment

If the toe-in is incorrect, proceed as follows :—

1. Slacken the clamp bolt at each end of each track rod.

2. Check that the track rod ends are in the same position on each rod, thus ensuring that the track rods are the same length.

3. Turn both track rods an equal amount to effect an adjustment. Turning the track rods so that the top moves to the rear will decrease the toe-in, and turning them so that the top moves forward will increase the toe-in.

When the toe-in is within specification (see continuation sheet 6), position the clamps as outlined on continuation sheet 4. Tighten the clamp bolts securely and re-check the adjustment.

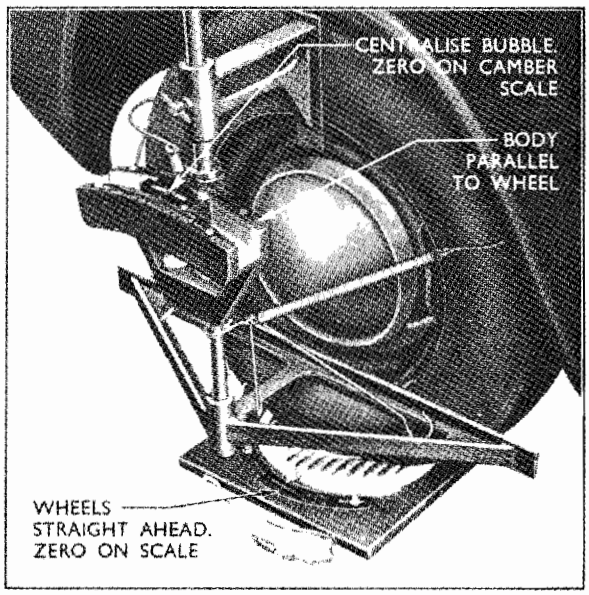

Fig. 13
Zeroing the Gauges

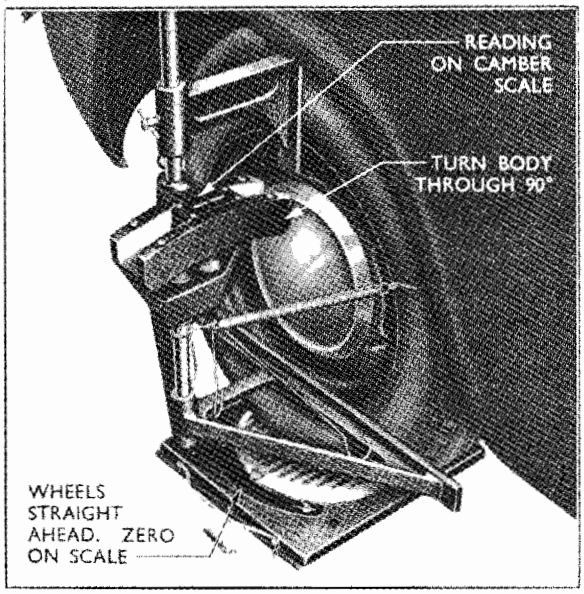

Fig. 14
Checking the Camber Angle

Checking Camber, Castor, King Pin Inclination, Toe-out on Turns

The wheel alignment figures can be accurately and speedily checked by using the Churchill wheel alignment equipment, group No. 121.

Zeroing the Gauges

The vehicle must be placed on absolutely level ground with the wheels in the straight-ahead position (see previous column). Place the turntables in front of the front wheels and " true-up " centrally with the vehicle, setting each pointer to zero with the adjustable scale and plate approximately central. Insert the locking pins, if fitted, to prevent the turntables moving.

Push the vehicle forward on to the turntables, apply the hand brake and remove the plate locking pins. For an accurate reading, the rear wheels must be raised by a corresponding amount. Check that the adjustable scale on each turntable is set to zero and clamp the scale.

Clip the steering gauge No. 121–L to one front wheel by means of the tyre clips and springs and turn the gauge body so that it is parallel with the wheel. Set the sliding block so that the bubble of the spirit level is central between the marker lines, with the gauge line reading zero on the " Camber " scale (see Fig. 13).

Checking Camber Angle

Turn the gauge body through 90° and set the sliding block, so that the bubble is central between the marker lines. The camber angles should now be read on the " Camber " scale (see Fig. 14). Refer to the Specification on continuation sheet 6.

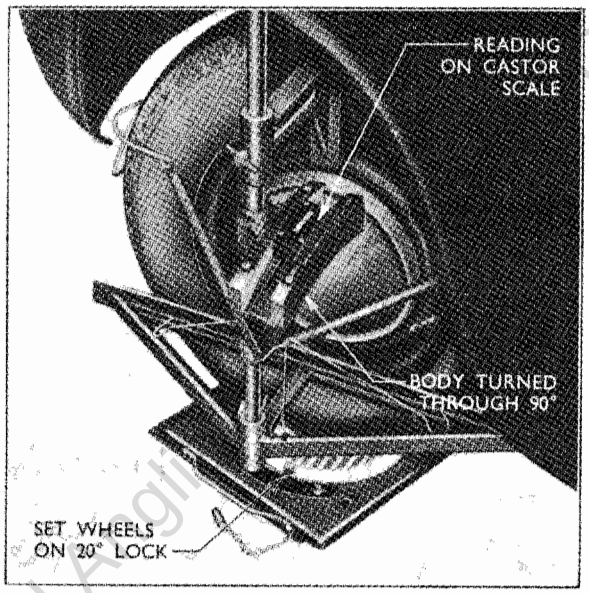

Fig. 15
Checking the Castor Angle

Checking Castor Angle

Zero the gauge with the body parallel to the wheel.

With the gauge body set at right angles to the wheel, turn the front wheels until the pointer on the turntable reads 20°. Move the sliding block to centralise the spirit level bubble and note the reading on the " Castor and K.P.I." scale (see Fig. 15).

Turn the front wheels to read 20° on the other lock, centralise the sliding block and note the reading on the " Castor and K.P.I." scale.

The difference between the two readings is the castor angle in degrees. (Refer to Specification on continuation sheet 6).

NOTE.—To determine whether the castor angle is positive or negative, take the first reading with the front of the wheel turned towards the gauge.

Checking King Pin Inclination

Lock the wheels by tightening the front brake adjusters fully.

Turn the gauge body parallel with the wheel, zero the gauge and turn the wheels until the turntable pointer reads 20°. Centralise the bubble in the sliding block and note the reading on the " Castor and K.P.I." scale.

Turn the wheels to read 20° on the other lock, centralise the bubble and note the reading on the " Castor and K.P.I." scale (see Fig. 16).

The difference between the two readings gives the king pin inclination in degrees. (Refer to Specification on continuation sheet 6.)

Slacken off the brake adjusters, and readjust the front brake shoes after the vehicle has been removed from the turntables.

Toe-out on Turns

This is the angular relationship between the front wheels when the vehicle is turning, and the determination of this angle may be used as a check on correct adjustment of the track rods and alignment of the steering arms. The gauge is not required when measuring this angle, as the turntables only are used.

Turn the front wheels to 20° right lock (read on the left turntable) and note the reading on the right turntable. Subtract 20° from this latter reading to obtain the toe-out on right lock.

Turn the wheels to 20° left lock (read on right turntable) and note the reading on the left turntable. Subtract 20° from this reading to obtain the toe-out on left lock.

INTERPRETATION OF WHEEL ALIGNMENT FIGURES

The castor, camber and king pin inclination angles are not adjustable.

The camber and king pin inclination angles are closely allied, as the spindle body is directly connected to the foot of the suspension unit.

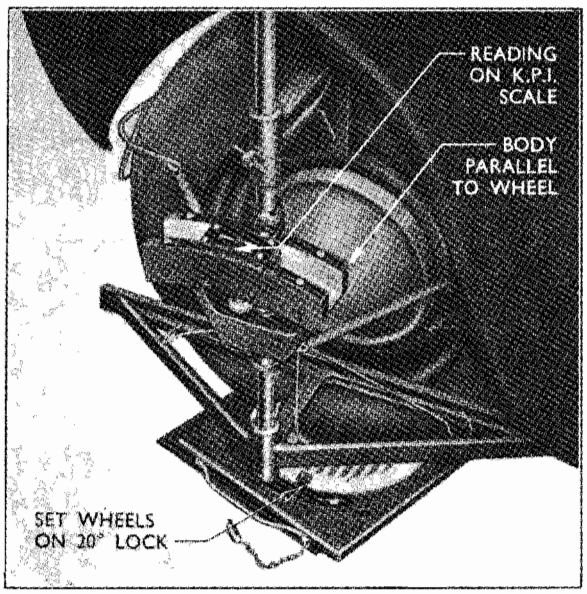

Fig. 16
Checking King Pin Inclination

Continued overleaf

Incorrect Castor Angle

If the castor angle is incorrect, first check that the stabiliser bar " U "-bolts are engaging in the slots of the stabiliser bar and that the securing nuts are tightened fully.

A check should also be made that the stabiliser bar attachment foot spindle nuts are tight and that the rubber bushes are not worn.

Incorrect Camber or King Pin Inclination Angles

If the king pin inclination angle is correct, but the camber angle is wrong, the spindle should be checked for distortion.

If the king pin inclination and camber angles are both wrong, check the track control arm for distortion and the spindle support ball joint for looseness or wear.

The track control arm mounting stud passing through the cross member should also be checked for distortion and the bush should be examined for wear.

Incorrect Toe-out on Turns

If the toe-out on turns is wrong on one side or is unequal, first check the toe-in and examine the track rods to ensure that they are of equal length and the adjusting sleeves are similarly positioned on both rods.

If the track rods are correct, examine the steering arms for distortion and the steering linkage ball joints for wear and looseness. The drop arm to idler arm rod should also be checked for distortion.

CENTRALISING THE STEERING LINKAGE

When it has been ascertained that the wheel alignment is correct, the linkage must be centralised between the two steering stops.

The steering stops are a bolt and locknut passing through a bracket on each body front side member.

If either stop bolt fails to limit steering movement at extreme lock the steering rocker shaft may then contact the walls of the steering box, and the appropriate adjustment should be made for setting the steering lock stops as described below.

To check this adjustment, the following procedure should be adopted :—

Raise the vehicle and turn the steering to maximum lock on either side : this should be limited by the idler arm or drop arm contacting either steering lock stop bolt in the body member.

Steering Lock Stop Adjustment

1. Drive the car on to turntables, slacken the locknuts on both steering stop bolts and screw the bolts outwards from the centre line of the vehicle.

2. With the vehicle unladen, turn the steering onto full left lock and check the clearance between the rear inside edge of the left-hand tyre and the body side member. Adjust the lock until a clearance of $\frac{7}{8}$ in. (2.22 cm.) is obtained at this point.

3. Screw in the right-hand lock stop bolt until it just contacts the drop arm on R.H.D. vehicles, or idler arm on L.H.D. vehicles.

4. Repeat operation two on the opposite lock.

5. Screw in the left-hand lock stop bolt until it just contacts the idler arm, or drop arm.

6. Tighten both stop bolt locknuts and check the adjustments made to ensure that the stop bolts have not been disturbed when tightening the locknuts.

SPECIFICATION AND REPAIR DATA

Wheel Alignment (Vehicle Unladen)

Castor	1° 30′ to 3° 0′
Camber	0° 30′ to 2° 0′
King Pin inclination	4° 45′ to 6° 15′
Toe-out on 20° turns	1° 36′ to 3° 6′
Toe-in	$\frac{1}{8}$ to $\frac{3}{16}$ in. (3.175 to 4.76 mm.)
Track	46 in. (116.84 cm.)
Turning Circle	32 ft. (9.75 m.)

Coil Spring	*Standard*	*Heavy Duty*
Free Length	14.06 in. (35.712 cm.)	13.25 in. (33.66 cm.)
Wire dia.	0.417 to 0.423 in. (1.058 to 1.074 cm.)	0.444 to 0.450 in. (1.128 to 1.143 cm.)
Deflection Rate	80 lbs./in. (0.855 Kgm.)	100 lbs/in. (1.149 Kgm.)
Loaded Length	7.66 in. (19.456 cm.)	8.13 in. (20.65 cm.)
Colour Code	Brown	Red

Tightening Torques

Steering ball joints
18 to 22 lbs. ft. (2.489 to 3.042 kg.m.)

Piston rod gland cap
23 to 31 lbs. ft. (3.180 to 4.286 kg.m.)

Suspension thrust bearing retaining nut
45 to 55 lbs. ft. (6.221 to 7.604 kg.m.)

Suspension unit upper mounting nuts
15 to 18 lbs. ft. (2.074 to 2.489 kg.m.)

Stabiliser bar retaining nut
25 to 30 lbs. ft. (3.46 to 4.148 kg.m.)

Track control arm ball joint nut
40 to 45 lbs. ft. (5.528 to 6.219 kg.m.)

Track control arm inner bushing
22 to 27 lbs. ft. (3.04 to 3.73 kg.m.)

Stabiliser bar mounting foot
22 to 27 lbs. ft. (3.04 to 3.73 kg.m.)

Stabiliser bar ' U ' bolts
15 to 18 lbs. ft. (2.074 to 2.489 kg.m.)

Steering spindle arm
30 to 35 lbs. ft. (4.15 to 4.84 kg.m.)

Idler arm bracket
25 to 30 lbs. ft. (3.655 to 4.146 kg.m.)

SERVICE BULLETIN **Passenger Cars**

Ford Motor Company Limited
Dagenham, England

Section 3: **FRONT AXLE-STEERING GEAR**
Subject: **THE STEERING GEAR**
Effective on: New Anglia (1959 onwards)

THE STEERING GEAR

A worm and nut steering gear, having a nut of the re-circulatory ball type and a ratio of 14 to 1 is fitted to cars in this range.

The construction of the steering gear provides for two adjustments :

(*a*) Steering shaft bearing adjustment (see continuation sheet 2)

(*b*) Rocker shaft end-float adjustment (see below and sheet 3).

Normally, only the adjustment for rocker shaft end-float should be attempted with the steering gear in position in the car. However, it is suggested that this adjustment and that for the steering shaft bearings, are completed with the steering gear removed, as in most cases, the presence of excessive steering shaft end-float indicates the need for overhaul.

On both left-hand drive and right-hand drive models the drop arm can be removed from the rocker shaft with the steering gear in the vehicle, using Tool No. P.3041.

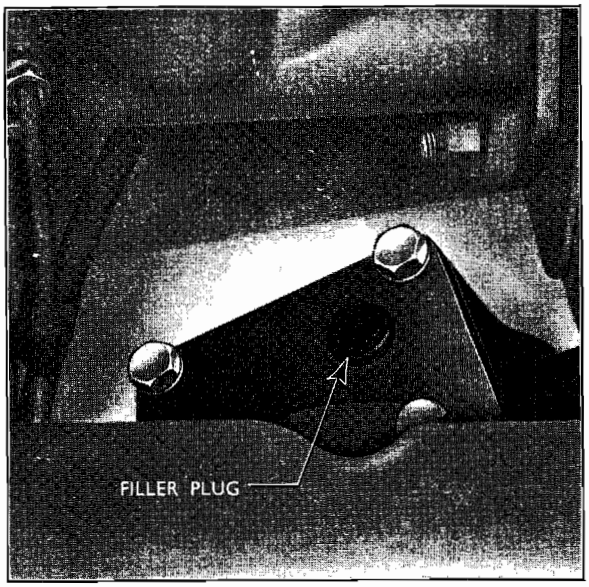

Fig. 2
Steering Gear Filler Plug

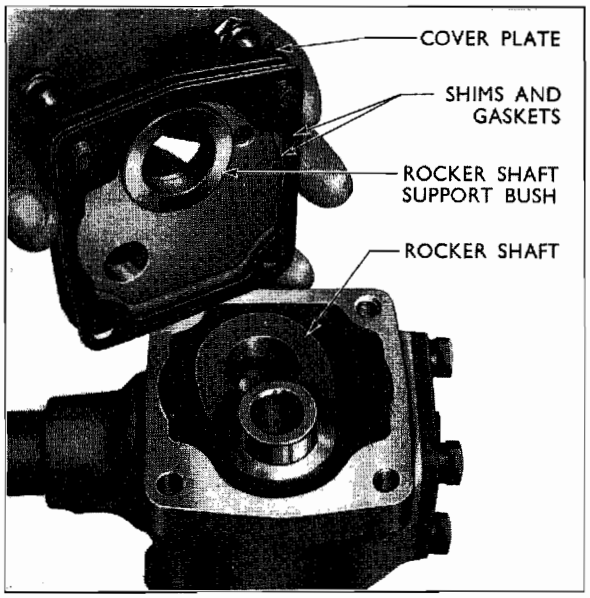

Fig. 1
Rocker Shaft End-float Adjustment

Lubrication

The oil level in the steering box should be checked every 1,000 miles (1,600 km.) and if necessary, topped-up with an approved oil (see Specification) to the bottom of the combined filler and level plug hole.

Rocker Shaft End-float Adjustment

Rocker shaft end-float may be corrected by varying the thickness of shims positioned between the steering gear housing and the top cover plate. Gaskets 0.010 in. (0.254 mm.) thick and shims 0.0035 in. (0.089 mm.) and 0.010 in. (0.254 mm.) thick are serviced for this adjustment. At all times, a gasket must be fitted on each side of the selected shim pack.

1. Disconnect the steering linkage at the drop arm.

2. Check the steering shaft bearing adjustment. If correct, proceed as follows : if incorrect, the steering gear should be overhauled.

3. Remove the steering gear top cover plate and turn the steering on either lock until the hole in the end of the rocker shaft and the hole in the mating

cone on the nut are concentric (see Fig. 8). **The steering gear must always be in this position when checking rocker shaft end-float.**

4. Refit the cover plate with the original shim and gasket pack and estimate the existing rocker shaft end-float by moving the shaft up and down in bushes. The correct end-float is 0.003 to 0.006 in. (0.076 to 0.152 mm.), if possible use a gauge to measure the movement, see sheet 3.

5. Again remove the cover plate and extract sufficient shims to give the correct end-float. Refit the cover plate with a new gasket on each side of the shim pack (to replace and not in addition to the original gaskets).

6. Check the adjustment and when correct, reconnect the steering linkage and also top-up the level of lubricant in the steering box with an approved oil.

To Remove the Steering Gear

The following sequence explains steering gear removal which is accomplished forwards, through the floor of the car, with the steering wheel removed.

1. Disconnect the car battery.

2. Remove the four screws which clamp the two half-housings to the steering column, and remove the housings.

3. From within the car remove the centre ornament by prising it from its location in the steering wheel hub.

4. Bend back the tabs on the steering wheel nut tab washer now exposed, unscrew the nut and remove the tab washer.

5. Fit the thread protector ($\frac{9}{16}$ in. × 28 U.N.F.) to the shaft end. Assemble the steering wheel puller, Tool No. CP.3045, to the wheel, tighten the centre bolt and pull off the steering wheel.

Fig. 3
Removing the Steering Wheel

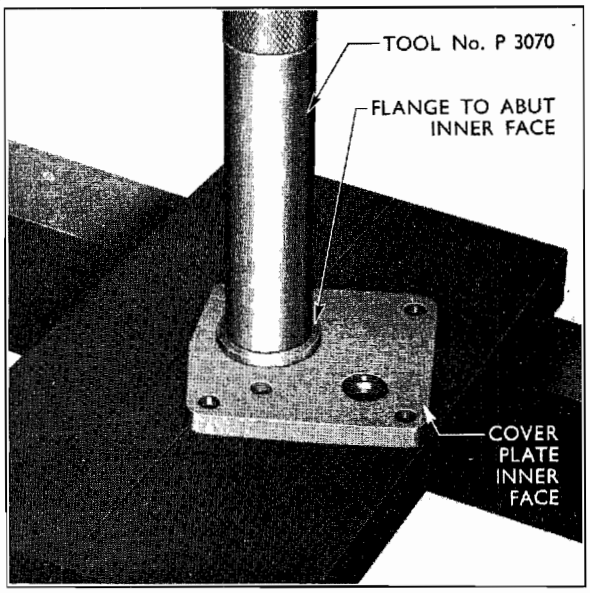

Fig. 4
Rebushing the Cover Plate

6. Unscrew the two screws securing the direction indicator and horn switch assembly to the steering column, and remove the switch, leaving it connected to the wiring. Also remove the two screws securing the dip switch to the steering column.

7. Remove the two screws securing the steering column bracket to the parcel tray, and remove the bracket.

8. Remove the two screws securing the steering column upper mounting to the underside of the facia panel, and the two screws which secure the floor opening cover plate and draught excluder to the floor.

9. Jack up the front end of the car and fit stands at each side of the vehicle, under the body members forward of the jacking brackets.

10. From underneath the car, disconnect the drop arm to idler arm rod at the drop arm. Remove the split pin, unscrew the castellated nut and use Tool No. P.3073–9 to separate the joint, first fitting the thread protector over the threaded portion of the ball joint stud.

11. Disconnect the track rod from the drop arm to idler arm rod. Detach the idler arm bracket from the body.

12. Remove the track rod. (If the engine has been removed it will only be necessary to disconnect at the steering box side.)

13. Remove the three bolts, three nuts and washers securing the steering box to the body member.

NOTE.—Two of these bolts also secure the steering stop bracket in position.

14. Withdraw the steering gear from underneath the vehicle.

To Dismantle

1. Remove the steering gear from the car as outlined. Remove the drop arm retaining nut and washer, using the puller, Tool No. P.3041, remove the drop arm.

2. Prise the rubber filler plug from the steering box cover and drain the oil into a suitable container.

3. Unscrew the two bolts securing the rocker shaft spring retainer to the cover plate and remove the retainer and spring.

4. Unscrew the two set screws and the two fitted bolts with nuts and spring washers from the cover plate, and remove the plate, gaskets and shims.

5. Remove the four bolts securing the end plate to the steering box and lift off the end plate, gaskets and shims. Note that a gasket is fitted on each side of the shim pack and the shims should be retained for reference on re-assembly.

6. Withdraw the direction indicator cam from the upper end of the steering shaft.

7. Partially remove the steering shaft from the housing, by screwing it downwards through the nut to displace the spacing washer and lower bearing assembly. When carrying out this operation the ten balls in the upper bearing will be displaced. Take care not to lose these, or the ten from the lower bearing, as the cup is withdrawn.

8. Completely remove the steering shaft, screwing it right through the steering nut again, taking care not to lose any of the thirty balls incorporated in the nut assembly.

9. Lift the rocker shaft and nut from the steering box, also withdraw the steering shaft upper bearing cup.

10. If necessary, remove the rocker shaft bushes as follows :

(*a*) Lever out the oil seal and discard it.

(*b*) Withdraw the bush located at the drop arm end using Tool No. P.3066, or alternatively, tap the bush to a suitable thread size, when it can be extracted by means of a suitable puller bolt, flat washer and tubular distance piece.

(*c*) Remove the flanged bush in the cover plate, using Tool No. P.3070.

11. Withdraw the steering shaft upper support bush (felt) from the steering tube.

To Reassemble

1. Soak a new steering shaft upper support bush (felt) for a reasonable period in hot heavy grease or tallow ; then install in the upper end of the steering tube to abut the retainer.

2. If the rocker shaft bushes have been removed, install new bushes. Note that a pre-sized bush is serviced for the cover plate, but the bush to be fitted to the steering gear housing must be broached when in position (Tool No. P.3022), using the cover plate bush as a pilot.

(*a*) Inspect the cover plate for burrs or damage and if satisfactory, press the flanged bush squarely into position, using Tool No. P.3070, so that the flange abuts the inner face of the cover plate, see Fig. 4.

(*b*) Turn the cover plate over so that the outer face is uppermost and very carefully stake the bush to retain it in position. As this bush is pre-sized it is essential that the bearing face is not damaged in any way.

(*c*) Check the condition of the steering gear housing. Locate the large plain rocker shaft bush on Tool No. P.3066 so that the closed end of the oil groove is adjacent to the shoulder on the tool. Press the bush into the steering gear housing until the shoulder of the tool abutting the bush is flush with the oil seal seating.

If the housing incorporates a bush locating shoulder, press in the bush sufficiently to abut this shoulder.

(*d*) Place the location bush detail " b " in the cover plate bush and then insert the broach P.3022 within detail " b." Refit the cover plate to the steering box, using the two set screws, the two fitted bolts, spring washers and nuts.

Now, using the flanged bush as a guide and supporting the lower bush with the pad detail " a," broach the lower bush to size. Use the press ram extension piece to press the broach completely through the bushes.

(*e*) Remove the cover plate, the broach, and wash the steering box thoroughly to remove any swarf.

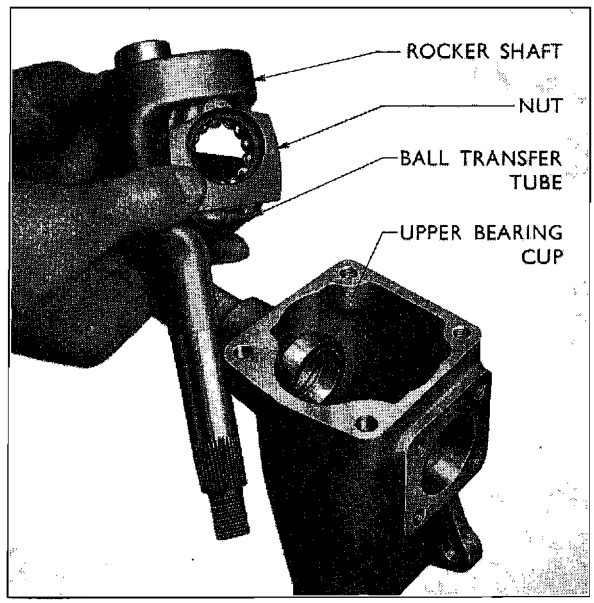

Fig. 5
Removing the Rocker Shaft and Steering Nut

Continued overleaf

3. Install a new oil seal in the housing with the sharp inner edge of the seal towards the interior of the steering box.

4. Fit the steering shaft upper bearing cup. Ensure that the bearing cup is pressed home squarely. It should be noted at this point that all the steel balls in the steering box assembly are of the same size and the upper and lower cups identical.

5. Using grease to retain them in position, install the thirty balls in the centre and transfer groove of the steering nut. Locate the spherical top of the steering nut in the recess in the rocker shaft and install the whole assembly in the housing, taking care not to damage the oil seal. The nut can be assembled either way round.

6. Carefully pass the steering shaft up through the steering box, rotating the shaft to screw it into the nut.

7. Invert the assembly and retain the steering shaft so that the bearing track is approximately ½ in. (12.7 mm.) above the upper bearing cup and install the ten balls.

8. Push the steering shaft right home to retain the upper bearing assembly in place.

9. Locate ten balls in the lower bearing cup, retain them in position with grease if necessary, and carefully install the cup in the steering box. Fit the thick spacing washer in its location against the lower bearing cup.

10. Adjust the steering shaft bearings, see continuation sheet 2.

11. Adjust the rocker shaft end-float, see sheet 3.

12. Refit the drop arm to the rocker shaft. Set the steering gear in the straight-ahead position (rotate the steering gear from full lock to full lock to establish the mid or straight-ahead position), locate

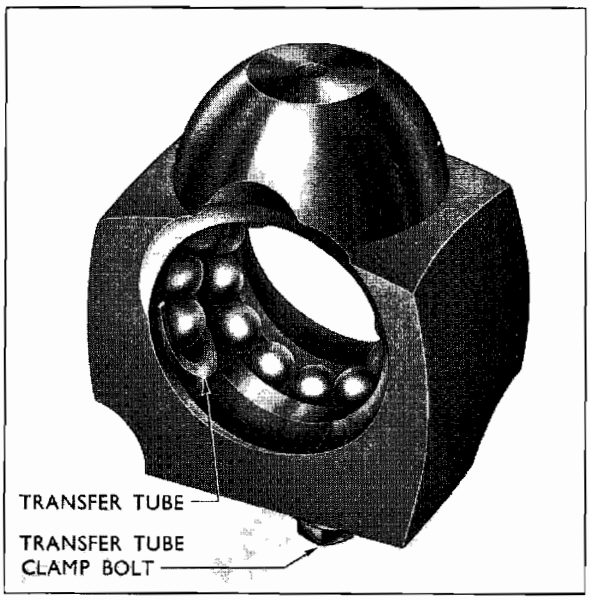

Fig. 6
The Steering Nut Assembly

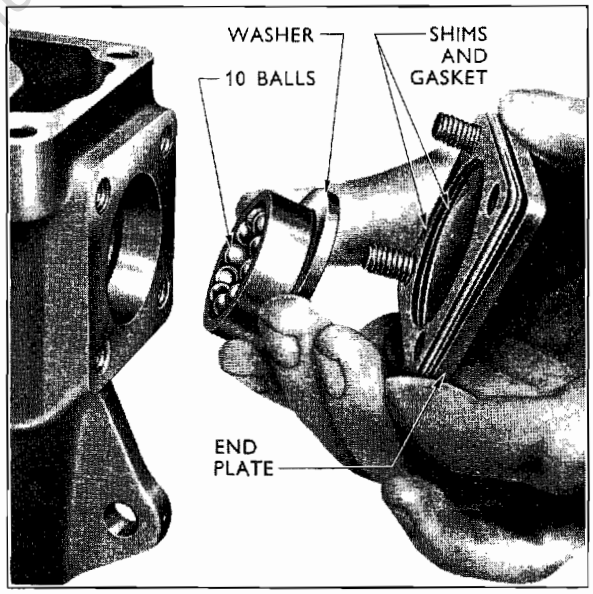

Fig. 7
Steering Shaft Lower Bearing and End Plate

the drop arm on the shaft splines so that it is parallel to the steering shaft, fit the spring washer and large nut and tighten securely.

Steering Shaft Bearing Adjustment

Steering shaft bearing adjustment is controlled by gaskets and shims positioned at the lower end of the steering box, between the housing and the end plate. To enable an accurate adjustment to be made, shims 0.004 in. (0.102 mm.) and 0.010 in. (0.254 mm.) thick together with paper gaskets 0.0025 in. (0.064 mm.) and 0.010 in. (0.254 mm.) are available and these should be used in the following manner :

1. Position a new paper gasket against the steering box face and locate the shims originally removed, then a second new gasket. Fit the end plate in position retaining this loosely with the four bolts and spring washers. Rotate the shaft and at the same time, carefully tighten the bolts so that any binding will be immediately felt, indicating that the shim thickness is insufficient.

At all times a paper gasket must be fitted on either side of the shim or shims.

2. Check the adjustment of the steering shaft bearings : the shaft should rotate freely with no end-float. If end-float can be felt on the shaft, remove the end plate and decrease the thickness of the shims and/or gaskets until end-float is just eliminated.

3. Finally, remove one 0.004 in. (0.102 mm.) shim to slightly pre-load the bearings.

Note.—If the steering gear has not been dismantled but adjustment is required, check the end-float as outlined above, then remove the end plate and withdraw the required shims, as in operation 2.

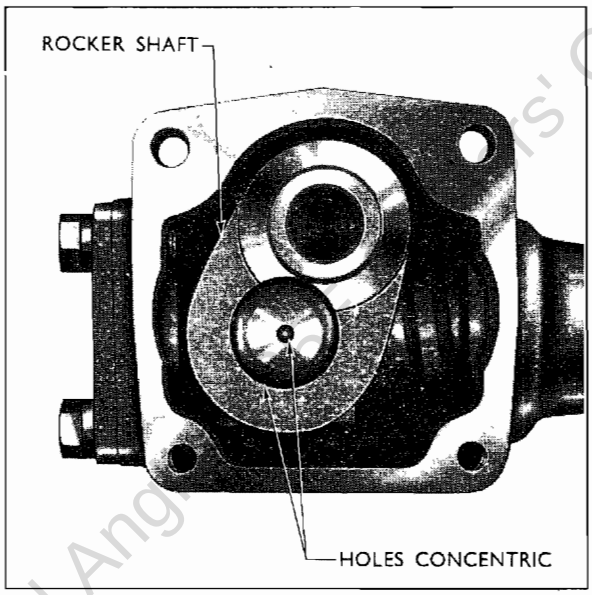

Fig. 8
Rocker Shaft Position for End-float Adjustment

Check the adjustment and finally pre-load the bearings as in operation 3.

Rocker Shaft End-float Adjustment

End-float of the rocker shaft may be set by varying the thickness of gaskets and shims positioned between the steering gear housing and the top cover plate. For this adjustment, only one thickness of gasket 0.010 in. (0.254 mm.) is available but shims 0.0035 in. (0.089 mm.) and 0.010 in. (0.254 mm.) thick are also serviced.

1. Check that the steering shaft bearing adjustment is correct.

2. With the cover plate removed, turn the steering on either lock until the hole in the end of the rocker shaft and the hole in the mating cone on the nut are concentric (see Fig. 8). **The steering gear must always be in this position when checking the rocker shaft end-float,** and to check this position, fit the indicator dial gauge as detailed in operation 4 below. Rotate the steering shaft in either direction until a minimum reading is obtained on the dial.

3. Locate a gasket against the steering box housing face, fit the shims originally removed, then another gasket and the cover plate. Fit the spring washers and two fitted bolts and nuts, the two set screws and spring washers, and tighten the bolts and nuts carefully ensuring that the rocker shaft does not bind.

4. Measure the rocker shaft end-float

(*a*) For convenience the indicator dial gauge and stand (Tool No. P.4008) used for checking crown wheel and pinion backlash may be used for an accurate adjustment.

(*b*) Assemble the gauge and stand to the housing so that the gauge spindle contacts the threaded end of the rocker shaft, see Fig. 9.

(*c*) Check the shaft end-float which should be 0.003 in. (0.076 mm.) to 0.006 in. (0.152 mm.).

If the end-float is incorrect, remove the cover and adjust the shims to give the correct end-float with the cover bolts and screws tight.

5. When end-float is correct, install the rocker shaft thrust spring, gasket and retaining plate, using two spring washers and bolts, tightening them securely.

Turn the steering slowly from lock to lock to avoid any flywheel effect of the steering wheel, and check that it does not bind in any position. It will be found that a characteristic of the steering gear is for it to be slightly tighter on either lock than in the straight-ahead position.

Note.—If the steering gear has not been dismantled for overhaul, first unscrew the two bolts and spring washers and remove the thrust spring retaining plate gasket and spring, then check the steering shaft bearing adjustment. If this is satisfactory, continue with operation 4 above.

To Refit the Steering Box

1. Pass the steering column through the hole in the floor pan from beneath the vehicle and loosely secure it to the body side member with three bolts, four flat washers and three self-locking nuts.

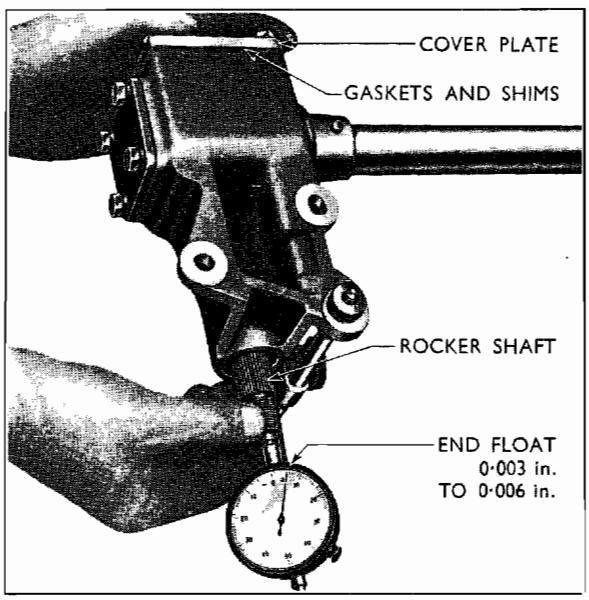

Fig. 9
Checking Rocker Shaft End-float

Continued overleaf

Note.—Two of these bolts also secure the steering stop bracket in position. Pass two bolts through the steering stop bracket, through the car body and the steering box mounting flange. Fit a flat washer and a self-locking nut to each bolt. Place a flat washer under the head of the third bolt, pass this bolt through the car body and the steering box mounting flange then fit another flat washer and a self-locking nut. Do not fully tighten the nuts until the steering column upper mounting has been refitted to the underside of the facia panel.

2. Slide the gasket and the floor opening cover plate over the steering column from inside the vehicle. Depress the clutch and brake pedals fully and install the cover plate securing it with two screws.

3. Locate the rubber mounting bush around the steering column and position it with the upper mounting packing piece (see Fig. 10) against the underside of the facia panel. Fit the shroud rubber gasket over the packing piece and against the instrument panel.

Place the clamp over the bush and secure the upper mounting to the facia panel with two screws and lockwashers.

4. Fully tighten the three self-locking nuts and bolts securing the steering gear to the body side member to a torque of 25 to 30 lbs. ft. (3.46 to 4.148 kg.m.)

5. Bolt the idler arm bracket to the car body (see Service Bulletin, Serial No. 27, The Front Suspension, sheet 5, " To Replace the Idler Arm and Bracket ").

6. Connect the track rod to the drop arm to idler arm rod (see Service Bulletin, Serial No. 27, The Front Suspension, continuation sheet 4, " To Replace a Track Rod ").

7. Connect the drop arm to idler arm rod to the drop arm (see Service Bulletin, Serial No. 27, sheet 5, " To Replace Drop Arm to Idler Arm Rod ").

8. Locate the direction indicator and horn switch assembly, also the dip switch on their respective brackets on the steering column, insert the two screws for each control and tighten securely. Install the upper and lower half-housings around the steering column and secure them with four screws.

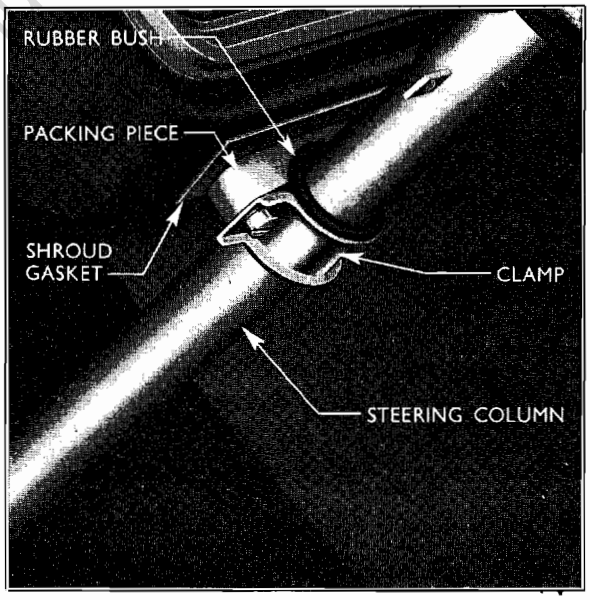

Fig. 10
Steering Column Upper Support

9. With the road wheels in the straight-ahead position, fit the direction indicator cam to the steering shaft and check for correct operation. Then fit the steering wheel with the spokes located across the car and the larger open section between the spokes uppermost. Fit the tab washer and the steering wheel nut to the shaft, tightening the nut to the specified torque. Lock the nut by bending up the tabs on the washer against the nut. Refit the centre ornament to the steering wheel.

10. Connect the battery, jack up the vehicle and remove the stands and lower the vehicle to the ground.

11. Refill the steering box to the correct level with an approved lubricant of the correct grade, and replace the rubber filler plug.

SPECIFICATION AND REPAIR DATA

Type	Recirculatory ball
Lubricant	S.A.E. 90 E.P.
Drop arm retaining nut torque	70 to 80 lbs. ft. (9.67 to 11.06 kgm.)
Steering wheel retaining nut torque	20 to 25 lbs. ft. (2.764 to 3.455 kgm.)
Steering ball joints tightening torque :	18 to 22 lbs. ft. (2.489 to 3.042 kg.m.)
Ratio	14 : 1
Steering shaft bearing adjustment	Shims
Steering shaft bearing pre-load :	0.004 in. (0.102 mm.) NIP
Shim thickness and identification :	0.004 in. (0.102 mm.) Steel 0.0025 in. (0.063 mm.) Paper 0.010 in. (0.254 mm.) Paper or Steel
Rocker shaft end-float adjustment	Shims
Rocker shaft end-float	0.003 to 0.006 in. (0.076 to 0.152 mm.)
Shim thickness ..	0.0035 in. (0.089 mm.) Steel 0.010 in. (0.254 mm.) Steel 0.010 in. (0.254 mm.) Paper
Rocker shaft bush diameter ..	0.812 to 0.813 in. (20.62 to 20.65 mm.)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 4 : **REAR AXLE**
Subject : **Service and Repair Procedure**
Effective on : New Anglia and Prefect (1959 onwards)

THE REAR AXLE

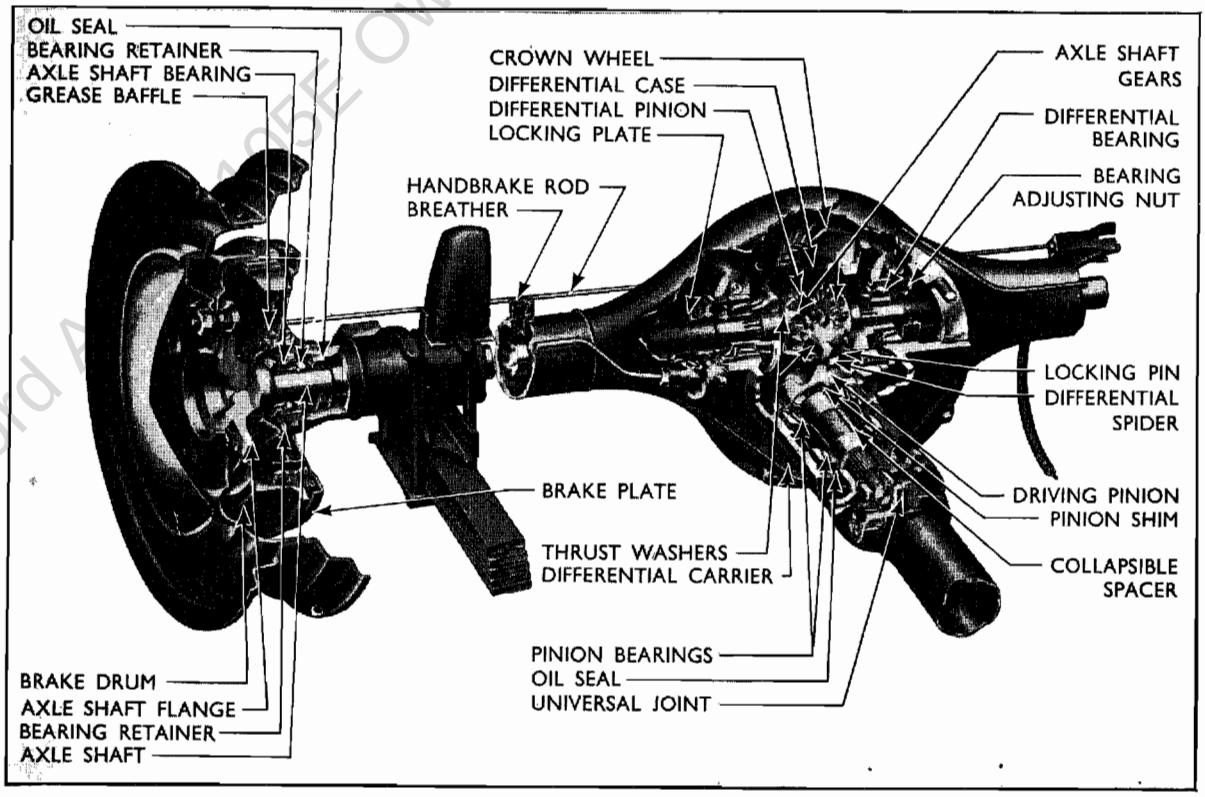

Fig. 1
Cutaway View of Rear Axle

Description

The rear axle is of the semi-floating type, incorporating a hypoid crown wheel and pinion and a two-pinion differential. The crown wheel and pinion are mounted in the differential carrier, which is bolted to the front face of the banjo-type axle housing.

Adjustments are provided for pinion bearing pre-load, crown wheel and pinion backlash and pinion depth of mesh. All repairs can be carried out to the component parts without removing the axle housing from the vehicle.

Lubrication and Maintenance

Each rear hub bearing is a pre-packed and sealed unit and normally does not require attention. The universal joints are the needle roller type, welded to each end of the tubular drive shaft, and should be lubricated every 1,000 miles (1,600 kilometres) with S.A.E. 250 oil or multi-purpose grease of the lithium base type.

The combined filler and level plug for the axle is situated in the rear of the banjo housing (see Fig. 2), whilst the drain plug is in the underside of the housing.

After the first 300 miles (500 kilometres) the axle oil should be drained, by removing the drain plug when the oil is hot. Refill the axle with the correct grade of hypoid gear oil (see Specification).

At each 1,000 miles (1,600 kilometres) interval, check the lubricant level with the vehicle standing on level ground. Remove the level plug and the oil should be to the bottom of the hole, add oil if necessary to bring it to this level. Replace the level plug and tighten it securely.

Note that only hypoid and not ordinary gear oil is to be used ; refer to the Specification for the correct grade of oil.

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At each 5,000 miles (8,000 kilometres) interval, drain off the lubricant when the oil is hot, and refill the axle to the correct level with approved oil.

If a new crown wheel and pinion or differential carrier assembly have been fitted, fill the axle to the correct level with ' running-in type hypoid gear oil,' and run-in the axle as for a new vehicle for 500 miles (800 kilometres). After 300 miles (500 kilometres) drain the axle and refill it with the correct grade hypoid gear oil as described previously.

Drive Shaft and Universal Joints

The drive shaft and universal joints can be removed as an assembly and should be treated with care as it is balanced to fine limits.

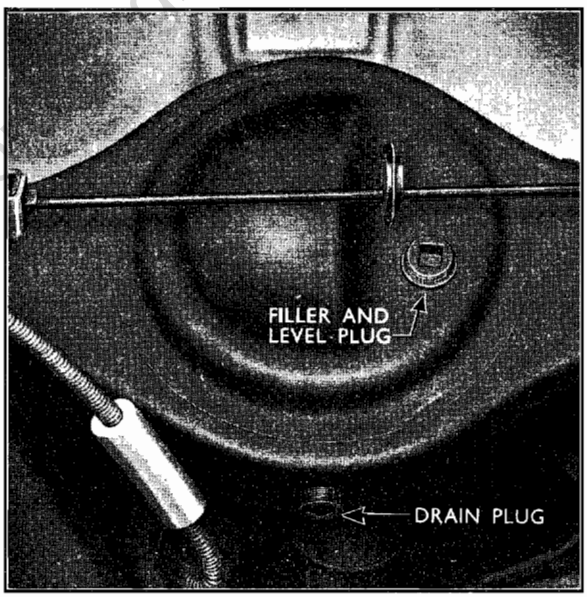

Fig. 2
Drain and Level Plugs

To Remove

1. Mark the drive shaft and pinion drive flanges to ensure correct alignment on replacement, remove the four self-locking nuts and bolts and push the shaft forward slightly to separate the two flanges.

2. Lower the rear end of the drive shaft and ease it to the rear to disengage the gearbox main shaft splines.

NOTE.—When the drive shaft is removed, a small quantity of oil may leak from the gearbox extension housing. The oil level of the gearbox must be checked and topped-up, if necessary, after road test.

Overhauling the Universal Joints

The universal joint spider, bearings, oil seals and retainers are serviced as a kit.

Fig. 3
Universal Joint Lubrication

1. To dismantle, extract each spider bearing snap ring (see Fig. 4), and remove the bearing cups and rollers by gently tapping the yoke at each bearing.

2. Remove the spider and detach the oil seal and seal retainer from each spider journal.

3. To reassemble, fit new oil seals to the retainers and locate them on the shoulders of the spider journals with the oil seals outwards. Position the spider in the drive shaft yoke, assemble the needle rollers in each bearing cup and refit the bearings, tapping them squarely into place. Take care not to dislodge the needle rollers.

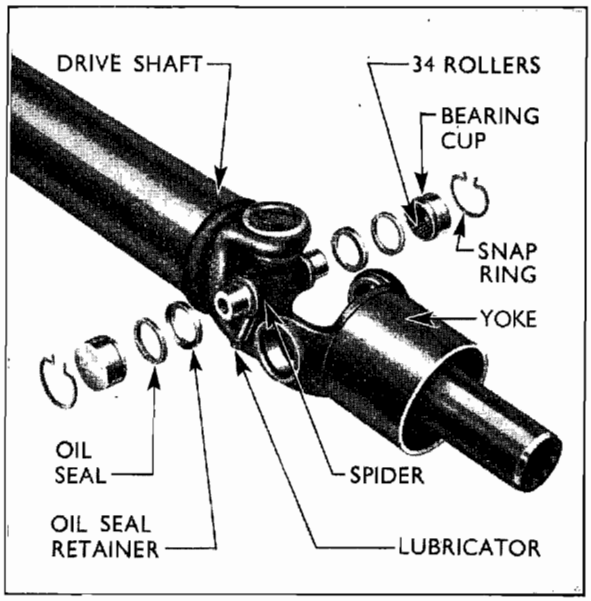

Fig. 4
Universal Joint—Exploded View

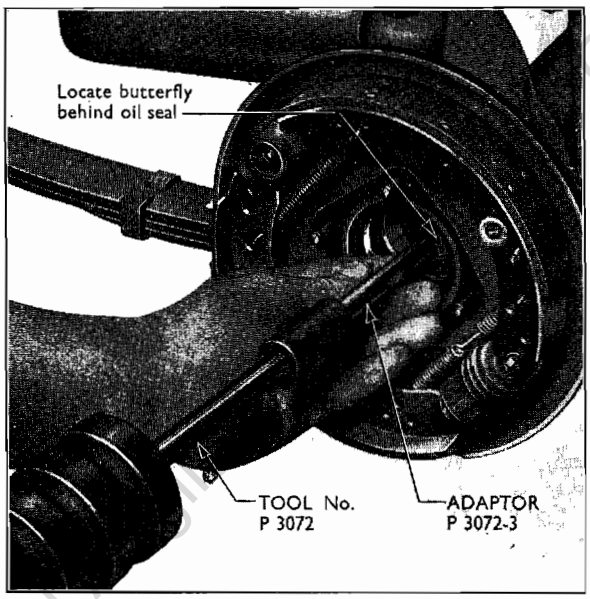

Fig. 5
Removing an Oil Seal

4. Similarly, refit the other half of the joint.

5. Refit the snap rings to each bearing and replace the lubricator in the spider. Lubricate the bearings thoroughly with S.A.E. 250 oil or a multi-purpose lithium base grease.

To Replace

1. Slide the front universal joint onto the gearbox mainshaft splines, taking care not to damage the extension housing rear oil seal or bearing.

2. Lift the rear end of the drive shaft and align the mating marks on the drive flanges. Fit the four bolts and self-locking nuts, tightening the nuts securely.

3. Road test the vehicle and *then* check the gearbox oil level.

Axle Shafts and Oil Seals

The axle shafts may be withdrawn without disturbing the differential assembly.

Axle shaft oil seals, to retain the differential lubricant, are provided at the outer ends of the axle casing. If leakage indicates that a seal requires renewal, then, provided the remover, Tool No. P.3072–3 is available, this may be accomplished after first withdrawing the axle shaft. The procedure forms part of the axle shaft removal instructions, see Fig. 5.

To Remove an Axle Shaft

1. Jack up the vehicle and fit stands. Suitable points for placing stands are just in front of the rear springs, under the frame side members.

2. Remove the road wheel from the side on which the shaft is to be withdrawn. Unscrew the one cheesehead screw retaining the brake drum to the axle shaft flange release the hand brake and pull off the brake drum. If necessary, first back off the brake shoe adjustments.

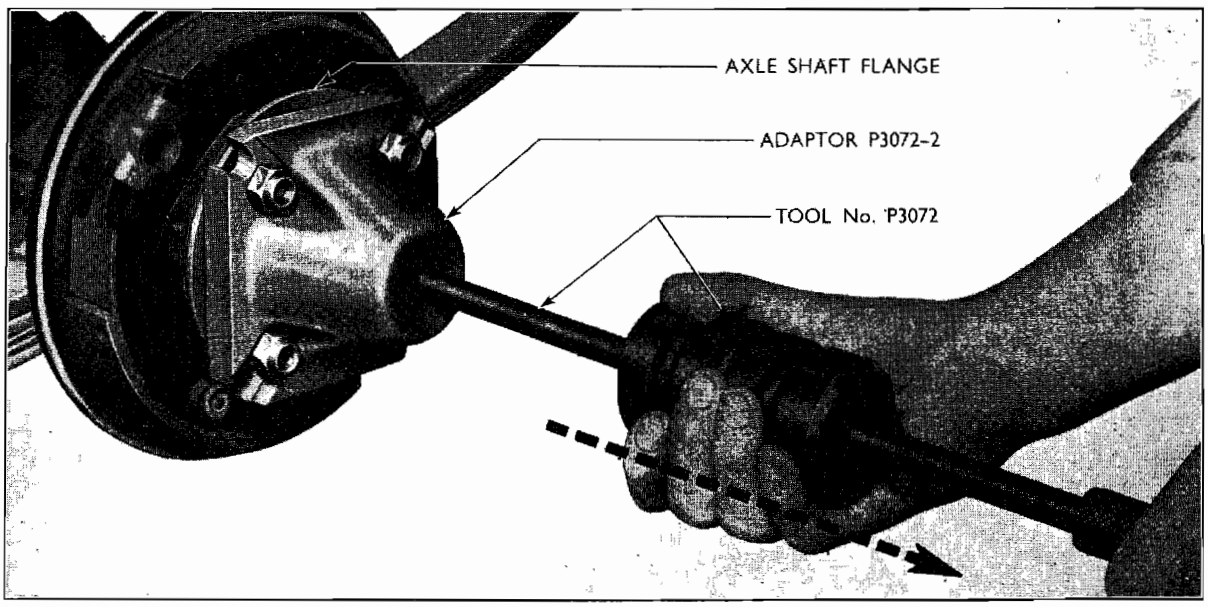

Fig. 6
Withdrawing an Axle Shaft

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3. Remove the four self-locking nuts which secure the axle shaft bearing retainer to the axle housing. These nuts are accessible through the holes in the axle shaft flange illustrated in Fig. 7.

4. Withdraw the axle shaft. Secure the base of the axle shaft removing tool (Tool No. P.3072–2, see Fig. 6) to the axle shaft flange by means of the wheel nuts, screw the centre bolt of the tool into the base already secured to the axle shaft flange and, by operating the slide hammer mounted on the centre bolt, withdraw the axle shaft.

5. Remove the axle shaft bearing (if required) :

(*a*) Locate the adaptors (Tool No. P.4090–1) and slave ring between the bearing and axle shaft flange. Support the assembly in the base plate (Tool No. 370) on the bed of a hydraulic press. Remove the press ram pad and fit the ram adaptor to the press ram. Press on the splined end of the axle shaft and push the shaft out of the bearing and retainer.

(*b*) Remove the bearing retainer plate and baffle from the axle shaft.

6. Renew the axle shaft oil seal :

(*a*) Screw the oil seal remover (Tool No. P.3072–3) on to the centre bolt and slide hammer assembly, and pass the oil seal remover through the seal so that the wings locate behind the metal casing, see Fig. 5. Hold the centre bolt and operate the slide hammer to extract the oil seal.

(*b*) Locate the new seal on the adaptor (Tool No. P.4078) so that its sealing edge will be towards the differential assembly when it is installed in the axle casing.

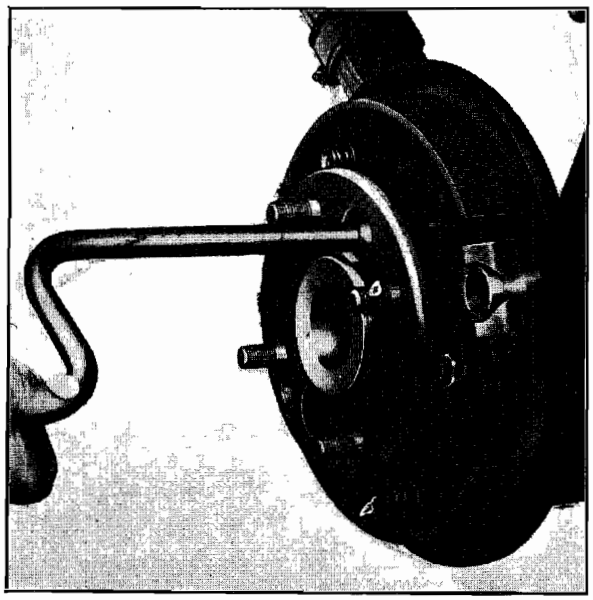

Fig. 7
Fitting an Axle Shaft

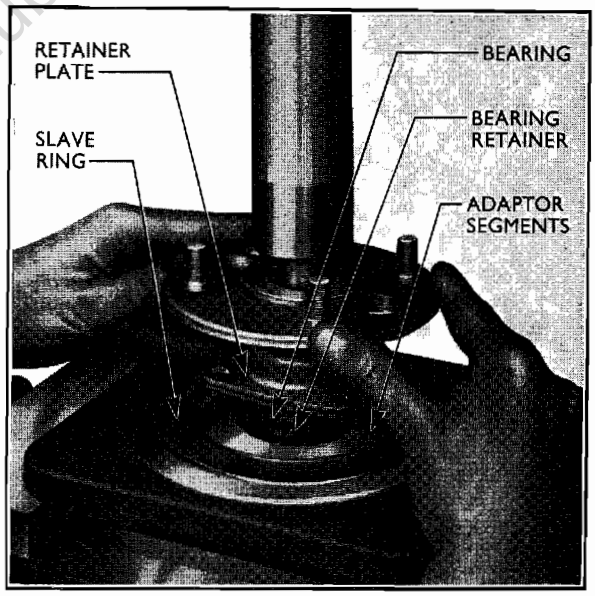

Fig. 8
Fitting an Axle Shaft Bearing

(*c*) Fit the adaptor on the handle (Tool No. 550) and drive the oil seal into place in the axle casing.

To Replace

1. (*a*) Locate the baffle and the bearing retainer plate on the axle shaft and fit the bearing.

(*b*) Support the assembly on the spacer ring in the adaptors (Tool No. P.4090–2), slave ring and base plate (Tool No. 370) on the bed on a hydraulic press, and, by pressing on the axle shaft flange, press the bearing right home. A minimum pressure of 1,200 lb. (545 kg.) should be required to do this; a pressure below this figure indicates an incorrect fit between shaft and bearing.

(*c*) Similarly, using the tools in operation (*b*) with the exception of the spacer ring, fit a bearing retaining ring to abut the bearing. A minimum pressure of 800 lb. (363 kg.) should be used.

2. Check that the oil drain hole in the brake back plate is unobstructed.

3. Fit the axle shaft, taking care not to damage the oil seal in the axle housing, when the splined end of the shaft passes through it.

4. Locate the axle shaft in the axle shaft gear and enter the bearing into the axle housing journal. Drive the axle shaft right home and fit the bearing retainer plate and baffle on the four studs.

5. Fit the four self-locking nuts to secure the bearing retainer and baffle to the axle casing and tighten the nuts securely.

6. Refit the brake drum, securing it in place with the drum retaining screw and refit the road wheel. If required, readjust the brake, lower the vehicle to the ground, recheck the wheel nuts and refit the hub cap.

Drive Pinion Oil Seal

To Renew

1. Withdraw the differential carrier assembly as described below and mount the assembly on the dismantling stand using adaptor, Tool No. P.4077.

2. Remove the differential bearing caps and lift out the differential assembly as explained on this sheet.

3. Withdraw the drive pinion assembly, also see continuation sheet 3.

4. Lever out the existing oil seal and, using Tool No. P4013-3, see Fig. 18, fit a new seal with the sealing edge facing into the carrier.

5. Lightly oil the seal, fit a new collapsible spacer to the pinion and adjust the pinion bearing pre-load as described in operation 9c onwards, see continuation sheet 5.

6. Reassemble the differential assembly to the carrier and set the crown wheel and pinion backlash and differential bearing pre-load, see operation 10, continuation sheet 5.

7. Complete the axle build up.

Differential Carrier Assembly

To Remove

1. Remove both brake drums and withdraw the axle shafts as described previously, see sheet 2.

2. Drain the oil from the axle housing.

3. Disconnect the drive shaft at the rear end, see continuation sheet 1.

4. Unscrew the eight self-locking nuts securing the differential carrier to the axle casing and withdraw the hydraulic brake pipe three-way connector from its locating stud.

5. Withdraw the carrier, complete with crown wheel and differential assembly.

To Replace

1. Before reassembly, check the mating flanges of the axle housing and carrier for burrs and place a new gasket on the axle housing studs.

2. Position the differential carrier with the pinion to the bottom, and locate it on the studs of the axle housing. Fit the eight self-locking nuts ensuring that the hydraulic brake pipe three-way connector is located on the correct stud and tighten the nuts to a torque of 15 to 18 lbs. ft. (2.074 to 2.489 kg.m.).

3. Reassemble the drive shaft, axle shafts, brake drums and road wheels.

4. Refill the axle to the level plug with 2 Imp. pints (2.4 U.S. pints, 1.14 litres) of the correct grade of hypoid gear oil (see continuation sheet 1). After a road test, check the gearbox oil level as some oil may have been lost if the drive shaft was completely removed from the vehicle.

To Dismantle

1. Remove the differential carrier assembly and, using the adaptor (Tool No. P.4077) mount it on the dismantling stand.

2. Check the mating marks on the differential bearing caps, unscrew the adjusting nut locking plate bolts and detach the locking plates.

3. Slacken the differential cap bolts and then using the spanner (Tool No. P.4079) back off the differential bearing adjusting nuts. Remove the differential bearing cap bolts and lockwashers and carefully detach the bearing caps (see Fig. 10).

4. Lift out the crown wheel assembly, together with the differential bearings and adjusting nuts. Take care to keep the bearings and cups as assemblies.

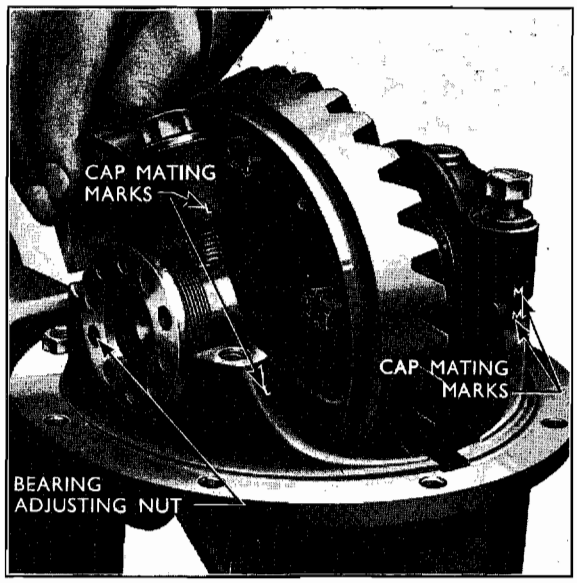

Fig. 9
Differential Bearing Cap Mating Marks

Continued overleaf

5. Withdraw the drive pinion. This is secured by a retaining nut which presses the coupling flange against the inner face of the front pinion bearing. A tubular spacer is fitted between the pinion bearings and the length of this spacer controls the pinion bearing preload. The drive flange retaining nut is staked to the pinion to lock it in position.

(*a*) Relieve the staking, then holding the pinion flange with the spanner (Tool No. P.4028), unscrew the drive flange retaining nut.

(*b*) Pull the drive flange from the pinion splines. The pinion with its tubular spacer and rear bearing cone can now be withdrawn from the carrier (see Fig. 11).

6. Remove the pinion bearing cups, front bearing and oil seal. Drive out the front bearing and oil seal

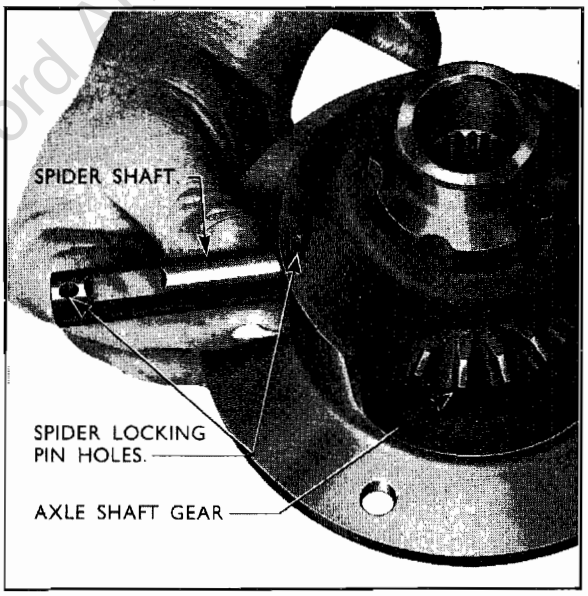

Fig. 10
Spider Shaft Location

first, using the special driver (Tool No. P.4015), passing the body of the tool through the rear bearing cup. Ensure that the spring-loaded legs of the driver are located in the notches provided behind the bearing cup, as shown in Fig. 12. Drive out the rear pinion bearing cup from the front, in the same manner.

7. Dismantle the pinion assembly :

(*a*) Detach and discard the collapsible bearing spacer from the pinion shaft.

(*b*) Locate the pinion assembly in the support ring with the lips of the adaptor segments (Tool No. P.4000–28) behind the bearing cone. Mount the assembly in the base plate on the bed of a press, check that the bearing cage is free to rotate and press out the pinion. Remove the spacer from the pinion shaft.

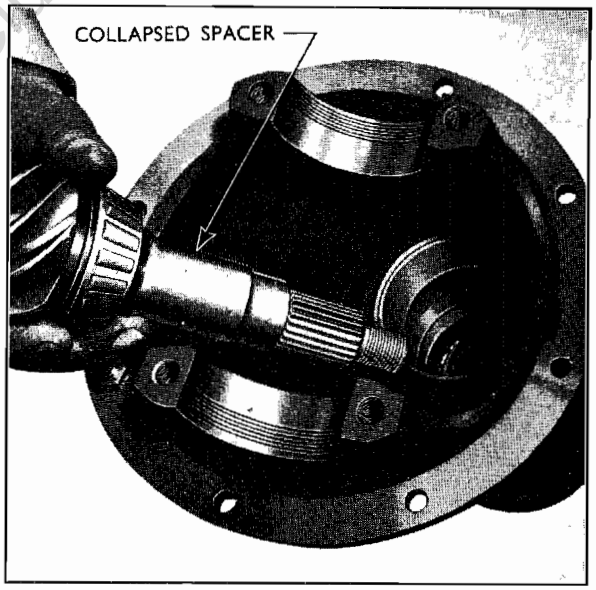

Fig. 11
Removing the Pinion

8. Dismantle the crown wheel and differential assembly :

(*a*) Unscrew the six self-locking bolts securing the crown wheel to the differential case.

(*b*) Suitably support the crown wheel and press the differential case through the crown wheel.

(*c*) Drive out the differential spider shaft locking pin. This pin is tapered at one end and must be driven out from the crown wheel side of the differential case.

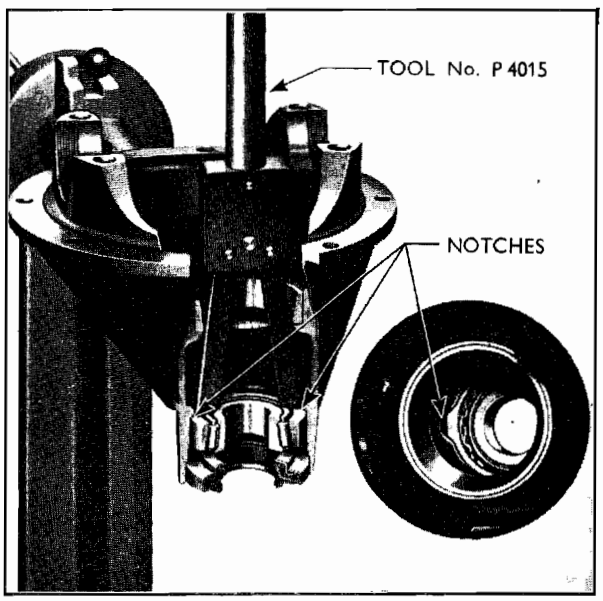

Fig. 12
Removing Front Pinion Bearing and Oil Seal

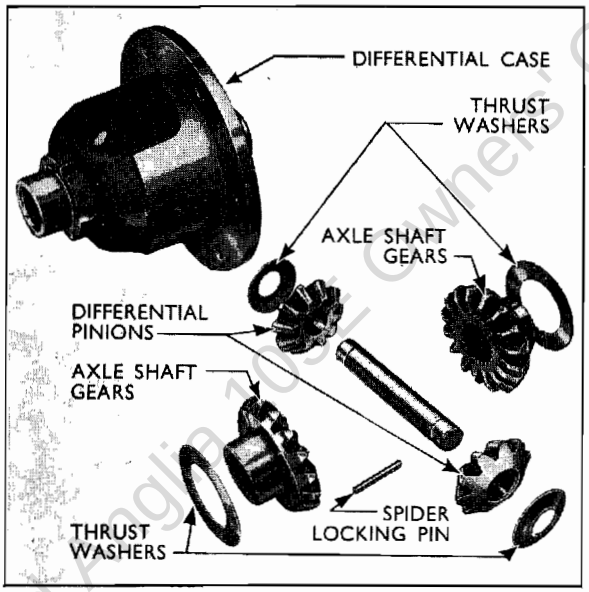

Fig. 13
Differential Assembly—Exploded

(*d*) Push the differential pinion shaft out of the case and rotate the pinions around the axle shaft gears so that they may be extracted through the apertures in the case. Spherical thrust washers are fitted between the pinions and the case ; if these are not removed with the pinions they should be withdrawn afterwards.

(*e*) Lift out the axle shaft gears and flat thrust washers located between the gears and differential case.

(*f*) Remove the differential bearing cones. Locate the bearing removing adaptors (Tool No. P.4000–27) around the differential bearing cones and in the support ring, support the assembly on the bed of a press and, using the driver press off the bearing cones. Ensure that the adaptors are correctly located under the cone and in the support ring to prevent damage to the roller cage.

(*g*) Clean and examine all parts renewing where necessary.

To Reassemble

1. Lubricate the flat thrust washers and position them on the backs of the axle shaft gears, then locate the gears in the differential case, see Fig. 13.

2. Lubricate the spherical thrust washers and locate them on the backs of the differential pinions. Position the differential pinions diametrically opposite each other in the cut-away portions of the differential case and rotate the axle shaft gears so that the pinions line up with the holes for the spider shaft.

3. Check that the thrust washers are not misplaced and, taking care that the hole in the spider shaft lines up with the locking pin hole in the differential case enter the shaft into the gears and push it right home (see Fig. 10).

4. Fit the locking pin (tapered end first) from the differential side of the case. Drive it right home and lightly pein the case to prevent the pin working out in service.

5. Refit the crown wheel. Examine the mating faces of the crown wheel and differential case for burrs ; any burrs found on these faces should be removed by lightly stoning. Locate the crown wheel on the differential case so that the retaining bolt holes are in line.

Enter three suitable bolts through the case flange into the crown wheel to ensure correct alignment and support the crown wheel, teeth downwards on the bed of a press. Using the differential bearing cone driver (Tool No. P.4080), press the differential case onto the crown wheel. Remove the three pilot bolts and fit six new self-locking bolts, tightening them evenly to a torque of 30 to 35 lb. ft. (4.148 to 4.839 kg.m.).

6. Refit the differential bearing cones. Suitably support the differential assembly and press or drive the bearing cones on to the differential case using the driver (Tool No. P.4080).

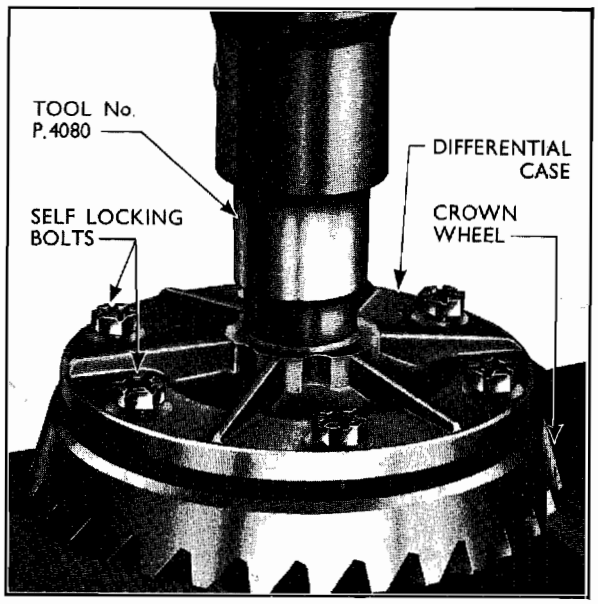

Fig. 14
Fitting the Crown Wheel to the Differential Case

Continued overleaf

7. Fit the pinion bearing cups :

(*a*) Place the rear bearing cup on the body of the tool (Tool No. P.4013–3) and pass it through the carrier throat from the rear.

(*b*) Assemble the front bearing cup, loose adaptor and wing nut to the centre bolt of the tool at the front of the housing.

(*c*) Tighten the wing nut and press the bearing cups fully home. Unscrew the wing nut and remove the tool and adaptors from the carrier throat.

The axle is now ready for adjustment. Quietness depends on the following adjustments, and every care should be taken to ensure that they are carried out in the proper order, carefully and conscientiously. The correct equipment properly used will ensure satisfactory results.

8. First select the pinion bearing shim to control depth of mesh.

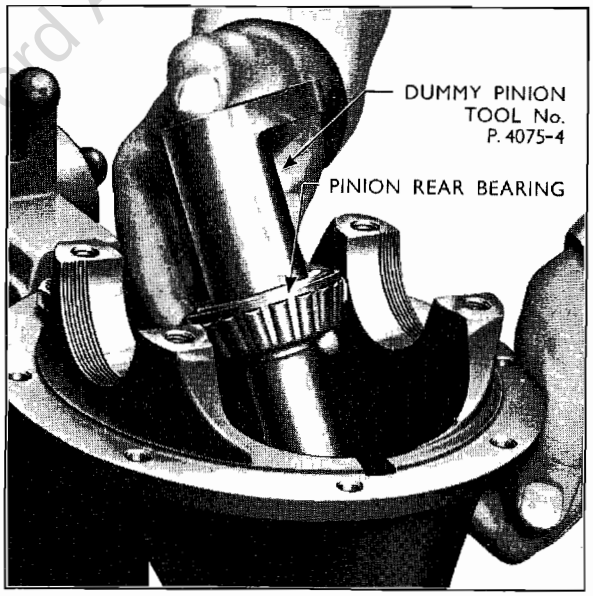

Fig. 15
Fitting the Dummy Pinion

(*a*) Slide the rear bearing cone onto its location on the dummy pinion (Tool No. P.4075–4), with the large diameter of the bearing towards the pinion flange and fit the assembly to the throat of the differential carrier (see Fig. 15).

(*b*) Slide the front bearing cone with its smaller diameter inwards, onto the dummy pinion, fit the drive shaft flange to the pinion splines and screw the pre-load gauge adaptor nut (Tool No. P.4030–2) onto the threaded end of the pinion.

(*c*) Pre-load the pinion bearings. Hold the pinion drive flange with the special spanner (Tool No. P.4028) and gradually tighten the flange retaining nut, rocking the pinion backwards and forwards whilst tightening the nut to ensure that the bearing rollers are correctly seated and continue to rock the

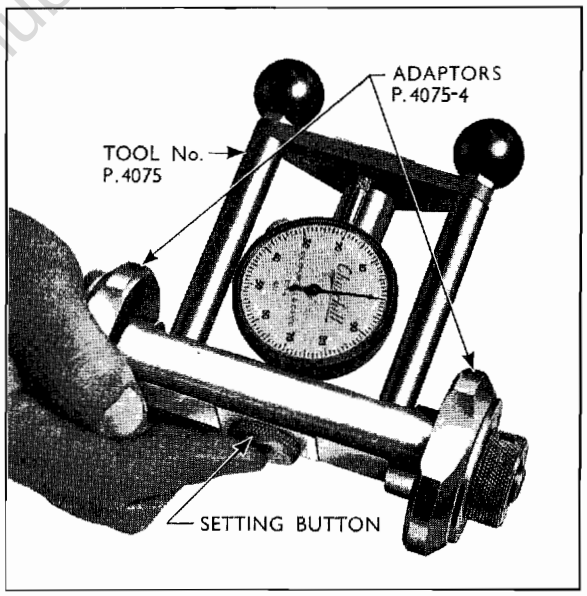

Fig. 16
Zeroing the Depth of Mesh Gauge

pinion until the bearing drag remains constant, indicating that the bearings are fully seated. Ensure that the dummy pinion flange does not strike and damage the differential bearing cap supports.

Fit the pre-load gauge (Tool No. P.4030) and as described previously, set the pinion bearing pre-load to a running torque of between 9 and 11 lbs. in. (0.104 to 0.127 kg.m.). If this pre-load is exceeded, first slacken the drive flange retaining nut to remove all pre-load from the bearings and then gradually retighten the nut to give the correct pre-load.

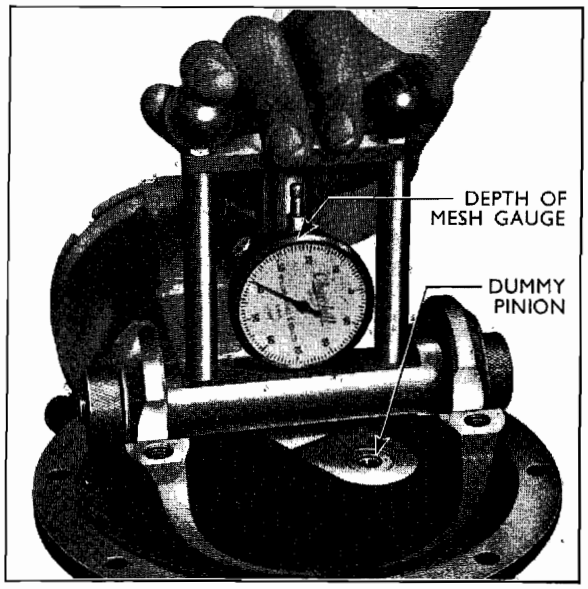

Fig. 17
Checking Pinion Depth of Mesh

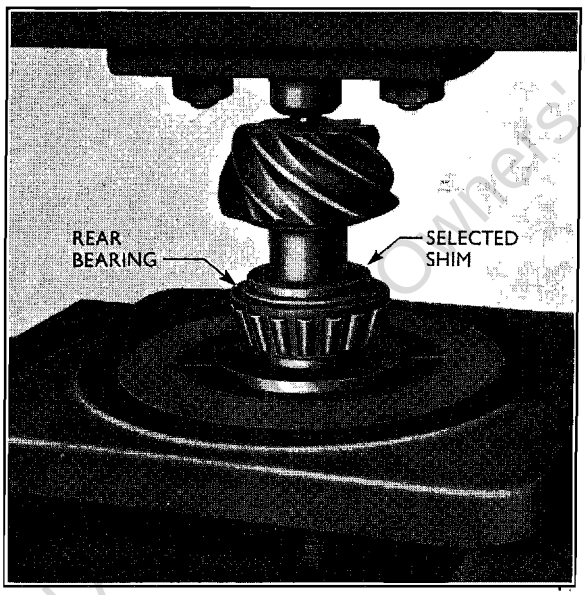

Fig. 18
Fitting Pinion Rear Bearing

(*d*) Check the pinion depth of mesh in the crown wheel. For correct tooth contact the pinion must be moved in or out in relation to the centre line of the crown wheel by fitting a suitable shim between the rear pinion bearing cone and the front face of the pinion. Depth gauge (Tool No. P.4075) in conjunction with adaptors (Tool No. P.4075–4) is used to determine the thickness of the shim required to give the correct depth of mesh.

Set the dial gauge to zero by sliding the setting button across the machined under-face of the gauge and adjust the dial as necessary to give a zero reading (see Fig. 16). Ensure that both machined faces are clean and free from grit or burrs, etc.

(*e*) Clean the differential bearing locations then position the gauge so that the dial plunger rests on the upper face of the dummy pinion. Rock the gauge slightly backwards and forwards to ensure that a minimum reading is obtained (see Fig. 17).

(*f*) Add 0.10 in. (2.54 mm.) to the gauge reading to obtain the exact thickness shim to be fitted between the pinion and the rear bearing cone. Referring to Fig. 17, the dial reading is 39 so a shim 0.139 inches thick is required. Where, however, etched markings exist on the tapered portion of the pinion shaft between the two bearing locations, alter the shim thickness accordingly. If the pinion is marked with a plus figure, this figure should be added to the gauge reading, if the marking is a minus figure, this should be subtracted from the gauge reading.

Shims in several thicknesses are available in service, identified by the Part Number suffix marked on one of the faces. Full details of these shims are given in the Specification at the end of this Bulletin.

(*g*) Dismantle the dummy pinion from the differential carrier. Unscrew the pre-load gauge adaptor nut, pull off the drive flange and front bearing cone and extract the dummy pinion and rear bearing cone from the housing.

9. Adjust the pinion bearing pre-load :

(*a*) Fit the shim selected in the previous operations to the drive pinion, with the internal chamfer on the shim towards the gear teeth. Fit the rear bearing cone to the pinion shaft, support the bearing in the adaptors (Tool No. P.4000–28), ensure that the bearing cage is free to revolve, then press the bearing right home on the pinion.

(*b*) Refit the front pinion bearing cone to its cup. Locate the oil seal in the axle throat with its lip towards the bearing, pass the centre bolt of Tool No. P.4013 through the carrier throat and fit the adaptor (Tool No. P.4013-3) so that its flat face is towards the oil seal. Tighten the wing nut to press the oil seal right home in its seating. Unscrew the wing nut and remove the tool.

(*c*) Lightly oil the seal and then assemble the pinion to the differential carrier. Fit a new collapsible spacer to the pinion shaft and fit the pinion into the front pinion bearing (see Fig. 20). Fit the drive flange retaining nut, then gradually tighten the nut until only very slight end-float can be felt on the pinion shaft.

(*d*) Locate the pre-load gauge adaptor (Tool No. P.4030-1) on the drive flange and fit the pre-load gauge. Check the running torque required to rotate the assembly, allowing the pre-load gauge to drop through the horizontal position. This torque is the resistance

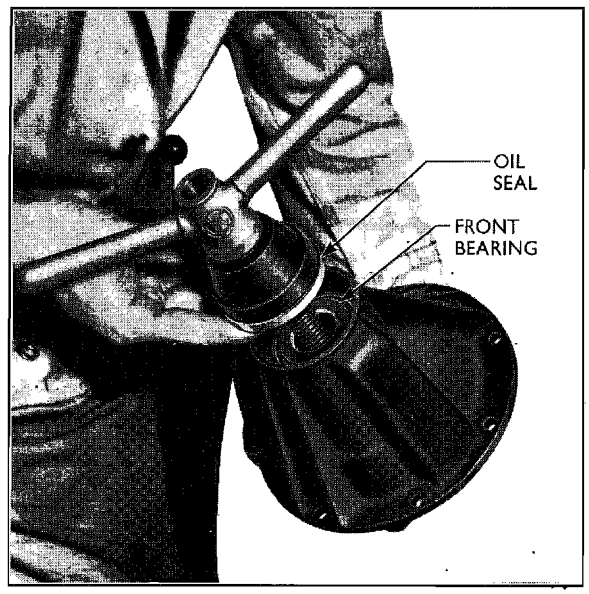

Fig. 19
Assembling the Pinion Oil Seal

Continued overleaf

offered by the oil seal to the drive flange, and when finally setting the pinion bearing pre-load this figure must be added to the pre-load figure of 9 to 11 lbs. ins. (0.104 to 0.127 kg.m.) for the pinion bearings alone. Therefore, if the torque required to rotate the drive flange within the oil seal is 5 lbs. ins. (0.058 kg.m.) the drive flange retaining nut must be tightened so that the assembly turns under a running torque of 14 to 16 lbs. ins. (0.162 to 0.185 kg.m.) gauged as above.

(*e*) Gradually tighten the drive flange retaining nut, rotating the pinion throughout the operation to ensure that the bearing rollers are correctly seated until the established pinion bearing pre-load is obtained. Frequent checks on the pre-load must be made whilst tightening the nut, as if the pre-load is exceeded, the assembly must be dismantled, the collapsible spacer removed and discarded and a new spacer fitted to the pinion.

(*f*) Once the correct pinion bearing pre-load has been obtained, stake the drive flange retaining nut securely to the pinion, using a suitable punch.

10. Adjust crown wheel and pinion backlash and differential bearing pre-load.

The adjustment of crown wheel and pinion backlash and differential bearing pre-load is of extreme importance for correct tooth contact.

(*a*) Locate the differential bearing cups on their bearing cones and position the assembly in the carrier housing. Ensure that the bearing cups are positioned squarely on the rollers.

(*b*) Refit the bearings caps ensuring that the mating marks on the caps and support brackets correspond (see Fig. 9), and replace the bearing cap bolts so that they nip the caps in position. Do not fully tighten the bolts.

(*c*) Refit the differential bearing adjusting nuts.

Fig. 20
Assembling the Pinion

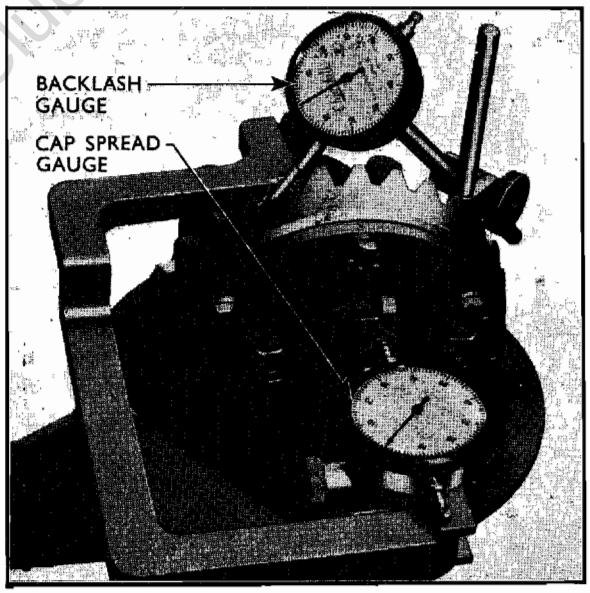

Fig. 21
Cap Spread and Backlash Gauges

(*d*) Install the bearing cap spread gauge (Tool No. P.4009) by bolting the gauge to the differential cap as shown in Fig. 21. Invert one of the adjusting nut locking plates and secure it on the bearing cap with a bolt, so that the plunger of the cap spread gauge locates on the vertical face of the locking plate. Set the dial face of the cap spread gauge to zero and screw in the bearing adjusting nuts, without spreading the caps, so that only slight backlash can be felt between the crown wheel and pinion. Rotate the crown wheel during this operation to ensure that the differential bearing rollers are correctly seated.

(*e*) Mount the backlash gauge (Tool No. P.4008–1) on a suitable hole on the differential carrier flange and fit the gauge plunger so that it is resting on the heel of a crown wheel tooth at right angles to it (again see Fig. 21). Zero the gauge and by means of the differential bearing adjusting nuts, adjust the backlash between the crown wheel and pinion until a reading of 0.001 to 0.002 in. (0.025 to 0.050 mm.) backlash is obtained. The adjusting nut on the crown wheel side must be tightened last.

(*f*) Swing the backlash gauge out of position, and rotating the crown wheel all the time, screw in the bearing adjusting nut on the differential side with the spanner (Tool No. P.4079), until a constant cap spread reading of between 0.005 and 0.007 in. (0.127 and 0.178 mm.) is obtained.

(*g*) Swing the backlash gauge back into position and zero the gauge. Hold the pinion and rock the crown wheel backwards and forwards noting the maximum and minimum readings on the gauge. The correct and final backlash between the crown wheel and pinion should be 0.005 to 0.007 in. (0.127 and 0.178 mm.).

If the backlash is outside these limits, adjust the position of the crown wheel relative to the pinion by slackening the adjusting nut on one side and

Fig. 22
Correct Tooth Marking

tightening the nut on the other side by a corresponding amount so that the cap spread is unaffected. (The final tightening must be made from the crown wheel side).

(*h*) Refit the adjusting nut locking plate ; noting that both left- and right-hand off-set locking plates are available as required. Tighten the locking plate retaining bolts to a torque of 12 to 15 lbs. ft. (1.659 to 2.074 kg.m.) and the differential cap retaining bolts to a torque of 45 to 50 lbs. ft. (6.221 to 6.913 kg.m.).

(*i*) Check the tooth contact at the crown wheel and pinion (see Fig. 22). Apply a thin coating of red lead or yellow ochre to the crown wheel teeth. Fit the axle shafts to the differential gears, hold the shafts to apply a load, and rotate the pinion in both directions.

If the pinion pre-load and crown wheel backlash have been correctly set the area of contact should be as shown in Fig. 22. Margins above and below the area of contact should be the same and contact markings should run approximately for three-quarters of the tooth length. Check the patterns on both sides of the gear teeth.

Fig. 24 shows four ways in which the contact pattern may be incorrect and the method of rectification.

11. Reassemble the differential carrier to the axle casing.

12. Refit the drive shaft, axle shafts, brake drums and road wheels as described earlier in this Bulletin.

13. Refill the axle with 2 pints of correct grade hypoid oil (see Specification).

If a new crown wheel and pinion have been fitted the run-in lubricant must be used and the axle drained after the first 300 miles (500 kilometres).

14. Road test the vehicle.

To Remove and Replace the Rear Axle

1. Jack up the vehicle, placing supports under the frame sidemembers in front of the rear springs.

2. Remove the wheels and support the axle.

3. Disconnect the drive shaft from the pinion drive flange.

4. Disconnect the handbrake cable at the left-hand brake plate, the rod at the right-hand brake plate, and the fabric strap from the axle casing.

5. Disconnect the shock absorber links from the spring seats and unscrew the union on the flexible brake pipe above the differential carrier. Fit a blanking plug on the end of the flexible pipe to prevent loss of fluid.

6. Remove the spring clip self-locking nuts and spring clip plates fitted below the road springs.

NOTE.—Whenever the rear spring clips are removed in service it should be noted that the inner

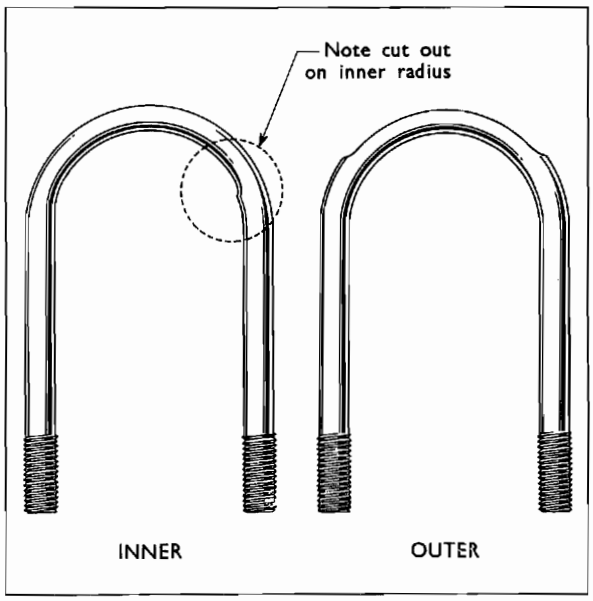

Fig. 23
Rear Spring Clip Identification

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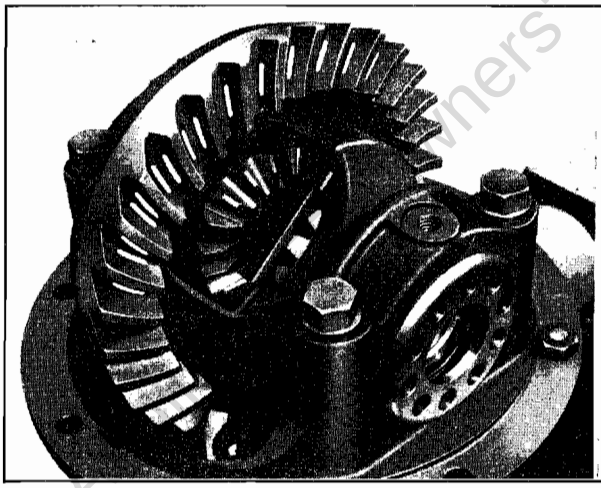
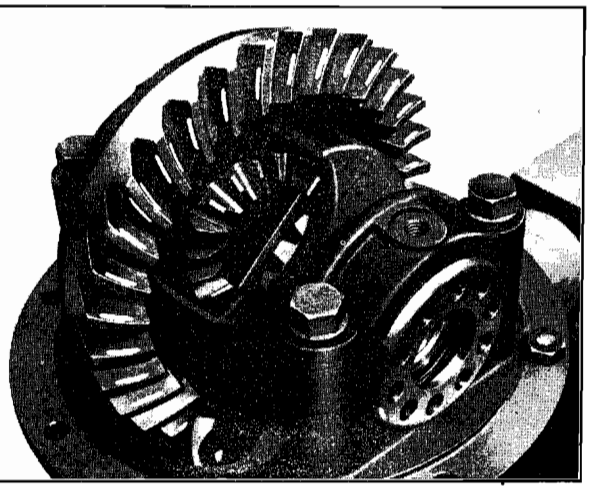
INCORRECT TOOTH MARKINGS



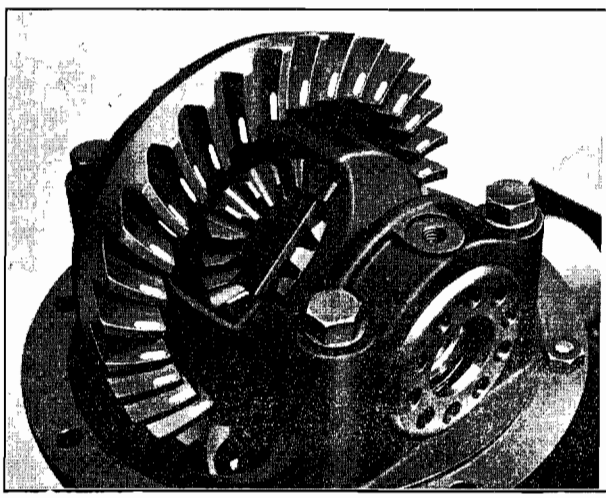


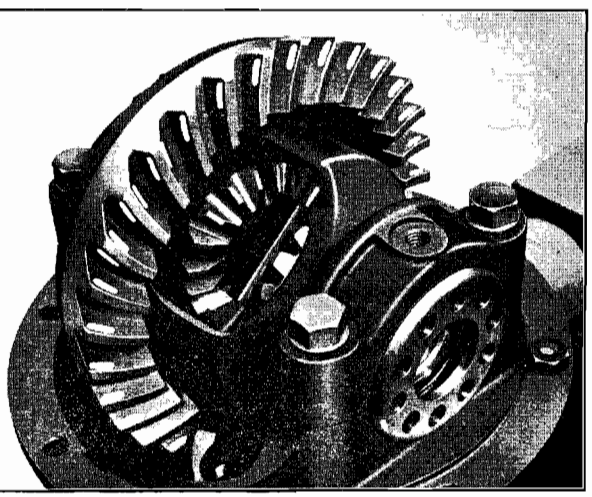
Heavy Flank Contact

In this case the area of contact is below the centre line of the tooth, and the condition should be rectified by moving the pinion away from the crown wheel, using a thinner shim behind the pinion. Reset the backlash and differential bearing pre-load.

Heavy Face Contact

In this case the area of contact is above the centre line of the tooth, due to the pinion being too far away from the crown wheel. Use a thicker pinion bearing shim to lower the contact area and reset the backlash and differential bearing pre-load.





Contact on Toe

When the area of contact is running off the toe of the pinion, move the crown wheel away from the pinion. Slacken the crown wheel side adjusting nut and screw in the differential side nut an equal amount. It may also be necessary to use a thicker shim behind the pinion in order to keep the backlash within the correct limits.

Contact on Heel

In this case the crown wheel is too far out from the pinion. Slacken the differential side adjusting nut and tighten the crown wheel side nut, re-check the backlash and differential bearing pre-load readings. If the backlash is reduced below the minimum specified, use a thinner shim behind the pinion and using a new collapsible spacer, readjust pinion bearing pre-load.

Fig. 24

and outer clips are not identical. In addition, the inner clip is not symmetrical.

The inner clip can be identified by an offset cut out on the inside of the curved end, see Fig. 23; the outer clip is plain on the inside of the curve.

When fitting the inner clip it should be passed through the hole in the base of the bump-stop with the cut-out described above towards the front of the vehicle. When correctly installed it will be found that the leading edge of the bump-stop mounting plate locates in this cut-out.

7. Withdraw the axle from the right-hand side of the vehicle.

8. To replace the axle, reverse this procedure. Fit the spring locating plate on top of each spring and ensure that the spring centre bolt heads engage in the mounting pads on the axle housing. Fit the spring clip plates and tighten the nuts to a torque of 20 to 25 lbs. ft. (2.76 to 3.46 kg.m.).

Bleed the brakes and adjust the handbrake linkage as required.

SPECIFICATION AND REPAIR DATA

	Anglia	*Prefect*
Axle ratio	4.125 : 1	4.429 : 1
No. of teeth on crown wheel	33	31
No. of teeth on pinion	8	7
Crown wheel and pinion backlash	0.005 to 0.007 in. (0.127 to 0.178 mm.)	
Pinion bearing pre-load	9 to 11 lbs. in. (0.104 to 0.127 kg.m.) excluding oil seal	
Differential bearing pre-load (cap spread)	0.005 to 0.007 in. (0.127 to 0.178 mm.)	
Differential pinion thrust washer thickness	0.030 to 0.032 in. (0.762 to 0.813 mm.)	
Differential pinion I.D.	0.628 to 0.629 in. (15.953 to 15.979 mm.)	

Bolt tightening torques :

Crown wheel to differential case bolts	30 to 35 lbs. ft. (4.148 to 4.839 kg.m.)
Differential carrier to axle housing nuts	15 to 18 lbs. ft. (2.074 to 2.489 kg.m.)
Differential bearing locking plate bolts	12 to 15 lbs. ft. (1.659 to 2.074 kg.m.)
Differential bearing cap bolts	45 to 50 lbs. ft. (6.221 to 6.931 kg.m.)
Axle shaft bearing retainer nuts	15 to 18 lbs. ft. (2.074 to 2.489 kg.m.)
Drive flange nuts	15 to 18 lbs. ft. (2.074 to 2.489 kg.m.)
Axle shaft bearing assembly pressure (min.)	1,200 lbs. (545 kg.)
Axle shaft bearing retainer pressure (min.)	800 lbs. (363 kg.)
Lubricant type	S.A.E. 90 hypoid
Capacity	2 pints (1.13 litres—2.4 U.S. pints)

Pinion bearing shims :

105E-4672-A	0.1304 to 0.1308 in. (3.31216 to 3.32232 mm.)
105E-4672-B	0.1314 to 0.1318 in. (3.33756 to 3.34772 mm.)
105E-4672-C	0.1324 to 0.1328 in. (3.36296 to 3.37312 mm.)
105E-4672-D	0.1334 to 0.1338 in. (3.38836 to 3.39852 mm.)
105E-4672-E	0.1344 to 0.1348 in. (3.41376 to 3.42392 mm.)
105E-4672-F	0.1354 to 0.1358 in. (3.43916 to 3.44932 mm.)
105E-4672-G	0.1364 to 0.1368 in. (3.47456 to 3.47472 mm.)
105E-4672-H	0.1374 to 0.1378 in. (3.48996 to 3.50012 mm.)
105E-4672-J	0.1384 to 0.1388 in. (3.51536 to 3.52552 mm.)
105E-4672-K	0.1394 to 0.1398 in. (3.54076 to 3.55092 mm.)
105E-4672-L	0.1404 to 0.1408 in. (3.56616 to 3.57632 mm.)
105E-4672-M	0.1414 to 0.1418 in. (3.59516 to 3.60172 mm.)
105E-4672-N	0.1424 to 0.1428 in. (3.60496 to 3.62712 mm.)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 6 : **ENGINE**
Subject : **REPAIR PROCEDURE**
Effective on : New Anglia and Prefect (1959 onwards)

THE ENGINE

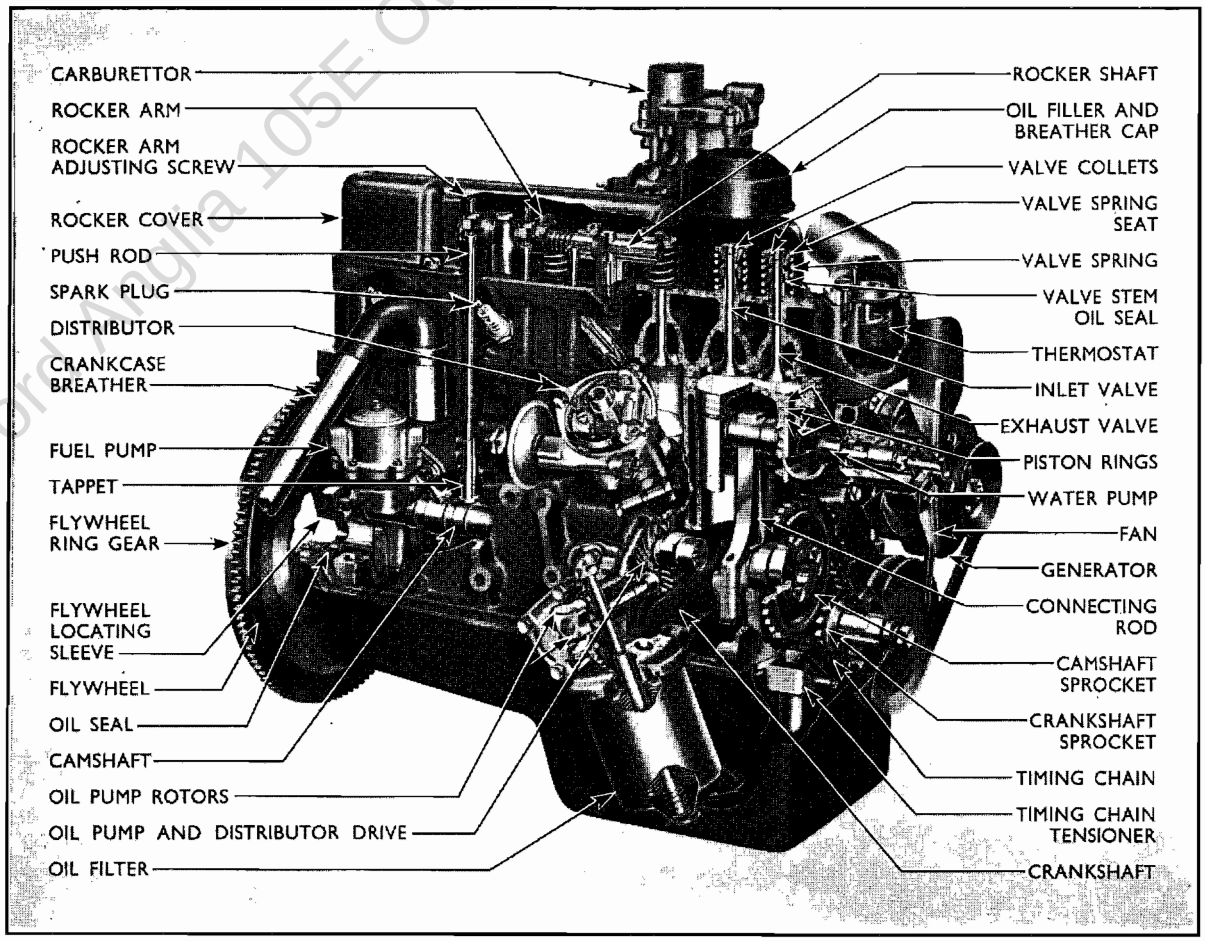


Fig. 1
Sectioned View of Engine

The engine is of the overhead valve type, being a 4-cylinder unit of 996.6 c.c. capacity, 3.187 in. (80.96 mm.) diameter bore and 1.906 in. (48.41 mm.) stroke.

The valves are mounted vertically in the cylinder head, the valve guides being cast integral. The heads of the inlet valves are of larger diameter than those of the exhaust valves.

Pistons are of the autothermic solid skirt type, the piston pins being fully floating and retained by means of end circlips fitted in the piston pin bosses.

A single row chain drives the camshaft from the crankshaft and a hydraulically operated timing chain tensioner is fitted.

The distributor which incorporates both mechanical and vacuum advance is mounted on the right-hand side of the engine and is driven through skew gears by the engine camshaft which also operates the fuel pump located on the right-hand side of the engine towards the rear, by an eccentric.

The following sheets provide complete instructions for the removal, replacement, dismantling and reassembling operations which may be necessary on this engine. Specifications will be found at the end of this Bulletin.

The following major operations can be carried out with the engine in place :

Remove Cylinder Head Assembly

Remove the rocker cover and rocker shaft assembly, lift out the push rods and unscrew the cylinder head bolts (see sheet 4).

Remove and Overhaul Oil Pump

Remove the three bolts securing the oil pump and filter assembly to the cylinder block, and withdraw the oil pump (see continuation sheet 2).

Remove Cylinder Front Cover, Timing Chain, Sprockets or Tensioner

Access to the above components can be gained after removing the radiator.

Remove Water Pump

First remove the fan belt and fan.

Remove Sump

The sump can be removed to gain access to the main and the connecting rod big-end bearing caps, the oil pump inlet pipe and filter screen, etc.

Remove the engine splash shield and the starter motor. Support the weight of the engine with suitable lifting tackle, and remove the bolts, nuts and washers securing the engine mounting brackets to the front crossmember. Raise the front of the engine approximately 2 in. (50.8 mm.).

Remove the set screws securing the sump to the cylinder block, and remove the sump.

LUBRICATION SYSTEM

An eccentric bi-rotor type oil pump is incorporated in the head of the full flow filter fitted to the engine and is driven by a skew gear on the engine camshaft.

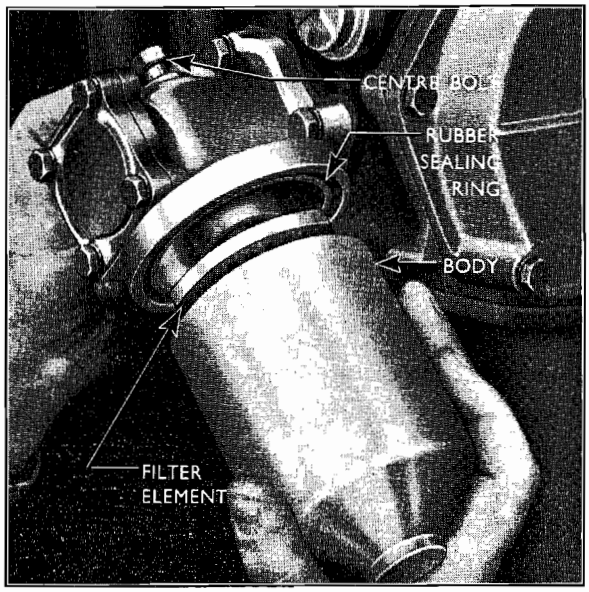


Fig. 2
The Engine Oil Filter

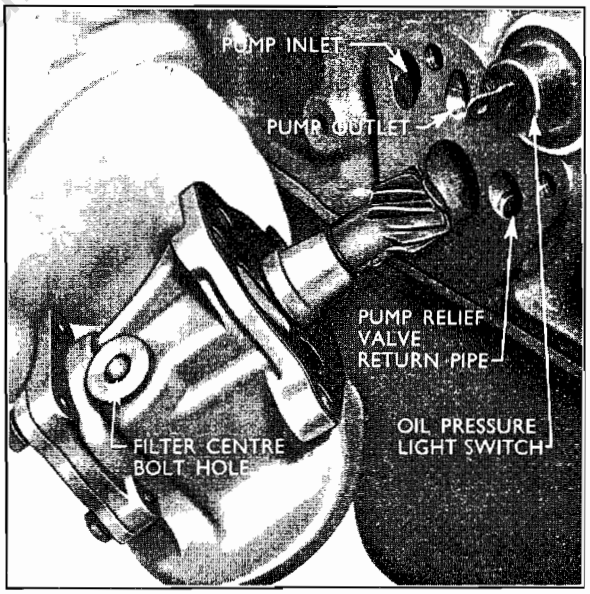


Fig. 3
Removing the Oil Pump

A full description of this pump will be found on sheet 2 of this Bulletin.

Oil from the engine sump is drawn through a gauze screen on the bottom of the pump pick-up pipe and into the oil pump. Incorporated in the oil pump is a pressure relief valve, which when open, allows oil to return direct to the sump. This oil returns via a pipe to the base of the sump, thus preventing aeration of the oil.

Oil from the pump is fed under pressure to the full flow filter, then through a cross drilling above the centre main bearing to the main oil gallery on the left-hand side of the engine. Oil is also fed via a short gallery to the oil pressure switch sender unit on the right-hand side of the engine.

From the main oil gallery oil passes through drillings to each main bearing and through drillings in the crankshaft from each main bearing to each big end bearing. A small drilling in each connecting rod web allows a jet of oil to lubricate the non-thrust side of the cylinders each revolution of the crankshaft.

The camshaft bearings are fed via drillings in the cylinder block from the three main bearings.

By means of a flat incorporated in the front camshaft journal, oil is fed through drillings in the cylinder block and head to the front rocker shaft pedestal, thence to the hollow rocker shaft to lubricate the valve rockers. Drillings in each rocker allow for lubrication of the valve stems and push rod ends. This oil feed to the rocker gear is at a reduced pressure, the system being pressurised once per revolution of the camshaft.

The timing gears are lubricated by a constant bleed from the drilling between the crankshaft and camshaft front bearings.

THE OIL FILTER

The oil filter is bolted to the underside of the oil pump which is attached to the right-hand side of the cylinder block.

The filter is of the full-flow type and is located in the lubrication circuit between the pump discharge port and the inlet to the main oil gallery.

The oil filter element should be renewed and the filter body thoroughly cleaned after every 5,000 miles (8,000 kms.), when the engine oil is changed. To remove the filter, unscrew the hexagon-headed bolt, and withdraw the filter body and element.

Remove the existing " O " ring from its recess in the oil pump housing, then locate the new ring (supplied with the replacement element) in the groove at four diametrically opposite points.

Do not fit the ring at one point and then work it round the groove, as the rubber may stretch, thus leaving a surplus which may cause an oil leak.

Thoroughly clean the filter body, insert a new element, and refit the filter assembly to the oil pump body.

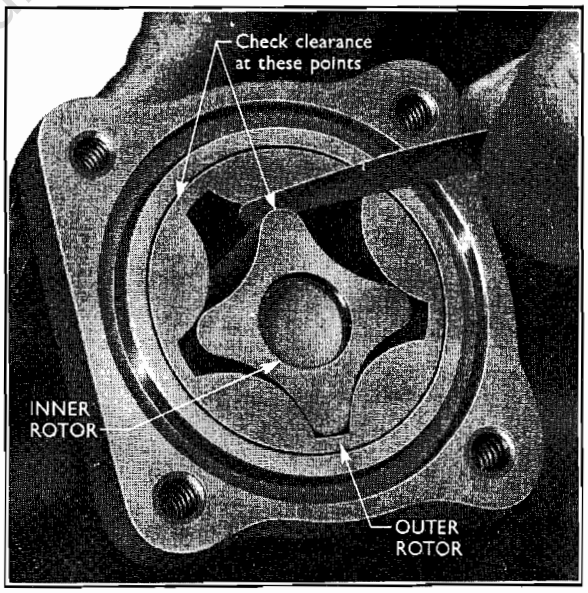


Fig. 4
Checking Rotor Clearances (a)

THE OIL PUMP

The oil pump and filter assembly is bolted to the right-hand side of the cylinder block, the oil pump being incorporated in the head of the unit and driven by a skew gear on the engine camshaft.

The pump is of the eccentric bi-rotor type and the suction port is connected directly to the gauze strainer located in the engine sump. A full flow filter is incorporated in the assembly between the pump discharge port and the inlet to the main oil gallery of the engine. A non-adjustable plunger type relief valve is fitted between the pump outlet and filter inlet, oil passing this valve is returned via a pipe to the base of the sump to prevent oil aeration.

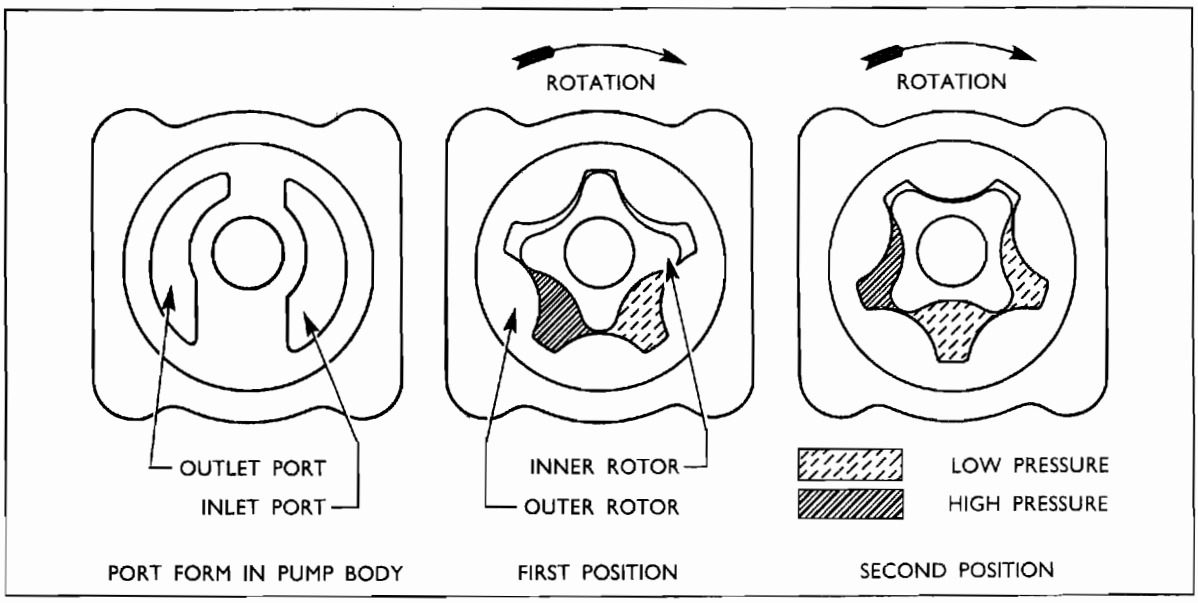


Fig. 5
Oil Pump Operating Sequence

Continued overleaf

The pump consists of two rotors housed in the pump body. The inner rotor, which is pinned to the drive shaft, has four lobes machined on it, the outer rotor has five internal segments machined in it, with which the lobes of the inner rotor mesh. The outer rotor is located in a machined recess in the pump body and the centre of it is offset to the centre of the inner rotor and drive shaft, so that as the inner rotor revolves the outer rotor is also rotated.

The operation of the pump is shown in Fig. 5. The inlet port on the right is connected to the sump, the outlet port on the left is connected via the full flow filter to the main oil gallery of the engine. In the first position, oil is drawn via the inlet port into the space between the inner and outer rotors. As the rotors revolve, the oil is carried round between them and in the second position, due to the offset between the centre of the rotors, the space between them starts to decrease so that oil is forced through the outlet port and filter into the engine. The action of the pump is a continuous repetition of this process, oil flowing into the space between the rotors from the inlet port is carried around in the space between the rotors and as this decreases the oil is then forced into the pump outlet port.

A non-adjustable pressure relief valve is incorporated between the pump outlet port and the full flow filter to prevent excessively high pressures being built up.

To Overhaul the Oil Pump

1. Unscrew the three bolts securing the pump to the cylinder block and detach the pump and gasket.

2. Detach the oil filter body and the element after unscrewing the centre bolt.

3. Remove the four bolts and lockwashers retaining the end plate and pull off the plate. Remove the rubber " O " ring from the sealing groove in the pump body.

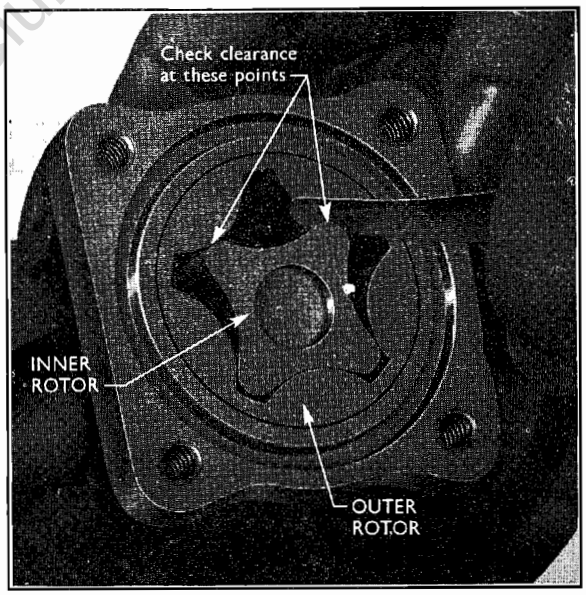


Fig. 6
Checking Rotor Clearances (b)

4. Check the clearance between the lobes of the inner and outer rotors. This should be checked in two positions as shown in Figs. 4 and 6, and must not exceed 0.006 in. (0.152 mm.). Check the clearance between the outer rotor and the housing, this should not exceed 0.0075 in. (0.19 mm.).

The rotors are supplied as a matched pair only so that if the clearance is excessive a new rotor assembly must be fitted. Similarly, if the clearance

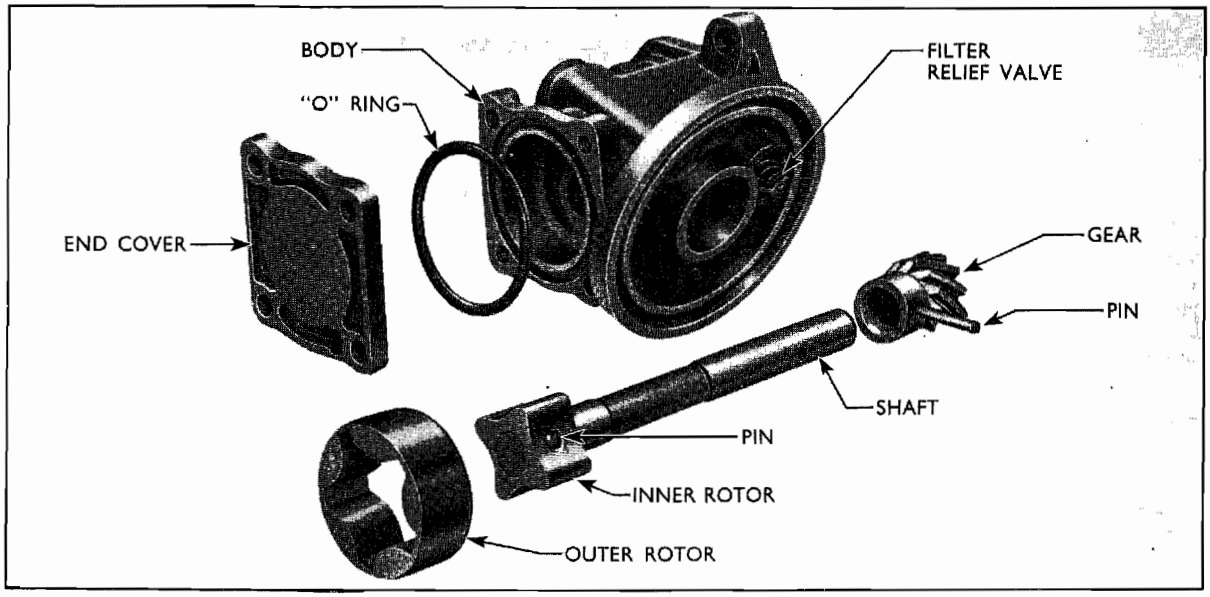


Fig. 7
The Oil Pump—Exploded

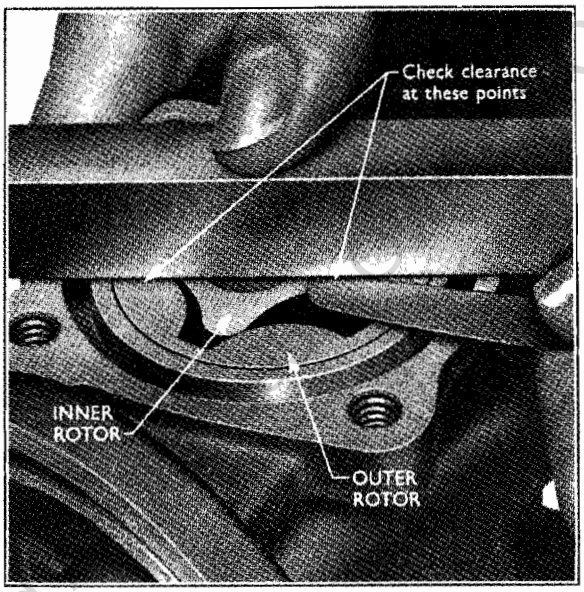


Fig. 8
Checking Rotor End Clearances

between the outer rotor and pump body is excessive a new rotor assembly and/or pump body should be fitted.

5. Lay a straight edge across the face of the pump body and check the clearance between the face of the rotors and the straight edge. This should not exceed 0.005 in. (0.127 mm.). If this clearance is excessive, the face of the pump body can be carefully lapped on a flat surface.

6. If it is necessary to renew the rotors, drive out the pin securing the skew gear to the drive shaft, and pull off the gear.

7. Remove the inner rotor and drive shaft (serviced only as an assembly) and withdraw the outer rotor.

8. Install the outer rotor with its chamfered end towards the pump body. Fit the inner rotor and drive shaft assembly, position the skew gear on the end of the drive shaft and install the pin. Pein the pin securely at both ends to prevent it becoming loose in service.

9. Position the rubber " O " ring in the groove in the pump body.

10. Fit the end plate, secure it in place with four bolts and lockwashers.

11. Locate a new filter sealing ring in the groove in the pump body at four diametrically opposite points. Do not fit the sealing ring at one point and then work it round the groove, as the rubber may stretch, thus leaving a surplus which could cause an oil leak. Refit the oil filter body and element.

Locate a new gasket on the cylinder block, fit the oil pump and filter assembly to the block and secure in place with three bolts and lockwashers.

NOTE.—Normally, the pump relief valve will not require attention ; if necessary the valve and spring can be withdrawn after carefully extracting the spring seat which is a press fit in the body. Similarly, the filter relief valve, which is also a press fit in the body, need not normally be removed.

THE ENGINE

To Remove the Engine

1. Drain the cooling system. A drain tap is situated beneath the radiator and one on the left-hand side of the cylinder block.

2. Drain the engine oil. Unscrew and remove the sump drain plug, preferably after operation while the engine is warm. Remove the engine splash shield.

3. Remove the bonnet. Disconnect the bonnet support, then unscrew the pivot bolt, lockwasher and flat washers on each side and lift off the bonnet.

4. Disconnect and remove the battery.

5. Remove the air cleaner.

6. Detach the upper and lower radiator hoses and heater hoses. Remove the radiator.

7. Disconnect the throttle linkage from the cross-shaft and the choke control cable from the carburettor.

8. Unscrew the exhaust pipe clamp bolts and disconnect the exhaust pipe from the manifold.

9. Disconnect the two leads from the generator terminals, the lead from the temperature gauge bulb and the lead from the oil pressure switch sender unit.

10. Temporarily detach the heater motor and place on one side to facilitate access to the engine compartment.

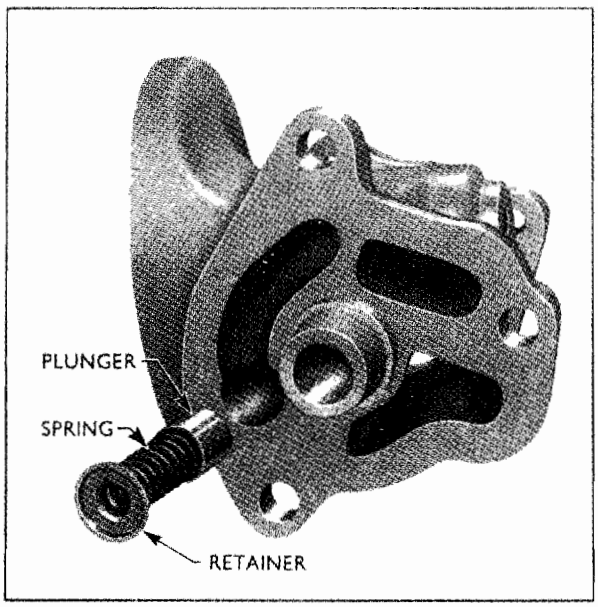


Fig. 9
The Oil Pump Relief Valve

11. Remove the starter motor. Disconnect the lead from the starter motor solenoid, unscrew the two bolts retaining the motor to the clutch housing, and withdraw the starter motor.

12. Dismantle the engine breather pipe. Unscrew the one bolt securing the breather pipe to the clutch housing and lift off the pipe and its rubber connector to the crankcase.

13. Disconnect the fuel feed pipe from the lift pump.

14. Unclip and lift off the distributor cap. Disconnect the high tension lead from the coil terminal and the low tension lead from the contact breaker terminal of the distributor.

15. Remove the splash shield secured to the front of the clutch housing.

16. Suitably support the gearbox, then unscrew and remove the bolts around the clutch housing.

If the special engine lifting bracket (Tool No. P.6115) is available, remove Nos. 2 and 3 spark plugs and the second and fourth cylinder head bolts on the left-hand side of the head. Locate the bracket ends in the plug recesses and secure the bracket to the cylinder head with bolts $\frac{1}{2}$ in. (12.7 mm.) longer than those removed.

When the bracket is not available, position a rope sling around the engine and support the weight of the engine on suitable tackle.

17. Remove the two bolts securing each engine mounting to the cross tube, pull the engine unit forward off the main drive gear and lift the assembly from the engine compartment.

Dismantling the Engine

1. (*a*) **Detach the generator,** engine drain tap and left-hand engine support bracket, bolt the universal stand adaptor (Tool No. P.6107) to the cylinder block at these locations and fit the engine on the universal stand.

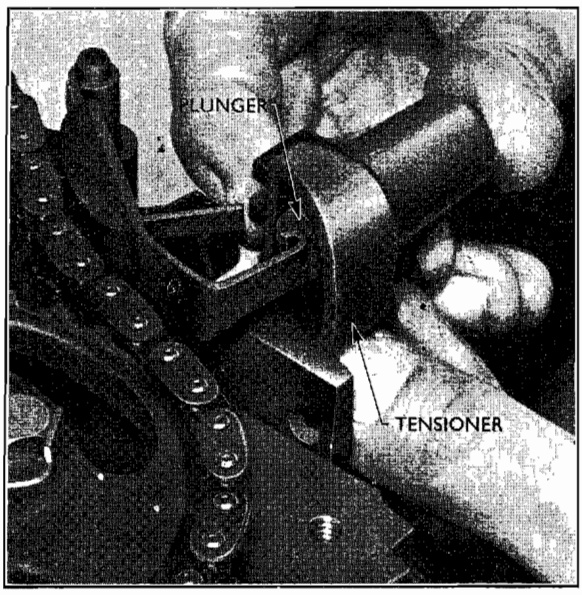


Fig. 10
The Timing Chain Tensioner

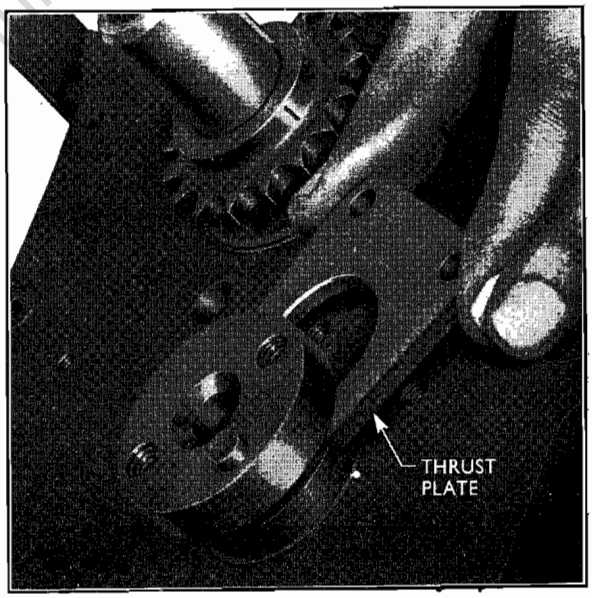


Fig. 11
Removing the Camshaft Thrust Plate

(*b*) **Remove the distributor.** Disconnect the vacuum pipe, unscrew the one bolt securing the clamp plate to the block and lift out the distributor.

(*c*) **Remove the oil pump** and filter head assembly. Unscrew the three bolts and lockwashers and withdraw the assembly from the cylinder block.

(*d*) **Detach the fuel pump** after unscrewing the two bolts and lockwashers securing it to the cylinder block.

(*e*) **Unscrew the oil pressure gauge unit.**

(*f*) **Remove the carburettor,** inlet and exhaust manifold assembly. The exhaust manifold is mounted on studs at each end and retained by bolts at its other locations. Note that no gasket is fitted between the manifold and head.

(*g*) **Detach the water outlet elbow and gaskets,** then lift the thermostat from its location in the cylinder head.

2. (*a*) **Unscrew the four rocker cover screws** and flat washers and lift away the cover and gasket.

(*b*) **Slacken the four rocker shaft support bolts** evenly to prevent distortion. Remove the bolts and lift off the rocker shaft assembly.

(*c*) **Withdraw the push rods** from their locations in the cylinder block, taking care to keep them in their correct order.

(*d*) **Dismantle the rocker shaft** assembly ; proceed as follows :—

Remove the split pin from one end of the shaft and detach the flat washer, spring cup washer and second flat washer which bear against the end rocker

Fig. 12
A Connecting Rod and Cap

arm. The rocker shaft supports, rocker arms and springs can now be removed from the shaft if necessary.

3. Unscrew the cylinder head bolts evenly in the reverse order to that shown in Fig. 20. Lift off the cylinder head and gasket.

4. Dismantle the valves. The valves may now be dismantled and removed from the cylinder head.

Extract the split tapered collets then remove the spring seats and valve springs.

An umbrella-type rubber seal is fitted on each valve stem and must be removed before the valve can be extracted from the valve port.

5. Dismantle the water pump and fan from the cylinder block, unscrewing the three retaining bolts. Note that one retaining bolt also helps to secure the timing cover to the cylinder block.

6. Remove the sump and detach the sump gaskets from the cylinder block face.

7. Detach the pulley and timing cover. Unscrew the retaining bolt, lockwasher and flat washer securing the crankshaft pulley and draw off the pulley, using the puller (Tool No. CP.4061). Unscrew the bolts securing the timing cover to the cylinder block, (two of the cover retaining bolts passing up through the sump flange have already been removed) and withdraw the timing cover.

NOTE.—Two of these bolts are dowel bolts.

8. (*a*) **Detach the clutch assembly.** Unscrew the pressure plate bolts evenly and detach the pressure plate and clutch disc. Note that the clutch pressure plate is located by three dowels on the face of the flywheel.

(*b*) **Remove the flywheel.** This is secured by four bolts and a locking plate, and is located by a sleeve and dowel in the crankshaft rear flange. Bend back the tabs on the locking plate, unscrew the bolts and gently tap the flywheel off the crankshaft flange.

NOTE.—The ring gear is normally serviced as an assembly with the flywheel. Under no circumstances should pressure be applied in an attempt to dismantle the gear for repositioning on the flywheel.

9. Detach the engine rear plate.

10. Dismantle the timing chain tensioner. Unscrew the two bolts securing the chain tensioner cylinder to the block and remove the cylinder. Detach the tensioner arm from the pivot pin on the front main bearing cap.

11. (*a*) **Remove the camshaft sprocket and chain.** Bend back the camshaft sprocket locking plate tabs and unscrew the two retaining bolts. Remove the locking plate and pull the camshaft sprocket off its locating dowel on the camshaft flange. Detach the timing chain from the crankshaft sprocket.

(*b*) **Remove the crankshaft sprocket,** using Tool No. P.6116 and remove the crankshaft sprocket key.

(*c*) **Remove the camshaft and thrust plate.** Bend back the thrust plate bolt locking tabs, unscrew the two bolts and withdraw the thrust plate from the groove behind the camshaft flange. Set the engine vertically on the stand, rotate the camshaft to fully

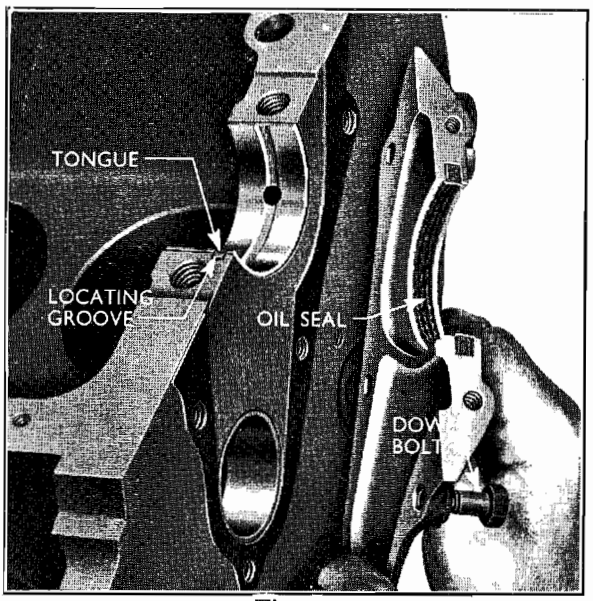


Fig. 13
The Crankshaft Rear Oil Seal

Continued overleaf

lift the tappets and withdraw the camshaft. Remove the tappets from the cylinder block noting their correct locations.

12. (*a*) **Withdraw the piston and connecting rod assemblies.** Release the locking tabs on the big end bolts, unscrew the bolts two to three threads and tap them to release each connecting rod from its cap, as these are located on the rods by dowel pins. Finally, completely remove the bolts and detach the big end caps. Push the pistons along the cylinder bores and withdraw the assemblies.

(*b*) **Dismantle the piston and connecting rod assemblies.** First remove the piston rings. Extract the two piston pin circlips and push the pin out of each piston. It may be necessary to warm the pistons slightly by immersing in hot water or oil to enable the piston pins to be removed.

13. (*a*) **Check that each main bearing cap is marked correctly** for its location on the cylinder block. Unscrew the bearing cap bolts evenly and lift off each cap.

(*b*) **Lift out the crankshaft.** Two half thrust washers are located, one on either side of the centre main bearing journal, in the cylinder block ; these can now be withdrawn. Remove the bearing liners.

14. Remove the crankshaft rear bearing oil seal. Unscrew the four bolts securing the oil seal housing to the cylinder block and detach the housing and gasket. Note that the two lower bolts in the housing are dowelled to ensure correct alignment.

15. If required, dismantle the oil pump inlet pipe and relief valve return pipe from the cylinder block.

To remove the inlet pipe, straighten the tab on the washer, unscrew the union nut and withdraw the pipe. The filter screen can be removed after relieving the swaging on the cover.

The return pipe is a press fit in the block.

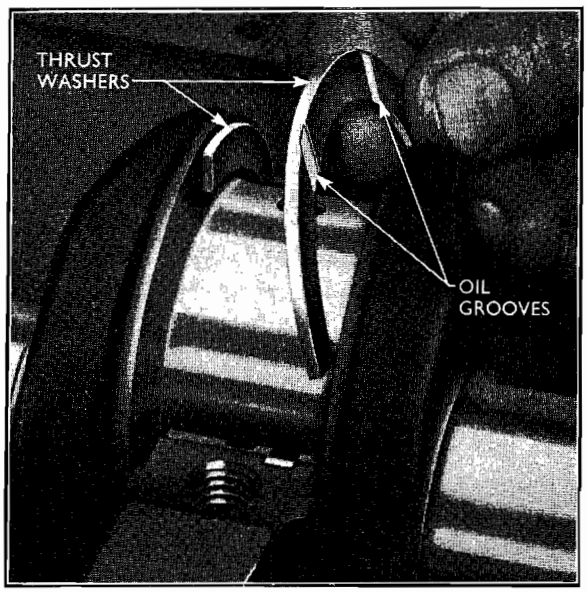


Fig. 14
The Crankshaft Thrust Washers

To Reassemble

Before reassembling the engine, the cylinder block and all components should be thoroughly cleaned, and all oil-ways checked to ensure that they are clear. All wearing parts should be dimensionally checked against the Specification at the end of this Bulletin and new parts selected where necessary.

All gaskets, oil seals and locking plates must be renewed.

Prepare the two halves of the rear main bearing oil seal by coating them with graphite paste. In no circumstances should this oil seal be fitted dry, otherwise the crankshaft bearing surface may be scored.

1. Fit new camshaft bearing liners (using Tool No. P.6031 with adaptor set P.6031–3) if those at present fitted require replacement. Ensure that the oil holes in the liners and cylinder block are correctly aligned before fitting the liners.

2. (*a*) **Replace the valve tappets.** Set the engine vertically on the stand and insert the tappets in the bores from which they were originally removed.

(*b*) **Slide the camshaft into position** after ensuring that all tappets are clear. Take care not to damage the edges of the bearing liners or the journals and cams of the camshaft. Rotate the camshaft to ensure that it revolves freely in its bearings after fitting.

(*c*) **Locate the camshaft thrust plate** in the camshaft groove and secure it to the cylinder block with the locking plate and two retaining bolts. Check the camshaft end-float. This should be between 0.002 and 0.007 in. (0.051 and 0.18 mm.).

If the camshaft end-float is correct, bend up the locking tabs to secure the retaining bolts. If end-float is incorrect, renew the camshaft thrust plate.

3. (*a*) **Turn the engine on the stand** so that the crankcase is upwards.

(*b*) **Fit the crankshaft rear bearing oil seal** to its housing, ensure that it is pressed fully home and that the ends of the seal do not protrude more than $\frac{1}{32}$ in. (0.79 mm.) above the face of the housing.

(*c*) **Fit a new oil seal housing gasket** to the rear face of the cylinder block and secure the housing to the block with four spring washers and the correct bolts, see Fig. 13. Note that the two bolts adjacent to the sump flange are dowelled to ensure correct alignment and these must be tightened first.

4. (*a*) **Position the upper halves of the main bearing liners** in their block locations. The tabs of the liners should engage in the machined key-ways in the sides of the bearing locations. Lightly oil the main bearing liners after they have been fitted to the cylinder block.

NOTE.—After approximate Engine No. 105E–52000, an oil feed is provided to the rear crankshaft thrust washer. The centre main bearing cap is provided with a 30° chamfer 0.03 in. (0.76 mm.) to

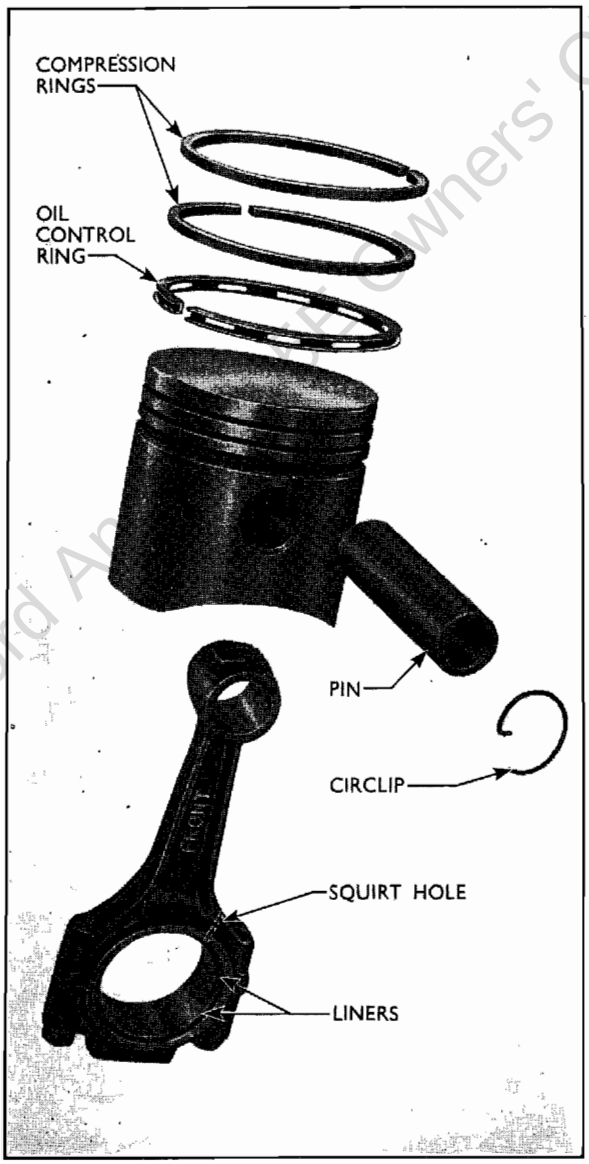


Fig. 15

A Connecting Rod and Piston Assembly—Exploded

0.04 in. (1.02 mm.) thick between the bearing locating notch and the rear face of the cap.

Oil is fed into the groove formed by this chamfer through a " vee " notch 0.07 in. (1.78 mm.) deep in the oilway at the locating tab end of the liner.

(*b*) **Replace the crankshaft** in the cylinder block and fit new end-float thrust washers of the same thickness as those removed from the engine. The thrust washers locate in recesses on either side of the main bearing in the cylinder block and should be fitted with the oil grooves facing the crankshaft flange. (See Fig. 14.) Check the crankshaft end-float which should be 0.003 to 0.011 in. (0.076 to 0.279 mm.). If the end-float is incorrect, select thrust washers to give the correct crankshaft end-float. Oversize thrust washers will be available to enable the correct end-float to be established.

(*c*) **Position the lower halves of the main bearing liners** in the appropriate caps, engaging the locking tabs in the machined grooves.

Refit the main bearing caps in accordance with the mating marks and with the cast arrows pointing to the front of the engine. Tighten the cap bolts to the correct torque.

5. Select pistons for the individual bores. Each piston should be fitted to its individual cylinder bore by direct measurement.

The cylinder bores are measured at a point 3.5 in. (8.9 cm.) from the top face of the cylinder block across the axis of the crankshaft. Graded numbers are stamped in accordance with the sizes at the end of this Bulletin. Pistons are also graded and stamped on the crown with the appropriate grade number.

Pistons of the same grade number are fitted to the appropriate bore. This gives the specified fit of 0.0005 in. to 0.0011 in. (0.0127 to 0.0275 mm.) clearance, when measured at the bottom of the skirt on the thrust axis.

When re-boring cylinders in service, to suit oversize pistons, it is essential that each cylinder bore is machined to suit the individual piston to give the specified fit. The piston skirt measurement at right angles to the piston pin holes must be measured accurately, the maximum measurement being taken as the piston skirt is cam ground.

Locate the piston compression and oil control rings in the unworn portion of the cylinder bore and check the ring gaps, which should be between 0.009 to 0.014 in. (0.229 to 0.356 mm.).

Check piston ring to groove clearances, which should be as follows :—

Top compression ring	0.0016 to 0.0036 in. (0.0406 to 0.0914 mm.)
Lower compression ring	
Oil control ring	0.0018 to 0.0038 in. (0.0457 to 0.0965 mm.)

Fit a circlip in position in one of the piston pin bosses and locate the connecting rod in the piston with the marking FRONT on the connecting rod on the same side of the assembly as the arrow mark in the piston crown. Heat the piston in water or oil and slide the piston pin through the pin bosses and connecting rod small end until it abuts the circlip already fitted. Fit the second circlip.

Assemble the piston rings, noting that the compression rings are marked TOP and that the upper compression ring is chromium plated. Space the ring gaps at 120°.

Fit the piston and connecting rod assemblies to the appropriate bores, with the arrow on the crown of each piston pointing towards the front of the engine. Compress the piston rings, using the ring

Continued overleaf

squeezer, Tool No. P.6108 and push each piston down its cylinder bore.

6. (*a*) **Fit the connecting rod liners,** locating the tabs of the liners in the machined grooves of the rod and cap. Check that the oil hole in the upper half of each liner coincides with the oil squirt hole in the connecting rod.

(*b*) **Turn the crankshaft** as necessary to fit the connecting rod big ends to the crank pins. Locate the big end caps on the connecting rod dowels, fit the " D " shaped locking plates to the connecting rod bolts and enter the bolts into the connecting rod. Tap the big end caps right home on the dowels and tighten the connecting rod bolts to the correct torque, see Specification.

Lock the bolts with the tabs on the locking washers.

7. (*a*) **Fit the crankshaft** key and sprocket to the front end of the crankshaft, pressing the sprocket into position, timing mark face to the front, using the sprocket replacer, Tool No. P.6032.

(*b*) **Turn the crankshaft** until the marked tooth of the sprocket is on the centre line between the crankshaft and camshaft centres (see Fig. 16) and temporarily fit the camshaft sprocket on the dowel. Turn the camshaft until the marked tooth is on the centre line between the two sprockets, then again remove the camshaft sprocket.

(*c*) **Fit the timing chain** around the camshaft sprocket, locate the chain around the crankshaft sprocket and fit the camshaft sprocket to the camshaft boss. Check that the timing marks are towards the centre and in line as illustrated.

(*d*) **Fit the locking plate** and retaining bolts to the camshaft sprocket. Tighten the bolts securely and bend up the locking plate tabs.

8. Install the valve assembly in the timing chain tensioner plunger and fit the spring and plunger to the operating cylinder. Position the tensioner arm on the hinge pin on the front main bearing cap and secure the cylinder assembly to the cylinder block with two bolts and lockwashers.

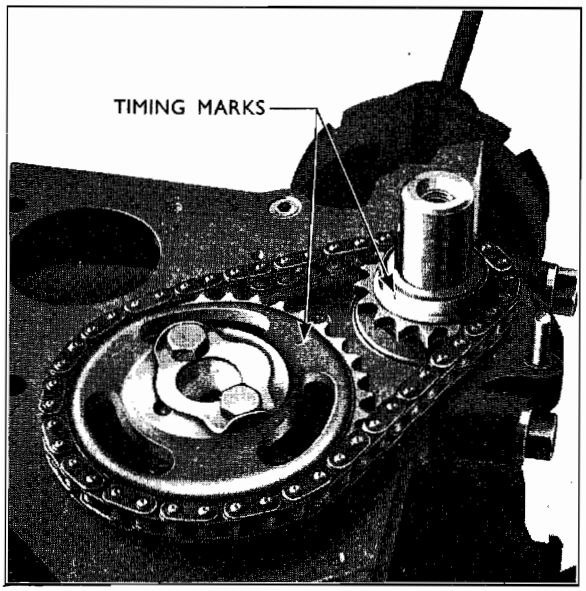


Fig. 16
Valve Timing Marks Location

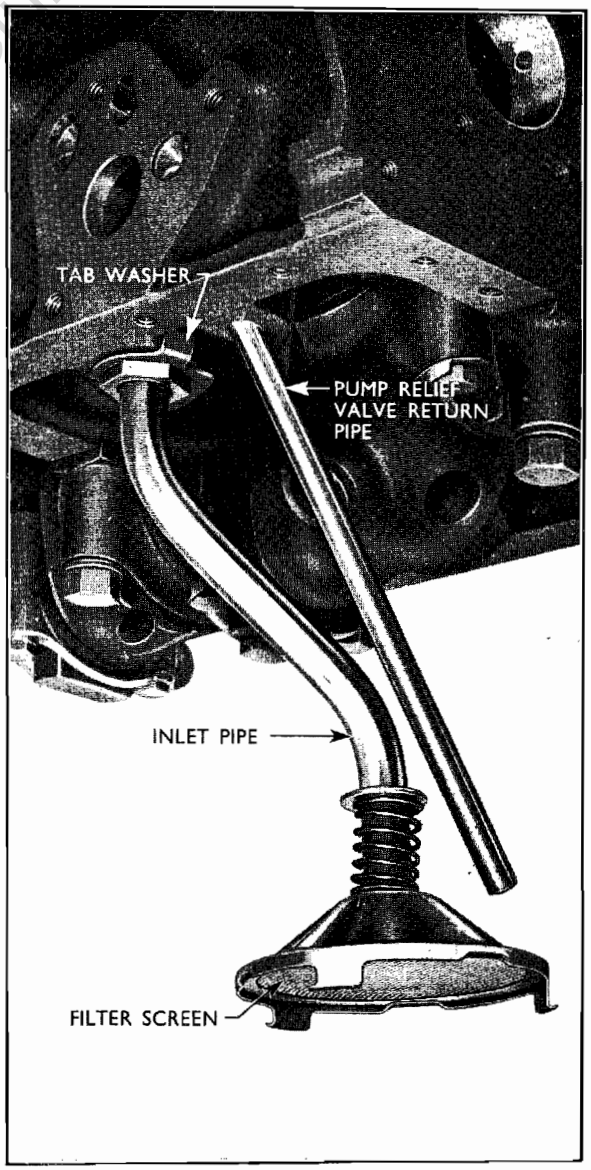
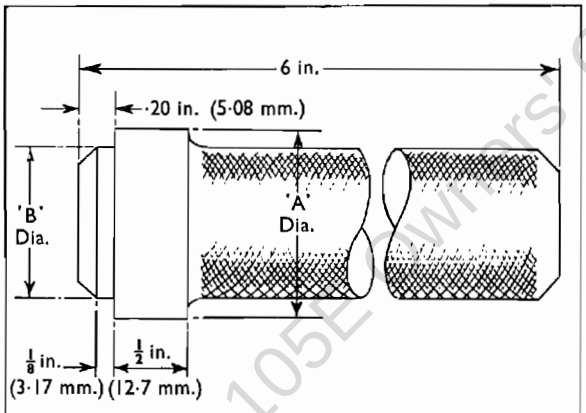


Fig. 17
The Oil Pump Inlet and Return Pipes

9. (*a*) **Renew the crankshaft front oil seal.** Extract the old seal carefully taking care not to damage the cover and use Tool No. P.6111 to press the new seal into the cover so that the sharp edge is inwards. Support the cover adequately around the oil seal location when pressing in the seal to avoid distortion.

(*b*) **Replace the cylinder front cover** and gasket. Position the gasket on the cylinder block face, fit the cover and secure it in place with the retaining screws and spring washers. Note that the two dowel bolts should be fitted and tightened first.



Valve	'A' Dia.	'B' Dia.
Inlet	1·41 in. (35·80 mm.)	1·14 in. (28·96 mm.)
Exhaust	1·26 in. (32 mm.)	1·03 in. (26·16 mm.)

Fig. 18
Valve Seat Insert Replacer Tool

10. (*a*) **Replace the oil pump inlet pipe** (if removed). Fit a new tab washer to the union nut, securely tighten the union retaining it in place with a tab on the washer.

(*b*) **Fit new gaskets on the block flange,** taking care that the tongues on the gaskets are correctly located at the front and rear of the block. Fit the cork packing strip at the front, and, at the rear, the rear main bearing seal in its location in the end of the sump.

NOTE.—The two sump gaskets should abut the crankshaft, and should be "nipped" by the cork packing strip at the front end of the engine, and by the rear main bearing seal at the rear end.

(*c*) **Refit the sump** securing it in place with the retaining bolts, lockwashers and flat washers.

11. Locate the rear engine plate on the tubular dowels and secure it to the cylinder block with one bolt and lockwasher.

12. (*a*) **Refit the flywheel** complete with locating sleeve (see Fig. 19), after first checking that the pilot bearing is in the crankshaft end and that the mounting flange and crankshaft flange are clean and free from burrs. Locate the flywheel squarely upon the dowel in the crankshaft flange, tap it into place, fit the locking plate and retaining bolts tightening them evenly to the correct torque.

(*b*) **Check the flywheel run-out,** using the gauge Tool No. P.4008. The flywheel run-out should not exceed 0.004 in. (0.102 mm.) total indicator reading.

If the flywheel run-out is within the limit, bend up the locking plate tabs to secure the retaining bolts, if the run-out is incorrect, remove the flywheel and check its mounting faces and the crankshaft flange for dirt or burrs.

(*c*) **Replace the clutch assembly** on the flywheel. Fit the clutch disc with the longer shoulder away from the flywheel using the locating Tool No. P.7091.

(*d*) **Locate the clutch pressure plate assembly** on the three dowels on the flywheel, and enter the securing bolts and spring washers. Tighten the bolts evenly to a torque of 12 to 15 lbs. ft. (1.658 to 2.073 kg.m.), then remove the clutch disc locator.

13. Valve Replacement. Where it is necessary to fit valve inserts, a suitable drift must be made to the dimensions given in Fig. 18. The insert must be pressed squarely into position, and it may therefore be found advantageous to extend the end of the drift into the valve stem guide. Valve seat inserts are serviced for both inlet and exhaust valves.

The recesses for the replacement valve seat inserts should be cut in the cylinder head to the dimensions given in the table at the end of this Bulletin. It should not be necessary to freeze the inserts before fitting.

(*a*) **Fit replacement inserts if required.** Enter the insert in the recess, chamfered edge first, and press it into position with the appropriate tool.

Valve guide bores are machined direct in the cylinder head and to compensate for wear, valves with stems 0.003 in. (0.076 mm.) and 0.015 in. (0.351 mm.) oversize are available in service ; this oversize is marked on the valve stem. To enable the 0.015 in. (0.38 mm.) oversize valves to be fitted it is necessary to ream the valve guide bores.

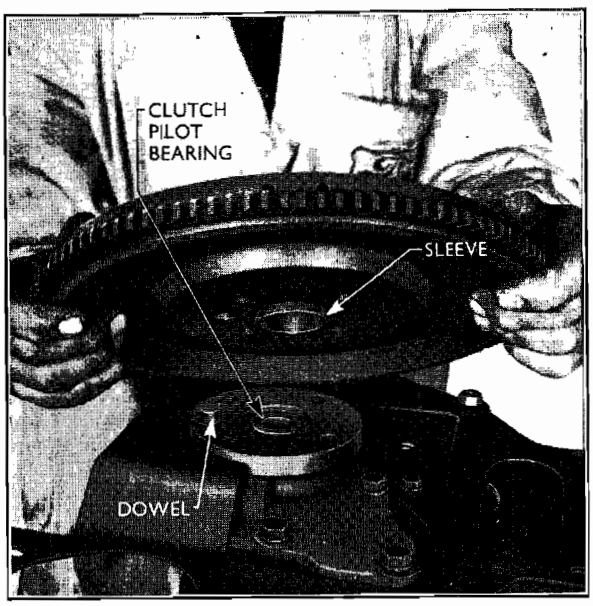


Fig. 19
Refitting the Flywheel

Continued overleaf

(*b*) If it is required to ream the valve guide bores in the cylinder head, this should be carried out with Tool No. P.6056. A reamer is supplied 0.015 in. (0.381 mm.) oversize with a standard size pilot. A small tap wrench should be used with the reamer and care should be taken to ream in line with the existing bore

(*c*) After reaming, recut the valve seats in line with the valve guide bores.

(*d*) Reassemble the valves after regrinding and cleaning the valve seats, etc. Lubricate each valve stem, and pass the valve stem through the appropriate valve port into position against the seat. Fit the umbrella type oil seals to the valve stems with the open ends to the guides.

(*e*) Place the valve springs in position around the valves and fit a valve spring seat on the top of each valve spring.

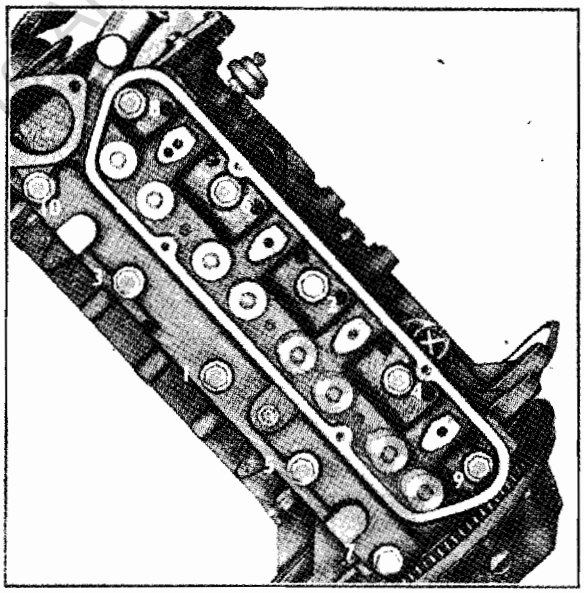


Fig. 20

Cylinder Head Bolt Tightening Sequence

(*f*) Compress the valve springs and place the split taper collets in the top groove of each valve stem with the tapers engaging in the tapered valve spring seat.

14. (*a*) **Refit the cylinder head and gasket.** Check the head and block faces for burrs, etc., and locate the cylinder head gasket in position steel face downwards with the water port holes in the block and gasket in line. Screw the locating studs PT.4063 into diagonally opposite bolt holes on the block face to locate the cylinder head gasket.

(*b*) **Install the cylinder head assembly** and refit the cylinder head bolts before removing the locating studs. Tighten down the head bolts evenly a little at a time, working outwards from the centre in the order shown in Fig. 20. Finally tighten the bolts down to the correct torque, see Specification.

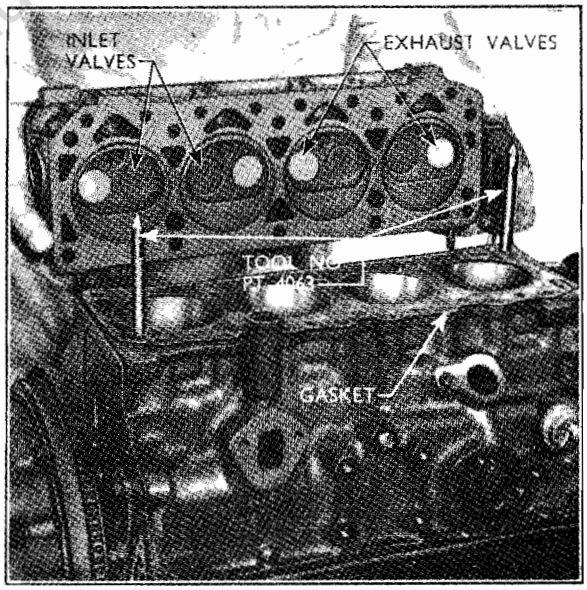


Fig. 21

Refitting the Cylinder Head

15. Reassemble the rocker shaft. Each rocker arm must abut a support with a compression spring between the rocker arms, except at each end, where the rocker arm is held against the support by two thrust washers and a spring cup washer.

(*a*) Build up the rocker shaft assembly, first fitting a split pin in the hole at one end of the shaft. Fit a flat washer, spring cup washer and another flat washer on the shaft to abut the split pin, slide a rocker arm onto the shaft followed by a rocker shaft support. The bolt hole through the rocker shaft

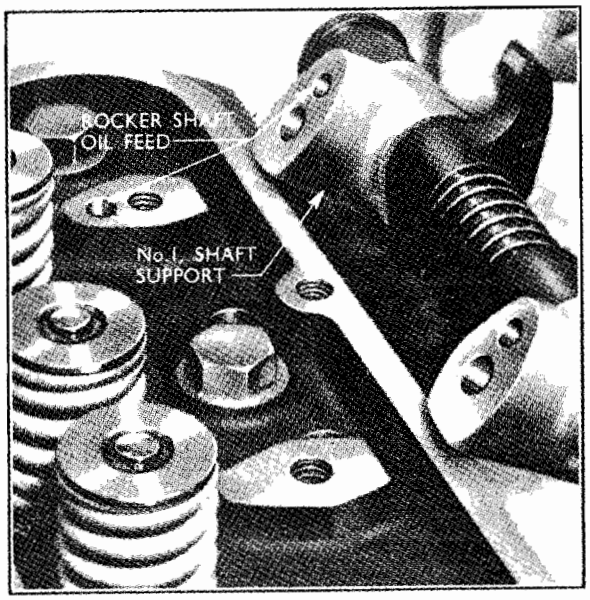


Fig. 22

Assembling the Rocker Shaft to the Cylinder Head

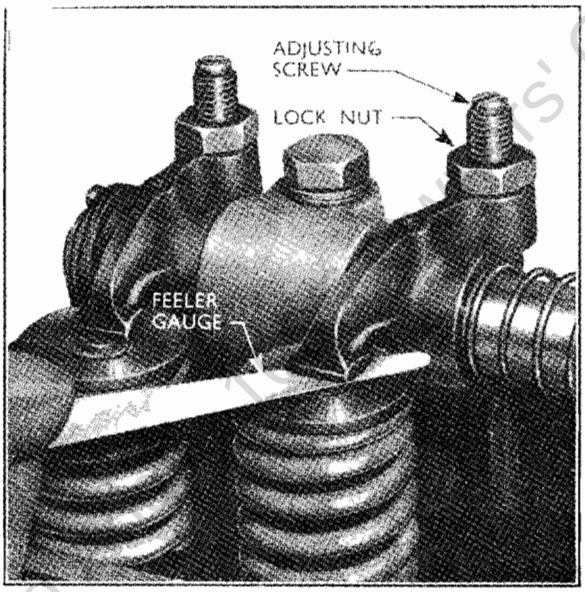


Fig. 23
Adjusting Valve Clearances

support must be on the same side as the valve stem adjuster.

(*b*) Next fit a rocker, spring and rocker followed by a support and complete the assembly in this manner.

(*c*) After the last rocker arm has been fitted, fit a flat washer, spring cup washer and another flat washer on the shaft securing them in place with a split pin.

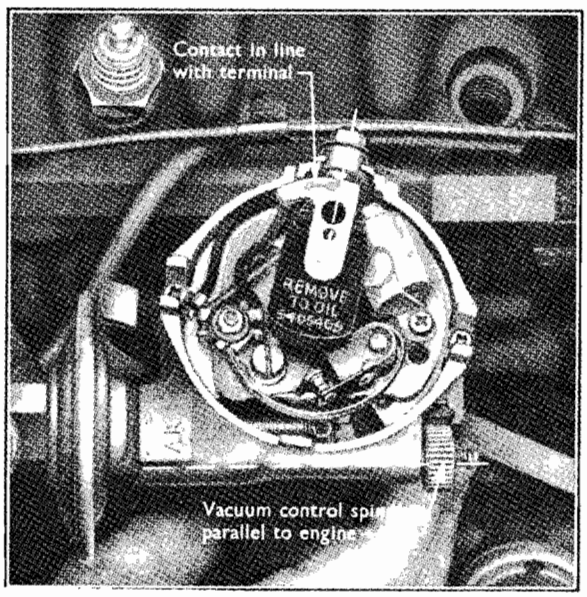


Fig. 24
Fitting the Distributor

(*d*) **Locate the push rods** in the push rod bores, ball ends first, to engage in the cupped tappet ends. Place the rocker shaft assembly on the cylinder head, ensuring that the cupped ends of the push rods correctly engage with the adjusters, fit and tighten the rocker shaft retaining bolts evenly to the correct torque. Adjust the valve clearances, see Specification.

(*e*) **Fit a new rocker cover gasket** and locate the rocker cover on the cylinder head, with the oil filler to the front of the engine. Fit the four flat washers and retaining screws.

16. Replace the water pump, noting that one of the retaining bolts also secures the timing cover in position.

17. Replace the crankshaft pulley, aligning the pulley slot with crankshaft key. Replace the pulley

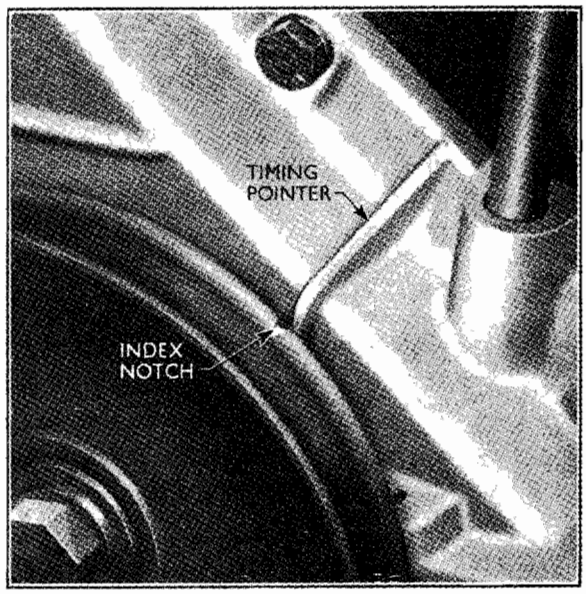


Fig. 25
Correct Engine Timing Position

securing bolt, lock and flat washers, and tighten securely.

18. Position the oil pump gasket on the cylinder block and fit the oil pump and filter assembly securing it in place with three bolts and lockwashers.

19. Retime the ignition

(*a*) Turn the engine until the timing mark on the crankshaft pulley is in line with the pointer on the timing cover with number one piston on compression stroke (check by feeling compression at No. 1 cylinder spark plug hole).

(*b*) Fit the distributor into position so that the rotor is pointing towards No. 1 segment in the distributor cap with the contact breaker points just opening. To allow for the helical gear drive, first

Continued overleaf

set the distributor with the tip of the rotor adjacent to the low tension terminal and the vacuum unit spindle parallel to the cylinder block, see Fig. 24. Secure the distributor to the cylinder block with one bolt and lockwasher through the clamp plate.

(*c*) Slacken the body clamp bolt, take up any lost motion in the drive and adjust the distributor body so that the contact breaker points are just opening. Tighten the clamp bolt to secure the body in this position.

20. (*a*) **Refit the fuel pump.** Locate a new gasket on the fuel pump and secure the pump to the cylinder block with two bolts and lockwashers.

(*b*) **Refit the oil pressure gauge unit.**

(*c*) **Refit the inlet and exhaust manifold** assembly. No gasket is fitted at this location and the manifold faces should be coated with a suitable sealer. Locate the manifold on the two studs at the front and rear of the cylinder head, fit a flat washer and a new self-locking nut to each stud. Secure the manifold to the cylinder head with flat washers, lockwashers and securing bolts at the other locations.

(*d*) **Fit a new carburettor gasket** to the carburettor flange, fit the carburettor securing it in place with two nuts and lockwashers.

(*e*) **Insert the thermostat** in the cylinder head water outlet, position the new gasket and refit the water outlet connection, two bolts and lockwashers.

(*f*) **Lift the engine from the universal stand** and remove the support bracket from the engine.

(*g*) **Refit the generator,** adjusting the fan belt tension so that there is $\frac{1}{2}$ in. (12.7 mm.) total movement between the generator and water pump pulleys.

(*h*) **Refit the engine mountings** to the cylinder block and refit the drain tap.

To Refit the Engine

1. Suitably support the engine by a sling and lower it into the engine compartment, locate the unit on the main drive gear ensuring that the tubular dowels are correctly located in the clutch housing and fit the clutch housing bolts.

2. Secure the engine mounting brackets to the cross member with two bolts and self-locking nuts in each bracket.

3. Refit the starter motor to the gearbox securing it in place with two bolts and lockwashers and reconnect the lead to the starter motor terminal.

4. Secure the splash shield to the clutch housing with the bolts and lockwashers.

5. Refit the engine breather pipe to the crankcase connection and secure the pipe to the clutch housing with one bolt and lockwasher and refit the engine splash shield.

6. Refit the heater motor to the heater.

7. Reconnect the leads to the "D" and "F" terminals of the generator, the lead to the temperature gauge unit and the lead to the oil pressure switch unit.

8. Refit the distributor cap. Reconnect the high tension lead to the coil terminal and the low tension lead to the contact breaker terminal of the distributor.

9. Reconnect the throttle linkage and choke control cable to the carburettor and the fuel pipe to the fuel pump.

10. Refit the radiator, reconnect the radiator and heater hoses (check that the fan does not foul the lower hose clip) and refill the cooling system.

11. Refit the carburettor air cleaner.

12. Refit and reconnect the battery.

13. Refill the engine with the correct grade engine oil, see Specification.

Refit the bonnet, pivot bolts and support.

SPECIFICATIONS, SERVICING AND REPAIR DATA

General

Type	4 cylinder-in-line-O.H.V.
Bore	3.1875 in. (8.096 cm.)
Stroke	1.906 in. (4.841 cm.)
Cubic capacity	60.84 cu. in. (996.6 c.c.)
Compression ratio	8.9 : 1 Standard 7.5 : 1 Optional
Maximum brake horse-power	39 at 5,000 r.p.m. (8.9 c.r.) 37 at 5,000 r.p.m. (7.5 c.r.)
Maximum torque	52.5 at 2,700 r.p.m. (8.9 c.r.) 50.0 at 2,700 r.p.m. (7.5 c.r.)
Firing order	1, 2, 4, 3
Location of No. 1 cylinder	Next to radiator
Engine mounting	3 point suspension on rubber mountings

Camshaft

Material	Special Ford cast alloy iron
Bearings	Steel backed babbit liners
Journal diameter	1.56 in. (3.692 cm.)
Bearing length—Front	0.79 in. (20.07 mm.)
Centre	0.68 in. (17.27 mm.)
Rear	0.79 in. (20.07 mm.)
Camshaft end-float	0.002 to 0.007 in. (0.051 to 0.178 mm.)
Camshaft thrust plate thickness	0.176 to 0.178 in. (4.47 to 4.52 mm.)
Camshaft drive	Single roller chain, with tensioner
Camshaft sprocket	Located by offset dowel and two bolts

Connecting Rods

Length between centres	4.611 to 4.612 in. (11.712 to 11.714 cm.)
Big end bearings	Steel backed copper lead or lead bronze, with 0.001 in. (0.025 mm.) lead overlay
Crankpin to bearing clearance	0.0005 to 0.0022 in. (0.0127 to 0.057 mm.)
Bearing length	0.875 in. (22.35 mm.)
Small end	Bronze bush, steel backed
Diameter	0.812 in. (20.62 mm.)
Piston pin to small end clearance	0.0001 to 0.0003 (0.0025 to 0.0076 mm.) (selective)

Crankshaft

Main bearings	White metal steel backed liners
Main bearing clearance	0.0005 to 0.002 in. (0.0127 to 0.051 mm.)
Bearing length	1.00 in. (2.54 cm.)
End-float	0.003 to 0.011 in. (0.076 to 0.279 mm.)

Cylinder Block

Type	Cylinders cast integral with top half of crankcase
Water jackets	Full length

Cylinder Head

Type	Cast iron with vertical valves. Separate inlet and exhaust ports
Combustion chamber	Fully machined

Flywheel Ring Gear

Type	Shrunk on
Number of teeth	110

Lubrication

Type	Pressure feed
Pressure fed bearings	Main, camshaft and connecting rod. Reduced pressure to rocker shaft
Piston pin and cylinder wall lubrication	Splash, with squirt holes in connecting rods
Timing chain lubrication	Controlled spray
Oil filter	Full flow incorporated with oil pump
Crankcase ventilation	Directed flow via road draught tube on right-hand side of engine
Grade of oil :	
Summer or winter	S.A.E. 20 or 20W
From 32°F. to —10°F.	S.A.E. 10W
Below —10°F.	S.A.E. 10W + 10% kerosene or S.A.E. 5W
Sump capacity	4 pints (2.27 litres)
Filter capacity	½ pint (0.284 litre)
Oil pump type	Eccentric bi-rotor
Oil pump relief pressure	35 to 40 lbs./sq. in. (2.46 to 2.81 kg./sq. cm.)
Oil pressure warning light operates at	5 to 7 lbs./sq. in. (0.391 to 0.492 kg./sq. cm.)
Oil pump capacity	2 galls. per min. at 2,000 r.p.m. (9.09 litres 2.4 U.S. galls.)

Pistons

Type	Autothermic aluminium alloy
Number of rings	Two compression, one oil control
Ring gap	0.009 to 0.014 in. (0.229 to 0.356 mm.)
Ring to wall pressure	6.4 to 8.3 lbs. (2.900 to 3.765 kg.) upper compression 6.00 to 8.00 lbs. (2.272 to 3.629 kg.) lower compression 5.35 to 6.90 lbs. (2.427 to 3.130 kg.) oil control

Piston grades :	*Standard Bore*	0.030 *in.* (0.762 mm.) *Oversize Bore*
Grade 1	3.1861 to 3.1864 in. (80.925 to 80.932 mm.)	3.2161 to 3.2164 in. (81.685 to 81.692 mm.)
Grade 2	3.1864 to 3.1867 in. (80.932 to 80.940 mm.)	3.2164 to 3.2167 in. (81.692 to 81.700 mm.)
Grade 3	3.1867 to 3.1870 in. (80.940 to 80.948 mm.)	3.2167 to 3.2170 in. (81.700 to 81.708 mm.)
Grade 4	3.1870 to 3.1873 in. (80.948 to 80.956 mm.)	3.2170 to 3.2173 in. (81.708 to 81.716 mm.)

Piston fit 8 to 11 lbs. (3.63 to 4.99 kg.) pull on 0.0015 in. (0.038 mm.) feeler blade, 0.5 in. (12.7 mm.) wide

Valves

Head diameter	1.262 to 1.272 in. (3.205 to 3.231 cm.) inlet 1.183 to 1.193 in. (3.004 to 3.030 cm.) exhaust
Stem diameter	0.3095 to 0.3105 in. (7.861 to 7.882 mm.) inlet 0.3086 to 0.3096 in. (7.838 to 7.864 mm.) exhaust
Stem to guide clearance	0.0008 to 0.003 in. (0.021 to 0.076 mm.) inlet 0.0017 to 0.0039 in. (0.043 to 0.099 mm.) exhaust
Valve lift	0.2893 in. (7.347 mm.) inlet 0.2904 in. (7.380 mm.) exhaust
Valve seat angle (cylinder head and valve)	45° inlet and exhaust
Valve clearance (normal operating temperature)	0.010 in. (0.254 mm.) inlet 0.017 in. (0.432 mm.) exhaust
Valve clearance (cold)	0.008 in. (0.203 mm.) inlet 0.018 in. (0.457 mm.) exhaust
Valve springs—free length	1.48 in. (4.57 cm.)
Spring load at fitted length	45 lbs. (20.41 kg.)

Valve timing (at valve clearance of .015 in. (0.381 mm.) inlet and .027 in. (0.686 mm.) exhaust, cold)

Inlet opens	10° B.T.D.C.
Inlet closes	50° A.B.D.C.
Exhaust opens	44° B.B.D.C.
Exhaust closes	10° A.T.D.C.

Valve Seat Inserts

Insert	*Valve*	*I.D. of Recess in Head*	*Depth of Recess in Head*
Standard	Inlet Exhaust	1.4195/1.4200 in. (36.055/36.068 mm.) 1.2680/1.2685 in. (32.207/32.220 mm.)	0.2175/0.2225 in. (0.7239/0.7266 mm.) 0.2175/0.2225 in. (0.7239/0.7266 mm.)
0.010 in. (0.254 mm.) o/s dia. std. depth	Inlet Exhaust	1.4295/1.4300 in. (36.309/36.322 mm.) 1.2780/1.2785 in. (32.461/32.474 mm.)	0.2175/0.2225 in. (0.7239/0.7266 mm.) 0.2175/0.2225 in. (0.7239/0.7266 mm.)
0.010 in. (0.254 mm.) o/s dia. and depth	Inlet Exhaust	1.4295/1.4300 in. (36.309/36.322 mm.) 1.2780/1.2785 in. (32.461/32.474 mm.)	0.2275/0.2325 in. (0.7393/0.7520 mm.) 0.2275/0.2325 in. (0.7393/0.7520 mm.)
0.020 in. (0.508 mm.) o/s dia. std. depth	Inlet Exhaust	1.4395/1.4400 in. (36.563/36.576 mm.) 1.2880/1.2885 in. (32.715/32.728 mm.)	0.2175/0.2225 in. (0.7293/0.7266 mm.) 0.2175/0.2225 in. (0.7293/0.7266 mm.)
0.020 in. (0.508 mm.) o/s dia. and depth	Inlet Exhaust	1.4395/1.4400 in. (36.563/36.576 mm.) 1.2880/1.2885 in. (32.715/32.728 mm.)	0.2375/0.2425 in. (0.7647/0.7774 mm.) 0.2375/0.2425 in. (0.7647/0.7774 mm.)

Bolt Tightening Torques

Cylinder Head	65 to 70 lbs. ft. (8.987 to 9.679 kg.m.)
Main Bearings	55 to 60 lbs. ft. (7.604 to 8.295 kg.m.)
Big End Bearings	20 to 25 lbs. ft. (2.765 to 3.456 kg.m.)
Flywheel	45 to 50 lbs. ft. (6.221 to 6.913 kg.m.)

ENGINE (1,198 c.c.):
OVERHAUL PROCEDURES
CONSUL CORTINA

The engine is of the overhead valve type, being a 4-cylinder unit of 1,198 c.c. capacity, 3.187 in. (80.96 mm.) diameter bore and 2.29 in. (58.17 mm.) stroke.

The valves are mounted vertically in the cylinder head, the valve guides being cast integral. The heads of the inlet valves are of larger diameter than those of the exhaust valves.

Pistons are of the aluminium alloy solid skirt type, the piston pins being fully floating and retained by means of end circlips fitted in the piston pin bosses.

A single row chain drives the camshaft from the crankshaft and a mechanically operated timing chain tensioner is fitted.

The distributor, which incorporates both mechanical and vacuum advance, is mounted on the right-hand side of the engine and is driven through skew gears by the engine camshaft which also operates the fuel pump located on the right-hand side of the engine towards the rear, by an eccentric.

The following sheets provide complete instructions for the removal, replacement, dismantling and reassembling operations which may be necessary on this engine. Specifications will be found at the end of this Bulletin.

The following major operations can be carried out with the engine in place.

Remove Cylinder Head Assembly

Remove the air cleaner, rocker cover and rocker shaft assembly, lift out the push rods and unscrew the cylinder head bolts (see continuation sheet 4).

Remove and Overhaul Oil Pump

Remove the three bolts securing the oil pump and filter assembly to the cylinder block and withdraw the oil pump (see sheet 3).

Remove Cylinder Front Cover, Timing Chain, Sprockets or Tensioner

Access to the above components can be gained after removing the radiator.

Remove Water Pump

First remove the fan belt and fan.

Remove Sump

The sump can be removed to gain access to the main and connecting rod big-end bearing caps, thrust washers, the oil pump inlet pipe and filter screen, etc.

Drain the sump and remove the sump shield (where fitted), the engine splash shield and the starter motor. Support the weight of the engine with suitable lifting tackle, and remove the bolts, nuts and washers securing the engine mounting brackets to the front crossmember. Raise the front of the engine approximately 2 in. (50.8 mm.) to clear the crossmember.

Remove the set-screws securing the sump to the cylinder block, turn the engine over to allow the sump to clear the crankshaft webs, and remove the sump.

ENGINE LUBRICATION SYSTEM

The lubrication system is of the forced feed type, the oil being circulated by either an eccentric bi-rotor or vane type oil pump incorporated in the head of the full flow filter fitted to the engine. The pump being driven by a skew gear on the engine camshaft. A full description of these pumps will be found on sheet 2 of this Bulletin.

Oil from the engine sump is drawn through a gauze screen on the bottom of the pump pick-up pipe and fed into the oil pump. Incorporated in the oil pump is a pressure relief valve, which, when open, allows oil to return direct to the sump. This oil returns via a pipe to the base of the pump, thus preventing aeration of the oil.

Oil from the pump is fed under pressure to the full flow filter, then through a cross drilling above the centre main bearing to the main oil gallery on the left-hand side of the engine. Oil is also fed via a short gallery to the oil pressure switch sender unit on the right-hand side of the engine.

From the main oil gallery oil passes through drillings to each main bearing and through drillings in the crankshaft from each main bearing to each big end bearing. A small drilling in each connecting rod web allows a jet of oil to lubricate the non-thrust side of the cylinder with each revolution of the crankshaft.

The camshaft bearings are fed via drillings in the cylinder block from the main bearings.

By means of a flat incorporated in the front camshaft journal, oil is fed through drillings in the cylinder block and head to the front rocker shaft pedestal, thence to the hollow rocker shaft to lubricate the valve rockers. Drillings in each rocker allow for lubrication of the valve stems and push rod ends. This oil feed to the rocker gear is at a reduced pressure, the system being pressurised once per revolution of the camshaft.

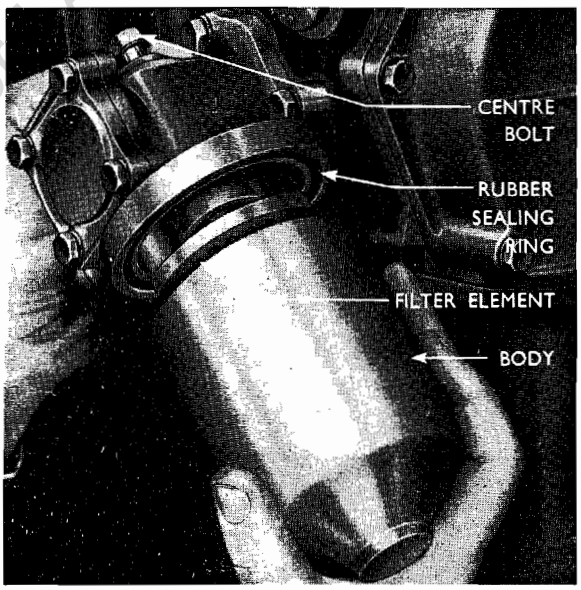


Fig. 1
The Engine Oil Filter

The timing sprockets and chain are lubricated by a constant bleed from the drilling between the crankshaft and camshaft front bearings.

THE OIL FILTER

The oil filter is bolted to the underside of the oil pump which is attached to the right-hand side of the cylinder block.

The filter is of the full-flow type and is located in the lubrication circuit between the pump inlet port and the outlet to the main oil gallery.

The oil filter element should be renewed and the filter body thoroughly cleaned after every 5,000 miles (8,000 kms.), when the engine oil is changed, or more frequently if the lubricant has become excessively fouled. To remove the filter, unscrew the hexagon-headed bolt, and withdraw the filter body and element (see Fig. 1).

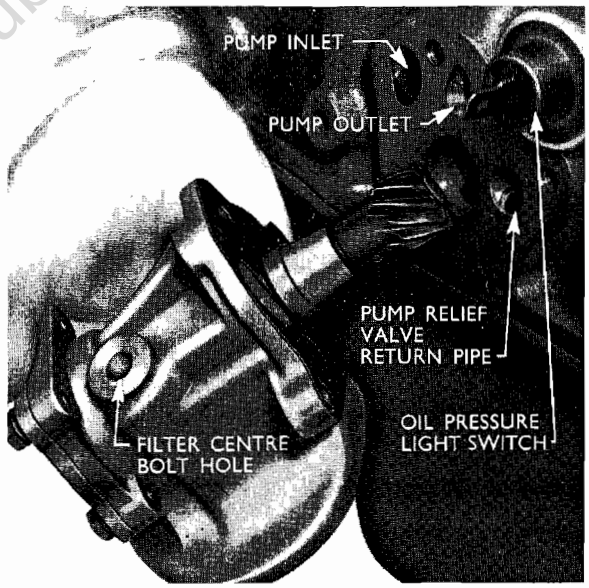


Fig. 2
Removing the Oil Pump

Remove the existing "O" ring from its recess in the oil pump housing, then locate the new ring (supplied with the replacement element) in the groove at four diametrically opposite points.

Do not fit the ring at one point and then work it round the groove, as the rubber may stretch, thus leaving a surplus which may cause an oil leak.

Thoroughly clean the filter body, insert a new element, and refit the filter assembly to the oil pump body.

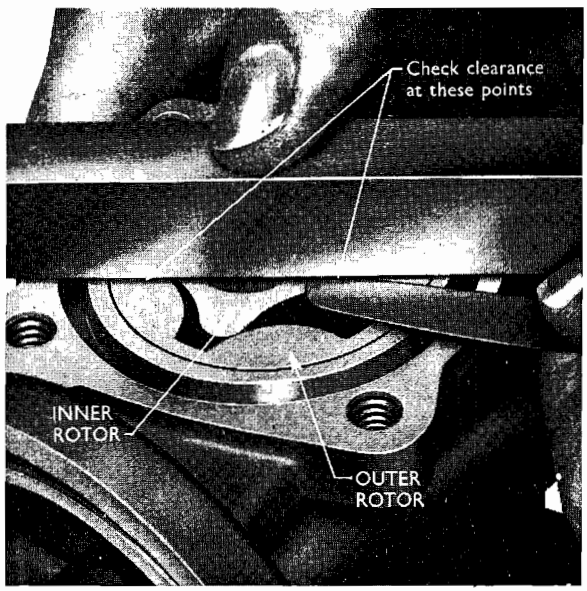


Fig. 3
Checking Rotor End Clearance
(Eccentric Bi-Rotor Type)

THE OIL PUMP

The oil pump and filter assembly is bolted to the right-hand side of the cylinder block, the oil pump being incorporated in the head of the unit and driven by a skew gear on the engine camshaft.

One of two types of oil pump is fitted in production. The eccentric bi-rotor type or the vane type. The pumps are directly interchangeable, differing only in internal design. However, they may be readily identified on the car by the different appearance of their end covers. The eccentric bi-rotor type has four cast recesses in the cover, the vane type is flat.

Both pumps are self-priming and designed to reduce any possibility of aeration. A relief valve is incorporated in the body of the pump ; this limits the oil pressure to 35 to 40 lb./sq. in. (2.46 to 2.81 gm./sq. cm.) To remove and replace the oil pump see previously.

On both the eccentric bi-rotor and the vane type of oil pump the suction port is connected directly to the gauze strainer located in the engine sump. A full flow filter is incorporated in the assembly between the pump and the outlet to the main oil gallery of the engine. A non-adjustable plunger type relief valve is fitted between the pump outlet and filter inlet, oil passing this valve is returned via a pipe to the base of the sump to prevent oil aeration.

Oil Pump Operation (Eccentric Bi-Rotor Type)

The pump consists of two rotors housed in the pump body. The inner rotor, which is pinned to the drive shaft, has four lobes machined on it, the outer rotor has five internal segments machined in it, with which the lobes of the inner rotor mesh. The outer rotor is located in a machined recess in the pump body and the centre of it is offset to the centre of the inner rotor and drive shaft, so that as the inner rotor revolves the outer rotor is also rotated.

The operation of the pump is shown in Fig. 4. The inlet port on the right is connected to the sump, the outlet port on the left is connected via the full flow filter to the main oil gallery of the engine. In the first position, oil is drawn via the inlet port into the space between the inner and outer rotors. As the rotors revolve, the oil is carried round between them and in the second position, due to the offset between the centre of the rotors, the space between them starts to decrease so that oil is forced through the outlet port and filter into the engine. The action of the pump is a continuous repetition of this process, oil flowing into the space between the rotors from the inlet port is carried around in the space between the rotors and as this decreases the oil is then forced into the pump outlet port.

A non-adjustable pressure relief valve is incorporated between the pump outlet port and the full flow filter to prevent excessively high pressures being built up.

Oil Pump Operation (Vane Type)

The pump consists of four vanes located within grooves in an eccentrically positioned rotor, which is housed in the pump body (see Fig. 9). The vanes being held against the pump body by centrifugal force whilst the pump is operating.

The operation of this oil pump is similar to that of the Eccentric Bi-Rotor Type. The inlet port on the right is connected to the sump. The outlet port on the left is connected via the full flow filter to the main oil gallery of the engine. In the first position the oil is drawn via the inlet port into the space between the rotor and pump housing. In the second position, as the rotor turns, the vanes are thrown out by centrifugal force and, due to the eccentricity between the centre of the pump housing and the rotor, the space between the rotor and the housing decreases

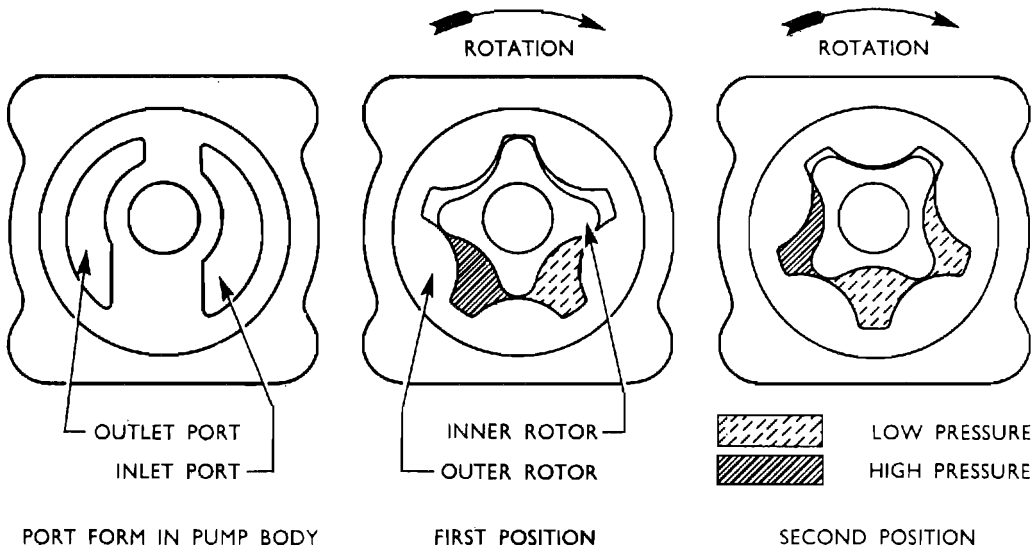


Fig. 4
Oil Pump Operating Sequence (*Eccentric Bi-Rotor Type*)

and the oil is forced by the vanes through the outlet port into the engine. The action of the pump is a continuous repetition of this process, oil flowing into the space between the rotor and the pump housing from the inlet port is carried around between the vanes and as this space decreases the oil is then forced into the pump outlet port.

A non-adjustable pressure relief valve is incorporated between the pump outlet port and the full flow filter to prevent excessively high pressures being built up.

To Overhaul the Oil Pump (Eccentric Bi-Rotor Type)

The oil pump can be overhauled by the following method by first removing the oil pump and filter assembly and detaching the oil filter body and element from the pump.

1. Suitably mount the pump so that the end cover lies in the vertical plane.

2. Remove the four bolts and lockwashers retaining the end plate and pull off the plate. Remove the rubber "O" ring from the sealing groove in the pump body.

3. Check the clearance between the lobes of the inner and outer rotors. This should be checked in two positions as shown in Figs. 5 and 6, and must not exceed 0.006 in. (0.152 mm.). Check the clearance between the outer rotor and the housing, this should not exceed 0.0075 in. (0.19 mm.).

The rotors are supplied as a matched pair only so that if the clearance is excessive a new rotor assembly must be fitted. Similarly, if the clearance between the outer rotor and pump body is excessive a new rotor assembly and/or pump body should be fitted.

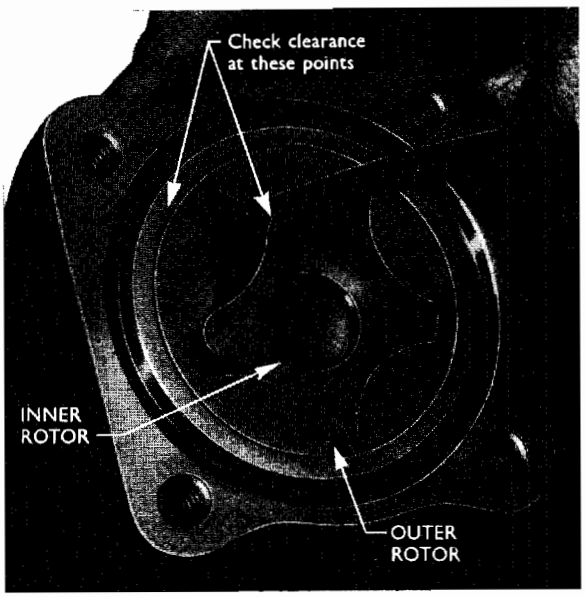


Fig. 5
Checking Rotor Clearance (a)
(Eccentric Bi-Rotor Type)

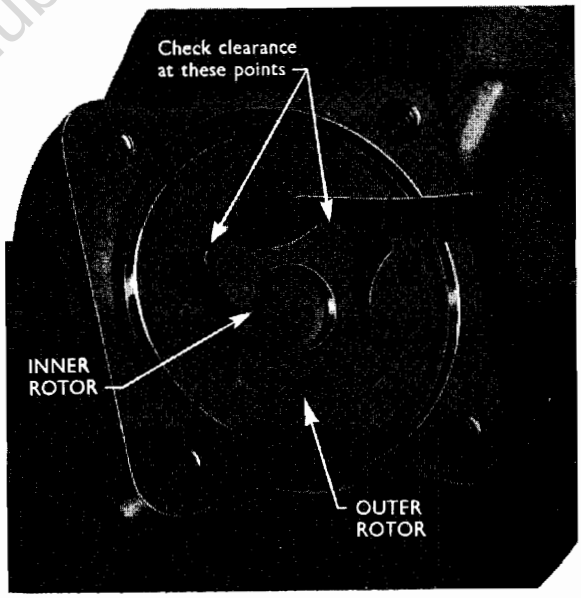


Fig. 6
Checking Rotor Clearance (b)
(Eccentric Bi-Rotor Type)

4. Place a straight edge across the face of the pump body and check the clearance between the face of the rotors and the straight edge (see Fig. 3). This should not exceed 0.005 in. (0.127 mm.). If this clearance is excessive, the face of the pump body can be carefully lapped on a flat surface.

5. If it is necessary to renew the rotors, drive out the pin securing the skew gear to the drive shaft, and pull off the gear.

6. Remove the inner rotor and drive shaft (serviced only as an assembly) and withdraw the outer rotor.

7. Install the outer rotor with its chamfered face inwards, towards the pump body. Fit the inner rotor and drive shaft assembly, position the skew gear on the end of the drive shaft and install the pin. Peen the pin securing at both ends to prevent it becoming loose in service.

8. Position the rubber "O" ring in the groove in the pump body.

9. Fit the end plate (machined face towards the rotors), secure it in place with four bolts and lockwashers.

10. Locate a new filter sealing ring in the groove in the pump body at four diametrically opposite points. Do not fit the sealing ring at one point and then work it round the groove, as the rubber may stretch, thus leaving a surplus which could cause an oil leak.

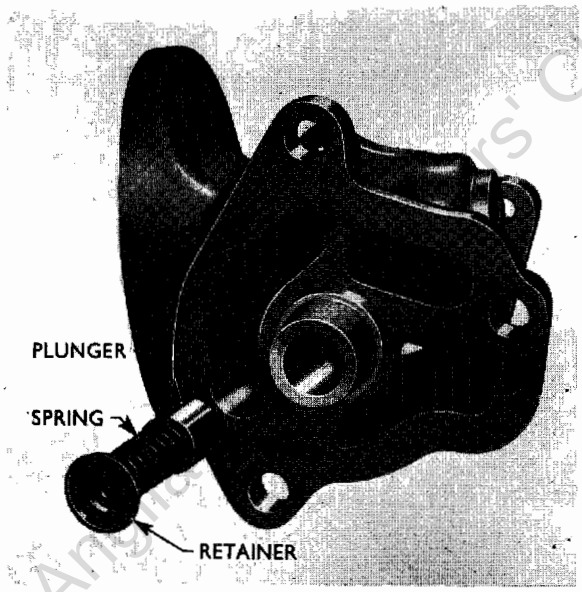


Fig. 7
The Oil Pump Relief Valve

NOTE.—Normally, the pump relief valve will not require attention ; if necessary the valve and spring can be withdrawn after carefully extracting the spring seat which is a press fit in the body. Similarly, the filter relief valve, which is also a press fit in the body, need not normally be removed (see Fig. 7).

To Overhaul the Oil Pump (Vane Type)

To check the pump, the following procedure can be adopted after first removing the oil pump and filter assembly as described on sheet 1 and detaching the oil filter body and element from the pump.

1. Suitably mount the pump so that the end cover lies in the **horizontal** plane.

2. Remove the four bolts and lockwashers retaining the end plate and pull off the plate. Remove the "O" ring from the sealing groove in the pump body.

3. Place a straight edge across the face of the pump body and check the clearance between the face of the vanes and rotor assembly and the straight edge (see Fig. 10). This should not exceed 0.005 in. (0.127 mm.). If this clearance is excessive, the face of the pump body can be carefully lapped on a flat surface.

Since the vanes are held against the pump by centrifugal force whilst the pump is operating, they are self-adjusting as regards wear. Therefore, the clearance between these vanes and the pump body does not need checking. However, should vanes, rings or the rotor need renewing, then the pump may be overhauled as follows :—

1. Suitably mount the pump so that the end cover lies in the **horizontal** plane.

2. Remove the four bolts and lockwashers retaining the end plate and pull off the plate.

Remove the "O" ring from the sealing groove in the pump body and pick out the top vane locating ring.

3. Drive out the pin securing the skew gear to the drive shaft, and pull off the gear.

4. Remove the drive shaft and rotor assembly (serviced only as an assembly); the bottom locating ring and vanes can be removed from the pump housing when the drive shaft and rotor assembly have been removed.

5. Place the bottom locating ring in the pump housing and fit the drive shaft and rotor assembly.

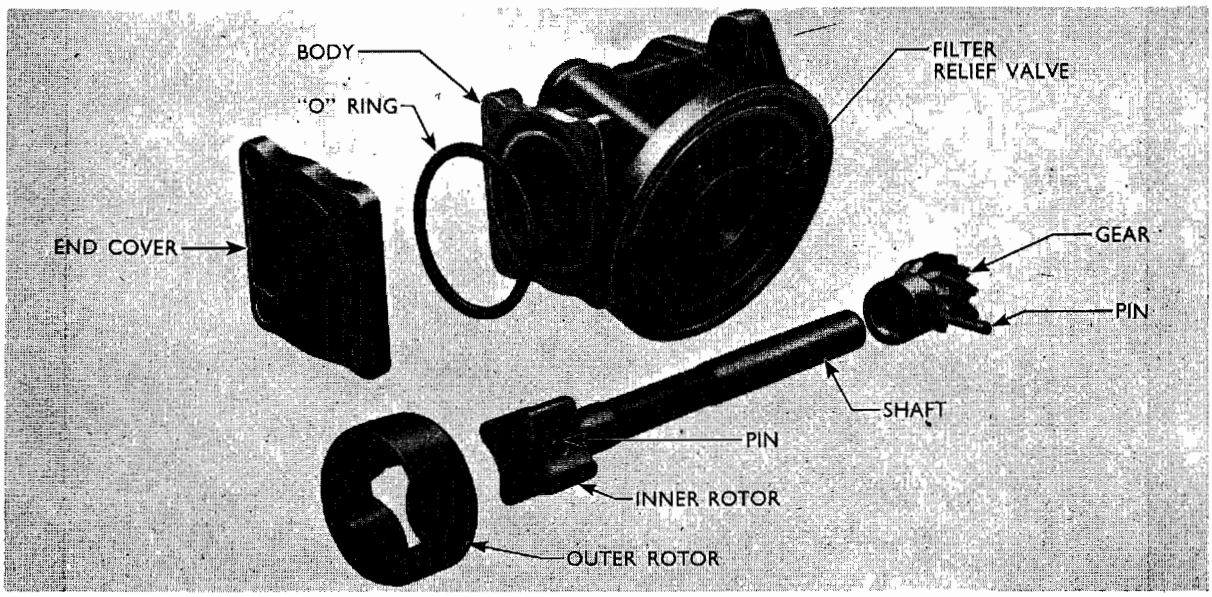


Fig. 8
The Oil Pump—Exploded (*Eccentric Bi-Rotor Type*)

6. Install the vanes and top locating ring.

7. Position the rubber "O" ring into the groove in the pump body.

8. Fit the end plate (machined face towards the rotor and vanes), secure it in place with four bolts and lockwashers.

9. Locate a new sealing ring in the groove in the pump body at four diametrically opposite points and then work it round the groove, as the rubber may stretch, thus leaving a surplus which could cause an oil leak.

NOTE.—Normally the pump relief valve will not require attention ; if necessary, the valve and spring can be withdrawn after carefully extracting the spring seat which is a press fit in the body. Similarly, the filter relief valve, which is also a press fit in the body need not normally be removed (see Fig. 8).

10. Refit the body and element.

11. Refit the pump and filter assembly as described on sheet 1.

THE ENGINE

To Remove the Engine

1. **Remove the bonnet.** Unscrew the four hinge bolts, two on either side and remove, together with the flat and spring washers.

2. **Disconnect the battery.**

3. **Drain the engine oil and coolant.**

4. **Jack up the front of the car** and fit stands beneath the forward jacking points.

5. **Detach the upper and lower radiator hoses,** at the engine end, then remove four bolts and spring washers securing the radiator.

6. **Remove the radiator.**

7. **Disconnect the fuel inlet pipe** to the fuel pump and remove the engine breather by unscrewing one engine to clutch housing bolt.

8. **Remove the top bolt** from the starter motor.

9. **Disconnect the spark plug leads** and remove Nos. 2 and 3 spark plugs.

10. **Unclip and lift off the distributor cap.** Disconnect the high tension lead from the coil terminal and the low tension lead from the contact breaker terminal of the distributor.

11. **Disconnect the oil warning light sender lead.**

12. **Remove both heater hoses,** one from the water pump and one from the cylinder head.

13. **Remove the air cleaner.** One of two types is fitted in production, either a dry gauze or a paper element type. Both types may be removed by slackening the retaining clamp at the base, removing

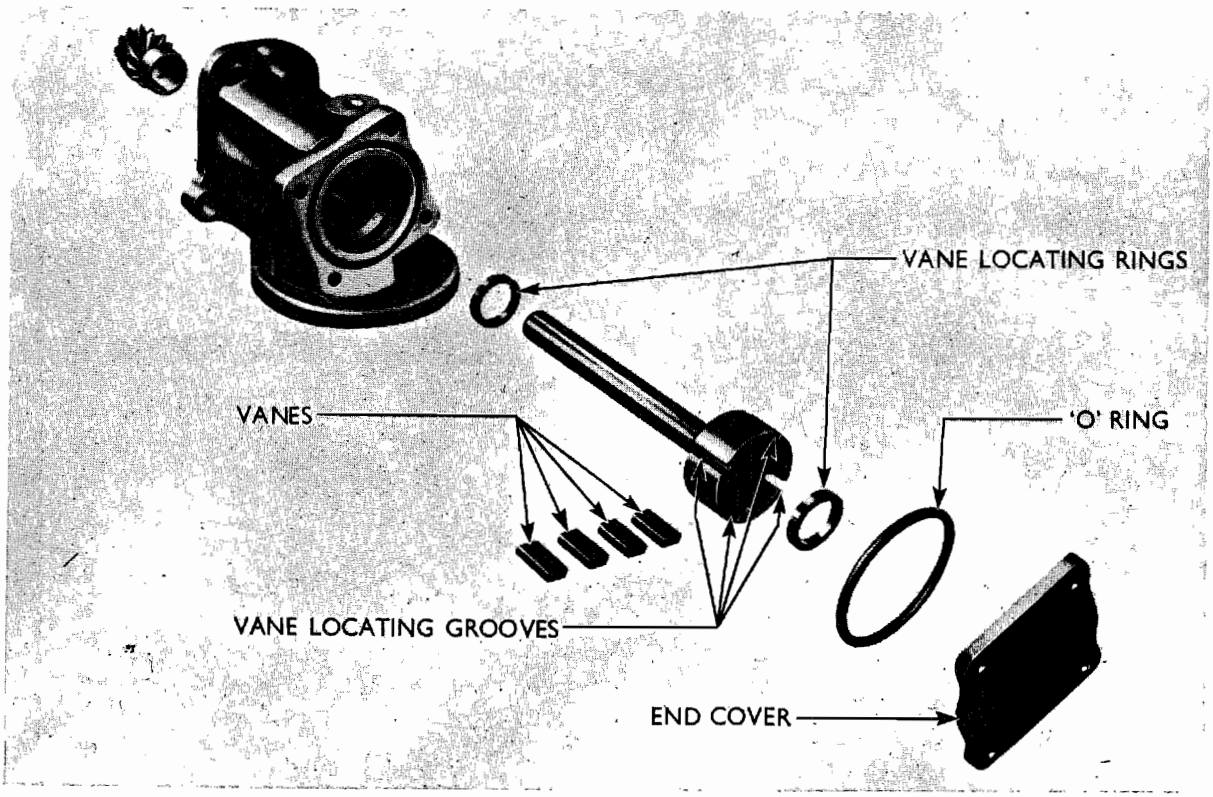


Fig. 9
The Oil Pump Exploded (*Vane Type*)

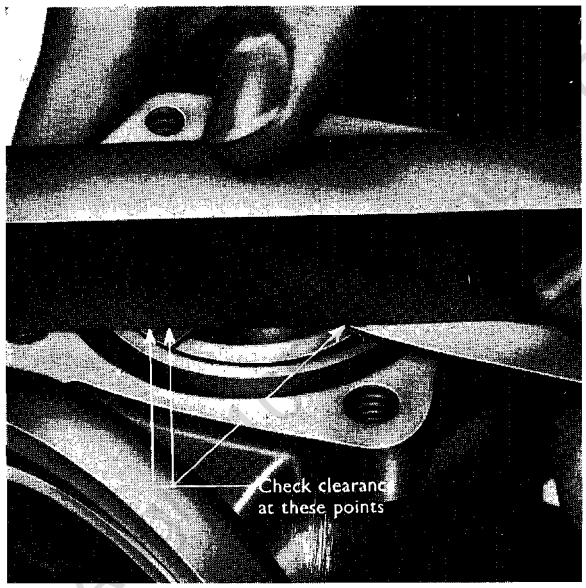


Fig. 10
Checking Rotor and Vane End Clearance
(*Vane Type*)

the bolt and spring washer securing the support, and lifting the air cleaner clear of the carburettor.

14. Disconnect the temperature gauge sender unit lead and the two generator leads.

15. Unscrew the exhaust pipe clamp bolts and disconnect the exhaust pipe from the manifold, then uncouple the choke and throttle controls at the carburettor end. Unscrew the two nuts and spring washers and detach the carburettor.

16. Remove the second and fourth cylinder head bolts on the left-hand side of the head. Locate the bracket ends of the lifting bracket, Tool No. P.6115A, in the plug recesses and secure the bracket to the cylinder head and block, using bolts $\frac{1}{2}$ in. (12.7 mm.) longer than those removed.

If a lifting bracket is not available, position a rope sling around the engine and support the weight of the engine on suitable tackle.

17. From underneath the car remove the four bolts retaining the sump shield (where fitted), then remove the four self-tapping screws and flat washers retaining the engine splash shield.

18. Unscrew the lower starter motor mounting bolt, disconnect the starter lead and withdraw the starter motor forwards.

19. Suitably support the gearbox.

20. Remove the eight remaining bolts and lockwashers securing the engine to clutch housing.

21. Remove the single bolt and flat washer on each engine mounting, securing the engine mounting to the front crossmember, pull the engine unit forward off the main drive gear and lift the assembly from the engine compartment.

Dismantling the Engine

1. (*a*) **Remove the oil pump** and filter by unscrewing the three mounting bolts.

(*b*) **Detach the generator,** engine drain tap and left-hand engine support bracket, bolt the universal stand adaptor (Tool No. P.6107) to the cylinder block at these locations and fit the engine on universal stand.

(*c*) **Remove the distributor.** Disconnect the vacuum pipe, unscrew the one bolt securing the clamp plate to the block and lift out the distributor.

(*d*) **Detach the fuel pump** after unscrewing the two bolts and lockwashers securing it to the cylinder block.

(*e*) **Unscrew the oil pressure gauge unit.**

(*f*) **Remove the inlet and exhaust manifold assembly.** The exhaust manifold is mounted on studs at each end retained by bolts at its other locations. Note a gasket is fitted between the manifold and head.

(*g*) **Detach the water outlet elbow and gaskets,** then lift the thermostat from its location in the cylinder head.

2. (*a*) **Slacken the four rocker shaft support bolts** evenly to prevent distortion. Remove the bolts and lift off the rocker shaft assembly.

(*b*) **Withdraw the push rods** from their locations in the cylinder block, taking care to keep them in their correct order.

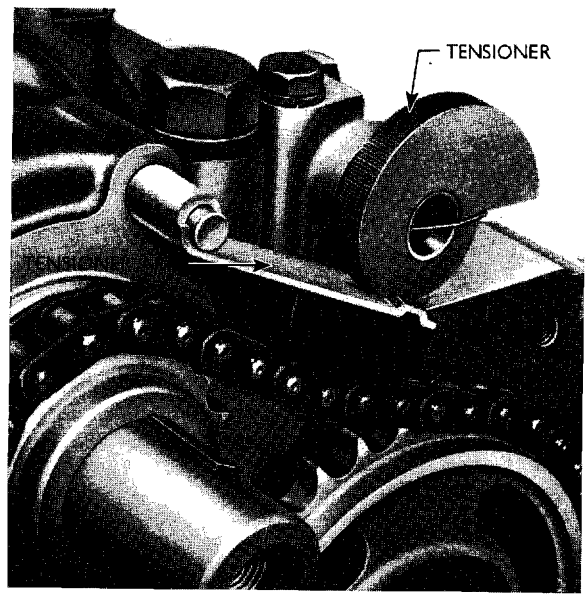


Fig. 11
The Timing Chain Tensioner

(*c*) **Dismantle the rocker shaft** assembly ; proceed as follows :—

Remove the split pin from one end of the shaft and detach the flat washer, spring cup washer and second flat washer which bear against the end rocker arm. The rocker shaft supports, rocker arms and springs can now be removed from the shaft if necessary, but must be retained in sequence ready for reassembly.

3. Unscrew the cylinder head bolts evenly in the reverse order to that shown in Fig. 27. Lift off the cylinder head and gasket.

4. Dismantle the valves. The valves may now be dismantled and removed from the cylinder head.

Extract the split tapered collets then remove the spring seats and valve springs.

An umbrella-type rubber seal is fitted on each valve stem and must be removed before the valve can be extracted from the valve port.

5. Dismantle the water pump and fan from the cylinder block, unscrewing the three retaining bolts. Note that one retaining bolt also secures the timing cover to the cylinder block.

6. Withdraw the dipstick and remove the sump, detach the sump gaskets from the cylinder block face.

7. Detach the pulley and timing cover. Unscrew the retaining bolt, lockwasher and flat washer securing the crankshaft pulley and draw off the pulley, using the puller (Tool No. CP.6041). Unscrew the bolts securing the timing cover to the cylinder block, (two of the cover retaining bolts passing up through the sump flange have already been removed) and withdraw the timing cover. Remove the crankshaft oil slinger.

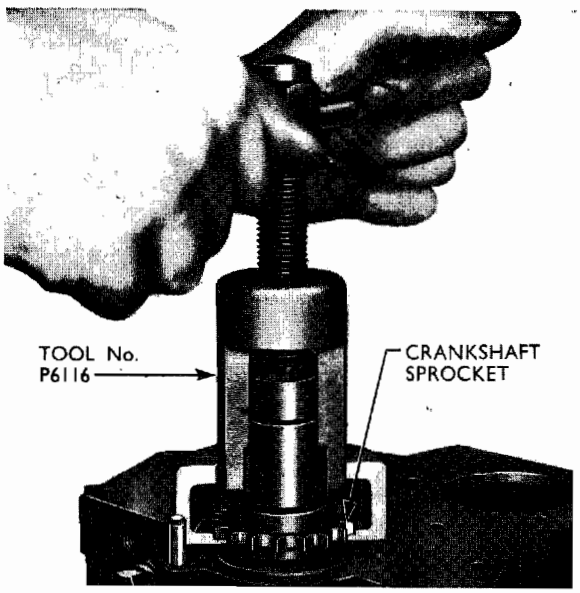


Fig. 12
Removing the Crankshaft Sprocket

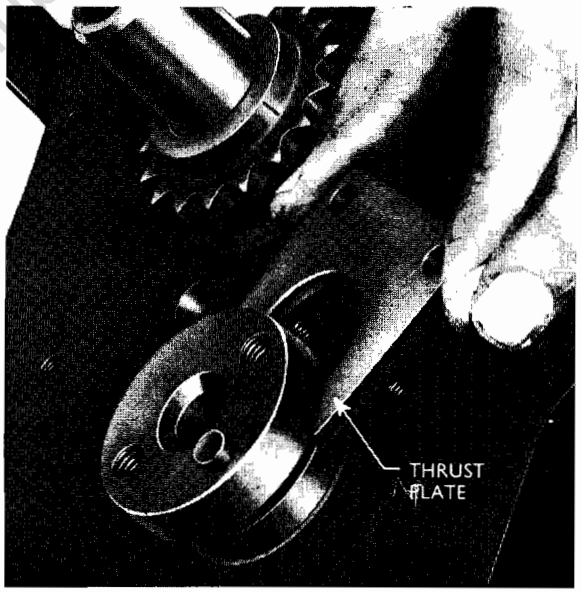


Fig. 13
Removing the Camshaft Thrust Plate

NOTE.—Two of these bolts are dowel bolts, and can be identified by the machined shanks.

8. (*a*) **Detach the clutch assembly** (a compressor is not required). Unscrew the pressure plate bolts evenly and detach the pressure plate and clutch disc. Note that the clutch pressure plate is located by three dowels on the face of the flywheel.

(*b*) **Remove the flywheel.** This is secured by four bolts and a locking plate, and is located by a sleeve and dowel in the crankshaft rear flange. Bend back the tabs on the locking plate, unscrew the bolts and gently tap the flywheel off the crankshaft flange.

NOTE.—The ring gear is normally serviced as an assembly with the flywheel. In no circumstances should pressure be applied in an attempt to dismantle the gear for repositioning on the flywheel.

9. Detach the engine rear plate. Unscrew the one bolt and spring washer and detach the rear plate from the tubular dowels.

10. Remove the timing chain tensioner. Unscrew the two bolts, then remove the bracket. The tensioner arm may then be detached from the pivot pin (see Fig. 11).

11. (*a*) **Remove the camshaft sprocket and chain.** Bend back the camshaft sprocket locking plate tabs and unscrew the two retaining bolts. Remove the locking plate and pull the camshaft sprocket off its locating dowel on the camshaft flange. Detach the timing chain from the crankshaft sprocket.

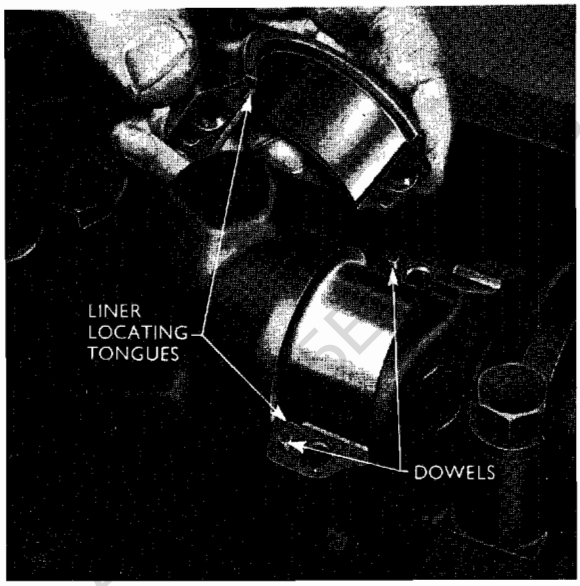


Fig. 14
A Connecting Rod and Cap

(*b*) **Remove the crankshaft sprocket,** using Tool No. P.6116, shown in Fig. 12, and remove the crankshaft sprocket key.

(*c*) **Remove the camshaft and thrust plate.** Bend back the thrust plate bolt locking tabs, unscrew the two bolts and withdraw the thrust plate from the groove behind the camshaft flange. Set the engine vertically on the stand, rotate the camshaft to fully lift the tappets and withdraw the camshaft. Remove the tappets from the cylinder block noting their correct locations. Instructions for camshaft bush replacement commence on continuation sheet 5.

Fig. 15
Main Bearing Cap and Liner

12. (*a*) **Withdraw the piston and connecting rod assemblies.** Release the locking tabs on the big end bolts, unscrew the bolts two to three threads and tap them to release each connecting rod from its cap. Each cap is located on its rod by dowels (see Fig. 14). Finally, completely remove the bolts and detach the big end caps. Push the pistons along the cylinder bores and withdraw the assemblies.

(*b*) **Dismantle the piston and connecting rod assemblies.** First remove the piston rings. Extract the two piston pin circlips and push the pin out of each piston. It may be necessary to warm the pistons slightly by immersing in hot water or oil to enable the piston pins to be removed.

13. (*a*) **Check that each main bearing cap is marked correctly** for its location on the cylinder block. Unscrew the bearing cap bolts evenly and lift off each cap.

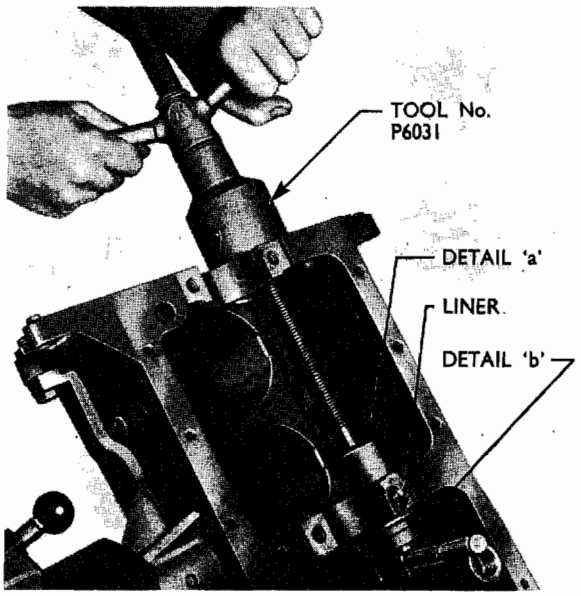


Fig. 16
Fitting Camshaft Bearing Liners

(*b*) **Lift out the crankshaft.** Two half thrust washers are located, one on either side of the centre main bearing journal, in the cylinder block ; these can now be withdrawn. Remove the bearing liners.

14. Remove the crankshaft rear bearing oil seal. Unscrew the four bolts securing the oil seal housing to the cylinder block and detach the housing and gasket. Note that the two lower bolts in the housing are dowelled to ensure correct alignment.

15. If necessary, dismantle the oil pump inlet pipe and relief valve return pipe from the cylinder block.

To remove the inlet pipe, straighten the tab on the washer, unscrew the union nut and withdraw the pipe. The filter screen can be removed after relieving the swaging on the cover.

The return pipe is a press fit in the block.

To Reassemble

Before reassembling the engine, the cylinder block and all components should be thoroughly cleaned, and all oil-ways checked to ensure that they are clear. All wearing parts should be dimensionally checked against the Specification at the end of this Bulletin and new parts selected where necessary.

All gaskets, oil seals and locking plates must be renewed.

Prepare the two halves of the rear main bearing oil seal by coating them with graphite paste. In no circumstances should this oil seal be fitted dry, otherwise the crankshaft bearing surface may be scored.

1. Fit new camshaft bearing liners (using Tool No. P.6031 with adaptor set P.6031–3), shown in Fig. 16, if those at present fitted require replacement. Ensure that the oil holes in the liners and cylinder block are correctly aligned before fitting the liners.

2. (*a*) **Replace the valve tappets.** Set the engine vertically on the stand and insert the tappets in the bores from which they were originally removed.

(*b*) **Slide the camshaft into position** after ensuring that all tappets are clear. Take care not to damage the edges of the bearing liners or the journals and cams of the camshaft. Rotate the camshaft to ensure that it revolves freely in its bearings after fitting.

(*c*) **Locate the camshaft thrust plate** in the camshaft groove and secure it to the cylinder block with the locking plate and two retaining bolts. Check the camshaft end-float. This should be between 0.002 and 0.007 in. (0.051 and 0.18 mm.).

If the camshaft end-float is correct, bend up the locking tabs to secure the retaining bolts. If end-float is incorrect, renew the camshaft thrust plate.

3. (*a*) **Turn the engine on the stand** so that the crankcase is upwards.

(*b*) **Fit the crankshaft rear bearing oil seal** to its housing, ensure that it is pressed fully home and that the ends of the seal protrude $\frac{1}{32}$ in. (0.79 mm.) above the face of the housing.

(*c*) **Fit a new oil seal housing gasket** to the rear face of the cylinder block and secure the housing to the block with four spring washers and the correct bolts, see Fig. 18. Note that the two bolts adjacent to the sump flange are dowel bolts to ensure correct alignment and these must be "nipped" first. Equally tighten the four bolts.

4. (*a*) **Position the upper halves of the main bearing liners** in their block locations. Wipe clean the liner locations in the block and fit the liners so that the locating tongues engage the machined locating grooves, see Fig. 18.

Lightly oil the main bearing liners **after** they have been fitted to the cylinder block.

NOTE.—An oil feed is provided to the crankshaft rear thrust washer. The centre main bearing cap is provided with a 30° chamfer 0.03 in. (0.76 mm.) to 0.04 in. (1.02 mm.) thick between the bearing locating notch and the rear face of the cap.

Oil is fed into the groove formed by this chamfer through a "vee" notch 0.07 in. (1.78 mm.) deep in the oilway at the locating tab end of the liner.

(*b*) **Replace the crankshaft** in the cylinder block and fit new end-float thrust washers. The thrust washers locate in recesses on either side of the main bearing in the cylinder block and should be fitted with the oil grooves facing the crankshaft flange. (See Fig. 19.) Check the crankshaft end-float which should be 0.003 to 0.011 in. (0.076 to 0.279 mm.).

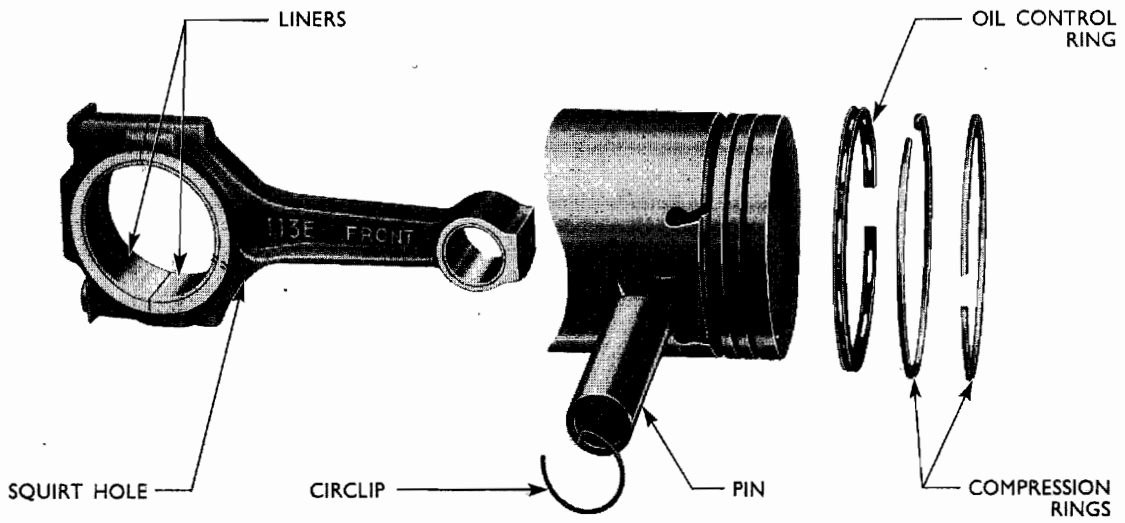


Fig. 17
A Connecting Rod and Piston Assembly (Exploded)

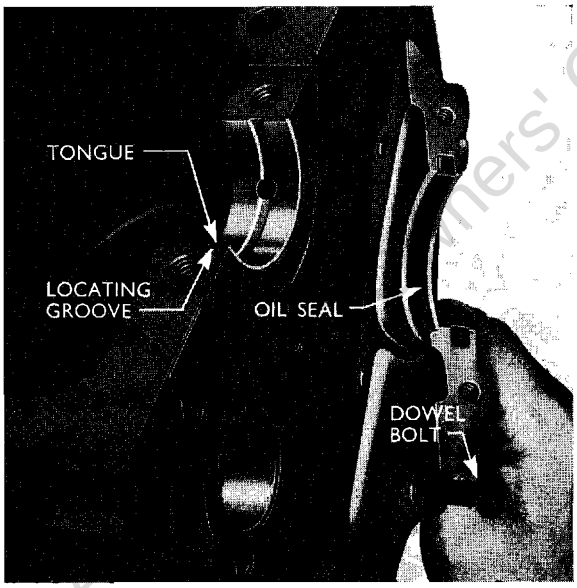


Fig. 18
The Crankshaft Rear Oil Seal

(*c*) **Clean and position the lower halves of the main bearing liners** in the appropriate caps, engaging the locating tongues in the machined locating grooves.

Refit the main bearing caps in accordance with the mating marks and with the cast arrows pointing to the front of the engine. Tighten the cap bolts to the correct torque (see Specification), and check crankshaft rotation.

5. Select pistons for the individual bores. Each piston should be fitted to its individual cylinder bore by direct measurement.

The cylinder bores are measured in production at a point 1.56 in. (3.96 cm.) from the top face of the cylinder block across the axis of the crankshaft. Grade numbers are stamped in accordance with the sizes at the end of this Bulletin. Pistons are also graded and stamped on the crown with the appropriate grade number.

Pistons of the same grade number are fitted to the appropriate bore. This gives the specified fit of 0.0008 to 0.0014 in. (0.0203 to 0.0356 mm.) clearance when measured at the grading plane, which is 0.74 in. (1.8796 cm.) from bottom of piston on major axis.

When re-boring cylinders in service, to suit oversize pistons, it is essential that each cylinder bore is machined to suit the individual piston to give the specified fit. The piston skirt measurement at right angles to the piston pin holes must be measured accurately, the maximum measurement being taken as the piston skirt is cam ground.

6. Piston Fit. Pistons (rings not fitted) are to be fitted to cylinder bores so that when a steel feeler blade ½ in. (12.7 mm.) wide and 0.0015 in. (0.038 mm.) thick is inserted between the piston, (at right angles to the axis of the piston pin) and the cylinder wall, a pull of 3 to 7 lbs. (1.36 to 3.18 kg.) is required to remove the blade.

The feeler must project, inside the bore, farther than the piston.

(i) Insert the 0.0015 in. (0.038 mm.) feeler blade (supplied with the pull scale, Tool No. 512), together with the piston, into the bore in which it is to operate, positioning the blade at right angles to the centre line of the piston pin (see Fig. 17). Holding the connecting rod as shown in Fig. 20, apply a steady pull to the piston scale, observing the poundage required to remove the feeler blade.

(ii) Select a piston for each bore to give a pull of between 3 and 7 lbs. (1.36 to 3.18 kg.).

Locate the piston compression and oil control rings in the unworn portion of the cylinder bore and check the ring gaps, which should be between 0.009 to 0.014 in. (0.229 to 0.356 mm.).

Check piston ring to groove clearances, which should be as follows :—

Top compression ring Lower compression ring	0.0016 to 0.0036 in. (0.0406 to 0.0914 mm.)
Oil control ring	0.0018 to 0.0038 in. (0.0457 to 0.0965 mm.)

Fit a circlip in position in one of the piston pin bosses and locate the connecting rod in the piston with the marking FRONT on the connecting rod on the same side of the assembly as the arrow mark in the piston crown. Heat the piston in water or oil and slide the piston pin through the pin bosses and connecting rod small end until it abuts the circlip already fitted. Fit the second circlip.

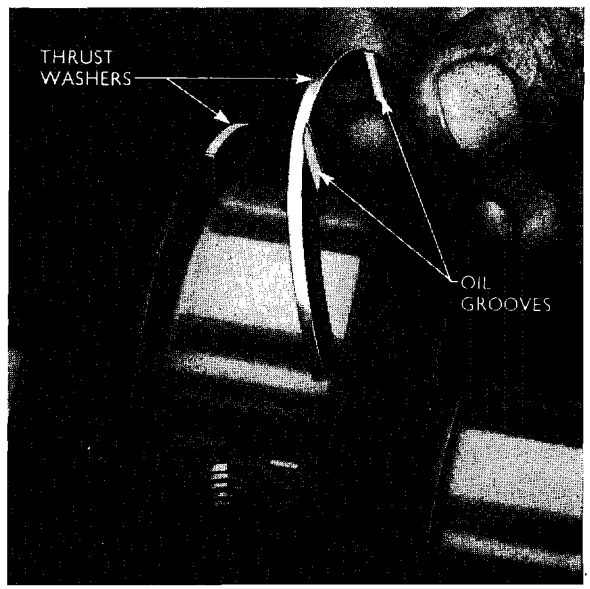


Fig. 19
The Crankshaft Thrust Washers

Assemble the piston rings, noting that the compression rings are marked TOP and that the upper compression ring is chromium plated. The lower compression ring is " stepped " on the bottom face. This " step " must face the piston skirt on assembly. Space the ring gaps at 120°.

Fit the piston and connecting rod assemblies to the appropriate bores, with the arrow on the crown of each piston pointing towards the front of the engine. Compress the piston rings using the ring squeezer, Tool No. P.6108 and push each piston down its cylinder bore.

7. (*a*) **Fit the connecting rod liners,** locating the tabs of the liners in the machined grooves of the rod and cap. Check that the oil hole in the upper half of each liner coincides with the oil squirt hole in the connecting rod.

(*b*) **Turn the crankshaft** as necessary to fit the connecting rod big ends to the crank pins. Locate the big end caps on the connecting rod dowels, fit new locking plates to the connecting rod bolts and enter the bolts into the connecting rod. Tap the big end caps right home on the dowels and tighten the connecting rod bolts to the correct torque, see Specification.

Lock the bolts with the tabs on the locking washers.

Check rotation of engine.

8. (*a*) **Fit the crankshaft** key and sprocket to the front end of the crankshaft, pressing the sprocket into position, timing mark face to the front, using the sprocket replacer, Tool No. P.6032.

(*b*) **Turn the crankshaft** until the marked tooth of the sprocket is on the centre line between the crankshaft and camshaft centres (see Fig. 21) and temporarily fit the camshaft sprocket on the dowel. Turn the camshaft until the marked tooth is on the centre line between the two sprockets, then again remove the camshaft sprocket.

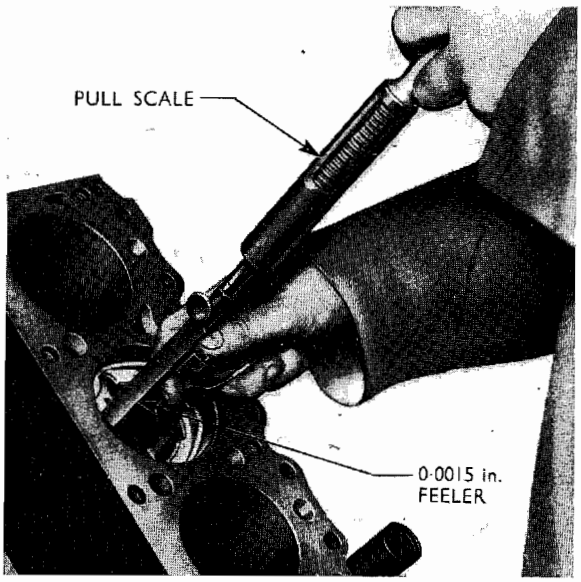


Fig. 20
Checking Piston Fit

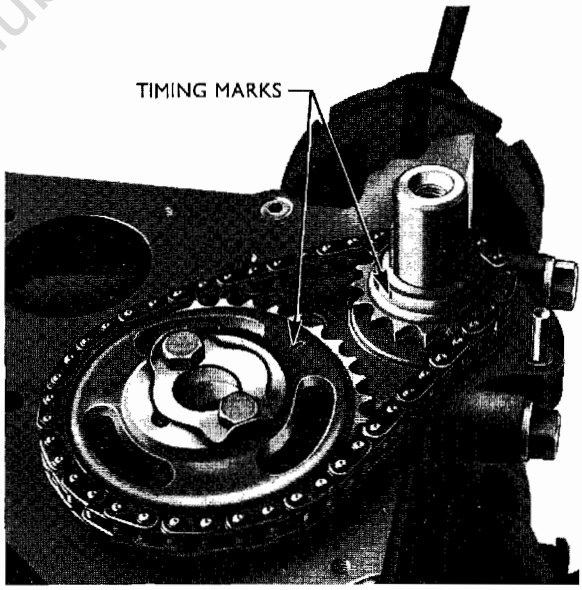


Fig. 21
Valve Timing Mark Locations

(*c*) **Fit the timing chain** around the camshaft sprocket, locate the chain around the crankshaft sprocket and fit the camshaft sprocket to the camshaft boss. Check that the timing marks are towards the centre and in line as illustrated in Fig. 21.

(*d*) **Fit the locking plate** and retaining bolts to the camshaft sprocket. Tighten the bolts securely and bend up the locking plate tabs.

9. **Position the tensioner arm** on the hinge pin on the front main bearing cap and secure the timing chain tensioner to the cylinder block with two bolts and two spring washers. (On initial assembly, tension will have been applied to the cam spring by rotating the spring approximately two and a half turns from the " free " position.)

10. (*a*) **Renew the crankshaft front oil seal.** Extract the old seal carefully, taking care not to damage the cover and use Tool No. P.6111 to press the new seal into the cover so that the lipped edge is inwards. Support the cover adequately around the oil seal location when pressing in the seal to avoid distortion. Fit the oil slinger to the crankshaft so that the outer circumference is dished towards the timing cover and the crankshaft pulley.

(*b*) **Replace the cylinder front cover** and gasket. Position the gasket on the cylinder block face, fit the cover and secure it in place with the retaining screws and spring washers. Note that the two dowel bolts should be fitted and " nipped " first.

11. (*a*) **Replace the oil pump inlet pipe** (if removed). Fit a new tab washer (see Fig. 22) to the union nut, also ensure that this pipe is located so that the filter screen housing will not foul the sump baffles. Securely tighten the union retaining it in place with a tab on the washer.

(*b*) **Fit new gaskets on the block flange,** taking care that the tongues on the gaskets are correctly located at the front and rear of the block. Fit the cork packing strip at the front and, at the rear, the rear main bearing seal in its location in the end of the sump.

NOTE.—The two sump gaskets should enter the recess for the cork packing in the front cover and abut the crankshaft at the rear. The gaskets will then be " nipped " by the cork packing strip at the front end of the engine, and by the rear main bearing seal at the rear end.

(*c*) **Refit the sump** securing it in place with the retaining bolts, lockwashers and flat washers.

12. Locate the rear engine plate on the tubular dowels and secure it to the cylinder block with one bolt and lockwasher.

13. (*a*) **Refit the flywheel** complete with locating sleeve (see Fig. 24), after first checking that the pilot bearing is in the crankshaft end and that the mounting flange and crankshaft flange are clean and free from burrs. Locate the flywheel squarely upon the dowel in the crankshaft flange, tap it into place, fit the locking plate and retaining bolts tightening them evenly to the correct torque (see Specification).

(*b*) **Check the flywheel run-out,** using the gauge Tool No. P.4008 at the rim, and on the clutch face adjacent to the rim. The flywheel run-out should not exceed 0.0006 in. (0.153 mm.) total indicator reading.

If the flywheel run-out is within the limit, bend up the locking plate tabs to secure the retaining bolts, if the run-out is incorrect, remove the flywheel and check its mounting faces and the crankshaft flange for dirt or burrs.

(*c*) **Replace the clutch assembly** on the flywheel. Fit the clutch disc with the hub assembly away from the flywheel using the locating Tool No. P.7091.

(*d*) **Locate the clutch pressure plate assembly** on the three dowels on the flywheel, and enter the securing bolts and spring washers. Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.658 to 2.073 kg.m.), then remove the clutch disc locator.

14. Valve Replacement. Where it is necessary to fit valve inserts, a suitable drift must be made to the dimensions given in Fig. 25. The insert must be pressed squarely into position, and it may therefore be found advantageous to extend the end of the drift into the valve stem guide. Valve seat inserts are serviced for both inlet and exhaust valves.

The recesses for the replacement valve seat inserts should be cut in the cylinder head to the dimensions given in the table at the end of this Bulletin. It should not be necessary to freeze the inserts before fitting.

(*a*) **Fit replacement inserts if required.** Enter the insert in the recess, chamfered edge first, and press it into position with the appropriate tool.

Valve guide bores are machined direct in the cylinder head and to compensate for wear, valves with stems 0.003 in. (0.076 mm.) and 0.015 in. (0.351 mm.) oversize are available in service ; this oversize is marked on the valve stem. To enable the 0.015 in. (0.38 mm.) oversize valves to be fitted it is necessary to ream the valve guide bores.

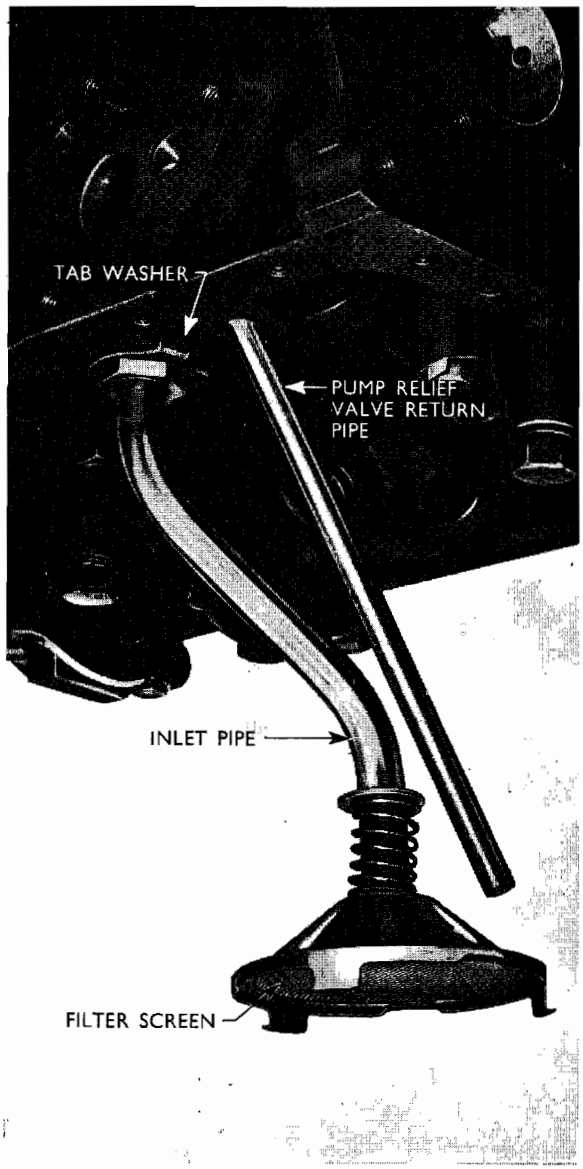


Fig. 22
Oil Pump Inlet and Return Pipes

(*b*) If it is required to ream the valve guide bores in the cylinder head, this should be carried out with Tool No. P.6056. A reamer is supplied 0.015 in. (0.381 mm.) oversize with a standard size pilot. A small tap wrench should be used with the reamer and care should be taken to ream in line with the existing bore.

(*c*) After reaming, recut the valve seats in line with the valve guide bores.

(*d*) Reassemble the valves after regrinding and cleaning the valve seats, etc. Lubricate each valve stem, and pass the valve stem through the appropriate valve port into position against the seat. Fit the umbrella type oil seals to the valve stems with the open ends to the head.

(*e*) Place the valve springs in position around the valves and fit a valve spring seat on the top of each valve spring.

(*f*) Compress the valve springs and place the split taper collets in the top groove of each valve stem with the tapers engaging in the tapered valve spring seat (see Fig. 23).

15. (*a*) **Refit the cylinder head and gasket.** Check the head and block faces for burrs, etc., and locate the cylinder head gasket in position steel face downwards with the water port holes in the block and gasket in line. Screw the locating studs PT.4063 into diagonally opposite bolt holes on the block face to locate the cylinder head gasket (see Fig. 26).

(*b*) **Install the cylinder head assembly** and refit the cylinder head bolts before removing the locating studs. Tighten down the head bolts evenly a little at a time, working outwards from the centre in the order shown in Fig. 27. Finally tighten the bolts down to the correct torque, see Specification.

Fig. 24
Refitting the Flywheel

16. Reassemble the rocker shaft. Note that the rocker arms are " handed " and if the original parts are being refitted they should be assembled in the locations from which they were originally removed, see continuation sheet 4. Each rocker arm must abut

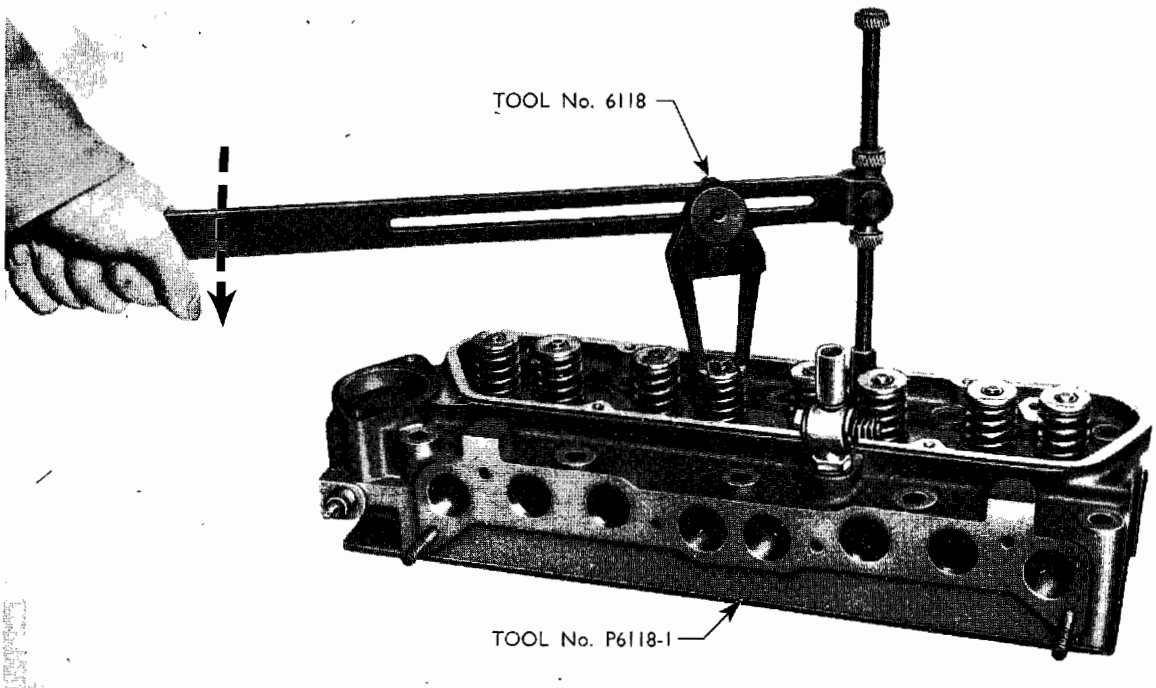
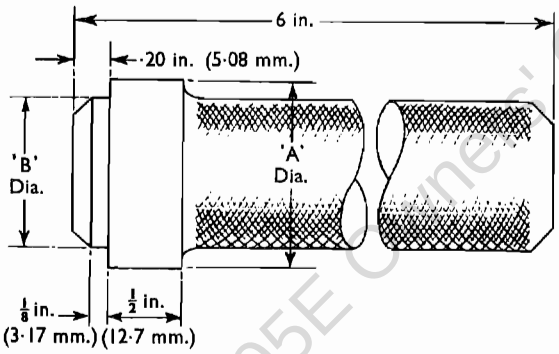


Fig. 23
Removing and Replacing Valve Cotters



Valve	'A' Dia.	B' Dia.
Inlet	1·41 in. (35·80 mm.)	1·14 in. (28·96 mm.)
Exhaust	1·26 in. (32 mm.)	1·03 in. (26·16 mm.)

Fig. 25
Valve Seat Insert Replacer Tool

a support with a compression spring between the rocker arms, except at each end, where the rocker arm is held against the support by two thrust washers and a spring cup washer.

(*a*) Build up the rocker shaft assembly, first fitting a split pin in the hole at one end of the shaft. Fit a flat washer, spring cup washer and another flat washer on the shaft to abut the split pin, slide a rocker arm onto the shaft followed by a rocker shaft support. The bolt hole through the rocker shaft support must be on the same side as the valve stem adjuster.

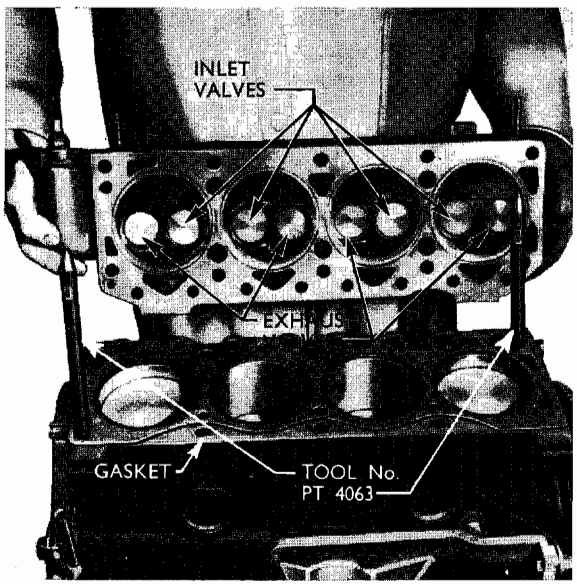


Fig. 26
Refitting the Cylinder Head

(*b*) Next fit a rocker, spring and rocker followed by a support and complete the assembly in this manner.

(*c*) After the last rocker arm has been fitted, fit a flat washer, spring cup washer and another flat washer on the shaft securing them in place with a split pin.

(*d*) **Locate the push rods** in the push rod bores, ball ends first, to engage in the cupped tappet ends. Place the rocker shaft assembly on the cylinder head, ensuring that the cupped ends of the push rods correctly engage with the adjusters, fit and tighten the rocker shaft retaining bolts evenly to the correct torque.

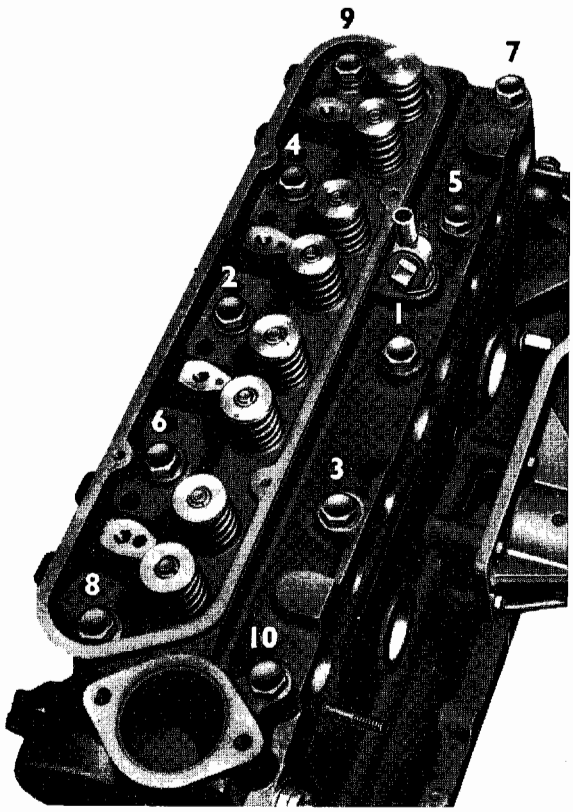


Fig. 27
Cylinder Head Tightening Sequence

(*e*) **Adjust the valve clearances.** The clearances must initially be set with the engine cold, to give a gap of 0.008 in. (0.203 mm.) inlet, and 0.018 in. (0.475 mm.) exhaust.

For valve clearances when the engine is at normal operating temperature, see Specification.

To check valve clearances turn the crankshaft until the valves given in the first column are fully

open, when the valves shown in the second column may be checked and adjusted as required :

Valves Open	*Valves to Adjust*
1 and 6	3 and 8
3 and 8	1 and 6
2 and 4	5 and 7
5 and 7	2 and 4

To adjust a rocker, slacken off the adjusting screw locknut and insert a feeler blade between the toe of the rocker and the valve end (see Fig. 29). Turn the adjusting screw until the correct clearance has been obtained and tighten the locknut. Recheck the gap after tightening the locknut.

NOTE.—The clearance must again be checked and readjusted if necessary, when the engine is at its normal operating temperature.

17. Replace the water pump, noting that one of the retaining bolts also secures the timing cover in position.

18. Replace the crankshaft pulley, aligning the pulley slot with crankshaft key. Replace the pulley securing bolt, lock and flat washers, and tighten securely.

19. Retime the ignition

(*a*) Turn the engine until the timing mark on the crankshaft pulley is in line with the lower or outer pointer on the timing cover with number one piston on compression stroke (check by observing valve positions or by feeling compression at No. 1 cylinder spark plug hole) (see Fig. 30).

(*b*) Fit the distributor into position so that the rotor is pointing towards No. 1 segment in the distributor cap with the contact breaker points just

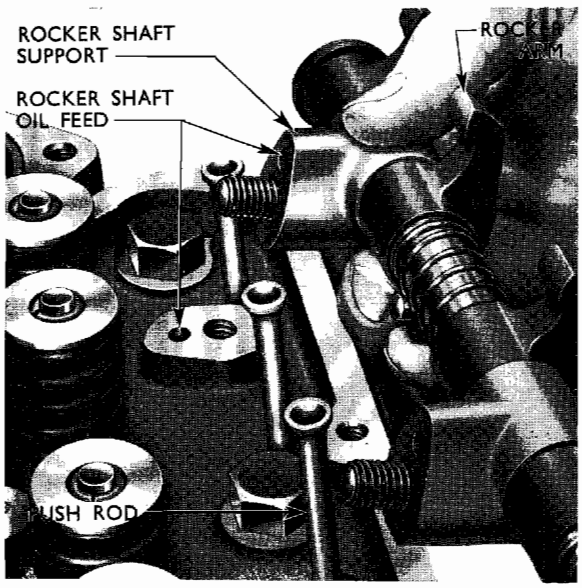


Fig. 28
Assembling the Rocker Shaft to the Cylinder Head

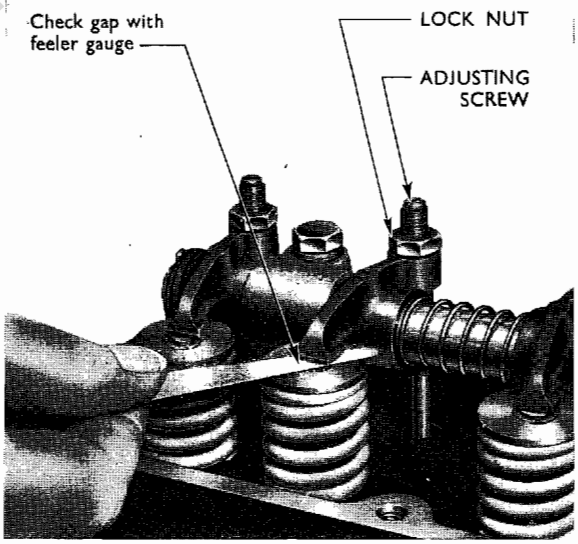


Fig. 29
Adjusting Valve Clearances

opening. To allow for the helical gear drive, first set the distributor with the tip of the rotor adjacent to the low tension terminal and the vacuum unit spindle parallel to the cylinder block, see Fig. 30. Secure the distributor to the cylinder block with one bolt and lockwasher through the clamp plate.

NOTE.—Two distributors are available for high and low compression engines. Check distributor type, see " Distributor Repair Procedure Bulletin " Section 10.

(*c*) Slacken the body clamp bolt, take up any lost motion in the drive and adjust the distributor body so that the contact breaker points are just opening. Tighten the clamp bolt to secure the body in this position.

20. (*a*) **Refit the fuel pump.** Locate a new gasket on the fuel pump and secure the pump to the cylinder block with two bolts and lockwashers.

(*b*) **Refit the oil pressure gauge unit.**

(*c*) **Refit the inlet and exhaust manifold** assembly. A gasket is fitted at this location and the manifold faces should be coated with a suitable sealer. Locate the manifold on the two studs at the front and rear of the cylinder head, fit a flat washer and a new self-locking nut to each stud. Secure the manifold to the cylinder head with flat washers, lockwashers and securing bolts at the other locations.

(*d*) **Insert the thermostat** in the cylinder head water outlet, position the new gasket and refit the water outlet connection, two bolts and lockwashers.

(*e*) **Lift the engine from the universal stand** and remove the support bracket from the engine.

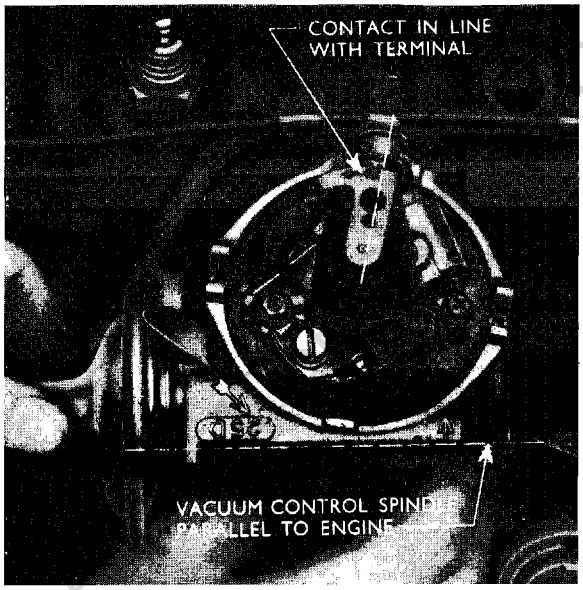


Fig. 30
Fitting the Distributor

(*f*) **Refit the generator,** adjusting the fan belt tension so that there is $\frac{1}{2}$ in. (12.7 mm.) total movement between the generator and water pump pulleys.

(*g*) **Refit the engine mountings** to the cylinder block and refit the drain tap.

(*h*) **Position the oil pump gasket** on the cylinder block and fit the oil pump and filter assembly, securing it in place with three bolts and lockwashers.

To Refit the Engine

1. To prevent the engine rear plate from being dislodged from the two tubular dowels, temporarily secure the rear plate to the cylinder block with two bolts and nuts. Fit the bolts through the hole above each tubular dowel with the bolt head facing **forwards** and secure with a nut. When the engine unit has been located securely on the main drive gear, these nuts and bolts can be removed, see operation 2.

2. Raise the engine by the lifting bracket Tool No. P.6115A and suitable lifting tackle, and lower it into the engine compartment, locate the unit on the main drive gear, ensuring that the tubular dowels are correctly located in the clutch housing and fit the clutch housing bolts.

3. Secure the engine mounting to the cross-member with a bolt and flat washer in each mounting.

4. Refit the starter motor to the gearbox, securing it in place with the lower mounting bolt. Reconnect the lead to the starter motor terminal.

5. Remove the engine lifting bracket, Tool No. P.6115A, and replace the second and fourth cylinder head bolts, tightening them to the correct torque.

6. Fit a new carburettor gasket to the carburettor flange, fit the carburettor securing it in place with two nuts and a lockwasher.

7. Reconnect the throttle linkage and choke control cable to the carburettor. Refit the rocker cover and gasket.

8. Reconnect the leads to the "D" and "F" terminals of the generator and the lead to the temperature gauge sender unit.

9. Inspect the rocker cover gasket and, if necessary, renew. Replace the rocker cover, tightening the four retaining screws securely.

10. Fit the air cleaner. Two types of air cleaner are fitted in production, the "wetted" gauze and "paper element" type. Both types are fitted to the carburettor body and located with the spout pointing forward and to the left. Secure to the carburettor with a hose clamp and to the support with a bolt and spring washer.

11. Connect up the heater hoses. The upper hose on the heater box must be attached to the connection on the cylinder head, the lower hose must be coupled to the connection on the water pump. Tighten the hose clamp securely.

12. Reconnect the lead to the oil pressure switch unit.

13. Connect up the high tension lead to the distributor cap, also the low tension lead to the contact breaker terminal of the distributor. Refit the distributor cap and secure with the two clips.

14. Fit Nos. 2 and 3 spark plugs complete with copper washers and tighten securely. Couple the plug leads to their respective plugs.

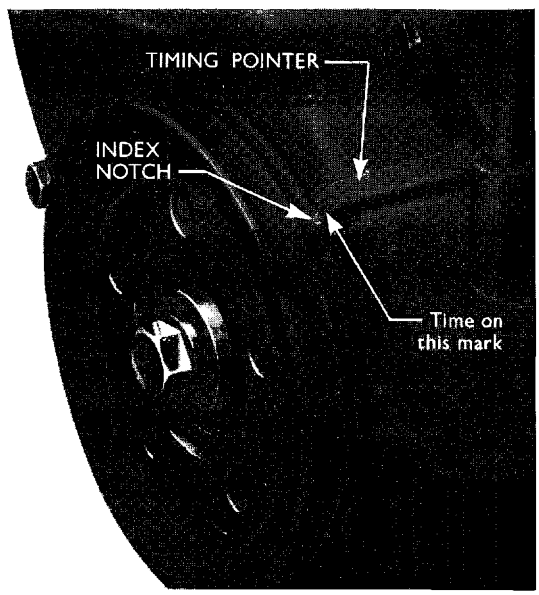


Fig. 31
Correct Engine Timing Position

15. Insert the starter motor upper mounting bolt and tighten this bolt and the lower bolt already fitted.

16. Connect up the fuel inlet pipe to the fuel pump, locate the engine breather pipe and secure to the clutch housing with a bolt and spring washer.

17. Refit the radiator securing it with four bolts and spring washers. Fit the upper and lower radiator hoses and tighten the hose clamps.

18. Refill the radiator with coolant, and refill the engine with the correct grade of engine oil (see Specification). Connect up the battery.

19. Run the engine and check for oil or water leaks. If satisfactory, locate the engine splash shield and secure with eight self-tapping screws and washers. Refit the sump shield (where fitted).

20. Replace the bonnet. Locate the bonnet on the bonnet hinges and loosely secure with four bolts, flat washers and spring washers. Close the bonnet and align it with the bonnet lock and adjacent bodywork. Open the bonnet and tighten the four retaining bolts securely. Check bonnet and release mechanism operation.

21. Jack up the car, remove the stands and lower the car to the ground.

22. Run the engine and carry out any minor adjustments that are necessary.

SPECIFICATIONS, SERVICING AND REPAIR DATA

General

Type	4 cylinder-in-line O.H.V.
Bore	3.1875 in. (80.96 mm.)
Stroke	2.29 in. (58.17 mm.)
Cubic capacity	73.09 cu. in. (1,197.8 c.c.)
Compression ratio	8.7 : 1 Standard 7.3 : 1 Optional
Maximum brake horsepower	48.5 at 4,800 r.p.m. (8.7 : 1) 46 at 4,800 r.p.m. (7.3 : 1)
Maximum torque	63 lb. ft. at 2,700 r.p.m. (8.7 : 1) 60 lb. ft. at 2,700 r.p.m. (7.3 : 1)
Firing order	1, 2, 4, 3
Location of No. 1 cylinder	Next to radiator
Engine mounting	3-point suspension on shear type bonded rubber mounting
Compression pressures	175 lb/sq. in. (12.3 kg/sq. cm.) at 400 r.p.m.

Camshaft

Material	Special Ford cast iron alloy
Bearings	Steel shell, babbitt-faced
Journal diameter	1.5600 to 1.5605 in. (3.962 to 3.963 cm.)
Bearing—inside diameter	1.5615 to 1.5620 in. (3.966 to 3.967 cm.)
Bearing length—Front	0.75 in. (1.90 cm.)
—Centre	0.64 in. (1.63 cm.)
—Rear	0.75 in. (1.90 cm.)
Bearing clearance	0.001 to 0.002 in. (0.025 to 0.51 mm.)
End-float	0.002 to 0.007 in. (0.051 to 0.178 mm.)
Thrust plate thickness	0.176 to 0.178 in. (447 to 452 mm.)
Drive	Single roller chain, with tensioner
Sprocket location	Offset dowel and two bolts
Maximum cam lift—Inlet	0.2108 in. (0.535 cm.)
—Exhaust	0.2176 in. (0.5523 cm.)
Cam heel to toe dimension	Inlet .. 0.77082 in. (19.581 mm.) Exhaust .. 0.76762 in. (19.494 mm.)

Connecting Rods

Type	"H" section
Length between centres	4.419 to 4.421 in. (11.22 to 11.23 cm.)
Big end bearings	Sintered copper/lead or lead/bronze, steel backed with 0.001 in. thick lead overlay
Big end bore (housing)	2.0830 to 2.0825 in. (5.2908 to 5.2894 cm.)
Big end bearing inside diameter	1.9380 to 1.9392 in. (4.9223 to 4.9256 cm.)
Crankpin to bearing clearance	0.0005 to 0.00022 in. (0.0127 to 0.056 mm.)

Effective bearing length	0.83 to 0.87 in. (2.11 to 2.21 cm.)
Small end bush	Steel backed bronze
Small end bush inside diameter	0.8122 to 0.8125 in. (2.0626 to 2.0629 cm.)
Piston pin to small end clearance	0.0001 to 0.0003 in. (0.0025 to 0.0076 mm.) selective
End-float on crankpin	0.004 to 0.010 in. (0.102 to 0.254 mm.)

Crankshaft and Main Bearings

Crankpin journal length	1.062 to 1.066 in. (2.698 to 2.708 cm.)
Main journal length—Front	1.219 to 1.239 in. (3.096 to 3.047 cm.)
—Centre	1.247 to 1.249 in. (3.168 to 3.173 cm.)
—Rear	1.358 to 1.368 in. (3.450 to 3.474 cm.)
Crankpin journal diameter	1.9370 to 1.9375 in. (4.9200 to 4.9213 cm.)
Main bearing journal diameter	2.1255 to 2.1260 in. (5.3988 to 5.4000 cm.)
Regrind diameters	0.010 in. (0.254 mm.), 0.020 in. (0.508 mm.), 0.030 in. (0.762 mm.) undersize
Block bore for bearing liners	2.2710 to 2.2715 in. (5.768 to 5.77 cm.)
Main bearing liner wall thickness	0.0719 to 0.0722 in. (1.8259 to 1.8354 mm.)
Main bearing clearance	0.0005 to 0.0022 in. (0.0127 to 0.056 mm.)
Crankshaft end-float	0.003 to 0.011 in. (0.076 to 0.279 mm.)
End-float thrust washer thickness	0.091 to 0.093 in. (2.31 to 2.36 mm.)
Overall length	19.505 in. (98.26 cm.)

Cylinder Block

Type	Cylinder cast integral with top half of crankcase
Water jackets	Full length
Lubrication	Pressure feed
Pressure fed bearings	Main, camshaft and connecting rods
Reduced pressure fed bearings	Rocker shaft
Piston pin and cylinder wall lubrication	Splash, with squirt holes in connecting rods
Timing chain	Controlled spray
Oil filter	Full flow, incorporated with oil pump
Crankcase ventilation	Oil filler cap and road draught tube

Cylinder Head

Type	Cast iron with vertical valves. Separate inlet and exhaust ports
Combustion chamber	" Bath Tub " type, fully machined

Flywheel and Ring Gear

Type	Ring gear shrunk on
Number of teeth on ring gear	110
Maximum run-out	0.006 in. (0.152 mm.)
Number of flywheel retaining bolts	4
Size	$\frac{3}{8}$ in. × 24 U N F
Clutch pilot bearing—Type	Sintered metal
—Inside diameter	0.6713 to 0.6725 in. (1.7053 to 1.7084 cm.)
—Outside diameter	1.5743 to 1.5753 in. (3.9988 to 4.0013 cm.)
—Length	0.495 to 0.505 in. (1.257 to 1.283 cm.)

Engine Dimensions

Length (fan to flywheel housing)	20.4 in. (51.82 cm.)
Height—Less air cleaner	23.2 in. (58.93 cm.)
—With air cleaner	26.3 in. (66.8 cm.)
Width (to clear)	17.6 in. (44.7 cm.)
Installation angle	2° 31′

Lubrication System

Grade of oil :

Temperature Range	*S.A.E. Viscosity No.*
Summer or Winter	20W
From 32°F. to —10°F.	10W
Below —10°F.	10W × 10% Kerosine or 5W if available

Sump capacity	4 Imp. pints (4.78 U.S. pints, 2.27 litres)
Oil pressure	35 to 40 lb. sq. in. (2.46 to 2.81 kg. per sq. cm.)
Oil filter capacity	0.5 Imp. pint (0.6 U.S. pint, 0.284 litre)
Oil pressure warning light operates at	5 to 7 lb. per sq. in. (0.352 to 0.492 kg. sq. cm.)
Oil filter type	Full flow

Oil Pump

Oil pump type	Vane or eccentric bi-rotor
Capacity	2.5 galls. at 2,000 r.p.m. (2.4 U.S. galls., 9.09 litres)
Housing bore inside diameter	0.500 to 0.501 in. (12.7 to 12.725 mm.)
Oil pump shaft diameter	0.4980 to 0.4985 in. (12.653 to 12.665 mm.)
Shaft to body clearance	0.0015 to 0.003 in. (0.038 to 0.076 mm.)
Clearance between lobes of inner and outer rotors—maximum	0.006 in. (0.152 mm.)
Clearance between outer rotor and housing—maximum	0.010 in. (0.254 mm.)
Shaft end-float—maximum	0.005 in. (0.127 mm.)

Pistons

Type	Aluminium alloy
Number of rings	Two compressing, one oil control
Width of ring grooves :	
Compression rings	0.0796 to 0.0806 in. (2.022 to 2.047 mm.)
Oil control ring	0.1578 to 0.1588 in. (4.008 to 4.034 mm.)
Piston pin—Offset	0.040 in. (1.016 mm.)
—Bore	0.8121 to 0.8124 in. (2.0624 to 2.0631 cm.)
—Diameter	0.8120 to 0.8123 in. (2.0621 to 2.0629 cm.)
Piston pin to piston clearance (selective)	0.000 to 0.0002 in. (0.000 to 0.0051 mm.)

Piston grades :	*Standard Bore*
Grade—1	3.1858 to 3.1861 in. (8.0917 to 8.0925 cm.)
—2	3.1861 to 3.1864 in. (8.0925 to 8.0932 cm.)
—3	3.1864 to 3.1867 in. (8.0932 to 8.0940 cm.)
—4	3.1867 to 3.1870 in. (8.0940 to 8.0948 cm.)
—5	3.1870 to 3.1873 in. (8.0948 to 8.0956 cm.)
—6	3.1873 to 3.1876 in. (8.0956 to 8.0964 c.m)

Piston grades :	0.030 *in.* (0.762 *mm.*) *oversize*
Grade—1	3.2158 to 3.2161 in. (8.1677 to 8.1685 cm.)
—2	3.2161 to 3.2164 in. (8.1685 to 8.1692 cm.)
—3	3.2164 to 3.2167 in. (8.1692 to 8.1700 cm.)
—4	3.2167 to 3.2170 in. (8.1700 to 8.1708 cm.)
—5	3.2170 to 3.2173 in. (8.1708 to 8.1716 cm.)
—6	3.2173 to 3.2176 in. (8.1716 to 8.1724 cm.)

Piston fit — 3 to 7 lb. (1.36 to 3.18 kg.) pull on 0.0015 in. (0.038 mm.) feeler blade, 0.5 in. (12.7 mm.) wide

(Grades 5 and 6 only supplied in service)

Piston Rings

Width—Compression	0.077 to 0.78 in. (1.956 to 1.9811 mm.)
—Oil control	0.155 to 0.156 in. (3.937 to 3.962 mm.)
Ring to groove clearance—Compression	0.0016 to 0.0036 in. (0.041 to 0.091 mm.)
—Oil control	0.0018 to 0.0038 in. (0.046 to 0.097 mm.)
Ring gap	0.009 to 0.014 in. (0.229 to 0.356 mm.)
Ring to wall pressure—Top compression	6.22 to 9.04 lb. (2.822 to 4.100 kg.)
—Lower compression	5.6 to 8.8 lb. (2.54 to 3.992 kg.)
—Oil control	5.35 to 6.90 lb. (2.43 to 3.13 kg.)

Tightening Torques

Cylinder head	65 to 70 lbs. (8.987 to 9.679 kg.m.)
Main bearings	55 to 60 lb. ft. (7.604 to 8.295 kg.m.)
Big end bearings	20 to 25 lb. ft. (2.765 to 3.456 kg.m.)
Flywheel	45 to 50 lb. ft. (6.221 to 6.913 kg.m.)
Manifold nuts/bolts	12 to 15 lb. ft. (1.66 to 2.67 kg.m.)

Valves

Head diameter	1.262 to 1.272 in. (3.205 to 3.231 cm.) inlet
	1.183 to 1.193 in. (3.004 to 3.030 cm.) exhaust
Stem diameter	0.3095 to 0.3105 in. (7.861 to 7.882 mm.) inlet
	0.3086 to 0.3096 in. (7.838 to 7.864 mm.) exhaust
Valve guide bore inside diameter	
Inlet	0.3113 to 0.3125 in. (7.903 to 7.934 mm.)
Exhaust	0.3113 to 0.3125 in. (7.903 to 7.934 mm.)
Stem to guide clearance	0.0008 to 0.003 in. (0.020 to 0.076 mm.) inlet
	0.0017 to 0.0039 in. (0.043 to 0.099 mm.) exhaust
Valve lift	0.315 in. (8.00 mm.) inlet
	0.319 in. (8.10 mm.) exhaust
Valve seat angle (cylinder head and valve)	45° inlet and exhaust
Valve clearance (normal operating temperature)	0.010 in. (0.254 mm.) inlet
	0.017 in. (0.432 mm.) exhaust
Valve clearance (cold)	0.008 in. (0.203 mm.) inlet
	0.018 in. (0.457 mm.) exhaust
Valve springs—free length	1.48 in. (4.57 cm.)
Spring load at fitted length—valve closed	46.5 lb. (21.09 kgs.) at 1.263 in. (32.08 mm.)
Valve timing (at valve clearance of 0.015 in. (0.381 mm.) inlet and 0.027 in. (0.686 mm.) exhaust, cold)	
Inlet opens	17° B.T.D.C.
Inlet closes	51° A.B.D.C.
Exhaust opens	51° B.B.D.C.
Exhaust closes	17° A.T.D.C.

Valve Seat Inserts

Insert	*Valve*	*I.D. of Recess in Head*	*Depth of Recess in Head*
Standard	Inlet	1.4195/1.4200 in. (36.055/36.068 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
	Exhaust	1.2680/1.2685 in. (32.207/32.220 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
0.010 in. (0.254 mm.) o/s dia. std. depth	Inlet	1.4295/1.4300 in. (36.309/36.322 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
	Exhaust	1.2780/1.2785 in. (32.461/32.474 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
0.010 in. (0.254 mm.) o/s dia. and depth	Inlet	1.4295/1.4300 in. (36.309/36.322 mm.)	0.2275/0.2325 in. (5.781/5.904 mm.)
	Exhaust	1.2780/1.2785 in. (32.461/32.474 mm.)	0.2275/0.2325 in. (5.781/5.904 mm.)
0.020 in. (0.508 mm.) o/s dia. std. depth	Inlet	1.4395/1.4400 in. (36.563/36.576 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
	Exhaust	1.2880/1.2885 in. (32.715/32.728 mm.)	0.2175/0.2225 in. (5.521/5.654 mm.)
0.020 in. (0.508 mm.) o/s dia. and depth	Inlet	1.4395/1.4400 in. (36.563/36.576 mm.)	0.2375/0.2425 in. (6.031/6.164 mm.)
	Exhaust	1.2880/1.2885 in. (32.715/32.728 mm.)	0.2375/0.2425 in. (6.031/6.164 mm.)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 7: **GEARBOX—CLUTCH**
Subject: **REPAIR PROCEDURE**
Effective on: New Anglia and Prefect Cars (1959 onwards)

THE GEARBOX

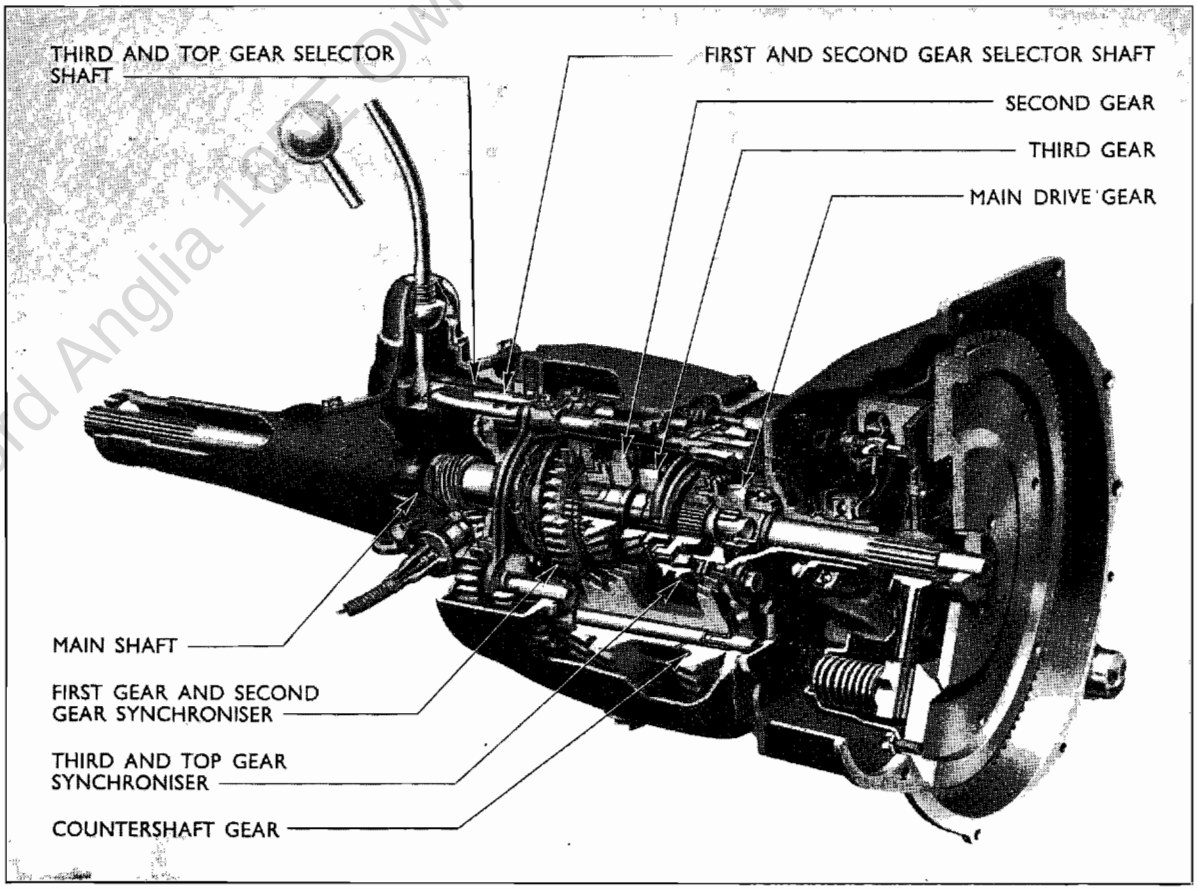


Fig. 1
The Gearbox

INTRODUCTION

The gearbox is of the constant mesh type (see Fig. 1), having four forward gears and one reverse, with synchromesh engagement on second, third and top gears. The constant mesh gears are helical to ensure silent operation.

The main drive gear and mainshaft are mounted on ball bearings, whilst the countershaft and mainshaft spigot are supported on needle rollers. The first gear, which is a spur gear, is also machined to form the second gear synchroniser. The synchroniser assemblies are splined to the mainshaft, whilst the second and third gears are in constant mesh with the corresponding gears on the countershaft gear. They rotate on the mainshaft on bronze bushes.

In neutral, with the engine running, the main drive gear, countershaft gear, and the second and third gears revolve on the mainshaft. The mainshaft, first gear and second gear synchroniser and the third and top gear synchroniser are, of course, stationary.

To engage first, the gear is moved rearwards into mesh with the countershaft gear, so that the power train is from the main drive gear to the front countershaft gear, then through the rear gear to the first gear on the mainshaft as illustrated in Fig. 2.

Second gear is engaged by moving the second gear synchroniser forward so that the internal teeth engage the dog teeth on the gear, so locking the second gear to the mainshaft. Power is then transmitted from the main drive gear to the front

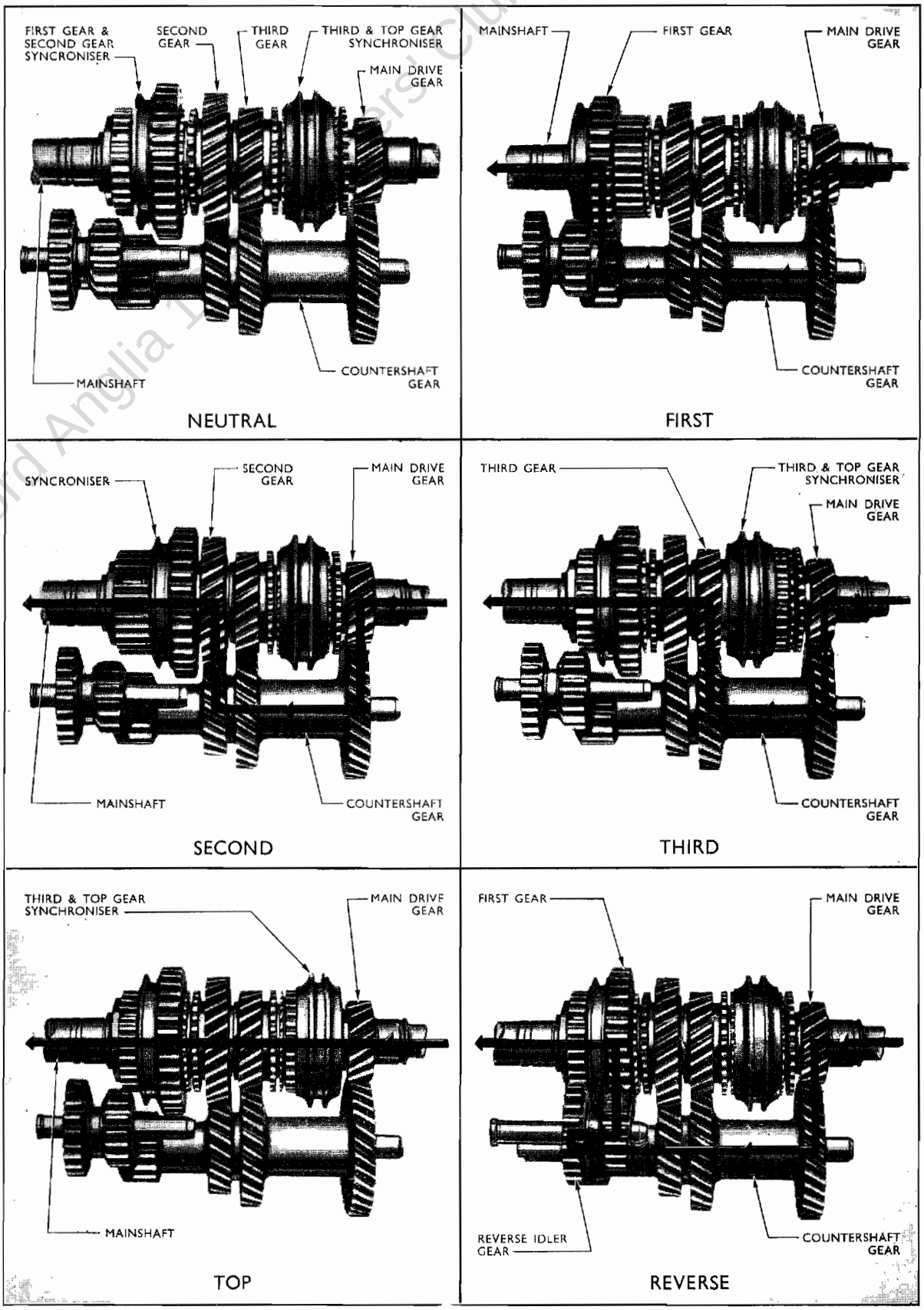


Fig. 2
Power Train Diagrams

countershaft gear, to the second gear, then to the second gear synchroniser and mainshaft.

Third gear is engaged by sliding the sleeve of the third and top gear synchroniser rearwards to engage with the dog teeth on the third gear, so locking it to the mainshaft. The power train is then from the main drive gear to the countershaft gear, to the third gear, third and top speed synchroniser and mainshaft (Fig. 2).

Top gear is direct drive, as shown by Fig. 2, the main drive gear being locked to the mainshaft by the action of the third and top gear synchroniser which has been moved forward so that the internal teeth on the sleeve engage the dog teeth on the main drive gear.

Reverse is engaged by moving the reverse idler gear forward so that the front row of teeth engage with those of the first gear on the mainshaft and the rear row of teeth engage with the countershaft gear. Power will be transmitted from the main drive gear to the countershaft gear, to the reverse idler gear, and then to the first gear and mainshaft (Fig. 2).

The synchroniser assemblies fitted to the second, third and top gears are of the " blocker " type. The hub, splined to the mainshaft, has three inserts or bars supported by two light circular springs, one on each side of the hub, whilst the outer sleeve is splined to the hub. Of the two ends of each circular spring, one is located in a common insert, the other end being free. A bronze blocker ring is interposed between the synchroniser and second gear, having a tapered face to mate with the corresponding face of the second gear.

The blocking ring has dog teeth cut externally on it. It is cut away at three points and these locate the inserts in the synchroniser. Radial clearance, to give approximately half a pitch of the dog teeth on the blocker ring and gear, exists between the slots and inserts. When engaging second gear, the frictional drag which exists between the tapered face of the blocker ring and gear (due to the inserts being pushed forward by the sleeve) will keep one side of the slots against the inserts, so that the dog teeth will be out of line with the teeth on the sleeve. This prevents gear engagement as long as there is any difference in the speeds between the mating cones. As the speeds equalise, however, the blocker ring centralises itself, allowing the sleeve to move fully forward and engage the dog teeth on the second gear.

The third and top gear synchroniser operates on the same principle, and is of similar construction.

Improvements have been incorporated since the introduction of this gearbox. They are:—

(*a*) Increased helix angle on all helical gears.

A table is included in the specification at the end of this Bulletin to identify the former and current gears.

The change affects the main drive gear, cluster gear, second and third gear, and the current and former gears are interchangeable only in complete sets. For this reason the former gears will continue to be serviced.

Since the current and former helical gears are very similar in appearance, care must be taken to ensure that they are not intermixed in service. However, the gears can be identified by the overall length of the teeth, measured along the top of a tooth, which has been increased on the current gears by $\frac{1}{16}$ in. (1.59 mm.) as a result of the increase to the helix angle.

Effective from approximate Engine No. 105*E*–20845

(*b*) Mainshaft assembly, incorporating a nut and spacer to replace three circlips, (two retaining the speedometer driving gear and one locating the rear gearbox bearing) to simplify assembly procedure.

Effective from approximate Engine Nos.:—

105*E*–34518 (*Anglia*)
105*E*–35089 (*Prefect*)

LUBRICATION AND MAINTENANCE

Every 1,000 miles (1,600 km.), remove the combined level and filler plug and check the oil level. This should be up to the bottom of the plug orifice. Add Extreme Pressure oil of the correct grade (see Specification) to correct the level if necessary.

At every 5,000 miles (8,000 km.) interval the gearbox should be drained by removing the drain

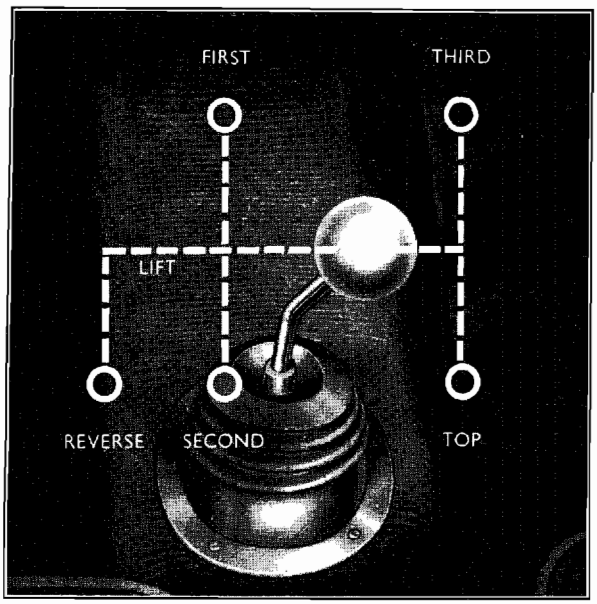


Fig. 3
Gear Lever Positions

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plug, preferably after a run to ensure that the oil is warm and will therefore drain freely. Replace the drain plug and add 1.75 Imp. pints (2.1 U.S. pints, 0.99 litres) of the correct grade Extreme Pressure oil (see Specification) through the level plug orifice. Replace the plug.

To Remove the Gearbox

1. Drain the oil from the gearbox.

2. Disconnect the battery and the lead from the starter motor terminal.

3. Unscrew the two bolts securing the starter motor and remove the motor, allowing it to lie on the engine splash shield.

4. Remove the bolts securing the clutch housing to the cylinder block and then remove the splash shield from the lower half of the flywheel housing.

5. Disconnect the clutch release arm retracting spring, slip the rubber boot off the operating cylinder and remove the retaining circlip from around the cylinder body. Push the cylinder out of its location, removing the boot and push rod simultaneously. Refit the boot to prevent the piston becoming misplaced with the resultant loss of fluid.

6. Unscrew the bolt securing the speedometer cable retainer to the extension housing, remove the retainer and withdraw the speedometer cable.

7. Disconnect the earth strap from the bracket on the floor pan.

8. Unscrew the four self-locking nuts and remove the four bolts at the drive shaft coupling flange. Mark the coupling and flange to ensure correct alignment on replacement and then tap the coupling gently to free the joint. Lower the rear end of the shaft, sliding it back so that the front end will clear the gearbox main shaft splines.

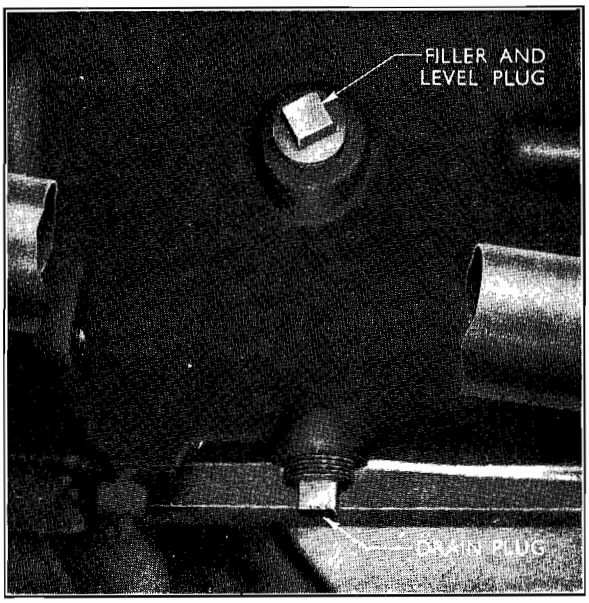

Fig. 4
Filler, Level and Drain Plug Locations

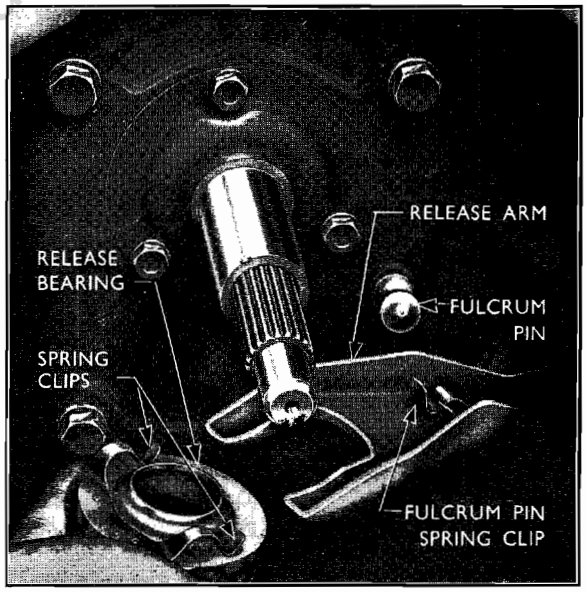

Fig. 5
Remove Clutch Release Bearing

9. Disconnect the exhaust pipe from the engine manifold.

10. Place the gear lever in the neutral position, remove the gear lever gaiter, unscrew the gear lever ball cap and lift out the gear lever.

11. Fit supports under the engine as necessary. Remove the four bolts and lockwashers securing the engine rear support member to the floor pan and then remove the gearbox from the vehicle complete with rear support.

12. Release the locking tabs on the two bolts securing the gearbox mounting to the extension housing, unscrew the bolts and detach the mounting and cross member.

Fit the support bracket (Tool No. P.7089) to the gearbox, by screwing the retaining plugs into the drain and level plug holes in the gearbox case and mount the gearbox on the dismantling stand.

To Dismantle the Gearbox

1. **Dismantle the clutch operating mechanism.** Remove the gaiter and slide the release arm out of the spring clip on the release bearing hub (see Fig. 5) and, lifting the arm off the fulcrum pin, slide the release bearing off the main drive gear bearing retainer. Remove the clutch release arm by withdrawing it into the clutch housing.

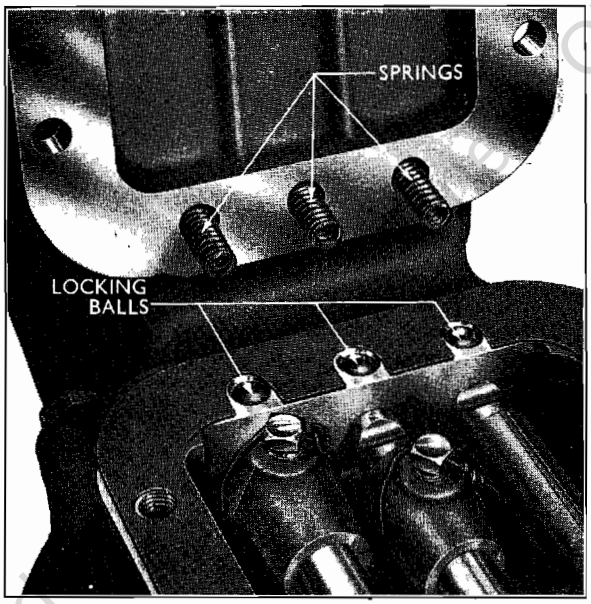

Fig. 6
Selector Shaft Balls and Springs

2. Remove the clutch housing. Unscrew and remove the four bolts and lockwashers securing the clutch housing to the gearbox case. If required, drive out the clutch release arm fulcrum pin.

3. Remove the gear lever housing. Unscrew the four bolts and lockwashers securing the housing to the extension housing and lift off the gear lever housing.

4. Remove the gearbox top cover plate. Unscrew the four bolts and lockwashers securing the cover plate to the gearbox and lift off the cover plate (see Fig. 6).

NOTE.—The selector shaft locking springs are normally located in the cover plate and can be lost when the cover is removed.

5. Withdraw the selector shaft locking springs and balls from their locations in the gearbox casing.

6. Dismantle the selector mechanism.

(*a*) Ensure that the gearbox is in the neutral position and remove the locking wire from the bolt heads. Unscrew the square-headed taper bolts securing the selector forks to the selector shafts.

(*b*) Withdraw the reverse selector shaft to the rear, then support the sleeve fitted to the third and top selector shaft and withdraw this shaft. Lift out the sleeve, see Fig. 7.

(*c*) Withdraw the first and second gear selector shaft and remove the floating pin from the cross drilling at the forward end of the shaft. Rotate the shaft through 90 degrees and remove it from the gearbox casing.

(*d*) Lift the selector forks from the locating grooves on their respective gears.

NOTE.—The two interlock plungers are located in the forward face of the gearbox and care should be taken to prevent losing them when carrying out subsequent operations.

(*e*) If required, remove the interlock plungers from their location in the gearbox casing, see Fig. 21.

7. Remove the extension housing and main shaft assembly.

NOTE.—If the oil seal located at the rear of the extension housing needs replacing, the old seal should be extracted before operation 7 is commenced. Screw the adaptor (P.7657–4) into the body of the main tool (P.7657) and then screw the tool into the oil seal. Tighten the centre bolt to extract the seal from the housing.

(*a*) Unscrew the five bolts and lockwashers securing the extension housing to the gearbox casing and pull the housing approximately $\frac{1}{4}$ inch (6.35 mm.) away from the rear face of the gearbox.

(*b*) Rotate the extension housing through 90 degrees in an anti-clockwise direction until the cut-away above the lower left-hand securing bolt hole is located above the countershaft (see Fig. 8). Using a brass drift, free the countershaft at the clutch

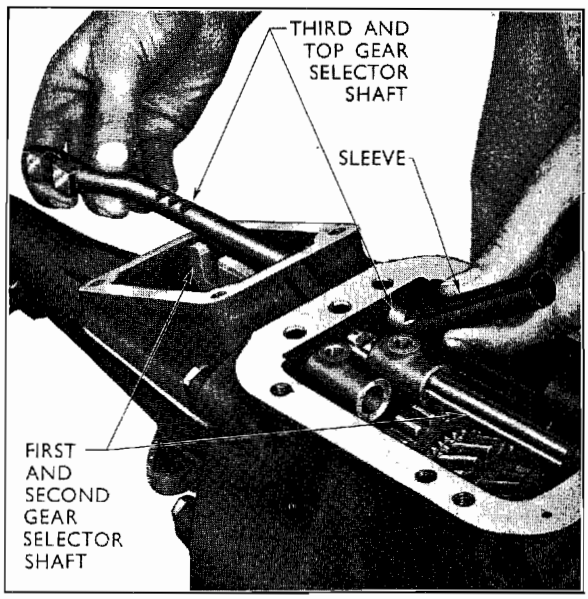

Fig. 7
Third and Top Selector Shaft Removal

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housing end and then using the dummy countershaft (Tool No. P.7090) push the countershaft out of the gearbox, allowing the cluster gear to lie in the bottom of the casing.

8. Withdraw the reverse idler gear and shaft.

Locate a nut, a flat washer and a sleeve on a $\frac{5}{16}$ in. 24 UNF2-threaded bolt, screw the bolt into the reverse idler shaft and tighten the nut to withdraw the shaft.

Lift out the reverse idler gear.

NOTE.—If at this stage the extension housing has been removed from the mainshaft, withdraw the reverse idler gear shaft using Tool No. P.7043.

9. Withdraw the extension housing and main shaft assembly from the gearbox.

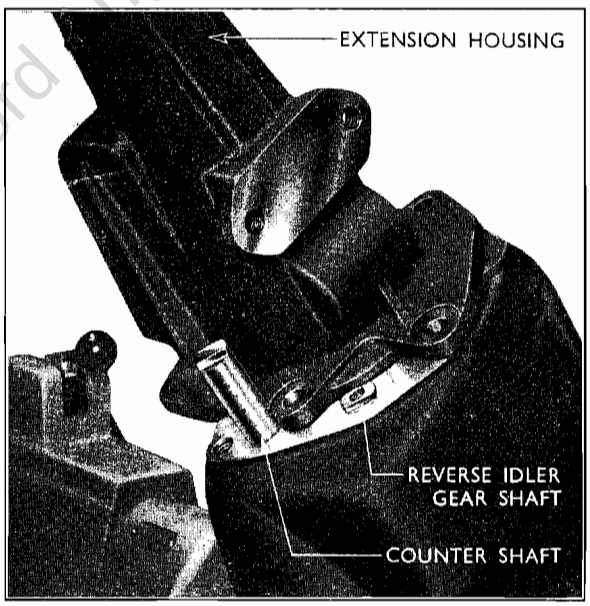

Fig. 8
Remove Countershaft

NOTE.—The main shaft spigot is located on needle rollers in the main drive gear and these will be displaced when carrying out this operation, unless the gearbox is vertical with the extension housing uppermost.

10. Remove the main drive gear bearing retainer after unscrewing the three retaining bolts and lockwashers.

11. Remove the main drive gear. Detach the large circlip from around the main drive gear bearing and press the gear and bearing into the gearbox, withdrawing it through the top of the box (see Fig. 10).

12. Withdraw the cluster gear and thrust washers from the gearbox. The cluster gear is mounted on forty needle rollers (twenty at each end)

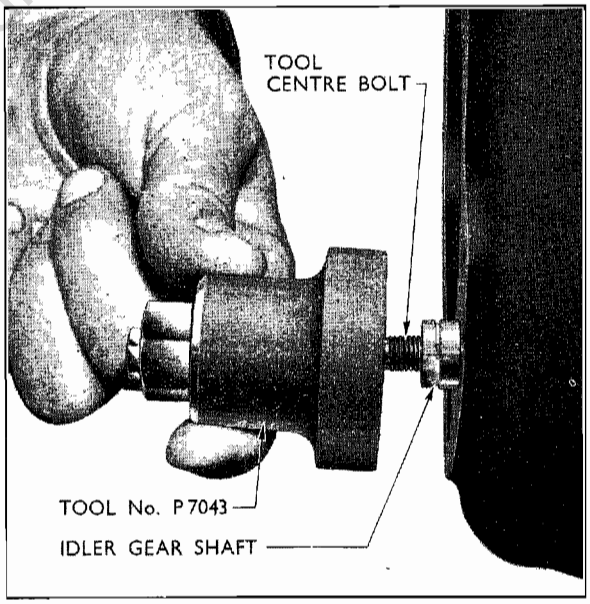

Fig. 9
Remove Reverse Idler Gear Shaft

separated by a tubular spacer and two washers, and retained by a small washer at each end of the cluster gear. Push out the dummy countershaft, remove the retaining washers, needle rollers and tubular spacer.

13. Dismantle the main shaft assembly.

(*a*) Remove the speedometer driven gear from the extension housing.

(*b*) Compress the circlip retaining the main shaft bearing in the extension housing and withdraw the main shaft assembly (see Fig. 11).

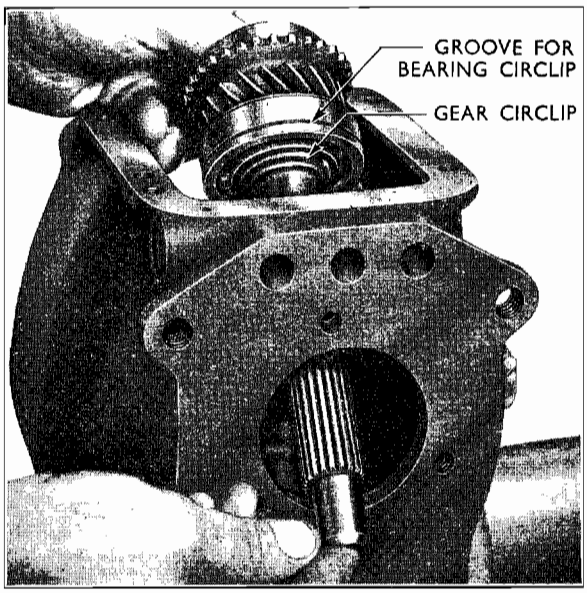

Fig. 10
Remove Main Drive Gear

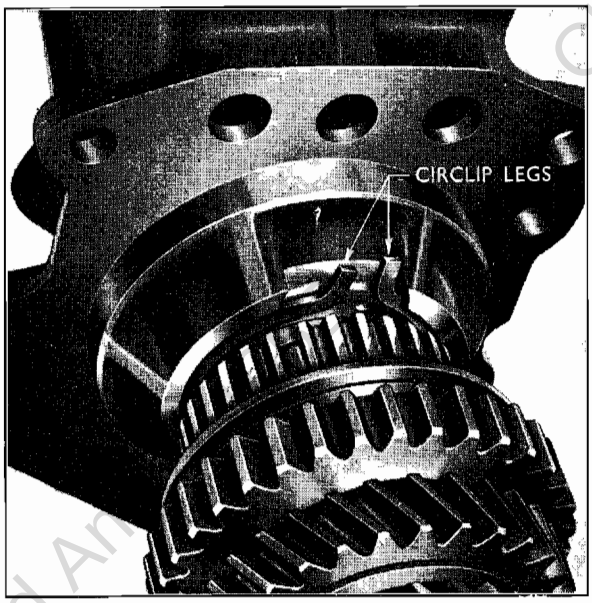

Fig. 11
Removing Mainshaft Circlip

(*c*) On current models lift up the tab on the tab washer and remove the retaining nut, tab washer and speedometer driving gear. Extract the locating ball and remove the spacer.

On former models expand and remove the circlip from the rear of the speedometer drive gear and slide off the gear. Extract the locating ball from the indentation in the mainshaft and remove the front gear retaining circlip.

Expand and remove the mainshaft bearing retaining circlip.

(*d*) Locate the adaptors (Tool No. P.4090–3) around front face of the second gear and in the support ring and base plate and press the mainshaft bearing, first gear and second gear synchroniser assembly, second gear blocker ring and second gear off the mainshaft.

NOTE.—The first gear and second gear synchroniser hub and sleeve are mated together and also to the mainshaft. Mating marks are etched on the corresponding splines of the hub and sleeve, and on the hub and mainshaft splines.

The first gear and second gear synchroniser and hub assembly are serviced only as a unit, consisting

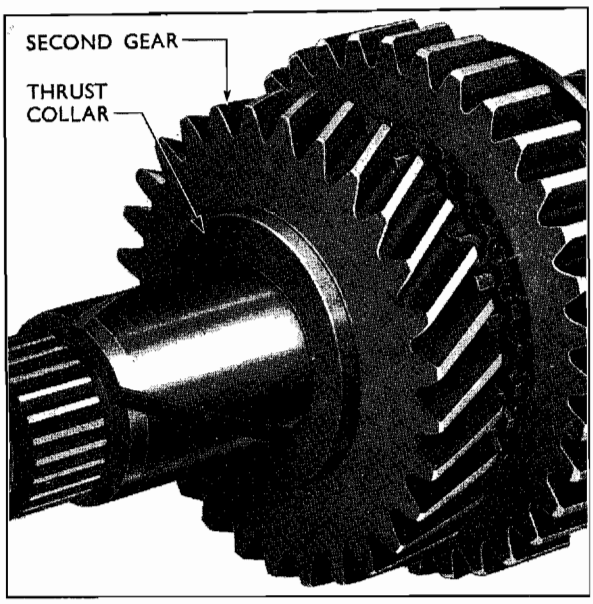

Fig. 12
The Second Gear and Thrust Collar

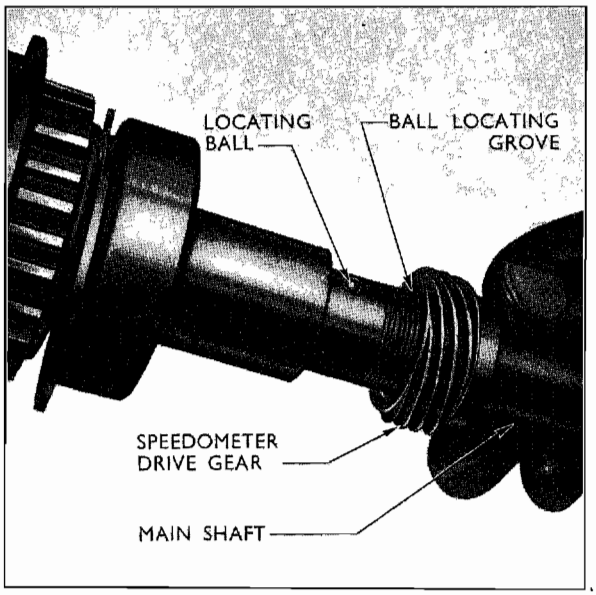

Fig. 13
Removing Speedometer Drive Gear

of the first gear and second gear synchroniser sleeve, the rear blocker bar spring and the blocker bar retaining plate which is secured to the synchroniser hub. The blocker bar retaining plate must not be dismantled from the hub nor the sleeves and hubs interchanged between assemblies. All circlips on the mainshaft assembly are the same size and are not selective.

(*e*) Remove the third and top gear synchroniser sleeve from the hub and extract the blocker bars and front spring. Remove the circlip securing the third and top gear synchroniser to the mainshaft. Locate the split adaptors (Tool No. P.4090–3) behind the third gear, support the assembly in the support

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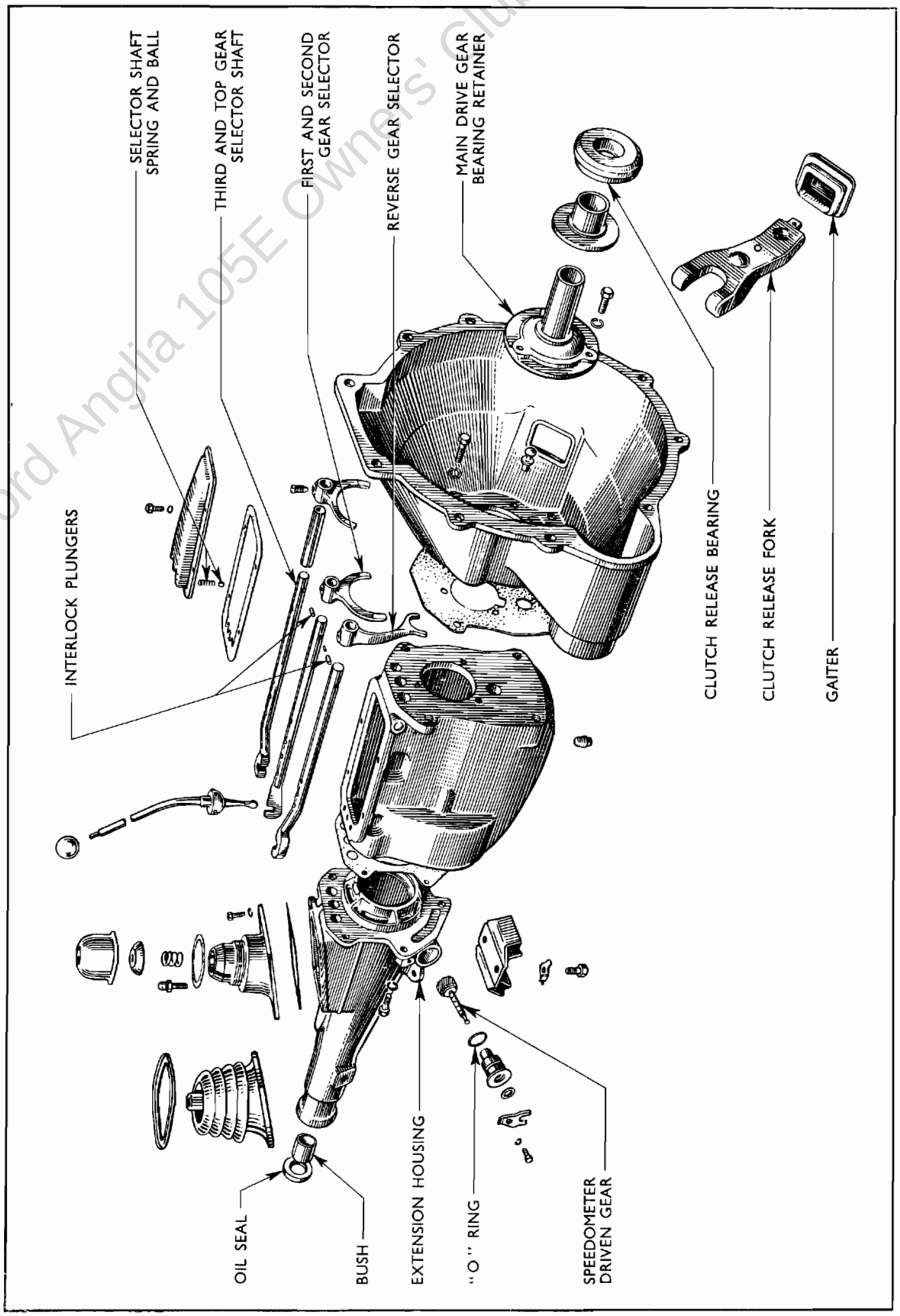

Fig. 14
Exploded View of the Gearbox (External)

ring and base plate and press off the third and top gear synchroniser hub, blocking ring and third gear.

Note that the synchroniser hub and sleeve are mated together and mated to the mainshaft and lines are etched on the corresponding parts.

14. Dismantle the main drive gear. Remove the circlip securing the main drive gear bearing to the main drive gear, support the bearing in the adaptors (Tool No. P.4090-1) and press the main drive gear out of the bearing. An oil slinger is fitted between the bearing and gear.

15. Overhaul the extension housing.

(*a*) Extract the oil seal from the rear of the extension housing if it has not already been removed.

(*b*) Examine the extension housing rear bearing bush and remove it if necessary, by driving it into the housing using Tool No. P.7038.

(*c*) Locate the new bearing over the appropriate diameter of the replacing tool (Tool No. P.7038) and enter it into the rear of the housing with the split in the bush uppermost.

(*d*) Drive the bearing squarely into position until the rear end of the bearing is flush with the recessed face of the extension housing.

(*e*) Locate the new oil seal on the replacer (Tool No. P.7095) so that the lip of the seal faces into the extension housing and drive the seal into position in the housing.

NOTE.—If preferred the oil seal need not be fitted until the extension housing has been replaced on the gearbox.

To Reassemble the Mainshaft

1. Assemble the first gear and second gear synchroniser unit.

(*a*) If a new unit is to be installed, slide the synchroniser sleeve off the hub, first noting the mating marks. Locate the blocker bars in the hub so that the flat extension on the bars are within the retaining plate and the tag on the end of the already installed spring is inside one bar. Leave the other end of the spring free.

(*b*) Note which blocker bar the spring tag is located in also the direction of rotation of the spring, and slide the second gear synchroniser sleeve with the selector fork groove to the rear onto the hub, ensuring that the mating marks on hub and sleeve correspond.

(*c*) Install the front blocker bar spring so that the tag is located in the same bar as the rear spring, the springs running in opposite directions.

2. Reassemble the mainshaft.

(*a*) Slide the second gear onto the mainshaft with the gear teeth towards the thrust collar machined on the shaft.

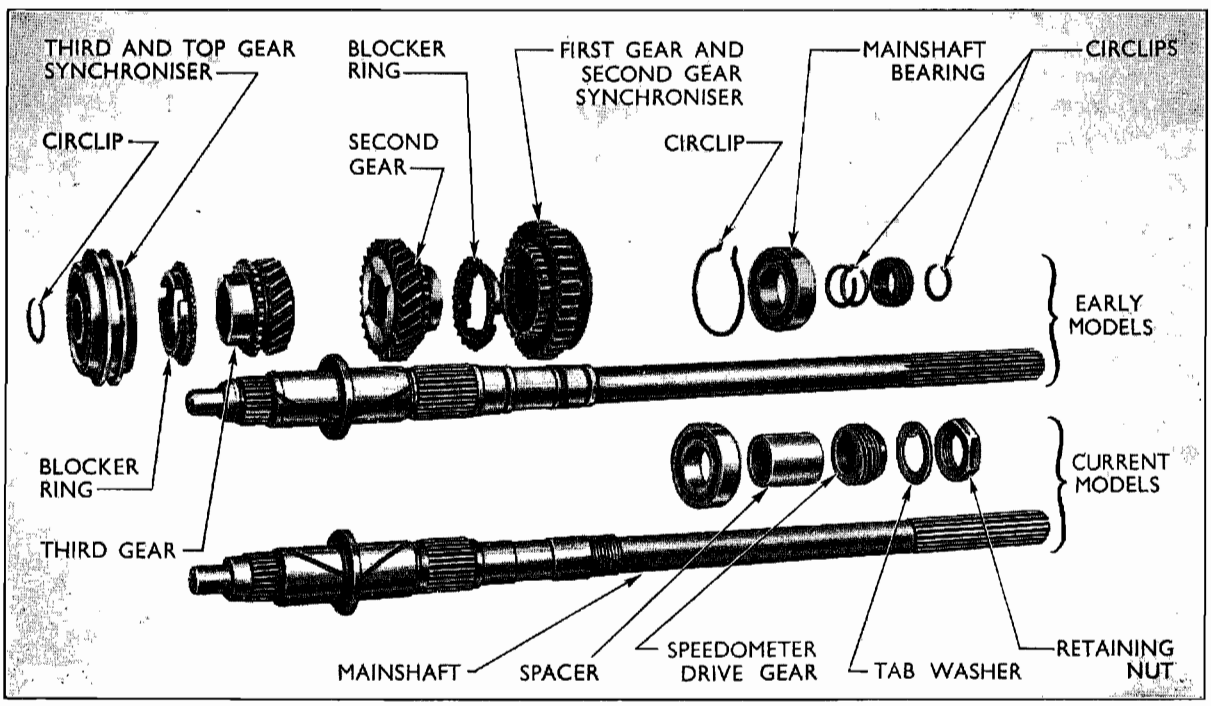

Fig. 15
Exploded Mainshaft Assembly

Continued overleaf

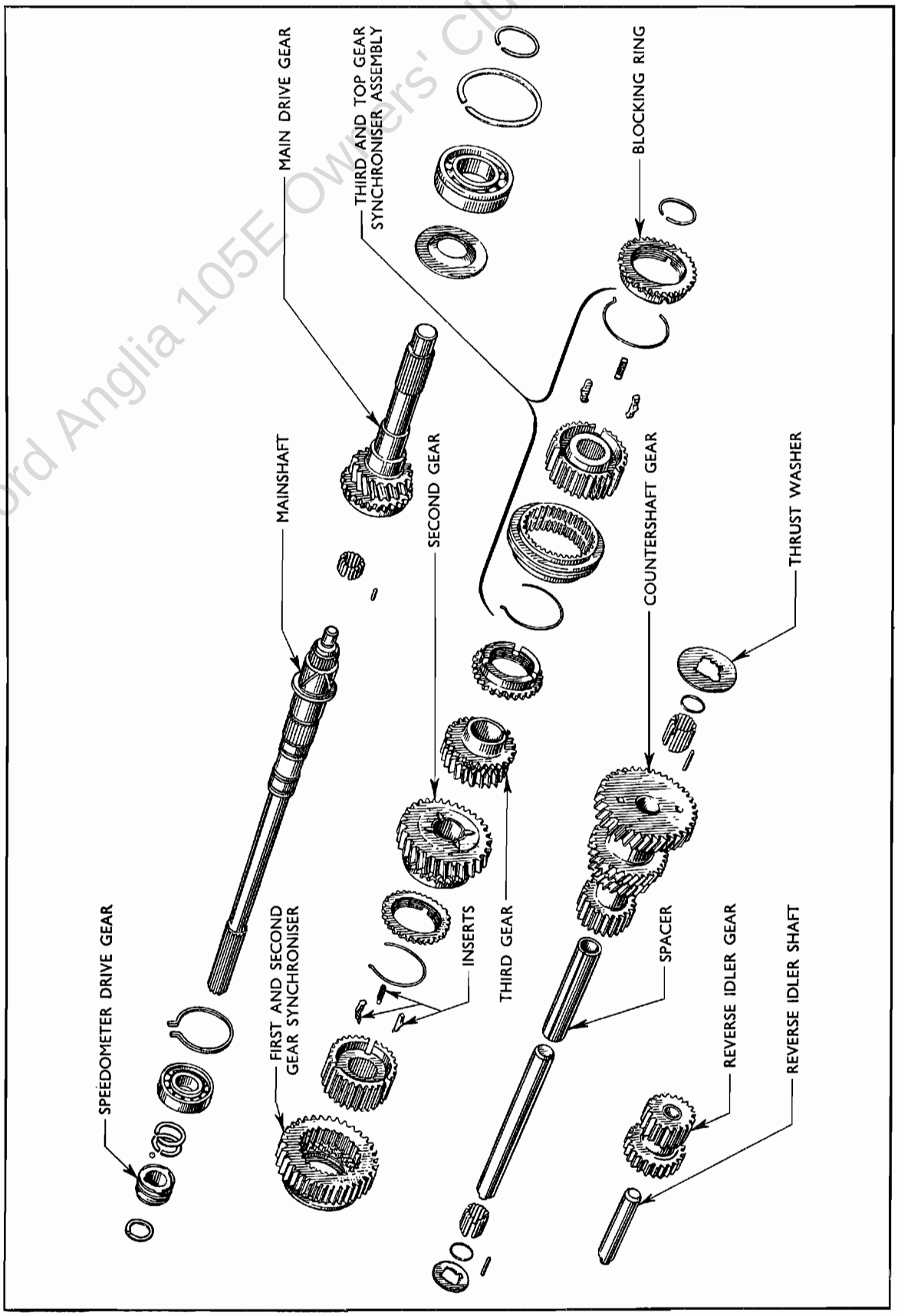

Fig. 16

Exploded View of the Gearbox (Internal, prior to approx. Engine Nos. Anglia 105E-34518 Prefect 105E-35089)

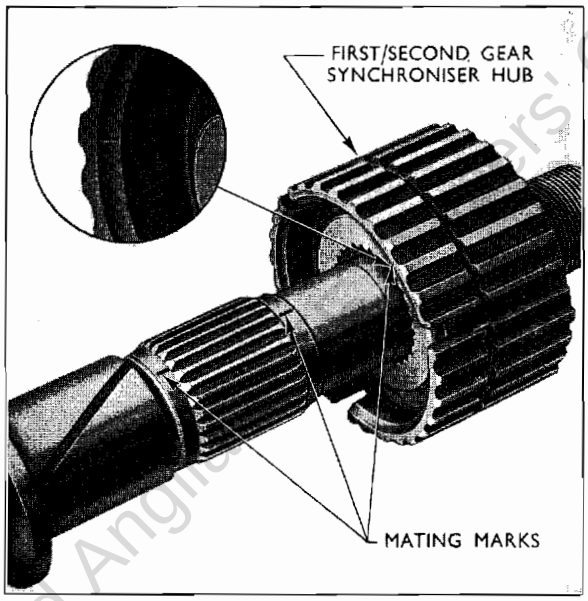

Fig. 17
Fitting Second Gear Synchroniser Hub

(*b*) Position the blocker ring on the taper face of the second gear.

(*c*) Locate the first gear and second gear synchroniser on the mainshaft, taking care that the mating splines on the hub and shaft correspond.

NOTE.—The hub should be pressed on the shaft until the rear face of the hub is level with the bearing shoulder on the mainshaft.

(*d*) Position the large mainshaft bearing circlip over the mainshaft and locate the bearing on the shaft, ensuring that the radius on the outside diameter of the bearing faces the extension housing. Using adaptors (Tool No. P.4000–30), support ring and base plate (Tool No. 370) support the assembly on the bed of a press and press the shaft right home in the bearing. On early models fit the small mainshaft bearing retaining circlip in its groove in the shaft.

(*e*) Slide the third gear onto the shaft with the gear teeth towards the thrust collar on the shaft and locate the blocker ring on the taper face of the gear.

(*f*) Install one blocker bar spring in the rear of the third and top gear synchroniser hub and locate the hub on the mainshaft with its long boss towards the front of the shaft.

(*g*) Support the assembly of the third and top gear synchroniser on the adaptor (Tool No. P.4090–4). Locate the shaft so that the mating marks on the hub and the shaft are in line. Press the synchroniser hub right home on the shaft. Fit the circlip in its locating groove to retain the assembly in position.

(*h*) Install the blocker bars and front spring, taking care that the tag on the end of each spring is located in the opposite end of each bar with the springs running in opposite directions. Leave the other end of each spring free. Refit the sleeve to the hub, ensuring that the mating marks correspond.

(*i*) On current models slide the spacer on the mainshaft, install the locating ball for the speedometer drive gear in its seating and fit the gear with the shoulder to the rear. Fit the tab washer over the shaft and locate the tab on the inner diameter into the groove on the inside of the speedometer drive gear. Screw on the nut and tighten it to a torque of 20 to 25 lb. ft. (2.76 to 3.45 kg.m.).

Bend over a section of the outer edge of the tab washer so that it securely locks the nut.

On former models fit the front speedometer drive gear retaining circlip in its groove in the shaft. Install the locating ball in its seating in the mainshaft, slide on the gear and fit the rear retaining circlip.

3. Install the main shaft assembly in the extension housing, taking care not to damage the oil seal (if this has been previously fitted) as the splined end of the main shaft passes through this seal. Ensure that the main shaft bearing is correctly located in the extension housing and fit the retaining circlip so that the two legs are located in the cut-away portion of the extension housing as shown in Fig. 11.

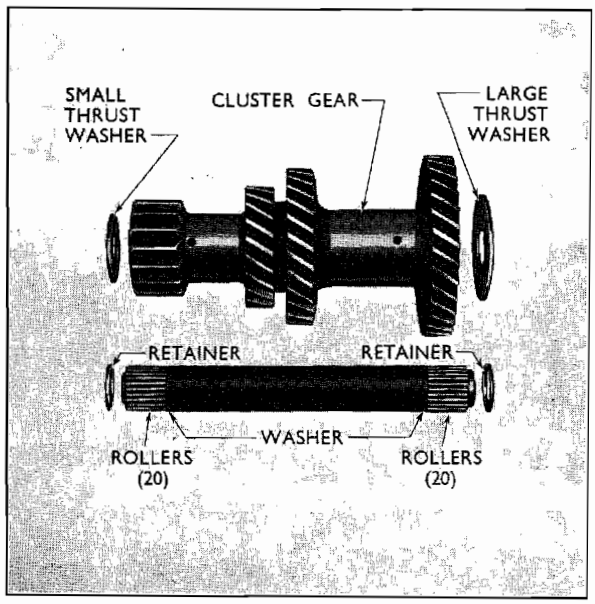

Fig. 18
Countershaft Assembly

Continued overleaf

4. Refit the speedometer driven gear and bearing checking that the " O " ring seal is in position.

5. Reassemble the countershaft (Fig. 18). Locate the tubular spacer with a washer at each end in the cluster gear and fit the dummy countershaft. Grease the needle rollers and locate twenty around the dummy countershaft at each end of the gear. Fit the retaining washers over each end of the dummy countershaft. Locate the two thrust washers (large diameter washer to the front) in position in the gearbox. Ensure that the tongue on each washer is located in the recess in the gearbox.

Lay the cluster gear in the bottom of the gearbox casing, taking care not to displace the thrust washers.

6. Install the reverse idler gear with the large gear towards the rear allowing it to rest in the box.

7. Assemble the main drive gear. Install the oil slinger on the main drive gear so that the outer circumference is dished towards the gear. Position the main drive gear bearing on the gear with the external circlip groove on the bearing away from the gear, support the assembly with the adaptor plates, Tool No. P.4000-29, and press the bearing right home on the gear. Fit the smaller diameter circlip in the groove provided in the shaft of the main drive gear.

8. Install the thirteen needle rollers in the bore of the main drive gear and fit the gear in the front face of the gearbox casing. Fit the larger diameter circlip in its location on the bearing.

NOTE.—When fitting the rollers, use grease to retain twelve in position and then slide the thirteenth, longitudinally into the remaining space, so locking all thirteen in place.

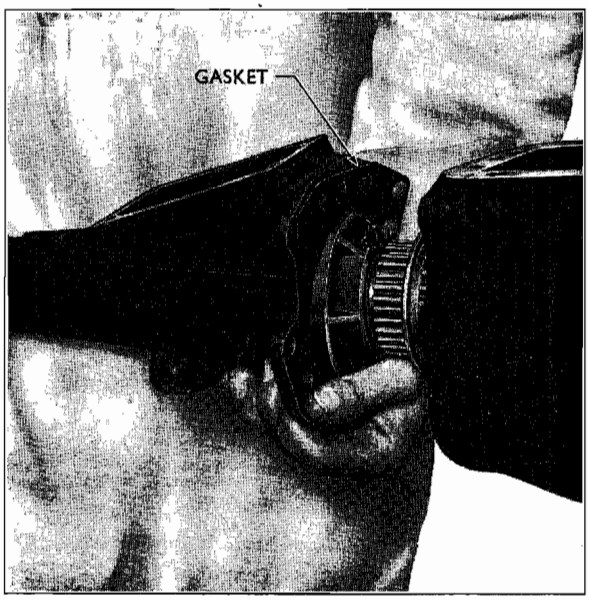

Fig. 19
Fitting Extension Housing

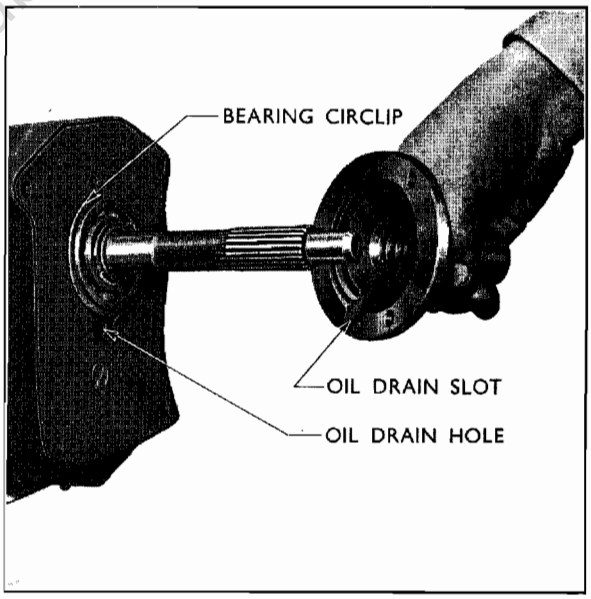

Fig. 20
Fitting Main Drive Gear Bearing Retainer

9. Fit the main drive gear bearing retainer. Place a new gasket on the gearbox front face and ensure that the oil groove in the retainer is in line with the oil passage in the gearbox casing and the gasket does not cover this passage (see Fig. 20). Secure the retainer with three bolts and lockwashers.

10. Fit the main shaft and extension housing. Locate a new gasket on the rear face of the gearbox and pass the main shaft assembly through the rear of the gearbox, locating the main shaft spigot in the bore of the main drive gear.

11. Install the reverse idler shaft in the gear so that the flats will line up in the recess in the extension housing.

12. Complete the assembly of the countershaft gear.

(*a*) Rotate the extension housing 90 degrees anti-clockwise from its normal position.

(*b*) Carefully lift the gear into mesh with the main shaft and main drive gear and, taking care that the thrust washers are not displaced, carefully refit the countershaft from the rear, keeping it in contact with the dummy shaft.

(*c*) Ensure that the locking face on the countershaft and the reverse idler shaft will engage with the recess cast in the extension housing, rotate the extension housing into its normal position and push the assembly right home.

(*d*) Secure the housing with five bolts and lockwashers. Note that the earth strap is secured to the lower right-hand bolt.

13. Refit the clutch housing. Secure it in place with four bolts and lockwashers.

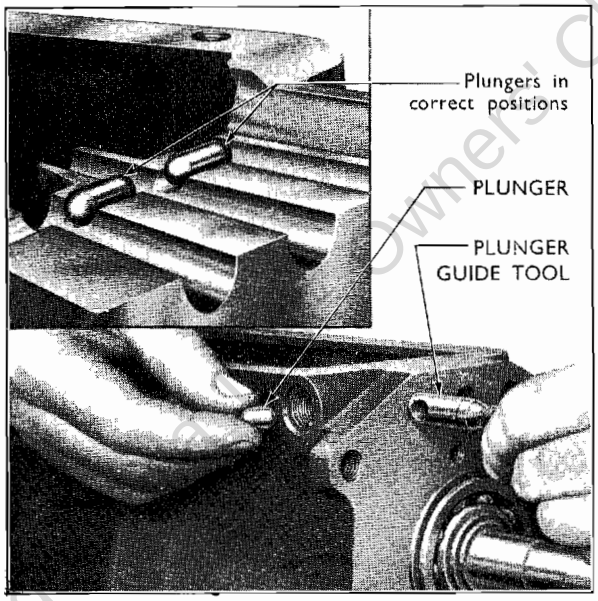

Fig. 21
Assembly of Interlock Plungers

14. Assemble the clutch release mechanism.

(*a*) Pass the clutch release fork through the clutch housing and locate the release bearing hub on the main drive gear bearing retainer.

(*b*) Push the fork into position so that the ends locate in the spring clips on the release bearing hub and the clip on the fork is correctly located under the head of the fulcrum pin.

(*c*) Fit the gaiter over the clutch release fork. Ensure that it is correctly located in the clutch housing and secure with the retaining clip around the release fork.

15. Reassemble the selector mechanism.

(*a*) Ensure that the interlock plungers are correctly located in the front face of the box (see inset, Fig. 21). If the interlock plungers have been removed it will be necessary to withdraw the expansion plug from the right-hand side of the gearbox casing to correctly locate the plungers.

Position the plunger guide (Tool No. P.7093), in the selector shaft hole nearest the expansion plug location and push the plunger into the casing and through the tool until it is located in the first cross drilling, see Fig. 21. Remove the guide tool and position it in the centre selector shaft hole and again push the plunger through until it locates in the second cross drilling in the casing. Locate the other plunger in the first cross drilling, using the tool in a similar manner. Refit the expansion plug.

(*b*) Locate the selector forks on the gears, ensure that the gearbox is in neutral and install the first and second gear selector shaft (see Fig. 22). Before the shaft is pushed fully home check that the floating pin is located in the shaft and then set the shaft in the neutral position. Align the hole in the shaft with the bolt hole in the selector fork and fit the square-headed taper bolt, tighten it securely and lock with a soft iron wire.

(*c*) Install the reverse selector shaft, then the third and top gear selector shaft. Locate the floating sleeve on the third and top gear selector shaft before pushing this right home, see Fig. 22. Fit and tighten the selector fork locking bolts, locking them with soft iron wire.

Position a new gasket on the top face of the gearbox and install the selector shaft locking balls and springs. Fit the gearbox cover plate, ensuring that the springs are correctly located in the drillings (see Fig. 22), and secure it with four bolts and lockwashers.

(*d*) Fit a new gasket to the gear lever housing and secure it to the extension housing with four bolts and lockwashers.

To Refit the Gearbox

1. Remove the gearbox from the stand and refit the support member to the extension housing. Secure and tighten the two bolts and lock the heads with the tabs on the locking washers.

2. Refit the gearbox to the engine ensuring that the clutch housing is correctly aligned on the tubular dowels. Fit and tighten the clutch housing bolts, then secure the support member to the floor pan with two bolts and lockwashers each side.

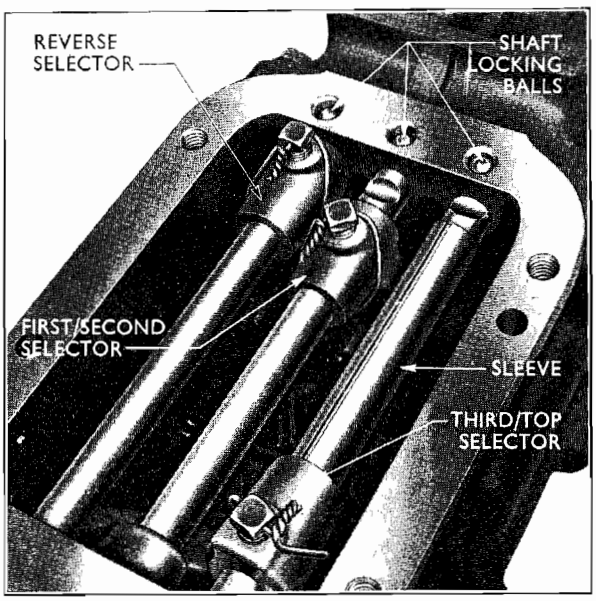

Fig. 22
Assembly of Selector Mechanism

Continued overleaf

3. Fit a paper gasket between the speedometer drive cable and the bearing and refit the drive cable securing it in place with a horseshoe retainer, one bolt and lockwasher.

4. Reconnect the earth strap to the bracket on the floor pan.

5. Replace the drive shaft. Slide the front universal joint sleeve onto the splines of the main shaft, taking care not to damage the extension housing bearing or oil seal. Align the mating marks on the rear flange and pinion drive flange, fit the retaining bolts and securely tighten the self-locking nuts.

6. Reconnect the exhaust pipe to the exhaust manifold.

7. Refit the clutch operating cylinder. Pass the cylinder through the gearbox housing, from the rear. Fit the circlip, rubber boot and push rod, then check and adjust if necessary the release arm clearance. (See appropriate Service Bulletin) and refit the spring.

8. Assemble the splash shield to the lower half of the clutch housing, fitting the four bolts and lockwashers.

9. Refit the starter motor securing it to the clutch housing with two bolts and lockwashers. Reconnect the starter motor cable and terminal.

10. Insert the gear lever, fitting the gasket between the ball cap and the gear change cover, securely tighten the ball cap and refit the rubber gaiter to the floor pan.

11. Refit the drain plug to the gearbox, refill the gearbox to the correct level with the correct grade of lubricant and replace the level plug.

12. Reconnect the battery.

SPECIFICATION

Lubrication

Grade of lubricant	S.A.E. 80 E.P.
Oil capacity	1.75 Imp. pints (1.46 U.S. pints, 1 litre)

Ratios

First	4.118 : 1
Second	2.396 : 1
Third	1.412 : 1
Fourth	1.000 : 1
Reverse	5.404 : 1

General Data

Third gear end-float
0.005 to 0.015 in. (0.127 to 0.381 mm.)
Second gear end-float
0.005 to 0.0187 in. (0.127 to 0.475 mm.)
Speedometer drive gear end-float
0.001 to 0.009 in. (0.025 to 0.229 mm.)
Mainshaft bearing end-float
0.001 to 0.008 in. (0.025 to 0.203 mm.)
Countershaft gear end-float
0.008 to 0.020 in. (0.203 to 0.508 mm.)
Mainshaft circlip thickness
0.091 to 0.093 in. (2.311 to 2.362 mm.)
No. of teeth on speedometer drive gear .. 6
No. of teeth on driven gear
22—(Anglia) natural 23—(Prefect) black

Gear Identification

The table below outlines the relevant dimensions for identification of the former and current type gears (see Introduction, sheet 2) :—

Description	*Overall Length of each Tooth*		*Part Nos.*	
	Former Gears	*Current Gears*	*Former*	*Current*
Main Drive Gear	$\frac{3}{4}$ in. (19.05 mm.)	$\frac{13}{16}$ in. (20.64 mm.)	105E–7017–B	105E–7017–C
Main Drive Gear Constant Mesh, Cluster Gear ..	$\frac{5}{8}$ in. (15.88 mm.)	$\frac{11}{16}$ in. (17.46 mm.)	105E–7113–C	105E–7113–D
Third Gear	$\frac{11}{16}$ in. (17.46 mm.)	$\frac{3}{4}$ in. (19.05 mm.)	105E–7101–D	105E–7101–E
Second Gear	$\frac{11}{16}$ in. (17.46 mm.)	$\frac{3}{4}$ in. (19.05 mm.)	105E–7102–C	105E–7102–D

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 7: **GEARBOX—CLUTCH**
Subject: **Clutch**
Effective on: New Anglia and Prefect (1959 onwards)

THE CLUTCH

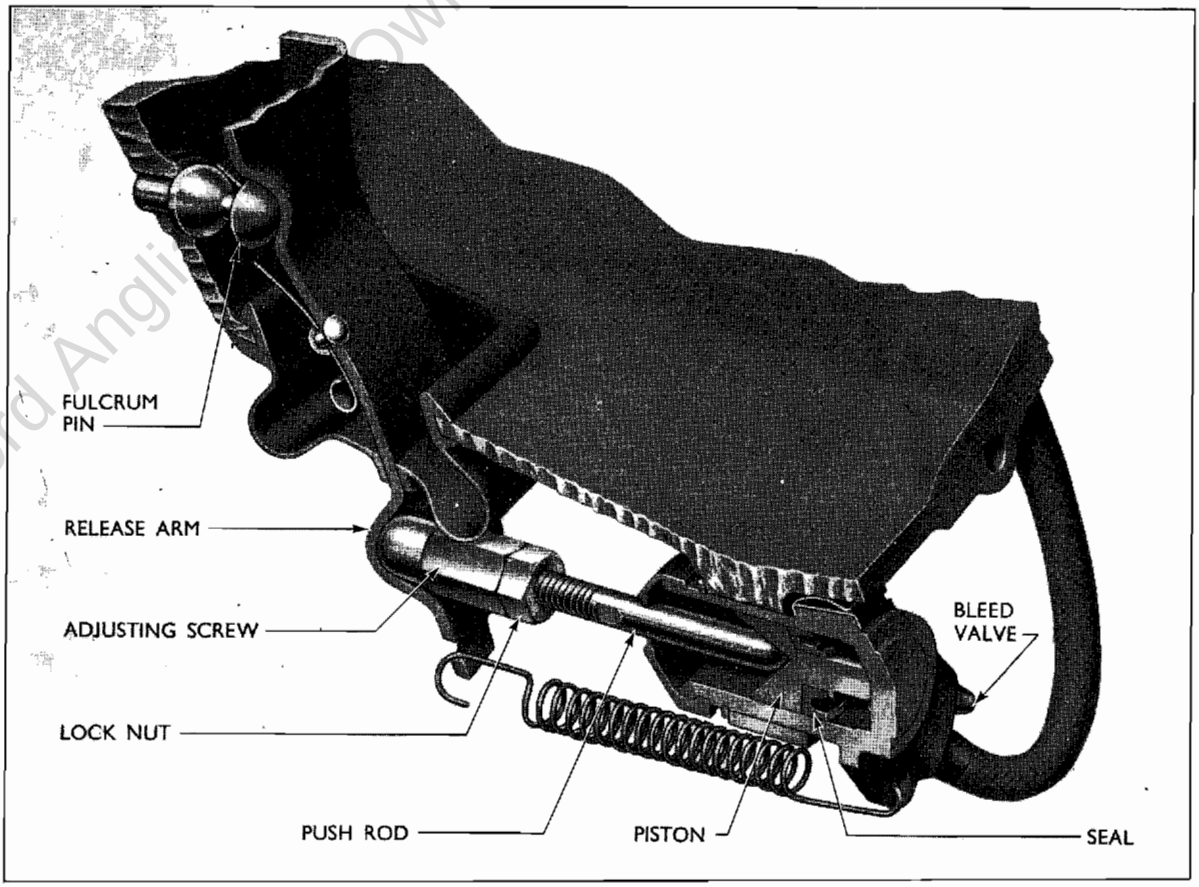

Fig. 1
Clutch Release Mechanism (Prefect)

Description

The clutch assembly fitted is of the single dry plate type of 7.25 in. (18.32 cm.) outside diameter. The clutch disc incorporates a spring-cushioned hub and the woven asbestos linings are flexibly mounted to ensure a smooth take up of the drive. The clutch disc hub is free to slide along the splines of the main drive gear, the forward end of which forms a spigot to fit into the clutch pilot bearing in the centre of the flywheel and crankshaft flange. The clutch cover, springs, clutch release mechanism and pressure plate are serviced as an assembly.

The clutch release mechanism is hydraulically actuated by a pendant pedal connected by a short push rod to the clutch master cylinder. A pipe line connects the clutch master cylinder with the clutch operating cylinder mounted on the clutch housing and retained by means of a circlip. This method of clutch operation eliminates the possibility of irregular clutch engagement due to relative movement between the clutch operating mechanism and the engine.

Maintenance

The maintenance required for the clutch is to top up the master cylinder, check clutch adjustment and if necessary to bleed the system. The details of these operations are given below.

Topping Up

The clutch fluid reservoir (see Fig. 3) should be checked every 1,000 miles. Top-up to the correct level (approximately $\frac{1}{2}$ in. (12.7 mm.) below the top face) with genuine hydraulic brake fluid, Part No.

ME-3833-E. The cap and cap surround should be wiped with a clean rag before removing the cap to ensure that no dirt or foreign matter enters the system. Make sure that the vent is clear before replacing the cap.

Clutch Adjustment

When the clutch mechanism is correctly adjusted the pedal will return to its stop without hesitation, and there will be $\frac{1}{16}$ in. (1.5 mm.) clearance between the clutch release arm and the domed nut on the operating cylinder push rod.

On a new vehicle, or after a new disc has been fitted, the clearance should be increased to $\frac{1}{10}$ in. (2.5 mm.). Should the clearance at this point be reduced, it is possible for the clutch release bearing to be in permanent contact with the clutch fingers, causing unnecessary wear and possibly clutch slip.

To effect this adjustment disconnect the retracting spring (see Fig. 2), slacken the locknut and turn the domed adjusting nut on the push rod until the correct clearance is obtained between the end of the release arm and the nut. Tighten the locknut securely, recheck the adjustment and reconnect the retracting spring.

Bleeding The Clutch Hydraulic System

Preliminary

Before bleeding the hydraulic system, the following points should be observed :—

1. Check for signs of fluid leakage at the master cylinder rubber dust cap ; this would indicate that the piston seal in the master cylinder is damaged and should be renewed.

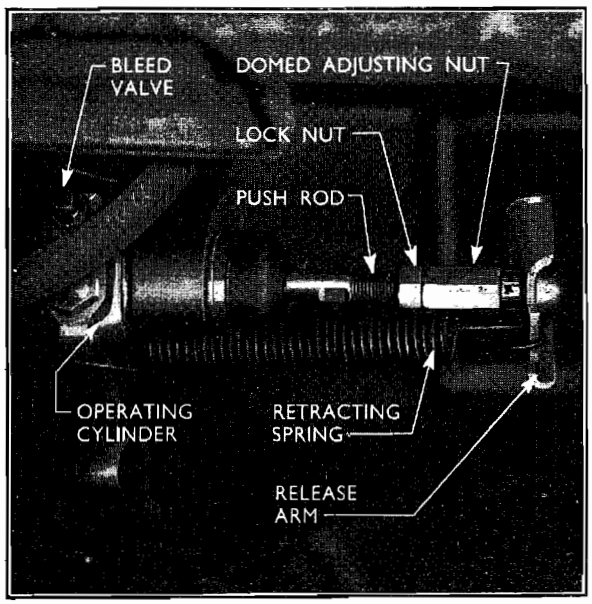

Fig. 2
Clutch Release Arm Adjustment (Prefect)

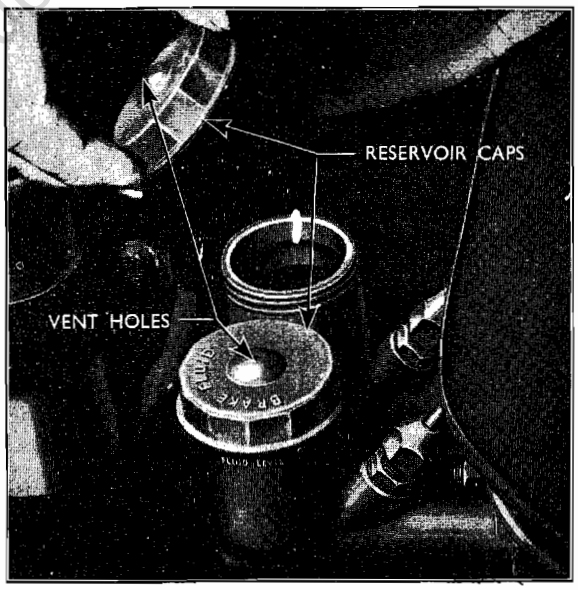

Fig. 3
Master Cylinder Location

If it is suspected that an incorrect fluid has been used in the hydraulic system, drain completely and flush out with methylated spirits or commercial alcohol.

Renew the piston seals in the master cylinder and operating cylinder and refill the system with genuine brake fluid (Part No. ME-3833-E).

2. Examine the fluid reservoir cap and ensure that the vent hole is clear.

3. The fluid level in the reservoir should be correct. Top-up if necessary as described on sheet 1.

4. All unions and connections should be checked for tightness and freedom from leaks. Also check the condition of the flexible rubber hose.

Bleeding the System

1. Clean the area surrounding the bleed valve on the operating cylinder and remove the dust excluding rubber cap.

2. Fit a suitable tube on the bleed valve and place the end of the tube in a bottle containing some brake fluid. Keep the end of the tube beneath the surface of the fluid throughout the bleeding operation.

3. Open the bleed valve by turning it anti-clockwise and slowly depress and release the clutch pedal several times. For each stroke some fluid or air should be pumped out of the tube. If neither fluid nor air is pumped out, the bleed valve is not properly opened or there is a blockage in the pipe line.

NOTE.—Where air in the system is suspected remember that when bleeding the system the initial application of the clutch pedal will cause the air trapped in the bleed tube to be forced into the fluid container.

4. Continue depressing the clutch pedal slowly until no more air bubbles emerge from the tube.

Ensure that the fluid level in the reservoir is maintained during the bleeding operation. Do not replenish it with the fluid drained from the system as it may be aerated or contaminated. If the fluid pumped out of the tube is dirty, drain the system completely and refill with fresh fluid.

5. When, with each stroke of the clutch pedal, fluid alone comes out of the bleed tube, close the valve tightly when the pedal is released.

Remove the tube and refit the dust excluding rubber cap on the bleed valve.

6. Refill the reservoir to the correct level and replace the cap.

OVERHAULING THE CLUTCH OPERATING CYLINDER

The clutch operating cylinder is mounted in the clutch housing flange on the left-hand side and is held in place by a circlip.

To Remove

1. Disconnect the retracting spring and using a pair of circlip pliers remove the circlip.

2. Withdraw the cylinder assembly forwards complete with push rod.

To Dismantle

1. Remove the push rod and the dust excluding rubber cap and gently depress the clutch pedal to push the piston and seal out of the cylinder.

2. Disconnect the flexible hose and fit a blanking plug to the hose to prevent ingress of foreign matter.

3. Remove the bleed valve from the cylinder.

4. Pull the rubber piston seal off the spigot at the front of the piston.

5. Wash all parts in approved hydraulic fluid, methylated spirits or commercial alcohol and examine the rubber piston seal carefully. Renew the seal if there is any sign of damage to the sealing lip. **Never use mineral fluids such as engine oil or paraffin for washing hydraulic system parts.**

To Reassemble

1. Locate the piston seal on the spigot at the front end of the piston so that the sealing lip is away from the body of the piston.

2. Dip the piston and seal in hydraulic fluid and carefully insert, spigot end first, into the cylinder. Push the assembly to the front of the cylinder.

3. Refit the rubber cover over the end of the cylinder.

4. Replace the bleed valve in the upper of the two unions but do not tighten.

To Replace

1. Remove the blanking plug from the end of the flexible hose and reconnect the hose to the cylinder.

2. Replace the push rod and slide the cylinder into its location on the clutch housing flange from the front. Replace the circlip and ensure that it locates correctly in its groove.

3. Bleed the hydraulic system as described on continuation sheet 1.

4. Adjust the clearance between the domed nut on the operating cylinder push rod and the clutch release arm as also described on continuation sheet 1.

THE CLUTCH MASTER CYLINDER

The clutch master cylinder is bolted to the engine compartment rear bulkhead. The front spigot end of the piston accommodates the valve stem and carries the valve spring retainer. The return spring (under compression) is fitted between the spring retainer and the valve spacer at the forward end of the cylinder, see Fig. 4.

A reservoir port, drilled at the front of the cylinder, allows fluid from the integral reservoir to enter the cylinder. The pipe line to the clutch operating cylinder leaves the master cylinder at a port inclined at an angle to the master cylinder body, see Fig. 4.

When the clutch pedal is in the fully released position, fluid is free to flow from the reservoir into the cylinder.

When the pedal is depressed the piston moves forward and closes the valve to prevent the fluid being pumped back into the reservoir. The fluid is, therefore, pumped through the outlet port to the operating cylinder on the clutch housing. When the pedal is once again released the return spring pushes back the piston, reducing pressure in the cylinder, and the release arm retracting spring acting on the operating cylinder piston pushes the fluid back into the master cylinder. The valve uncovers the reservoir port so that fluid may be replenished in the cylinder as necessary.

A rubber dust cap fits over the end of the master cylinder and seals off the push rod, thus preventing the entry of dirt into the cylinder.

To Remove

1. Detach the fluid line, using a blanking plug, Tool No. A/ET.2000 to avoid dirt entering the system.

2. Unscrew the nut, remove the spring washer and the eccentric (or concentric) bolt securing the master cylinder push rod to the pedal.

3. Withdraw the master cylinder after unscrewing the two nuts securing the master cylinder to the bulkhead.

4. Empty the contents of the fluid reservoir into a clean container.

To Dismantle

1. Remove the rubber boot. Withdraw the circlip and remove the push rod.

2. Pull the piston and valve assembly from the cylinder.

3. The piston is held in the spring retainer by a tab which engages under a shoulder on the front of the piston. Carefully lift this tab, and remove the piston as shown in Fig. 5.

4. Compress the spring and move the retainer to one side which will release the end of the valve stem from the retainer.

5. Slide the valve spacer and shim off the valve stem.

6. Remove the rubber valve seal and the piston seal, if necessary.

7. Wash the parts in methylated spirits, brake fluid or commercial alcohol. Do not use a mineral fluid such as engine oil or paraffin for washing the parts. Carefully inspect the piston rubber seal and renew if there is any sign of damage to the sealing lip. It is not advisable to turn the seal inside out when examining as slight distortion is sometimes caused. Examine the piston and cylinder bore for scores or damage.

To Reassemble

1. Replace the piston seal with the lip towards the smaller diameter of the piston.

2. Fit the valve seal with the lip away from the spring.

3. Slide the shim, the valve spacer, with the legs over the valve seal, and the return spring, in this order, over the valve stem, see Fig. 4.

4. Insert the spring retainer in the rear end of the return spring, and compress the spring to permit the valve stem to be located in the spring retainer by means of the offset hole.

5. Insert the front of the piston in the spring retainer, and secure it by locating the spring retainer tab under the front shoulder of the piston.

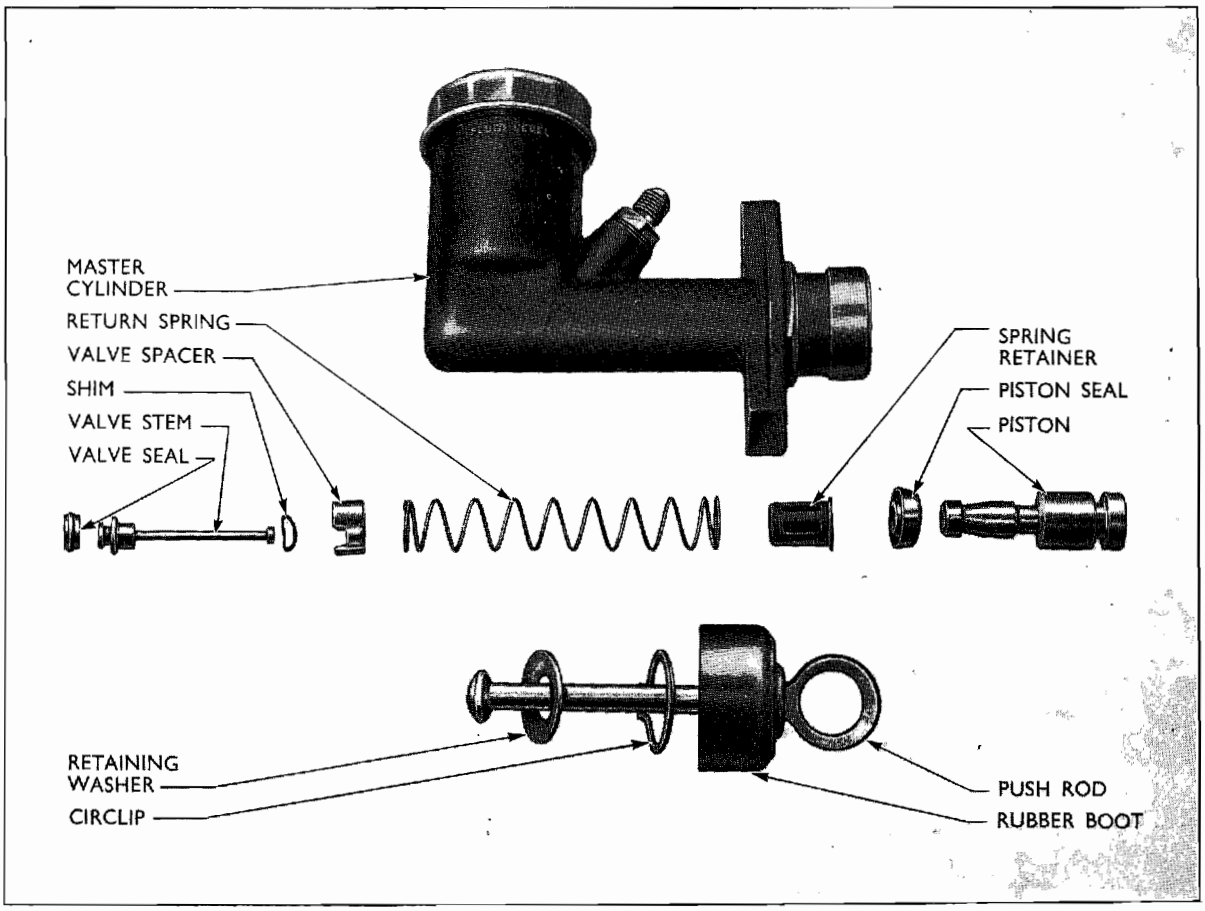

Fig. 4
Master Cylinder—Exploded

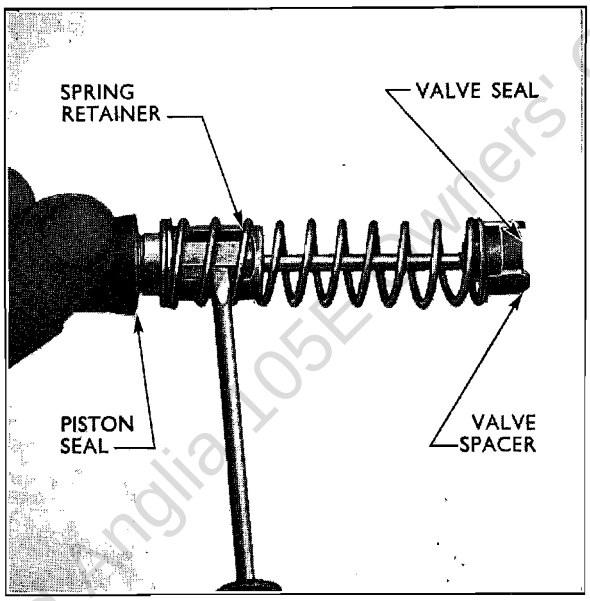

Fig. 5
Removing the Piston Valve

6. Lubricate the piston and seal. Insert the piston assembly in the cylinder, valve seal end first. Ensure that the piston seal is not damaged as it enters the master cylinder.

7. Install the push rod in the master cylinder. Locate the washer and install the retaining circlip.

8. Replace the rubber boot.

To Replace

1. Refit the master cylinder to the engine bulkhead, replace the two securing nuts and tighten securely.

2. Reconnect the fluid pipe, tighten the union securely, but do not overtighten.

3. Locate the plastic washers in the eye of the push rod and fit the bolt, lockwasher and nut.

4. Top up the master cylinder reservoir with clean approved fluid, and then bleed the system as described on continuation sheet 1. If necessary, readjust the clutch. Check the action of the clutch on road test.

OVERHAULING THE CLUTCH AND RELEASE MECHANISM

To gain access to the clutch, the gearbox must first be removed.

Clutch Disc and Pressure Plate

To remove the clutch disc and pressure plate assembly, slacken the six securing screws evenly and detach the assembly. The clutch disc contains six coil springs and these should be checked for end-float. Inspect the clutch disc and check that the linings are not loose and are free from oil. The disc should also be checked for excessive wear or signs of overheating. Replace the disc if the linings are worn down near to the rivet heads or if any of the above conditions are apparent.

Check the condition of the pressure plate surface and the compression springs. Should any sign of scoring, overheating or distortion be present, change the assembly.

Depress each clutch finger in turn and release it slowly to check the action of the release mechanism.

Pilot Bearing

The clutch pilot bearing is located in the centre of the crankshaft flange and is a self-lubricating sintered bronze bush. The bearing must be fitted with the flat face towards the crankshaft, shouldered face towards the clutch.

To Remove

1. Dismantle the clutch pressure plate and disc from the flywheel.

2. Remove the flywheel.

3. Engage the legs of the puller (Tool No. CPT-7600-3) behind the bearing and tighten the nut of the centre bolt to extract the bearing.

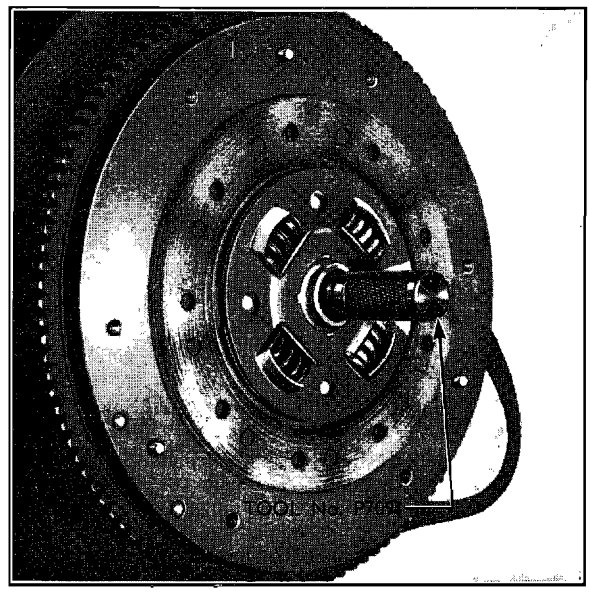

Fig. 6
Clutch Disc Locator

Continued overleaf

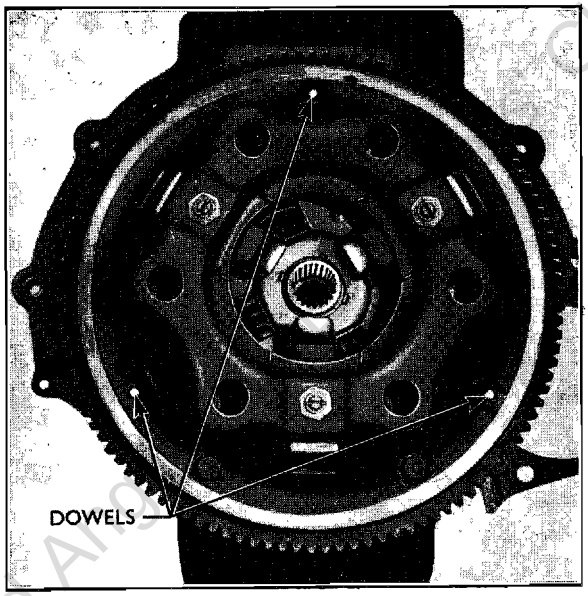

Fig. 7
Clutch Pressure Plate

To Replace

1. Position the bearing bush in the crankshaft flange with its flat face towards the crankshaft. Using the replacer (Tool No. CPT-7091) with the driver handle (Tool No. 550), tap the bearing gently into position, ensuring that it fits squarely in its bore.

2. Refit the flywheel.

3. Locate the clutch disc on the flywheel with the longer boss on the hub away from the flywheel. Align the clutch disc with the pilot bearing using the aligner (Tool No. P-7091).

4. Refit the pressure plate, locating it on the three dowels. Fit the six retaining bolts and spring washers, tightening them evenly to a torque of 12 to 15 lbs. ft. (1.658 to 2.073 kg.m.).

Release Bearing

To remove the clutch release bearing, disconnect the retracting spring, remove the spring clip securing the rubber gaiter to the release arm and detach the gaiter. Pull the forked end of the release arm out of the spring clips of the release bearing hub and disengage the arm from the fulcrum pin. Pull the hub and bearing off the main drive gear bearing retainer and withdraw the release arm.

To dismantle the clutch release bearing assembly, which is a light press fit on the hub, hold it with the bearing downwards and tap the shoulder of the hub sharply on the bench.

Reassemble the clutch release bearing. Check that the release arm fork spring clips on the rear face of the hub are in good condition and assemble the new bearing on the hub with the thrust face of the bearing away from the hub.

Suitably support the bearing on the bed of a press, leaving sufficient clearance for the shouldered end of the hub to protrude. Press the hub into position, ensuring that it enters squarely into the bearing bore.

Pass the clutch release arm through the aperture at the side of the clutch housing, with the fulcrum pin spring clip, facing towards the rear. Engage the clip around the fulcrum pin head.

Check the machined sleeve of the gearbox main shaft bearing retainer for burrs, etc., lightly smear the sleeve with high melting point grease and replace the release bearing assembly, engaging the forked end of the release arm in the spring clips on the hub. Check that movement on the outer end of the release arm is freely transmitted to the bearing. Refit the rubber gaiter to the clutch release arm.

THE PEDAL ASSEMBLY

The clutch pedal is of the pendant type and is mounted with the brake pedal in a bracket assembly bolted to the engine bulkhead beneath the instrument panel.

Clutch Pedal Adjustment

On cars built prior to approximate Engine No. 13,000 adjustments are provided to vary the height of the clutch and brake pedals. Each master cylinder push rod is attached to its pedal lever by means of an eccentric adjuster bolt, which, when rotated, varies the effective length of the master cylinder push rod.

At all times, ensure that with the pedal fully returned, there is clearance between the push rod end and the piston in the master cylinder.

On cars built after this engine number a concentric bolt is fitted in place of the eccentric bolt and therefore no adjustment is provided.

To Remove

1. Unscrew the four nuts securing the bracket and master cylinders to the engine bulkhead.

2. Remove the accelerator pedal by unscrewing the clamp bolt, also remove the pedal return spring. Disconnect the linkage from the carburettor, and the engine bulkhead, so that it can be moved to the left out of engagement with the bush provided in the brake and clutch pedal bracket.

On L.H.D. vehicles disconnect the accelerator linkage at the carburettor and the engine bulkhead, and move the linkage to the right to disengage it from the bush in the pedal bracket.

3. Unscrew the nuts and remove the bolts securing the master cylinder push rods to the pedals.

4. Remove the bolt from each side of the upper face of the bracket assembly.

5. The assembly may now be manoeuvred downwards and removed from its location.

To Dismantle

1. Detach the pedal return spring from its location in the arm and remove.

2. Detach the circlip from one end of the pedal spindle and slide the spindle out of the assembly. Remove the pedals, noting that there is a sintered bronze washer between the two pedal bosses.

The clutch pedal bearing is a bronze bush.

3. Wash the pedal bearings thoroughly and check for wear.

4. Check the condition of the spindle and also the pedal return spring.

To Reassemble

1. Lubricate the bushes, position the two pedals in the bracket and replace the washer in the position detailed in paragraph 2 of the dismantling instructions. Reinsert the spindle and replace the circlip previously removed.

2. Refit the pedal return spring.

To Replace

1. Position the assembly beneath the instrument panel, and replace the two upper mounting bolts and lockwashers.

Do not fully tighten the bolts at this stage.

2. Locate the accelerator linkage in the bush provided on the pedal bracket. Connect the linkage to the engine bulkhead and the carburettor. Refit the accelerator pedal return spring, the pedal and tighten the clamp bolt.

On L.H.D. vehicles slide the accelerator linkage to the left to engage with the bush provided on the pedal bracket. Connect up the linkage at the engine bulkhead and on the carburettor.

3. Replace the four nuts to retain the bracket and master cylinders to the front of the engine bulkhead and tighten these securely. Tighten the two upper mounting bolts.

4. Locate the plastic washers in the push rod eyes and fit the eccentric bolts (or concentric bolts, see sheet 1), lockwashers and nuts.

SPECIFICATIONS

Type	Single Dry Plate
Actuation	Hydraulic
Clutch Disc Diameter	7.22 to 7.25 in. (18.34 to 18.42 cm.)
Total Friction Area	43.28 sq. in. (279 sq. cm.)
Clutch Release Arm Free Travel	$\frac{1}{16}$ in. (1.5 mm.)
Clutch Disc Thickness	0.125 to 0.135 in. (3.18 to 3.43 mm.)
Pressure Plate to Flywheel Bolt Tightening Torque	12 to 15 lbs. ft. (1.658 to 2.073 kg.m.)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 8 : **COOLING SYSTEM**
Subject : **Maintenance and Overhaul**
Effective on : New Anglia and Prefect (1959 onwards)

THE COOLING SYSTEM

Description

The pressurised cooling system is of the impeller assisted thermo-syphon type, with the water pump bolted to the front face of the cylinder block.

Water circulates from the base of the radiator up through the pump and into the cylinder block. The coolant then passes round the combustion chambers and valve seats, up through the thermostat located at the upper water outlet and so through to the radiator top tank. Then the coolant flows down the radiator tubes and is cooled by air passing through the radiator induced by the water pump fan.

To Drain the Cooling System

Two drain taps are fitted, one in the radiator lower tank and the other on the side of the cylinder block behind the generator. The vehicle should be standing on level ground with the filler cap removed, when drained. If an anti-freeze mixture has been used the coolant should be drained into a clean container and retained.

1. Open the drain taps referred to and remove the radiator filler cap slowly.
2. When the coolant has finished running, probe the tap orifices to make sure that no sediment, scale, etc., has prevented the entire contents draining away.

NOTE.—It is advisable to leave an indication on the vehicle that the cooling water has been drained, should it be left standing.

To Fill

1. Turn off the radiator and cylinder block taps if this has not already been done.
2. If an anti-freeze solution has been in use and has been retained, return this to the cooling system, but if there is insufficient coolant to fill the system, do not add plain water, otherwise the solution will be weakened and the freezing point raised. Add the correct mixture of anti-freeze solution and water as required. Fill the cooling system slowly to avoid a possibility of air locks.

NOTE.—Water used for the cooling system should, preferably, be soft rain water from which foreign matter has been strained. Some tap waters contain impurities which can cause considerable fur deposits, etc., and should any undue deposits be present, the radiator should be flushed.

3. Replace the radiator cap securely, check for any signs of water leakage.

Anti-Freeze Mixture

In the winter months an anti-freeze solution should be used to prevent damage to the engine, which could result if the cooling water froze.

Salt solutions such as calcium, sodium and magnesium chloride or organic solutions such as honey, sugar and glucose solutions are extremely harmful and should never be used. Glycerine, ethylene glycol and alcohol are solutions which are satisfactory for anti-freeze purposes, but these inorganic compounds do not contain an anti-rust inhibitor. An approved anti-freeze solution is available which contains a suitable inhibitor which will reduce rust formation and corrosion in the cooling system to a minimum.

The percentage of anti-freeze solution in the cooling system will determine the degree of protection and it is advisable to allow a margin of safety in cases where lower temperatures than normal may be encountered. The cooling system should be flushed out thoroughly before adding anti-freeze solution. It is advisable to mix the solution with water in a separate container before filling the cooling system. The quantities of anti-freeze for various degrees of protection are given in the table in the specification at the end of this Bulletin. The approximate percentage of anti-freeze solution in the cooling system can be checked by measuring the specific gravity of the coolant and a suitable hydrometer is required having a range of 1.000/1.050, calibrated at 60°F. When checking the specific gravity, the temperature of the coolant should be 58° to 62°F. Compare the hydrometer readings with the figures, given in the Specification.

Continued overleaf

WATER PUMP

The water pump is mounted on the front face of the cylinder block and is driven by a fan belt from the crankshaft pulley.

To Remove

1. Drain the cooling system as described earlier.
2. Unscrew the four bolts and lockwashers securing the fan blades to the water pump.
3. Remove the fan blades (and the spacer fitted to Prefect engines only).
4. Disconnect the radiator lower hose.
5. Slacken the generator adjusting arm clamp bolt and mounting bolts, pivot the generator towards the engine and detach the fan belt.

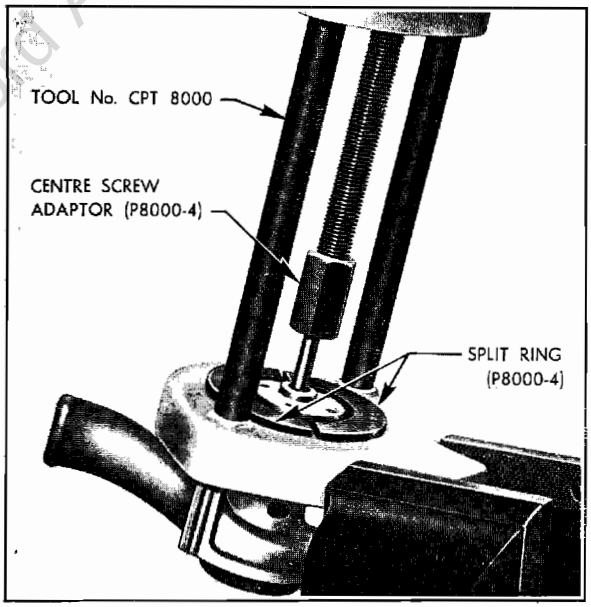

Fig. 1
Removing the Pulley Hub

6. Unscrew the three bolts and lockwashers retaining the water pump to the cylinder block and detach the pump and gasket. Note that one bolt helps to retain the timing cover in position.

Overhauling the Water Pump

Throughout the following operations, the water pump overhaul tools Nos. CPT.8000 and P.8000–4 are used and the appropriate adaptors are indicated by means of their respective detail letters.

1. Remove the water pump as described above.
2. Remove the pump pulley hub from the shaft, using adaptors details a and b as shown in Fig. 1. Do not omit adaptor detail b which pushes against the centre of the shaft. Lever the bearing retainer clip out of the slot in the housing. (Fig. 2)

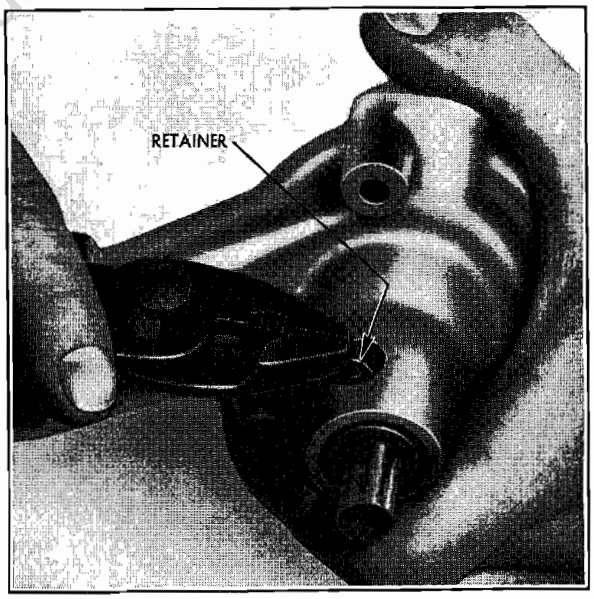

Fig. 2
Removing the Retainer

3. Press the impeller, seal, slinger, shaft and bearing assembly out of the housing using adaptors details d and e. Adaptor detail e is hollow and it fits over the shaft and bears against the outer diameter of the bearing.
4. Press the impeller off the end of the shaft, using adaptors details a and b as shown in Fig. 3, ensuring that the vanes avoid the slots.
5. Remove the pump seal from the shaft and carefully split the slinger bush with a chisel to detach it from the shaft.

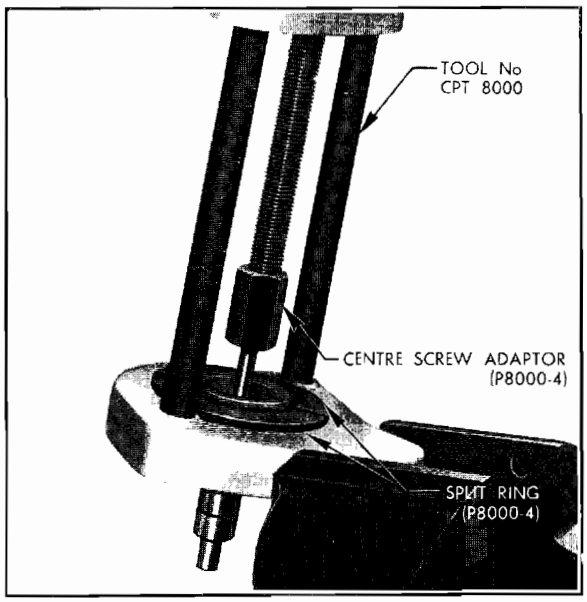

Fig. 3
Removing the Shaft and Bearing Assembly

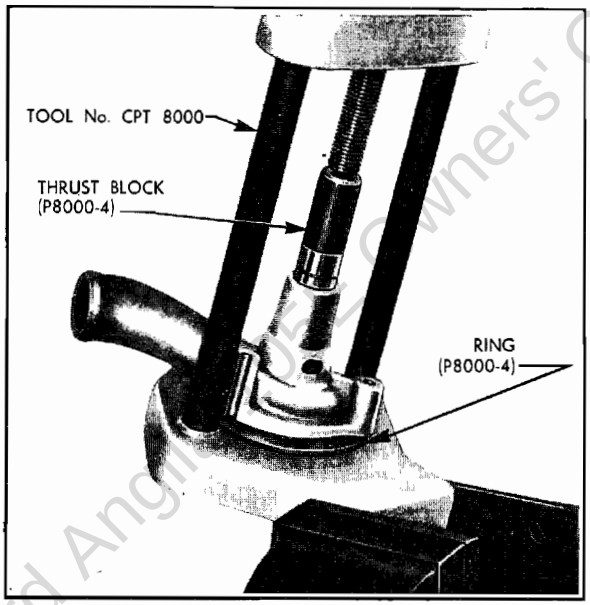

Fig. 4
Refitting the Shaft and Bearing

To Reassemble the Water Pump

1. Press the shaft and bearing assembly into the housing (short end of shaft to the front of the housing) until the groove in the shaft is in line with the groove inside the housing, using details d and e as shown in Fig. 4.

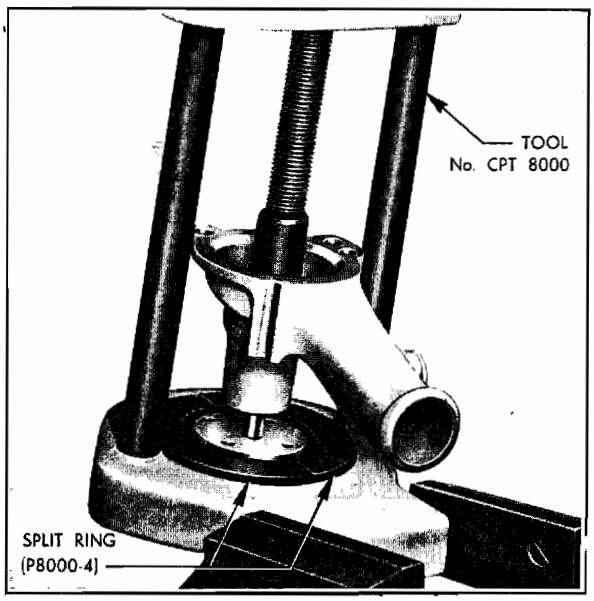

Fig. 5
Fitting the Pulley Hub

2. Refit the bearing retainer clip in the groove of the bearing and housing.
3. Press the pump pulley hub on to the front end of the shaft until the end of the shaft is $\frac{1}{2}$ in. (12.7 mm.) away from the outer front face of the hub, using adaptors details a and e as shown in Fig. 5.
4. Fit the new slinger bush (flanged end first) on the rear end of the shaft, using driver detail f, and refit the pump seal on the slinger bush with the carbon thrust face towards the impeller.
5. Press the impeller on to the shaft, using the adaptor details a and b, until a clearance of 0.030 in. (0.762 mm.) is obtained between the impeller blades and the housing face as shown in Fig. 7.

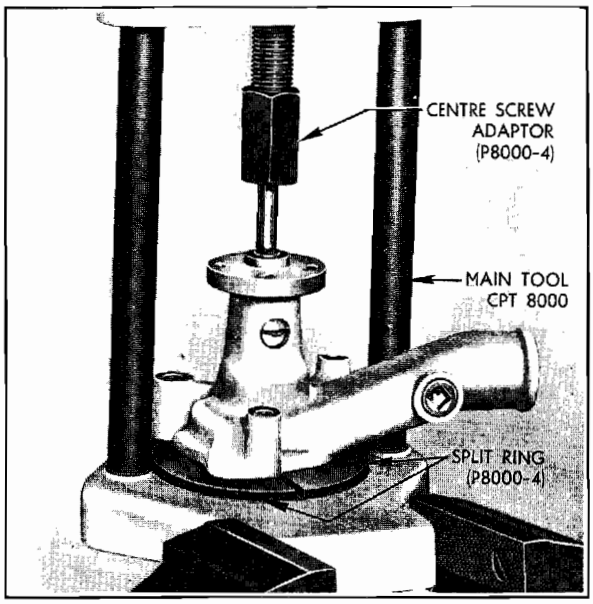

Fig. 6
Fitting the Impeller

To Replace

1. Locate a new pump gasket on the cylinder block face.
2. Fit the water pump, using the three bolts and lockwashers, and refit the fan belt and lower water hose.

   NOTE.—Generator adjusting strap is fitted under one bolt.
3. Refit the fan blades (with spacer on Prefect engines) and adjust the fan belt as described on sheet 3.
4. Check all water connections for indications of leaks.

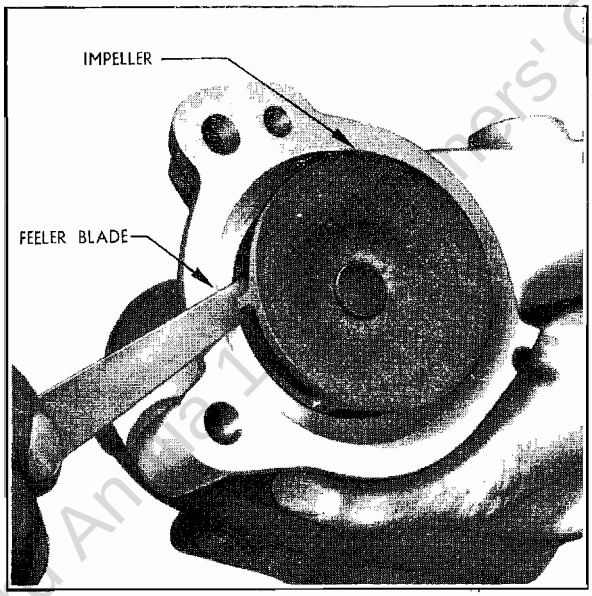

Fig. 7
Checking the Clearance of Impeller Blades

RADIATOR

To Remove

1. Drain the cooling system.
2. Disconnect the hose connections at the upper and lower radiator tanks.
3. Remove the bolts securing the radiator to the engine compartment bulkhead.
4. The radiator can now be lifted from the vehicle.

To Replace

1. Enter the radiator and replace the four bolts, screwing these into the spring clip nuts.
2. Connect the upper and lower hoses.
3. Refill the system.
4. Check hoses and radiator for signs of leaks.

THERMOSTAT

A thermostat is located beneath the water outlet on the cylinder head.

To Remove

1. Drain the cooling system as previously described and disconnect the hose from the water outlet.
2. Unscrew the two bolts securing the water outlet connection to the cylinder head.
3. Remove the water outlet connection, lift off the gasket and extract the thermostat from the recess in the cylinder head.

Testing the Thermostat

Usually, if it is suspected that the thermostat is not operating correctly, it may be tested in the following manner.

Suspend the thermostat in water in a suitable container, and gradually heat the water, checking the temperature at frequent intervals with an accurate thermometer. Neither the thermostat nor the thermometer must touch the bottom of the container.

The valve should commence to open and be fully opened at the appropriate temperatures shown in the specification.

If the thermostat does not function properly, do not attempt an adjustment but replace with a new unit.

To Replace

1. Locate the thermostat in the recess at the front of the cylinder head, fit a new gasket and replace the water outlet connection, securing with two bolts and spring washers.
2. Connect the upper hose, refill the cooling system and check for water leaks.

FAN BELT

A single V-type belt is used to drive the generator and water pump from the crankshaft pulley, the fan being mounted on the end of the water pump shaft. Correct fan belt adjustment is important, otherwise the belt itself may be damaged or undue strain placed on the generator or water pump bearings.

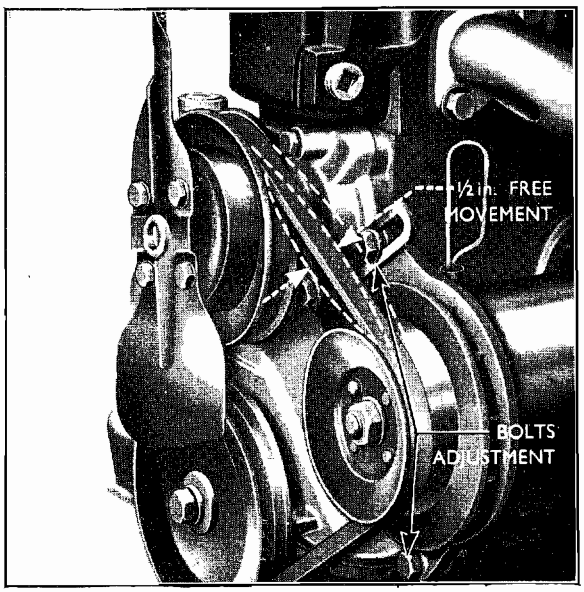

Fig. 8
Fan Belt Tension Adjustment

There is provision for fan belt adjustment by moving the generator on its mountings and it is important that this adjustment be carried out when a new fan belt is fitted, otherwise any attempt to strain a new belt over the sides of the pulley can easily cause damage to the rubber plies.

To Adjust the Fan Belt Tension

The correct tension of the fan belt is such that when the belt is alternately pushed and pulled at a point midway between the generator and the water pump pulley, a total movement of $\frac{1}{2}$ in. (12.7 mm.) is obtained.

1. Slacken the generator adjustment locking screw and the two generator mounting bolts.
2. Move the generator towards or away from the engine as necessary until the correct belt tension is obtained, testing the tension midway between the generator and water pump pulleys. (See Fig. 8)
3. Lock the adjustment locking screw and tighten the two generator mounting bolts.

FAN

The fan and fan pulley are secured to the water pump pulley hub by four bolts and spring washers.

The fan should be checked periodically to ensure that the blades are true, as distorted blades may cause damage to the water pump bearings.

NOTE.—Do not attempt to turn the engine by means of the fan as this may distort the blades and cause them to run out of true.

SPECIFICATIONS

Cooling System Capacity :

New Anglia	10.25 imp. pints (12.3 U.S. pints) (5.8 litres)
New Prefect	11.4 imp. pints (12.68 U.S. pints) (6.48 litres)

Radiator Cap Release Pressure :

New Anglia	7 lbs./sq. in. (0.492 kgs./sq. cm.)
New Prefect	4 lbs./sq. in. (0.281 kgs./sq. cm.)

Thermostat Data :

Starts to open	170° to 179°F.
Fully open	199°F.

Fan :

2 blades	9 in. (22.86 cms.)
4 blades	9 in. (22.86 cms.)

Belt Tension .. $\frac{1}{2}$ in. (12.7 mm.) free movement

Anti-freeze Quantities : New Anglia

Capacity of Cooling System	*Volume of ME-1163 in Water*	*Anti-Freeze Protection*	*Specific Gravity*	*ME-1163 Pints*	*Water Pints*
10.25 Imp. pints	10%	Down to 17°F. or equivalent of 15°F. of frost	1.017	1.25	9
	15%	Down to 7°F. or equivalent of 25°F. of frost	1.024	1.75	8.5
	20%	— 3°F. or equivalent of 35°F. of frost ..	1.032	2.25	8
	25%	—20°F. or equivalent of 52°F. of frost ..	1.040	2.75	7.5

Anti-freeze Quantities : New Prefect

Capacity of Cooling System	*Volume of ME–1163 in Water*	*Anti-Freeze Protection*	*Specific Gravity*	*ME–1163 Pints*	*Water Pints*
11.4 Imp. pints	10%	Down to 17°F. or equivalent of 15°F. of frost	1.017	1.25	10.25
	15%	Down to 7°F. or equivalent of 25°F. of frost	1.024	1.75	9.75
	20%	— 3°F. or equivalent of 35°F. of frost ..	1.032	2.5	9.0
	25%	—20°F. or equivalent of 52°F. of frost ..	1.040	3.0	8.5

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 9: **FUEL SYSTEM**
Subject: **REPAIR PROCEDURE**
Effective on: New Anglia and Prefect (1959 onwards)

THE FUEL SYSTEM

Description

The fuel system consists of a fuel tank, a mechanical fuel pump operated by the camshaft and a down-draught carburettor together with the necessary fuel lines.

A two-stage starting device is incorporated in the carburettor, which in the first stage consists of a progressive starting device up to the half-way or intermediate position of the choke control. In the fully out position it gives a rich mixture for starting under extreme cold conditions.

A fuel tank, capacity 7 imperial gallons (8.4 U.S. gallons, 31.82 litres) is located at the rear of the car beneath the luggage compartment (in the compartment for Prefect models as on previous models).

On the Anglia the fuel tank filler cap is positioned to the right of the rear number plate, and it may be removed by turning it in an anti-clockwise direction. The Prefect tank filler cap is located on top of the left-hand rear wing.

Always check when fitting a replacement filler cap to make sure it is of the vented type.

The fuel gauge on the instrument panel registers the quantity of fuel in the tank, when the ignition is switched " on."

One of two types of gauge is fitted in production; that fitted to the Anglia is designed to eliminate needle fluctuation whilst the vehicle is in motion. With this type of gauge the needle moves slowly across the scale, taking about 30 seconds to indicate the correct reading after switching on the ignition.

The fuel gauge fitted to Prefect cars is of the conventional type and registers the fuel contents immediately the ignition is switched 'on.'

The fuel pump is supplied from the tank by means of a fuel line which runs beneath the floor of the vehicle. A short length of flexible hose between the fuel pipe and the fuel pump is also incorporated.

An air cleaner of either the dry gauze or oil bath type can be fitted to the engine, and is mounted above the carburettor.

THE FUEL LINE

The fuel pipe is clipped to the underside of the floor pan and requires little attention except a periodic check on the tightness of unions and securing clips. A check should also be made to ensure that the pipe is not chafing on the floor at any point.

THE FUEL TANK (ANGLIA)

The Anglia fuel tank is mounted at the rear of the car beneath the luggage compartment. The tank is retained in position by two straps and clamps which are adjustable and hook into brackets attached to the floor pan. There are anti-squeak pads attached to the fuel tank in the area covered by the tank support straps and on the upper surface of the tank. A drain plug is fitted to the tank.

To Remove

1. From below the car, disconnect the fuel line from the right-hand front face of the tank, draining the fuel into a suitable container.

2. Remove the fuel tank filler cap.

Unscrew the two filler neck hose clamps. Remove the rubber hose and filler neck from inside the boot.

4. Suitably support the fuel tank, and unscrew the nuts on the threaded clamps. Unhook the clamps from the brackets on the floor pan and lower the tank towards the ground the maximum amount permitted by the yellow green tracer wire connected to the fuel gauge tank unit.

5. Disconnect the yellow-green tracer wire from the fuel gauge tank unit.

6. If necessary the rubber grommet surrounding the fuel tank filler neck orifice may be removed.

To Replace

1. If removed, the rubber grommet surrounding the fuel tank filler neck orifice may be replaced from the inside of the luggage compartment.

2. Raise the fuel tank sufficiently to connect up the yellow-green tracer wire to the fuel gauge tank unit.

3. Raise the fuel tank into its location under the luggage compartment floor, engage the hook clamps on the end of each support strap in their respective brackets on the floor pan, ensuring that these support straps run over the anti-squeak pads attached to the underside of the tank. Do not fully tighten the nuts on the hook clamps.

4. Refit the rubber hose and the filler neck to the tank, tighten up the two hose clamps.

5. From underneath the car connect the fuel pipe line to the tank.

Continued overleaf

6. Tighten up the nuts on the hook clamps until the fuel tank is firmly located.

7. Refill the tank with fuel and replace the filler cap.

AIR CLEANER

A dry gauze type air cleaner is fitted to domestic and an oil bath type to export vehicles.

Cleaners should be removed and elements washed in petrol every 5,000 miles (8,000 km.), or sooner in heavily dust-laden atmospheres.

Dry Gauze Type Air Cleaner

To Remove

1. Slacken the clamp securing the air cleaner hose to the top of the carburettor.

2. Lift off the air cleaner.

To Clean

1. Wipe the outside of the casing and wash the element in petrol until all dirt is removed. To facilitate cleaning the element, pour petrol in the large orifice (on the carburettor side of the air cleaner), swirl around and pour out through the "spout," or air inlet.

2. Allow to dry, pour in engine oil in a similar manner, shake out any surplus oil.

To Replace

1. Locate the air cleaner, reconnecting the air cleaner hose to the carburettor, so that the spout of the air cleaner is pointing forward and to the left.

2. Tighten the cleaner to carburettor hose clamp.

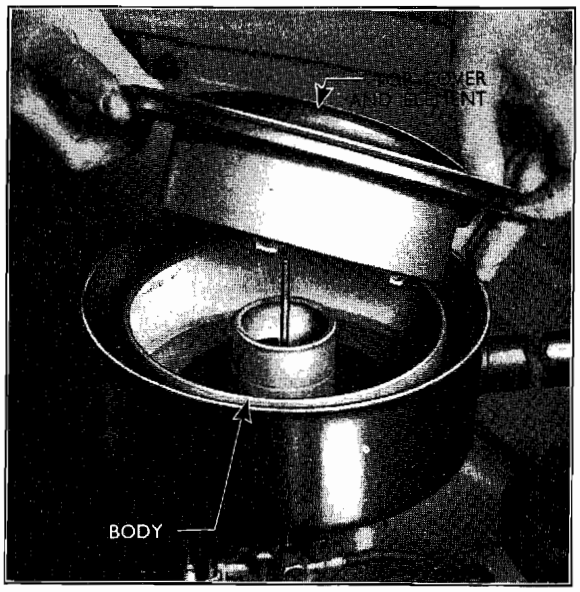

Fig. 1
Oil Bath Air Cleaner Element

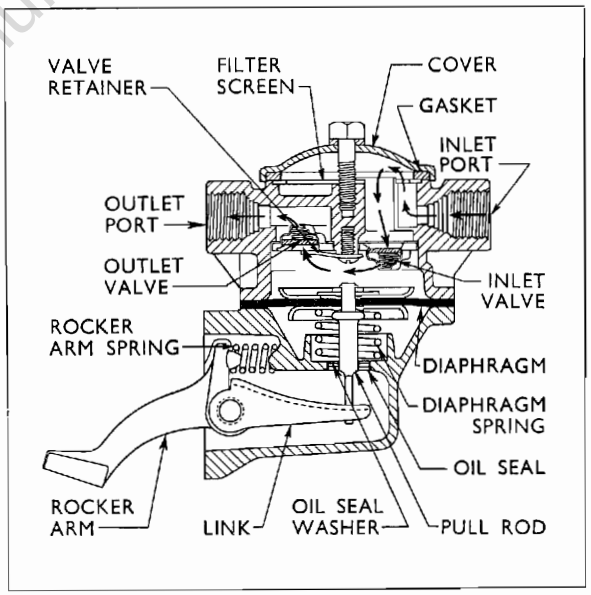

Fig. 2
Sectioned Fuel Pump (Anglia)

Oil Bath Type Air Cleaner

To Remove and Replace

The oil bath air cleaner can be removed and replaced in a similar manner to the dry gauze type.

To Clean

1. Unscrew the wing nut on the centre rod and detach the air cleaner cover.

2. Lift out the filter element and wash thoroughly in petrol. Shake out the surplus petrol and dip in engine oil, shaking out thoroughly.

3. Drain the oil from the filter bowl, clean out and refill to the level indicated by the arrow (see Fig. 1) with clean engine oil.

4. Check that the cork gasket is in good condition, and refit the element.

5. Refit the top cover and tighten the centre rod wing nut securely.

THE FUEL PUMP

Description and Operation

The fuel pump is a self-priming unit, operated through a spring-loaded arm from an eccentric on the camshaft. The pump on the Prefect also incorporates a vacuum pump to operate the wiper motor.

As the engine camshaft revolves, the eccentric moves the pump rocker arm upwards, causing the diaphragm to be moved downwards against the pressure of the diaphragm spring, by means of the diaphragm pull rod. This creates a partial vacuum in the pump chamber sufficient to open the inlet

valve and draw fuel from the tank, entering at the inlet port and so into the sediment chamber, see Fig. 2.

The fuel is then drawn through the filter screen and down through the non-return inlet valve into the pump chamber immediately above the diaphragm.

Further movement of the engine camshaft allows the spring-loaded rocker arm to move outwards from the pump, allowing the diaphragm spring to push the diaphragm upwards. This forces the fuel in the pump chamber through the outlet valve into the outlet pipe connecting the pump to the carburettor float chamber.

When the carburettor bowl is full, the float will close the needle valve, thus preventing further petrol supply from the pump chamber. The pressure thus created will hold the diaphragm downwards against the pressure of the diaphragm spring and it will remain in this position until the carburettor requires more fuel and the needle valve opens.

The operating linkage of the pump is such that idling movement of the rocker arm is allowed when there is no movement of the fuel pump diaphragm. A spring holds the rocker arm in constant contact with the eccentric to minimise operating noise.

The fuel pump incorporates valve assemblies which are serviced as complete units. Each unit consists of a small brass cage holding the valve and spring, which can be fitted in either an inlet or outlet position, see Fig. 2.

Operation of the Vacuum Pump (Prefect)

When the engine is started up, a depression is created in the inlet manifold, vacuum pump and windscreen wiper motor hose, thus causing the vacuum pump diaphragm to be held down against its spring and allowing the pump link to idle.

As soon as the depression falls, the spring beneath the diaphragm forces the diaphragm upwards, allowing the pump to come into operation. Air is drawn from the wiper motor side of the pump and is returned to the inlet manifold on both up and down strokes of the diaphragm.

When the windscreen wipers are inoperative, the pump exhausts air from the wiper motor side of the pump until sufficient depression is created to hold the diaphragm down, so allowing the pump to idle.

Cleaning the Fuel Pump

The filter screen and sediment bowl should be cleaned in petrol every 5,000 miles (8,000 km.).

To Remove the Filter Screen (Anglia)

1. Remove the pump cover screw and fibre washer, lift off the cover, retaining the gasket fitted between the cover and the pump body (Fig. 3).

2. Carefully remove the filter screen and wash it in petrol. Flush all traces of sediment from the sediment chamber.

To Replace

1. Replace the filter screen on the fuel pump body with the metal reinforcement facing upwards, see Fig. 3.

2. Renew the gasket under the pump cover should it be hard or broken. This point is very important, as any leakage at this point can reduce pump efficiency or, in extreme cases, render the pump inoperative due to the leakage of air.

3. Replace the pump cover and screw, fitting the fibre washer under the screw head. Do not over-tighten this screw or the washer may be damaged or the cover distorted.

To Remove the Filter Screen (Prefect)

1. Turn off the fuel supply at the tap screwed into the pump inlet union.

2. Unscrew the sediment bulb retainer clamp and lift off the bulb and filter screen. Carefully wash the screen in petrol.

To Replace

1. Refit the screen to the fuel pump body.

2. Ensure that the gasket is in good condition and refit the sediment bulb. Tighten the clamp to retain the sediment bulb in position.

3. Turn on the fuel supply.

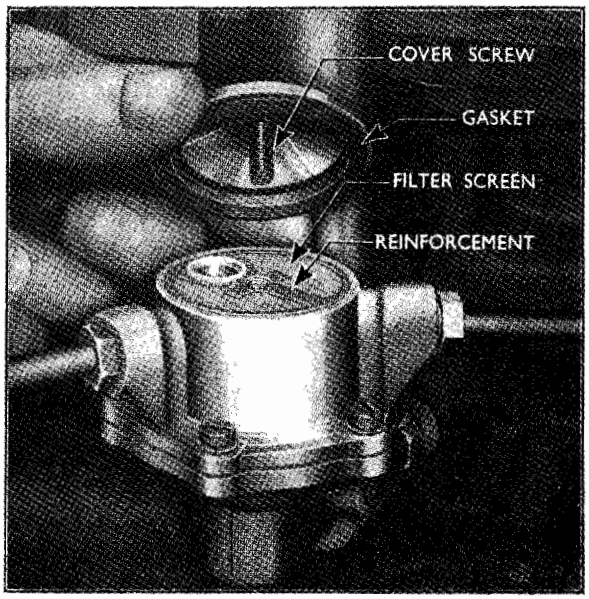

Fig. 3
Fuel Pump Screen (Anglia)

Testing the Fuel Pump

Providing there are no leaks or obstructions in the fuel line, a quick check of the fuel pump efficiency can be made as follows :—

1. Disconnect the fuel pump to carburettor pipe at the pump outlet.

2. Crank the engine by means of the starter motor, when a well-defined spurt of fuel should be apparent for each revolution of the camshaft. If the pump does not operate correctly, check the inlet depression and delivery pressure using suitable gauges. (The gang gauge set (Tool No. 500) and the Diagnosis Test Set have suitable gauges and adaptors for this work.)

Fuel Pump Inlet Depression Test

1. Fill the carburettor float chamber with petrol.

2. Disconnect the main fuel line from the fuel tank at the pump inlet, suitably plugging the end of the pipe to prevent loss of fuel from the tank.

3. Connect the vacuum gauge to the inlet union, start the engine and allow it to run at idling speed, when a vacuum reading of at least 8½ in. (21.59 cms.) mercury should be obtained.

4. Stop the engine when the gauge needle should take at least one minute to return to zero.

Fuel Pump Delivery Pressure Test

1. Fill the carburettor float chamber with petrol.

2. Disconnect the fuel pump to carburettor pipe and connect the pressure gauge to the pump outlet.

3. Start the engine and observe the pressure when running at idling speed. Momentarily race the engine and observe the pressure. This should not be less than 1¼ lb. per sq. in. (0.088 kg. per sq. cm.) and should not exceed 2 lb. per sq. in. (0.141 kg. per sq. cm.) at any speed.

Low fuel pump outlet pressure may limit engine performance. An excessive pressure may result in a high float chamber level, with possible flooding. High fuel pump pressure may also cause the engine to stall, due to an over-rich mixture.

4. Disconnect the pressure gauge from the pump and reconnect the fuel pump to carburettor pipe.

Vacuum Pump Depression Test (Prefect)

If the windscreen wipers operate sluggishly when the engine is pulling under heavy load, the vacuum pump inlet depression should be checked.

1. Disconnect both hoses at the vacuum pump and connect the vacuum gauge to the wiper motor side of the pump.

2. Start the engine and note the vacuum reading, which should be 8 in. (20.32 cm.) of mercury at idling speed, rising to 10½ in. (26.67 cm.) of mercury at maximum speed.

Overhauling the Fuel Pump

To Remove

1. Disconnect the fuel pump to carburettor pipe by unscrewing the union nut at each end. Remove the pipe.

2. Unscrew the union nut on the fuel line from the petrol tank and on Anglia cars withdraw the pipe from the fuel pump inlet. On Prefect cars withdraw the pipe from the fuel tap, then unscrew the tap from the pump body. The pipe should be suitably plugged to prevent a loss of fuel.

Care should be taken to prevent the flexible fuel pipe from becoming twisted and so ruptured. This can be readily achieved by holding the nut on the flexible pipe with one spanner (to prevent rotation) whilst tightening or loosening the union nut on the pipe line from the fuel tank with another spanner.

3. Unscrew and remove the two bolts and spring washers securing the fuel pump to the cylinder block and detach the fuel pump, lifting the operating lever to clear the eccentric and the slotted hole in the block.

To Dismantle (Anglia)

1. Unscrew the filter cover bolt and remove the cover, filter screen and gasket. Mark the upper and lower bodies to ensure correct alignment on reassembly.

2. Remove the five screws and spring washers securing the upper and lower fuel pump bodies, taking care when separating the flange joint to avoid damaging the diaphragm.

3. Turn the diaphragm, approximately a quarter turn (in either direction) to free the diaphragm rod from the operating lever, and detach the diaphragm.

4. The diaphragm and pull rod are riveted together and should not be dismantled. Remove the diaphragm spring, oil seal retaining washer and rubber oil seal.

5. The inlet and outlet valves are both retained by a spring steel plate secured by two screws. Remove the screws and plate, when the two valve assemblies together with the "figure 8" gasket can be lifted from the upper body.

6. Should it be necessary to dismantle the lower body, remove the circlip from one end of the pin on which the rocker arm operates and press the pin from the pump lower body. The rocker arm, spring, link and two washers can then be removed.

To Reassemble

If the lower body has been completely dismantled, first replace the rocker arm and link assembly as follows :—

1. Insert the rocker arm pin through one boss in the lower body, so there is sufficient room to position the two thrust washers, one at each side of the longitudinal aperture adjacent to the pin.

2. Fit one thrust washer, insert the link, slotted end first, with the two holes in line with the pin, and the central web uppermost.

3. Insert the rocker arm, with the boss between the flanges of the link, and place the rocker arm spring in position so that the ends are located by the registers on the body and the rocker arm.

4. Press the pin into position, fitting the second thrust washer between the link and the body, ensuring that the pin passes through the two washers, the two holes in the link and the rocker arm. Inspect the pin to make sure it is properly positioned and the rocker arm and link operate correctly.

Test by moving the rocker arm towards the pump body, when the link should move downwards. If the link is held downwards, as will occur in operation when the carburettor float chamber is full, the rocker arm should be free to move without transmitting any movement to the diaphragm and link. If the link is satisfactory, refit the circlips on the pin to retain it in position.

5. To install the diaphragm assembly, proceed as follows :—

Assemble the spring, oil seal washer and oil seal to pull rod, taking care to avoid damage.

Insert the end of the rod in the slotted end of the link, engaging the grooves in the pull rod end by turning the diaphragm a quarter of a turn, so that the SMALLER TABS on the diaphragm align with the mating mark on the lower body flange.

6. Hold the upper body with the valve locations uppermost. Fit the " figure 8 " gasket in the upper body, then fit the two valve assemblies as shown in Fig. 2. Note that these will only seat properly when in the correct locations.

Assemble the retainer plate securing it with the two screws.

7. Position the fuel pump upper body over the diaphragm on the lower body so that the inlet and outlet unions are directly opposite the mounting flange. Ensure that the mating mark on the lower body is in line with the SMALLER TAB on the diaphragm. Depress the rocker arm until the diaphragm is level with the flange, fit the five screws and spring washers and tighten them finger-tight.

8. Work the rocker arm several complete strokes to centralise the diaphragm and tighten the five screws evenly and securely, with the diaphragm in the " down " position.

9. Replace the filter screen with the reinforcement frame uppermost. Fit a new gasket to the pump cover, replace the cover and fit the cover screw and fibre washer. Tighten down securely, but take care not to distort the cover or damage the fibre washer. It is essential that an airtight joint is made at this point, otherwise the pump will be rendered inoperative or its efficiency will be reduced.

To Dismantle (Prefect)

1. Mark the fuel pump flanges to ensure correct replacement.

2. Unscrew the sediment bulb clamp nut and detach the bulb, clamp, gasket and filter screen.

3. To remove the fuel pump upper body, unscrew the six screws securing it to the lower body and lift off the body.

4. Remove the two screws securing the valve retainer plate and detach the fuel pump valves.

5. To remove the vacuum pump body, unscrew two opposite securing screws and replace by two screws, 1½ in. (3.81 cm.) long (2 B.A. thread). Remove the other flange screws and carefully unscrew the two long screws until the pressure is taken off the vacuum pump diaphragm spring.

Detach the vacuum pump body, diaphragm spring and spring retainer—the valves are staked into the vacuum pump body and should not be removed unless they are to be renewed.

6. Remove the two screws securing the vacuum diaphragm pull rod oil seal retainer to the pump centre body.

7. File off the head of the rocker arm pin and drive out the pin, when the rocker arm, spring, links and washers can be extracted.

Two more valve assemblies are located in the underside of the fuel pump lower body. The outer valve is held in position by the vacuum pump body flange, but the inner valve is staked in position and should not be removed unless it is to be renewed.

To Reassemble

1. Locate the figure " 8 " paper gasket in the fuel pump valve ports and replace the valve assemblies. The outlet valve in the centre of the pump body fits with the *valve seat* outward, and the inlet valve fits with the *valve spring* outward. (The pump body is designed to prevent the valve assemblies seating properly if incorrectly fitted.)

Continued overleaf

Replace the retainer plate and two screws, tightening them securely.

2. Reassemble the rocker arm and links. The fuel pump link fits in the centre of the rocker arm, hooked ends upwards, with the legs of the rocker arm link spacer on either side. The vacuum pump right- and left-hand links and shim washers fit on either side of the rocker arm link spacer.

3. Locate this assembly between the shoulders of the rocker arm and replace the steel bush, locating a spacing washer on each end of the bush.

Refit this assembly to the lower body, locating the rocker arm return spring between the projection inside the body and the projection on the rocker arm link spacer.

To locate the rocker arm, use a piece of $\frac{16}{64}$ in. (5.95 mm.) dia. steel, 6 in. (15 cm.) long, having half its length reduced to $\frac{8}{16}$ in. (4.76 mm.) dia.

4. Insert the thinner end of the rod through the rocker arm pin holes in the body and steel bush to hold the rocker arm and links temporarily in position.

5. Replace the fuel pump pull rod oil seal with the raised centre outward. Lightly stake the casting around the oil seal to hold it in position.

6. Tap the larger diameter of the temporary pin through the housing and refit the rocker arm pin, pushing it into position through the pin bosses.

Locate a small flat washer on either end of the pin and pein over each end to hold it in place.

7. Locate the fuel pump spring retainer and spring on the diaphragm pull rod and pass the rod through the oil seal. The large tab on the diaphragm is located adjacent to the sediment bowl.

Tilt the diaphragm assembly slightly to move the slotted end of the pull rod away from the fuel pump link, invert the pump body so that the link falls to its lowest position, and then move the diaphragm assembly so that the slot in the end of the pull rod hooks into the notch in the link.

8. Replace the fuel pump upper body on the lower body, with the mating marks together. Depress the rocker arm until the fuel pump diaphragm is level with the flange, fit the six screws with spring washers and tighten the screws finger-tight.

Work the rocker arm several complete strokes to free off the diaphragm and tighten the six screws evenly and securely.

9. Reassemble the vacuum pump body if the valve assemblies have been removed, they should be located in their recesses in the fuel pump lower body and vacuum pump body. Both valves in the fuel pump lower body fit with the valve seats outwards. The outlet valve in the vacuum pump body fits into its recess and the inlet valve stands on the recess. All valve assemblies, except the inlet valve in the fuel pump lower body (adjacent to the rocker arm) should be lightly staked around the casting to secure them in position.

10. Replace the oil seal (with the lugs to the diaphragm), oil seal (with the bell end away from the diaphragm) and split washer on the diaphragm spindle.

11. Fit the two diaphragm push rod oil seal retainer screws loosely to the pump body. Pass the push rod through the aperture in the body and locate the retainer under the screws. Tighten the screws.

12. Hold the fuel pump lower body with the vacuum pump flange facing you and the rocker arm pointing downwards. Replace the vacuum pump diaphragm, inserting the push rod through the oil seal. Keep the two tabs of the diaphragm parallel with the engine mounting flange.

Tilt the push rod away from the engine flange and depress the rocker arm, when the two vacuum pump links should be heard to hook into the slot in the push rod.

Check that both link ends are engaging in the slot by observation through the engine mounting flange aperture.

13. Secure the fuel pump lower body in a vice with the vacuum diaphragm upwards, and insert a suitable spacer between the lower end of the rocker arm and the pump body to keep the rocker arm depressed, so that the vacuum pump diaphragm is level with its flange.

Locate the spring retainer on the diaphragm and fit the diaphragm spring into the vacuum pump body.

Align the vacuum pump body on the flange with the mating marks together and refit the two long screws previously used. Tighten these screws to compress the spring and replace the normal flange screws and spring washers, tightening them finger-tight.

Remove the two long screws and refit the correct length screws and spring washers.

Remove the temporary spacer between the rocker arm and lower body to allow the diaphragm spring to flex the diaphragm and tighten the screws evenly and securely.

14. Refit the fuel filter. Check that the gasket is in good condition. Fit the sediment bulb and tighten the clamp to retain the bulb.

To Replace

1. Ensure that the inlet and outlet ports and threads are perfectly clean.

2. Clean the flange on the cylinder block, removing any traces of damage to the gasket which may be adhering to the face joint. Fit a new gasket to the cylinder block flange, holding it in place with a smear of grease.

3. Insert the rocker arm through the slot in the crankcase wall so that the arm lies on the camshaft eccentric.

4. Fit the fuel pump to the cylinder block with two spring washers and bolts, tightening each bolt evenly and securely.

5. Ensure that the pipe unions are clean and refit the fuel pipe from the fuel tank. On Prefect cars fit the fuel tap to the pump inlet port, then refit the fuel pipe from the tank to the tap. Refit the fuel pump to carburettor pipe. On the Prefect reconnect the vacuum pipes.

6. Run the engine and check for fuel leaks at the unions.

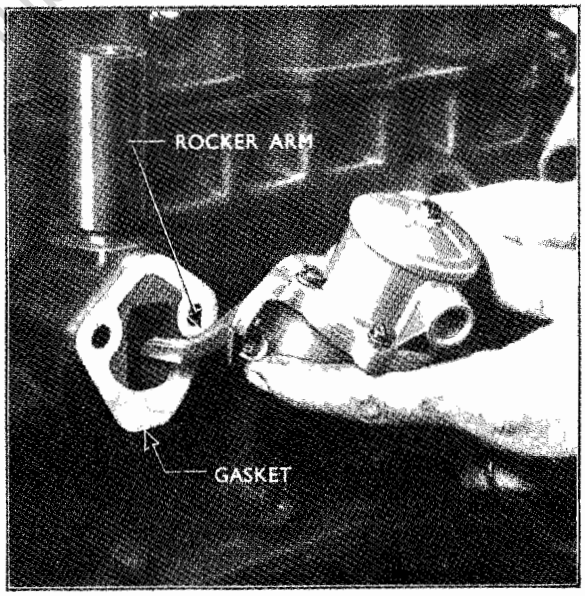

Fig. 4
Refitting the Fuel Pump (Anglia)

THE CARBURETTOR

The carburettor fitted is of the single venturi down-draught type. A separate two-stage starter device is incorporated, this progressively weakens the mixture as the choke control is pushed in from the intermediate to the "off" position. The starter device is dustproof, all combustion air being drawn from above the choke tube.

Description and Operation

Starting

The starting device consists of a separate chamber secured to the main body of the carburettor and contains two spring-loaded disc valves. The disc valves are secured to a spindle which in turn is connected by a lever to the choke control on the facia panel.

The inner disc valve has a slot machined in it which, when the choke control is pulled fully out, connects the starter fuel supply drilling to the starter device outlet port and inlet manifold. The outer disc valve is lightly spring loaded against the air ports in the face of the outer cover.

When the choke control is pulled fully out the disc valves are rotated so that the slot in the inner disc valve lines up with the fuel supply channel and starter outlet port. The drilling in the lower half of the inner disc valve also connects the starter outlet port to the inside of the starting device.

Fuel is supplied from the float chamber through the starter jet to the starter well. A dip tube incorporating an air bleed is pressed into the float chamber cover and is located in the starter jet well. The upper end of the dip tube is connected via drillings in the carburettor body to the fuel inlet port in the starter device.

As the engine is cranked by the starter motor the depression is felt through the starter device outlet port, through the slot in the disc valve and the drillings in the carburettor body to the top of the starter dip tube. Petrol is drawn up the inside of the dip tube, this being emulsified by air drawn in through the air bleed in the tube, through the connecting drillings in the carburettor body, across the slot in the inner disc valve and through the outlet port into the inlet manifold. As soon as the engine fires, the increased depression on the starter outlet port lifts the outer disc valve off its seat against the spring admitting additional air past the valve and through the drilling in the inner disc valve so weakening the mixture.

When the choke is pushed into the half-way position (located by a spring-loaded ball) the disc valves are rotated so that the volume of mixture drawn from the starter dip tube is considerably reduced at the same time the maximum amount of

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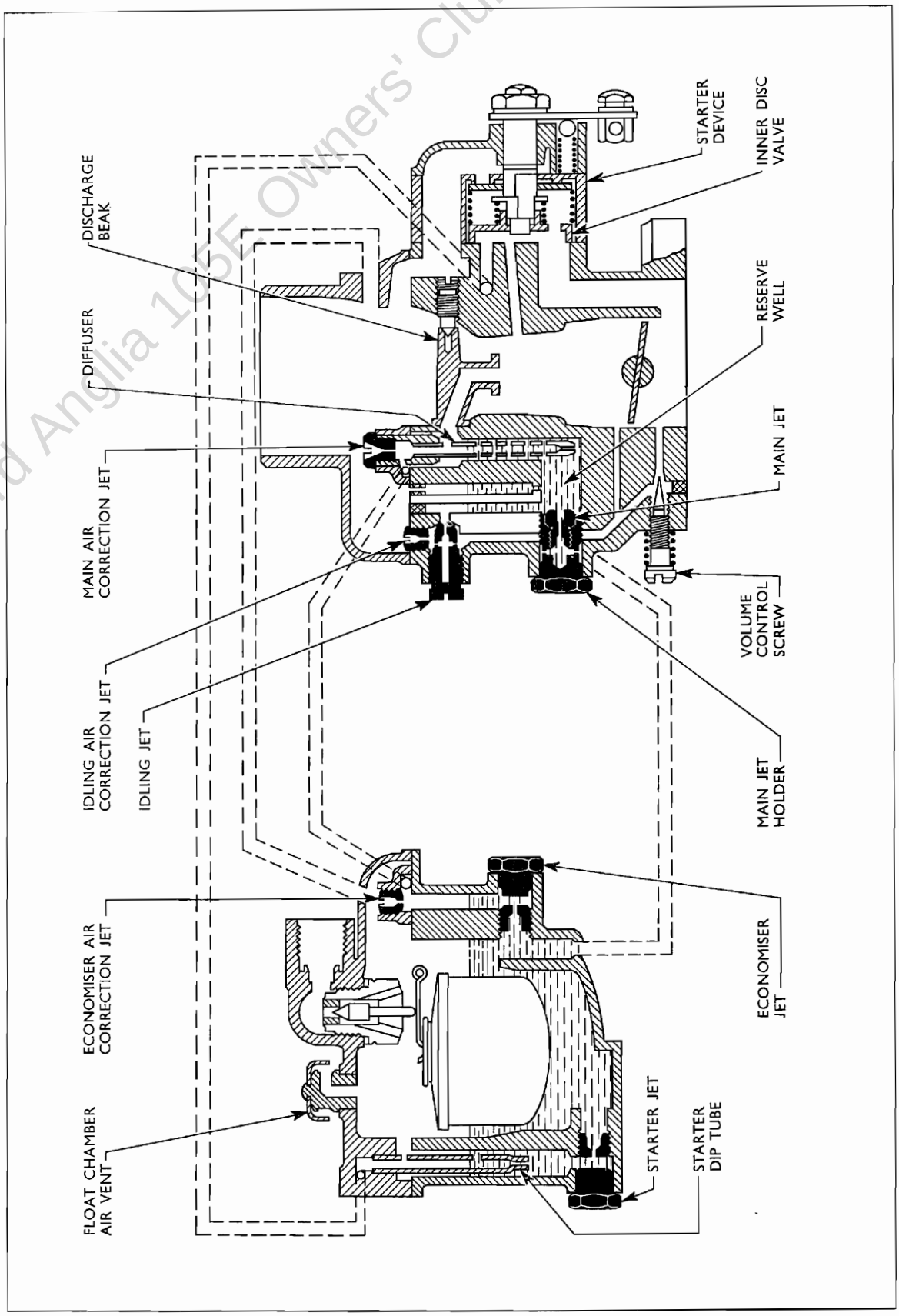

Fig. 5
Operation of Carburettor

air is drawn past the outer disc valve into the starting device. Air is also drawn through the starter air bleed channel again reducing the volume of fuel drawn from the starter dip tube. If the vehicle is driven with the choke in the half-way position, the air speed through the choke tube past the end of the starter air bleed channel causes a depression to be felt on this channel and mixture supplied from the starter dip tube is drawn through it additional to the mixture drawn from the starter device.

As the choke control is pushed in the mixture supplied by the starter device is progressively weakened until the fuel supply port and starter outlet port are completely blanked off.

Idling Supply

With the engine running, the choke control pushed fully home and the throttle in the idling position depression is felt on the idling discharge port, past the volume control screw on to the idling petrol and air correction jets. Petrol is supplied from the main jet to the reserve well and is drawn from this well through the idling jet. The fuel metered by the idling petrol jet is emulsified by air drawn through the idling air correction jet, extra air being drawn through the progression drilling to further weaken the mixture. The volume of mixture supplied by the idling port is controlled by the setting of the volume control screw. The mixture supplied by the idling discharge port is still further emulsified by air drawn past the slightly opened throttle plate.

As the throttle is opened further the air drawn past the throttle plate creates a depression on the progression drilling and mixture is drawn from this in addition to mixture supplied from the idling port.

Main Supply

As the throttle is opened still further, the air speed through the choke tube creates a depression around the main discharge beak. This depression is felt on the main jet well and through the top drilling in the emulsion tube on the main air correction jet. Fuel is supplied by the main jet to the main jet well and reserve wells. The depression on the discharge beak draws fuel from the main jet well this fuel being emulsified by air drawn through the air correction jet and through the lateral holes in the emulsion tube.

As the engine speed and consequently the air speed increases the level of fuel in the main jet well drops, progressively uncovering the remaining holes in the emulsion tube and increases the volume of air bled in to maintain the uniform mixture strength at all engine speeds.

Economy Device

An economy device is incorporated in the carburettor. The operation of this unit is dependant upon engine speed and the consequent air speed and depression created around the main discharge beak, so that at high engine speeds the fuel supplied by the main jet is supplemented by the discharge from the economiser jet. At cruising and lower engine speeds the fuel is supplied only by the main jet.

Fuel is supplied through the economiser jet to the economiser jet well. Located in the economiser body at the top of the jet well is the discharge port and economiser air bleed. At high engine speeds the depression on the main jet well is felt on the economiser discharge port through the centre of the main jet diffuser so that emulsified fuel drawn from the economiser well supplements the discharge from the main jet. As the engine speed and depression decrease the discharge from the economiser ceases, fuel then being supplied by the main jet only.

To Remove the Carburettor

1. Remove the air cleaner, after unscrewing the clamp securing the air cleaner to the carburettor. Disconnect the fuel feed pipe union and distributor vacuum pipe at the carburettor.

2. Detach the throttle control link from the throttle lever by springing it off the ball joint on which it is held by spring pressure.

3. Disconnect the choke control cable from the starter device after slackening the cable and outer casing locking bolts.

4. Unscrew the nuts on the two carburettor flange to manifold studs and remove the lockwashers and carburettor. Lift off the gasket.

To Replace

1. Position the gasket over the inlet manifold to carburettor studs.

2. Place the carburettor in position and secure it with two lockwashers and nuts.

3. Reconnect the starter device control cable. This control must be fitted so that the outer conduit is set in the abutment bracket, with three coils of the conduit protruding through the bracket. Then check the operation of the starting device.

If necessary, adjust the length of the operating cable, so that with the operating lever fully "off" a slight gap exists between the control knob and the instrument panel to ensure that the starting device

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is not brought into partial operation due to the cable being too short.

4. Attach the throttle link to the throttle lever, ensuring that it fits securely in the spring-loaded ball joint.

5. Refit the fuel and vacuum pipes.

6. Refit the air cleaner, screwing the clamp securely to its mounting on the carburettor.

To Dismantle

1. Remove the four screws and spring washers securing the float chamber cover to the body, lift off the cover and gasket.

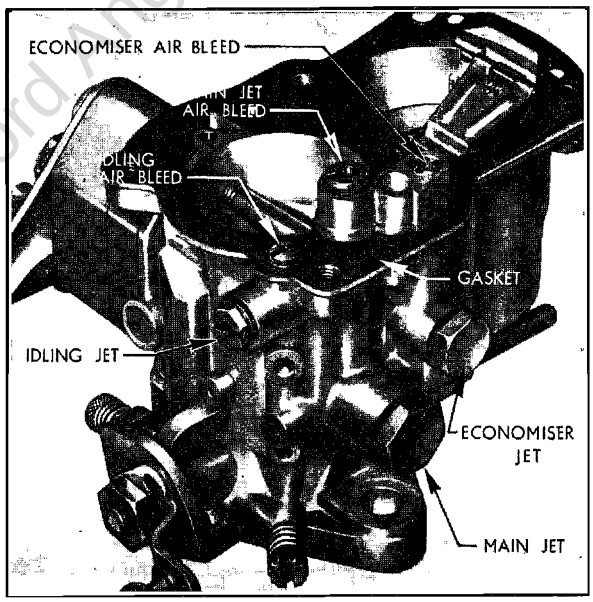

Fig. 6
Carburettor Jet Positions

2. Lift out the float arm and hinge pin and remove the float.

3. Remove the nut and flat washer retaining the operating lever to the starter device spindle, pull off the lever and extract the locking ball and spring.

4. Unscrew the four bolts securing the starter device to the body and remove the starting device. The disc valves can be removed as an assembly after removing the circlip securing the inner cover to the shaft.

5. Unscrew the economiser and main jet air correction jets from the economiser body, remove the screw securing the economiser body, lift off the body and diffuser tube assembly. Remove the gasket from the carburettor and economiser body.

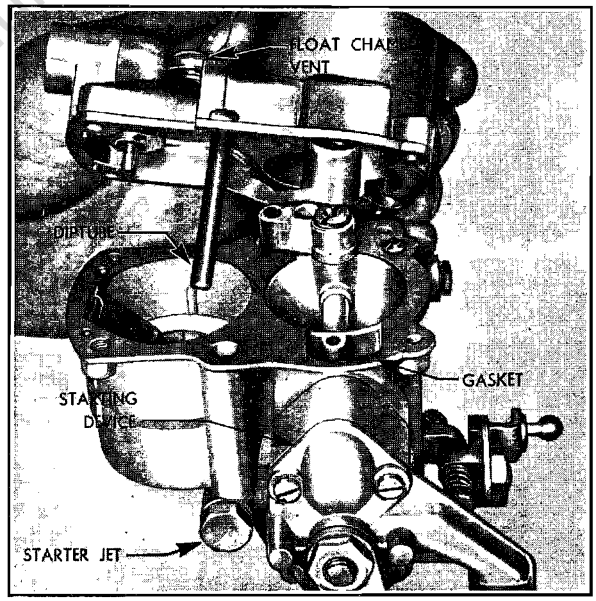

Fig. 7
Float Chamber Cover

7. Remove the starter petrol jet, main jet holder (note the main jet is screwed into the end of the main jet holder), idling petrol jet and idling air correction jet. Note that fibre washers are fitted to all petrol jets with the exception of the idling jet.

8. To remove the throttle plate or spindle, extract the two screws securing the throttle plate in position and withdraw the spindle and plate.

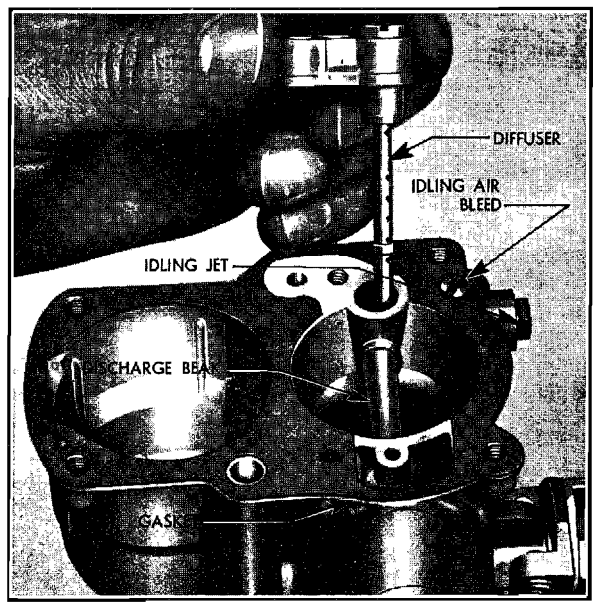

Fig. 8
Removing the Diffuser Tube

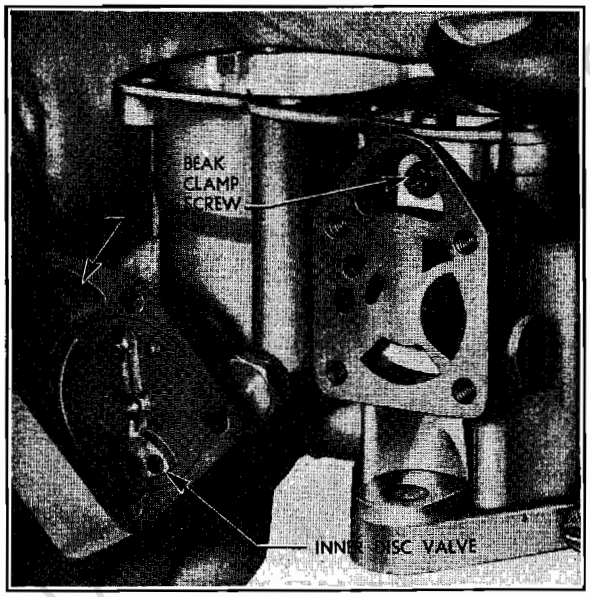

Fig. 9
Removing Starter Device

To Reassemble

1. Refit the throttle spindle to the carburettor body and fit the throttle plate. Ensure that when the throttle is closed, the " number 8 " stamped on the plate is towards the starter device and facing downwards. Fit and tighten the two securing screws and lightly pein the ends to lock them in position.

2. If the main jet has been removed, refit it into its holder. Ensure that the fibre washer on the main jet holder is in good condition and refit the main jet holder. Similarly, check the washers on the economiser and starter petrol jets and refit these. Install the idling petrol and air correction jets. Note the idling petrol jet has a taper seat on its inner end and this jet must not be overtightened when refitting it.

3. Refit the discharge beak, securing it with the taper-ended clamp screw (Fig. 10).

4. Locate the gasket on the economiser body and refit the body and diffuser tube assembly securing it with one screw. Refit the economiser and main air correction jets.

5. Install the starter disc valve assembly in the inner cover, fit the retaining circlip on the spindle and fit the outer cover. Locate the ball and spring in the outer cover, set the disc valves with the slot in the inner valve vertical and install the operating lever. Check this when the assembly is viewed from the front with the cable abutment bracket on the right, the locking ball hole on the lever is to the left, fit and tighten the lever retaining nut.

6. Fit the starter device to the carburettor body and secure it in place with the four screws.

7. Install the float in the float chamber with the cup washer upwards. Fit the float lever and hinge pin with the curve on the end of the float lever towards the float.

8. Position a new gasket on top of the float chamber, fit the float chamber cover and secure it in place with four bolts and spring washers.

Carburettor Adjustments

Provision is made for adjusting the volume of mixture at idling speed, by means of the volume control screw, and the idling speed, by means of the slow-running adjustment screw, see Fig. 11.

Volume Control Screw

The volume control screw is provided to adjust the fuel/air mixture when the engine is idling. Screwing it inwards reduces the volume of mixture and vice versa.

A small compression spring is fitted beneath the knurled head of the screw and this must be in good condition, otherwise vibration may affect the adjustment.

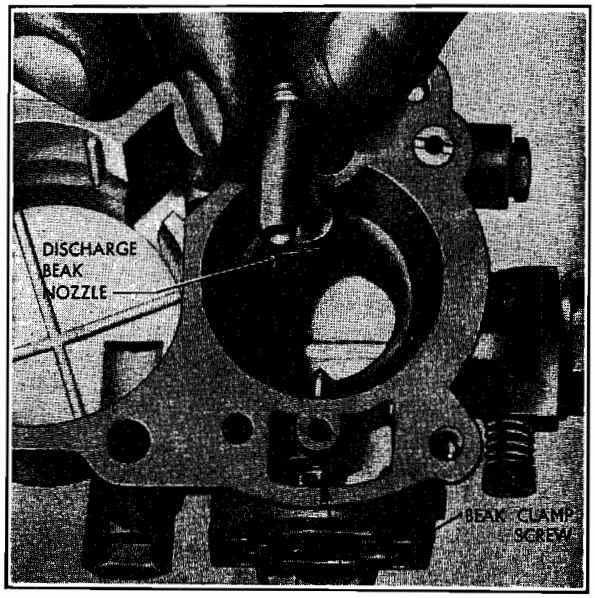

Fig. 10
Refitting Discharge Beak

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Slow-Running Adjustment

To obtain the exact setting for an individual engine, the slow-running adjustment screw and volume control screw should be adjusted together when the engine is thoroughly warm.

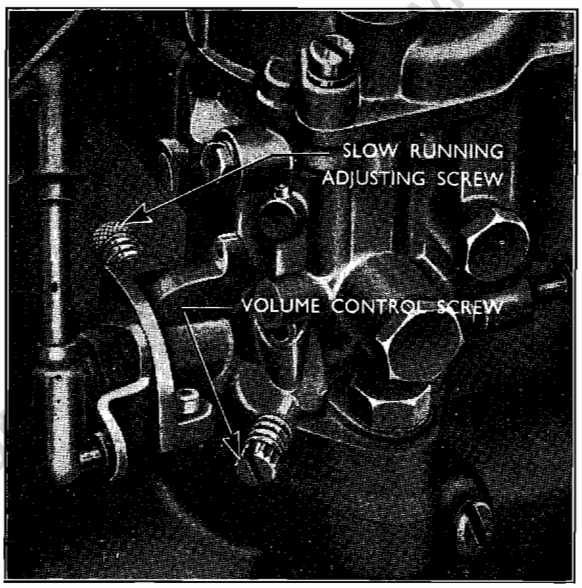

Fig. 11
Slow-Running Adjustments

The best slow-running adjustment can be obtained when the engine is tuned against a vacuum gauge, which should be connected to the inlet manifold.

Check the air cleaner to ensure that the element is clean and, in the case of the oil bath type cleaner, that the oil is clean and at the correct level.

1. Screw in the slow-running adjustment screw until the idling speed is a little faster than normal.

2. Unscrew the volume control screw until the engine begins to " hunt " (or if a vacuum gauge is in use, screw in or out to obtain maximum reading).

3. Screw the volume control screw in again until the engine runs evenly.

4. If the engine speed is then too high, unscrew the slow-running screw until a reasonably slow idling speed is obtained.

This may cause a slight resumption of " hunting." If so, screw in the volume control screw until the idling is perfect.

Note it is not advisable to have too slow an idling speed, or excessive movement of the engine on its flexible rubber mountings will result.

5. Once the carburettor has been readjusted, it may be found advisable to check and, if necessary, readjust the ignition setting.

SPECIFICATION

Fuel tank capacity	7 Imp. galls. (8.4 U.S. galls., 31.82 litres)		
Carburettor :		*Prior to Jan.* 1960	*After Jan.* 1960
Main jet		115	115
Main Air Correction Jet		175	175
Economiser jet		140	140
Economiser air correction jet		195	195
Idling jet		50	40
Idling air correction jet		120	150
Starting jet		125	125
Choke tube		22 mm.	22 mm.
Fuel pump :	*Anglia*	*Prefect*	
Type	Mechanical	Mechanical	
Delivery pressure	1¼ to 2 lbs./sq. in. (0.0879 to 0.1406 kg./sq. cm.)	1¼ to 2 lbs./sq. in. (0.0879 to 0.1406 kg./sq. cm.)	
Diaphragm spring :			
Test length	0.468 in. (11.883 mm.)	0.59 in. (14.99 mm.)	
Test pressure	3¼ to 3½ lbs. (1.474 to 1.588 kg.)	4 to 4½ lbs. (1.814 to 2.041 kg.)	
Vacuum pump :			
Vacuum	N.A.	10½ ins. (26.67 cms.) of mercury at 1,800 r.p.m.	
Diaphragm spring :			
Test length	1.719 in. (3.363 cm.)		
Test pressure	24 to 28 lbs. (10.886 to 12.701 kg.)		

FUEL SYSTEM: OVERHAUL PROCEDURES

NEW ANGLIA SALOON and ESTATE CAR

(May 1962 Onwards)

Introduction

The fuel system of all models consists of a fuel tank, a mechanical fuel pump operated by the engine camshaft and a downdraught carburettor with the necessary fuel lines.

The carburettor fitted to Anglia "Saloons" subsequent to approximate Vehicle Serial No. 084397 (Domestic), 414516 (Export), and Anglia "Estate" Cars subsequent to approximate Vehicle Serial No. 093674 (Domestic), 604778 (Export) is a new single venturi downdraught type. It incorporates an accelerator pump, an economy device controlled by manifold depression, and a choke of the semi-automatic strangler type with a friction locking choke control.

For details of the earlier type carburettor, refer to Service Bulletin No. 32 : Section 9 : Fuel System, issued 12th October, 1959.

An air cleaner of either the dry gauze or paper element type can be fitted to the engine, and is normally mounted above the carburettor.

A fuel tank, capacity 7 Imp. galls. (8.4 U.S. galls, 31.82 litres) is located at the rear of the car beneath the luggage compartment.

The fuel tank filler cap is positioned to the right of the rear number plate and may be removed by turning in an anti-clockwise direction.

On " Saloons " always check when fitting a replacement filler cap to make certain it is of the vented type.

The fuel gauge on the instrument panel registers the quantity of fuel in the tank when the ignition is switched on. The gauge is designed to eliminate needle fluctuation whilst the car is in motion and the needle moves slowly across the scale, taking about 30 seconds to indicate the correct reading after switching on the ignition.

The fuel pump is supplied from the tank by means of a fuel line which runs beneath the floor of the car. A short length of flexible hose between the fuel pipe and the fuel pump is also incorporated.

FUEL LINE

The fuel line is clipped to the underside of the floor pan and requires little attention except for a periodic check on the tightness of unions and securing clips. A check should also be made to ensure that the pipe is not chafing on the floor at any point.

FUEL TANK

On Anglia " Saloons " the fuel tank is mounted at the rear of the car beneath the luggage compartment. The tank is retained in position by two straps and clamps which are adjustable and hook into brackets attached to the floor pan. There are anti-squeak pads attached to the fuel tank in the area covered by the tank support straps and on the upper surface of the tank. On Anglia " Estate Cars " the tank is similarly situated but is retained in position by ten bolts and nuts.

A drain plug is fitted to the tank.

Certain export models are equipped with a fuel tank shield.

To Remove

1. From below the car, disconnect the fuel line from the right-hand front face of the tank, draining the fuel into a suitable container.

2. Disconnect the vent pipe also from the front face of the tank adjacent to the fuel line, " Estate Cars " only.

3. Remove the fuel tank filler cap. Unscrew the two filler neck hose clamps, remove the rubber hose and filler neck from inside the boot.

4. Suitably support the fuel tank and unscrew the nuts from the threaded clamps. Unhook the clamps from the brackets on the floor pan, " Saloons " only, and lower the tank towards the ground, the lowest amount permitted by the fuel gauge tank unit.

On " Estate Cars " remove the ten tank retaining bolts and nuts and lower as before.

5. Disconnect the yellow-green tracer wire from the fuel gauge tank unit.

6. Lower the tank to the ground, if necessary the rubber tank-filler neck orifice may be removed.

To Replace

1. If removed, the rubber grommet surrounding the fuel tank filler neck orifice may be replaced from the inside of the luggage compartment.

2. Raise the fuel tank sufficiently to connect the yellow-green tracer wire to the fuel gauge tank unit.

3. Raise the fuel tank in its location under the luggage compartment floor, engage the hook clamps on the ends of each support strap in their respective brackets on the floor pan, " Saloons " only, ensuring that these support straps run over the anti-squeak pads attached to the underside of the tank. Do not fully tighten the nuts on the hook clamps.

On " Estate Cars " replace the ten tank retaining bolts and nuts and tighten securely.

4. Refit the rubber hose and the filler neck to the tank. Tighten up the two hose clamps.

5. From underneath the car connect the fuel line to the tank. Reconnect vent pipe, " Estate Cars " only.

6. Tighten up the nuts on the hook clamps until the fuel tank is firmly located, " Saloons " only.

7. Refill the tank with fuel and replace the filler cap.

To Clean the Fuel Tank

In course of time, sediment may collect in the fuel tank, its presence is usually denoted by sediment deposit in the glass bowl of the fuel filter.

Apart from normal impurities to be found in the fuel, water tends to collect due to condensation and it is suggested that the fuel tank connection be removed at regular intervals, a small quantity of fuel run off and the fuel line connection replaced. The sample thus drawn off should be examined for signs of water, sediment, etc.

If excessive deposit of water is present the tank should be flushed, steamed and allowed to stand for at least 24 hours to evaporate all fumes from the tank.

FUEL GAUGE TANK UNIT

The tank unit is mounted on the top of the tank. The unit consists of a float suitably hinged and provided with the necessary wiper contact for the rheostat, so that as the float rises or falls according to the fuel level, a greater or lesser number of turns on the rheostat are put into the electrical circuit by the wiper contact.

The voltage applied at the fuel gauge thus varies according to the height of petrol in the tank and indicates the quantity of fuel in the tank.

To minimise the effect of fuel gauge needle fluctuation a weight is fixed to the tank unit float arm which partially submerges the float as the fuel level rises.

To Remove

1. Lower the fuel tank as described previously. Disconnect the tank gauge unit wire.

2. Unscrew the six screws securing the tank unit to the tank, taking care not to bend the float.

Examine the tank unit to ensure that the rheostat is not damaged and that the wiper contact is bearing against the coil.

To Replace

1. Position a new gasket on the tank unit aperture and refit the tank unit so that the float arm makes an angle of 30° with the float towards the left-hand rear corner of the tank, " Saloons " only.

On " Estate Cars " the float arm hangs vertical.

2. Replace the six screws and spring washers and tighten securely. Ensure that a good earth is made between the unit and the tank.

3. Raise the fuel tank and reconnect the fuel gauge unit wire to the tank.

4. Refit the fuel tank (refer to sheet 1).

AIR CLEANER

An air cleaner of the oil wetted, dry gauze type is fitted to domestic cars and either a paper element or a dry gauze type to export cars.

NOTE.—These air cleaners are of a new type and are not interchangeable with those fitted to the previous type carburettor covered in the earlier Bulletin, Serial No. 32.

The dry gauze type cleaner element should be removed and the element washed in petrol every 5,000 miles (8,000 km.). Paper element type cleaners should have the element renewed every 15,000 miles (24,000 km.). More frequent attention may be necessary should the vehicle be operating in heavily dust-laden atmosphere. Full cleaning instructions for both types of air cleaner are given under the following heading :

Dry Gauze Type Air Cleaner

To Remove

1. Slacken the clamp securing the air cleaner hose to the top of the carburettor.

2. Lift off the air cleaner.

To Clean

1. Remove the centre screw and detach the air cleaner top cover.

2. Lift out the gauze element, wash in petrol and allow to dry.

3. Clean the top cover and base of the air cleaner by either washing in petrol, or wiping with a petrol-moistened rag.

4. Dip the gauze element in clean engine oil, shake off the surplus oil and refit the element onto the base of the cleaner.

5. Replace the top cover and tighten the centre screw securely.

Fig. 1

Gauze and Paper Element Air Cleaners
(Paper Element Type shown inset)

Paper Element Type Air Cleaner

To Remove and Replace

The paper element type air cleaner can be removed and refitted in a similar manner to the dry gauze type.

To Renew Element

1. Remove the centre screw and detach the air cleaner cover.

2. Lift out and discard the paper element and two rubber sealing rings.

3. Thoroughly clean the top cover and base in petrol and allow them to dry.

4. Fit two new rubber sealing rings, one round the boss inside the top cover, shown in Fig. 1, the other locating at the bottom, on the body of the cleaner.

5. Place the new paper element in the centre of the body so that it seats on the lower sealing ring.

6. Carefully replace the top cover, ensuring that the upper sealing ring remains in place on the boss.

7. Tighten the centre screw securely.

FUEL PUMP

Description and Operation

The fuel pump is a self-priming unit operated through a spring-loaded arm from an eccentric on the camshaft.

As the engine camshaft revolves, the eccentric moves the pump rocker arm upwards, causing the diaphragm to be moved downwards against the pressure of the diaphragm spring, by means of the diaphragm pull rod. This creates a partial vacuum in the pump chamber sufficient to open the inlet valve and draw fuel from the tank, entering at the inlet port and so into the sediment chamber.

The fuel is then drawn through the filter screen and down through the non-return valve into the pump chamber immediately above the diaphragm.

Further movement of the engine camshaft allows the spring-loaded rocker arm to move outwards from the pump, allowing the diaphragm spring to push the diaphragm upwards. This forces the fuel in the pump chamber through the outlet valve into the outlet pipe connecting the pump to the carburettor float chamber.

When the carburettor bowl is full, the float will close the needle valve, thus preventing further petrol supply from the fuel pump. The pressure thus created will hold the fuel pump diaphragm downwards against the pressure of the diaphragm spring and it will remain in this position until the carburettor requires more fuel and the needle valve opens.

The operating linkage of the pump is such that idling movement of the rocker arm is allowed when there is no movement of the fuel pump diaphragm. A spring holds the rocker arm in constant contact with the eccentric to minimise operating noise.

The fuel pump incorporates valve assemblies which are serviced as complete units. Each unit consists of a small brass cage holding the valve and spring which can be fitted in either inlet or outlet position (see Fig. 2).

Cleaning the Fuel Pump

The filter screen, glass sediment bowl and the sediment chamber should be cleaned with petrol every 5,000 miles (8,000 km.)

To Remove the Filter Screen

1. Unscrew the sediment bowl retainer clamp and lift off the bowl, filter screen and glass bulb.

2. Carefully wash the screen in petrol. Flush all traces of sediment from the sediment chamber.

To Replace

1. Refit the screen to the fuel pump body.

2. Ensure that the gasket is in good condition and refit the sediment bowl. Tighten the clamp to retain the sediment bowl in position.

Testing the Fuel Pump

Providing there are no leaks or obstructions in the

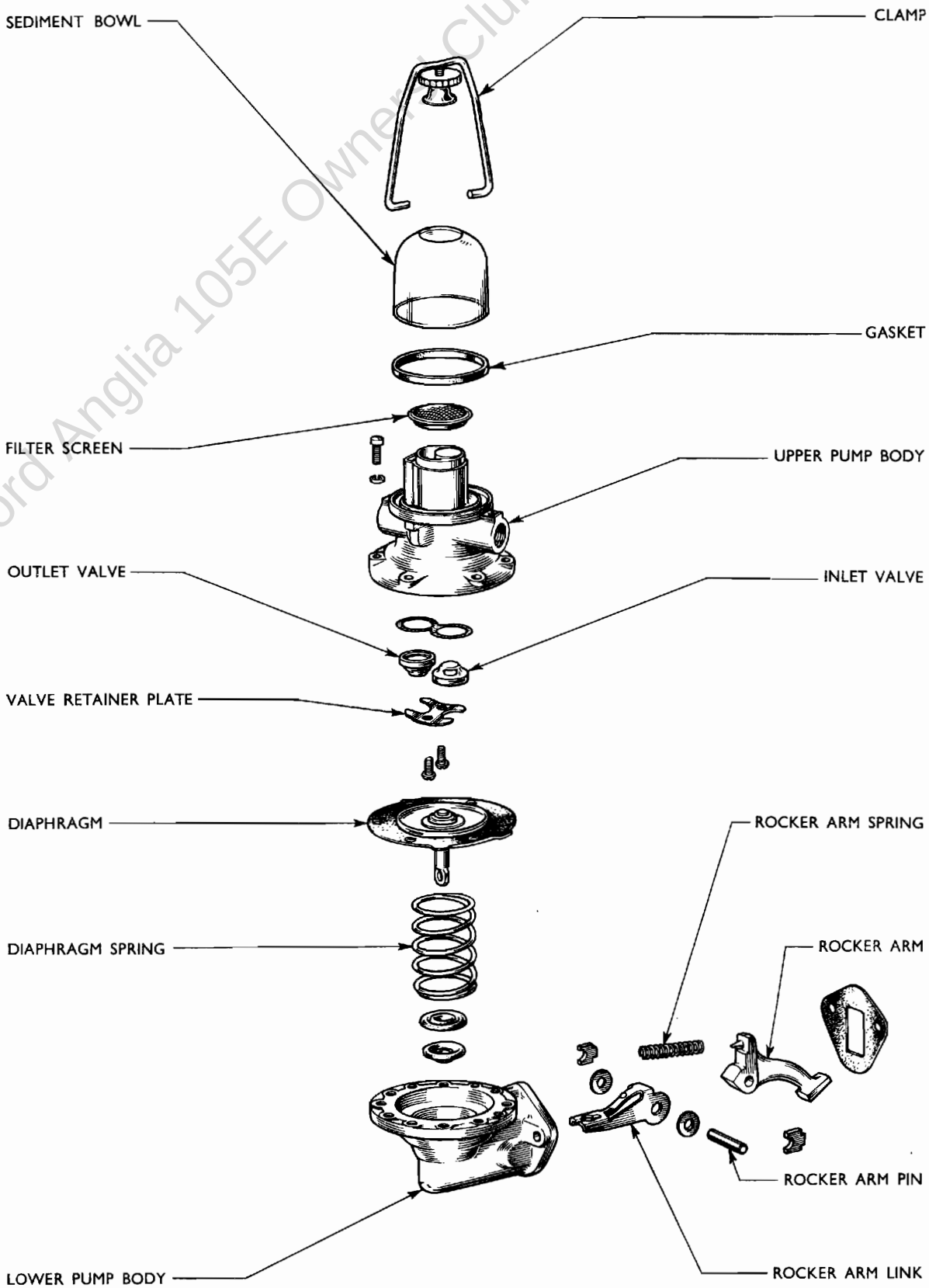

Fig. 2
Exploded View of Fuel Pump

fuel line, a quick check of the fuel pump efficiency can be made as follows :

1. Disconnect the fuel pump to carburettor pipe at the pump outlet.

2. Crank the engine by means of the starter motor, when a well-defined spurt of fuel should be apparent for each revolution of the camshaft. If the pump does not operate correctly, check the inlet depression and delivery pressure using suitable gauges. (The gang gauge set (Tool No. 500) or a Diagnosis Test Set have suitable gauges and adaptors for this work.)

Fuel Pump Inlet Depression Test

1. Fill the carburettor float chamber with petrol.

2. Disconnect the fuel line from the fuel tank at the pump inlet, suitably plugging the end of the pipe to prevent loss of fuel from the tank or the ingress of foreign matter.

3. Connect the vacuum gauge to the inlet union, start the engine and allow it to run at idling speed, when a vacuum reading of at least $8\frac{1}{2}$ in. (21.59 cms.) mercury should be obtained.

4. Stop the engine when the gauge needle should take at least one minute to return to zero.

Fuel Pump Delivery Pressure Test

1. Fill the carburettor float chamber with petrol.

2. Disconnect the fuel pump to carburettor pipe and connect the pressure gauge to the pump outlet.

3. Start the engine and observe the pressure when running at idling speed. Momentarily race the engine and observe the pressure. This should not be less than $1\frac{1}{4}$ lb. per sq. in. (0.088 kg. per sq. cm.) and should not exceed 2 lb. per sq. in. (0.141 kg. per sq. cm.) at any speed.

Low fuel pump outlet pressure may limit engine performance. An excessive pressure may result in a high float chamber level, with possible flooding. High fuel pump pressure may also cause the engine to stall, due to an over-rich mixture.

4. Disconnect the pressure gauge from the pump and reconnect the fuel pump to carburettor pipe.

Overhauling the Fuel Pump

To Remove

1. Disconnect the fuel pump to carburettor pipe by unscrewing the union nut at each end. Remove the pipe.

2. Unscrew the union nut on the fuel line from the petrol tank and withdraw the pipe from the fuel pump inlet. The pipe should be suitably plugged to prevent a loss of fuel or the ingress of foreign matter.

Care should be taken to prevent the flexible fuel pipe from becoming twisted and so ruptured. This can be readily achieved by holding the nut on the flexible pipe with one spanner (to prevent rotation) while tightening or loosening the union nut on the pipe line from the fuel tank with another spanner.

3. Unscrew and remove the two bolts and spring washers securing the fuel pump to the cylinder block and detach the fuel pump, lifting the operating lever to clear the eccentric and the slotted hole in the block. Remove the gasket.

To Dismantle

Mark the upper and lower bodies adjacent to the smaller tab on the diaphragm to ensure correct alignment on reassembly.

1. Unscrew the sediment bowl retainer clamp and lift off the bowl, filter screen and gasket.

2. Remove the five screws and spring washers securing the upper and lower fuel pump bodies, taking care when separating the flange joint to avoid damaging the diaphragm.

3. Turn the diaphragm, approximately a quarter turn (in either direction), to free the diaphragm rod from the operating lever, and detach the diaphragm.

4. The diaphragm and pull rod are riveted together and should not be dismantled. Remove the diaphragm spring, oil seal retaining washer and rubber oil seal.

5. The inlet and outlet valves are both retained by a spring steel plate secured by two screws. Remove the screws and plate, when the two valve assemblies together with the " figure 8 " gasket can be lifted from the upper body.

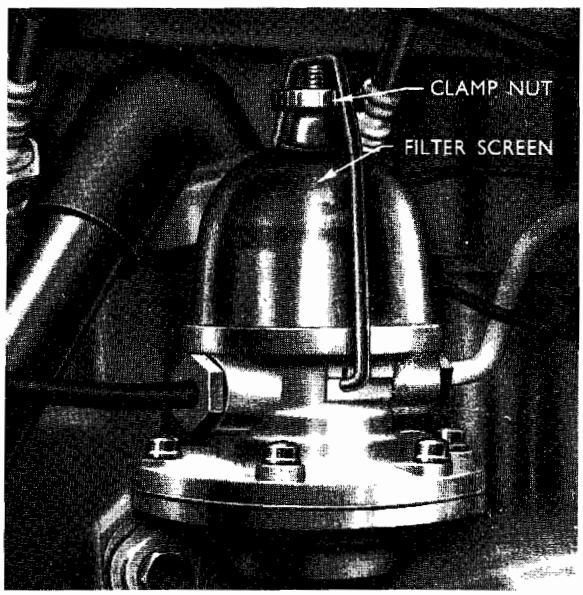

Fig. 3
Fuel Pump in Location

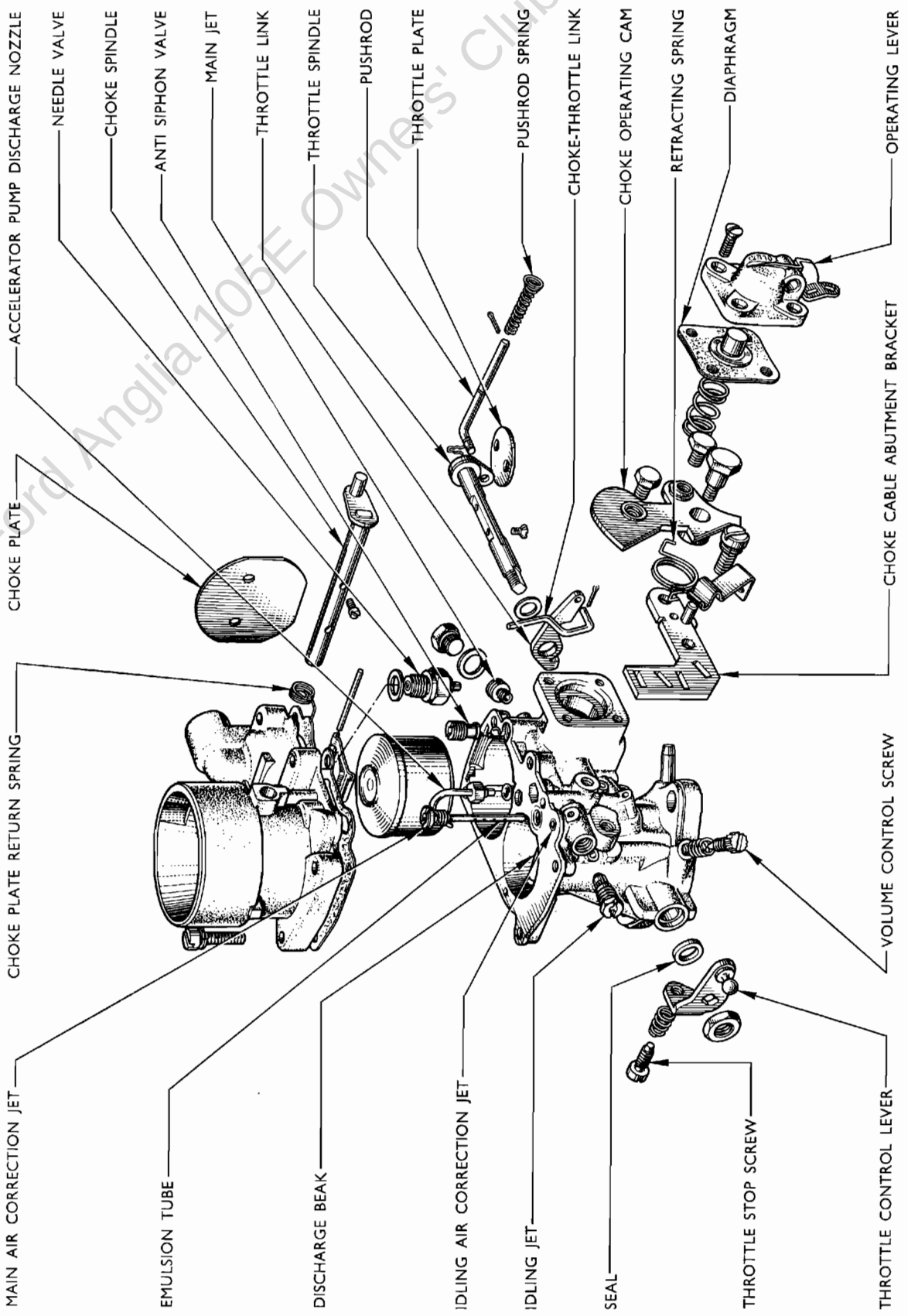

Fig. 4
Exploded View of Carburettor

6. Should it be necessary to dismantle the lower body, relieve the staking over the two pin retainers and withdraw these retainers from the casting. The pin, rocker arm, spring, link and two washers may then be removed as an assembly.

To Reassemble

If the lower body has been completely dismantled, replace the rocker arm and link assemblies as follows :

1. (*a*) Position the rocker arm, with the boss between the flanges of the link, ensuring that the central web of the link and the spring seat location on the rocker arm are both uppermost (see Fig. 2). Align the holes in the link and rocker arm and insert the pivot pin.

(*b*) Fit one thrust washer to each end of the pin, next to the link, and carefully insert the assembly into the lower pump body casting, with the spring seat on the rocker arm uppermost. Place the rocker arm spring in position so that the ends are located by the registers on the body and the rocker arm.

(*c*) Insert two new pin retainers, one at each end of the pin, ensuring that these positively locate the pin in the casting. Stake over the casting to the pin retainers in two locations each side.

NOTE.—New pin retainers should always be fitted after dismantling the lower pump body, as service replacement parts are supplied oversize with a shorter shoulder to enable the staking to be carried out satisfactorily. No attempt should be made to replace the old pin retainers.

Inspect the pin to make sure it is properly positioned and the rocker arm and link operate correctly. Test by moving the rocker arm towards the pump body, when the link is held downwards. If the link is held downwards, as will occur in operation when the carburettor float chamber is full, the rocker arm should be free to move without transmitting any movement to the diaphragm and link.

To install the diaphragm assembly, proceed as follows :

1. Assemble the spring, oil seal washer and oil seal to pull rod, taking care to avoid damage.

2. Insert the end of the rod in the slotted end of the link, engaging the grooves in the pull rod end by turning the diaphragm a quarter of a turn, so that the SMALLER TAB on the diaphragm aligns with the mating mark on the lower body flange.

3. Hold the upper body with the valve locations uppermost. Fit the " figure 8 " gasket in the upper body, then fit the two valve assemblies as shown in Fig. 2. Note that these will only seat properly when in their correct locations the correct way up.

Fit the retainer plate securing it with the two screws.

4. Position the fuel pump upper body over the diaphragm on the lower body so that the inlet and outlet unions are directly opposite the mounting flange. Ensure that the mating mark made on the lower body is in line with the SMALLER TAB on the diaphragm. Depress the rocker arm until the diaphragm is level with the flange, fit the five screws and spring washers and tighten them finger-tight.

5. Work the rocker arm several complete strokes to centralise the diaphragm and tighten the five screws evenly and securely, with the diaphragm in the " down " position.

6. Refit the screen to the fuel pump body, ensure that the gasket is in good condition and then refit the sediment bowl. Tighten the clamp to retain the sediment bowl in position.

To Replace

1. Ensure that the inlet and outlet port threads are perfectly clean.

2. Clean the mounting pad or flange on the cylinder block, removing any trace of gasket which may be adhering to the face. Fit a new gasket to the cylinder block flange, holding it in place with a smear of grease.

3. Insert the rocker arm through the slot in the crankcase wall so that the arm lies on the camshaft eccentric.

4. Fit the fuel pump to the cylinder block with two spring washers and bolts, tightening each bolt evenly and securely to a torque of 12 to 15 lb. ft. (1.66 to 2.07 kg.m.).

5. Ensure that the pipe unions are clean and refit the fuel pipe from the fuel tank. Refit the fuel pump to carburettor pipe.

6. Run the engine and check for leaks at the unions.

CARBURETTOR

The carburettor is of the single venturi down-draught type. It incorporates an accelerator pump to ensure smooth and rapid acceleration, an economy device controlled by the manifold depression and a choke valve of the semi-automatic strangler type.

Description and Operation

The starting device consists of a choke plate which is connected by means of a flexible cable to a friction locking type control on the facia panel. Pulling the control closes the choke plate and at the same time, by means of an interconnecting rod opens

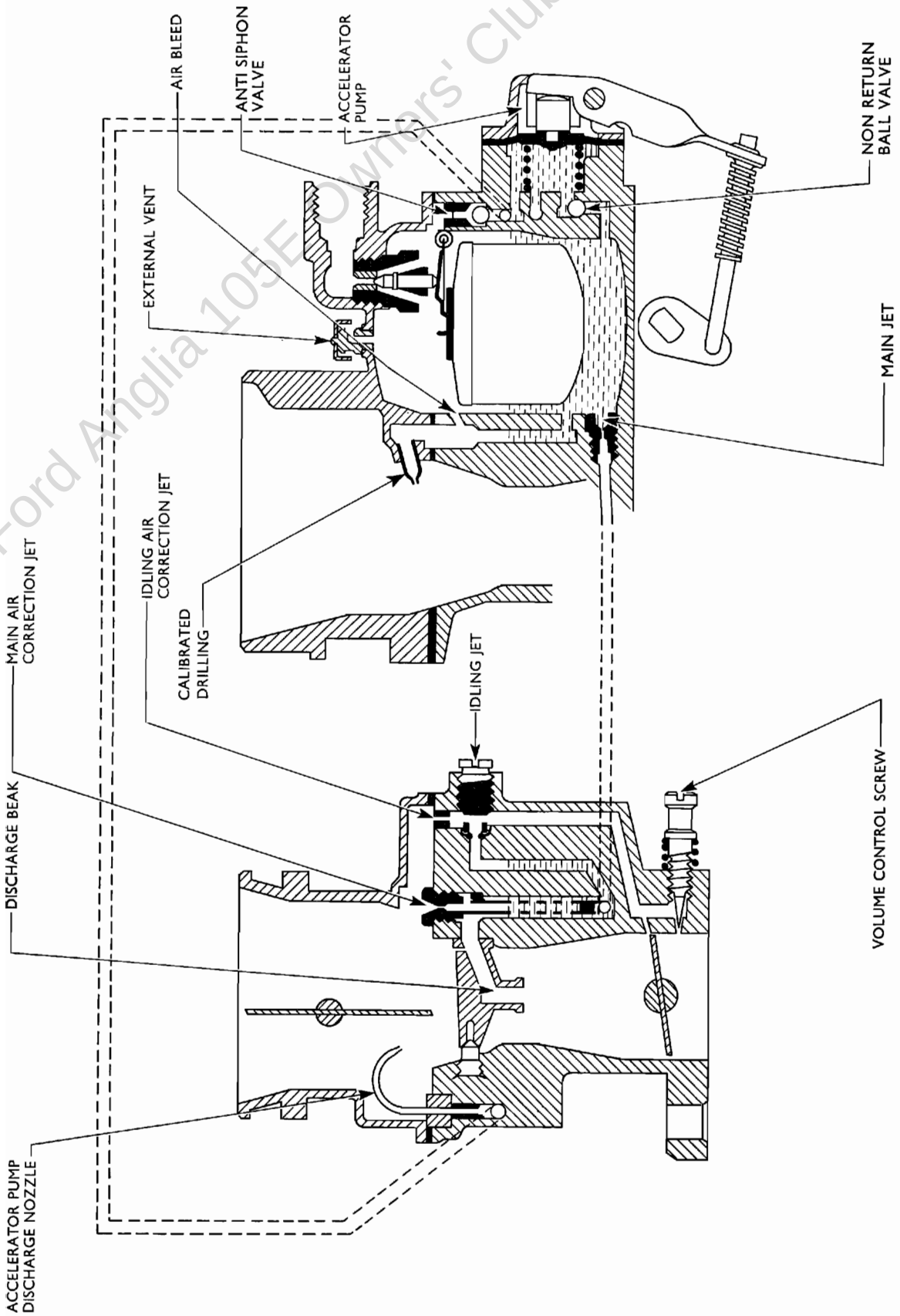

Fig. 5
Theoretical Fuel System Diagram

the throttle plate a pre-determined amount ; the degree of throttle opening allowing depression created by the induction strokes to reach the mixture chamber and choke tube areas, and ensuring a fast idle speed after starting.

As the engine is rotated by the starter motor, depression caused by the induction strokes causes a suitably proportioned mixture to discharge from the main spraying well through the main spraying orifice, into the manifold. At the instant of the engine firing and running, a rise in depression consequent upon the increase in engine revolutions will automatically open the choke plate a certain amount, thus admitting air for the dual purpose of weakening the mixture, and, together with the partly opened throttle plate allowing the engine to develop a pre-determined fast idle speed to prevent stalling during the warming up period.

As the engine temperature rises the control knob should be gradually pushed in towards the " off " position in accordance with the requirements of the engine. Once the normal operating temperature has been reached the control knob should be pushed fully in.

Idling Supply

With the engine running, the choke control pushed fully home and the throttle in the idling position, depression is felt on the idling discharge port, past the volume control on to the idling petrol and air correction jets. Petrol is supplied from the main jet to the reserve well and is drawn from this well through the idling jet. The fuel metered by the idling petrol jet is emulsified by air drawn through the idling air correction jet, extra air being drawn through the progression drilling to maintain correct mixture strength. The volume of mixture supplied by the idling port is controlled by the setting of the volume control screw. The mixture supplied by the idling discharge port is still further emulsified by air drawn past the slightly opened throttle plate.

As the throttle is opened further the air drawn past the throttle plate creates depression on the progression drilling and mixture is drawn from this in addition to the mixture supplied from the idling port until the throttle has been opened sufficiently for the main spraying system to come into operation.

Main Supply

As the throttle is opened still further, the air speed through the choke tube creates a depression around the main discharge beak.

This depression is felt on the main jet well and through the drillings in the emulsion tube and the main air correction jet. Fuel is supplied by the main jet to the main jet well and reserve well. The depression on the discharge beak draws fuel from the main jet well, this fuel being emulsified by air drawn through the air correction jet and through the lateral holes in the emulsion tube.

As the engine speed and consequently the air speed increases, the level of the fuel in the main jet well drops. This progressively uncovers the remaining holes in the emulsion tube and increases the volume of air to maintain the uniform mixture strength at all engine speeds and loads.

Econostat Device

The econostat device allows maximum economy to be maintained over the cruising range. The unit is non-mechanical and completely automatic, being controlled by the demands of the engine.

The system includes an air bleed and calibrated petrol drilling, together producing an emulsified mixture that is discharged into the air intake at a point above the choke tube. As the engine speed increases, the discharge will take place, only when the depression within the discharge tube has become great enough to lift the petrol up to its inner end. The depression inside the tube is controlled by the depression at the outer end of the tube and the relative size of the air bleed and outlet orifice. The size of the air bleed determines the point at which the device comes into operation, the calibrated drilling controlling the rate at which fuel is supplied.

The size of the air bleed and calibrated petrol drilling make it possible from a chosen engine speed up to maximum r.p.m. to supplement the mixture supplied by the main jet with that from the econostat device. Thus, the device allows the size of the main jet to be chosen with regard to cruising economy, whilst over richness under full throttle low speed conditions can be avoided.

Accelerator Pump System

The purpose of the accelerator pump is to ensure smooth acceleration, and prevent any hesitation when the throttle is suddenly opened. The richer mixture required to fulfil these conditions is provided by a controlled and metered supply of fuel from the accelerator pump into the carburettor coincident with the opening of the throttle.

When the accelerator is depressed the movement of the actuating rod and lever displaces the pump diaphragm, this action forces petrol through the calibrated pump injector tube into the main air stream thereby ensuring a condition of rapid smooth acceleration. The non-return valve prevents petrol returning to the float chamber when the diaphragm is displaced.

An anti-siphon valve is positioned between the fuel chamber of the pump and the float chamber in order to prevent overspill from the injector tube thus eliminating the possibility of difficult restarting when warm. A ball is positioned beneath the anti-siphon valve to prevent air entering the system when the pump fuel chamber re-charges.

Fuel Level

To check the float it is necessary to remove the float chamber cover, the float may then be examined to ensure that it is not punctured.

The level of the fuel in the float chamber is automatically regulated by the slight rise and fall of the float, closing or opening the needle valve (see Fig. 4) to cut off or admit petrol from the fuel pump as required. This form of design ensures complete stability of the pre-determined level, thus eliminating all need for routine checking. In event of damage, however, the float assembly **must** be replaced immediately in order to maintain the correct fuel level.

To Remove

1. Remove the air cleaner, slacken off the clamp securing the air cleaner hose to the carburettor top and lift off the air cleaner.

2. Disconnect the fuel feed pipe union and distributor vacuum pipe at the carburettor.

3. Disconnect the choke control cable at the choke operating cam and detach the clip securing the outer cable in position.

4. Remove the two nuts and spring washers securing the carburettor to the manifold and lift off the carburettor.

5. Remove the carburettor to manifold gasket.

To Dismantle

1. Remove the five screws and spring washers securing the float chamber cover to the body and lift off the body and gasket.

2. Lift out the float arm and hinge pin and remove the float.

3. Detach the split pin retaining the push rod and spring.

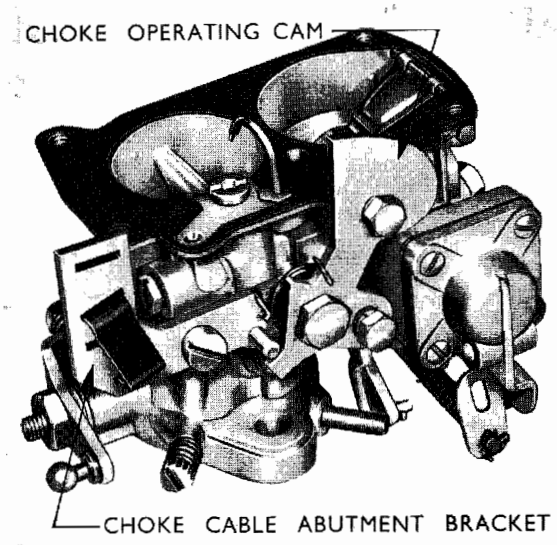

Fig. 6
Choke Operating Mechanism

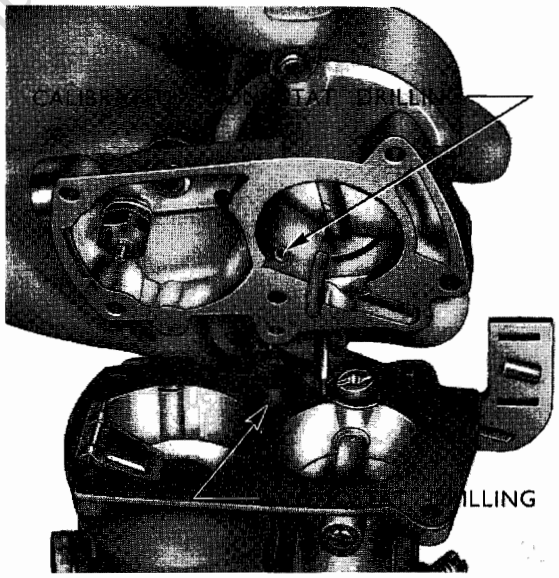

Fig. 7
Float Chamber Cover

4. Unscrew the four screws securing the accelerator pump in position and remove the accelerator pump body and operating arm, diaphragm and return spring.

5. Detach the outer spring clip retaining the choke-throttle link, unscrew the screw securing the link to the choke operating cam and manipulate the link clear of the carburettor.

6. Remove the centre bolt securing the choke operating cam and return spring.

7. Unscrew the cheese-head screw retaining the choke cable abutment bracket and remove the bracket.

8. Unscrew the idling jet, high speed air correction jet and emulsion tube assembly and lift off the accelerator pump discharge nozzle.

9. Unscrew the anti-siphon valve and remove the glass ball.

10. Remove the taper-end screw securing the discharge beak in position.

NOTE.—It is not normally necessary to remove the discharge beak. However, if the beak is removed it will be necessary to lock the taper-end screw on replacement with a lead shot. This shot should be inserted through the vertical drilling immediately above the taper end screw.

11. Unscrew the bolt and flat washer giving access to the main jet and remove the jet (see Fig. 10).

12. To remove the throttle plate or spindle, extract the two screws securing the throttle plate in position and withdraw the spindle and plate.

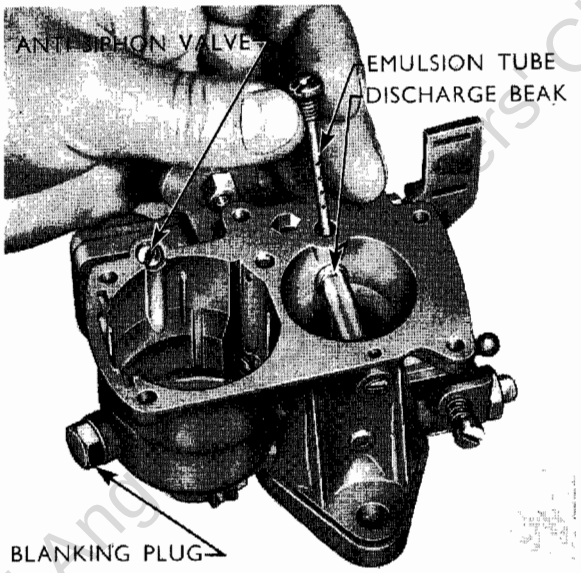

Fig. 8
Removing Emulsion Tube

To Reassemble

1. Refit the throttle spindle to the carburettor and fit the throttle plate. Ensure that when the throttle is closed the " number 8 " stamped on the plate is away from the accelerator pump and facing downwards. Fit and tighten the two securing screws and lightly peen the ends to lock them in position.

2. Refit the main jet and replace the blanking plug and washer. Refit the idling jet, main air correction jet and emulsion tube assembly, and the accelerator pump discharge nozzle.

3. Replace the glass ball and refit the anti-siphon valve.

4. Replace the discharge beak ; secure it with the taper-ended screw (see Fig. 11). which should be locked in position, using a suitable size lead shot (see previously).

5. Refit the choke cable abutment bracket, tightening the cheese-head retaining screw finger tight. Locate the choke operating cam and retracting spring in position using the hexagon-headed bolt, as a guide. Ensure that the inner end of the retracting spring is located in the slot in the abutment bracket and the outer end against the " V " in the operating cam. Tighten both screws securely.

6. Replace the choke link, securing it to the choke-throttle link with a spring clip and to the choke operating cam with the adjustment bolt.

7. Refit the push rod to the spindle link securing it with a spring clip. Replace the push rod spring, attach the accelerator pump operating lever to the push rod and replace the retaining split pin.

8. Install the return spring and diaphragm in the pump housing, present the assembly to the carburettor body and refit the four retaining screws, tightening them securely. Check the action of the return spring.

9. Install the float in the float chamber with the cup washer upwards. Fit the float lever and hinge pin with the curve on the end of the float lever towards the float.

10. Position a new gasket on top of the float chamber ; fit the float chamber cover, holding the choke plate in the " full open " position, and secure it in place with five screws and spring washers.

To Replace

1. Locate a new gasket on the manifold flange. Refit the spring washers and nuts on the mounting studs and tighten them securely.

2. Reconnect the distributor vacuum pipe to the rubber connection on the right-hand side of the carburettor.

3. Refit the fuel pump line tightening the union securely.

4. Refit the throttle control rod to the upper end of the throttle lever connecting rod.

5. Connect the choke control cable (at the rear of the carburettor) and tighten the clamp. Pass the cable inner wire through the choke operating cam trunnion and tighten the clamping screw. Check that the choke opens and closes correctly, and that there is slight play in the cable when the control is pushed fully home.

6. Refit the air cleaner.

Fig. 9
Refitting Accelerator Pump

Cleaning the Carburettor

At periodic intervals the float chamber cover should be removed from the carburettor, the float arm and float lifted out, and the bowl swilled in petrol to remove all sediment. The jets should occasionally be removed and cleared, using compressed air supply.

Carburettor Adjustments

Certain adjustments may be required from time to time and these are detailed under the following headings :—

Choke Adjustments

The choke control cable is adjusted at the choke operating cam so that there is approximately $\frac{1}{8}$ in. free play in the cable when control is pushed in fully.

The correct degree of throttle opening when the choke plate is closed for starting is obtained by placing a 1.1 mm. drill (No. 57) between the edge of the throttle plate and the carburettor body at right-angles to the throttle spindle. This setting can, alternatively, be obtained by screwing in the throttle stop screw approximately three turns from the position at which it abuts the throttle plate stop when the throttle is fully closed (it will be necessary to remove the throttle stop screw spring for making this adjustment as the spring becomes "coil-bound"). The length of the choke-throttle link, shown in Fig. 4 should then be adjusted so that the choke operating cam is in the fully closed position.

Slow-Running Adjustment

To obtain the best slow-running adjustment, the engine should be tuned against a vacuum gauge connected to the inlet manifold. This connection can be made by removing the blanking plug shown in Fig. 12, and fitting the appropriate adaptor and gauge.

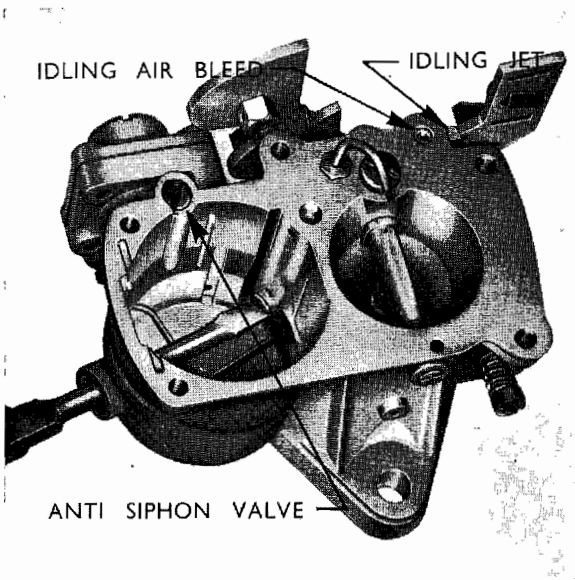

Fig. 10
Refitting Main Jet

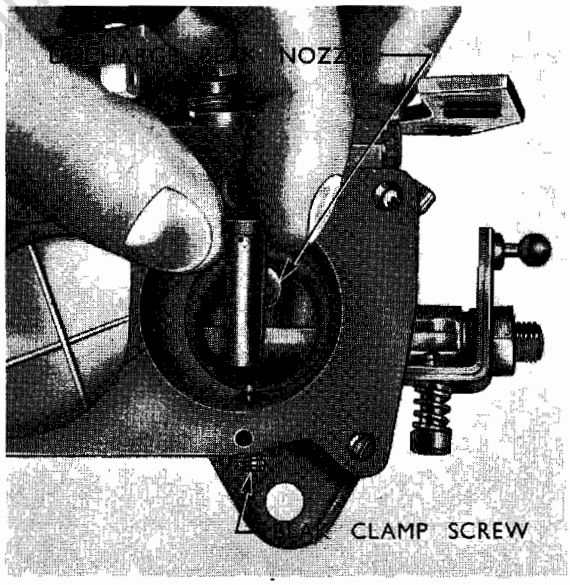

Fig. 11
Refitting Discharge Beak

Before commencing adjustment, check the air cleaner to ensure that the element is clean and, in the case of the oil bath cleaner, that the oil is clean and at the correct level.

Run the engine allowing it to warm up. To adjust the slow-running, screw in the throttle stop screw (see Fig. 12) until a fast idling speed is obtained, then turn the volume control screw, illustrated in Fig. 12, either clockwise or anti-clockwise to obtain the maximum vacuum reading. Readjust the idling speed as necessary and continue the adjustment until the maximum possible reading is obtained with a reasonable slow-running speed. It may be necessary to adjust the ignition setting, see the appropriate Bulletin in Section 10.

When a suitable vacuum gauge is not available, the engine should be warmed up and the throttle stop screw turned clockwise so that the engine is running at a fast idling speed. Screw the volume control screw in or out until the engine runs evenly. Readjust the throttle stop screw if the engine is running too fast, followed by a further readjustment of the volume control screw.

These operations should be repeated until the idling speed is satisfactory and, if necessary, followed by a readjustment to the ignition setting.

Accelerator Pump Stroke Adjustment

For normal operating conditions set the pump so that the push rod passes through the outer elongated hole in the operating lever and the split pin through the outer hole in the push rod.

For cold climatic conditions set the pump so that the push rod passes through the inner elongated hole in the operating lever and the split pin through the inner hole in the push rod.

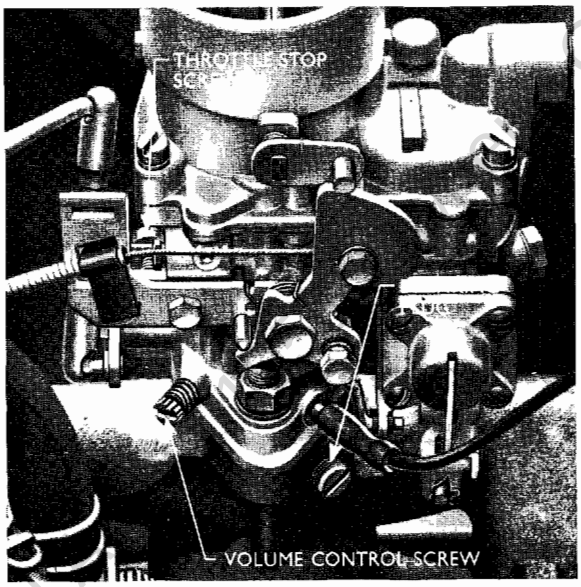

Fig. 12
Slow-Running Adjustments

GENERAL DIAGNOSIS

If the engine operation is unsatisfactory and it is suspected that the fault is due to **poor carburation,** the items listed under the following headings may, when checked, help to locate the cause.

Difficult Starting from Cold

1. Ensure first that fuel is being supplied from the fuel pump.

2. Check that the needle valve at the top of the float chamber is free to operate and that fuel is supplied through this valve when the engine is rotated. If the needle sticks on its seating, this can be overcome by washing the assembly in methylated spirit.

3. Remove air cleaner and check that the choke plate closes completely when the control is operated. Should this plate fail to close fully, ensure that the choke plate spindle is not bent or the return spring broken, also check that the spindle bearings are free from dirt, thus preventing full movement of the choke plate.

Difficult Starting of a Warm Engine

This is usually due to an over-rich mixture which may normally be cleared by fully opening the throttle and turning the engine over on the starter motor with the ignition switched off. However, should this condition be recurrent, check the following items to determine the actual cause.

1. Ensure that the air cleaner is serviceable, cleaning as described on sheet 2 if necessary.

2. Check the fuel pump delivery pressure as described on sheet 3.

3. Ensure that the needle valve and seating at the top of the float chamber are not damaged or dirty, and are screwed tightly in place.

4. Examine the float ensuring that it has not been punctured, and the float arm to see that this is not damaged or bent.

Stalling and Irregular Slow-Running

1. Check adjustment of volume control and idling control screws as described under the heading " Slow-Running Adjustment."

2. Clean the idling jet and check that the idling air correction jet is free from obstruction.

3. Check that the slow-running and progression outlet holes are clear.

4. Remove the volume control screw and inspect to ensure that the taper end has not been damaged and that the coil spring is in good condition, spring loading the screw to prevent it from vibrating out of position.

Poor Acceleration

1. Ensure that fuel is emitted into the venturi when the accelerator pump is operated.

2. Clean the accelerator pump discharge nozzle, main air correction jet and main jet.

3. Check that the econostat drillings are free from obstruction.

Excessive Fuel Consumption

1. Check that the air cleaner is serviceable and, if necessary, clean as described on sheet 2.

2. Ensure that the choke plate returns to the open position when the control is released. Failure to do this may be caused by dirty spindle bearings or a dirty return spring.

3. Thoroughly clean all jets and passages. Inspect the pump diaphragm and ensure that the spring is in good condition, located on the metal seating in the centre of the diaphragm on reassembly. Tighten the screws retaining the pump securely when replacing.

4. Check that the econostat drillings are free from obstruction.

SPECIFICATION

Fuel tank capacity	7 Imp. galls. (8.4 U.S. galls., 31.82 litres)
Carburettor :	
Main jet	97.5
Main air correction jet	160
Accelerator pump discharge jet nozzle	45
Idling air correction jet (fixed)	.85
Idling jet	50
Choke tube	21.5 mm.
Needle valve	1.3
Fuel pump :	
Type	Mechanical
Delivery pressure	1¼ to 2 lb./sq. in. (0.088 to 0.141 kg./sq. cm.)
Diaphragm spring :	
Test length	0.468 in. (11.883 mm.)
Test pressure	3¼ to 3½ lb. (1.474 to 1.588 kg.)
Rocker arm spring :	
Test length	0.44 in. (11.18 mm.)
Test pressure	5 to 5½ lb. (2.268 to 2.495 kg.)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 10: **ELECTRICAL SYSTEM**
Subject: **DISTRIBUTOR**
Effective on: New Anglia and Prefect (1959 onwards)

DISTRIBUTOR REPAIR PROCEDURE

Description

The distributor is mounted on the front right-hand side of the engine and is driven by a skew gear from the camshaft. The ignition advance is mechanically controlled, according to engine speed by governor weights inside the distributor body, and according to engine load by vacuum control acting directly on the contact breaker plate, which is movable in relation to the distributor body.

Correction to the spark advance is necessary because of the wide variation in engine speed and load under normal operating conditions. When accelerating or climbing hills, the engine load can be high and the range of spark advance required is not necessarily as much as it would be on level ground at an equivalent constant engine speed.

In the vacuum control mechanism, one side of the diaphragm is linked to the breaker plate and the other side is connected by a vacuum line to the carburettor, just above the throttle plate. A spring is fitted between the vacuum side of the diaphragm and the vacuum unit connection.

The vacuum applied at the diaphragm, combined with the action of the diaphragm spring, gives correct spark advance according to the load placed on the engine. Maximum advance is obtained when manifold depression on the vacuum diaphragm is between 12½ and 18 in. (31.75 and 45.72 cm.) of mercury, depending upon distributor and engine type (see continuation sheet 3). As the vacuum advance does not operate at idling speed, due to the throttle plate being almost closed, a correctly retarded spark is obtained for starting.

The mechanical governor mechanism consists of two weights pivoted so that they move outwards from the distributor shaft as the engine speed rises. As the weights move outwards they turn the cam relative to the distributor shaft and thus advance the firing point. The weights are restrained by two springs of different tension thus giving a progressive advance action, and the amount the weights move outwards is in direct proportion to the distributor shaft speed. To maintain a smooth operation throughout the engine speed range the weights follow the contours of fixed cam segments as they move outwards, and this system has the advantage of reducing the number of moving parts to a minimum.

Remember that, in practice, the total advance provided by the distributor at a constant engine speed is determined by a combination of both engine speed and manifold depression, according to the engine load.

Identification

Distributors for high and low compression engines can be identified by the low tension terminal which has a red washer on distributors for high compression engines, and a green washer on those for low compression engines. The only other differences between the high and low compression distributors are as follows:—

	High Compression	*Low Compression*
Spring (dist. weight)	105E–12191–A	105E–12191–B
Spring (dist. weight)	105E–12242–A	105E–12242–B
Vacuum Unit	105E–12371–A	105E–12371–B

(see continuation sheet 3)

Should it be necessary to convert a distributor from one type to the other in service, these parts plus Identification washer 118180–ESB (Red) or 118180–ESA (Green) should be changed. All other distributor components are common.

Lubrication

The cam (and contact breaker plate pivots and bushings when assembling after overhaul) should be lubricated with petroleum jelly and the cam spindle, governor weights and breaker arm pivot lubricated with engine oil every 1,000 miles (1,600 km.). To lubricate the cam spindle remove the rotor and apply two drops of oil to the centre of the spindle, and to lubricate the governor weights apply a few drops of oil through the apertures in the breaker plate. Only a film of engine oil should be applied to the breaker arm pivot, ensuring that none contaminates the distributor points.

CAUTION: Do not over-lubricate any part of the distributor, otherwise lubricant may reach the breaker contacts, resulting in burning and difficult starting.

CONTACT BREAKER POINT ADJUSTMENT

To Adjust

1. Remove the distributor cap and rotor arm.

2. Turn the engine so that the heel of the contact breaker is on the highest point of the cam.

3. Slacken the one locking screw and by means of the slot in the end of the adjustable

Serial No. 31 *(Re-issue)*

Last issue was No. 30 *See Sec.—ELECTRICAL SYSTEM*

No. of sheets: 5 *Sheet No.* 1

Date: **28th MARCH, 1960**

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Continued overleaf

contact bracket, adjust the points gap to 0.014 to 0.016 in. (0.356 to 0.406 mm.) (see Fig. 1). If necessary, align the breaker points to make full face contact by bending the adjustable contact bracket. Do not bend the breaker arm.

4. Tighten the screw securing the adjustable contact bracket in position and re-check the gap.

5. Refit the rotor arm.

6. Check that the high tension leads are securely retained and then refit the distributor cap.

To Remove

1. Detach the distributor cap and rotor from the distributor cam.

2. Remove the breaker arm after unscrewing the terminal nut and detaching the flanged nylon bush, together with the primary and condenser leads. The breaker arm and spring assembly can now be lifted off followed by the fibre washers from the terminal and pivot posts.

3. Detach the adjustable contact after removing the one locking screw.

To Replace

Check the condition of the points and fit new parts if the contacts are worn or burnt. Contacts showing a greyish colour and only slightly pitted need not be renewed. If necessary, contacts can be smoothed with a very fine emery stone and then thoroughly cleaned with carbon tetrachloride.

1. Secure the adjustable contact to the breaker plate (see Fig. 2) with one flat washer, lockwasher and screw, but do not tighten the screw fully at this stage.

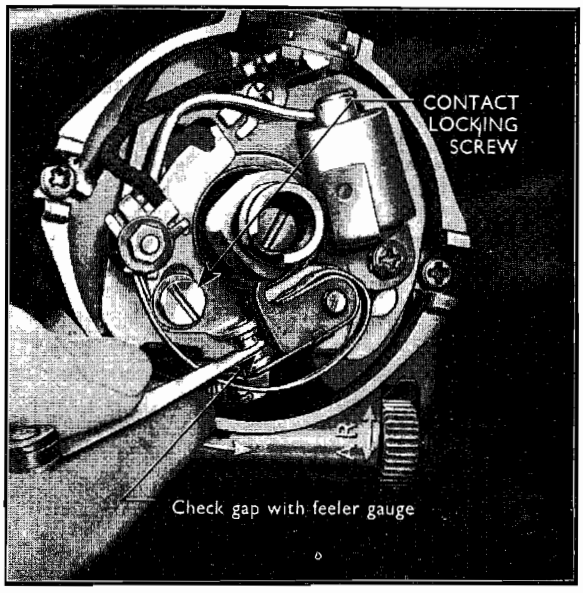

Fig. 1
Checking Contact Breaker Points Gap

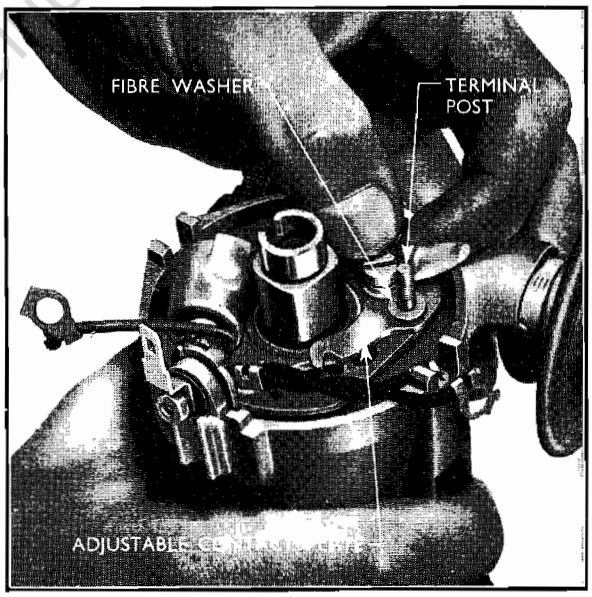

Fig. 2
Replacing Adjustable Contact

2. Locate the fibre washer on the pivot post and breaker arm terminal post and refit the breaker arm assembly so that the contact points are together (see Fig. 3).

3. Locate the primary and condenser leads on the shouldered bush and pass this over the terminal post and through the looped end of the breaker spring. Replace the terminal nut on the post and tighten the nut securely.

4. Ensure that the contact points abut squarely and check the breaker arm spring tension with the spring scale (see continuation sheet 3).

5. Adjust the contact breaker points as described above.

6. Refit the rotor squarely on the distributor cam boss with the slot and lug in line. Press the rotor into position so that the lower face abuts the cam. Replace the distributor cap.

DISTRIBUTOR CONDENSER

The condenser is fitted in parallel across the contact breaker points and a short circuit in the condenser will cause ignition failure as the points will no longer interrupt the low tension circuit. In such cases the condenser will have to be replaced.

An open circuit, however, cannot readily be checked without the use of specialised equipment, such as the Diagnosis Test Set. The usual signs of this are excessively burnt contact breaker points and difficult starting.

The capacity of the condenser is 0.18 to 0.22 microfarad.

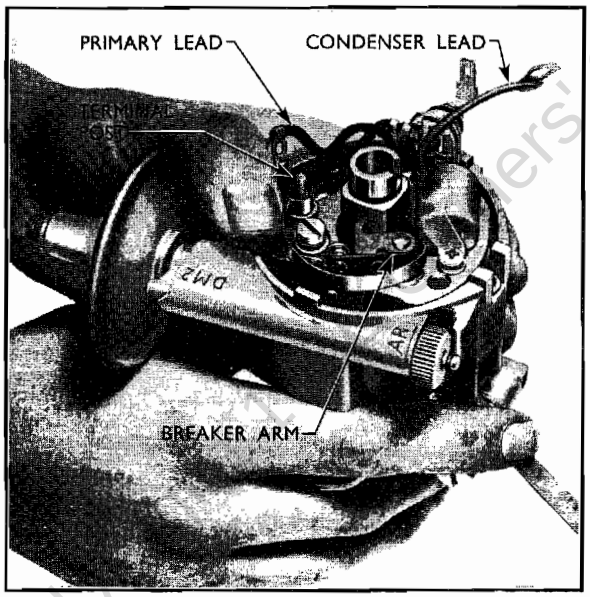

Fig. 3
Fitting the Breaker Arm Assembly

To Remove the Condenser

1. Remove the distributor cap and rotor, unscrew the breaker arm terminal nut and detach the nylon bush, condenser and primary leads.

2. Unscrew the screw retaining the condenser to the breaker plate and remove the condenser.

To Replace

1. Locate the condenser in the slot on the breaker plate and refit the securing screw and lockwasher.

2. Refit the condenser and primary leads on the breaker arm terminal and refit the nylon bush and retaining nut, tightening it securely.

3. Check that there is no possibility of a short circuit between the condenser lead and the breaker plate and refit the rotor and distributor cap.

OVERHAULING THE DISTRIBUTOR

To Remove

1. Disconnect the spark plug leads from the plug terminals.

2. Disconnect the low tension lead from the distributor primary terminal and the high tension lead from the coil.

3. Disconnect the vacuum line from the distributor vacuum housing.

4. Loosen the distributor body clamp bolt and remove the distributor assembly (it is not necessary to remove the clamp plate securing bolt).

To Dismantle (refer to Fig. 7)

1. Remove the distributor cap.

2. Lift the rotor straight up from the distributor cam.

3. Remove the contact breaker points as described on continuation sheet 1.

4. Unscrew the condenser retaining screw and detach the condenser.

5. Remove and dismantle the contact breaker plate assembly.

(*a*) Unhook the vacuum unit spring from its mounting pin on the breaker plate assembly.

(*b*) Remove the two screws and lockwashers securing the assembly to the distributor body sides (note that the screw adjacent to the vacuum unit retains the other end of the contact breaker plate earth wire).

(*c*) Remove the low tension terminal, nylon block and wire by sliding the assembly up from its location in the breaker bearing plate

(*d*) Lift out the breaker plate assembly.

(*e*) Twist the breaker plate fully anti-clockwise until the locating peg enters the opening at the end of the slot in the breaker bearing plate. Separate the breaker plate and breaker bearing plate by unhooking the spring clip (see Fig. 4)

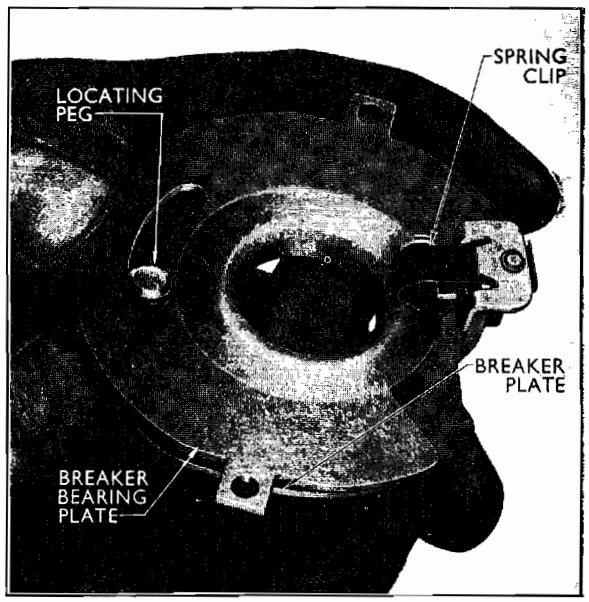

Fig. 4
Separating the Breaker Plate and Bearing Plate

Continued overleaf

6. Unhook the governor weight springs from the pegs on the cam plate.

7. Remove the screw retaining the cam to the distributor shaft, and carefully lift the cam clear of the governor weights.

8. Disconnect the springs from the pegs on the action plate and lift off the weights.

9. If it is necessary to remove the distributor driving shaft due to wear or excessive end-float (see Specification, sheet 5), drill out the end of the skew gear retaining pin and drive it through the gear with a suitable thin punch. Remove the gear and washer.

10. Remove the distributor shaft and action plate from the distributor body together with the spacing washer beneath the action plate.

11. To remove the vacuum unit, detach the small circlip securing the advance adjustment nut and unscrew the nut, when the vacuum unit may be pulled out of the distributor body.

Remove the vacuum unit ratchet spring and advance adjustment nut spring (take care they do not fly out and become lost). The vacuum unit is sealed and no attempt should be made to dismantle it.

12. If, due to wear, it is necessary to remove the thrust pad which bears against the distributor shaft upper journal, carefully drill out the cap and remove the spring and thrust pad.

13. Check all parts for wear (see Specification sheet 5).

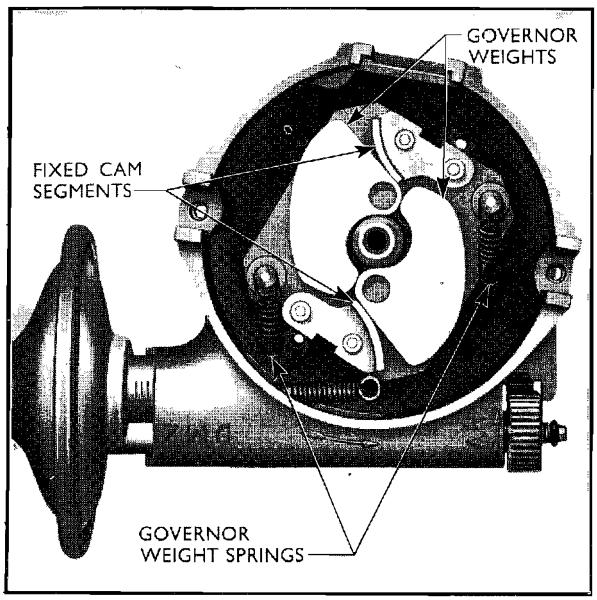

Fig. 5
Governor Weights in Position Prior to Fitting Cam Assembly

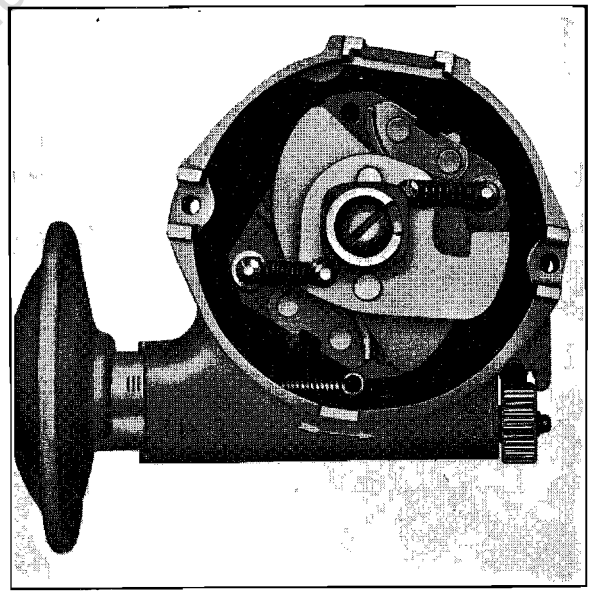

Fig. 6
Cam Assembly in Position

To Reassemble

1. If the thrust pad and spring have been removed, locate the spring on the thrust pad and insert into the distributor body. Fit a new retaining disc and tap this lightly in the centre to retain it in the distributor body.

2. Locate the spacing washer on the underside of the distributor shaft action plate and refit the assembly in the distributor body.

3. Locate the washer on the lower end of the shaft and refit the skew gear. Fit a new skew gear retaining pin and pein over the end.

If a new distributor driving shaft has been fitted, locate a new brass washer on the shaft followed by the skew gear. With the assembly held tightly together drill the driving shaft with a No. 16 (0.177 in. ; 4.5 mm.) drill, using the hole in the skew gear as a guide and fit a new retaining pin as described above. Turn the distributor shaft through a few revolutions to remove the three protrusions on one face of the washer thus giving the correct end-float.

4. Fit the governor weight restraining springs to the pegs on the action plate.

5. Locate the governor weights on the action plate with the flat sides abutting the fixed cam segments and the cut-away portions nearest the shaft (see Fig. 5).

6. Refit the distributor cam assembly to the shaft and ensure that it turns smoothly without tightness. Engage the cam pegs in the governor weight holes and refit the securing screw.

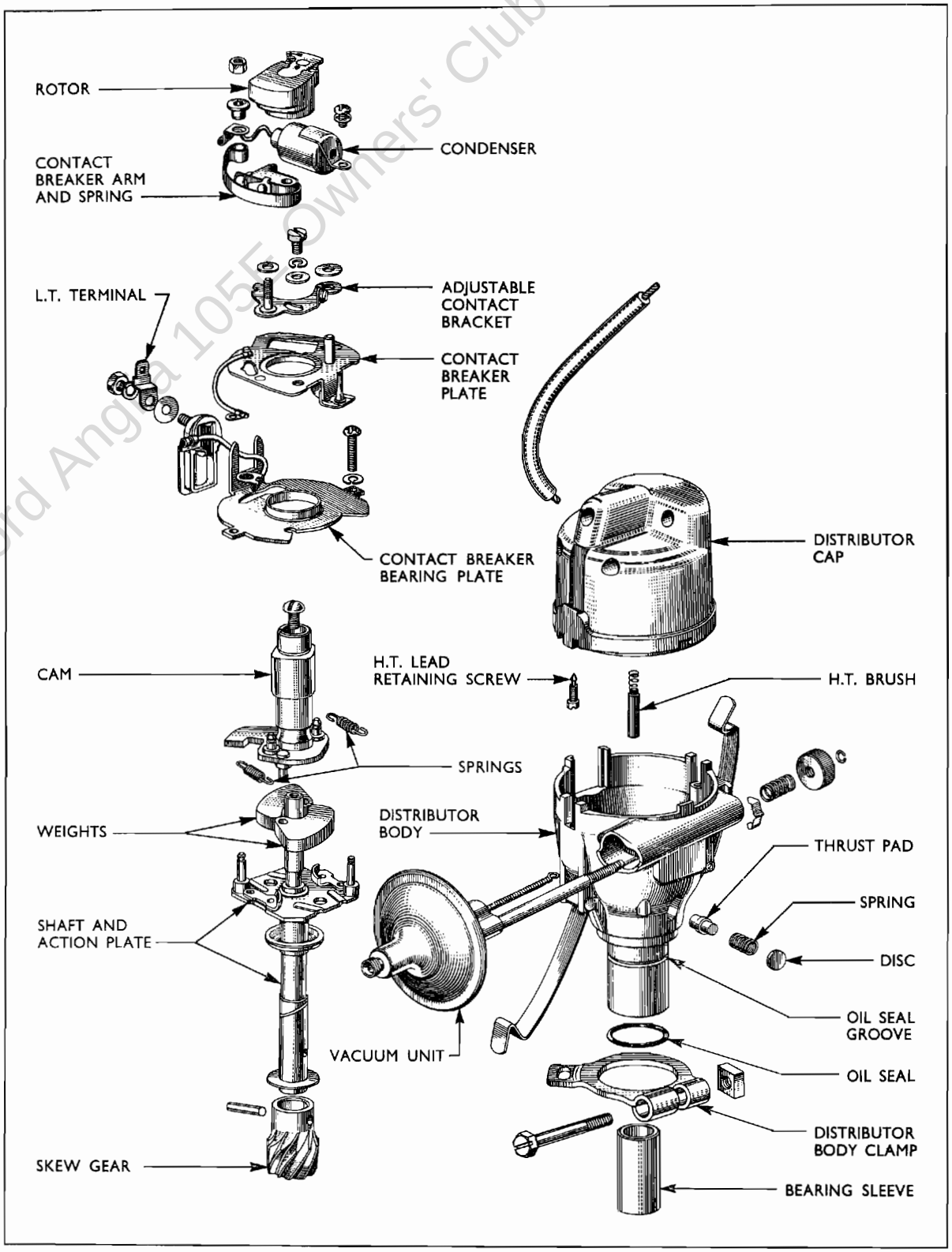

Fig. 7
Exploded View of Distributor

Serial No. 31 (*Re-issue*)	*No. of sheets:* 5 *Sheet No.* 3
Last issue was No. 30 *See Sec.—ELECTRICAL SYSTEM*	*Date:* **28th MARCH, 1960**

Continued overleaf

7. Connect the springs to the pegs on the cam plate (see Fig. 6), and check the action of the weights in the fully advanced and retarded positions for freedom of movement and lightly lubricate all parts with engine oil.

8. Check the vacuum unit linkage for wear, and refit the vacuum unit to the distributor body. It is most important that the correct vacuum unit is fitted to the appropriate distributor, otherwise ignition advance and engine performance will be affected. Vacuum units are identified by the following numbers which appear on the unit adjacent to the union :—

High Compression	5	12	6
Low Compression	5	13	10

The first figure of each of these groups represents the inches of mercury at which advance begins, the second group represents the inches of mercury at which advance ends, and the third group represents the number of degrees of advance between these two limits.

Replace the adjustment nut spring, ratchet spring, and adjustment nut and circlip. Tighten the nut until the fourth line on the timing scale behind the vacuum housing is in line with the edge of the distributor body.

9. Check the fit of the breaker plate on the bearing plate and also the breaker arm pivot for looseness or wear.

10. Reassemble the breaker plate assembly. Refit the breaker plate to the bearing plate by springing the spring clip over the bearing plate slot edge, inserting the peg of the breaker plate in the slot in the bearing plate and twisting it slightly clockwise.

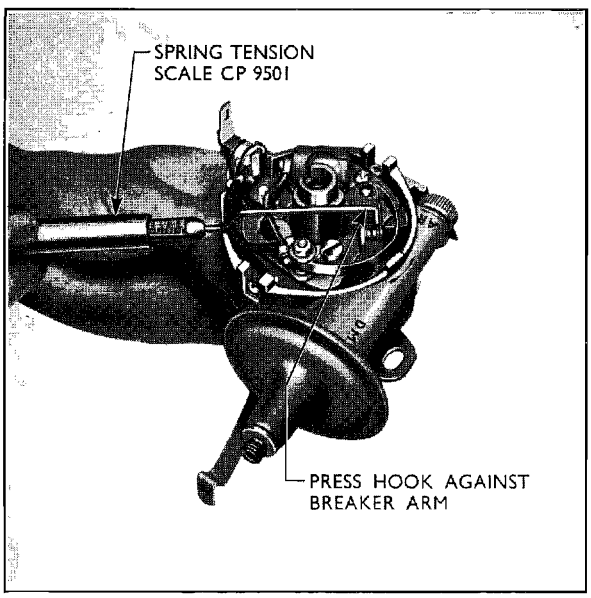

Fig. 8

Checking Contact Breaker Arm Spring Tension

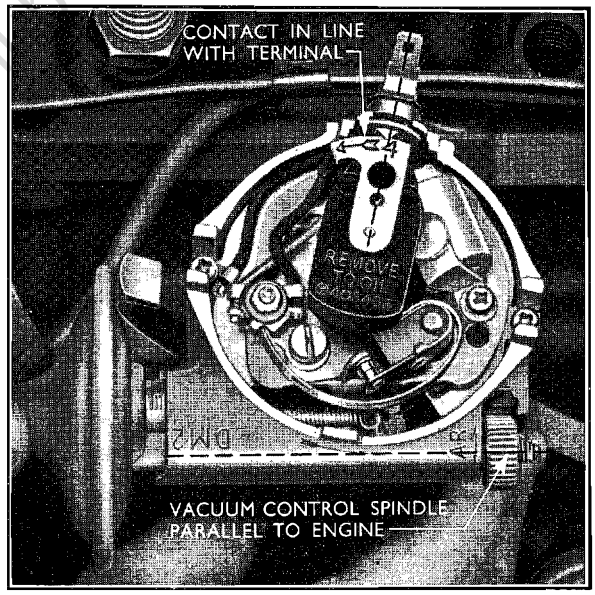

Fig. 9

Locating the Distributor on the Engine

11. Locate the contact breaker plate assembly in the distributor body, securing the end of the vacuum unit spring to the attachment on the breaker plate. Secure the plate with two screws and lock-washers to the distributor body, noting that the screw adjacent to the vacuum unit retains one end of the contact breaker plate earth wire.

12. Check the condenser and renew if necessary. Locate the condenser on the breaker plate and refit the securing screw.

13. Replace the contact points, as described on continuation sheet 1, and initially set the gap to 0.014 to 0.016 in. (0.356 to 0.406 mm.).

Rotate the cam to close the points, then measure the contact breaker arm spring tension by pressing the hook of the scale CP.9501 against the breaker arm, adjacent to the contact point (see Fig. 8).

The reading should be taken just as the points separate and should be between 18 to 24 oz. (510.3 to 680.36 gms.). If not to specification the breaker arm spring may be bent to increase or decrease tension as required.

14. Replace the rotor, locating the tongue in the slot in the distributor cam.

To Replace

1. Set the engine, with the timing mark on the cylinder front cover in line with the notch in the crankshaft pulley as No. 1 piston comes up on the compression stroke.

2. Locate the distributor on the engine, firstly ensuring that the rear face of the rotor arm contact is in line with the low tension terminal on the distributor body and that the vacuum diaphragm spindle is parallel to the engine (see Fig. 9).

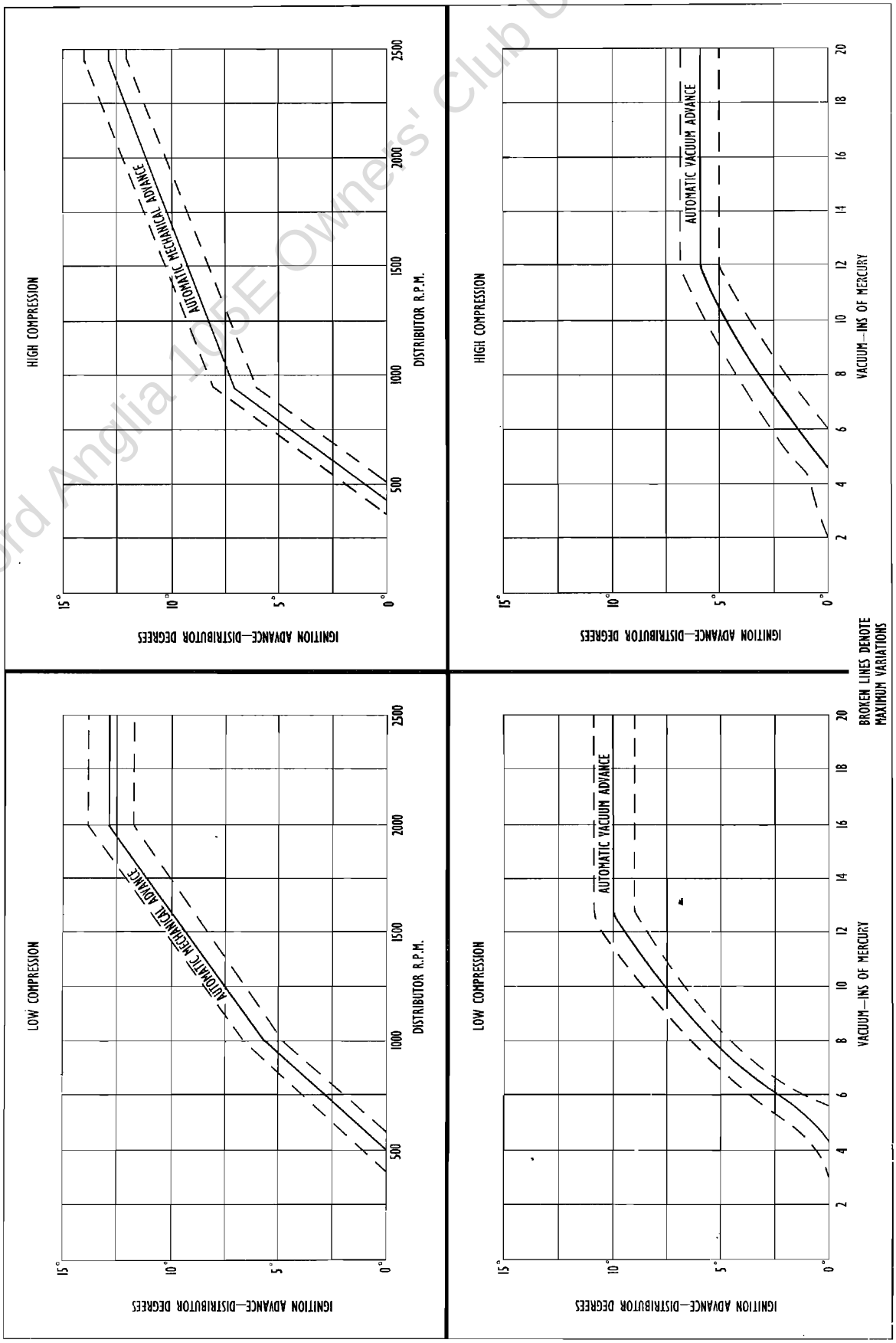

Fig. 10 **Mechanical and Vacuum Advance Curves**

Serial No. 31 (*Re-issue*)	*No. of sheets:* 5 *Sheet No.* 4
Last issue was No. 30 *See Sec.—ELECTRICAL SYSTEM*	*Date:* **28th MARCH, 1960**

Continued overleaf

As the distributor is fitted the rotor arm will rotate towards the condenser as the skew gear engages. Secure the distributor in position.

3. Replace the distributor cap and leads securing the cap with the two retaining clips.

4. Reconnect the leads to the spark plug terminals, the high tension lead to the coil and the low tension coil wire to the distributor.

5. Reconnect the vacuum line to the vacuum housing connector and tighten the nut securely.

6. Re-time the ignition as described below.

IGNITION TIMING

A. To Adjust the Timing without the use of a Timing Light

1. If the engine has not been previously set, turn it with No. 1 piston coming up to T.D.C. on the compression stroke (this can be checked by removing No. 1 spark plug and feeling the pressure developed in the cylinder).

Continue turning the engine until the notch on the crankshaft pulley is in line with the timing mark on the cylinder front cover.

This will give the initial timing setting of 10° B.T.D.C.

2. Check that the fourth line on the ignition timing scale, counting from the vacuum diaphragm housing, is in line with the edge of the distributor body. Remove the distributor cap.

3. Slacken off the distributor body clamp bolt and rotate the body clockwise until the contact breaker points are just opening when the rotor is adjacent to No. 1 H.T. contact in the distributor cap.

4. Tighten the distributor body clamp bolt and replace the distributor cap.

NOTE.—A slight readjustment to the distributor may be necessary to suit the particular type of fuel in use and this setting should be determined after checking the timing as described above, or after road tests.

Only premium grade fuel (above 90 octane, research method) should be used with the high compression cylinder head which can be identified by the letter "H" stamped on one inlet manifold mounting pad.

B. To Adjust the Timing using a Timing Light

1. Complete operations Nos. 1 to 3 inclusive from the previous section, A.

2. Replace the distributor cap.

3. Connect the two main leads of the timing light to six volts only of the battery, using the clips provided. The positive lead clip has a red outer covering and the negative lead clip has a black covering. Connect the third lead, which has a smaller clip, to the L.T. terminal of the distributor.

4. Check that the notch on the crankshaft pulley is visible and mark with chalk or paint if necessary.

5. Disconnect the vacuum pipe line and start the engine, allowing it to idle.

6. Point the timing light at the timing indicator. Check that the indicator and the notch on the pulley are in line.

If the notch of the pulley is above the indicator, the engine is too far advanced and the distributor body should be turned anti-clockwise slightly to retard the ignition.

Should the notch be below the indicator, the distributor body should be turned clockwise slightly to advance the ignition.

7. Securely tighten the distributor body clamp bolt after the adjustment has been made.

Reconnect the vacuum pipe line.

The operation of the governor weights may be checked by opening and closing the throttle. As the throttle is gradually opened, the notch should move away from the indicator upwards ; and as the throttle is closed the notch will move down in line with the indicator.

Any tendency for erratic advance shown by the notch jumping suddenly away from the indicator shows that the governor weights are binding, or that the springs are weak.

NOTE.—As in "A" a slight readjustment to the distributor may be necessary to suit the particular type of fuel in use and this setting should be determined after checking the timing as described above, or after road tests.

Only premium grade fuel (above 90 octane, research method) should be used with the high compression cylinder head which can be identified by the letter "H" stamped on one inlet manifold mounting pad.

SPECIFICATIONS AND REPAIR DATA

General

Type .. .. Single contact breaker point
Drive .. .. .. Skew gear from camshaft
Ignition advance :
Centrifugal and vacuum controlled
Static advance .. .. .. 10° before T.D.C.
Automatic advance (no vacuum) :
Starts .. .. .. 900 r.p.m. (crankshaft) (8.9 c.r.)
1,000 r.p.m. (crankshaft) (7.5 c.r.)
Ends .. .. .. 4,900 r.p.m. (crankshaft) (8.9 c.r.)
4,000 r.p.m. (crankshaft) (7.5 c.r.)
Breaker arm spring tension .. .. 18 to 24 oz. (510.3 to 680.36 gms.)

Condenser capacity .. 0.18 to 0.22 microfarad
Contact breaker points gap .. 0.014 to 0.016 in. (0.356 to 0.406 mm.)
Spark plug gap .. .. .. 0.023 to 0.028 in. (0.58 to 0.71 mm.)

Distributor Shaft

Diameter .. .. .. 0.4895 to 0.490 in. (12.432 to 12.450 mm.)
End-float .. .. .. 0.002 to 0.006 in. (0.051 to 0.152 mm.)
Clearance .. .. .. 0.000 to 0.0015 in. (0.000 to 0.038 mm.)

VACUUM ADVANCE CHARACTERISTICS (On Deceleration)

High Compression

Vacuum (Inches of Mercury)	Degrees Advance (Distributor)
18	5° to 7°
11	4½° to 6½°
8½	2½° to 4½°
6½	½° to 3°
3	0° to ½°

Low Compression

Vacuum (Inches of Mercury)	Degrees Advance (Distributor)
18	9° to 11°
12	8½° to 10½°
8½	5° to 7°
6½	2° to 4¼°
5	0° to 1½°
4	0° to ½°

MECHANICAL ADVANCE CHARACTERISTICS (On Deceleration)

High Compression

Distributor R.P.M.	Degrees Advance (Distributor)
2,500	12° to 14°
2,000	10¼° to 12¼°
1,500	8° to 10¼°
1,000	6¼° to 8¼°
500	0° to 2°

Low Compression

Distributor R.P.M.	Degrees Advance (Distributor)
2,500	12° to 14°
2,000	12° to 14°
1,500	8¼° to 10¼°
1,000	4¾° to 6¾°
500	0° to 1°

DISTRIBUTOR: OVERHAUL PROCEDURES

NEW ANGLIA

(1959 Onwards)

Introduction

With effect from approximate Engine No. 105E–408130 new type distributors are fitted in production. Generally, distributor Part No. 105E–12100–C is for use with high compression engines, whilst distributor, Part No. 105E–12100–D is for use with low compression engines. As the selection of a distributor and engine compression ratio is also governed by the octane rating of fuel to be used, reference should be made to the section of this Bulletin headed " Distributor Selection."

These two distributors are similar in design, manufacture and characteristics to those fitted to cars in the Consul 315 range. The Anglia distributors can be identified by horizontal fitting high tension leads, as opposed to the vertical fitting high tension leads on the Consul 315.

Description

The distributor is mounted on the front right-hand side of the engine and is driven by a skew gear from the camshaft. The ignition advance is mechanically controlled, according to engine speed by governor weights inside the distributor body, and according to engine load by vacuum control acting directly on the contact breaker plate, which is movable in relation to the distributor body.

Correction to the spark advance is necessary because of the wide variation in engine speed and load under normal operating conditions. When accelerating or climbing hills, the engine load can be high and the range of spark advance required is not necessarily as much as it would be on level ground at an equivalent constant engine speed.

In the vacuum control mechanism, one side of the diaphragm is linked to the breaker plate and the other side is connected by a vacuum line to the carburettor, just above the throttle plate. A spring is fitted between the vacuum side of the diaphragm and the vacuum unit connection.

The vacuum applied at the diaphragm, combined with the action of the diaphragm spring, gives correct spark advance according to the load placed on the engine. Maximum advance is obtained when manifold depression on the vacuum diaphragm is between 14½ and 15½ in. (36.83 and 39.37 cm.) of mercury, depending upon distributor and engine type (see continuation sheet 3). As the vacuum advance does not operate at idling speed, due to the throttle plate being almost closed, a correctly retarded spark is obtained for starting.

The mechanical governor mechanism consists of two weights pivoted so that they move outwards from the distributor shaft as the engine speed rises. As the weights move outwards they turn the cam relative to the distributor shaft and thus advance the firing point. The weights are restrained by two springs of different tension thus giving a progressive advance action, and the amount the weights move outwards is in direct proportion to the distributor shaft speed. To maintain a smooth operation throughout the engine speed range the weights follow the contours of fixed cam segments as they move outwards, and this system has the advantage of reducing the number of moving parts to a minimum.

Remember that, in practice, the total advance provided by the distributor at a constant engine speed is determined by a combination of both engine speed and manifold depression, according to the engine load.

Identification

Distributors for high and low compression engines can be identified by the low tension terminal which has a yellow washer on distributors for high compression engines, and a brown washer on those for low compression engines. The only other differences between the high and low compression distributors are as follows :—

	High Compression	*Low Compression*
Spring (dist. weight)	109E–12191–A	109E–12191–B
Spring (dist. weight)	109E–12242–A	109E–12242–B
Vacuum Unit	109E–12371–A	109E–12371–B
Cam Assembly	109E–12179–A	109E–12179–B

(see continuation sheet 3)

Should it be necessary to convert a distributor from one type to the other in service, these parts plus Identification washer 118180–ESD (Yellow) or 118180–ESF (Brown) should be changed. All other distributor components are common.

Distributor Selection

The selection of a distributor for a particular engine is dependent on the compression ratio of the engine and the octane rating of the fuel to be used. The octane numbers quoted are by the research method.

(*a*) All high compression engines (8.9 : 1) using a fuel of a 95 and above octane rating must use a " high compression " distributor, identified by a yellow washer on the L.T. terminal.

(*b*) All high compression engines (8.9 : 1) using a fuel below 95 octane but above 88 octane must use a " low compression " distributor, identified by a brown washer on the L.T. terminal.

(*c*) All low compression engines (7.5 : 1) using a fuel below 88 octane must use a " low compression " distributor, identified by a brown washer on the L.T. terminal (see also Fig. 14).

Lubrication

The cam (and contact breaker plate pivots and bushings when assembling after overhaul) should be lubricated with petroleum jelly and the cam spindle, governor weights and breaker arm pivot lubricated with engine oil every 1,000 miles (1,600 km.). To lubricate the cam spindle remove the rotor and apply two drops of oil to the centre of the spindle, and to lubricate the governor weights apply a few drops of oil through the apertures in the breaker plate. Only a film of engine oil should be applied to the breaker arm pivot, ensuring that none contaminates the distributor points (see Fig. 1).

CAUTION: Do not over-lubricate any part of the distributor, otherwise lubricant may reach the breaker contacts, resulting in burning and difficult starting.

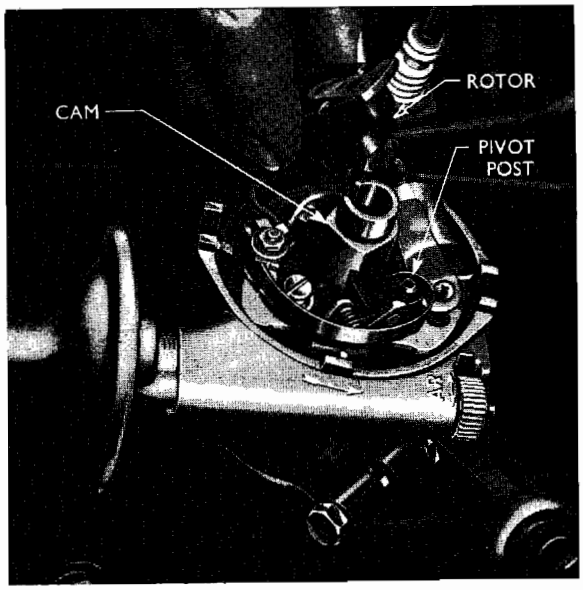

Fig. 1
Distributor Lubrication

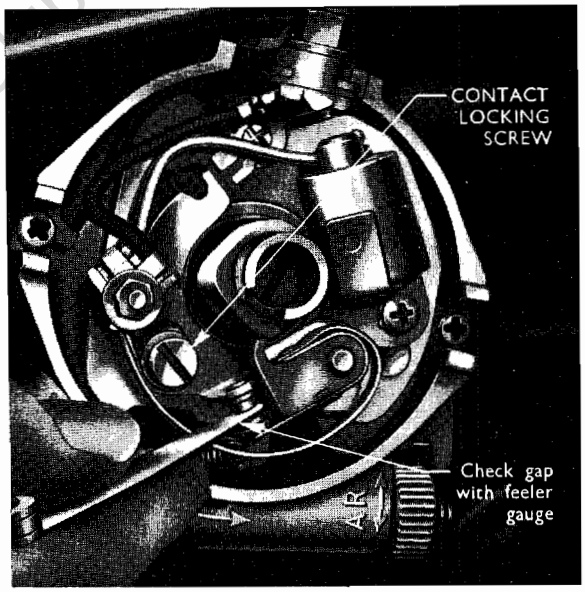

Fig. 2
Checking Contact Breaker Points Gap

CONTACT BREAKER POINT ADJUSTMENT

To Adjust

1. **Remove the distributor cap and rotor arm.**

2. **Turn the engine** so that the heel of the contact breaker is on the highest point of the cam.

3. **Slacken the one locking screw** and by means of the slot in the end of the adjustable contact bracket, adjust the points gap to 0.014 to 0.016 in. (0.356 to 0.406 mm.) (see Fig. 2). If necessary, align the breaker points to make full face contact by bending the adjustable contact bracket. Do not bend the breaker arm.

4. **Tighten the screw securing the adjustable contact bracket** in position and re-check the gap.

5. **Refit the rotor arm** squarely on the distributor cam boss with the slot and lug in line. Press the rotor into position so that the lower face abuts the cam.

6. **Check that the high tension leads are securely retained** and then refit the distributor cap.

To Remove

1. **Detach the distributor cap** and rotor from the distributor cam.

2. **Remove the breaker arm** after unscrewing the terminal nut and detaching the flanged nylon bush, together with the primary and condenser leads. The breaker arm and spring assembly can now be lifted off followed by the fibre washers from the terminal and pivot posts.

3. **Detach the adjustable contact** after removing the one locking screw.

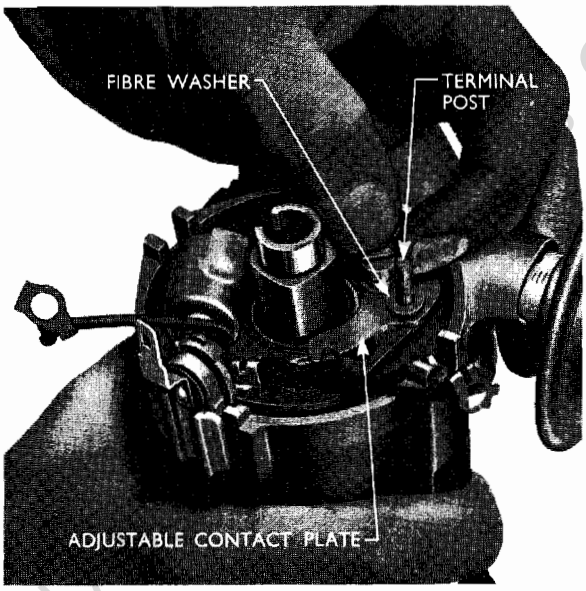

Fig. 3
Replacing Adjustable Contact

To Replace

Check the condition of the points and fit new parts if the contacts are worn or burnt. Contacts showing a greyish colour and only slightly pitted need not be renewed. If necessary, contacts can be smoothed with a very fine emery stone and then thoroughly cleaned with carbon tetrachloride.

1. **Secure the adjustable contact to the breaker plate** (see Fig. 3) with one flat washer, lockwasher and screw, but do not tighten the screw fully at this stage.

2. **Locate the fibre washer on the pivot post** and breaker arm terminal post and refit the breaker arm assembly so that the contact points are together (see Fig. 4).

3. **Locate the primary and condenser leads** on the shouldered bush and pass this over the terminal post and through the looped end of the breaker spring. Replace the terminal nut on the post and tighten the nut securely.

4. **Ensure that the contact points abut squarely** and check the breaker arm spring tension with the spring scale (see continuation sheet 3).

5. **Adjust the contact breaker points** as described previously.

6. **Refit the rotor** squarely on the distributor cam boss with the slot and lug in line. Press the rotor into position so that the lower face abuts the cam. Replace the distributor cap.

DISTRIBUTOR CONDENSER

The condenser is fitted in parallel across the contact breaker points and a short circuit in the condenser will cause ignition failure as the points will no longer interrupt the low tension circuit. In such cases the condenser will have to be replaced.

An open circuit, however, cannot readily be checked without the use of specialised equipment, such as the Diagnosis Test Set. The usual signs of this are excessively burnt contact breaker points and difficult starting.

The capacity of the condenser is 0.18 to 0.22 microfarad.

To Remove the Condenser

1. **Remove the distributor cap and rotor,** unscrew the breaker arm terminal nut and detach the nylon bush, condenser and primary leads.

2. **Unscrew the screw retaining the condenser** to the breaker plate and remove the condenser.

To Replace

1. **Locate the condenser in the slot on the breaker plate** and refit the securing screw and lockwasher.

2. **Refit the condenser and primary leads on the breaker arm terminal** and refit the nylon bush and retaining nut, tightening it securely.

3. **Check that there is no possibility of a short circuit** between the condenser lead and the breaker plate and refit the rotor and distributor cap.

OVERHAULING THE DISTRIBUTOR

To Remove

1. **Disconnect the spark plug leads** from the plug terminals, taking care not to pull the leads, but pull the terminals from each plug.

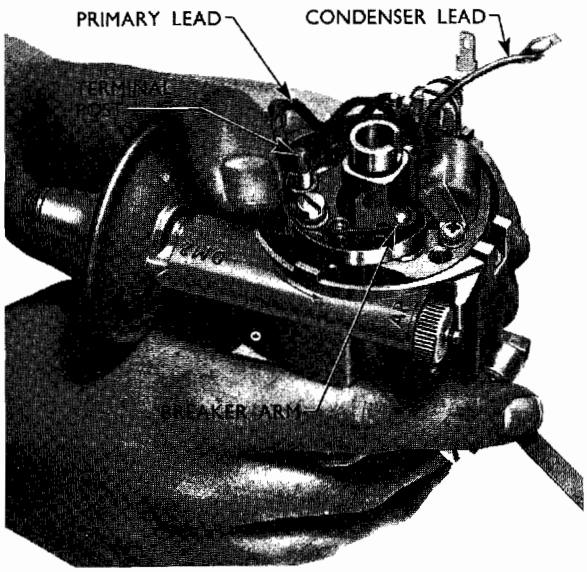

Fig. 4
Fitting the Breaker Arm Assembly

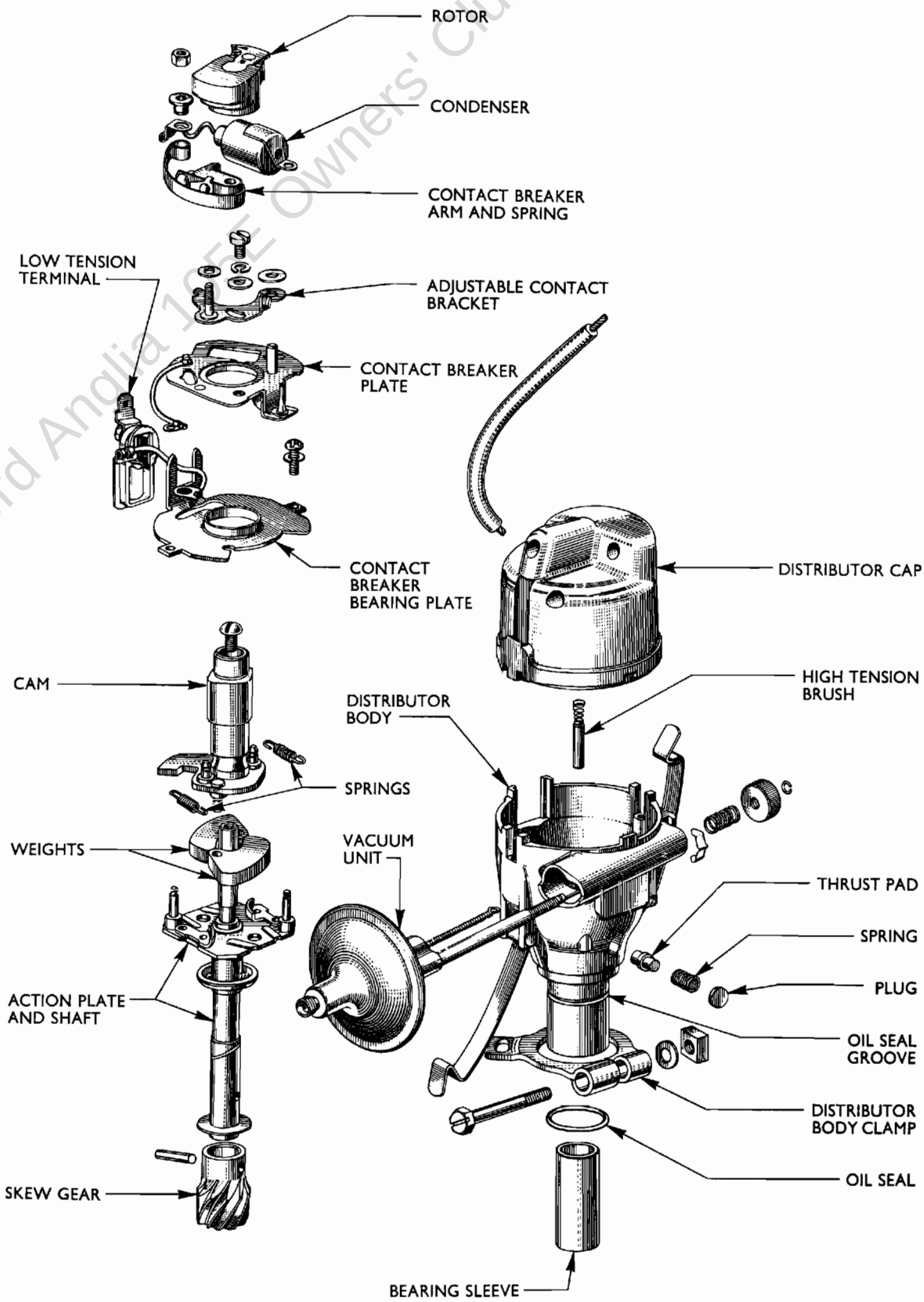

Fig. 5
Exploded View of Distributor

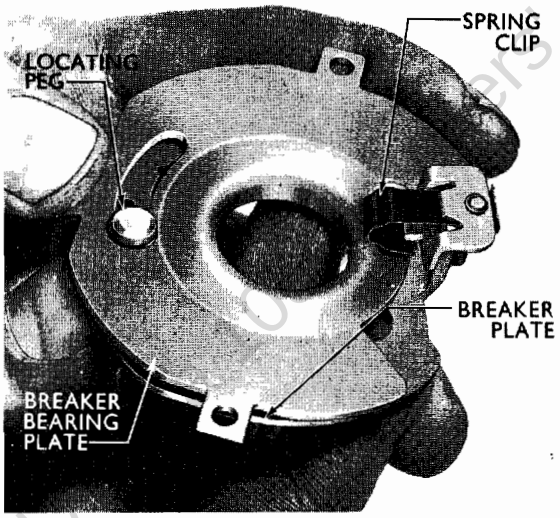

Fig. 6
Separating the Breaker Plate and Bearing Plate

2. Disconnect the low tension lead from the distributor primary terminal and the high tension lead from the coil.

3. Disconnect the vacuum line from the distributor vacuum housing.

4. Loosen the distributor body clamp bolt and remove the distributor assembly (it is not necessary to remove the body clamp securing bolt).

To Dismantle (refer to Fig. 5)

1. Remove the distributor cap.

2. Lift the rotor straight up from the distributor cam.

3. Remove the contact breaker points as described on continuation sheet 1.

4. Unscrew the condenser retaining screw and detach the condenser.

5. Remove and dismantle the contact breaker plate assembly.

(*a*) Unhook the vacuum unit spring from its mounting pin on the breaker plate assembly.

(*b*) Remove the two screws and lockwashers securing the assembly to the distributor body sides (note that the screw adjacent to the vacuum unit retains the other end of the contact breaker plate earth wire).

(*c*) Remove the low tension terminal, nylon block and wire by sliding the assembly up from its location in the breaker bearing plate.

(*d*) Lift out the breaker plate assembly.

(*e*) Twist the breaker plate fully anti-clockwise until the locating peg enters the opening at the end of the slot in the breaker bearing plate. Separate the breaker plate and breaker bearing plate by disengaging the spring clip (see Fig. 6).

6. Unhook the governor weight springs from the pegs on the cam plate.

7. Remove the screw retaining the cam to the distributor shaft, and carefully lift the cam clear of the governor weights.

8. Disconnect the springs from the pegs on the action plate and lift off the weights.

9. If it is necessary to remove the distributor driving shaft due to wear or excessive end-float (see Specification, sheet 6), drill out the end of the skew gear retaining pin and drive it through the gear with a suitable thin punch. Remove the gear and washer.

10. Remove the distributor shaft and action plate from the distributor body together with the spacing washer beneath the action plate.

11. To remove the vacuum unit, detach the small circlip securing the advance adjustment nut and unscrew the nut, when the vacuum unit may be pulled out of the distributor body.

Remove the vacuum unit ratchet spring and advance adjustment nut spring (take care they do not fly out and become lost). The vacuum unit is sealed and no attempt should be made to dismantle it.

12. If, due to wear, it is necessary to remove the thrust pad which bears against the distributor shaft upper journal, carefully drill out the cap and remove the spring and thrust pad.

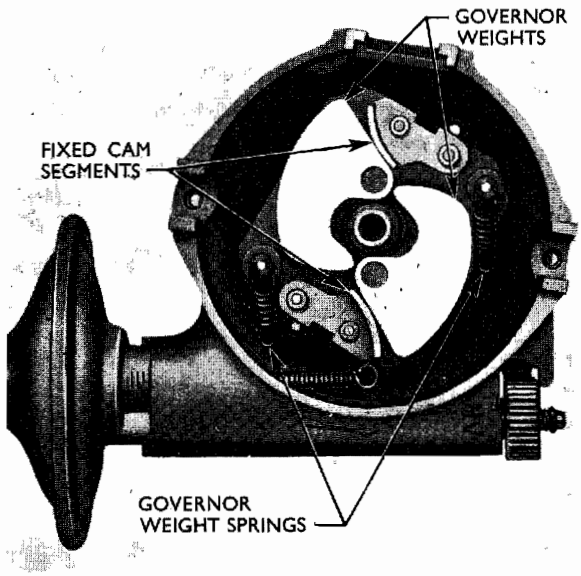

Fig. 7
Governor Weights in Position Prior to Fitting Cam Assembly

13. Check all parts for wear (see Specification sheet 6).

To Reassemble

1. If the thrust pad and spring have been removed, locate the spring on the thrust pad and insert into the distributor body. Fit a new retaining disc and tap this lightly in the centre to retain it in the distributor body.

2. Locate the spacing washer on the underside of the distributor shaft action plate and refit the assembly in the distributor body.

3. Locate the washer on the lower end of the shaft and refit the skew gear. Fit a new skew gear retaining pin and pein over the end.

If a new distributor driving shaft has been fitted, locate a new brass washer on the shaft followed by the skew gear. With the assembly held tightly together drill the driving shaft with a No. 16 (0.177 in. ; 4.5 mm.) drill, using the hole in the skew gear as a guide and fit a new retaining pin as described above. Turn the distributor shaft through a few revolutions to remove the three protrusions on one face of the washer thus giving the correct end-float.

4. Fit the governor weight restraining springs to the pegs on the action plate.

5. Locate the governor weights on the action plate with the flat sides abutting the fixed cam segments and the cut-away portions nearest the shaft (see Fig. 7).

6. Refit the distributor cam assembly to the shaft and ensure that it turns smoothly without tightness. Engage the cam pegs in the governor weight holes and refit the securing screw.

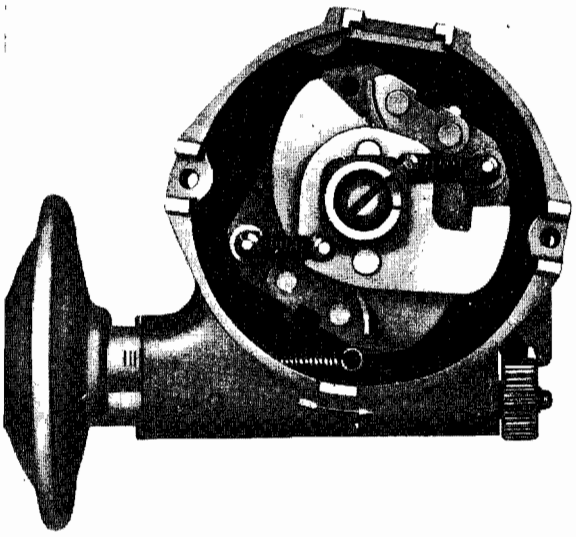

Fig. 8
Cam Assembly in Position

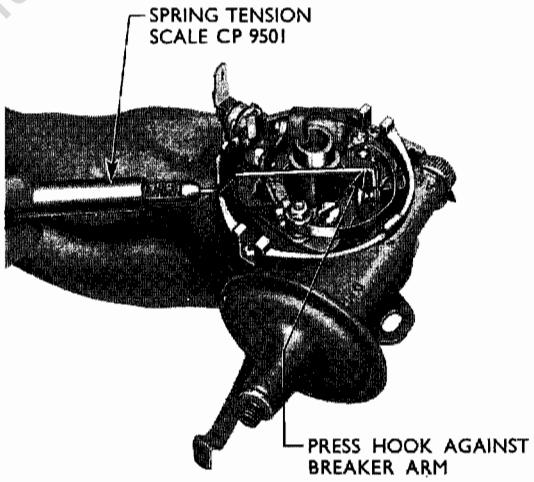

Fig. 9
Checking Contact Breaker Arm Spring Tension

7. Connect the springs to the pegs on the cam plate (see Fig. 8), and check the action of the weights in the fully advanced and retarded positions for freedom of movement and lightly lubricate all parts with engine oil.

8. Check the vacuum unit linkage for wear, and refit the vacuum unit to the distributor body. It is most important that the correct vacuum unit is fitted to the appropriate distributor, otherwise ignition advance and engine performance will be affected. Vacuum units are identified by the following numbers which appear on the unit adjacent to the union :—

High Compression	5	17	10
Low Compression	5	16	12

The first figure of each of these groups represents the inches of mercury at which advance begins, the second group represents the inches of mercury at which advance ends, and the third group represents the number of degrees of advance between these two limits, in distributor degrees.

Replace the adjustment nut spring, ratchet spring, and adjustment nut and circlip. Tighten the nut until the fourth line on the timing scale behind the vacuum housing is in line with the edge of the distributor body.

9. Check the fit of the breaker plate on the bearing plate and also the breaker arm pivot for looseness or wear.

10. Reassemble the breaker plate assembly. Refit the breaker plate to the bearing plate by springing the spring clip over the bearing plate slot edge, inserting the peg of the breaker plate in the slot in the bearing plate and twisting it slightly clockwise.

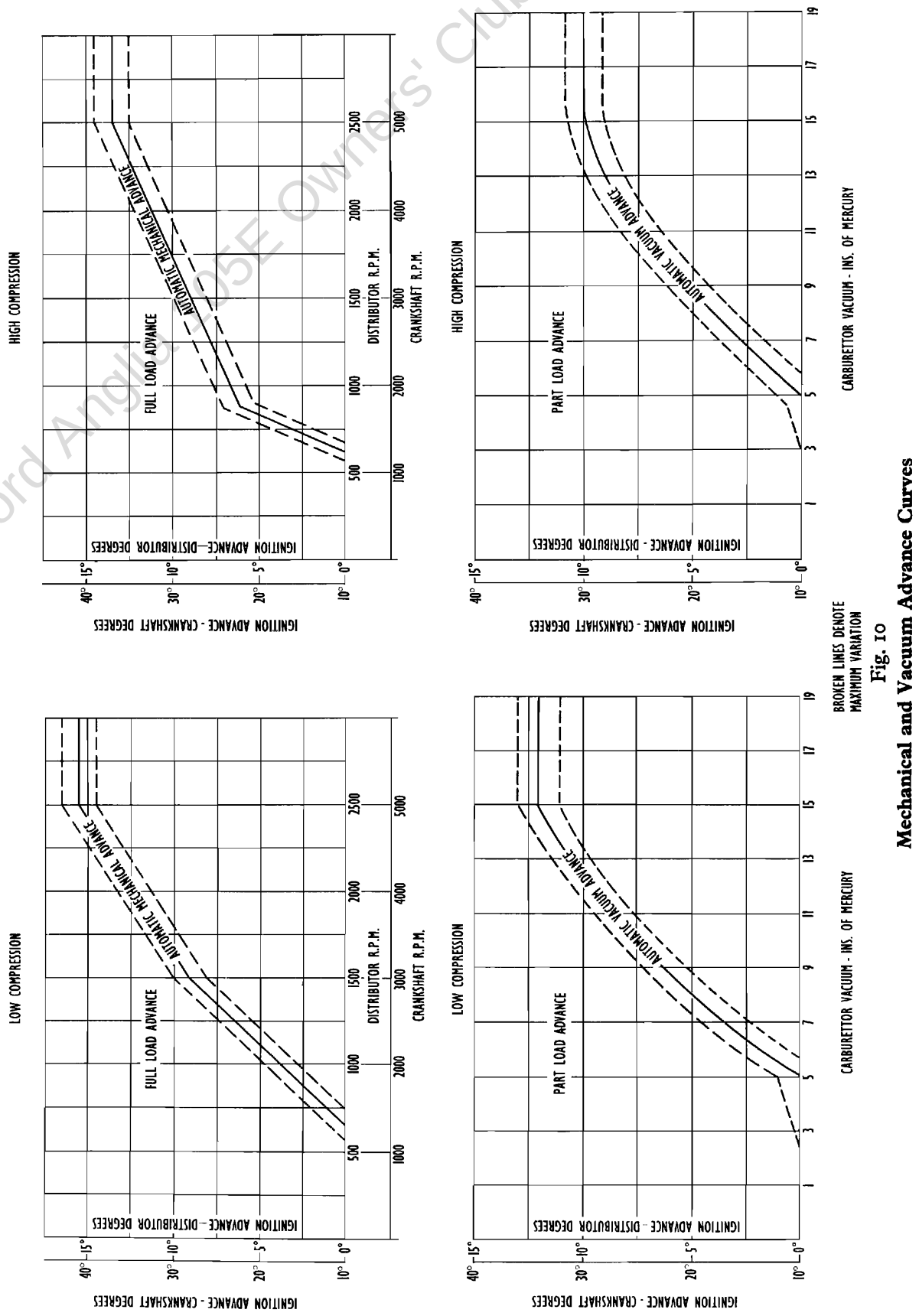

Fig. 10
Mechanical and Vacuum Advance Curves

NOTE.—The bearing plate must be located under the spring clip and the horizontal lug shown in Fig. 6.

11. Locate the contact breaker plate assembly in the distributor body, securing the end of the vacuum unit spring to the post on the breaker plate lug. Secure the plate with two screws and lock-washers to the distributor body, noting that the screw adjacent to the vacuum unit retains one end of the contact breaker plate earth wire.

12. Check the condenser and renew if necessary. Locate the condenser on the breaker plate and refit the securing screw.

13. Replace the contact points, as described on continuation sheet 1, and initially set the gap to 0.014 to 0.016 in. (0.356 to 0.406 mm.).

Rotate the cam to close the points, then measure the contact breaker arm spring tension by pressing the hook of the scale CP.9501 against the breaker arm, adjacent to the contact point (see Fig. 9).

The reading should be taken just as the points separate and should be between 18 to 24 oz. (510.3 to 680.36 gms.). If not to specification the breaker arm spring may be bent to increase or decrease tension as required.

14. Replace the rotor, locating the tongue in the slot in the distributor cam.

To Replace

1. Set the engine, with the upper (inner) timing mark on the timing cover in line with the notch in the crankshaft pulley as No. 1 piston comes up on the compression stroke (see Fig. 11).

2. Locate the distributor on the engine, first ensuring that the rear face of the rotor arm

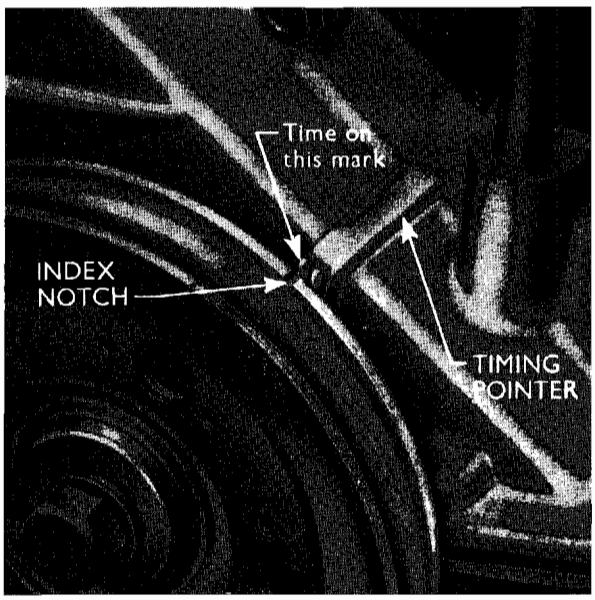

Fig. 11
Correct Engine Timing Position

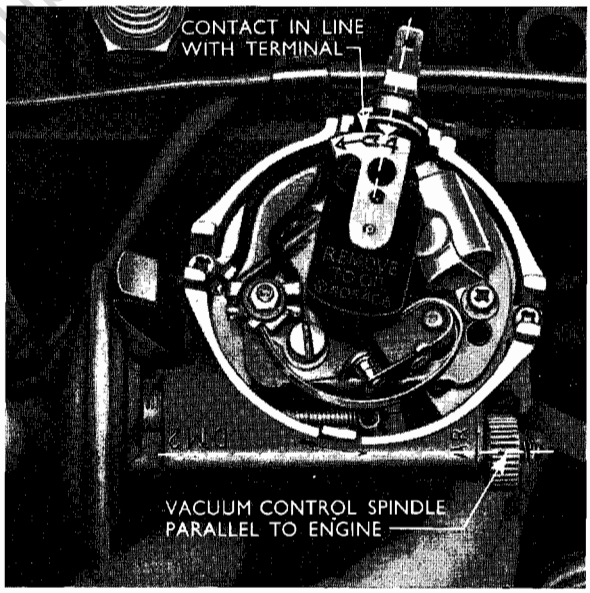

Fig. 12
Locating the Distributor on the Engine

contact is in line with the low tension terminal on the distributor body and that the vacuum diaphragm spindle is parallel to the engine (see Fig. 12).

When the distributor is fitted the rotor arm will rotate towards the condenser as the skew gear engages. Secure the distributor in position.

3. Replace the distributor cap and leads securing the cap with the two retaining clips.

4. Reconnect the leads to the spark plug terminals in the correct firing order (1, 2, 4, 3); noting the direction of rotation of the rotor arm. Connect the high tension lead to the coil and the low tension coil wire to the distributor.

5. Reconnect the vacuum line to the vacuum housing connector and tighten the nut securely.

6. Re-time the ignition as described below.

IGNITION TIMING

General

(*a*) Prior to adjusting the ignition timing ascertain the engine compression ratio. This can be readily identified by the letter "**H**" (High Compression 8.9 : 1) or the letter "**L**" (Low Compression 7.5 : 1) stamped on one inlet manifold mounting pad.

(*b*) Check also the fuel octane rating that is to be used with this engine. Establish that the correct distributor is fitted for this combination of compression ratio and fuel. See continuation sheet 1 "Distributor Selection," and Fig. 14.

(*c*) The static advance of 10° before T.D.C. is "built in" to the engine and when No. 1 cylinder is on the compression stroke and the notch on the crankshaft pulley aligns with the upper (inner) timing mark on the timing cover (see Fig. 11) the crankshaft

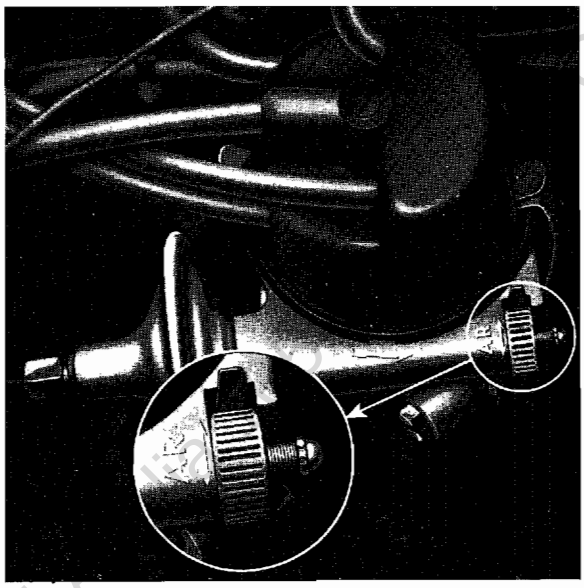

Fig. 13
Varying the Ignition Setting

is at the static advance setting and no further adjustment is required at this stage, see operation 5.

(*d*) All reference to degrees (advance or retard) on the distributor are in terms of crankshaft degrees as in ' c ' above.

(*e*) If the vehicle is normally operated at a high altitude the distributor settings on the graphs (see Fig. 14) must be **advanced** by 4° (one division on the ignition timing scale) for each 2,000 ft. (609.6 m.) above sea level.

A. To Adjust the Timing without the use of a Timing Light

1. If the engine has not been previously set, turn it with No. 1 piston coming up to T.D.C. on the compression stroke (this can be checked by removing No. 1 spark plug and feeling the pressure developed in the cylinder).

Continue turning the engine until the notch on the crankshaft pulley is in line with the upper (inner) timing mark on the timing cover (see Fig. 11).

This will give the initial timing setting of 10° B.T.D.C. (static advance).

2. Check that the fourth line on the ignition timing scale, counting from the vacuum diaphragm housing, is in line with the edge of the distributor body.

At this fourth graduated line the distributor is still at the 10° static advance position. If the octane number of the fuel cuts the horizontal line on the ignition advance graph (Fig. 14) only correct for high altitudes. See operation ' e.'

If the octane rating of the fuel falls on the ' slope ' of the ignition advance graph **retard** as indicated by the graph (one graduation or division on the distributor is equal to 4°).

Remove the distributor cap.

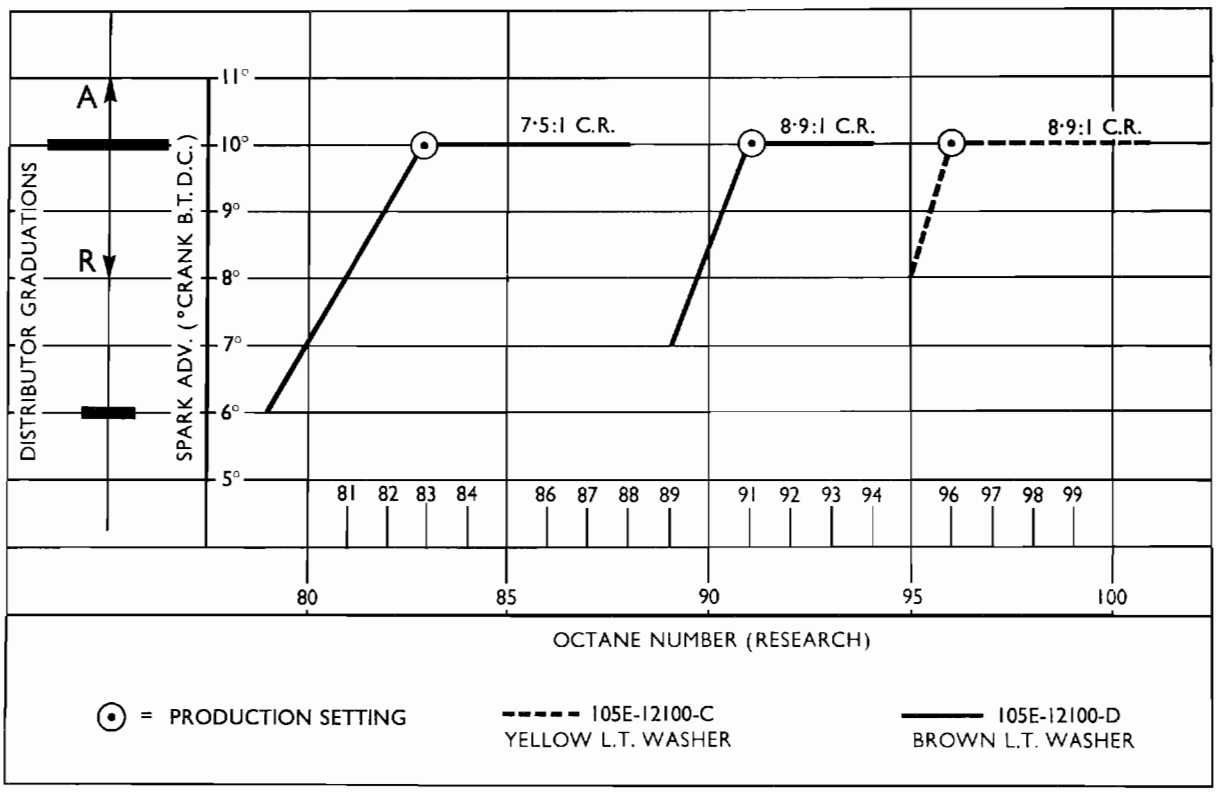

Fig. 14
Octane Rating, Compression Ratio and Distributor Combination Graphs

3. Slacken off the distributor body clamp bolt and rotate the body clockwise until the contact breaker points are just opening when the rotor is adjacent to No. 1 H.T. contact in the distributor cap. Note direction of rotation of arm.

4. Tighten the distributor body clamp bolt and replace the distributor cap.

5. A slight readjustment to the distributor may be necessary and should be carried out on the road in the following manner :—

(*a*) Warm up the engine to normal operating temperature.

(*b*) Accelerate in top gear on wide throttle opening from 20 m.p.h. (32 k.p.h.) to 40 m.p.h. (64 k.p.h.).

(*c*) If heavy pinking occurs, **retard** the ignition (see Fig. 13) until a trace pink can just be heard under these conditions of acceleration.

NOTE.—It is not necessary to advance the ignition beyond the static setting of 10° B.T.D.C. (except under high altitude operating conditions previously detailed). Also, there is no need to use a fuel of a higher octane rating (or number) than that indicated by the circle on the graphs (see Fig. 14).

B. To Adjust the Timing using a Timing Light

1. Complete operations Nos. 1 to 3 inclusive from the previous section, A.

2. Replace the distributor cap.

3. Connect the two main leads of the timing light to six volts only of the battery, using the clips provided. The positive lead clip has a red outer covering and the negative lead clip has a black covering. Connect the third lead, which has a smaller clip, to the L.T. terminal of the distributor.

4. Check that the notch on the crankshaft pulley is visible and mark with chalk or paint if necessary.

5. Disconnect the vacuum pipe line and start the engine, allowing it to idle (approx. 600 r.p.m.).

6. Point the timing light at the timing indicator. Check that the upper (inner) indicator and the notch on the pulley are in line (see Fig. 11).

If the notch of the pulley is above the indicator, the engine is too far advanced and the distributor body should be turned anti-clockwise slightly to retard the ignition.

Should the notch be below the indicator, the distributor body should be turned clockwise slightly to advance the ignition.

7. Securely tighten the distributor body clamp bolt after the adjustment has been made.

Reconnect the vacuum pipe line.

The operation of the governor weights may be checked by opening and closing the throttle. As the throttle is gradually opened, the notch should move away from the indicator upwards ; and as the throttle is closed the notch will move down in line with the indicator.

Any tendency for erratic advance shown by the notch jumping suddenly away from the indicator shows that the governor weights are binding, or that the springs are weak.

NOTE.—As in "A" a slight readjustment to the distributor may be necessary to suit the particular type of fuel in use and this setting should be determined after checking the timing as described on continuation sheet 5, operation 5.

High Altitudes

Should a vehicle be operating in high altitude locations, as stated previously, a correction must be made for every 2,000 ft. (609.6 m.) above sea level. For the first 2,000 ft. (609.6 m.) this is effected by advancing the ignition 4° (one graduation on the ignition timing scale). No further advance can be made beyond this setting because the distributor advance has now reached its limit. Therefore, the distributor must now be reset as detailed below.

For altitudes of 2,000 ft. (609.6 m.) and above :—

1. Rotate the engine to bring No. 1 piston up to T.D.C. on compression stroke. A socket and ratchet wrench fitted on the crankshaft pulley retaining bolt will enable this operation to be carried out. Continue turning until the notch on the crankshaft pulley is in line with the upper timing mark on the timing cover. This will give the initial timing setting of 10° B.T.D.C.

2. Readjust the ignition timing scale so that the second graduated line, counting from the vacuum diaphragm housing, is in line with the edge of the distributor body.

3. Slacken off the distributor body clamp bolt and rotate the body clockwise until the contact breaker points are just opening when the rotor is adjacent to No. 1 H.T. contact in the distributor cap, (still at 10° static advance).

4. Tighten the distributor body clamp bolt and replace the distributor cap. Adjust the ignition timing scale until the third graduated line aligns with the edge of the distributor body.

5. Make final adjustments on road test as detailed in operation 5 on sheet 5.

6. The sequence of operations just detailed has corrected the ignition timing for an altitude of up to 2,000 ft. (609.6 m.). Any 2,000 ft. (609.6 m.) increment above 2,000 ft. (609.6 m.) can be corrected by advancing the ignition timing by one graduation (4°) at a time.

SPECIFICATIONS AND REPAIR DATA

General

Type .. .. Single pair contact breaker point
Drive .. .. .. Skew gear from camshaft
Ignition advance :
Centrifugal and vacuum controlled
Static advance (Initial).. .. 10° before T.D.C. (on upper timing mark)

Automatic advance (no vacuum) :

Starts	1,250 r.p.m.	(crankshaft) (8.5 c.r.)
	1,325 r.p.m.	(crankshaft) (7.2 c.r.)
Ends	5,000 r.p.m.	(crankshaft) (8.5 c.r.)
	5,000 r.p.m.	(crankshaft) (7.2 c.r.)

Breaker arm spring tension .. .. 18 to 24 oz. (510.3 to 680.36 gms.)
Condenser capacity .. 0.18 to 0.22 microfarad
Contact breaker points gap .. 0.014 to 0.016 in. (0.356 to 0.406 mm.)
Spark plug gap .. .. .. 0.023 to 0.028 in. (0.59 to 0.70 mm.)

Distributor Shaft

Diameter .. .. .. 0.4895 to 0.490 in. (12.432 to 12.450 mm.)
End-float .. .. .. 0.002 to 0.006 in. (0.051 to 0.152 mm.)
Clearance .. .. .. 0.000 to 0.0015 in. (0.000 to 0.038 mm.)

VACUUM ADVANCE CHARACTERISTICS (On Deceleration)

High Compression

Vacuum (Inches of Mercury)	Degrees Advance (Distributor)
20	9° to 11°
13	8° to 10°
11	6½° to 8½°
8	3° to 5°
6	¼° to 2½°
3	No advance

Low Compression

Vacuum (Inches of Mercury)	Degrees Advance (Distributor)
20	11° to 13°
13	9¾° to 11¾°
9½	6° to 8°
6½	1½° to 4°
5	0° to 1°
2½	No advance

MECHANICAL ADVANCE CHARACTERISTICS (On Deceleration)

High Compression

Distributor R.P.M.	Degrees Advance (Distributor)
2,500	12½° to 14½°
2,050	10½° to 12½°
1,500	8° to 10°
950	5½° to 7½°
850	4½° to 6½°
700	½° to 3°
600	0° to ½°

Low Compression

Distributor R.P.M.	Degrees Advance (Distributor)
2,500	14½° to 16½°
2,050	11½° to 13½°
1,500	8° to 10°
1,100	3½° to 5½°
800	½° to 2½°
650	0° to 1°

No mechanical advance below 575 R.P.M. (Distributor)

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited

Dagenham, England

Section 10 : **ELECTRICAL SYSTEM**

Subject : **Voltage Control Regulator**

Effective on : New Anglia and Prefect (1959 onwards)

VOLTAGE CONTROL REGULATOR

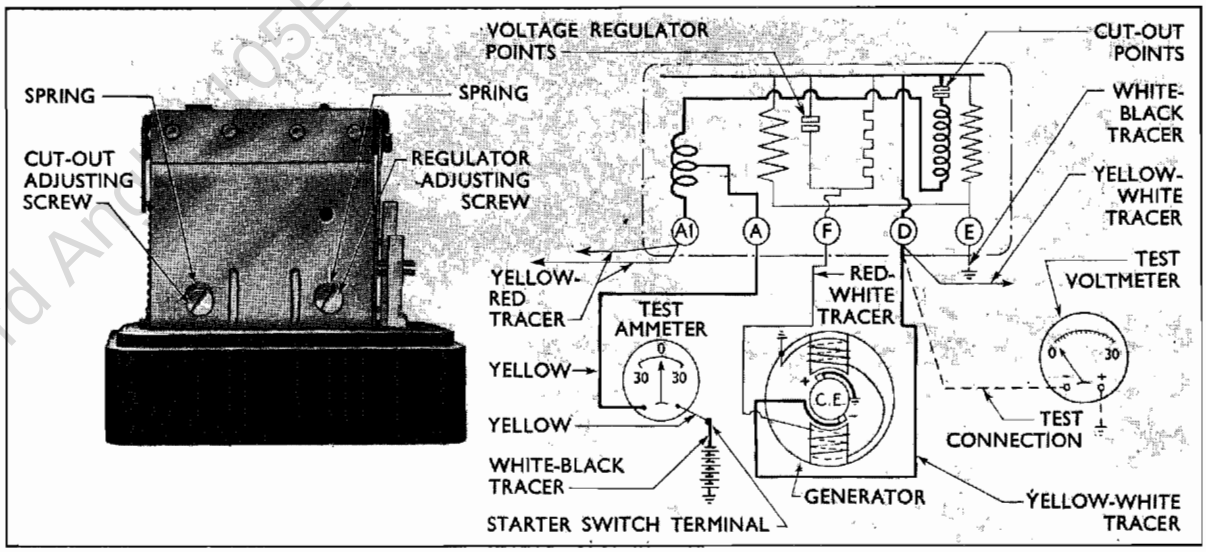

Fig. 1
Regulator and Wiring Diagram

The regulator incorporates a combined cut-out and voltage regulator. Normally this regulator requires very little attention in service.

Should, however, it be suspected that it is not functioning correctly, tests should be made to ensure that the rest of the electrical circuits are in good condition and are not affecting the operation of the regulator.

PRELIMINARY CHECKS

Important points which can give a false indication of a regulator fault are given below, and should be carefully checked before attempting to effect any replacements.

Fan Belt

Make certain that the generator support brackets are securely tightened in position. Check the fan belt and ensure that it is adjusted correctly without the slightest suspicion of belt "slip." A slipping belt may cause an erratic or low charging rate. Ensure that the fan belt is correctly aligned and that the pulleys are not damaged.

Battery

Check the battery and test with a hydrometer and high rate discharge test-meter. Top up if necessary. Clean off any corrosion from the battery lugs and cable ends and make certain that the top of the battery is dry.

A sulphated battery or corroded lugs will cause a low output even though the open circuit setting of the regulator may be correct. Both these conditions will probably result in unsatisfactory starter motor operation.

If a battery has a short-circuited cell, or the top of the battery has become soaked with acid, or is in a poor condition due to abuse or prolonged service, it will cause a high output.

Check the earth connections from the battery to the body, and from the regulator, to ensure that they are tight and in good condition, as a poor earth will cause a rise in voltage.

Generator and Connections

Check that the generator is functioning satisfactorily and ensure that the leads " D " and " F " are not crossed either at the regulator or generator. If the leads are crossed, the regulator points will have " welded together " the moment the engine was started. Make sure that the leads are not broken or damaged and that the connections are tight.

To Test the Generator

(1) Disconnect the leads from the regulator terminals marked " D " and " F " respectively and connect them together. Attach the negative lead of a moving-coil type voltmeter, calibrated to at least 30 volts, to these leads and the positive lead to a good earth.

(2) Start the engine and gradually increase the speed to a fast idle (approximately 1,000 r.p.m.), when the voltmeter reading should rapidly rise without fluctuation above 24 volts. DO NOT increase the engine speed above a fast idle in an endeavour to obtain this voltage as this will give a false reading.

If there is a low or no reading, first check the generator leads. If the leads are in good condition, carefully check over the generator and effect any repairs that may be required in line with the usual procedure. It may be that the generator has become demagnetised, possibly due to the leads having been crossed (regulator points will be " welded " together in this case).

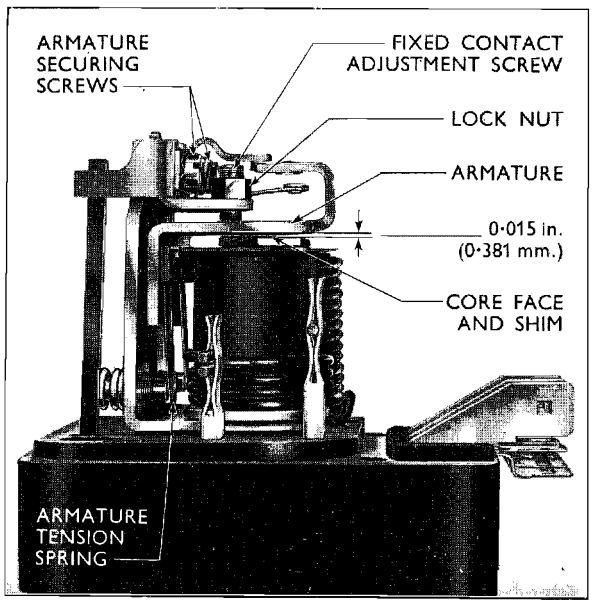

Fig. 2
Voltage Regulator

After checking that the generator is in good order, proceed to test the regulator. This should only be carried out by an experienced electrician who is thoroughly acquainted with the correct method to be adopted.

(3) Reconnect the leads " D " and " F " from the generator to the terminals " D " and " F " on the regulator.

TESTING AND ADJUSTING THE REGULATOR

(1) Insulate the cut-out points with a thin strip of mica or withdraw the cables from the terminals marked "A" and "A1 " (see Fig. 1) and join them together.

(2) Connect the negative lead of the test voltmeter to terminal " D " on the regulator and the positive lead to a good earth, or the " E " terminal.

(3) Adjustment must be made with the regulator cold, i.e., immediately on starting the engine the atmospheric temperature should be noted by means of a thermometer.

(4) Start the engine and gradually increase the speed until the voltmeter needle " flicks " and then steadies (approx. 1,500 generator r.p.m.). This should occur at a voltmeter reading between the limits given below for the approximate temperature of the regulator unit.

Atmospheric Temperature	*Regulator Setting Volts*
50°F. (10°C.)	15.7 to 16.1
68°F. (20°C.)	15.6 to 16.0
86°F. (30°C.)	15.5 to 15.9
104°F. (40°C.)	15.4 to 15.8

If the reading is not between these limits the regulator is in need of adjustment.

(5) Increase the speed gradually to 3,000 r.p.m. when the voltmeter needle should not rise more than half a volt above the tabulated readings.

If the voltmeter reading continues to rise as the engine speed is increased, possibly swinging the needle right over, it is indicative that either the regulator points are not opening or there is a poor or no earth between the regulator and the vehicle.

If the points are not opening, the regulator should be renewed, as it is probable that they are " welded " or shorted, or there is an open circuit in the shunt coil.

(6) If the voltage at which the reading becomes steady occurs outside these limits the regulator must be adjusted.

Shut off the engine and remove the cover. Turn the regulator adjusting screw (Fig. 1) in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the screw only a fraction of a turn at a time. Again run up the engine and repeat as above until the correct setting is obtained.

Adjustment of regulator open-circuit voltage should be completed within 30 seconds, otherwise heating of the shunt winding will cause false settings to be made.

A generator run at high speed on open circuit will build up a high voltage. Therefore, when adjusting the regulator, increase engine speed *slowly* until the regulator operates, otherwise a false setting may be made.

(7) Reconnect the wires to terminals "A" and "A1" or remove the insulation from the cut-out points.

Ampere Output Test

(1) Disconnect the lead from terminal "A" and connect a test ammeter in series with the lead and terminal "A."

(2) Speed up the engine and observe the charging rate. This will vary according to the state of charge of the battery.

(3) Reconnect the lead to terminal "A".

To Clean the Regulator Points

These must be removed for cleaning, and this should be carried out as follows :—

(1) Slacken the locknut securing the fixed contact and screw to its bracket. Unscrew and remove the fixed contact and screw.

(2) Remove the two armature screws and lock-washers (refer to Fig. 2) and detach the metal strip.

(3) Move the fixed contact mounting over slightly, enabling the moving contact bracket to be lifted out. Take care not to lose the insulating strips positioned on either side of the fixed contact mounting bracket.

(4) Clean the contact points with a suitable cleaning fluid or carborundum paper operated in a circular movement. Carefully wipe away all traces of dirt or other foreign matter. Finally, wipe both points with methylated spirits (de-natured alcohol).

(5) Replace the points in the reverse sequence to that described above in paragraphs (1) to (3), and reset the air gaps as described below.

In the event of the regulator not functioning correctly after adjustment, re-examine the regulator contacts. Any pitting or dirt must be removed as a clean smooth surface is essential.

Resetting the Regulator Armature

The armature or moving contacts should not normally be removed, as the air gaps between the core and the frame are accurately set and are of great importance to the satisfactory operation of the regulator. If, for any reason, however, the armature has been removed, or its setting altered, it should be reset as follows :—

(1) Disconnect the battery and if preferred remove the regulator.

(2) Slacken the fixed contact screw locknut and unscrew the contact screw until it is clear of the armature moving contact (refer to Fig. 2).

(3) Slacken the regulator adjusting screw until it is completely clear of the armature tension spring.

(4) Slacken the two armature assembly securing screws. Using a 0.015 in. (0.381 mm.) feeler blade, wide enough to cover the complete core face, insert the blade between the armature and core shim, taking care not to damage or burr the edge of the shim.

(5) Press the armature **squarely** down against the blade and, holding it firmly, retighten the two armature assembly securing screws.

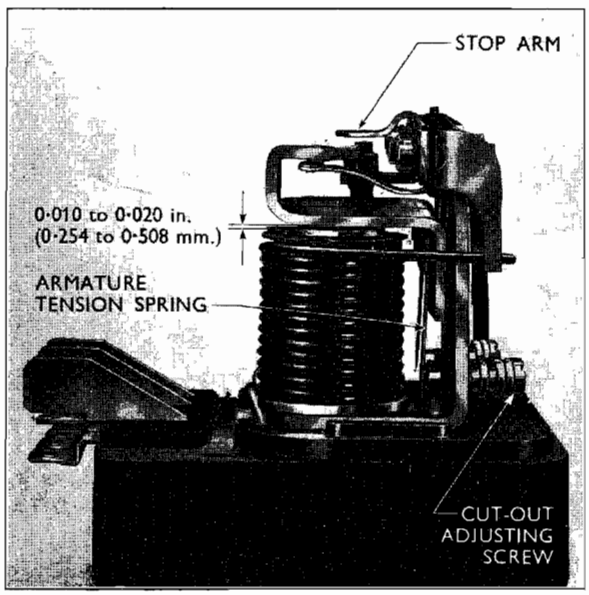

Fig. 3
Cut-out Points
(Setting Armature Stop Arm)

Continued overleaf

(6) With the blade and armature still in the above position, screw the adjustable contact down until it just touches the armature contact. Re-tighten the locking nut.

(7) If removed earlier, refit the regulator and then reconnect the battery.

(8) Reset the regulator adjusting screw as described in " Testing and Adjusting the Regulator."

THE CUT-OUT

Examine the cut-out points and, if necessary, clean with a suitable cleaning fluid or carborundum paper. Ensure that the points are meeting correctly (see Figs. 3 and 4).

To Test and Adjust the Cut-out

(1) Connect the voltmeter between the " D " terminal and a good earth, or the " E " terminal.

(2) Speed up the engine slowly and note the voltage immediately before the points close.

This voltage should be 12.7 to 13.3 volts. The voltage may be adjusted by turning the cut-out adjusting screw (see Fig. 1), in an anti-clockwise direction to decrease the voltage and vice versa. Turn the adjusting screw a little at a time and re-test as above.

Resetting the Cut-out Armature

If it is suspected that the above setting is incorrect and the cut-out points setting has been disturbed, proceed as follows :—

(1) Slacken the adjusting screw until it is clear of the armature tension spring.

(2) Slacken the two armature securing screws.

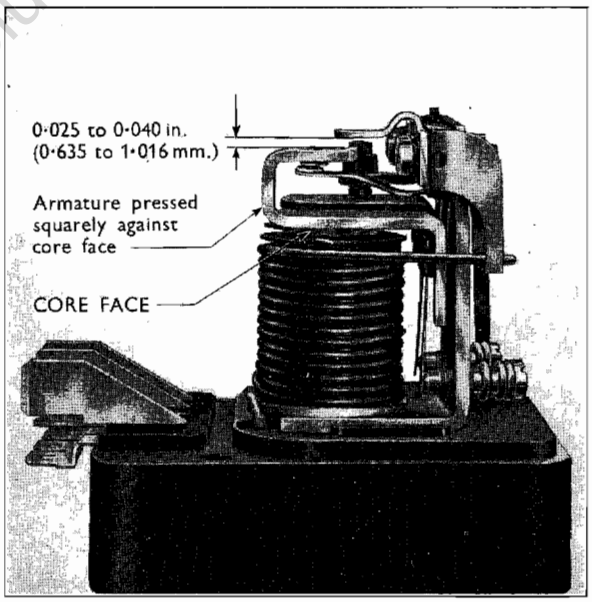

Fig. 4
Cut-out Points
(Setting the Fixed Contact)

(3) Press the armature down **squarely** against the copper-coated core face and, holding it there, retighten the armature securing screws.

(4) Still holding the armature down against the core, bend the armature stop arm so that a gap of 0.025 to 0.040 in. (0.635 to 1.016 mm.) exists between it and the armature tongue (see Fig. 3).

(5) Insert the end of a 0.010 to 0.020 in. (0.254 to 0.508 mm.) feeler blade between the outer end of the armature and core face, and set the fixed contact, by bending the arm, so that the points are **just** touching (see Fig. 4).

(6) Reset the cut-out adjusting screw as described in " To Test and Adjust the Cut-out."

SERVICE BULLETIN **PASSENGER CARS**

Ford Motor Company Limited
Dagenham, England

Section 10 : **ELECTRICAL SYSTEM**
Subject : **BATTERY AND GENERATOR**
Effective on :
New Anglia & Prefect (1959 onwards)

THE ELECTRICAL SYSTEM

The electrical system is of the 12 volt earth return type, the positive terminal of the battery being earthed.

Batteries of two types, for use in standard or cold climatic conditions, are available and full specifications appear on sheet 4.

Complete vehicle wiring diagrams appear in Figs. 2 and 3.

THE BATTERY

The battery, on Anglia cars, is located on the right-hand side of the engine compartment, forward of the suspension unit and adjacent to the radiator. On Prefect cars, the battery is also situated on the right-hand side of the engine compartment, but is adjacent to the engine oil pump and filter.

Provided a battery is properly maintained, it will function satisfactorily between the extreme temperatures of summer and winter.

To Remove

1. Disconnect the positive earth strap followed by the negative lead, removing the nuts, bolts, and washers securing the leads to the battery.

2. Unscrew the two nuts securing the battery retaining clamp, and remove the clamp. Note that on Anglia cars the clamp extends across the battery whilst on Prefect cars the clamp is located along the edge of the battery.

3. Carefully lift the battery from the engine compartment, ensuring that it is kept horizontal to avoid spilling the electrolyte.

To Replace

1. Lower the battery onto its mounting tray.

2. Locate the battery clamp over the clamp bolts and fit the retaining nuts, tightening them evenly.

3. Secure the negative lead, followed by the earth strap, to the battery terminals with a bolt, lockwasher and nut. Smear the terminals with petroleum jelly to avoid corrosion.

Maintenance

Cleanliness

Keep the battery and the surrounding parts, particularly the tops of the cells, clean and dry and brush away any dirt or dust.

Fig. 1
The New Anglia Battery

The terminals should be kept clean and coated with petroleum jelly (not grease).

If distilled water or electrolyte has been spilled on top of the battery, it should be cleaned off immediately, as even weak electrolyte will quickly attack and corrode the cable connections, clamp frame and bolts. Use a rag soaked in a weak solution of hot water and ammonia to counteract the action of spilled electrolyte.

Electrolyte Level

The correct working level of the electrolyte is $\frac{1}{4}$ in. to $\frac{3}{8}$ in. (6 to 10 mm.) above the separators. It is good practice to only top up the battery just prior to running the car, especially in cold weather, to ensure thorough mixing of the electrolyte and the water and so prevent freezing.

When topping up, use distilled water. Use only a clean lead, glass or earthenware container and funnel.

If the battery is found to need an excessive amount of topping up, steps should be taken to determine the

reason. For example, the battery may be receiving an excessive charge, in which case the regulator setting should be checked. If one cell in particular needs topping up more than another, it is likely that the case is cracked in which event the battery must be replaced and the battery carrier cleaned and repainted if necessary.

Specific Gravity

The specific gravity reading indicates the state of charge of the battery and should be checked with a hydrometer.

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 one hour.

Table "A" gives the specific gravity of the electrolyte at various electrolyte temperatures when the battery is fully charged.

Table " B " gives the low limits of specific gravity at various electrolyte temperatures when the battery is fully discharged at the normal rate.

Table "A"

1.264 at	110°F.	(43°C.)
1.268 at	100°F.	(38°C.)
1.276 at	80°F.	(27°C.)
1.280 at	70°F. (normal)	(21°C.)
1.284 at	60°F.	(16°C.)
1.292 at	40°F.	(4°C.)
1.300 at	20°F.	(— 7°C.)
1.308 at	0°F.	(—18°C.)
1.316 at	—20°F.	(—29°C.)

Table "B"

1.094 at	110°F.	(43°C.)
1.098 at	100°F.	(38°C.)
1.106 at	80°F.	(27°C.)
1.110 at	70°F. (normal)	(21°C.)
1.114 at	60°F.	(16°C.)
1.122 at	40°F.	(4°C.)
1.130 at	20°F.	(— 7°C.)
1.138 at	0°F.	(—18°C.)
1.146 at	—20°F.	(—29°C.)

Temperature Correction

When the temperature of the electrolyte varies from the standard of 70°F. (21°C.), a correction should be made. Specific gravity varies with temperature and any readings taken with a hydrometer should therefore be corrected as follows :—

Add four points (0.004 specific gravity) for every 10°F. (5½°C.) above 70°F. (21°C.).

Subtract four points (0.004 specific gravity) for every 10°F. (5½°C.) below 70°F. (21°C.).

Variations in Cell Specific Gravity

There should be little variation in the specific gravity readings from cell to cell on any battery in reasonably good condition. If the variation is greater than 0.025, then the reason should be investigated.

If electrolyte has been spilled at any time or lost owing to a leak, topping up the level with distilled water will lower the specific gravity.

This can be corrected when next charging the battery by adding a dilute solution of sulphuric acid which has a specific gravity approximating to the values tabulated, until the specific gravity of the electrolyte is again standard.

1.255 ; 29.5° Baumé (temperate climates)

1.239 ; 28° Baumé (tropical climates)*

*A tropical climate may be taken as one in which water will never freeze, or where maximum air temperatures are frequently above 90°F. (32°C.) in the shade.

Never use concentrated acid alone for this purpose. Always add the acid to the water when preparing the electrolyte : it is dangerous to add water to acid.

A large variation, which is not the result of electrolyte loss, is probably an indication of an internal short circuit and an early inspection of the battery by a competent electrician is advisable.

Checking Battery Condition

There are three methods of checking battery condition : (*a*) open circuit voltage test, (*b*) high rate discharge test, and (*c*) specific gravity.

(*a*) The open circuit voltage of a 12 volt battery should be above 12.6 volts (2.1 volts per cell) for a battery in good condition.

However, the voltage reading on open circuit is liable to be misleading. If the voltage is low then the cells are definitely in poor condition, but a high voltage reading on open circuit does not necessarily indicate that the cells are in good condition.

(*b*) The high rate discharge test gives an indication of the condition and capacity of the battery. On test, a 12 volt battery should maintain 100 amp. flow for 10 seconds with no appreciable fall in voltage.

Where a hand instrument (incorporating a high resistance device) is used for checking the individual cells of a battery, the actual reading obtained will depend upon the exact type of instrument used, but the cell voltage on a 5 to 6 seconds test should remain steady between 1.2 and 1.7 volts.

Variations in individual cell readings can

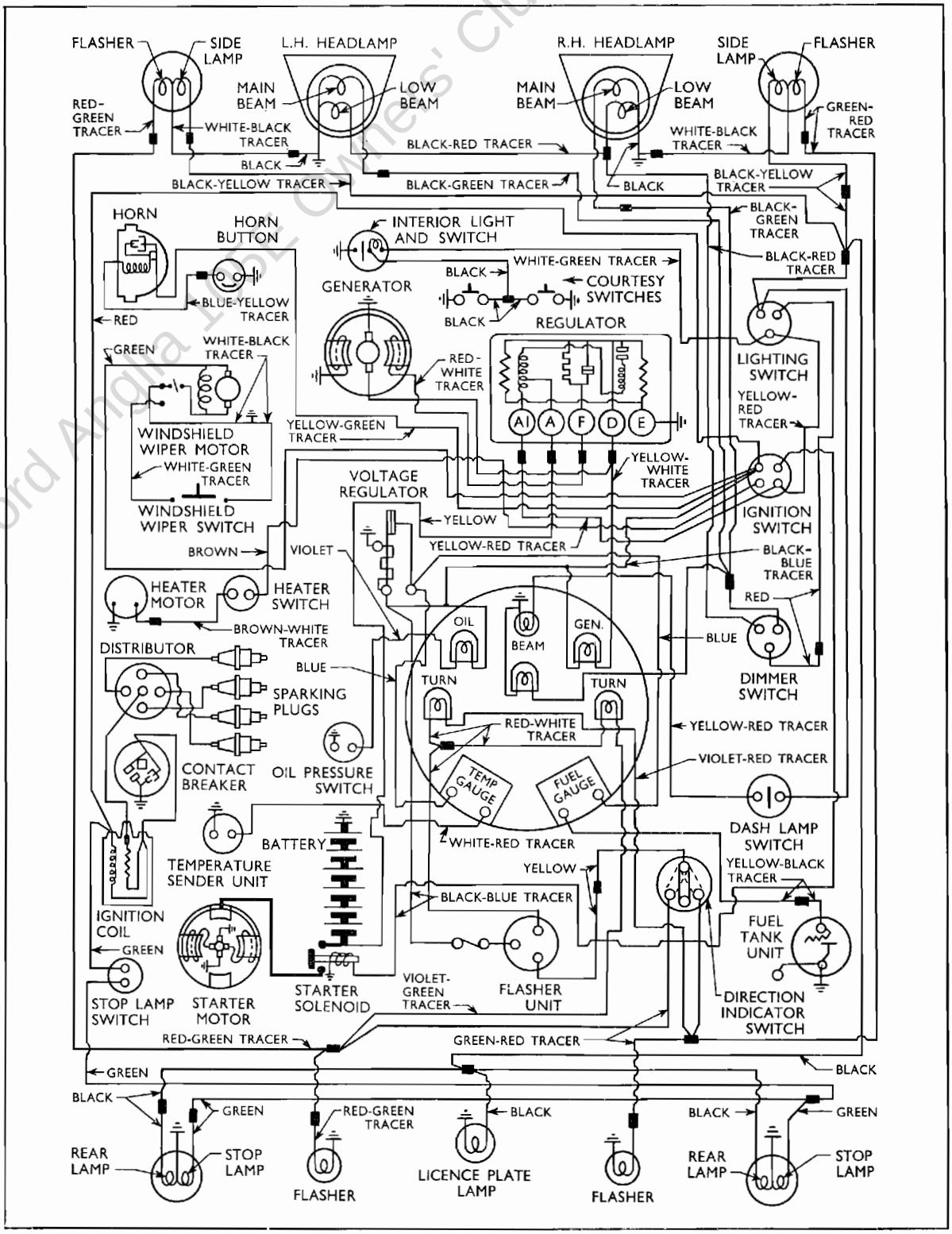

Fig. 2
The New Anglia Wiring Diagram

Serial No. 36 *(Re-issue)*	*No. of sheets:* 4 *Sheet No.* 2
Last issue was No. 35 *See Sec.—GEARBOX—CLUTCH*	*Date:* **28th MARCH, 1960**

Continued overleaf

indicate faults, but if all cells in any one battery fall below standard, re-charge and again test before rejecting the battery.

Never make a high rate discharge test on a battery known to be low in charge.

(*c*) The best method of checking the state of charge of a battery is by means of a specific gravity reading, taken on a suitable hydrometer. A fully charged battery should give specific gravity readings of :—

1.272 to 1.283 : 31° to 32° Baumé (temperate climates)

1.239 to 1.255 : 28° to 29½° Baumé (tropical climates)

checked with a hydrometer and corrected to 70°F. (21°C.).

CHARGING FROM AN EXTERNAL SOURCE

Before starting the charge, the electrolyte level should be topped up with distilled water to ¼ in. to ⅜ in. (6 to 10 mm.) above the separators.

The normal charge rates are as follows :—

Battery	*Bench Charge Normal Rate*	*Initial Charge Rate (converting uncharged dry batteries)*	
		Rate	*Hours*
38 A.H.	3 amps.	2.25 amps.	48 to 60
51 A.H.	3.5 amps.	2.5 amps.	48 to 60

The charge should be continued until the specific gravity and cell voltage in each cell show no further rise during five hours on continuous charging and all cells gas freely. If the specific gravity of the electrolyte in any cell or cells fails to rise while on charge and gassing does not take place, the cells should be tested for internal short circuits.

The maximum permissible temperature of electrolyte during external charging is 110°F. (43°C.) and, if this is exceeded, the charge should be suspended or reduced to one-half to allow the temperature to fall.

If, at the end of the charge, the specific gravity varies by more than 10 points (i.e. 0.010), from the figures given in table "A" (see continuation sheet 1), the specific gravity must be adjusted, either raised by adding fresh electrolyte, the S.G. of which should be 1.343 (37° Baumé), or lowered by the addition of distilled water. The specific gravity of any two cells of a battery should not vary more than .015.

When adjusting the specific gravity, care must be taken not to leave too much electrolyte in the cell or cells, any surplus over ⅜ in. (10 mm.) above the tops 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 when charged, carry out a high rate discharge test. The cell voltage between individual cells should not vary more than 0.15 volt. The voltage of a faulty cell on high rate discharge will fall rapidly. If it is confirmed that a cell is internally shorted, the battery must be renewed.

SPECIAL INSTRUCTIONS

Cold Climates

In cold climates, the electrolyte of a discharged battery (specific gravity approximately 1.151 : 19° Baumé) will be frozen at temperatures below 0°F. (—18°C.), and a fully discharged battery (specific gravity approximately 1.111 : 14½° Baumé) will freeze at 16°F. (—9°C.). For this reason, special precautions should be taken when operating in cold climates to prevent the battery state from falling below the conditions indicated by the following specific gravities :—

1.198 (24° Baumé) specific gravity at 0°F. (–18°C.)
1.245 (28½°Baumé) specific gravity at –20°F. (–29°C.)
1.266 (30½°Baumé) specific gravity at –30°F. (–35°C.)

The electrolyte level in each cell should be frequently checked and adjusted to ¼ in. to ⅜ in. (6 to 10 mm.) above the separators. When topping up, use clean distilled water. This should be done only during charging and preferably when the cells are gassing freely, so that the water becomes mixed with the electrolyte before it has time to freeze.

Tropical Climates

A tropical climate may be taken as one in which water will never freeze, or where maximum air temperatures are frequently above 90°F. (32°C.) in the shade.

Wet batteries supplied with new cars or as service replacements have an electrolyte specific gravity of 1.272 to 1.283 (31° to 32° Baumé) when in a fully charged condition. These readings are corrected to 70°F. (21°C.).

The specific gravity of the electrolyte in batteries to be used under tropical conditions should, however, be between 1.239 and 1.255 when corrected to 70°F. (21°C.) (Baumé equivalent : 28° to 29½°). It will, therefore, be necessary to adjust the specific gravity of all wet batteries supplied in service or with cars, on arrival at their destination.

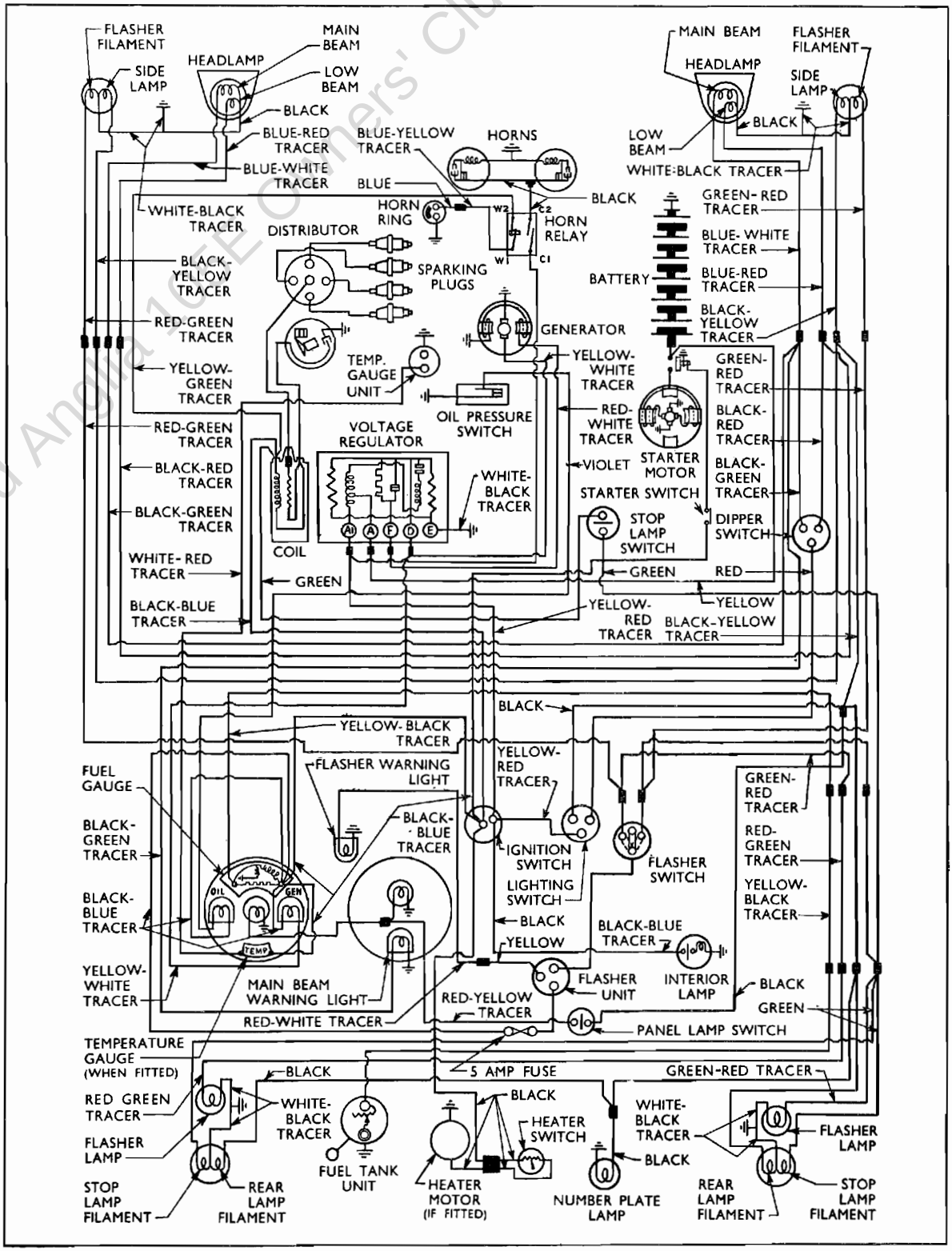

Fig. 3

The New Prefect Wiring Diagram

Serial No. 36 *(Re-issue)*	*No. of sheets:* 4 *Sheet No.* 3
Last issue was No. 35 *See Sec.—GEARBOX—CLUTCH*	*Date:* **28th MARCH, 1960**

Continued overleaf

Methods of Adjusting Specific Gravity in Tropical Climates

1. Immediately the battery arrives at its destination, check and top up the electrolyte level with distilled water. Then place the battery on charge at its normal rate (see table, continuation sheet 2).

2. Continue the charge until the specific gravity has reached its maximum, i.e. until the specific gravity of each cell remains constant for a period from 2 to 5 hours and all cells are gassing freely.

3. Discontinue the charge, turn the battery upside down and allow it to drain for 10 to 15 minutes.

4. Turn the battery back to its normal upright position and clean the exterior surface of the casing thoroughly, using a cloth moistened with ammonia. This will counteract the effect of spilled electrolyte.

5. With a minimum of delay, refill each cell with electrolyte of 1.142 specific gravity (18° Baumé).

If the cells are not refilled directly after draining, the negative plates will tend to oxidise.

6. Again place the battery on charge at its normal rate and continue the charge for 4 to 6 hours.

7. If the specific gravity following the charge is above 1.255 ; 29½° Baumé when corrected to 70°F. (21°C.), adjust by withdrawing the electrolyte from the cells with a squeeze ball and restore the level with distilled water.

If the specific gravity is below 1.239 ; 28° Baumé when corrected to 70°F. (21°C.), adjust by adding electrolyte of specific gravity greater than 1.250.

8. Following an adjustment to the electrolyte specific gravity, replace the battery on charge at the normal rate until the specific gravity of the electrolyte in each cell has stabilised.

9. Before putting the battery into service again, check the electrolyte levels, adjusting if necessary to ¼ to ⅜ in. (6 to 10 mm.) above the separators. Remove electrolyte if the levels are too high or add electrolyte of the correct specific gravity if too low.

Always give idle batteries a freshening charge at least once a month.

THE GENERATOR

The generator is of the two-brush type and is used in conjunction with the voltage control regulator. The generator is driven at 1.5 times engine speed.

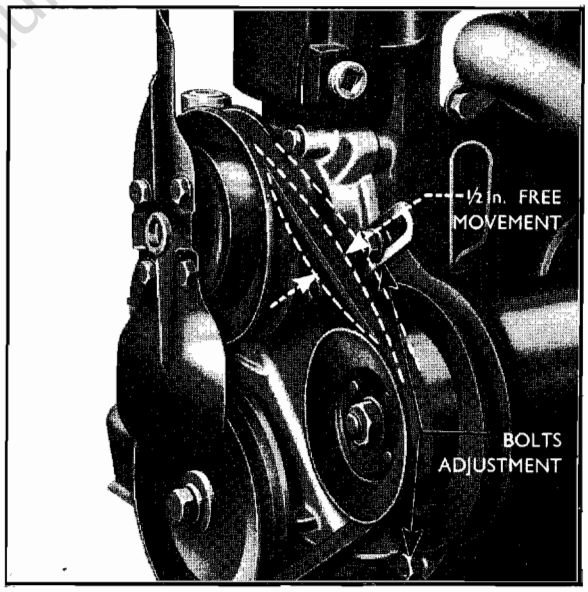

Fig. 4
Generator and Fan Belt Adjustment

To Remove

1. Slacken the three securing bolts and move the generator in towards the engine so that the fan belt may be detached.

2. Disconnect the generator to regulator leads and remove the three securing nuts and bolts.

3. Lift the generator from its supports on the side of the cylinder block.

To Dismantle

1. Secure the pulley, unscrew the nut and lock-washer and pull off the pulley.

2. Mark the carcase and end plates to ensure correct assembly.

3. Unscrew and remove the two through bolts and pull off the end plate. Take care not to lose the spacer washer on the end of the armature shaft.

4. Pull the armature and drive end bracket from the generator yoke. The drive end bearing is a pre-packed assembly. If it is necessary to renew this bearing pull out the woodruff key and press the armature out of the end bracket, remove the rivets securing the bearing retainer and extract the bearing from the end bracket.

5. Lift up the brush springs and withdraw the brushes from the holders. Unscrew and remove the screws securing the brush pigtails to the brush holders.

To Reassemble

1. Secure the brush pigtails to the holders with two screws and lockwashers.

2. If the drive end bearing has been removed, refit it to the housing and secure the retainer with three rivets. Fit the armature to the end plate and install in the carcase.

3. Locate the brushes in their holders, hold them apart with the fingers and fit the end plate onto the armature shaft, ensuring that the spacing washer is in position.

4. Align the mating marks and replace the two through bolts, tightening securely.

5. Replace the pulley locating key and refit the pulley, securing it with a lockwasher and nut.

To Replace

1. Place the generator on its support brackets with the end brackets in front of the support bracket legs and locate it with the three securing bolts. (It may be necessary to slacken the bolt securing the generator adjusting strap to the cylinder block).

2. Refit the fan belt over the generator pulley and move the generator away from the engine until there is ½ in. (13 mm.) free movement in the fan belt, measured midway between the generator and fan pulleys. Tighten the adjustment bolt and generator mounting bolts securely.

SPECIFICATIONS AND REPAIR DATA

Battery :	
Type	Lead/acid
Battery voltage	12V.
Plates per cell	9 Standard 11 Cold Climate
Specific gravity (charged)	1.270 to 1.285
Low limit while discharging at 20 hr. rate — S.G.	1.15 Standard 1.1 Cold Climate
Low limit while discharging at 20 hr. rate — Cell Volts	1.8 both
Terminal earthed	Positive
Capacity in A.H. when discharging at 20 hr. rate	38 Standard 51 Cold Climate
Amperes for 20 mins.	47.5 Standard 64.5 Cold Climate
Electrolyte capacity	4.8 Imp. pt. Standard (5.76 U.S. pt. 2.73 lt.) 6.4 Imp. pt. Cold Climate (7.68 U.S. pt. 3.76 lt.)
Generator :	
Type	12V. Two-brush
Speed (ratio to engine)	1.5 : 1
Brush length	0.718 in. (18.233 mm.)
Max. continuous output with 2 in. (5.1 cm.) dia. pulley	20 amps.
Fan belt tension (measured mid-way between pulleys)	½ in. (13 mm.)

SERVICE BULLETIN PASSENGER CARS

Ford Motor Company Limited
Dagenham, England

Section 12 : **BODYWORK, MUDGUARDS AND BONNET**
Subject : **Water and Dust Sealing**
Effective on : New Anglia (1959 onwards)

WATER AND DUST SEALING

The subject of sealing bodies against the entry of dust or water is one that has received considerable attention and if the initial qualities of a well-sealed car are to be preserved it must also receive careful attention in service.

In production, different types of sealers are used according to the location of the joint, the types of sealers and method described in this bulletin will be found quite satisfactory for normal service purposes in body repairs or for complaints arising of imperfect water or dust sealing.

We would emphasize that all joints and holes which connect to the outside of the car are potential points of water and dust entry. It is important that the trim wind cords are correctly positioned and the rubber weather strips around the doors and luggage compartment lid are in good condition and firmly cemented in position.

There are three important points to bear in mind when investigating a complaint of water ingress.

1. Carry out a step by step water test to locate possible leaks.

2. Ascertain the locations to which sealer is applied in production.

3. To ensure proper sealing, use the correct type of sealing material for the location to be sealed. Before starting work on a complaint of water or dust entry, the front carpet, cowl side trim panels and rear seat cushion should be removed, the carpet under-felt lifted around the edges and panel joints, and the car given a careful water test, to determine the actual points of water entry. Use a low pressure hose on the upper parts of the bodywork mentioned (e.g. windscreen and roof drain channels) and a high pressure hose on the joints under the front and rear mudguards.

In some cases, it may be an advantage to apply a strong light to the outside of each joint and inspect from the inside of the car ; if the light can be seen through the joint, the necessary corrective action should be taken.

Sealing Materials

There are many different types of sealing compound available on the market which are suitable for use on the various locations on the car. In all probability dealers will have stocks of these materials, and a general purpose sealer, or alternatively, sealers of the following general specifications should be used when carrying out the operations described in this bulletin.

(*a*) A sealing compound for general application to panel joints where a neat fillet of sealer is required. This sealer should be water resistant and available in a fairly fluid form which dries to a rubbery consistency with good adhesive properties, so that it may be applied with a gun or tube and nozzle.

(*b*) A brush on sealer with good adhesive and water resistant properties which dries fairly hard and can be applied in locations under the front mudguard, etc., without being penetrated by grit and stones thrown up by the road wheels.

(*c*) A liquid sealer suitable for sealing the windscreen and rear window weather strips to the glass and body metal which can be applied by means of a force feed oil can, or sealer gun.

(*d*) A bulk sealer for use in protected locations where the joints are not exposed to the weather.

(*e*) A plastic sealer tape $\frac{3}{4}$ in. wide for use round the screen and rear window aperture.

(*f*) A suitable adhesive for re-sticking the carpet under-felt, and sponge weather strips to doors, etc.

The successful use of any sealing compound depends upon absolute cleanliness of the joint faces, consequently all dirt and water should be removed from the area of the joints before applying a sealing compound.

In general, fairly fast drying sealers are required to ensure that the joints are dry before the car is put back in service. Although many sealers are touch dry within an hour or so, it is advisable to allow at least 24 hours to elapse before using the car.

If it is necessary to smooth off the fillet of sealer, this can be done directly after application with a well-moistened finger. Excess sealer on the paintwork can be removed with petrol or white spirit, and after drying, fillets of sealer on the exterior bodywork should be touched up with the correct colour paint to preserve the appearance of the car. If difficulty is experienced in removing the adhesive used for retaining door and window weather strips in position, Bostik cleaner, or cellulose thinner can be carefully applied to the effected area. **On no account should cellulose thinner be applied to a body finished in cellulose.**

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LEAKS ONTO THE FLOOR OF THE CAR

Water leaks onto the carpet may be divided into the following categories :—

(*a*) Water dripping onto front carpet under dash panel and from door pillar faces (items A1 to A4).

(*b*) Water seeping onto front carpet through the joints and holes in engine rear bulkhead and/or floor pan (items B1 to B6).

(*c*) Leaks at other points onto the car floor.

Water dripping onto front carpet

A1. Examine the roof drain channels for leaks through the joints of the channels and roof panel. Seal along the inner and underside edge of each channel with a smooth fillet of sealer applied from a suitable gun or tube and nozzle. It is advisable to seal these joints along the entire channel lengths on both sides of the car. If it is suspected that water is entering the windscreen pillars and is finding its way down into the corners of the belt rail panel, remove the chrome mouldings on the windscreen pillars by drilling out the three rivets on each moulding. Ensure that the beads of sealer between the roof panel and channels extend to the extreme front ends (see Fig. 1).

Examine the waterproof tape covering the flange joint of roof panel and screen opening panel (as shown in Fig. 1) and ensure that the flange is well covered, paying particular attention to the top corners. If in doubt, a small quantity of sealer type (*c*) can be applied.

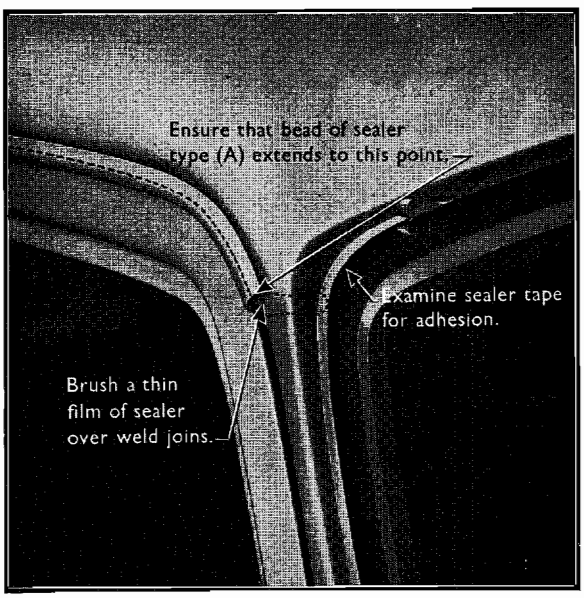

Fig. 1
Location of Sealers at Windscreen Pillars

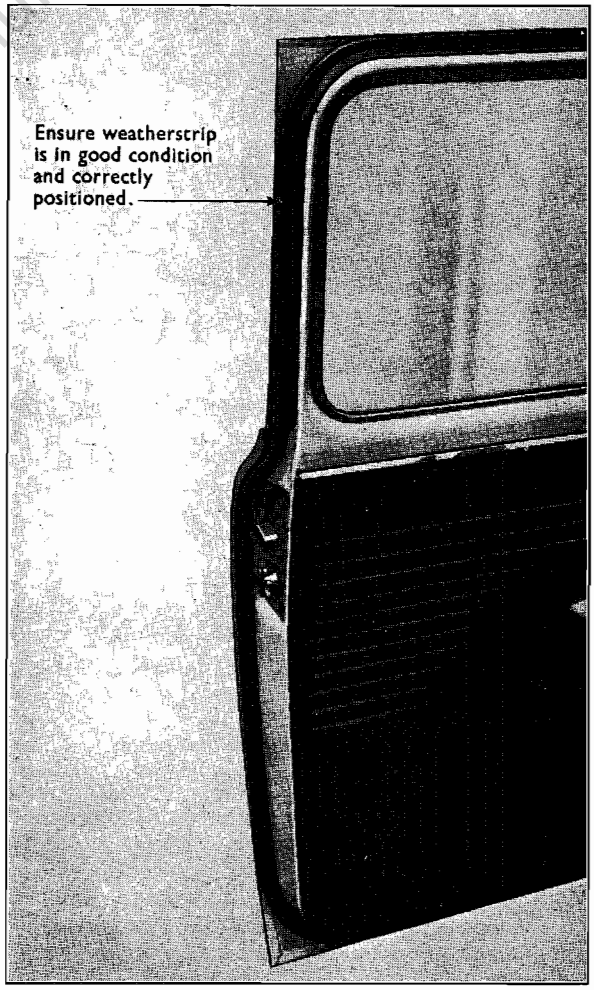

Fig. 2
Checking Door Weatherstrip

As a further precaution, the two gas-welded joints on the windscreen pillar can also be covered with a thin film of sealer type (*a*), and a further check made by examining the front underside of the roof drain channels, and any breaks in the sealer film filled by application of sealer type (*a*).

A2. Whilst the chrome mouldings are removed, examine the seal around the windscreen weather strip and if necessary, apply a continuous bead of sealer type (*c*) to the inner and outer lip of the weather strip using a force feed oil can or sealer gun, again paying particular attention to the top corners. Clean any surplus sealer from the glass and rubber immediately.

From inside the car, examine the joints between the windscreen opening panel to the cowl side panel, and the windscreen opening panel to the dash panel (see Figs. 3 and 4). If necessary, apply a fillet of sealer type (*b*).

A3. In some cases, a water leak may occur at the windscreen wiper grommet below the windscreen. Remove the wiper blades and arms, chrome nuts,

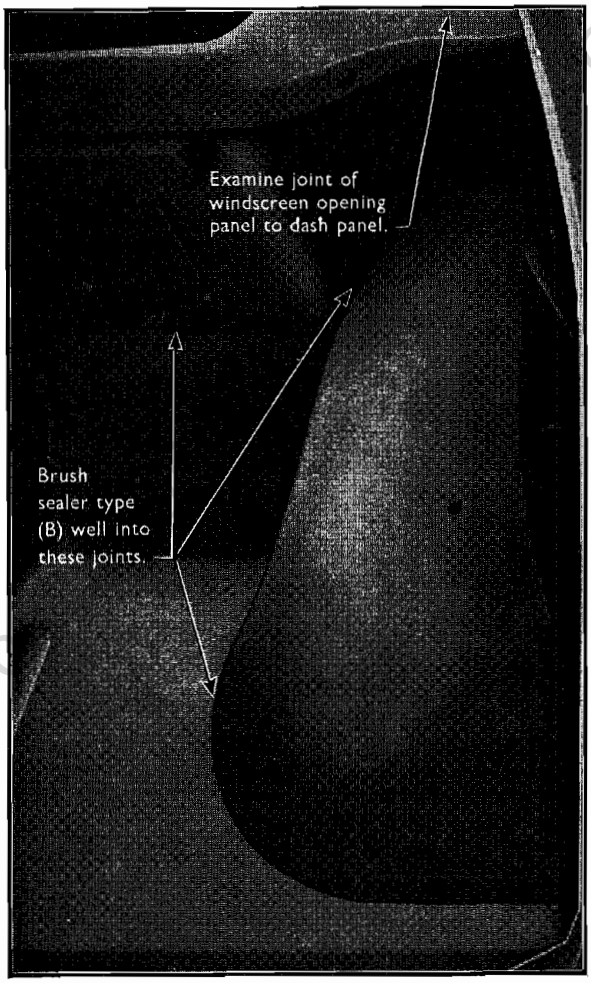

Fig. 3
Sealing Cowl Side (Interior)

rubber grommets and wiper motor. Renew the rubber grommets if necessary and seal the front face of the aperture before refitting the nuts, arms and blades. When replacing the blades, adjust them so that they rest on the glass when in the parked position and not on the windscreen weather strip.

A4. If water is running down the door pillar faces after test (see Fig. 4), check that the rubber weather strips around the doors are in good condition and that there is a good joint between the rubber on the pillar and the door weather strip when the door is shut. This can be checked by pressing a piece of paper over the weather strip closing the door and attempting to pull out the paper. If the paper is nipped, this indicates that a satisfactory seal is being made. If the seal is unsatisfactory, check that the door is aligned correctly and then, if necessary, pack out the weather strip with slivers of rubber between it and the door. If the weather strip is correctly cemented it should withstand an outward pull of approx. 6 lbs. (2.72 kg.) which can easily be measured with a spring scale, attached to a suitable toothed clip which will grip the weather strip.

Apply sealing adhesive between the rubber weather strip and the front body pillar and check that the five securing clips are in position, and are firmly holding to the flange joint (see Fig. 4).

Ensure that the front vent window rubber weather strips are in good condition and correctly located. If a gap is apparent between a window and the weather strip remove the vent window and tighten the self-locking nut on the threaded end of the lower pivot stud until the gap is eliminated but the window continues to operate without excessive friction. If at any time the plastic sheeting beneath the door trim pad is disturbed, it is essential that when replacing or renewing the sheet, care is taken when applying the adhesive so that drain holes provided on the inner door frame are not sealed off (see Fig. 6.)

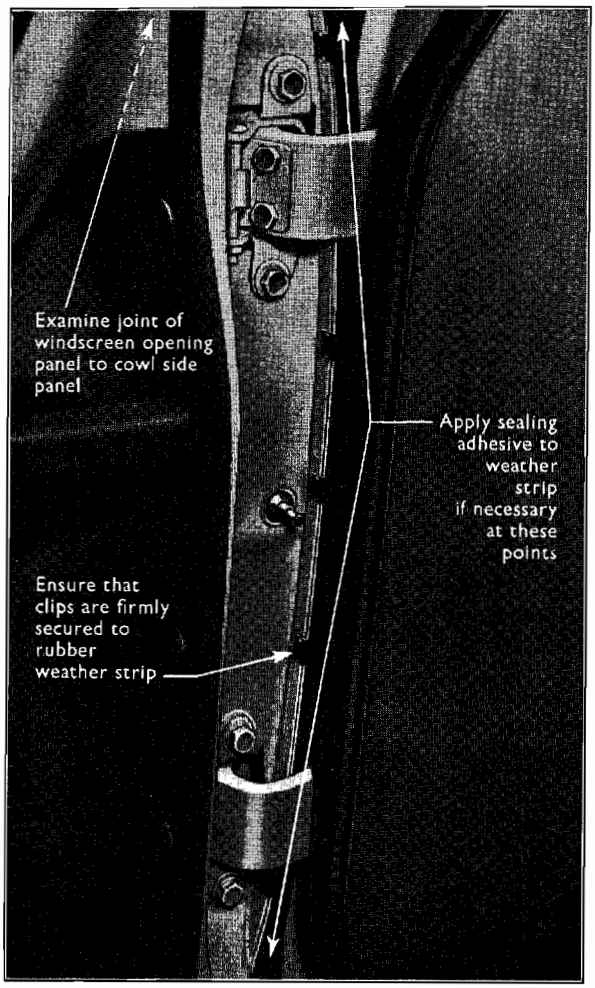

Fig. 4
Checking Door Pillar Weatherstrip

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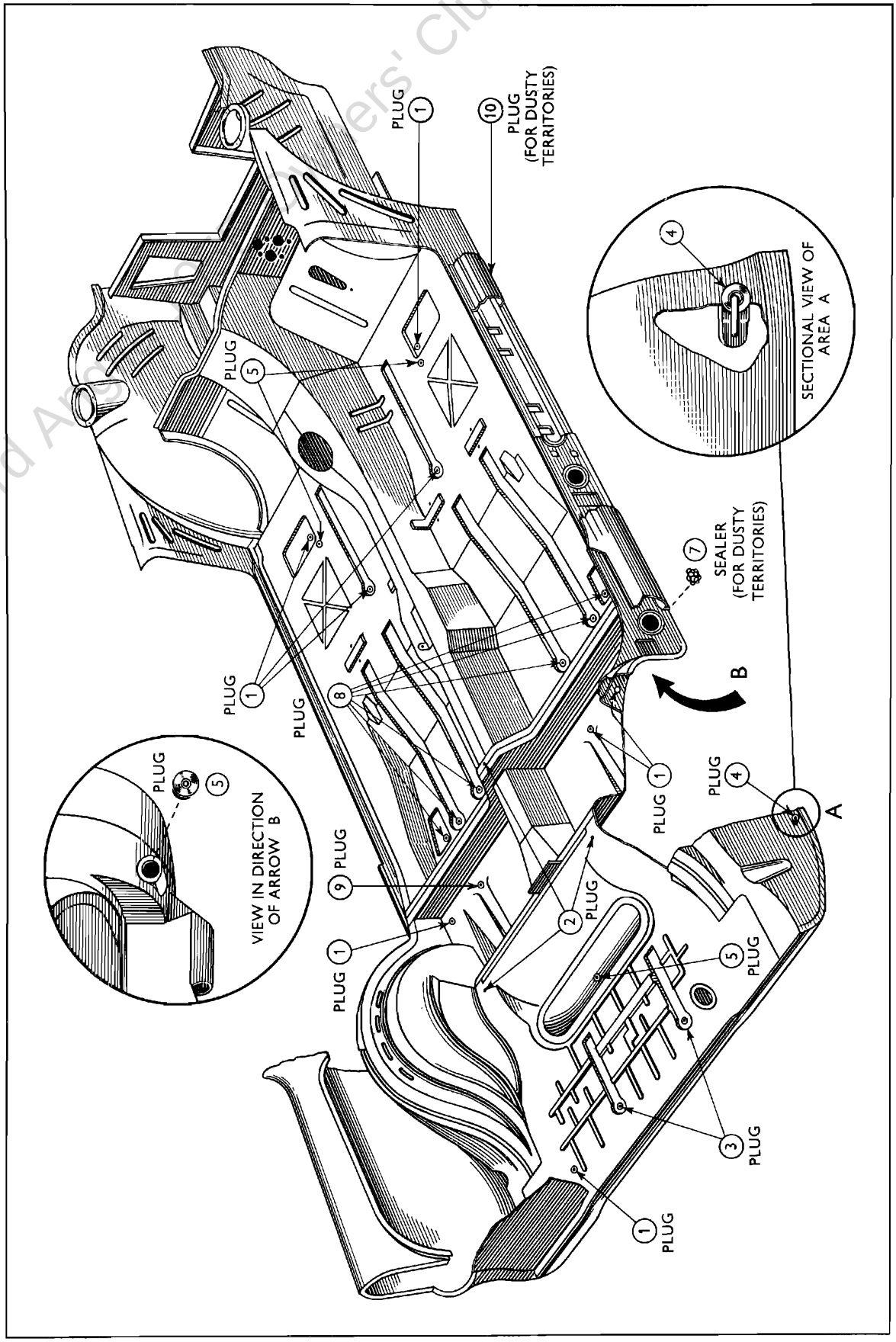

Fig. 5 **Location of Plugs, etc., positioned in Floor Pan Assembly**

Fig. 6
Application of Adhesive to Door Plastic Sheeting

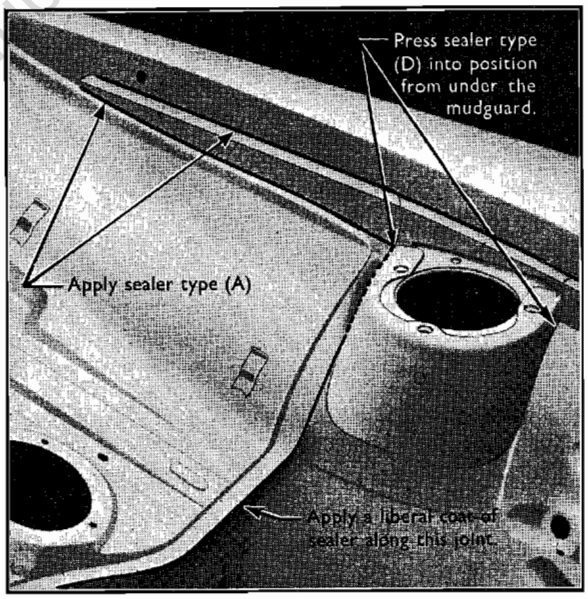

Fig. 7
Sealing Locations on Dash and Bulkhead Panels

Water Entry through Bulkhead and Floor Pan

B1. Check the sealing of all bulkhead joints, and apply sealer where necessary. All locations are listed in the Table A below with recommended sealing materials and are illustrated (see Fig. 7).

A steering column cover plate forms part of the

Location	Sealer	Figure	Action
Windscreen opening panel to front mudguard panel joint	A	7	Cover with a liberal coating of sealer and brush over the joint.
Windscreen opening panel to dash panel joint	A	7	Apply a liberal coating of sealer along the joint.
Windscreen opening panel to front mudguard apron joint	A	7	Flow sealer along the joint.
Front mudguard to cowl side and front mudguard to front mudguard apron joint	A	7	Apply a continuous bead of sealer along the joint.
Front suspension unit reinforcement to side apron joint	D	7	Press sealer firmly in position from underneath the mudguard.
Junction of dash panel to front mudguard apron	D	7	Press into position.
Hood weather strip retainer to windscreen opening panel joint	A	—	Apply a continuous bead of sealer and brush in neatly.
Master cylinder bracket to dash panel joint	A	—	Apply a continuous bead of sealer around the perimeter of the bracket.

Table A

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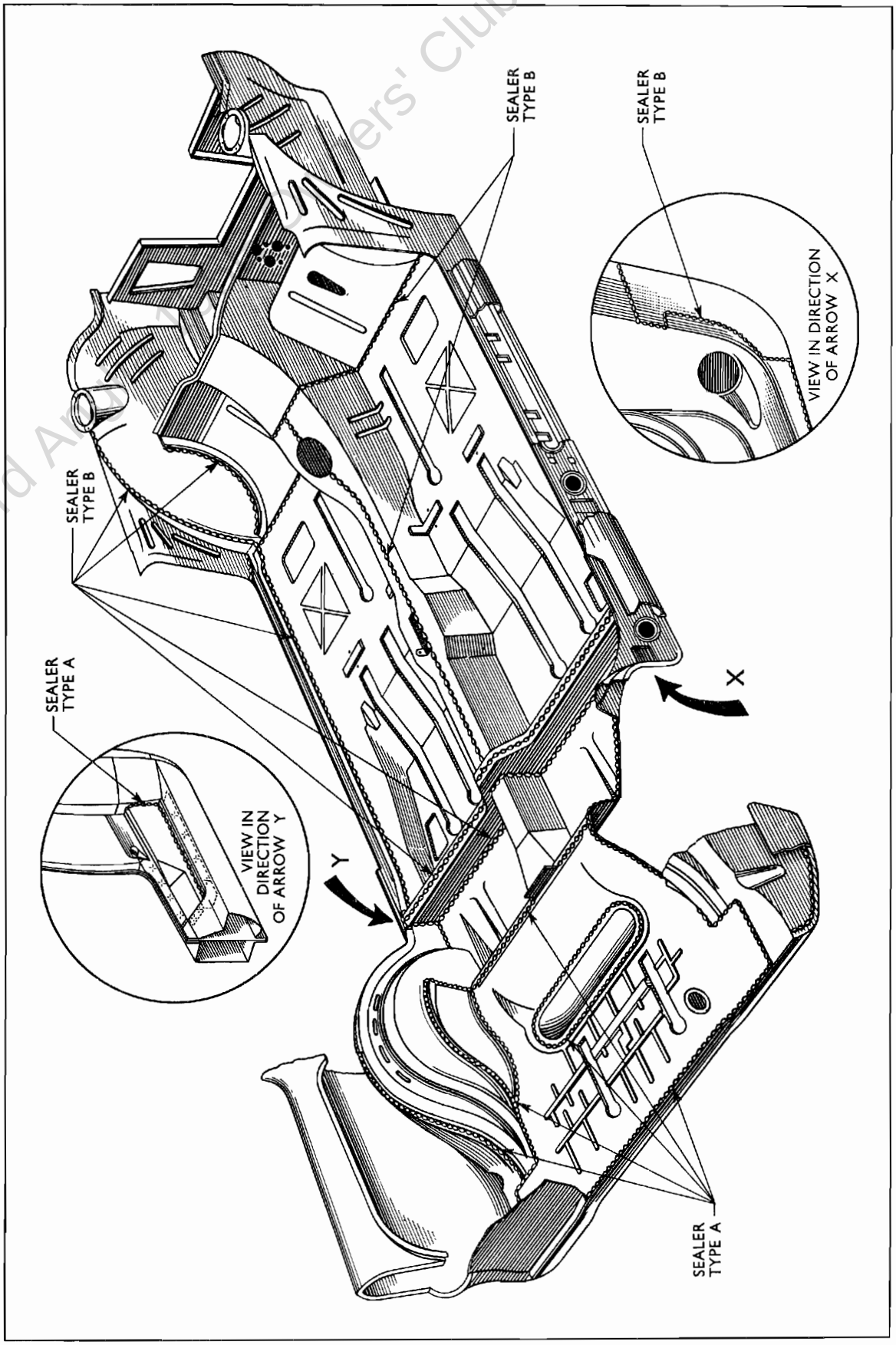

Fig. 8 **Sealing Locations on Floor Pan Assembly**

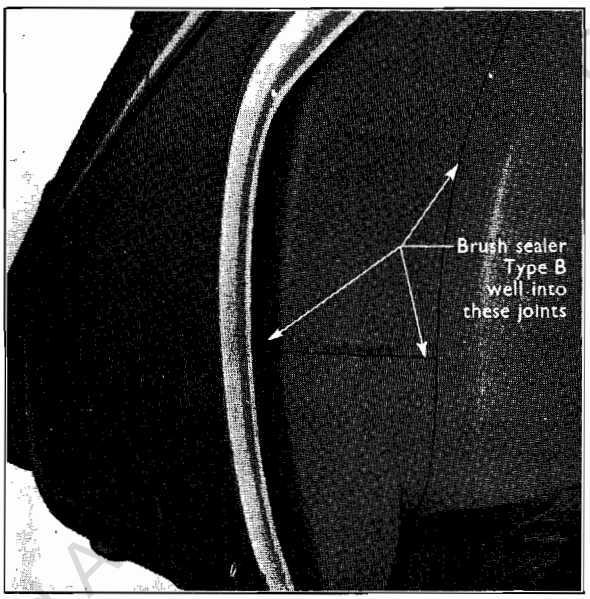

Fig. 9
Sealing Under Rear Wheel Housing

bulkhead. Ensure that the rubber gasket is firmly secured by the cover plate ; if necessary, apply sealer to the plate retaining screws.

B2. Potential points of water and dust entry through the front floor pan, with the appropriate corrective action to be taken are described on sheet 3.

Note — On left-hand drive vehicles fitted with a floor dipper switch, check that the rubber boot is in good condition and correctly located ; renew if necessary. If dust or water entry is still suspected from this location, seal around the joint of the dipper switch and floor pad with a suitable sealer.

B3. Check that the rubber washers are correctly positioned behind the bonnet or hood lock assembly, and if necessary, apply sealer between the front face of each washer and the engine bulkhead.

B4. The holes provided in the engine bulkhead for wires, cables, tubes, etc., should be checked to ensure that they are adequately sealed against the ingress of water and dust by the appropriate rubber grommet. If any of these holes are not used, check that the blanking plugs are inserted. Fit new plugs if any are missing and seal with an adhesive compound if loose.

B5. Ensure that the rubber covers of hand brake lever and gear change lever are securely positioned by the cover plate, and if necessary seal around the cover plate retaining screw holes.

B6. If water or dust entry through the front seat mountings is suspected, remove the seat and apply a daub of sealer at each bolt location before replacing the bolts.

Leaks at other points onto the car floor

1. Check that all the blanking plugs are inserted in the paint drain holes in the floor pan. Fit new plugs if any are missing and seal with an adhesive compound if loose. (All plug and sealing locations on the underbody are shown in Figs. 5 and 8.)

2. On the standard model New Anglia seal around the rear quarter window weather strips—as described for sealing around the windscreen weather strips (see A2). On the De luxe Anglia if a leak is occurring between the weather strip and the body, the weather strip should be removed and a continuous bead of sealer applied to the weather strip groove before refitting to the aperture. If the leak is between the quarter window frame and the weather strip, the lock catch can be re-located to provide additional pressure on the weather strip sealing lip.

3. If it is suspected that water is entering the well section, forward of the rear wheel housing, examine the underside of the rear wheel housing and if any breaks in the sealer film are noticed apply a liberal coating of sealer type (*b*) (see Fig. 9).

LEAKS INTO THE LUGGAGE COMPARTMENT

1. Seal around the rear window weather strip as described for sealing around the windscreen weather strip (see Fig. 10). Carefully ease the chrome mouldings from around the rear window and examine the plastic sealer tape covering the flange of rear window aperture and rear quarter panel. Check that the luggage compartment lid weather strips are securely cemented to the lid, and are seating securely on the drain channel edges when the lid is closed. If necessary, re-cement the weather strips with sealing adhesive, ensuring that the weather strip is securely

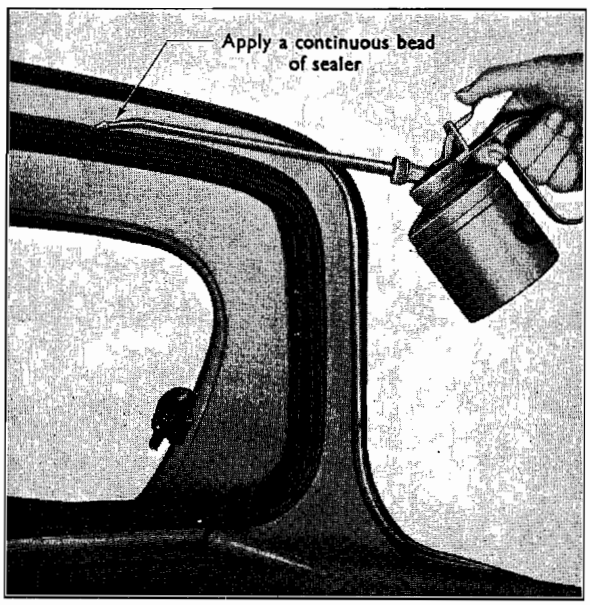

Fig. 10
Sealing Rear Window

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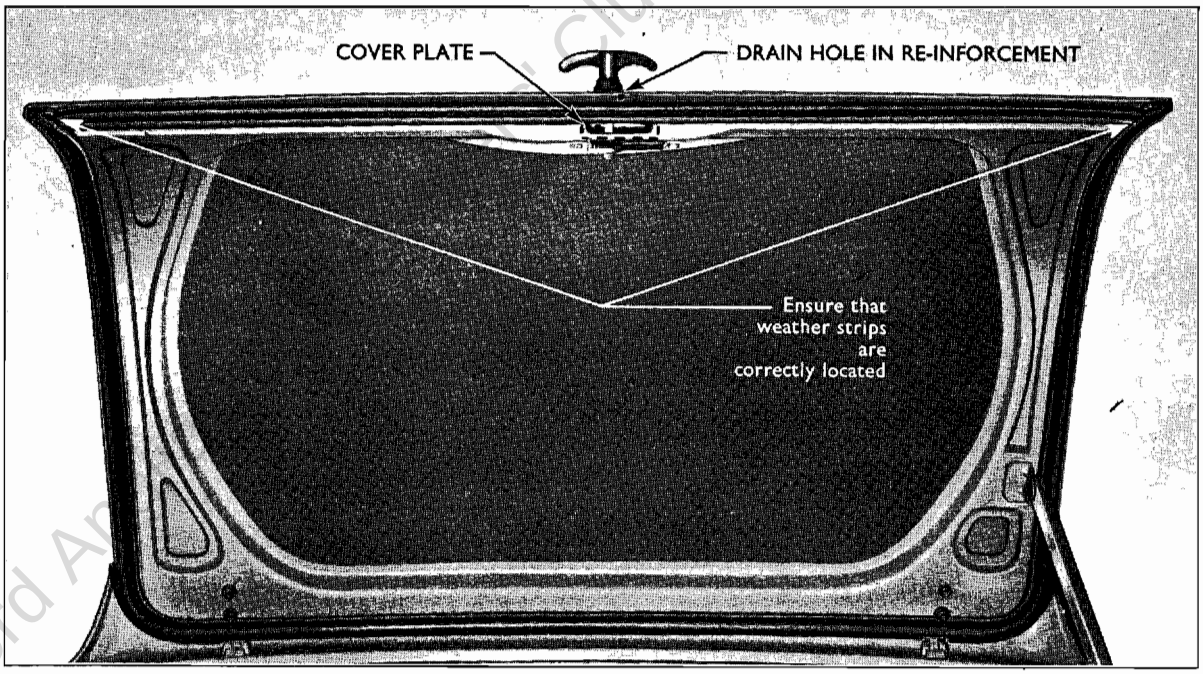

Fig. 11
Luggage Compartment Lid and Lock Cover Plate

Location	Sealer	Figure	Action
Quarter panel to drain trough joint	A	12	Apply a bead of sealer and carefully brush into the joint.
Rear lamp reinforcement to rear quarter panel joint	A	13	Apply a bead of sealer and carefully smooth off.
Rear lamp reinforcement and back panel joint	A	13	Apply a bead of sealer and carefully smooth off.
Rear quarter panel to rear back panel joint	A	12	Flow a bead of sealer into the joint.
Spare wheel well to boot compartment floor joint	A	12	Apply sealer liberally.
Rear wheel house inner panel to rear floor panel joint	A	12	Apply sealer liberally and brush smooth.
Back panel lower to rear floor pan joint	A	12	Flow a bead of sealer around the joint from inside the boot compartment.
Inner and outer rear wheel housing joint	A	12	Apply sealer and brush into the joint.
Outer wheel house to rear quarter panel joint	B	12	Inject a liberal quantity of sealer between these two panels.
Reinforcement panel to front end of rear wheel housing joint	B	9	Apply sealer liberally from the underside of the rear quarter panel.

Table B

fitted at the junction of the upper and lower strips (see Fig. 11).

Check that the channels are clear of excess sealer ; if water is leaking through the spot welded joints of the channel, apply a small fillet of sealer along the inside of the channel, taking care not to obstruct the flow of water. Later production vehicles have a drilled hole in the luggage compartment lid reinforcement, and if water is found to be present within the framework a $\frac{3}{16}$ in. hole should be drilled in the reinforcement (see Fig. 11).

If the above checks do not cure water leaks at this location, inspect for distortion of the luggage compartment lid and drain channel edges. If necessary, lift the weather strip along the upper edge of the lid and insert a packing strip between the lid flange and the rubber to increase the compression of the weather strip when the lid is shut. Cement the rubber with sealing adhesive. Check the sealing of all luggage compartment body joints, and apply sealer when necessary. All locations are listed in Table B on continuation sheet 4 with recommended sealing materials.

Dust Entry

The problem of dust entry raises additional problems, since a body sealed effectively against water entry is not necessarily proof against dust. It should be remembered that the forward motion of a car creates a slight vacuum or depression within the body, particularly if a window or ventilator is open. Any small crevice in the body will permit air to enter carrying dust with it. This dust may seep into the hollow box section rocker panels, which extend along the edge of the floor below the door panels, and accumulate there. Dust may then find its way into the box sections of the rear wheel housing and become apparent in the rear passenger compartment and luggage compartment.

When investigating a complaint of dust entry, a careful examination to reveal the point of entry should be carried out. As explained above, the point of entry can sometimes be deceptive, because dust may enter at one point then follow the passages formed by box members and make itself apparent at another point. As previously stated for water leaks, it will be necessary to remove the front carpet

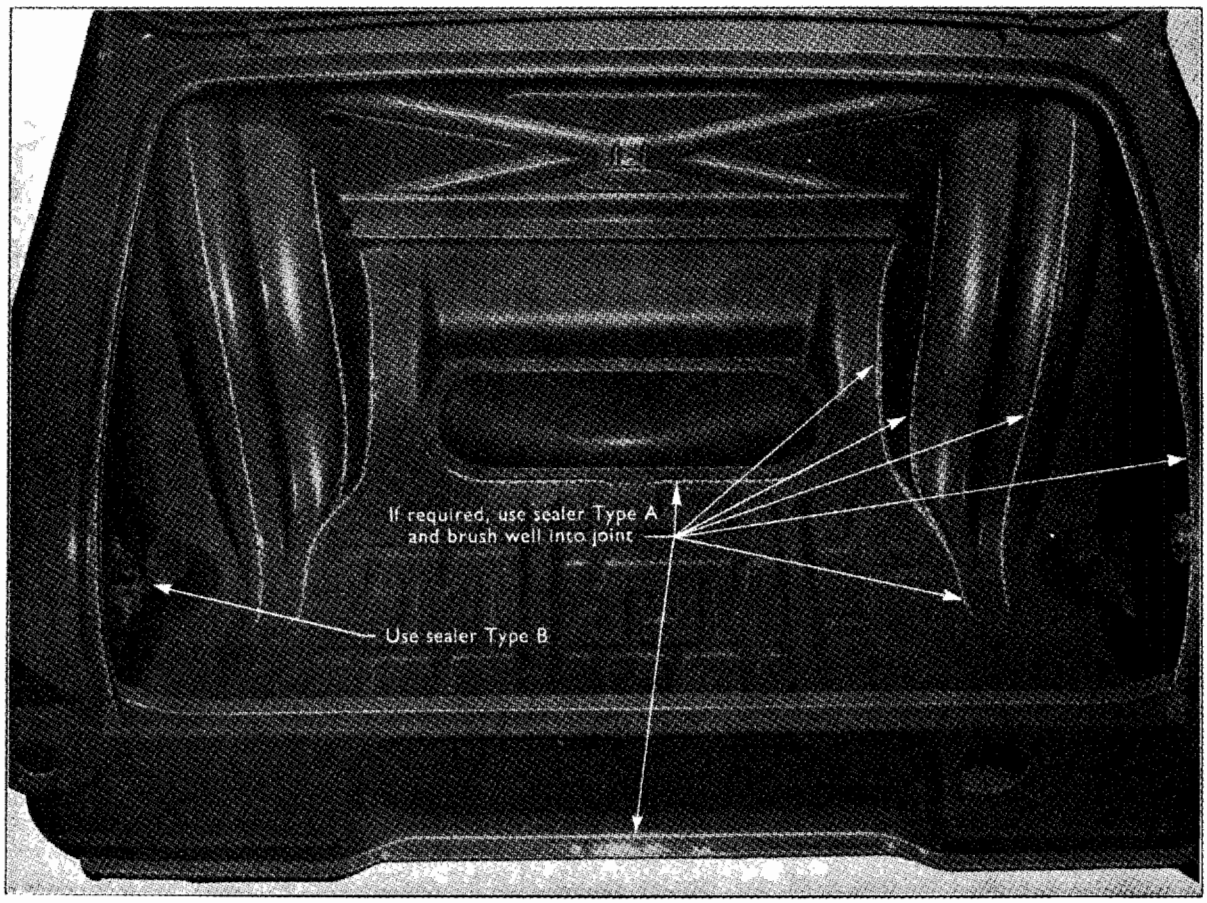

Fig. 12
Sealer Locations in Luggage Compartment

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cowl side trim panels, rear seat cushions and to lift the underfelt around the edges and panel joints before making any checks. It may again be an advantage to use a strong light on the outside of each joint and inspect from the inside of the car.

1. Badly fitting trim windcords, or windcords that have deteriorated may allow dust entry into the car interior, particularly below the waistline, and it is thus necessary to check the condition of these items and renew if necessary.

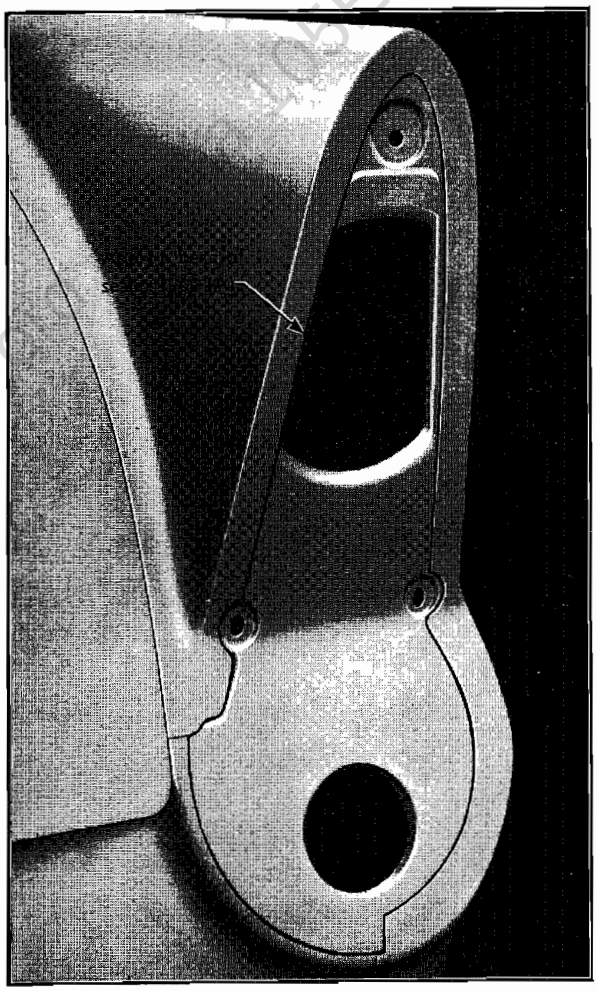

Fig. 13
Sealing a Rear Lamp Reinforcement

2. Ensure that the polyurethene packings fitted over the trim clips on rear quarter panel lower trims are correctly fitted (see Fig. 15).

3. A polyurethene packing is also fitted to the drain holes on door frames (see Fig. 14) and a careful examination should be made and if necessary the packings renewed.

4. On later production models, a cover plate part No. E2854/AA/1 secured by two self-tapping screws has been incorporated on the luggage compartment lid, to cover the lock assembly, and can be fitted to earlier production cars if dust is found to be entering at this point (see Fig. 11).

5. If dust is found to be entering at the fuel tank

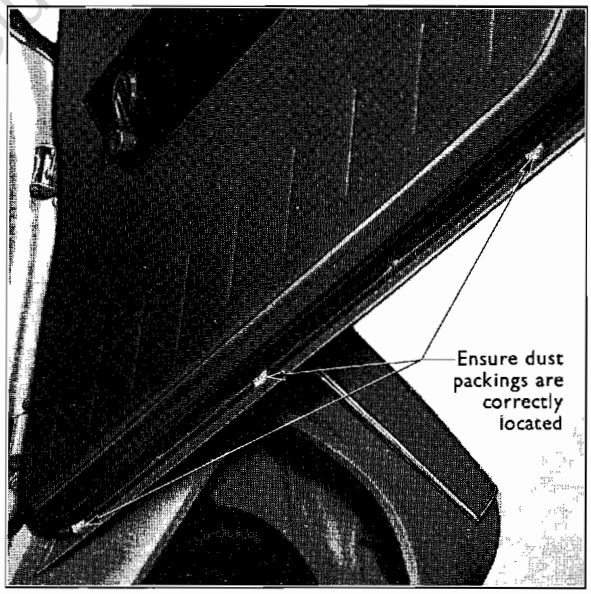

Fig. 14
Dust Packing Fitted to Drain Holes in Door Frame

neck grommet, apply a filler of sealer type (*a*) around the perimeter of the rubber seal to floor pan.

Note — In territories with low rainfall and excessively dusty conditions, it may be an advantage to seal the holes provided in the rocker panels for water drainage, in order to prevent dust entry. **However, it must be appreciated that the advantages which these drain holes provide, in respect of water drainage, are hereby eliminated and it would be advisable under these circumstances, to remove this sealing periodically, or after washing the vehicle, to ensure that no water is trapped within these members.**

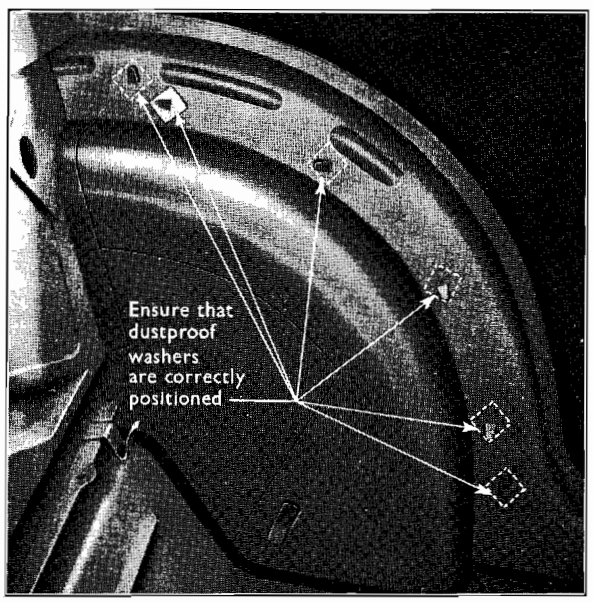

Fig. 15
Dustproof Packings on Rear Quarter Panel Trim

SERVICE BULLETIN	PASSENGER CARS
Ford Motor Company Limited *Dagenham, England*	

Section 12 :	BODYWORK, MUDGUARDS AND BONNET
Subject :	**Repair Procedure**
Effective on :	Passenger Cars

BODYWORK REPAIR PROCEDURE

Dimensional drawings of the underbody and upper bodywork of Anglia and Prefect (1953–1959), Popular (1959 onwards), Anglia (1959 onwards) and Consul, Zephyr and Zodiac (1956 onwards) are contained in this Bulletin. When used in conjunction with a level floor and suitable stands, these drawings will be of assistance in checking or undertaking repairs to the body. Engine compartment jigs which will ensure accurate alignment of front suspension and engine mounting points are readily available for each of the afore-mentioned models and these will complete the equipment necessary for dimensional checking. Remarks applicable to individual models are listed below, together with the appropriate steering geometry tables.

Metric equivalents for dimensions shown, are tabulated in dimensional sequence on the reverse side of each drawing.

CONSUL, ZEPHYR, ZODIAC (1956 onwards)

Where one measurement only is indicated the measurement is common to all three models ; where two measurements are indicated the measurement marked with an asterisk applies to Zephyr and Zodiac and the unmarked measurement applies to Consul models.

Wheel Alignment (unladen)

Castor	−0° 15′ to + 0° 45′ (Prior to Sept. 1956) 0° to + 1° 15′ (After Sept. 1956)
Camber	0° 30′ to 2° 15′
King pin inclination	3° 30′ to 4° 30′
Toe-out on 20° turns	1° 30′ to 2° 45′
Toe-in	$\frac{1}{16}$ in. to $\frac{1}{8}$ in. (1.58 to 3.17 mm.)

ANGLIA (1959 onwards)

In the plan view two reference points have been taken at each front suspension unit location ; a centre line through the pitch circle formed by the three front suspension mounting support stud holes, and the centre line through the inner of these three holes. However, in the side view, only the reference line through the pitch circle is employed and care should be taken not to confuse the centre lines when checking measurements.

Wheel Alignment (unladen)

Castor	1° 30′ to 3° 0′
Camber	0° 30′ to 2° 0′
King pin inclination	4° 45′ to 6° 15′
Toe-out on 20° turns	1° 36′ to 3° 6′
Toe-in	$\frac{1}{8}$ in. to $\frac{3}{16}$ in. (3.17 to 4.76 mm.)

ANGLIA AND PREFECT (1953–1959), POPULAR (1959 onwards)

It will be noted that front end dimensions are given to the suspension unit upper mountings under the mudguards. It is essential that the suspension units are correctly located, otherwise the steering geometry will be affected. The wheelbase dimension can vary between $86\frac{3}{8}$ in. (219.39 cm.) and $87\frac{1}{8}$ in. (221.3 cm.) provided that the variation between these dimensions on left-hand and right-hand sides of the same vehicle does not exceed $\frac{1}{4}$ in. (6.35 mm.).

Wheel Alignment (unladen)

Castor	1° 0′ to 3° 0′
Camber	0° 30′ to 2° 15′
King pin inclination	3° 30′ to 5° 0′
Toe-out on 20° turns	3° 0′ to 5° 0′
Toe-in	$\frac{1}{16}$ in. to $\frac{1}{8}$ in. (1.58 to 3.17 mm.)

Serial No. 39	
Last issue was No. 38	*See Sec.—ACCESSORIES*

No. of sheets : 3	*Sheet No.* 1
Date :	**11th NOVEMBER, 1960**

Continued overleaf

METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE) CONSUL, ZEPHYR AND ZODIAC (1956 ONWARDS)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
0.09 in 18	.228 in 45.72	$31\frac{23}{32}$ to $31\frac{25}{32}$	80.56 to 80.72	$32\frac{13}{64}$	81.80
$\frac{5}{16}$	.794	$31\frac{29}{32}$ to $31\frac{31}{32}$	81.04 to 81.20	$32\frac{7}{32}$ to $32\frac{9}{32}$	81.84 to 81.99
$\frac{3}{8}$ to $\frac{39}{64}$	.95 to 1.15	$10\frac{25}{32}$ to $10\frac{27}{32}$	27.38 to 27.54	$35\frac{5}{16}$ to $35\frac{3}{8}$	89.69 to 89.85
$1\frac{3}{4}$	4.44	$10\frac{61}{64}$	27.82	$36\frac{19}{64}$	92.19
$2\frac{5}{8}$ to $2\frac{21}{32}$	6.66 to 6.74	$11\frac{23}{32}$ to $11\frac{25}{32}$	29.77 to 29.92	$37\frac{1}{16}$	94.14
$3\frac{51}{64}$	9.64	$11\frac{7}{8}$ to $11\frac{15}{16}$	30.16 to 30.32	$40\frac{29}{32}$ to $41\frac{3}{32}$	103.90 to 104.38
$4\frac{1}{4}$	10.79	$12\frac{3}{32}$ to $12\frac{5}{32}$	30.72 to 30.88	$42\frac{5}{64}$	106.88
$4\frac{21}{64}$ to $4\frac{7}{16}$	10.99 to 11.27	$12\frac{5}{8}$ to $12\frac{11}{16}$	32.07 to 32.23	$42\frac{19}{64}$	108.62
$4\frac{7}{8}$ to $4\frac{61}{64}$	12.38 to 12.58	$13\frac{21}{64}$ to $13\frac{3}{8}$	33.85 to 33.97	$44\frac{25}{64}$	113.15
$5\frac{7}{32}$ to $5\frac{9}{32}$	13.25 to 13.41	$14\frac{3}{64}$ to $14\frac{5}{64}$	35.68 to 35.76	$47\frac{59}{64}$ to $48\frac{5}{32}$	121.72 to 122.32
$6\frac{27}{32}$ to $6\frac{29}{32}$	17.38 to 17.54	$14\frac{53}{64}$ to $14\frac{7}{8}$	37.66 to 37.78	$49\frac{19}{32}$	125.96
7	17.78	$15\frac{1}{32}$ to $15\frac{3}{32}$	38.18 to 38.34	$53\frac{1}{64}$	134.66
$7\frac{5}{32}$ to $7\frac{7}{32}$	18.18 to 18.33	$15\frac{5}{8}$ to $15\frac{21}{32}$	39.69 to 39.77	$53\frac{29}{64}$ to $53\frac{37}{64}$	135.77 to 136.09
$7\frac{21}{64}$ to $7\frac{25}{64}$	18.61 to 18.77	$16\frac{21}{64}$ to $16\frac{3}{8}$	41.47 to 41.59	$53\frac{29}{32}$	136.92
$7\frac{61}{64}$	20.20	$17\frac{53}{64}$	45.68	$54\frac{51}{64}$	139.18
$8\frac{3}{4}$ to $8\frac{25}{32}$	22.22 to 22.30	$19\frac{21}{32}$	49.92	$55\frac{9}{32}$	140.41
$8\frac{7}{8}$ to $8\frac{63}{64}$	22.54 to 22.82	$19\frac{5}{8}$ to $19\frac{11}{16}$	49.85 to 50.01	$58\frac{7}{32}$ to $58\frac{9}{32}$	147.88 to 148.03
$9\frac{1}{8}$ to $9\frac{3}{16}$	23.18 to 23.34	$20\frac{51}{64}$	52.82	$104\frac{1}{2}$	265.43
$9\frac{25}{64}$ to $9\frac{1}{2}$	23.85 to 24.13	$21\frac{25}{64}$ to $21\frac{33}{64}$	54.33 to 54.65	107	271.78
$10\frac{3}{64}$ to $10\frac{5}{64}$	25.52 to 25.60	$21\frac{31}{32}$ to $22\frac{1}{32}$	55.80 to 55.96	$160\frac{43}{64}$	408.35
$10\frac{7}{64}$ to $10\frac{9}{64}$	25.68 to 25.78	$28\frac{1}{2}$ to $28\frac{17}{32}$	72.39 to 72.47	$167\frac{1}{8}$	424.49
$10\frac{33}{64}$ to $10\frac{37}{64}$	26.71 to 26.87	$29\frac{13}{32}$ to $29\frac{16}{32}$	74.69 to 74.85		

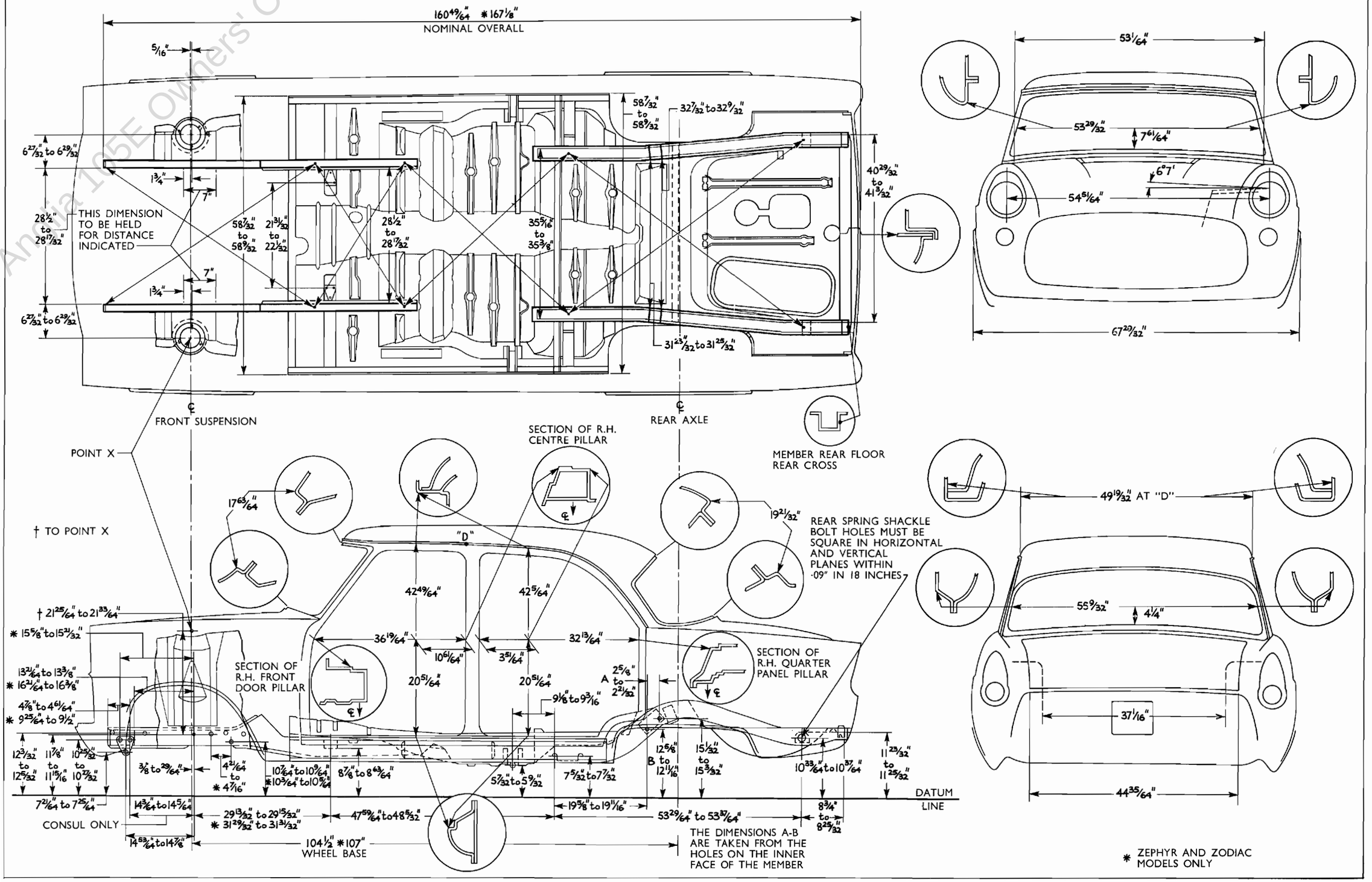

Fig. 1 **Body Tolerance Chart—Consul, Zephyr and Zodiac (1956 onwards)**

METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)
ANGLIA MODEL (1959 ONWARDS)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
$\frac{1}{64}$	0.04	$11\frac{31}{32}$ to $12\frac{1}{32}$	30.40 to 30.56	41	104.14
$\frac{1}{32}$	0.079	$12\frac{5}{32}$ to $12\frac{5}{16}$	30.88 to 31.28	$41\frac{3}{64}$	104.26
$\frac{3}{32}$ in 18	0.238 in 45.72	$12\frac{3}{8}$	31.43	$42\frac{23}{64}$	107.59
$\frac{19}{64}$	0.754	$16\frac{1}{8}$	40.96	$43\frac{13}{64}$	109.73
$1\frac{1}{8}$	2.86	$16\frac{3}{4}$	42.55	$43\frac{33}{64}$ to $43\frac{41}{64}$	110.53 to 110.85
$4\frac{3}{8}$ to $4\frac{29}{64}$	11.11 to 11.31	$21\frac{25}{32}$ to $21\frac{27}{32}$	55.32 to 55.48	$45\frac{7}{64}$	114.58
$4\frac{59}{64}$ to $4\frac{63}{64}$	12.50 to 12.66	$22\frac{7}{16}$ to $22\frac{15}{32}$	56.99 to 57.07	$55\frac{55}{64}$	141.88
$5\frac{5}{16}$ to 6	15.08 to 15.24	$23\frac{63}{64}$ to $24\frac{1}{64}$	60.92 to 61.00	$57\frac{11}{32}$	145.65
6	15.24	$25\frac{19}{64}$ to $25\frac{23}{64}$	64.25 to 64.41	$68\frac{35}{64}$ to $68\frac{33}{64}$	174.11 to 174.55
$6\frac{53}{64}$ to $6\frac{57}{64}$	17.34 to 17.50	$29\frac{5}{64}$ to $29\frac{19}{64}$	73.86 to 74.18	$90\frac{1}{2}$	229.87
7	17.78	$32\frac{15}{32}$ to $32\frac{1}{2}$	82.47 to 82.55	$141\frac{35}{64}$	359.53
8	20.32	$32\frac{31}{32}$ to $33\frac{1}{2}$	83.74 to 83.89	$145\frac{7}{8}$	370.52
$8\frac{13}{16}$ to $8\frac{7}{8}$	22.38 to 22.54	$39\frac{9}{64}$	99.42	$147\frac{1}{4}$	374.02
$9\frac{7}{32}$ to $9\frac{1}{4}$	23.42 to 23.49	$40\frac{41}{64}$	103.23		
$11\frac{59}{64}$ to $11\frac{15}{16}$	30.28 to 30.32	$40\frac{29}{32}$	103.9		

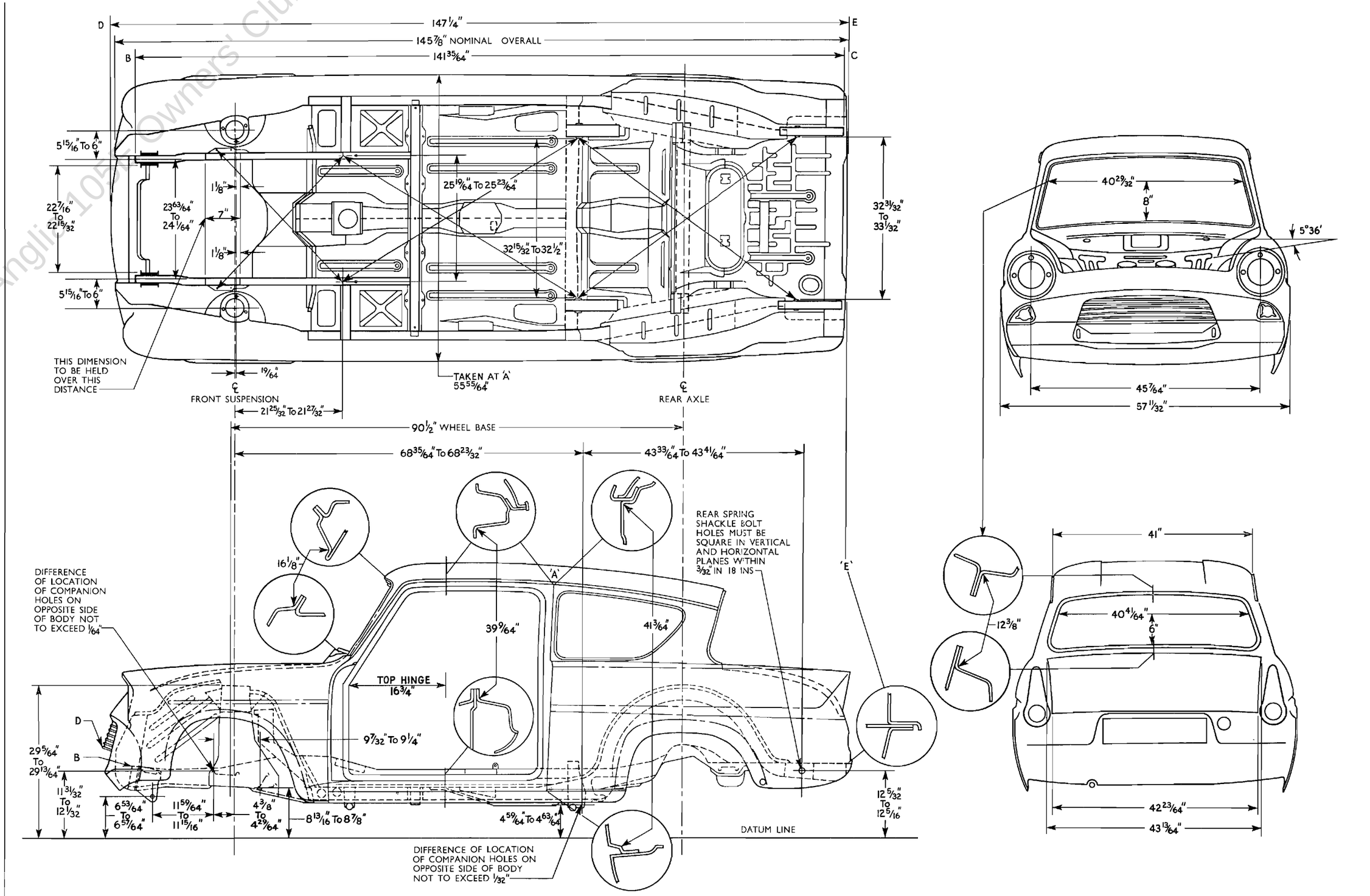

Fig. 2 **Body Tolerance Chart—Anglia (1959 onwards)**

METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)
ANGLIA AND PREFECT (1953–1959) POPULAR (1959 ONWARDS)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
$\frac{1}{16}$	0.159	$15\frac{3}{32}$	38.34	$36\frac{1}{2}$	92.71
$1\frac{7}{32}$	3.09	$15\frac{35}{64}$ to $15\frac{39}{64}$	39.49 to 39.65	$38\frac{1}{2}$	97.79
$1\frac{5}{16}$	3.33	$16\frac{11}{32}$	41.51	$38\frac{5}{8}$	98.11
$2\frac{21}{64}$	5.91	$17\frac{17}{32}$	44.53	$40\frac{13}{16}$ to $40\frac{15}{16}$	103.66 to 103.98
$2\frac{1}{2}$	6.35	$18\frac{15}{64}$	46.31	$42\frac{1}{4}$	107.31
$5\frac{5}{64}$	13.29	$19\frac{15}{32}$	49.45	$42\frac{5}{8}$	108.27
$5\frac{7}{8}$	14.92	$20\frac{11}{32}$ to $20\frac{15}{32}$	51.67 to 51.99	$44\frac{1}{8}$	112.08
$6\frac{1}{2}$	16.51	$24\frac{61}{64}$ to $25\frac{1}{64}$	63.38 to 63.54	$44\frac{3}{8}$	112.71
$7\frac{1}{2}$	19.05	$25\frac{63}{64}$ to $26\frac{3}{64}$	66.00 to 66.16	$45\frac{17}{64}$	114.97
$7\frac{37}{64}$	19.25	27	68.58	46	116.84
$7\frac{27}{32}$	19.92	$27\frac{7}{16}$ to $27\frac{9}{16}$	69.69 to 70.01	$53\frac{13}{16}$ to $54\frac{1}{16}$	136.68 to 137.32
$11\frac{1}{4}$	28.57	$28\frac{3}{8}$	72.07	$60\frac{45}{64}$	154.18
$11\frac{33}{64}$	29.25	$30\frac{5}{8}$	77.79	$64\frac{11}{16}$ to $64\frac{15}{16}$	164.31 to 164.94
$11\frac{27}{32}$	30.08	31	78.74	$86\frac{3}{8}$ to $87\frac{1}{8}$	244.79 to 246.70
$13\frac{11}{16}$	34.77	32	81.28	$141\frac{17}{32}$	359.49
$14\frac{17}{32}$	36.91	$34\frac{5}{16}$	87.15	$144\frac{5}{16}$	366.55
$15\frac{5}{64}$	38.30	$35\frac{25}{32}$	90.88		

Serial No. 39

Last issue was No. 38 *See Sec.—ACCESSORIES*

No. of sheets : 3 *Sheet No.* 3

Date : **11th NOVEMBER, 1960**

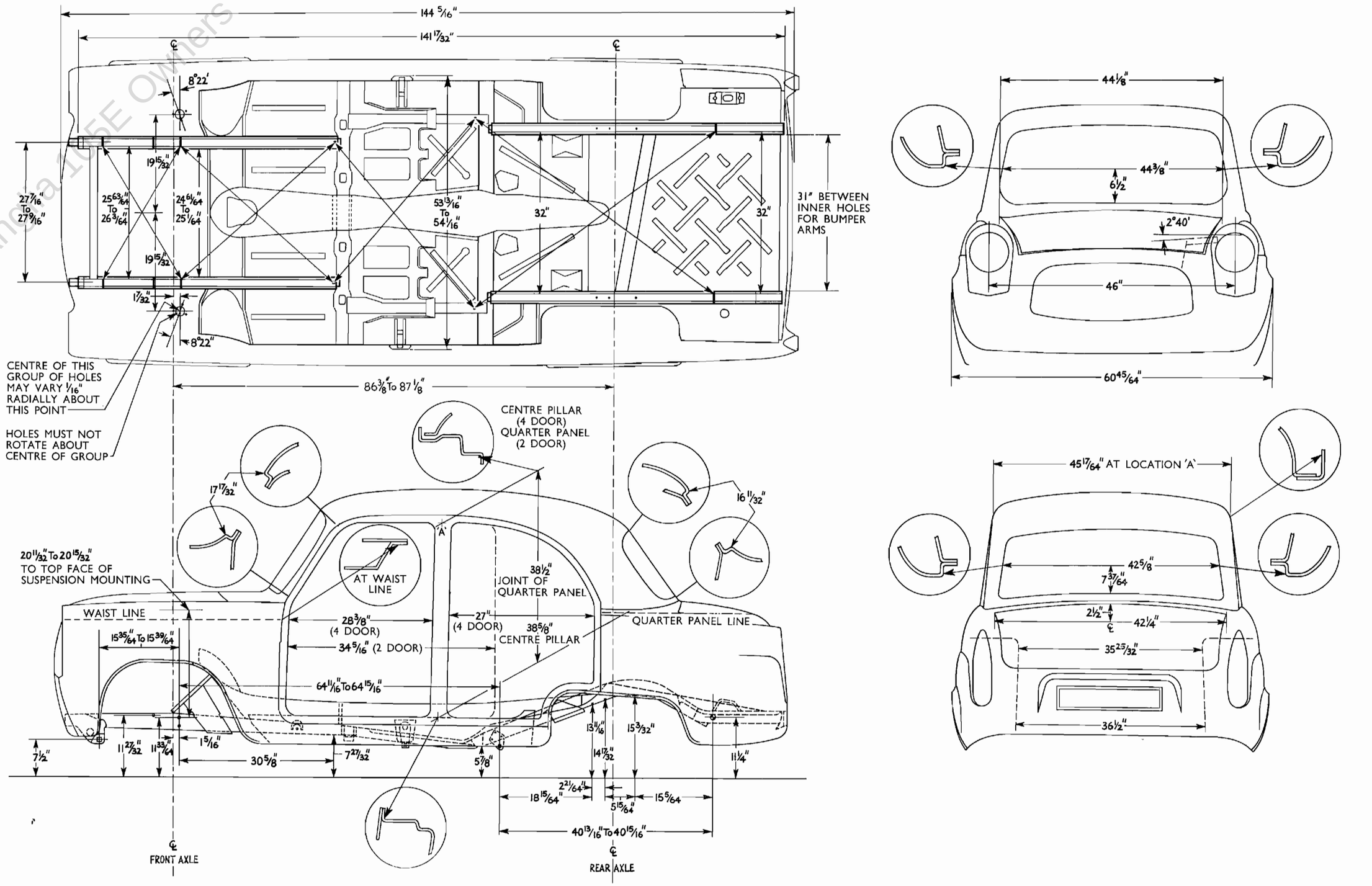

Fig. 3 **Body Tolerance Chart—Anglia and Prefect (1953-1959) Popular (1959 onwards)**

BODYWORK: BODY ALIGNMENT

NEW ANGLIA ESTATE CARS

Dimensional drawings of the underbody and upper bodywork are contained within this Bulletin. When used in conjunction with a level floor and suitable stands, these drawings will be of assistance in checking and undertaking repairs to the body. To complete the equipment necessary for accurate alignment of the front suspension and engine mounting points, a jig is needed. Available from our approved suppliers under Tool No. P.5509, the jig is common to new Anglia cars (1959 onwards), Anglia Estate cars (1961 onwards) and Thames 5 and 7 cwt. vans (1961 onwards). It is built to meet a mean tolerance of new bodies and two types of locating pins are provided for the upper suspension mounting location.

Type 1 Internally threaded pins (6 off) are used for two purposes.

(*a*) In conjunction with wing-headed bolts, to align the upper suspension mounting reinforcement ring during the rectification of accident repairs.

(*b*) To check the position of the upper suspension mounting reinforcement ring in the case of suspected misalignment.

Type 2 Larger diameter plain pins (6 off) are used to locate and align the engine side apron panels during the rectification of accident repairs.

In addition, two further sets of locating pins (each set consisting of two pins) are provided to locate the lower portion of the jig to the front body side members and the stabiliser bar brackets.

CHECKING THE ENGINE COMPARTMENT

If the damaged car is still on its wheels and misalignment of the body within the engine compartment is suspected, carry out a full steering geometry check. If these checks indicate any discrepancy outside the allowed tolerances and no damage to the suspension or steering controls exists, then it will be necessary to investigate further in the following manner.

Remove the engine assembly, the front suspension crossmember and the front suspension completely from the car.

Remove the detachable locating pins from the engine compartment jig and slide in the telescopic bar located in the front cross tube.

Place the jig in position within the engine compartment, locating the lower portion between the front body side members. From under the front mudguards, pass the longer threaded locating pins (one either side) through the foremost holes in each body front side member for the front suspension crossmember securing bolts. Engage the corresponding holes in the jig and tighten the locating pins.

Extend the telescopic bar of the jig and secure it in position with the attached locking pin by entering the locking pin in the holes provided in the gauge bar and the front cross tube.

Raise the front of the jig and fit a locating pin through each of the front stabiliser bar brackets to engage in the corresponding holes in the jig.

To check the alignment of the holes in the upper suspension reinforcement ring in relation to those of the jig, engage the internally threaded pins. The three pins in each of the two clusters should pass freely through the holes in the body. Under no circumstances should they be forced into engagement.

Check the clearance between the upper face of the mudguard side apron panel and the underside of the jig top plate. A clearance of $\frac{9}{64}$ to $\frac{15}{64}$ in. (3.57 to 5.95 mm.) should be present.

Finally, determine the clearance between the inner face of each front stabiliser bar mounting bracket and the end of the jig front cross tube where a clearance of $\frac{39}{64}$ to $\frac{41}{64}$ in. (15.48 to 16.27 mm.) should be present.

If distortion to any major component affecting the front suspension (e.g. a distorted front side member or apron panel) is disclosed as a result of tests carried out, no attempt should be made to straighten members, etc. by using hydraulic body jacks with the jig in position, or damage to the jig will result. In view of the importance of the front end alignment, it is suggested that in general, distortion to these items should be corrected by replacing affected parts.

PASSENGER CAR SERVICE BULLETIN

ACCIDENT REPAIRS

When rebuilding the engine compartment as part of an accident repair, the jig may be used to align and assemble any or all of the engine compartment components. Thus, if necessary, a complete engine compartment may be built and welded together as a sub-assembly around the jig. The two longest locating pins which are threaded may be used to hold the body side members and side apron panels to the jig during this operation. To establish a dimension between the stabiliser brackets, utilise the $\frac{15}{32}$ in. (11.9 mm.) spacers attached to the jig. To position the apron bulkhead panel, the " H " shaped locating bar hinged to the front of the jig, should be raised and located under the top flange of the panel.

NOTE.—If a complete engine compartment is built around the jig in this manner, offer the welded assembly to the body **with the jig in position.** When correctly aligned to the body, the sub-assembly may then be welded in position. Do not remove the jig until both front mudguards and the radiator grille panel have been welded in position, otherwise distortion to the engine compartment may occur.

In a similar manner, when changing a radiator grille panel, to avoid the possibility of distortion to the engine compartment during this operation, secure the side apron panels with a temporary tie bar secured to each front suspension unit top mounting stud. (This tool may be improvised from a length of strip steel approximately $\frac{3}{16}$ in. thick by 2 in. wide by 34 in. long, suitably drilled at either end, but accurate dimensions may be obtained by direct measurements taken from an undamaged car.)

BODY ALIGNMENT

Before attempting to repair a damaged body where misalignment is apparent or suspected, it is necessary to check the underbody tolerances which are given in this Bulletin.

Checking the Underbody

Support the body on suitable stands or adjustable supports on a level floor extending the full length of the vehicle. Check the dimensions shown along the whole length of the body and note any discrepancy outside the allowed tolerances shown on the chart overleaf.

The diagonals marked on the plan view can be checked by using large callipers or a pair of trammels, or alternatively, they may be checked by using a plumb bob and line. The latter method enables a simple and accurate check to be made. Suspend the plumb bob from the appropriate reference points on the body and carefully mark the floor at each location. Connect these points by a chalk line and then draw a line through the intersecting points of the diagonals.

Finally, check the dimensions between the front and rear side members.

Wheel Alignment (unladen)

Castor	1° 30′ to 3° 0′
Camber	0° 30′ to 2° 0′
King pin inclination	4° 45′ to 6° 15′
Toe-out on 20° turns	1° 36′ to 3° 6′
Toe-in	$\frac{1}{8}$ in. to $\frac{3}{16}$ in. (3.17 to 4.76 mm.)

METRIC EQUIVALENTS (IN DIMENSIONAL SEQUENCE)

Inches	*Centimetres*	*Inches*	*Centimetres*	*Inches*	*Centimetres*
$\frac{1}{64}$	0.04	$11\frac{31}{32}$ to $12\frac{1}{32}$	30.40 to 30.56	$37\frac{11}{64}$ to $37\frac{23}{64}$	94.42 to 94.89
$\frac{1}{32}$	0.08	$12\frac{5}{32}$ to $12\frac{5}{16}$	30.87 to 31.27	$37\frac{3}{8}$	94.93
$\frac{3}{32}$ in 18	0.23 in 45.72	$16\frac{5}{64}$	40.64	$39\frac{9}{64}$	99.42
$\frac{19}{64}$	0.75	$16\frac{1}{8}$	40.96	$40\frac{17}{32}$	102.95
$1\frac{1}{8}$	2.86	$16\frac{3}{4}$	42.54	$40\frac{29}{32}$	103.90
$4\frac{3}{8}$ to $4\frac{29}{64}$	11.11 to 11.31	$21\frac{25}{32}$ to $21\frac{27}{32}$	55.32 to 55.48	$43\frac{33}{64}$ to $43\frac{41}{64}$	110.53 to 110.85
$4\frac{59}{64}$ to $4\frac{63}{64}$	12.50 to 12.66	$22\frac{7}{16}$ to $22\frac{15}{32}$	56.99 to 57.07	$44\frac{23}{64}$	112.67
$5\frac{15}{16}$ to 6	15.08 to 15.24	$23\frac{63}{64}$ to $24\frac{1}{64}$	60.92 to 61.00	$57\frac{11}{32}$	145.65
$6\frac{53}{64}$ to $6\frac{57}{64}$	17.34 to 17.50	$25\frac{19}{64}$ to $25\frac{23}{64}$	64.25 to 64.41	$68\frac{35}{64}$ to $68\frac{23}{32}$	174.11 to 174.55
7	17.78	$29\frac{5}{64}$ to $29\frac{13}{64}$	73.86 to 74.17	$90\frac{1}{2}$	229.87
8	20.32	32	81.28	$141\frac{35}{64}$	359.53
$8\frac{13}{16}$ to $8\frac{7}{8}$	22.38 to 22.54	$32\frac{15}{32}$ to $32\frac{1}{2}$	82.37 to 82.55	$144\frac{25}{32}$	367.74
$9\frac{7}{32}$ to $9\frac{1}{4}$	23.41 to 23.49	$36\frac{5}{32}$	91.84		
$11\frac{59}{64}$ to $11\frac{15}{16}$	30.28 to 30.32	$36\frac{31}{32}$ to $37\frac{1}{2}$	93.90 to 94.06		

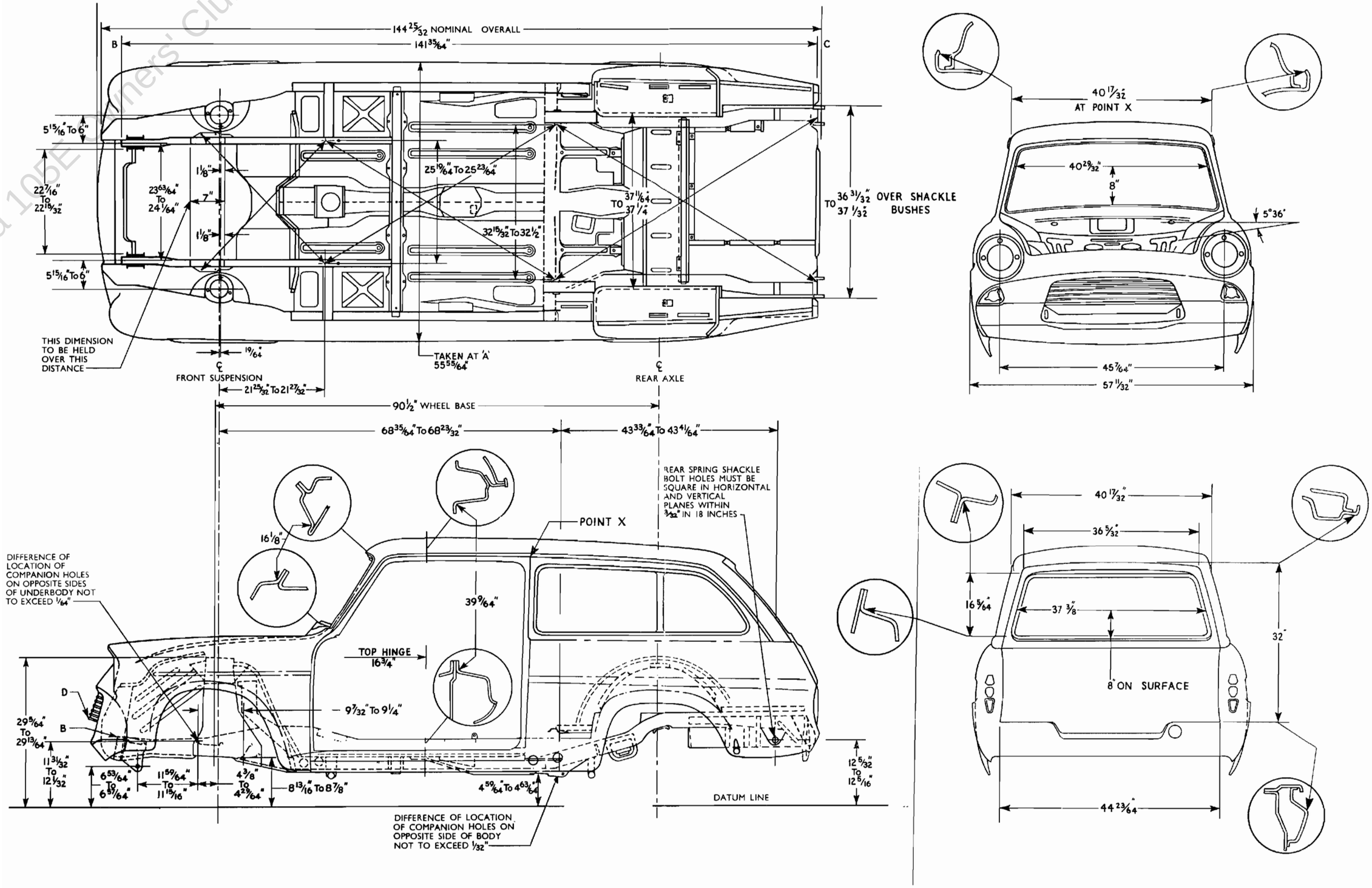

Fig. 1 **Body Tolerance Chart** (Estate Car)