THE CASSELL BOOK OF THE
AUSTIN A35 (1957–9)
Cassell Motoring Series

By Ellison Hawks

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Austi N A35
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Ellison Hawks

Cassell London
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PREFACE

THE PURPOSE OF THIS BOOK is to describe in simple language how the owner-driver may obtain the best possible satisfaction from his Austin A35.

The inherent reliability of modern cars may sometimes tempt owners to neglect the routine maintenance so necessary if the best performance is to be obtained. Neglect reduces efficiency and causes both appearance and mechanism to deteriorate, thus rendering a breakdown on the road more probable. The efficient running, reliability and length of life of any car are determined by the attention given to it.

This book is written for the owner who takes pride in the appearance of his car, and who is able to devote the relatively small amount of time necessary to maintain it in first-class order. The jobs involved are for those who subscribe to the ‘Do it Yourself’ vogue.

Minor running adjustments may be required from time to time. The old proverb that ‘a stitch in time saves nine’ is very true, for neglect may lead to expense that might have been avoided had the owner been familiar with some small routine attention.

Detailed instructions are given so that lubrication may be carried out regularly and thoroughly. A section has been devoted to overhauling to the extent possible by the average mechanically-minded owner. When extensive attention is necessary, however, it is generally advisable to allow your local Austin dealer to do the heavy work. He has better facilities to handle such jobs. His staff is thoroughly familiar with all Austin models, can diagnose symptoms of failure and suggest remedies. The Austin Motor Co. Ltd. give a course of training and instruction to selected
mechanics from dealers' staffs, and owners are advised to make use of the expert knowledge thus gained.

Another point to bear in mind is that the Company has gained considerable experience from years of research. Naturally, it stresses that only genuine Austin replacement parts are used when necessary.

A few readers may feel that some of the information given is elementary. Experience shows, however, that often the minor point is the one that is overlooked, due to lack of knowledge of its importance or unfamiliarity with a particular feature. This can give rise to inconvenience due to delay on the road, as well as expense in upkeep.

This book is not published by the Austin Motor Co. Ltd., who have no responsibility for it. At the same time I would tender my thanks to them for the assistance they have given, and for supplying illustrations and technical data.

ELLISON HAWKS

Victoria House,
Southport

CHAPTER I

INTRODUCING THE AUSTIN A35

THE AUSTIN A35 is another outstanding example of a popular light car designed to give comfortable transport at low running cost. Equipped with the most up-to-date developments, it also has the commodious luggage space so necessary for touring. Suspension incorporates semi-elliptic leaf-springs at rear, and independent front wheel coils and wishbones at front. The driver has a clear view of the road ahead, and controls fall readily to hand.

There are two touring models—the two-door and four-door saloons, and three other types—the A35 Van, Pick-up and Countryman.

Mechanical design follows typical Austin practice in that the car is simple to maintain. Construction is such that it can be relied on to give many years of care-free motoring. Driver's bucket seat is adjustable to five positions and passenger's seat to three positions, thus meeting requirements of individual drivers and passengers and ensuring that long-distance travelling imposes a minimum of fatigue.

Once the car is in use it is the responsibility of the owner to keep it in good condition by careful attention to lubrication and maintenance. The main components are described briefly in the general specification given below.

Engine

Engine, identical in all models, is of the usual four-cylinder four-stroke type. Bore, 2·48 in. (62·9 mm.) and stroke 3·00 in. (76 mm.). Capacity: 57·82 cu. in. (948 c.c.) giving 34 b.h.p. at 4,750 r.p.m. with a maximum torque of 50 lb./ft. at 2,000 r.p.m. Compression ratio: 8·3 to 1.

Cylinders are cast en bloc and, with upper half of the crankcase, provide a rigid mounting for the three main bearings carrying the counterbalanced crankshaft. This construction ensures the least possible vibration.

A detachable cover gives ready access to overhead-type
push-rod operated valves. Oil seals are fitted to prevent oil reaching the combustion heads by way of the valve guides.

The camshaft, which is on the near side of the engine, is driven by a duplex roller chain. It incorporates a special rubber insert in the sprocket to ensure silent running and correct chain tension. The overhead valves have a simple screwed rocker adjustment. The totally enclosed valve mechanism is lubricated from the engine, thus reducing adjustment to a minimum. The rocker shaft bearings are lubricated under pressure from the oil pump.

The overhead-valve rockers have a passage along which oil is fed to an outlet at the spherical ball-end, this latter fitting into the correspondingly shaped end of the push rod. Oil at this point naturally obviates wear but also, as it is delivered under pressure, it takes up the small clearance purposely provided between the end of the valve and the rocker tip thus minimizing valve noise.

The four I-section connecting rods carry gudgeon pins locked in the little-end eyes by clamp bolts. As the gudgeon pins are not free to turn in the connecting-rod little-end eyes, it is unnecessary to provide circlips or pads to take care of endwise pin movement.

The big-end bearings are provided with small holes to permit oil to reach the cylinder walls, thus assuring an adequate supply of lubricant under all operating conditions and particularly when the engine is cool.

The dish-headed pistons are of a special aluminium alloy with aluminate surface to ensure efficient lubrication, the skirts being of the split type. There are four rings: the uppermost is a plain compression ring, the second and third are taper compression rings, and the bottom ring is an oil-controlled slotted scraper ring.

Lubrication by pressure is developed by a submerged-type oil pump situated in a housing that contains two intermeshing gears driven from the camshaft. Oil is constantly passed through an external filter mounted on the offside of the engine and cleaned by a filter element before it returns to the sump. Should this filter become completely choked, the oil flow to the various bearings would not be interrupted although the purpose of the filter would be lost. Instead of the oil passing through it to be cleaned, the filter would be by-passed.

Oil is also supplied under pressure to the crankshaft main bearings, big-end bearings, camshaft, and overhead-valve gear. A special arrangement is made for the front camshaft bearing to provide oil to the timing chain. The pump itself has a filter that prevents the ingress of larger particles of carbon or other foreign matter. The external filter takes care of small particles in suspension in the oil stream.

The oil sump has a capacity of 6 pints. When the oil filter has been renewed an extra pint will be required to

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**FIG. 1.—LEADING DIMENSIONS OF THE A35**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>ft. in.</th>
<th>Dimension</th>
<th>ft. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedal to seat squab</td>
<td>A 12 1/2</td>
<td>Overall height</td>
<td>N 4 11/16</td>
</tr>
<tr>
<td>Steering wheel to seat squab</td>
<td>B 10</td>
<td>Overall length</td>
<td>O 11 4/16</td>
</tr>
<tr>
<td>Distance between seats</td>
<td>C 7</td>
<td>Overall width</td>
<td>3 9/16</td>
</tr>
<tr>
<td>Rear seat cushion depth</td>
<td>D 1 1/2</td>
<td>Scuttle width</td>
<td>3 9/16</td>
</tr>
<tr>
<td>Height over rear seat</td>
<td>E 2 11/16</td>
<td>Body width between centre pillars</td>
<td>3 11/16</td>
</tr>
<tr>
<td>Maximum interior height</td>
<td>F 4 1</td>
<td>Rear seat width</td>
<td>2 11/16</td>
</tr>
<tr>
<td>Height of front seat</td>
<td>G 3 1</td>
<td>Body width over rear seat</td>
<td>3 10</td>
</tr>
<tr>
<td>Height of door opening</td>
<td>H 3 1/2</td>
<td>Wheelbase</td>
<td>6 7/8</td>
</tr>
<tr>
<td>Front seat cushion depth</td>
<td>I 1 5/8</td>
<td>Track, front (at ground level)</td>
<td>3 9/16</td>
</tr>
<tr>
<td>Front seat cushion width</td>
<td>I 7 1/2</td>
<td>Track, rear</td>
<td>3 8 1/2</td>
</tr>
<tr>
<td>Steering wheel to seat cushion</td>
<td>J 5</td>
<td>Ground clearance</td>
<td>6 1/2</td>
</tr>
<tr>
<td>Front seat cushion above floor</td>
<td>K 1 2</td>
<td>Turning circle</td>
<td>35 0</td>
</tr>
<tr>
<td>Rear seat cushion above floor</td>
<td>L 1 11/16</td>
<td>Luggage compartment : Height of opening</td>
<td>1 8</td>
</tr>
<tr>
<td>Approximate weight unloaded</td>
<td>13 3/4 cwt.</td>
<td>Minimum width of opening</td>
<td>2 6 1/2</td>
</tr>
<tr>
<td>Approximate weight laden (including oil and water, less fuel)</td>
<td>13 3/4 cwt.</td>
<td>Depth</td>
<td>1 6</td>
</tr>
</tbody>
</table>

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INTRODUCING THE AUSTIN A35
compensate for the amount normally retained in the filter and circulating pipes. To enable the engine-oil level to be readily determined, a dip-stick is fitted on the offside of the engine near the distributor.

The engine and gearbox, bolted together to form a single unit, are mounted on rubber pads. This type of mounting not only insulates sound but also absorbs vibration from the power unit. The front engine mountings also incorporate rubber pads to control undue movement that may tend to occur under certain conditions.

The water in the cooling system is circulated by a centrifugal pump built into the front of the cylinder block and driven by a V-type belt from the crankshaft pulley. It is controlled by a thermostat fitted in the water outlet at the front end of the cylinder head. Its working is entirely automatic with a normal operating temperature of 164°F.

The radiator incorporates a chamber in the header tank to prevent loss of water due to expansion. A fan, mounted on the pump shaft, draws air through the radiator core to assist cooling. The water capacity of the cooling system is 84 pints.

Two drain taps are provided to allow the system to be drained in frosty weather if an anti-freeze solution is not used.

Carburettor

The Zenith carburettor (Model 26 VM6) of down-draught type on near side of engine, has a choke for easy starting. Fuel fed by a pump operated by the camshaft is drawn from the tank mounted at the rear of the car. The fuel capacity of the tank is 5½ gallons.

The A.C. oil-wetted air cleaner fitted to the carburettor is efficient in reducing noise due to the rush of air entering the carburettor particularly when accelerating. It also has the advantage of preventing grit from being drawn into the engine where it can cause premature wear. A pipe leads from the valve cover to the air cleaner so that oil fumes from the engine do not reach the body. Instead, they are drawn into the engine by the natural suction at this point.

An electric-type petrol contents gauge is mounted on the dashboard so that the driver can see at a glance the level of the fuel in the tank. This gauge will only read when the ignition is 'on'.

Clutch

The Borg and Beck single dry-plate clutch has a spring-loaded friction disc giving smooth engagement. The clutch-release bearing is of the carbon type, requires no lubrication, and will operate indefinitely without attention provided that the clutch pedal free movement is correctly adjusted. This linkage is so designed that little effort is required to free the clutch. When necessary, the ¾ in. adjustment of the free-pedal travel is a simple matter.

Gearbox

The gearbox, of unit construction with the engine, is bolted directly to the flywheel housing. It has four forward speeds and reverse with remote central lever control.

There is synchro-mesh engagement on second, third and top gears, making gear-changing easy and effortless.

The gears are of the helical type, ensuring a considerable degree of silence as well as great strength. A pair of helical gears transmit drive to speedometer through a flexible cable. This arrangement ensures automatic lubrication for drive gears as well as obviating the need for any adjustment.

Oil capacity of gearbox: 2¾ pints.

Transmission

The drive from the gearbox to the rear axle is by an open-type propeller shaft at each end of which is a Hardy-Spicer universal joint with needle roller bearings. At the front end of the shaft is a splined member that engages in a correspondingly splined part of the universal joint. With the rise and fall of the rear axle, the propeller shaft is free to move slightly at the splined end, so taking up the change in length that occurs due to this movement.

Rear Axle

A 'banjo'-type housing construction results in a rear axle that is rigid yet light. The axle shafts are of the three-quarter floating type, splined at their inner ends and readily detachable. On the axle-housing ends the hubs
are mounted on ball races. A flange formed on each axle-shaft outer end is bolted to the hub to impart the final drive.

The crown wheel and pinion are of spiral bevel design, the pinion being mounted on taper roller bearings. The differential is of the two-pinion type and mounted on a single centre spindle. The cage is mounted on combined journal and thrust ball bearings, provision being made for mesh adjustment.

The oil capacity of the rear axle is 1½ pints.

**Braking System**

The Lockheed braking system employs hydraulically-operated leading brake shoes on the front wheels and mechanically operated brake shoes on the rear. The mechanical linkage is actuated by means of a hydraulic cylinder and stirrup mounted under the body. A pull-up type of handbrake operates directly on the mechanical linkage to the rear wheels.

The front wheel brakes consist of two leading shoes. Those of the rear have one shoe of the trailing type and the other leading. This combination—two leading shoes at the front and single leading at the rear—results in extremely efficient braking.

Brake-shoe lining wear is taken up by a simple means. The brake shoes can readily be examined by drawing off the brake drums, these being so mounted that the hubs do not have to be dismantled for this purpose.

**Steering**

The steering, of the cam-gear type, is a self-contained unit of extreme simplicity with a ratio of 12:1. The steering box is mounted forward of the toeboard and provides a short steering column of great rigidity.

**Body**

The body of the A35 is essentially a single unit and does not require a chassis frame. The engine, gearbox, and front and rear suspension units are anchored to the reinforced body shell. This is made up of six major sections welded and riveted together to form a box section of great rigidity.

The body itself is of all-steel unitary construction with fully stressed skin. Its number will be found on the top left of the scuttle in the engine compartment.

Suspension at the front is independent for each wheel. This is achieved by coil springs and 'wish-bone' with members of unequal length, a compression spring being interposed. A double-acting Armstrong hydraulic piston-type shock absorber is incorporated on each side in the upper wish-bone member.

The rear road springs, of the multi-leaf semi-elliptic type, are under-slung beneath the axle housing to give a low body mounting. The spring-eyes, with their rubber-bushed shackles, do not require any lubrication. The lubricators at the centre of the upper rear shackles should periodically be given attention.

An anti-roll bar—a device to limit body roll when cornering—is fitted to the rear axle. It consists of a U-shaped steel bar mounted so that its two arms point to the rear. Each arm is bolted to the shock-absorber lever arm and thence connected, through rubber-bushed links, to the axle housing. A fuller description of this ingenious device is given on page 60.

The four hydraulic shock absorbers assist in damping out road shocks and in conjunction with the independent front suspension help to give a comfortable ride.

The pressed-steel road wheels have ventilation slots pierced in their discs adjacent to the rim to permit air to cool the brake drums.

Extra low-pressure 520—13 tubeless tyres are fitted.

**Electrical Equipment**

Lighting and starting equipment is of the 12-volt type. The 43-amp. hr. battery (at 20-hr. rate) is fitted on the engine side of the bulkhead where it is readily accessible.

The generator is ventilated to prevent it becoming too hot. Output is automatically controlled by a regulator according to the requirements of the system.

The starter motor is mounted on the off side of the engine, rotating it as required by a small pinion automatically brought into and out of mesh with the flywheel ring gear.

The ignition system is of the high-tension type, with
distributor and rotor readily accessible both for contact-breaker gap setting and for timing.

Ignition switch, mounted on the dash, is locked ‘off’ when the key is removed.

Automatic advance and retard are controlled centrifugally by the engine speed. A vacuum-assisted device enables an appropriate degree of advance to be made according to the load.

The lighting equipment consists of two 42/36-watt headlamps mounted in each front wing, and two 6-watt sidelamps mounted on top of the wings. The switch for the lights, located on the right-hand side of the steering column, is turned clockwise to the first notch for the side and rear lights, and to the second notch to dip the headlamps. The third notch brings the headlights to the normal full-ahead position.

A warning light on the facia panel is illuminated when the headlamp beams are in the full-ahead position. This serves as a warning that on-coming traffic may be dazzled and that the headlamps should be dipped.

The twin stop and tail lamps are automatically switched on when the brake pedal is depressed.

Under the facia panel is a courtesy light to illuminate the car floor when the doors are opened.

The instrument panel is lit by concealed interior lamps only available when the side lights or headlamps are in use.

Switching on of these panel lights indicates that the sidelamps have also been switched on.

There is a warning lamp to show the driver if the ignition has been left on with the engine stationary. It also shows if the generator is not charging.

The trafficators, of the solenoid-operated type, are controlled from a switch to the right of the steering wheel in early models, and at the centre of the dashboard in later models.

The windscreen wipers are electrically operated and have a separate control.

The heater, when fitted, circulates heated air by means of a small electric fan controlled from the facia panel.

The electric horn is controlled from the centre of the steering wheel and operates independently of the ignition switch.

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**CHAPTER II**

**FOR THE BEGINNER**

The following hints are given in the hope that they may be helpful to a new driver who it is assumed is already familiar with the rudiments of road courtesy. There are not only the niceties of driving that are to be learned from experience, but also various detrimental practices that may result in reducing potential performance and duration of the normal life of the car.

This chapter describes some of the correct methods of procedure. If at the outset you are not clear about the habits to avoid, you may train yourself to adopt a technique that will not only enable you to obtain the best from your A35 but will also avoid undue mechanical wear and tear.

Although an inanimate object a car requires to be conscientiously looked after as much as a horse or a dog. By following the instructions you will find that you are amply repaid for care and attention by enjoying the many thousands of miles of pleasurable motoring that lie ahead.

First let us refer to the instruments and controls illustrated in Figs. 2 and 3, by sitting in the car with the relevant illustrations available. It is important to be able to find, and use, any appropriate control without hesitation.

The ideal to attain is to be able to place the hand or foot on the control desired without the necessity of removing the eyes from the road. Obvious as this advice may seem, it is surprising how many drivers find it necessary to look for any particular control they want. In the congested state of the roads at the present time, and bearing in mind the normal road speed of traffic, you must have supreme confidence not only in your car but also in your ability to operate the various controls swiftly and automatically. At night you cannot expect to control your car efficiently if you must have the interior top light switched on so that you can determine the position of the gear or brake levers. It is also important to know how the control should be operated in order to give the necessary
results. By carefully practising, you will increase your ability to control the car on the road by day or night until the operation becomes automatic.

Within certain limits the positions of both front seats can be adjusted nearer to or farther from the steering wheel by operating a hand lever and catch on the outer side of each seat. The seats may be moved and locked in the desired positions when the control is released.

The adjustment of the driver's seat should be such that both the clutch and foot-brake pedals can be operated with ease. Make sure that the locking device does actually engage one of the slots in the runners, otherwise the seat may move rearwards unexpectedly if pressure is applied to, say, the brake pedal. An unsuitable position may easily lead to fatigue or even to cramp, particularly on long journeys. It will reward you to spend a few moments in selecting the most comfortable adjustment.

To deal with the foot controls; that at the extreme left is the clutch pedal (4, Fig. 3). When pressed fully forward it disconnects the drive from the engine. Carefully allowing it to return gradually with the engine in gear connects the power of the engine to the gearbox and thence to the rear axle, thus causing the car to move forward.

Make an inflexible rule never to rest the foot on the clutch pedal except when necessary to operate it. Some drivers tend to use it as a foot-rest, a habit to be avoided, for it not only causes the clutch mechanism to wear unnecessarily but can contribute also to clutch slip. This will necessitate an expensive repair job and also embarrassment when you cannot get the car home!

The pedal in the centre is the footbrake (5, Fig. 3). This pressed forward applies the hydraulically operated brakes on all four wheels, so bringing the car to rest.

On the extreme right is the accelerator pedal (7, Fig. 3). This pedal is connected by a short cable and conduit to the carburettor. Pressing the pedal forward opens the throttle, causing the engine speed to increase and the car to move faster when travelling along the road.

These are the only controls for which the driver uses his feet. In conjunction with the steering wheel, they are the driving controls.
Dashboard Controls and Instruments

The instrument panel is well placed and as will be seen the layout is essentially practical. The main instrument is the easily read speedometer that indicates the road speed of the car. Below the 40 mile per hour figure is a small panel showing the total mileage covered.

Above the 20 miles per hour figure on dial is the warning light that glows red when headlight beams are directed full ahead (3, Fig. 2). When beams are dipped it is extinguished by turning light switch to second position.

In centre partition below speedometer is the petrol gauge (11, Fig. 2) showing petrol level when ignition switch is 'on'. When filling up with fuel, switch on ignition and gauge will record rise in tank level as fuel is supplied from the garage pump.

To the left of the fuel gauge is the oil-pressure warning light. This light (4, Fig. 2) glows green when ignition is switched on and is extinguished when engine is started and oil pressure builds-up. Should this light come on at normal running speeds the engine should be stopped immediately and a check of the oil level made, otherwise severe damage to the engine may result. So fool-proof is the oil-pressure system, however, that this normally would not occur. It is important to realize that this warning light gives no indication of the quantity of oil present in the sump—it merely shows that pressure is in the system. If you round a corner and the oil-pressure light flickers it may be regarded as a warning that the sump level is unduly low. Your daily oil check by the dip-stick (see page 19) should ensure that oil is maintained at the correct level.

The ignition warning light (12, Fig. 2) is situated to right of fuel gauge. This light glows red when ignition is switched on and when the engine is stationary or idling, to indicate that current is being drawn from the battery. When the engine speed is increased the light is extinguished, indicating that the generator is charging the battery. Should the engine stop without it having been switched off the light warns that ignition remains on and that the battery may become unduly discharged. If the light glows when the engine is running at its normal speed it is an indication that the generator is not charging. Investigation should be made to establish the fault. The car should not be driven for any lengthy period with the generator not charging or the battery will become discharged.

If a radio is fitted it may be placed below instrument panel with loud-speaker in pocket to left of speedometer.

The two controls (6 and 9, Fig. 2) above demister controls are respectively windscreen wiper and panel light switch.

To start wipers, switch on control W. To park wipers switch off when arms are at the end of their stroke. Do not push the arms across the windscreen.

When control is turned 90° the blades start to work. The wipers are driven by a motor and gearbox mounted under the bonnet, coupled to a flexible cable rack mechanism that transmits drive to wiper spindles. Mounted at bottom of windscreen, they are so placed as to clear wide arcs in front of driver's and passenger's seats. An interesting safety feature incorporated in wiper motor eliminates any possibility of damage to mechanism should wiper blades jam—as, for example, on ice or packed snow. The motor will automatically restart when the obstruction is cleared. Switch off when blades are at their end of travel. Do not attempt to push them across by hand, or drive mechanism may be damaged. Wiper motor can be operated only when ignition is switched on.

Panel light control (9, Fig. 2) turns through 90° to switch on concealed lights to illuminate instrument panel. This switch will operate only when sidelights are 'on'.

Below parcel tray is heater and demister control for use when these accessories are fitted. As with radio, heater is an optional extra. Instructions for operating the controls are given on page 132.

Below speedometer is key-operated ignition switch (10, Fig. 2). Turn clockwise for 'on' and anti-clockwise for 'off'. As previously explained, switching-on of ignition illuminates warning light and also brings into circuit other accessories. Ignition key cannot be withdrawn until switch is 'off'. Do not leave ignition 'on' with engine stationary. The same key is used to lock the driver's door.

At each side of speedometer are two further controls. That at the left is the choke control (1, Fig. 2). When starting from cold this control should remain fully pulled...
out until engine fires. Directly engine is running, partly push in knob so that a medium-rich mixture is available for warming-up.

It is good practice to push control home as soon as possible, otherwise the unduly rich mixture drawn into engine will dilute the oil and contribute to cylinder wear at a greater rate than normal.

In a corresponding position to choke control, but on right (15, Fig. 2) is starter-motor control. This will not operate until ignition is switched on. Starter motor engages and disengages without any action on driver's part, other than pulling of control outwards.

Two important points to bear in mind are that this control should never be operated when engine is running or when car is in gear. Apart from the fact that this would make a heavy drain on battery, the car will lurch forward. This can be dangerous should anyone be standing in front.

Should engine fail to start or suddenly stop do not again operate control until it has come to rest, otherwise damage may be caused to the ring gear on flywheel or to starter-motor pinion drive.

If engine does not start at first few turns, do not keep starter in action for any considerable length of time or battery will be run down.

Instead, find out what is wrong by referring to fault-finding chart on page 218.

Combined lighting and dip switch is mounted on an arm extending to the right below steering column (2, Fig. 3). Turning this clockwise to first notch switches on side and tail lights; to second, headlights in dipped position; and the third, headlights to full ahead. As previously explained, the light at top of speedometer face is illuminated when headlights are at full-ahead position and is extinguished when they are dipped.

The horn button (3, Fig. 3) is in centre of steering wheel and can be operated when ignition switch is off.

Flasher indicator control is mounted at centre of panel and above speedometer. Move it clockwise to show turning right and anti-clockwise for left. A warning light incorporated with switch shows when flashers are in use.

Gear Lever

The gears are operated by a direct-acting lever located centrally in a turret mounting directly under the dashboard. The head of the gear lever falls naturally to the left hand and provides a direct and positive gear control. Reference to Fig. 4 will show that the gear lever has a central neutral position and in this it has a considerable amount of horizontal play. With engine stationary it may not be possible to move the lever into the various positions since the gear wheels may be ‘edge on’. If the engine is running, therefore, remember to depress the clutch pedal whilst you are moving the gear lever so as to get ‘the run of the gears’.

To engage first gear press the gear lever to the left and move it forward. For second gear draw the lever backwards through the neutral position, keeping it to the left-hand side. To change into third from second, push the lever forward into neutral, move it to the right and then forwards when it will be in the required position. For top gear, draw the lever backwards keeping it pressed towards the right hand side. To engage reverse gear raise the lever
by pulling it upwards against the spring pressure, move it fully to the right and then rearwards. The resistance by spring pressure prevents its being engaged accidentally.

The handbrake lever is to the right of the driver’s seat adjacent to his right hand. It is of the pull-on type, the lever being pulled up and rearwards to apply the brake to the rear wheels. A ratchet locks the lever in the ‘on’ position by a trigger and a pawl. By squeezing this trigger the pawl is disengaged and the handbrake is released.

Sometimes, and particularly if the brake has been applied with some force, it is necessary to take the weight off the rear wheel brakes either by pressing the foot-brake pedal or by drawing the handbrake slightly harder on and then clearing with the trigger.

There are two tips you may like to know. If you want to apply the handbrake very securely, press down the foot-brake pedal at the same time pulling the handbrake lever on. The leverage obtained on the foot-brake is rather greater than that developed by the handbrake lever and this method of application may be found helpful particularly in cases where the car is left on a gradient. If the handbrake cannot readily be released, press down the foot-brake pedal; this will be found of assistance in releasing the pawl.

The doors of the A35, either the two- or four-door model, may be opened from either inside or outside. The passenger doors can be locked from the inside by raising the inside handles upwards beyond the normal position. The driver’s door is locked from the outside with the ignition key. When thus locked, and with handles of other doors raised, no doors can be opened. This position also locks automatically the sliding front door windows, when they are raised. Remember to shut all the windows sufficiently to prevent anyone from inserting a stick to release one of the inside door handles and so gain entrance to the car.

It is useful to make a note of the code number of the ignition key so that you may be able to obtain a replacement without delay should the need arise. A duplicate key can be obtained at any time through your dealer.

The luggage compartment boot has a lock that accepts the ignition key enabling you to leave your luggage in the car when necessary.

There are several body fittings that will be found convenient and helpful. For instance, a visor fitted to the roof above the windscreen on the driver’s side, and capable of being readily hinged down, reduces glare from the sun. It can also be moved sideways within limits and is spring-loaded to provide the necessary degree of friction to retain it in the desired position.

Checking Radiators

Before taking the car on the road at least two checks should be made. There must be sufficient water in the radiator and the engine-oil level must be near the ‘Full’ mark on the dip-stick—not more than $\frac{1}{2}$ in. below it.

Normally, it will not be necessary to attend to these matters every time the car is used but both these points should be checked periodically. Grasp and hinge forward the ‘A’ motif on the bonnet front. This releases the bonnet catch and allows the bonnet to be lifted slightly. It cannot be fully raised because it is retained by a safety catch that can be released by inserting the fingers (Fig. 5).
The bonnet can be held open by using the strut clipped to its underside and hinged downwards. There is a cup-shaped depression in the top of the radiator into which the lower end of the strut can be fitted. The bonnet is locked in the closed position by pressing it fully downwards. If it is not so secured the safety catch will prevent it rising but it probably will vibrate and rattle until such time as it is pressed fully home.

The radiator filler cap is removed by turning it anticlockwise and pressing it fully downwards. Add water if required, filling so that the level is just below the top of the filler-plug threads when the engine is cold. Preferably, use rain water—this contains no harmful deposits—for in some areas tap water can tend to fur formation. Replace the cap securely. You will notice that it is of the pressurized type, a detail dealt with more fully in Chapter X.

**Checking Engine Oil**

The engine-oil level can readily be checked by first removing the engine dip-stick fitted on the near side of the engine at the front. It is as well to have the car on level ground when checking the oil level otherwise a misleading reading will result. After the dip-stick has been pulled out, wipe the lower end and replace the stick pushing it home. On again withdrawing it you will see that the oil level is indicated on the scale by the oil marking (Inset, Fig. 6). If necessary, add sufficient oil to bring the amount to the full mark.

A point to note is that whilst the level should never be allowed to fall unduly, do not add so much oil that the full mark is exceeded. Apart from causing over-oiling, this excess oil will be wasted.

Do not be tempted to use inferior or unsuitable lubricating oils for these not only contribute to difficult starting—since the engine may become too stiff to turn—but they often prove expensive in the long run because of their inferior lubricating properties.

By switching on the ignition the state of the petrol supply will at once be evident by the reading on the fuel gauge. Should the car have been standing for any length of time the carburettor float chamber may have become empty. The fuel pump has a priming lever fitted to it, and with it you can easily supply fuel to the float chamber without turning the engine (see page 117). To prime the carburettor pull the lever upwards several times. If it is felt to operate freely it may mean either that the float chamber is already full or that the diaphragm is held down by its operating cam. In the latter case, turn the engine through one revolution with the starting handle when the diaphragm will return to the released position. Then operate the priming lever again, ceasing to do so when it is felt to work freely for this means that the carburettor float chamber is filled to the correct level.

Close the bonnet, making sure that the catch secures it, and you are ready to drive away.
Starting the Engine

After taking your seat see that the handbrake lever is on, i.e. pulled up, and that the gear lever is in the neutral position—that is, where it can be easily moved sideways through its central position. This is important as accidents have been caused by failure to take this routine precaution.

When starting from cold, particularly during frosty weather, it is helpful to turn the engine by the starting handle a few times before switching on. This relieves its initial stiffness and greatly reduces the load both on the starter motor and—much more important—on the battery. It is also good practice to press down the clutch pedal for this again reduces the load and eliminates the drag of the oil on the gear wheels.

If the engine is cold, pull out the choke control. This is held frictionally in any intermediate position if turned. Pull the starter knob and the engine should soon commence to run. Directly it does so, release the starter control. If the engine 'cuts out' and stops do not again use the control until the engine is at rest otherwise the drive of both starter and flywheel may be damaged.

When the engine is running, gradually release the choke, resisting the temptation to keep it in use longer than is necessary under the impression that the engine will warm up more quickly if this is done. It is better practice to drive away slowly since the engine will then warm up, allowing the choke to be fully released sooner. By adopting this procedure not only will the lubricating oil retain its properties longer, because it will not tend to become diluted by excess petrol, but petrol will not be wasted.

Starting When Warm

Once the engine is warmed up it is not normally necessary to use the choke and, of course, the accelerator must be left in the normal idling position. If it is pressed down, so opening the throttle, not only will the idling jet be rendered inoperative—since it relies for its action on the suction set up by the virtually closed throttle—but the accelerating pump may inject petrol into the manifold and cause difficult starting should the mixture become too rich.

This matter is covered more fully when we deal with the Carburettor (Chapter VIII).

If the engine has cooled down a little it may be found advisable to use the choke momentarily. If so, beware of having the mixture too rich for then the plugs may be short-circuited with petrol and no spark will occur. If this happens, push in the choke control fully at the same time pressing down the accelerator so that as the engine turns the unduly rich mixture will be cleared. As soon as the engine commences to fire, gradually release the choke when it is felt to pick up speed and again run normally.

If the engine still refuses to start remove the plugs for cleaning. The simplest method of treating sparking plugs that have become wetted with petrol as the result of 'over-choking' the engine is to place them on the ground with their 'business-ends' together, apply a lighted match and allow the petrol to burn off. If you have that most useful accessory a 'file-card', brush them up with this; otherwise wipe away the soot with a rag. Before replacing them in the engine make sure that the gap between the points is not bridged with carbon or fluff from the rag.

The golden rule is to use the choke with discretion.

Driving Hints

Before you can take the car on to the road you must obtain a provisional driving licence so that you may be taught to drive by an experienced friend or by one of the many motoring schools instructors. Until you have passed the official driving test you must always be accompanied by a driver who holds a current driving licence. It is most desirable to take your lessons with some competent driver among your acquaintances or at a school with a good reputation. Even so, the following instructions may well be set down and borne in mind:

To start from rest, first press down the clutch pedal and move the gear lever to the bottom-gear position by pressing it fully towards the left and then forwards. You may find that the lever will not readily enter the bottom-gear position. If this occurs, return it to neutral, momentarily engage the clutch, declutch and again move the gear lever to the bottom-gear position when it should fully engage. This
difficulty sometimes arises due to the fact that the sliding gear teeth are 'edge on' to each other and thus cannot mesh. Allowing the clutch pedal to engage momentarily alters their relative positions and so permits them to engage.

Now release the handbrake lever, first pulling it upwards slightly to ease the pressure, squeeze the trigger to free the ratchet and push the lever forwards and downwards. If it is difficult to release the holding ratchet, press firmly on the foot-brake pedal to relieve the tension on the hand-brake linkage.

Press down the accelerator slightly at the same time allowing the clutch pedal to come gently up and the car will move forward as the clutch engages. The first point to note is that the simultaneous actuation—one up and one down—of the clutch and accelerator pedals is not easy and possibly uneven clutch engagement may ensue. Persevere, however, for it is only mastered by experience. Bear in mind that the hallmark of a good driver is smooth clutch engagement and that harsh clutch engagement is harmful for it causes severe mechanical stress.

**Gear Changing**

When the car is moving forward steadily it will be necessary to change into second gear. One of the main bugsbears of the novice—gear changing—is almost entirely eliminated by the synchromesh device.

To change from first to second gear, allow the accelerator to return to its closed position at the same time pushing down the clutch pedal as far as it will go. Then, without undue haste, move the gear lever rearwards maintaining a steady pressure on the lever. A slight resistance may be felt but maintain the pressure on the knob. When the synchromesh device has come into action the gears will mesh and second gear will be engaged noiselessly. Allow the clutch pedal to return gently. At the same time press down the accelerator when the car will move forward with increased speed.

To change from second to third similarly release the accelerator and depress the clutch pedal. Move the gear lever deliberately forward into the neutral position main-

taining a pressure to the right through the gate and then forward into third speed. Allow the clutch pedal to return and control the speed of the car by the accelerator pedal.

The final change into top gear is effected by releasing the accelerator pedal, depressing the clutch pedal, and moving the gear lever rearwards into top-gear position, maintaining a pressure on the lever towards the right-hand side.

Practise gear changing in this manner until the car moves forward smoothly and steadily after each gear change. Carefully synchronize pedal movement to ensure smooth engagement in all circumstances.

**To Change Down to a Lower Gear**

It is equally necessary to learn how to change down from a higher to a lower gear. This is essential when climbing a hill that normally the car could not ascend in top gear or whichever other gear may be in use at the time. Also, traffic conditions may necessitate travelling more slowly than normally is permitted by top or third gear.

In changing down from top to third gear and from third to second adopt the following procedure. Maintain the pressure on the accelerator and de-clutch. Simultaneously, push the gear lever steadily into the desired position. The synchromesh device again comes into action to give a silent change. Release the clutch pedal, controlling the speed of the car by using the accelerator pedal as necessary.

A slightly different procedure should be adopted when changing down from second to bottom as in this case there is no synchromesh device. An easy change can be made, however, by adopting the technique known as 'double de-clutching'. Although this procedure may appear to be complicated it is simple and you should practise until you are proficient.

Proceed as follows:

(a) De-clutch. Move the gear lever into neutral, releasing the pressure on the accelerator.
(b) Allow clutch to engage, with gear lever in neutral, and accelerate the engine.
(c) Release pressure on accelerator pedal, de-clutch and move gear lever into first-gear position at once.
(d) Engage clutch, operate accelerator to maintain desired speed.

Practice this drill until you can be sure of making a certain and rapid gear change in any circumstances, particularly when ascending hills on which bottom gear could have been used.

To stop the car, first of all take your foot off the accelerator and move it over to the foot-brake to the left. Just before the vehicle comes to a standstill depress the clutch. When stopped apply the handbrake, move the gear into neutral and then release the clutch and footbrake.

Reversing

When engaging reverse gear the car must always be stationary. Any attempt to go into reverse when the car is moving forwards will cause severe strain or damage to the transmission system.

With the car stationary and the engine running, de-clutch and lift the gear lever upwards until you feel it will rise no further. Then move it through the gate to the right maintaining the lift. Next, pull it rearwards into the reverse position. If it does not engage fully, move it forwards momentarily allowing the clutch pedal to return as when engaging first gear. De-clutch once more and again move the lever backwards. Engage the clutch and gently accelerate when the car will move backwards.

Almost the first thing you will realize, of course, is that the steering is now reversed. That is to say, turning the steering wheel to the right causes the front of the car—temporarily the rear—to move to the left. You will soon become familiar with these changed conditions, however, and learn how to back your car neatly into the desired position.

It is a helpful idea to erect two guide marks and then to practise reversing between them—for instance, as if backing into a line of parked vehicles. Nothing indicates the novice so much as inability to back his car neatly into place. Do not forget to allow for the swing of the front mudguard and bumper when pulling out from behind a car that is ahead of you. A little practice will very soon show you how much room you may allow.

Skidding

The brakes on your Austin A35 are powerful and efficient but it is bad driving technique to use them harshly except, of course, in emergency. Harsh braking reduces tyre life as well as straining the car generally.

Every novice fears a skid. Whilst it is easy to say 'never provoke a skid' you may be compelled, because of some other person's stupidity, to jam on your brakes when the surface is wet. Then you may experience the unpleasant feeling that the car is not entirely under your control. It slides forward and not necessarily radiator first! If you have time to make a split-second decision, immediately release the brakes. Then carefully re-apply them avoiding any tendency to lock the wheels. Often this factor is the cause of a skid.

What generally happens is that the rear wheels swing sideways towards the gutter or to the lower side of the road. Often the skid will become controllable if you turn the steering wheel in the same direction as that to which the skid develops. If you turn the wheel in the other direction you may finish up across the road!

Do not forget that knowing what to do in an emergency may be of great value. If you are able to practise skid control in an isolated place you will realize the reason why bus drivers and drivers of police cars use a 'grease-patch' to teach them the correct technique.

Try to bear in mind the following four points:

(1) Steer a steady course. Never swerve abruptly.
(2) Do not accelerate nor apply the brakes suddenly or harshly.
(3) Do not drive on the crown of the road, particularly if your road speed is low. Keep well to the left.
(4) Do not allow the engine to labour. If the speed falls so that the engine runs heavily, pinks, or appears to vibrate unduly, change down to a lower gear.

Running-in a Reconditioned Engine

When the engine has done considerable service it may become beyond further repair—in that case a reconditioned
engine may be obtained from the Austin Motor Co. Ltd. Consult your Austin agent who will arrange the matter for you. An allowance may be made for your old engine.

For the first 500 miles—or, if your can manage it, for the first 1,000 miles—handle the new engine with care. If it is carefully run-in your consideration and trouble will be repaid by smooth and efficient performance for a long time afterwards.

When starting from cold, do not ‘rev-up’ the engine. Release the choke control as soon as possible. When driving away avoid rapid acceleration.

The engine is produced within extremely fine limits in so far as the bearing surfaces are concerned. In order to allow the working parts to become run in and to attain that surface hardness that ensures long life, high engine revolutions and excessive speeds should be restricted during the early stages. Do not be in a hurry to see how fast your car can travel nor to maintain high road speeds until the running-in period has been completed. The following are the suggested maximum speeds in the various gears during the running-in period, changing down as road conditions dictate:

- **Bottom gear:** 7 miles per hour
- **Second** 15
- **Third** 25
- **Top** 40

Endeavour to become accustomed to the sound that the engine makes at these running-in speeds. It is not necessary to drive at any particular running-in speed but allow the engine to run easily within the ranges tabulated. If the engine feels stiff, stop for a time to allow it to ‘ease off’. All the working parts are assembled somewhat on the tight side and care in the early stages will enable them to bed in satisfactorily.

As the engine becomes run-in you will quickly sense the added power and response.

Some owners like to use a running-in compound. There are several on the market, any one of which may be used provided it is the product of a maker of repute and that the proportions used are as advised. Some of these graphite compounds may tend to become separated out in filters of the full-flow type. If that occurs it may be found desirable to fit a new element when the oil is changed after the first 500 miles.

**General Check at 500 miles**

When the reconditioned engine has run for some 500 miles, the engine oil should be drained and the sump replenished with new oil of the correct grade and of an approved brand. If it is necessary to flush out the sump do not do it with paraffin but use a suitable flushing oil instead.

At the same time the cylinder-head nuts should be tested and tightened in the order shown in Fig. 32. After this initial tightening, the cylinder head should not require any further attention.

The thin steel cylinder-head gasket used on the A35 will not compress to the same degree as a gasket of the copper-asbestos type. Nevertheless, it is advisable to check the overhead-valve rocker clearance after tightening the cylinder-head nuts (see page 96).

Check also that the sparking plug gaps are 0.025 in. (0.64 mm.) (see page 179, and Fig. 72).

The contact-breaker gap should be checked and set at from 0.014 to 0.016 in. and the index scale might usefully be re-set at this stage (see page 174).

Now that the engine is running more freely, the carburettor adjustment should be checked and re-set if necessary. Full instructions are given on page 109.

A check on nuts and bolts is worth while to make sure that the reconditioned engine has bedded-down and that it is secure in its mountings after the initial 500 miles running.

**Choice of Petrol**

The choice of particular brand of petrol is a matter for your individual decision as also is that of the grade—a different matter from brand.

The particular grade of fuel used will affect engine performance. In general, altering the ignition advance is all
that is required to obtain the maximum benefits from the different grades of fuel available. For the higher octane fuels, however, full advantage can only be obtained by increasing the compression ratio, a procedure that is not generally worth while at present due to the limited distribution of this special grade of petrol. The method of road testing the car to obtain the most efficient ignition setting, is described on page 177.

At the time of writing, there are two main grades generally available. These are 'Regular' and 'Premium'. Regular is somewhat similar to war-time 'Pool'. Premium corresponds roughly to No. 1 petrol available before the War.

Premium grades contain some additives that confer properties giving improved performance.

In addition, in determining which grade to use, there must also be taken into consideration the matter of compression ratio, and whether this ratio has been lowered or increased by the introduction of a different gasket to the one originally fitted.

When it cleared the Works, your reconditioned engine was adjusted to accept Regular fuel. With this original ignition setting, Premium fuel may not give the fullest benefit. This advantage may be obtained only if the ignition is set to suit this grade of petrol. Usually the ignition must be advanced (see page 177).

Conversely, an engine with ignition timed to operate with Premium fuel will not give a good performance if the Regular grade is used. Again, the ignition should be adjusted to suit it.

CHAPTER III
GENERAL MAINTENANCE

Body, Wheels and Tyres

THOSE MOTORISTS who are of the opinion that a chassis is a metal frame the purpose of which is to support the body may wonder what maintenance such a chassis can require. Actually, the term chassis embraces the wheels, axles, springs, steering connections, tyres, etc. These components do not require a great amount of attention but care in keeping nuts and bolts tight and all parts properly lubricated will do much to remove the squeaks and rattles that are not only annoying but advertise to the world the owner's neglect.

Keeping Nuts and Bolts Tight

Manufacturers today use torque spanners to enable a definite degree of tightness to be obtained. As cork or rubber gaskets are used in many parts it is very desirable to control tightness of nuts securing these parts. Correct tension is achieved by pre-set loadings rather than by individual assessments of what 'seems to be tight enough'.

It is advisable to periodically examine all nuts for tightness. If neglected they will become rapidly looser and rattles, squeaks and accelerated wear will result. Some bolts are secured by tab washers, some by cotter pins. If there is evidence that such bolts are not correctly tightened remove the pin or bend back the tab washer as required and re-tighten. Do not forget to secure them when they have been tightened. Cotter (or sometimes called split) pins and tab-washers are two means of preventing nuts from becoming loose.

A cotter pin passed through a hole in the end of a nut or stud passes through the slots in a castellated nut. When so positioned the ends of the split pin are bent back thus making it impossible to withdraw the pin and preventing any slackening of the nut itself.
Removing Nuts and Bolts

It often becomes necessary to unscrew nuts and bolts that have rusted. Some bolts—for instance, in the body—screw into nuts that are inaccessible so preventing a second spanner being placed on them to stop them from turning. If the enthusiastic owner tries to unscrew these it is possible that the nut, having firmly rusted, will refuse to unscrew. If there is any doubt about it, brush the mud off the bolt threads and apply paraffin or penetrating oil, allowing reasonable time for this to do its work. Always use a set-spanner or box-spanner wherever possible. An adjustable spanner, even of the best type, usually springs a little and is apt to damage the sides of the nut.

A split pin can often prove surprisingly difficult to remove. A useful tool for the purpose is an old screwdriver carefully ground down to a pointed prong. This can be inserted in the head of the pin, enabling it to be levered out once a firm grip is obtained. If the pin cannot be extracted hold the bolt head with one spanner and, using another set-spanner on the nut, shear off the pin. This practice is rather one of despair for the threads of the bolt and of the nut can be damaged by this procedure. After the nut has been unscrewed, assuming that the threads are in good order, punch out the pin that still remains in the drilled hole of the bolt.

Road Springs and Shackles

The rear road springs should be examined periodically to see that the nuts are full tightened (5 and 6, Fig. 7). If they become loose the centre bolt may shear or the spring leaves break.

Simmonds locknuts or single self-locking nuts are used for the spring-clip bolts, i.e. those bolts holding the centre of the spring to the rear axle.

The upper end of each shackle at the rear of the road springs is adjustable so that there should be no end-float (Fig. 7). If there is too much end-float a perceptible knock may be heard. Any adjustment required should be made as described below.

First loosen the locknut, or outermost nut of the two, on the shackle, holding the inner one if necessary whilst doing so. The single nut at the other end does not affect the adjustment so it must always be kept tight. Then tighten up the inner nut carefully until there is just running clearance between the side of the shackle plate and the spring eye. Do not overtighten or there will be undue friction and wear. Tighten the locknut, holding the inner nut to prevent the adjustment being altered.

Brake Linkage

If at any time it is necessary to disconnect any of the brake linkage, take particular care not to alter the rod setting. Any haphazard attempt to adjust the brake-rod linkage is strongly to be deprecated for the system must be correctly balanced for full efficiency to be obtained. Detailed instructions regarding the brake linkage are given in Chapter VI.
Steering Gear

The alignment of the front wheels is an extremely important point. Whilst the rear wheels are definitely fixed, the front wheels are not. If there is any incorrect adjustment at the steering linkage not only can undue tyre wear occur but the steering can be affected.

The steering connections are of the adjustable type and with proper lubrication will give long service, but if the car has bumped into a curb, for instance, one of the steering arms may have become bent.

The standard setting of the front wheels is that they shall point together slightly to the front. In other words, the distance at hub height measured between the wheels is \( \frac{1}{8} \) to \( \frac{3}{8} \) in. less than the corresponding dimension at the rear edge. The reason for this is that in use the wheels tend to separate slightly to take up this initial 'toe-in' and so run in the most efficient position. If you wish to check the 'toe-in' refer to page 57, where this adjustment is described.

The steering linkage and front suspension are very important points and if you feel that there is some part strained or bent it is best to let your Austin dealer inspect the parts to make sure everything is in order.

Grease, Oil and Lubricants

The chapter on lubrication (see page 193) describes the various parts to be greased or oiled. It is not sufficient to place the oil gun on a lubricator, press it several times and assume the job is well done. The lubricator itself may have been damaged (possibly it may have been hit accidentally with a spanner), or the passage may have become choked. In either case the lubricant will not enter when the grease gun is applied to it. When lubricating the chassis, therefore, it is always good practice to continue until the lubricant can be seen escaping from the bearing that is receiving attention. This does not apply to lubricators on, for instance, the wheels, where excess lubricant can reach the brake linings.

Oil and grease not only lubricate but also form a seal that prevents water and grit from entering the bearing and causing it to wear much more rapidly than would be the case if it were adequately lubricated.

Hence the importance of operating the gun several times if necessary so that the old lubricant, carrying with it any grit or water, is forced out and clean grease takes its place on the bearing surfaces.

If a lubricator has been damaged, it is cheaper to replace it than to leave it in place for this can only result in the bearing running dry and wearing out much earlier than it should. The bearing thus damaged can cost many times the small charge for the lubricator. Assuming that you cannot force anything through the lubricator, it is advisable to replace it with a new one. If the lubricator is free, however, it can only mean that the bearing itself has become choked and it will be necessary to dismantle it for cleaning. Certain grades of cheap lubricant are liable to harden in use and choke the passages. Always buy a good lubricant of correct grade and type marketed by a manufacturer of repute.

Care of the Bodywork

Although the modern body finish will stand much rougher use than the varnish finish of earlier cars, there are certain ways in which the owner even with the best intentions can mar its lustre.

Do not be tempted to dust the car down without using water. Road dust is an abrasive and unless liberal quantities of water are used to float this dust off the surface the cloth, acting on the dust, will produce myriads of minute scratches. In a short time the finish will have been considerably dulled.

The first rule, then, is to wash the car, using preferably a hose and running water in conjunction with a sponge or soft cloth. An important point is to keep the hose itself clear of the body. Inevitably it collects grit and when accidentally pressed against the body or wings can cause deep scratches.

Dry the car with a chamois leather and then polish. Do not be tempted to overdo the polish. Too frequent an application, particularly in the case of wax polishes, can
actually dull the surface. Properly applied, a film of polish protects the body and gives a good gloss. On the other hand, a thick coat is not twice as good as one thin one, for it cannot be adequately polished and must tend to attract dust so dulling the lustre. The best method is to apply the polish sparingly, rubbing it on evenly and then polishing it vigorously.

The windscreen and windows should be cleaned with wash leather. Do not omit the rear window because clear vision from the rear is essential.

When washing the car a minor point to note is to avoid water on the brake plates and drums. Although it will not do any permanent harm, it will reduce immediate braking efficiency. When taking the car on the road for the first time after it has been washed it is good practice to test the brakes and gauge their performance. If it is obvious that water has reached the shoes, apply them several times whilst the car is in use. This will have the effect of warming the drums and evaporating the moisture.

Many owners, particularly those living near the sea, give the car an occasional wax treatment as a further aid in protecting and maintaining the finish. Some apply wax but using a portable electric tool as supplied for handyman’s ‘do it yourself’ tasks. To get best results work on a day when it is not very hot so that solvent in wax does not evaporate too quickly. On the other hand, a humid day is unsuitable, a solvent will evaporate too slowly.

Method of application is important. Take up a little wax on a pad of mutton-cloth slightly damped with cold water. Apply evenly over a small area, say, for instance, half a door panel. When wax has been spread, polish immediately by fast strokes with a clean linen rag or mutton-cloth. Carry on in this way until all body surface has been covered. Experience alone will tell you how much polish to use and how large an area can be done at a time. Remember to include interior mouldings and also that wax polish may be used to brighten rubber mouldings around windows and windscreen.

Removing Tar

Summer usually brings tar-sprayers into action, and you will be lucky if you can avoid collecting at least a few spots

on your car. They can usually be removed, however, by dipping a soft cloth in linseed oil and rubbing gently. If possible, tackle the job before tar has time to set. If spots are really obstinate, try a mixture of two parts petrol to one of engine oil. With cloth around one finger moisten it in solution and rub spots. Avoid applying this cleaning agent to any other parts of car. Immediately tar spot has been removed, wash away all traces of petrol and oil mixture and re-polish.

Touching-up Enamel

It is inevitable that the synthetic-enamelled parts of the car will be scratched or possibly damaged by flying stones. If neglected, rust will attack the bare metal surfaces and gradually cause the surrounding enamel to flake off. The careful owner will find it most advantageous to touch up such bare places as soon as practicable. Not only will the appearance of the car be preserved, but it will depreciate far less rapidly. Do not touch up a surface that has already rusted but carefully rub it down with very fine glass paper until the bare metal is bright before applying the enamel. Use quick-drying synthetic enamel for the purpose and not one of the cellulose type. These latter have a different weathering rate, and even if the colour match is good at first it may soon change its tint considerably and call attention to the minor blemish it was desired to conceal.

Care of the Interior

It is important to keep the interior of the body free from dust or road grit. To prevent road grit from being carried inside the car is impossible, but once it is there it is trodden into the carpet and damages the fibres. A vacuum cleaner, if available, is the most convenient way of cleaning the interior. It may also be used to keep the upholstery clean.

Seat covers are a worth-while investment for they tend to keep the original upholstery in good condition. When the time comes to sell the car, a clean and attractive appearance is a good sales feature so far as the upholstery is concerned.

Leather upholstery may be cleaned by using a damp cloth having a little soap on it and applied briskly to the
leather. The soap film should be rubbed off with another damp cloth. The upholstery can be finished by polishing with a soft, dry cloth.

Do not be tempted to use an unsuitable polish on leather upholstery for this sometimes makes it tacky and your passengers, particularly your lady passengers, will not appreciate the sensation of sticking to the seats or having their costumes marked!

If desired, a good quality furniture cream may be rubbed on the leather when it is thoroughly dry.

Cloth upholstery can be cleaned with one of the carbon tetrachloride liquid cleaners. But, the best advice is to avoid getting it dirty in the first place!

Doors, Locks and Hinges

The working parts of the door-lock striker plate and lock should be lightly lubricated—not only to cause the parts to work smoothly but also to eliminate undue wear. It is advisable to examine and tighten periodically, if necessary, the various screws securing the door locks, striker plates and hinges.

Sometimes it may be necessary to remove the interior handles but, if so, their method of attachment is not always obvious. By adopting the following procedure no difficulty should be experienced.

First, push the chrome-plated washer, or escutcheon, away from the handle as far as possible. Then a pin will be seen in the handle shank and this can readily be pushed out of the shank when the handle may be pulled off the shaft.

To refit the handle first make sure that the handle is on the square that has a drilled hole to align with the one in the handle. Check to make sure that the handle position is the one that is most convenient. Replace the handle half a turn out when it may be found more suitable.

Check the seat slides for free movement. Usually a film of oil on the working parts will assist the slide to work freely. Nothing is more annoying than to struggle with a sliding seat that will not slide—or, alternatively, will slide and not lock. Avoid applying excessive lubricant to the slides for this may come in contact with clothing and leave marks.

Protection During Storage

Before placing car in storage it is advisable to protect cellulose finish and plated parts by applying a heavy film of wax and leaving it without polishing. When car is to be used again, remove this wax coating by cleaning with liquid car polish and following up with a normal wax treatment.

 Carpets should be protected with an anti-moth preparation after interior has been thoroughly brushed out.

Batteries should be sent to your local Austin dealer or Lucas Service Station for maintenance during the time car is laid up (see page 168).

TYRES

Tyres eliminate high-frequency vibrations and minimize shocks due to inequalities in road surfaces. They function because amount of tread in contact with road covers a comparatively small area. Not only must tyres be flexible but also strong enough to contain air under pressure, tough enough to resist damage, giving long mileage, and be able to transmit driving and braking forces satisfactorily. Further, they must provide road grip, stability and good steering properties. To this somewhat formidable list of requirements tyre manufacturers have nobly responded, and tyres today seldom trouble us.

Modern tyres have a strong casing built up of several plies of cord fabric—or, more recently, of rayon or even steel wire—forming a tough wall and tread. They are secured to wheel rim position by wire bead cores.

Part of the work done by deflection of tyres on a moving car is converted into heat within them. This is easily demonstrated if you place your hand on a tyre after a fast run. You will find it quite warm, sometimes excessively so. Both rubber and fabric are indifferent conductors of heat, and internal heat is not easily dissipated. Such temperatures weaken tyre structure and reduce tread resistance to general wear.

Importance of Correct Tyre Pressure

Tyres are designed for use under pre-determined conditions, and tables are available to show pressures to be used
under different loads and deflections. It is important to ensure that tyres are always maintained at pressures recommended by their makers, for these are the result of considerable laboratory work and practical tests. Recommended pressure for the A35 is 20 lb. per sq. in. for both front and rear, giving a suitable distribution of load to that part of tyre in contact with road surface. This is for two persons. With a full load the pressure of the rear tyres should be increased to 23 lb. per sq. in. Tyre size: 5.20—13.

Do not attempt to judge pressure merely by appearance. Check with pressure gauge, obtainable from your dealer who will inflate your tyres to correct pressure on request. Check by applying gauge directly to valve when tyres are cold and not when they have attained running temperature. Appearance of a tyre may be normal, despite the fact that gauge shows it to be under-inflated. This is sufficient to cause abnormal tread wear.

Some owners consider that a slightly reduced tyre pressure gives more comfortable riding. Even if this were so there are distinct drawbacks in having tyre pressures too low. One is that tyre will be damaged internally since plies—due to excessive flexing—deteriorate much sooner than normally. Consequently there may not be that exact control as is the case when tyre pressures are held at recommended figures. Under-inflation causes unnecessary tyre wear—on an average 13 per cent. for every 10 per cent. reduction in pressure below recommended figure. This results in unmistakable evidence on tread and causes considerable friction and excessive temperature within casing (Fig. 8).

On the other hand, over-inflation causes wheel bounce, resulting in discomfort to occupants of car. It also results in excessive wear, especially in rear wheels, for they spin immediately they lift in the air. When they touch ground again their speed is suddenly reduced by contact with road surface and in that brief instant their tread is abraded. This cycle of events is continually repeated, for no road surface is quite smooth nor is any shock-absorber system perfect. Excessive pressure also reduces comfort and tread life, for there is a concentration of load and wear on a smaller area of tread. On front wheels it contributes to wheel wobble. Particularly is this the case if there is some wear at steering connections or swivel axles, or if there is local wear in the form of a narrow band around the circumference at centre of tread.

Even when in good condition, pressure is lost due to chemical diffusion of compressed air through walls of the inner tube. Rate of loss is from 1 to 3 lb./sq. in. per week, or about 10 per cent. of the original pressure. Therefore, it is advisable to check all tyres once a week and maintain pressures at recommended figures. Do not anticipate leaking by over-inflating, nor reduce pressure that has increased owing to a rise in temperatures—for example, as on a hot day—for it will be reduced to normal with the cool of evening.

It will be seen that variations in tyre pressure, either up or down, result in reduced tyre life. A few moments spent each week in checking pressures and correcting them if necessary is time well spent.

Although the spare wheel is a real help in time of trouble, many an owner has found to his discomfort that when required it is flat, or its pressure is below normal. Do not forget, therefore, to check its pressure also as part of normal routine.

**Tubeless Tyres**

Tubeless tyres are fitted as standard equipment to all Austin A35 models. They have many advantages over the conventional type in which a tube under tension is stretched by internal air pressure. If punctured, say by a nail, the hole

![Fig. 8.—Excessive Wear caused by Under Inflation](image-url)
immediately enlarges and the tyre often deflates suddenly. With a tubeless tyre, however, the nail is usually retained in the cover, in which case any escape of air will be so slow that a journey—even of a hundred miles or so—may be completed without wheel-change. Tubeless tyres incorporate a special interior liner as an integral part of the tyre giving protection against rapid air loss when the tyre is punctured (Fig. 9).

Tubeless tyres give a high mileage because they generate little heat and are extremely flexible. Excessive wear caused by under- or over-inflation is eliminated because they keep their correct pressure for a longer period.

If a tubeless tyre is damaged so that it becomes deflated, the wheel can be changed in the normal manner, but the chance of this happening is much less remote than with the conventional tyre and tube. For an emergency repair an inner tube may be fitted.

An air-tight seal between wheel and tyre is achieved by accurate forming of bead bases to suit contour of wheel rims. In addition some tyres have sealing ribs formed in side of beads that contact side of rim. On tyres not provided with sealing ribs, the beads have very smooth and carefully formed surfaces to provide an efficient seal.
pressure to 5 lb. per sq. in. and removing the nail, the hole is cleaned and tread-filler injected into it with a special sealing gun.

**Plug Method.** After removing the puncturing object a rubber cement is applied to the hole and a rubber plug inserted with a special needle. Needle is then withdrawn, leaving plug in position. Outer end of plug is trimmed off flush with tyre tread. Plugs are supplied in three sizes: large, medium and small.

![Fig. 10.—Testing Air-tightness of Valve](image)

**Cold Patch Method.** Puncture is first cleaned with solvent then filled with tread-filler from outside. After roughening and cleaning inside of tyre around puncture, special cold patching material is affixed. Any trapped air is removed from between patch and tyre with a corrugated stitches.

**Hot Patch Method.** After cleaning puncture with solvent it is filled with tread-filler from outside. Necessary cleaning and preparatory operations inside tyre are carried out and tyre vulcanized in the normal way.

**Tyre Valves**

Sometimes when the car is standing pressure may drop unduly due to a leaking valve. As valve caps also act as additional air seals they should be kept fully tightened to prevent dust and water from entering. When removed for tyre inflation they should not be placed on the road or on any other dusty surface.

Air-tightness of a valve depends on correct functioning of its interior. Test by rotating wheel until valve is at top, and then insert it in an egg-cup of water (Fig. 10). If bubbles appear, faulty seating should be removed and replaced by a new one.

**Installing the Valve**

There are two types of valves for tubeless tyres—the metal clamp-in type and the rubber snap-in type. The metal clamp-in type (left, Fig. 11) is suitable for use with any type of rim. It should be fitted by inserting valve through valve hole in rim, making sure that the washer is flush against rim. Place the flat rubber washer W over stem and against rim. Apply metal washer M (with raised side up) and nut. Tighten until rubber washer is almost flush with edge of metal washer.

On some rims that have a deeper well it is possible to fit the snap-in valve (right, Fig. 11) which is simpler in some ways, although a special tool must be used for installation. To fit this type of valve, lubricate with water or soap solution. Push valve threaded-end first through valve hole in rim from tyre side of rim. Hold valve base with one hand, screw knurled knob of lever tool into mouth of
valve, rest rubber-covered part of tool against rim base and lever valve gently until it jumps into position.

**Causes of Tyre Wear**

Uneven patches on tyres may be due to a combination of factors such as incorrect tyre pressures, front-wheel bearing wear, slack bushes, wheels out of track, or a bent spindle.

Speed has a considerable effect on tyre wear, the rate being twice as much at 50 as at 30 m.p.h. This is largely due to more deflections per minute and a more rapid rate of deflection and recovery. Other causes of abnormal wear are fierce acceleration, heavy braking and skidding when negotiating bends or corners. It is not necessary to lock the wheels to attain maximum braking. To do so means that an abnormal amount of rubber will be torn off tread to no considerable purpose. ‘Driving on the brakes’ can do nothing but increase wear very considerably.

Tyres are also affected by factors other than braking. For instance, correct brake lining clearances and freedom from binding are of considerable importance. Braking may vary between one wheel position and another, due to oil or foreign matter on shoes even when brake mechanism is free and correctly balanced. Therefore, it is recommended that brakes should be relined and drums reconditioned in complete sets and not individually. Use material recommended by the Austin Motor Co. Ltd., for any other material may have unsuitable characteristics, especially if linings differ between one wheel position and another in such a way as to upset balance. Front tyres, and particularly that of near-side wheel, are very sensitive to any condition that adds to the severity of front braking in relation to rear.

‘Picking-up’ of shoe lining leading edges tends to cause brake grab and can reduce tyre life. Local flats on treads may be caused by brake drum eccentricity (Fig. 12). Braking effect varies during revolution of each wheel as uneven parts of drum pass alternatively over shoes. If excessive tyre wear is apparent, you should have drums examined and if necessary replaced by your Austin dealer.

Another cause of wear can be traced to climatic conditions, and especially to those appertaining overseas. Even in this country, rate of tread wear during a dry warm

Fig. 12.—Local Flats due to Brake Drum Eccentricity

summer may be twice as much as during an average winter. Resistance of tread decreases with increase in temperature. Consequently, tyre wear is greater during summer months or with higher temperatures that are normal in countries overseas. Wear is much less on wet roads than on dry because water tends to act as a lubricant to the tread.

Cornering and negotiating road bends has a severe effect on tyres. A car is steered by slightly mis-aligning its wheels

Fig. 13.—Illustrating Slip Angles
relative to direction of travel. This applies equally to rear
tyres as to front ones. Resulting tyre slip and distortion
increase rate of wear according to speed, load, road camber
and other factors (Fig. 13).

When drawing up to kerb, or parking against it, care
should be exercised to prevent what are known as ‘impact
fractures’ causing damage to casing cords. Sometimes
this damage is caused without owner being aware that
anything unusual has occurred, initial shock having been
absorbed by tyre and road springs. It is desirable to renew
cover when first signs of damage are noticed, for later it
may suddenly fail completely and a ‘blow-out’ can have
disastrous results if you are travelling at speeds.

It is of the greatest importance that wheels are aligned
and this detail should be regularly checked (see page 57).
Mis-alignment causes lateral wear on tread because, as
already mentioned, natural direction of wheel differs from
that of line of travel.

Keep an eye on front tyres and particularly on their
treads. Due to the ‘camber’ of the front wheels the tread
will wear more on one side than the other but any con-
dition such as ‘feather-edges’ (Fig. 14), or uneven patches.

should be suspect. ‘Feather-edges’ can be felt on a tyre
by drawing the fingers across the tread first in one direction
and then the other. If a distinctly sharp edge can be felt
then the wheel toe-in requires correcting (see page 58).

Uneven patches on the tyres may be due to a combination
of factors such as incorrect tyre pressure, front-wheel bear-
ing wear, slack swivel-pin bushes, wheels out of track, or a
bent spindle.

When buying new tyres always buy those of a known
make. A set of tyres will normally run many thousands
of miles and the difference in cost between a good make
and an inferior one is really trifling. An inferior tyre may
let you down at a most inconvenient moment and then you
feel it was not really so cheap after all.

Equalizing Tyre Wear

To equalize tyre wear it is a good plan every 5,000 miles
to change front wheels to rear. This prevents undue wear
on any individual tyre by compensating for different kinds
of wear experienced in front and rear wheel positions.
Also, bring spare wheel into this plan, for it is bad policy
to allow a new spare tyre to remain idle until other tyres
are being worn out as it may deteriorate from lack of use.

Diagonal interchanging between near front and off rear,
and between off front and near rear position, provides the
most satisfactory alternation, for it reverses direction of
rotation for each wheel (Fig. 15).
Change the wheels as follows:
- Spare to off-side rear.
- Off-side rear to near-side front.
- Near-side front to near-side rear.
- Near-side rear to off-side front.
- Off-side front to spare.

Wheel Balancing
Correct rotational balance of all wheels, and particularly of front ones, is essential if smooth high-speed running and long tyre life are to be obtained. It is particularly necessary on all cars having independent front suspension. It obviates vibration, steering wheel tremor, and ensures precise steering.

Wheels and tyres should be statically and dynamically balanced after every tyre change. When a new tyre is fitted—or if it should be suspected that in normal use tyre and wheel balance have been affected—rotational balance should be checked. Your Austin dealer may have a machine that enables balance to be checked and, if necessary, corrected without removing the wheels.

Tyres are now made with coloured spots on bead to indicate lightest parts (Fig. 16). If some tyres are slightly outside standard balance limits they are corrected before issue. This is done by attaching loaded patches inside cover casing. In order that these are not mistaken for repair patches they are embossed 'Balance Adjustment Rubber'. These patches, or sometimes discs, should on no account be removed or balance will be upset.

Original balance subsequently may be affected by uneven tread wear or by repairs. Also, the car may become increasingly sensitive to unbalance due to normal wear on moving parts. Should roughness, or high-speed steering troubles develop, wheel and tyre balance should be checked and adjusted.

Jacking-up the Car
The Austin A35 is provided with two points for using the type of jack known as Smith’s ‘Steady-lift’. One of these points is underneath each side of vehicle, enabling either right or left side to be raised. As the front and rear wheels on either side are raised there is no need to insert the jack under either axle. The effort required to raise the car with this jacking system is relatively small.

A few words about jacking-up. If possible, never change an off-side wheel in a road on which there is a continual stream of traffic. Should it be impracticable to turn off the road into a quiet lane or lay-by, drive to the other side so that the wheel to be changed is on the side away from the passing traffic.

Before jacking-up make sure that there is sufficient room between the car and the curb for the wheel to be lifted off the hub when raised.

The next thing to do is to apply the handbrake firmly. Remove the spare wheel from the luggage compartment, placing it adjacent to the wheel that is to be changed. Thus the car is not standing without a wheel any longer than is necessary.

Before fitting, test the pressure of the spare wheel to make sure that it is fully inflated.

Now remove the hub disc that covers the wheel nuts by levering it off with a coin or screwdriver applied at the edge. The road-wheel nuts should be loosened a little at a time and then the car is ready to be jacked up.

Open the front door and insert the jack lug into the socket provided under the vehicle (Fig. 17). Be certain that the lug is fully engaged in the socket and also that the base of the jack has a firm footing on the ground. Now attach to the head of the jack the wheel-nut brace supplied in the tool kit. Turn in a clockwise direction to raise the car off the ground on the side to which it is attached.

Remove the brace from the jack, unscrew the wheel nuts, remove the wheel and fit the spare wheel.

Enter the nuts, coned ends first, so that the wheel is
correctly centralized. Slightly tighten up each nut diagonally, a little at a time, to ensure that the wheel seats evenly against the hub.

Lower the car to the ground by turning the brace anti-clockwise and so release and detach the jack.

Finally, tighten the wheel nuts with the wheel-brace and fit the disc cover.

Check the nuts of the wheel you have just fitted at the end of the day, after which they should remain secure indefinitely.

CHAPTER IV

STEERING GEAR

THE STEERING GEAR of the Austin A35 is of the cam-and-lever type with a ratio of 12:1, giving easy manoeuvrability when negotiating sharp corners. The steering box, which is mounted just forward of the toe-board, provides a short steering column of great rigidity. A cross-tube runs behind the engine and gives the steering mechanism ample protection.

The lower end of the steering inner column terminates in a cam mounted on ball races. The rocker shaft to which the double lever is bolted has a short cam lever at its inner end with a conically shaped peg pressed into contact with the cam groove.

As the steering shaft is turned, the peg follows the groove in the cam. This partly rotates the rocker shaft moving the double lever and this, in turn, actuates the steering linkage and front wheels.

In the steering linkage, which has independent front wheel suspension, one of the tubes—referred to as side-tubes—is connected directly to the front arm of the double lever of the steering gear. Its other end is joined to the swivel arm of the right-hand wheel. To the rear end of the double lever is connected the cross-tube. It transmits movement to the left-hand wheel through the medium of an idler shaft and bracket. This is bolted to the other side member, symmetrically opposite in mounting to the steering gearbox, again with a double lever. From the rear of this idler lever is another side-tube connected to the wheel by way of its swivel arm. This method of connecting the steering gear to the front wheels—through equally mounted side-tubes—ensures that as each wheel rises and falls, due to normal road inequalities, any deviations will be equal for each wheel.

The working parts of the steering gear operate in oil. Providing that the level is correctly maintained, long service will be enjoyed before any adjustment is required.
The linkage connecting the double lever and cross-tubes is of the ball-and-socket type and regular lubrication will eliminate any other attention for a considerable time.

The steering box has adjustments for wear but it is strongly advised that if adjustment becomes necessary you should ask your Austin dealer to carry this out. Unskilled attempts can cause tight adjustment resulting in heavy steering and accelerated wear or ‘back-lash’ (undue movement), contributing to ‘steering wander’.

It may be that you find it necessary to effect some adjustment yourself, however, and if these instructions are carefully followed you should be able to do it satisfactorily.

Before adjusting, it is desirable to ascertain exactly what wear is present and where it has taken place. The first symptom is either excessive movement at the steering wheel before the road wheels move, or a tendency for wheel wobble or ‘wander’ to develop. This may be due to linkage wear and not to wear in the box. The following test should disclose the source of the trouble.

Have someone slowly turn the steering wheel first one way and then the other whilst you prevent the road wheels from moving sideways. Note any signs of lost motion at the steering linkage connection. Do not forget that these connections are held in tapered holes in the swivel-arms and double levers. If allowed to become loose, they may wear oval. This is a condition that subsequent tightening will not correct as a true seating is then no longer possible.

Assume the wear is found to be in the steering box. Grasp the double lever and see if this can be pulled and pushed, so bringing the end in the box nearer to or further away from the cam. If movement is found at this point there is an adjustment whereby it can be taken up. On the side cover towards the top is a hexagon-headed screw with a locknut fitted to it. Loosen this locknut and carefully turn the adjusting screw clockwise a little at a time until the end-flat is taken up. Remember that the cam is so constructed that there is least ‘back-lash’ when the wheels are directed straight ahead. Therefore, always adjust with the wheels in this position otherwise the steering will be unduly stiff at the central position.

When the correct adjustment has been obtained securely tighten the locknut making sure the screw does not turn any more. Re-check the adjustment in case this has happened. It is permissible for the steering gear, with both wheels jacked up, to have very slight ‘drag’ at this central position but there must be no undue resistance.

Another point at which there may be wear is the steering-wheel shaft. This may be gauged by grasping the steering wheel firmly with both hands and by alternately pushing down and pulling up along the length of the column. If end-float is felt, it will be necessary to remove the steering gearbox end cover to extract the adjustment shims.

At the lower end of the steering box is a hexagon gland nut. It locks the long stator tube in its correct relative position. Provided that the end cover is marked so that a known edge is to the top, the stator tube need not be further removed.

As the removal of the end plate will allow the oil to escape, use a receptacle to prevent messing the floor.

**Removal of Shims**

Unscrew the four bolts of the end plate and move it downwards slightly, disclosing the adjustment shims fitted between it and the steering box. These shims are of two types—brass and steel. Remove one at a time and after the removal of each, bolt up the end plate and re-test. If they are not removed thus the elimination of several shims at a time may unduly tighten the ball races causing them to wear rapidly as well as making the steering stiff. Should you suspect that the bearing adjustment appears to be too tight, a quick check may be made by loosening slightly—say half a turn each—the four end-cover securing bolts. If the steering now appears to be free it indicates that too many shims have been removed. Therefore, a suitable number must be refitted to obtain the correct adjustment.

A stiff steering gear is sometimes traceable to the column itself having been strained and out of position. Try the effect of loosening the column-support bracket allowing the column to move into its normal unrestricted position. If the column in this position is now free, the steering box mounting and bracket should be set so that the column can be bolted into position without placing any undue constraint on it.
The correct steering adjustment is when a very slight 'drag' is felt as the steering wheel is turned from lock to lock with the front wheels raised.

Do not forget that removing the end-plate will have allowed all the oil in the box to escape. Therefore, refill the box to level of orifice.

**Overhauling Steering Gear**

Possibly the owner may find it necessary to overhaul the steering gear when adjustment no longer becomes effective. The same advice applies here also—do not attempt this work unless you feel you have sufficient mechanical skill. At the outset it should be pointed out that special tools are necessary for the removal of the steering wheel and the double lever. Both parts are secured on tapers and hap-hazard attempts to remove them without proper tools will either be abortive or will cause damage.

If you have decided to do the work yourself, first take out emblem cap set in hub of steering wheel by gently prising it with a screwdriver. Next unscrew steering-wheel nut and withdraw washer. Remove cotter pin securing castellated nut holding double lever to rocker shaft. A special extractor will have to be used to draw this off its tapered mounting.

Unscrew bolts at edges of side cover and lift it off the box. Draw rocker shaft out of its bushes in steering box.

Before the steering inner column can be dismantled the four bolts holding the end cover must be unscrewed. Extract the key on the steering-wheel taper and draw the inner column out of the steering-column tube. The major parts of the steering gear may now be inspected in detail (Fig. 18).

Inspect the rocker shaft for wear on the ball peg. This is a press fit in the lever and is replaceable. Look for twisted splines and if any are found the shaft must be renewed.

Inspect the face against which the adjusting screw abuts for it may have been scored if at some time the steering gear has been adjusted too tightly or operated without sufficient lubricant. Providing that the scoring is not too deep the face can be restored by carefully grinding it flat on an oil stone. At the same time examine the adjusting screw for similar signs of wear and if necessary treat in the same way. Inspect the rocker shaft for wear at the point where it is mounted in its bearing bush. Also, inspect the cam for wear in the grooves and at the ball tracks that form its bearings. Wear at either of these points will necessitate renewing the unit.

The corresponding ball cups should be examined for wear and if they are pitted they should be renewed. Both cups are replaceable.

Thoroughly wash all parts ready for reassembly.

**Reassembling**

Inspect the cork gland at the outside end of the cross shaft and replace if necessary. It is secured in position by a steel washer to be retained in place by lightly peening over the metal at three points around its circumference.

Place the steering outer column in the vice so that the end of the box is pointed upwards with the steering-wheel end to the bottom.

Assemble the ball cages and cups (if removed) and install the inner column. Refit the end cover and shims, tightening the four bolts securely.

Temporarily reassemble the steering wheel and test for end float or, alternatively, for too tight an adjustment (see also page 53). The correct adjustment is when there is no end float but just a slight 'drag'. Remove or add shims between the steering box and end cover until this setting is achieved.

The upper bush—just beneath the steering wheel—is replaceable but is scarcely likely to require renewal except after very considerable use.

The upper shaft bush is of a felt material. A new felt should be first soaked in engine oil and inserted by pushing one corner between the inner column and outer tube. Then gradually work the remainder into position with a screwdriver or similar tool. It is advisable to apply graphite to the part of the felt that makes contact with the steering shaft. Apply a few drops of oil here every 500 miles.

Next, oil the rocker shaft and ball peg and insert into position in the box, the peg to enter the groove in the cam.

Undo the locknut of the side cover plate and screw back the adjusting screw several turns.
Adjust the rocker shaft by means of the adjusting screw so that at the central position there is no end float nor is the steering at this point stiff.

Refit the steering gear in the reverse manner from that when removing.

One or two points require care, however. Do not tighten up the three bolts holding the steering box to the side member until the strap at the instrument panel has been assembled.

When reconnecting the steering linkage, take care that the tapers on the connection and in the outer end of the drop arm are clean and that the nut is pinned when tight.

If the steering-box bolts are first tightened it may be that the steering column will not line up with the bracket. If secured in this manner it will be stiff and undue bearing wear may ensue (see also page 53).

Re-attach the lighting switch to the steering column.

**Adjusting Front Wheel Toe-in**

For technical reasons, into which it is not necessary to enter, the front wheels must either be exactly parallel or point towards each other slightly at the front. An equivalent measurement, taken at hub height at the front of the wheels, is \( \frac{17}{16} \) in. to \( \frac{5}{8} \) in. less than at the rear (Fig. 19). They must not toe-in more than \( \frac{3}{16} \) in., otherwise tyre-wear will result and the steering itself will not be as accurate nor as responsive as it should be. If it does appear that there is considerable toe-in or toe-out, it may be that one wheel has been buckled slightly or possibly the tyre is not running true. Before proceeding further in such cases, it is as well to spin each wheel to establish if any of the above conditions are present. Always test for front-wheel toe-in with the wheels in the ‘straight-ahead’ position.

To adjust the wheel toe-in loosen the locknut at each end of the cross tube remembering that one end has a right-hand and the other a left-hand thread. With all these nuts loose it is only necessary to turn the cross tube in the required direction. This will have the effect of moving both wheels nearer together, or further apart, according to the direction in which the tube is turned. When the correct setting has been obtained securely tighten both locknuts.

Oil the surfaces of the adjusting screw and cross shaft where they touch one another.

Fit a washer between the box and side cover and bolt it up securely.

Refit the double lever noting that both it and the shaft are marked to ensure reassembly on the correct splines. Tighten up the castellated nut and lock it securely with a new cotter pin.
It is a matter of some difficulty to measure toe-in without special apparatus but you may find it practicable to devise a suitable make-shift gauge from a wooden strip. Cut this to such a length that it will exactly enter between the tyre walls at the front of the wheels. Provide yourself with two rests so that when the wooden strip is resting on one at each end it is at hub height. Assuming the wood strip is a snug fit between the wheels at the front then when similarly installed at the rear of the front wheels there should not be more than $\frac{3}{8}$ in. play.

**Fig. 19.—Toe-in between Wheel Rims.** A is $\frac{3}{8}$ to $\frac{3}{4}$ in. Less than B

**CHAPTER V  
SUSPENSION**

It is only natural that owners should discuss the performance of their respective cars. Next to performance the question of the springing, or suspension, generally is either praised or blamed. The suspension of a car is not merely the method of springing used. There are many other factors that whether taken singly or collectively contribute to comfortable riding. For instance, on two similar cars one driver who may habitually drive alone will experience a somewhat different ‘ride’ as compared with an owner who carries three passengers or an equivalent load. Therefore, the designer has to bear in mind these two extremes in producing a suspension system that will be satisfactory under widely varying conditions.

The Austin A35 is fitted with semi-elliptic underslung reverse camber leaf springs at the rear. At the front there is independent suspension employing large coil springs and wish-bones.

**Road Springs and Rear Axle**

Two factors that have a considerable bearing on suspension are neglected springs—these tend to become stiff—and tyre pressure. Too low a pressure contributes to roll, whilst too high a pressure tends to produce pitching and hard suspension generally.

Provided that the springs are lubricated regularly and the tyre pressures checked (see page 38) the rear suspension should be found satisfactory for all normal conditions. Each rear spring has eight leaves and between the top four leaves three zinc strips are inserted. These prevent squeaking and undue wear by virtue of their natural non-rusting qualities.

The spring eyes at each end have silent-bloc bushes requiring no lubrication. At the rear a spring shackles fitted, one end of which is carried in the silent-bloc bush, the other in a bracket attached to the chassis frame. This
bracket locating the shackle to the chassis frame needs weekly lubrication with the grease-gun. Access is obtained by removing the rubber plug situated at each side of the luggage compartment floor.

**Fig. 20.—Removing Bush from Spring-eye**

Do not be tempted to apply any oil to the silent-bloc bushes under the impression that it will improve their wearing qualities. In actual fact, it will have the reverse effect.

**Rear Shock Absorbers and Anti-roll Bar**

An ingenious, yet simple, device is fitted to the rear axle to minimize body sway or roll such as is caused by cornering or abnormal road conditions. In effect, this device consists of a steel bar mounted across the chassis frame parallel to and in front of the rear axle. An arm is extended at each end and bolted to the hydraulic shock absorber at both sides whilst a rubber-bushed link connects the end of each arm to the rear axle itself. (This device is illustrated in Fig. 20.) Suppose the car hits a bump that moves the axle upwards. Since the anti-roll bar is connected to the shock-absorber levers, normal hydraulic control is obtained so far as rebound and compression are concerned. Should one wheel move upwards or downwards to a greater degree than the other, however, then this movement will be resisted. This takes place because instead of the bar moving up or down as a whole one end only moves and considerable resistance is then developed. From this you will see that the anti-roll bar prevents undue side movement of the body and tends to give steady and smooth suspension. The shock-absorber operation and maintenance is described later in this section.

**Front Suspension**

Each front wheel is mounted on a type of front suspension usually called the 'wish-bone' because the upper and lower arms take this shape. This system permits the front wheels to move up and down according to the inequalities of the road surface, at the same time assuring that correct steering geometry shall exist. Between the lower wish-bone member and the chassis frame is fitted vertically a large helical compression spring in such a manner as to
cause the wheel to absorb road shocks. A conical rubber pad fitted within this spring prevents abnormal loading from causing the suspension to ‘go solid’.

The top wish-bone member incorporates a hydraulic shock absorber. Although its external appearance differs somewhat from that fitted on the rear axle, the operation is the same.

The upper and lower wish-bone arm takes the place of the front axle beam. Provided that the various working parts are lubricated periodically they should give good service. It will be found that at some points there are rubber bushes. These require no lubrication but the other bearings fitted with lubricators must be lubricated, especially where they meet axle swivel housings (Fig. 21). There are two lubricators, one beneath upper wish-bone arm, the other above lower wish-bone arm.

Swivel axle has an ‘oilite’ washer mounted to absorb friction caused when wheels turn from side to side as steering wheel is rotated. This thrust washer and swivel axle bearings are lubricated through two nipples to which reference has already been made.

Checking for Wear

Should it be suspected that there is wear within the front suspension the following method will assist in diagnosing the trouble. First, wedge the rear wheels so that the car will not move. Release the handbrake and jack-up the front wheels, one at a time.

Grasp the front wheel with both hands, one at the top, the other at the bottom. Now try to rock the wheel, and if movement can be felt, this may be due to wear at the king-pin bushes or at the hub bearings. If the hub bearings have worn, movement between the brake drum and the brake plate can be seen or felt.

By grasping the wheels with the hands in a horizontal position and moving each to and fro, any lost motion or wear in the steering linkage can be traced. This is a matter where a friend to look out for movement is most helpful.

In course of time, a little wear may develop in the rubberbushed ends of the wish-bone arms as well as in the metalbushed ends. But there is little the owner himself can do about this for dismantling the front suspension is not an easy matter.

Front Shock Absorbers

The shock absorbers, sometimes overlooked, play an important part in damping-out road shocks and checking any tendency to ‘pitch’ on wavy road surfaces.

Armstrong shock absorbers are fitted to the front and rear suspension. Their shock-absorbing property is obtained by using a piston to force a quantity of fluid through a small orifice so causing a resistance. The value of this resistance is less when the axle is moving upwards than when it rebounds or returns. This feature is obtained automatically by a system of spring-loaded valves contained within the body of the shock absorber.

The front shock absorbers are mounted in such a position that the upper wish-bone arms connect directly to them, giving a neat and simple method of incorporating them within the suspension linkage.

Rear Shock Absorbers

Each rear shock absorber is mounted on the chassis side member directly above the axle. The operating arm of the shock absorber is coupled to the axle by a link that incorporates rubber bushes at each end thereby obviating the necessity for lubrication. No lubrication at either end of the link is required and the addition of oil will only cause deterioration. Indeed, care should be taken to see that they are kept free from grease or oil. If oil or grease finds its way into them, clean off with warm water at once. The rubber bushes are part of the operating arm and cannot be renewed. If they become worn, new arms should be fitted.

Maintenance and Testing

The design of the shock absorbers is such that they will function for long periods. All that is necessary is to check the fluid level and top up if required every 6,000 miles.

Two important points to remember are:

(a) Grit or dust, the natural enemies of highly loaded working parts, must not be allowed to enter the
shock absorbers. Before unscrewing the filler plug it is essential to clean around it so that when it is removed no dirt will fall into the orifice.

(b) The shock absorbers operate hydraulically and only the recommended fluid should be used. An unsuitable oil can damage the working parts and an incorrect grade will alter the characteristics of its resistance.

After cleaning around the filler plug, unscrew it ready for topping up if required. The fluid level at the rear can be seen by using a small mirror and pocket torch. For adding fluid a force-feed oil-can is most convenient. Do not mix engine oil and shock absorber fluid in the same can.

The design of the lid or cover is such that when filled to the bottom of the orifice sufficient air space is left to allow for natural expansion of the fluid that occurs as the shock absorber warms up in use.

Periodically inspect the lever shaft at the point where it enters the body and note any signs of fluid leakage. If there is a consistent leak at this point it indicates that the gland, and possibly the bearing, has worn and the shock absorber should be overhauled. This is not an operation that you can carry out yourself, so your Austin dealer should be consulted.

At some time you may feel that the suspension is not what it was and you may probably suspect the shock absorbers as being responsible. This is a matter that can be determined as follows:

Remove the anti-roll bar from the shock-absorber lever and carefully disconnect the link from the rear axle. Grasping the link you may then raise and lower it between the extremes of its travel. If no real resistance is felt the shock absorber may require refilling. Do this and again test, bearing in mind that it will take several strokes for the fluid to be circulated within the internal passages and to build up its normal resistance. Heavy resistance may mean that an unsuitable oil has been used—possibly two different oils have been mixed—or there may be some derangement of the internal mechanism.

It is not practicable to give precise resistance figures that could be used as a guide. In general, when testing the shock absorber the lever should move steadily with equal resistance for the whole extent of its travel in one direction. The effort required to push up the lever is slightly less than that required to pull it down. If you gain this impression when testing and if it takes you several seconds to move the lever through one complete stroke then it may be assumed that all is well.

If you still suspect that the riding qualities are not what they were, check the road springs and shackles for correct lubrication and the tyres for correct pressure.

Finally, examine the springs themselves as sometimes a leaf breaks and the axle may then bear on one of the rubber rebound pads causing rough suspension.
CHAPTER VI

BRAKING SYSTEM

Efficient brakes are not only a necessity to enable the car to be controlled on the road but the law requires that any braking system shall conform to certain standards. It also requires that brakes are kept in such mechanical order as to permit the car to be used with safety under all conditions. Therefore, apart from the owner's natural desire to have efficient brakes readily available whenever they may be needed, he must also remember that at any time the police may require a demonstration of their complete efficiency.

It is not always appreciated that much of the pleasure in driving a car is dependent to a considerable degree on the driver's confidence in his brakes. Two particular symptoms that cause the driver acute anxiety are harsh braking and inefficient braking, i.e. when efficiency is so reduced that undue force has to be used to apply the brakes.

Harsh braking can not only cause the car to skid—sometimes uncontrollably in wet weather—but it also imposes severe strain throughout the transmission. It is directly responsible for undue tyre wear. On the other hand, poor braking gives the driver an unpleasant feeling that he may not be able to stop in time should some vehicle in front draw up suddenly.

No matter how well designed the braking system may be in the first place—and the Austin system certainly is well designed—it is materially affected by the periodic attention it receives. Neglect is soon shown by stiffness in the working parts with resultant loss of efficiency.

Therefore, it is the driver's responsibility to see that his brakes are correctly adjusted and are in thorough working condition at all times.

Front and Rear Brakes

The braking system of the Austin A35 is designed to operate for long periods without the necessity for adjustment, provided that periodic lubrication is carried out. The various points requiring attention are shown on the lubrication chart (see page 206).
The brake pedal operates shoes on all wheels through the hydraulic system. On the front wheels the brakes have two leading shoes. This type of braking enables an extremely powerful braking effort to be obtained with a minimum of mechanical effort. Brakes on the rear wheels have one trailing and one leading shoe in each drum. This arrangement not only permits satisfactory braking in all conditions but also has the additional advantage of permitting the car to be held on severe gradients without undue effort.

The method of applying the front and rear brakes relies on a master cylinder (Fig. 24), pedal-operated and connected to hydraulic ‘slave’ cylinders on each front wheel with an expander unit on the rear wheels. On each front wheel two brake cylinders actuate the leading brake shoes. At the rear a hydraulic cylinder and a push rod actuate two shoes through mechanical linkage (Fig. 23).

The pipe line connecting master cylinder to cylinders on front wheels is attached to the frame by a flexible pipe. This allows for rise and fall that naturally takes place at this point due to movements of road wheels relative to chassis.

The foot-brake pedal, mounted on chassis side member, is connected to master cylinder through the medium of a rod so that when the pedal is depressed the rod moves rearwards. In turn, this pushes down the plunger in master cylinder thus forcing fluid under pressure to the brake cylinders (Fig. 25).

The handbrake lever operates rear shoes by linkage between it and rear-cylinder push rod. This causes stirrup to move and so to apply rear brakes in a similar manner to foot operation of the brakes (Fig. 25).

A reservoir, or supply tank, is fitted under the cover plate located to right of gear lever on the floor (Fig. 26). The fluid it contains is permitted to enter the master cylinder through a suitable connecting pipe and union.

It is important that no other fluid than the correct grade of hydraulic fluid should be used when the system is replenished.

The use of an unsuitable fluid such as a mineral oil, could cause rapid deterioration of oil seals, thus preventing the system from working correctly.

As already described, on the front wheels there is an hydraulic cylinder to each brake drum. One end of each
shoe rests on an abutment that forms a stop. The other end is attached to the piston and expands when the brake pedal is depressed. Each shoe is separately operated so that the moving ends face the direction of brake-drum movement. Thus, a powerful braking effect is obtained because of the 'leading-shoe' effect.

The rear brakes are operated by the cylinder shown in Fig. 25, located at the rear off side and secured under the floor-boards. When brake pedal is depressed, fluid from the master cylinder causes cup 2 to thrust outwards piston 6 and push rod 4. This push rod abuts a stirrup and this moves with it. Attached to it is a pull rod and this, through mechanical linkage, causes the lever to be thrust outward until the brake shoes are bearing against the drum.

Because only one shoe in each rear drum is 'leading', a somewhat less powerful effect is obtained. This is intentional, however, for the design is intended to produce a greater proportion of braking on the front wheels.

The other end of each pair of rear brake shoes is mounted on the abutment that acts as a stop. An ingenious means within this abutment enables an adjustment screw to expand the shoes to take up any lining wear that may occur naturally in course of time. This screw has a slotted end and as it protrudes through the brake plate it is easily accessible for adjustment when required.

Every 1,000 miles check level in brake fluid reservoir. This should be ⅜ in. below filler opening. To gain access to reservoir pull back carpet from under foot pedals to reveal a metal cover plate in the floor. This plate can be removed after releasing the two fixing screws rendering the reservoir cap accessible (Fig. 26).

The brake linkage itself is adjusted at the works. Resetting will not be necessary provided that the linkage is regularly lubricated and inspected to ensure that the nuts do not become loose (Fig. 24).

Apart from periodically topping-up master cylinder and adjusting brake shoes as required, there should be no necessity for the system to be disturbed in any way.

It cannot be too strongly stressed that braking efficiency can be completely upset unless adjustments are correctly made. Consequently, if you have any doubt about your ability to make them as necessary, you will be well advised to ask your Austin dealer to carry out the work.

To maintain your braking system in efficient condition by
Before proceeding further, unscrew brake supply tank cover and if necessary add fluid to maintain correct level. Loosen bleed nipple—about three-quarters of a turn will be sufficient.

All that is now needed is to operate the foot-brake, using regular steady strokes between the limits of its travel, but

![Diagram of Front Brake Assembly]

**FIG. 28.—FRONT BRAKE ASSEMBLY**

1. Brake Linings and Shoe
2. Wheel Cylinder
3. Slotted Adjusting Screw
4. Flexible Brake Hose
5. Cylinder Bridge Pipe
6. Large and Small Fixing Bolts
7. Back-plate
8. Clicker Wheel
9. Dust Cover
10. Pull-off Springs

that the master brake-supply tank has been inspected and topped up as necessary, air should never enter the system. However, if it is felt the system requires bleeding, due to the brake pedal feeling 'spongy', proceed as described below.

Obtain a jar, a length of rubber pipe, and a spanner of a size to fit the bleed-nipple hexagon at B, Fig. 27. Then, partly fill the jar with clean hydraulic brake fluid. A rubber cover (A) acting as a dust cap is fitted over the bleed nipple. Pull off and retain this cap and enter one end of the tube on the nipple. Place the other end of tube in jar, passing it well below fluid level.

a second person to watch the jar and pipe for you is desirable. Probably, he will see that at first bubbles are discharged from the rubber pipe under the level of the fluid. The pedal should be operated until no further air bubbles are observed. It is most important not to let the level of the brake supply tank fall unduly or air may enter here. Top up if necessary.

Preferably use complete strokes and allow the pedal to return fully yet slowly. The bleed valve should be tightened after the air has been expelled on a down stroke thus minimizing any possibility of air entering the system.

When no more air bubbles are seen to be issuing from the rubber tube tighten the bleed nipple, detach the rubber tube and fit the protecting rubber cap.
The same procedure should be carried out on the other wheels and it may then be safely assumed that if any air was in the system it will have been expelled.

It is not usually good practice to use again the brake fluid that you have poured into the jar when bleeding the system. In the first place, it is liable to contain dust or particles of grit that can cause wear or failure should they reach working parts of the system. Secondly, air bubbles are liable to persist for some time and if any of this fluid is used in the system it will tend to create the very condition you have been trying to correct.

**Brake-shoe Adjustment**

The necessity for adjustment is indicated when there is undue foot-brake pedal movement. The careful owner will never allow the pedal to travel to within less than 2 in. of the toe-board. Should there be no undue pedal movement and yet the braking appears poor, it may be due to oil or grease on the brake shoes. In such a case it will be necessary for the brake drums to be removed and for the shoes to be cleaned.

If the shoes are soaked with oil or grease they can rarely be satisfactorily cleaned and it is better to fit replacement shoes. Detailed instructions for this are given on subsequent pages.

**Front Brake Adjustment**

To maintain maximum efficiency, all brakes require adjusting approximately every 1,000 miles. To do this proceed as follows. Apply handbrake and jack up one front road wheel until it is free to revolve. Spin wheel in forward direction and apply footbrake firmly to centralize shoes in drum. Remove road wheel cap and align hole in wheel and brake drum with clicker wheel on one wheel cylinder (Fig. 29). Insert screwdriver or short lever and turn clicker wheel in clockwise direction relative to wheel cylinder until brake shoe bears hard against drum. Back off adjustment the least possible amount (usually two or three clicks) until wheel is free to revolve. Repeat these operations on other wheel cylinder. Replace road wheel cap. Adjust opposite front wheel brakes in a similar manner. (For clicker wheels see also 10, Fig. 28 and 4, Fig. 30.)

**Rear Brake Adjustment**

First place chocks under the front wheels before fully releasing the handbrake. Never attempt to adjust with the handbrake lever 'on' because in these circumstances the shoes are expanded within the drums. This will make it difficult if not impossible to operate the adjusters. Next jack up one rear wheel until it is free to revolve. Remove the wheel cap and proceed as for the front brakes by aligning the hole in the wheel and brake drum with the adjuster screw.

You will find that there is only one adjusting point for both shoes and the adjuster wheel must be turned until one shoe bears against the drum. Continue turning until both shoes bear hard. Back the adjuster the least possible amount until the wheel can revolve. Replace the wheel cap and adjust the other rear wheel in a similar manner. Apply the brake pedal once or twice to make sure the shoes have centralized themselves.

**Handbrake Linkage Adjustment**

The adjustment made at the Works for the handbrake normally should not require any alteration as lining wear will have little effect. Should it be found necessary to take up lost motion in the handbrake linkage, however,
there is adjustment at that point at which the handbrake rod is secured to the sliding link. It is essential to provide some free travel in the handbrake before the expander unit expands the shoes.

The above are the only adjustments that the driver should normally have to make, but it may be that some adjustment becomes necessary to the handbrake linkage, possibly as a result of cumulative wear or for some other reason. Generally, your Austin dealer should be allowed to carry out this work, but there may be exceptional circumstances when the linkage has to be reset when no dealer is available.

**Replacing Brake Shoes**

In the course of time, after continued adjustment, it may be found necessary to replace the brake shoes. This is an operation that is well within the capabilities of the average owner, provided he follows these instructions carefully. A feature of the Austin design, which will commend itself to the owner-driver keen on carrying out his own repairs, is that the four brake drums may be removed without the necessity for using a wheel puller.

First jack-up the car with all four wheels clear of the ground. The most convenient way of doing this usually is to jack-up one side at a time, placing suitable wooden blocks or bricks under the axles in turn. The important thing is to ensure that when the car is jacked-up it rests on a firm base, for you will have to remove all the wheels in order to work on the brake shoes. It is very disturbing to have to support the weight of the car on your toes until some friends can be found to free you! In any case, it is not good for the car to fall off its supports on to the ground.

**Replacing Front Brake Shoes**

There are two precautions to observe when either of the front brake drums is removed. First, do not apply the hand or foot-brake far, since, as there is no restraining limit on brake-shoe travel, the pistons may be moved beyond their normal limited movement thus permitting fluid to escape. Air could enter the system if the pistons moved beyond the limits of the cylinders. The brake fluid, which could be lost under these conditions, would seriously affect braking efficiency if it reached the brake linings.

Secondly, when the brake shoe is removed take care not to let the piston move out of position in the cylinder. An elastic band placed around it is a useful makeshift.

Each brake drum can easily be removed by undoing the countersunk screw and then drawing it off the wheel studs. If you mark the drum in its position relative to the hub you will be sure that when replaced it will run as truly as it did before you withdrew it. If the brake drum cannot be removed make sure that the brake adjustment is not too tight. If this is so, then slackening off each adjuster will facilitate removal.

It is better to obtain replacement shoes from your Austin dealer rather than try to rivet new linings yourself. The linings should be firmly bedded and accurately machined after fixing to suit the brake-drum radius. The shoes obtainable through your dealer will be found efficient in this respect.

When fitting the new shoes, engage them in the slots of the adjuster screw and the opposed-wheel cylinder.

It is advisable to apply a film of grease to the steady-posts situated between brake-shoe web and back plate.

The shoe return springs are fitted with the hooked ends of the spring to the outside behind the brake shoe (Fig. 28).

After replacing both brake shoes, refit the brake drum. If marked for position, ensure that the marks are in line. In any case take care to wipe carefully the flanges on the hub and brake drum to prevent grit from throwing the brake drum slightly out of tune. Secure the drum with the countersunk screw.

When adjusting the brakes, after fitting replacement shoes, it is advisable to loosen each cylinder anchor bolt. There are two on each brake plate. Each should be slackened off to the extent of about one turn. Then the brakes should be applied hard so that the cylinders, which also form the brake-shoe anchorage, line themselves up within the brake drum. The anchor bolts should be tightened securely and with the brakes applied in the manner described above. When the bolts have been set in this manner it will be found advisable to check the brake-shoe clearance and adjust if necessary.
Usually it is beneficial to adjust new or reconditioned shoes to a slightly greater clearance than in the case of shoes that have already bedded themselves in but later normal close adjustment can be made.

**Replacing Rear Brake Shoes**

Remove the rear brake drum the mounting of which is the same as that of the front. Note that the disposition of the shoes and springs differs slightly. It is best to dismantle the shoes and springs together by placing a large screwdriver or similar lever against one of the brake-plate studs as a fulcrum (Fig. 30).

Pressing the shank against the brake shoe will force it upwards and outwards when each end may be disconnected from the expander and adjuster units. Use only sufficient pressure to free the brake shoes otherwise the springs may be strained. With one shoe free, the other may readily be pulled away.

When prising the shoes from their mountings take care not to cause damage to the brake cylinder either by levering on it or allowing a brake shoe to strike it. Should the cylinder bore be distorted brake-shoe operation could be seriously affected. Disconnect the brake spring and take the shoes to your Austin agent for re-lining.

The brake plate should be carefully cleaned, also the brake drum, but take good care not to leave any grease or oil on the polished braking surface of the drum. A tip to note when handling brake shoes is to avoid fingerling the linings when the hands are oily and greasy. It is advisable at this stage to unscrew the adjuster fully as any stiffness can now be corrected more readily than when everything is reassembled.

Apply a film of grease to each end of the brake-shoe web where it enters the jaws of the piston and adjuster unit.

Each pair of brake shoes can be reassembled with the springs already fitted. The longer spring fits at the adjuster end and the shorter spring fits at the abutment pad end. Fit each in the correct location installing them so that the spring is between the shoe web and the brake plate. Position the screwdriver as for dismantling and gently expand the second shoe until it can be inserted into place in the piston and adjuster units.

If it is necessary to alter the linkage refer to the paragraph on page 75. Make sure that both shoes are correctly entered when all is ready for the brake-drum replacement. Check that all locknuts are tight and that all split pins are entered. Then carefully road-test the car.
CHAPTER VII

ENGINE

THE MODERN CAR ENGINE is so reliable that, provided the radiator is kept filled with water, the oil level maintained, and the fuel tank replenished from time to time, it will function for an indefinite period with great reliability.

It is no longer considered necessary for the driver to be a skilled mechanic capable of coping even with a major breakdown on the road as was the case in the early days of motoring. It is this reliability inherent in the modern motor-car that sometimes tempts the owner to neglect normal routine maintenance. If the best service is to be obtained, however, this maintenance remains necessary even with the highly efficient product of today.

Although your Austin A35 is capable of running indefinitely without much attention, neglect will ultimately reduce its efficiency causing its mechanism and appearance to deteriorate as well as to render a breakdown on the road more probable. This book is written for the owner who takes a pride in his car and who is prepared to devote a relatively small amount of time to keeping it in first-class running order.

As the working of the modern internal combustion engine is no doubt familiar to the owner, no lengthy description is justified in these pages. At the same time, a knowledge of the various parts and of their functions cannot but be of assistance in helping to obtain the best performance out of your car. Once these principles are clearly understood, the diagnosis of any fault is made easier. To assist further, a fault-finding table is given on page 218. In case of need, reference to this table usually provides a clue to the particular component that is causing trouble.

The design of the Austin A35 engine is based on the 4-stroke or Otto-cycle principle, as are the majority of car engines today. A downward movement of the pistons draws a correctly proportioned gaseous mixture of petrol and air from the carburettor. This flow enters the cylinders through the manifold and inlet valves.

Dealing with only one cylinder, we find that at the bottom of the induction stroke the inlet valve closes, its movements being controlled by the camshaft. On the upward—compression—stroke both inlet and exhaust valves are closed. Consequently, the mixture is compressed into the small space above the piston by the time it has completed its upward travel.

At the top of the compression stroke an electric spark, from current generated through the ignition coil and timed to occur at the correct instant, fires the charge in the cylinder. The highly compressed gaseous mixture expands powerfully, rapidly forcing the piston downwards and imparting a power impulse to the crankshaft to which the piston is connected. At the bottom of this stroke, the expansive effect being now largely spent, the exhaust valve opens and the piston moves upwards on the exhaust stroke. The burnt gases are forced past this valve into a silencer and so out to the air. The piston is now ready to repeat the complete cycle.

All the four pistons work in a similar manner, each being so timed that two power impulses are applied for every complete revolution of the crankshaft. Thus, an even and continuous turning effort, or torque, is obtained during the whole time the engine is running.

The camshaft is driven at half the crankshaft speed by a duplex roller chain passing over suitably sized sprockets to give this reduction. A helical gear on the camshaft drives the distributor responsible for producing a high-tension spark from the coil at the exact instant and for delivering it to the plug of the correct cylinder.

Unlike the steam engine, the internal combustion engine develops little power at a low number of revolutions per minute but the power rises considerably with increase in engine speed. It is obvious, therefore, that all the components must be so timed that the engine may revolve at the requisite speed to develop the power required. Should the road gradients or traffic conditions reduce the speed of the engine it will be necessary to change down to a lower gear. Should the engine be called upon to propel the car whilst running at too low a number of revolutions per
minute (r.p.m.), severe stresses will be imposed on all the working surfaces of the engine and transmission leading to excessive wear. Any attempt to drive the car too slowly in any gear will readily be apparent by the harsh and irregular running resulting in pinking or knocking. Another symptom is when individual power impulses can be felt instead of the normal smooth surge. The hammer-like blows caused when the engine 'labours' in this manner can do great harm to the working surfaces.

**Loss of Power**

When it is realized that the engine is capable of revolving at speeds considerably in excess of 4,800 r.p.m., any derangement or even slight misadjustment can affect its performance considerably. With loss of efficiency the revolutions will fall and so the engine will not develop sufficient power. If any falling off in power be noticed the reason should be ascertained and the remedy applied as soon as possible.

For instance, if for any reason one plug misfires, 25 per cent. of the available horse-power will be lost and the remaining cylinders will be correspondingly over-loaded. At the same time, the engine will no longer run smoothly. If the various adjustments are known to be in order, and if there is still some reduction in engine power, this may be due to the need of 'top overhauling' or as it is more commonly known decarbonizing.

In normal use carbon deposit accumulates on the pistons, valves, and cylinder head. This carbon is the product of combustion combined with burnt oil, a proportion of which inevitably passes into the combustion head albeit in small amounts. The valves tend to become less gas-tight and particularly so the exhaust valves responsible for controlling the escape of the burning exhaust gases.

This deterioration is a gradual process so that generally the resulting loss of power will not at once become apparent. If there is some loss of power usually associated with pinking, however, this is generally an indication that decarbonization is necessary although it is not possible to say exactly how often this overhaul will be required. As a general guide, every 10,000 miles is usually sufficient although some owners with misplaced pride declare they have not decarbonized their engine for 40,000 or 50,000 miles. The point to bear in mind is that unless steps are taken to correct slight leakage at the exhaust valves these valves may 'burn' so causing damage to their faces and to their seats in the cylinder block.

To test compression. Hold the accelerator fully open with the ignition off. Turn the engine by the starting handle or alternatively by the fan-belt. You should then feel a decided resistance at each half turn, sufficient to make the engine rock back against the pressure until you pass top dead centre when it will turn partly forward due to air pressure developed moving the piston partly downwards.

Remember to give the engine at least two consecutive turns otherwise you will not feel if each of the four cylinders has the proper degree of compression. All four compressions should be equal. If one or more has not the same degree of resistance it may be due to leaking valves or to tappets with insufficient clearance. Another cause of compression loss is leaking piston rings but this is not likely to occur until many thousands of miles have been covered.

A point to remember is that carbon deposit will very slightly raise the compression ratio by decreasing the combustion-head area. In some cases the deposit may become red hot and ignite the mixture before it is fully compressed. This condition, known as pinking, can cause heavy loading on the working parts because the piston—still moving upwards at the end of its compression stroke—receives the heavy blow of the ignited mixture before it is fully at the end of its stroke.

The makers advise that valves of a reconditioned engine should be ground-in and the rocker clearances should be re-set after the first 1,000–2,000 miles. The procedure for carrying out this operation is given in the following pages, together with instructions on how to remove the carbon deposit.

**Decarbonizing the Engine**

This operation is well within the ability of the intelligent owner, but suitable preparations will reduce unnecessary work and assure its being carried out with a minimum of inconvenience.

The old tag 'if a job is worth doing at all, it is worth doing
well applies to the work you are to carry out on your car. Apart from the unsatisfactory results of a badly performed job being a continued source of irritation, any oversight or scamped work may result in a hold-up on the road, possibly miles from a garage.

First, place the car in the garage so that as far as possible you have unhampered access to the engine. It will be found helpful to have an inspection lamp, operated either from the mains or connected by a flexible lead to the car battery. Dark corners can then be clearly illuminated since nothing is worse than fumbling in the dark with components the location of which is not clear to you.

Next, place on a convenient bench the various tools you are likely to need. Procure two or three small boxes in which to place the various parts dismantled from the engine so as to prevent their loss. Although a new part can be fitted, once a part is lost there is always the possibility that it may have fallen into the engine where sooner or later it may cause damage. It is a good idea, also, to cover the wings with cloths to prevent their surfaces from being scratched.

When decarbonizing, use new gaskets for the cylinder head and exhaust manifolds obtained in advance from your Austin dealer. Apply a film of grease to the cylinder-head gasket when it is replaced or use gold size or one of the proprietary gasket cements marketed for the purpose. You will be well advised to remember that the use of a cement can make the cylinder head extremely difficult to remove subsequently. Should it have been used on a previous occasion, thoroughly clean the surfaces of both cylinder block and head of all traces of the old cement before the new gasket is fitted. You will require some clean rag of some material that does not leave fluff since particles of this may find their way into the engine possibly leading to a choked oil passage.

Valve-grinding paste will also be needed and can usually be bought in convenient tins containing either a fine or a coarse grade ready mixed with oil. It is usually more economical to buy it in this form rather than attempt to mix a supply from powder and grease.

A suitable tin is useful to hold paraffin for washing the various parts dismantled during the operation. Since you will probably also be draining the engine sump at the same time, another similar tin will be required to be placed under the sump to allow the oil to drain into it. This tin should be capable of holding 6 pints.

Raise the bonnet and securely prop it open with the strut hinged to the radiator cowl. Open the radiator drain tap and allow the water to run away, but if you have an anti-freeze solution in the system keep the liquid for re-use. Another tin should be provided for this purpose if necessary. Capacity about 8½ pints.

With these preparations completed the work can now proceed.

**Dismantling the Engine**

In the author's opinion the practice sometimes advised of warming up the engine prior to removing the various parts may do more harm than good. A part that is detached while hot may distort slightly on cooling and afterwards it may be impossible to obtain the original perfect fit between the various flange faces. Therefore, dismantle the engine cold.

To avoid any possibility of short-circuits or of the engine being inadvertently turned if the starter motor switch is operated, disconnect the battery by removing the negative terminal. This will isolate the electrical system.

The air cleaner is held on the carburettor by a clamp bolt. A hose clip secures the hose connecting the air cleaner to the valve cover. Loosen the clamp bolt sufficiently to allow the cleaner to be removed with the valve cover.

The valve-rocker cover should next be removed. This is held by two cap nuts, one at each end on top. The rubber bush and washer fitted on the shank of each cap nut should not be lost. Carefully raise the rocker cover, otherwise the joint washer may be damaged.

Remove the choke cable from the carburettor by loosening the pinch bolt on the choke lever sufficiently to allow the cable to be pulled through its location. Remove the accelerator-to-throttle-lever control rod and disconnect the petrol pipe by unscrewing the nut securing the filter union to the float chamber and at the petrol pump. Take care not to lose the fibre washers fitted on each side of the
carburettor-filter banjo union. It will also be necessary to disconnect the distributor-vacuum control-pipe union.

Unscrew the terminals from the four high-tension plug leads and if you are not sure of being able to replace them afterwards in their correct order label them 1, 2, 3, and 4 in order as they are removed, number 1 being nearest the radiator. Remove the sparking plugs.

Loosen the hose clamp at each end of the upper water-hose connections. It is often found that this hose adheres firmly but with care it can usually be removed without damage. If you try to loosen it by pushing a screwdriver between the hose and the radiator connection you may split the hose. If it appears firmly fixed it may be an advantage to cut it, replacing it with a new one when reassembling the engine.

Undo the hose clips and hoses so that the heater return pipe can be removed completely as otherwise it will be in the way when the cylinder head is removed. A clip for this is fitted at the front end of the return pipe and is held by one of the yoke-washer nuts. Do not forget to disconnect the other heater pipe at the control valve on the right-hand side of the engine above the distributor.

It is best at this stage to remove the manifolds, first removing the exhaust pipe at the manifold joint.

Next, unscrew the nuts securing the inlet and exhaust manifolds to the cylinder head (Fig. 33). Do not lose the yoke washers that bridge the lugs of the exhaust and inlet manifold flanges. The manifolds and carburettor can then be lifted off as a unit.

It is advisable to remove the push rods otherwise they may be bent when you are trying to lift away the cylinder head. To facilitate removing them slacken back the rocker-adjusting screws (3, Fig. 34). This allows the ball end of rocker to be detached from the push rod and drawn upwards out of position. It will be necessary to turn the engine if it is found that one of the push rods is holding a valve open.

If you prefer to remove the valve-rocker gear first this can be done. First, disconnect the oil feed pipe and then unscrew the nuts securing each rocker-shaft bracket. The rocker shaft may then be lifted off the cylinder head.

Unscrew the nine cylinder-head nuts, the positioning of which is shown in Fig. 32. The actual cylinder-head nuts are those below the level of the rocker shaft, those above it being used to secure the rocker-shaft brackets to the cylinder head. Plain washers are fitted beneath the cylinder-head nuts except to the four adjacent to the rocker shaft. These washers are of the spring type. Disconnect the clips securing the thermostat by-pass hose.

It should now be possible to lift away the cylinder head by easing it upwards parallel with the cylinder block so that it does not bind on the studs.
If the cylinder head is difficult to remove do not try to force it off by driving a wedge or screwdriver into the face joint. If the head is really obstinate tap it carefully along the face joint with a mallet or a wooden block. Another way is to turn the engine several times with the plugs refitted and the push rods installed so that cylinder compression will loosen the head.

If the rocker gear has not already been removed, unscrew the oil feed pipe union nut, after doing which the nine nuts holding rocker-shaft brackets to cylinder head may be unscrewed and rocker shaft lifted off its studs. Spring washers are fitted beneath these nine nuts.

Valve Removal

Before removing the valves carefully clean their heads to see if they are numbered. If they are not numbered you may either consider it worth numbering them yourself by stamping or preserving them in the same relative position for replacement. If you consider it necessary to number them yourself, a point worthy of notice is that this should only be done when each valve is fully on its seat,
otherwise the stem may be bent and the valve will leak subsequently. A convenient way of preserving their order is to drill eight holes in a board, the holes being of such a size that only the valve stems may pass through.

![Image: Using Tool to Compress Valve Spring](image)

They may then be kept in the same order as when in the engine.

The next operation, valve removal, is greatly facilitated by using a valve-spring compression tool (Fig. 35). There are several variations of this tool but the essential purpose is that whilst one end rests on the head of the valve, the other fits on to the valve cotter cup. By suitable means the tool is then actuated to compress the valve spring and cotter cup, so allowing the two split cotters at the valve-stem end to be freed from their location in the groove around the valve-stem end.

You will see that a spring circlip is fitted around the two cotters and must be detached before they in turn can be withdrawn.

An alternative method of removing the valve spring is to place a suitable block of wood inside the combustion head so that it rests on the valve to be removed. The wood should not be appreciably thicker than the depth of the combustion space within the head. By placing this wood as directed, and with the cylinder head flat on the bench, all that is then necessary is to press down firmly on the cotter cup, removing the cotters as described above. The block of wood is to prevent the valve moving downwards when the pressure is applied. Take care not to allow the spring and cotter cup to jump out of position before you are ready, otherwise they may take some finding!

Be methodical over this valve removal. Immediately you have released the two cotters and circlips place them in the box you are using for parts and repeat this with the other seven valves. This will ensure that you have actually retained all the parts.

Each valve cotter cup has an upper and a lower part between which is an oil seal. This seal is there to prevent oil working downwards past the cotters and reaching the combustion chambers by way of the valve guides. Preferably, renew these oil seals when reassembling.

By dividing the valve cotter cup upper and lower parts the rubber seal will be disclosed and can then be removed. Carefully clean away any traces of the rubber should this have adhered to the metal surfaces.

**Carbon Removal**

Clean away all carbon from inside the combustion heads and valve ports. It is as well to take care not to scratch the valve seats in the head for it is essential that they should form a perfect seal.

When the cylinder head has been thoroughly decarbonized it is a good plan to remove the carbon deposit also from the pistons and the following procedure should be adopted.

Since carbon is an abrasive and usually breaks away in small particles it is best to work on one piston at a time. Owing to the crankshaft construction two pistons will be up whilst two are down. Stuff rag into the two cylinder bores in which the pistons are at the bottom of their stroke to prevent carbon chips entering them. A good tip is to smear grease around the edge of the piston at the junction with the cylinder bore. This will prevent carbon entering at this point.

Take great care not to scratch the piston heads since
these are of relatively soft aluminium alloy. Do not clean the whole surface of the piston but leave a ring of carbon approximately ½ in. in width around the circumference of the piston to assist in keeping down oil consumption. If the whole surface is cleaned oil consumption may be temporarily increased until such time as the carbon ring has again formed when an improvement will be found. Take care to remove any carbon deposit from the under surface of the cylinder head.

When satisfied that the carbon has been completely removed take your rag and clean the top of the engine, particularly around the cylinder-head studs.

The valves should next be washed. Any heavy deposit of carbon should be carefully scraped off not only from the top of the head but also from the underneath and from the stems. A steel-wire scratch-brush, or 'file card', is usually found to be effective for this purpose.

Wash the valve springs and examine them for any signs of fatigue, loss of temper, or breaks. As a rough guide all valve springs should be the same length (1¾ in.) and when stood on a flat horizontal surface should be perpendicular to it. If any of the exhaust valve springs appear to be shorter this is a sign of loss of temper and it would be advisable to replace the whole set. Finally, wash the cotter cups and crotters.

Before grinding in the valves try each valve in its guide. Holding each valve just off its seating see if the head can be moved sideways. Undue side movement indicates wear on the valve stem or in the guide. Undue wear of the inlet valves can account for uneven slow running due to air leaks and in any case some loss of efficiency at high speed due to imperfect seating. A note is given on page 98 regarding how to fit new valve guides but if you feel in any doubt as to your ability to do this your Austin dealer can do it for you.

Examine particularly the valves numbered 1, 4, 5 and 8. These are the exhaust valves and they may have been affected by heat although if you have periodically checked the engine there should be nothing to worry about in this direction. They are somewhat smaller in diameter than the inlet valves and are therefore not interchangeable with them. A burnt exhaust valve is usually characterized by a brown appearance while in extreme cases it will be found to be warped, with part of the seating burnt away. Incipient burning is denoted by a series of parallel lines forming a kind of criss-cross pattern. All is well provided that the valve seating appears all around the underside of the valve head in the form of a grey-white surface with the valve head itself normal steel colour.

**Valve Grinding**

Now you are ready to grind-in No. 1 valve. With a match-stick, apply a little coarse grinding paste to the valve seating. Fit the valve in the head, engage the rubber suction tool on the valve head and lightly turn it backwards and forwards (Fig. 36). Periodically raise the valve slightly from its seating and continue to turn. Do not forget to rotate the valve approximately ¼ turn at a time during the grinding-in process so that the seating is ground evenly.

Carefully remove the valve and wash off the paste from
its head and taking a cloth also wipe away the paste from the cylinder head.

Now examine the seating on the valve and in the head. It should show an even matt surface all around where the two surfaces have been in contact. You may find one or two pits and if these are deep, or if they extend across the seating, it may be necessary for the valve or the seating to be treated with a special machine that your Austin dealer will have. If the pits are shallow normal hand grinding will probably remove them. The point to bear in mind is that a pit is an imperfection that prevents a perfect seat and it will permit leakage and ultimate failure of the valve itself with possible damage to the seat in the head.

Finish by using a fine grinding paste. Grind in the remaining valves in the same manner.

Dip a rag into some clean paraffin, but make sure it is only moistened with it. Then thoroughly clean all traces of valve-grinding paste from the seatings in the head. This is most important. You are now ready to reassemble the valves.

Re-fitting Valves

Before replacing valves clean rag should be positioned in such a manner as to prevent the loss of any cotter that might fall out of position or be dropped accidentally.

Install the valve with the stem lubricated in its correct location, then fit the spring in the recess provided for it. Place the oil-seal retainer in position and fit the rubber seal in the location at the centre.

Fit the valve compression tool and compress the spring and the cotter cup. You now have to fit the two split cotters. Examination will show that these have a conical form on the outside. The inside upper end of each is machined somewhat larger to accommodate the shoulder on the valve stem. Make sure that the two cotters are correctly paired with the wider parts of the cones and that the inner relieved parts are uppermost. It will help if a film of grease is applied to the inside of each cotter so that when they are pressed together around the location machined on the valve stem they will not move out of position as the spring is released on to them. The circlip should next be fitted to retain them securely. Remove the tool taking care to check thoroughly that the cotter cup has passed over both of them and is compressing both into their positions on the valve-stem end.

Proceed with the others in the same manner making an individual check each time to ensure that both cotters are correctly mounted within the cotter cup on the valve stem and that they are seated in the groove of the valve stem.

Sparking Plugs

The sparking plugs should be cleaned and gaps carefully checked. These should be 0.025 in. (0.64 mm.). If it is necessary to close the gap slightly, since there is a tendency for it to increase in use, do not bend the centre electrode as by so doing you may crack the insulation and render the plug useless. Adjust the side electrode nearer to or further from the centre electrode to give the correct gap setting.

If the plugs have been in use for a considerable mileage it is good policy to renew them. Whilst apparently indefinite, their life can be unsatisfactory after a certain mileage—say, 10,000—has been covered because their deterioration results in less efficient operation.

Do not forget that when your engine has been decarbonized and the valves ground-in, the compression will probably be higher than it was before. This factor alone may cause misfiring of sparking plugs that have seen considerable service.

Install the sparking plugs and reconnect the high-tension leads. Firing order 1, 3, 4, 2.

The Austin Motor Co. Ltd. recommend that Champion N5 Long Reach plugs should be used (see page 179).

Replacing Cylinder Head

Take care to fit the thermostat by-pass pipe so that as the head is lowered into position the hose enters on the stub of the pump body and the thermostat. Tighten the clips securely when the pipe is correctly located.

Thoroughly clean the under side, or cylinder-block side, of the head, also the cylinder-block face, and install a new
gasket. This should be fitted with the side marked 'Top' uppermost. Grease is advised as a gasket seal.

Fit the cylinder head over the studs and lower it carefully into position. Lubricate the push rods, top and bottom, and insert them in the location provided making the cup end uppermost. Correct replacement is important, for damage may result if the engine is turned with a push rod not fully entered into the tappet. Carefully examine the rocker shaft and rocker ends for any signs of lack of lubricant. As described on page 202, the rocker shaft is hollow and it may be that one of the oil passages has become choked although this is unlikely because of the efficient oil-filtration system.

Replace the valve-rocker shaft and rockers taking great care to ensure that the bottom of the rocker-shaft brackets and the machined face of the cylinder head on which they seat are clean.

Engage the rocker with the push rod again noting that it may be necessary to turn the engine if the cam is holding up the push rod.

Reconnect the oil-feed pipe union.

Install the spring washers and nuts on the rocker-shaft brackets and pull down securely.

Fit plain washers on brackets that do not pass through rocker-shaft brackets, for these latter have spring washers. Enter nuts and tighten down a little at a time, spreading pressure evenly over cylinder head. For order of tightening these nuts see Fig. 32.

Adjust clearance to 0.012 in. (0.305 mm.) (Fig. 37). To ensure that a valve is not held partly open by a cam, adopt the following procedure. Turn engine by starting handle until valve has just closed. Note this point and then give starting handle a half turn to ensure satisfactory clearance. Adopt this procedure for each valve. Make sure that you tighten lock nuts securely when you have set rockers to give correct clearances.

It is advisable also to use new exhaust-manifold gaskets and when these have been fitted the inlet and exhaust manifolds should be offered up into position. The studs, one at each end, should have a spring washer and nut entered finger-tight. Slip the spring washer over the threaded end of the set screws, followed by the yoke washer. The yoke washers bridge the lugs on the inlet and exhaust manifolds and ensure a satisfactory joint (Fig. 33).

Install a new gasket on the lower flange and couple up the pipe at this point.

Refit water-heater return-pipe hose to connection provided for it on radiator. It connects bottom radiator outlet to block at water pump. Secured to the nut at front of induction manifold is a clip for supporting heater return pipe where it passes along outside of engine.

Reconnect water-flow pipe for heater.

**Fig. 37.—Adjusting Rocker Clearance**

1 Screwdriver Blade in Adjusting Screw. Arrow points to Locknut. 2 Feeler Gauge

Connect carburettor and controls and refit rocker cover and air cleaner together. Make sure that rubber bush is next to cover with plain washer above it. If there is any doubt about gasket this should be renewed otherwise oil may escape when engine is running.

Replace the air cleaner noting that the breather pipe must be correctly attached to the connection on the rocker cover by the clip.

Refit the radiator top hose, turn off the drain taps and refill the system. It may be found that the thermostat
tends to cause an air lock, and that the heater will take a little time to fill. Consequently, it may be necessary to recheck the water level before finally starting the engine. Usually, the heater will not fill until the engine has been started (see page 133).

Reconnect the battery earth terminal, tighten its clamp bolt and protect the connection with a film of petroleum jelly.

The engine is now ready to be started and when it has warmed up, carefully inspect it for water leaks or signs of exhaust or compression leaks. Check the oil pressure by noting the behaviour of the green oil-pressure warning light. By accelerating the engine verify that the generator is charging and that it cuts in and out satisfactorily. Complete the reassembly and the car may then be taken out on the road for test. After its first run the cylinder-head nuts should be tightened down finally in their correct order, also exhaust-manifold nuts (Figs. 32 and 33).

When the engine has covered about 500 miles recheck the tappet adjustment and make any slight adjustments if necessary. Again examine the cylinder-head nuts and see they are tight. If the ignition timing requires alteration see page 176.

**Fitting New Valve Guides**

As you will probably do your own decarbonizing it may be that in time you will find it necessary to fit one or more new valve guides. If you feel competent to do this set about it in the following manner.

The cylinder head must be removed, the rocker shaft detached and the valve withdrawn from the port in which the guide is to be replaced.

The guide itself—a press fit in the head—may be driven downwards by means of a drift and hammer. The drift should be of brass or copper, otherwise the guide may be damaged or a burr raised that may prevent the valve stem from entering it.

A 'stepped' drift (A, Fig. 38) should be used so that it will be readily located in position. Keep the drift square on the guide and then with steady blows it can be driven out from the combustion-head side.

A new guide should be inserted in the same way, i.e.
driven in from the combustion-head side. The valve guides are not interchangeable—the inlet valve guides are cast iron and the exhaust valve guides bronze. The latter have an internal diameter that is somewhat larger at the valve-head end. In the case of the inlet valves the close fit of the guide at the upper end of the valve stem prevents oil from working down at this point.

Referring to Fig. 38, carefully drive in the guide until the top is \( \frac{3}{4} \) in. above the level of the recessed location on which the valve spring seats, as shown at B in inset bottom right.

**Connecting Rod Removal**

Instructions are given below so that you may remove the connecting rod and pistons but it is suggested that this operation is best left to your Austin dealer who has the necessary equipment to carry out the work. Any incorrect replacement can not only cause unsatisfactory running but may in turn lead to mechanical failure the cost of which could easily exceed any economy you might make by trying to do this work yourself.

However, these instructions have been compiled for the conscientious and careful owner who desires to carry out this operation himself.

It is advisable to disconnect the battery to obviate the possibility of someone operating the starter when your hands are inside the engine!

First jack up the car using wooden blocks or similar packing to give yourself plenty of room to lie underneath. Make sure that this packing is substantial and carefully fitted as you will find it extremely painful should the car collapse on your chest during the operation! An additional convenience is a cushion on which to rest your head.

Remove the sump (as described on page 198) and the cylinder head to allow the piston and connecting rod to be withdrawn through the bore.

Turn the engine so that No. 1 connecting rod is at the bottom of its stroke. Free the locking tabs of the two connecting-rod bolts and unscrew them. Carefully release the cap and examine this for identification markings to ensure correct replacement. Take care not to lose the big-end bearing liners (II, Fig. 39).

![FIG. 39.—CONNECTING ROD AND PISTON ASSEMBLY](image)
Push the connecting rod and piston upwards through the cylinder bore. If there is any accumulation of carbon at the top of the bore remove it.

You are now able to examine the piston rings and connecting-rod bearings. These latter are of the non-adjustable shell type. The rings may be replaced if necessary. It will be found of help if three pieces of metal are used to

**act as 'skids' when removing the rings to avoid breaking them. Insert these equally around the circumference and expand the rings gradually so that the 'skids' pass between the piston and the inside face of the ring (Fig. 40). Make sure that rings are not too tight in their grooves. Test with a feeler gauge. There should be not less than 0.0015 in. nor more than 0.0035 in. (0.0381 to 0.0889 mm.) vertical movement (Fig. 41). If the rings conform to these dimensions insert them in the cylinder bore approximately one-third of the way down and truly square. Pushing the piston into the bore will position the ring. The gaps in this position should be between 0.006 and 0.011 in. (0.1524 to 0.2794 mm.). If the gap is less than 0.006 in. it will be necessary to file one end of the ring very accurately with a fine file until the requisite dimension is obtained. Carefully remove any burrs and the ring is ready for replacement on the piston.

**Gudgeon Pin**

Any wear at the gudgeon pin may be due to the cumulative effect of movement between piston and pin. To remove gudgeon pin unscrew and remove clamp bolt with spring washer (9, Fig. 39) to allow pin to be pressed out of connecting rod in which it is a push fit.

Gudgeon-pin replacement is effected by pressing the pin through the piston boss and aligning it with the little end
of the connecting rod so that the cut-away slot in the pin registers with the bolt hole in the little end. Refit the clamp bolt and spring washer, and tighten up securely.

If you are fitting new connecting-rod bearings note that these have a small locating tongue that registers with a suitably cut location in the connecting rod and cap. These must be scrupulously clean on both surfaces and the oil holes (6 and 10, Fig. 39) must be unobstructed.

Correct order of assembly of connecting rods is shown in Fig. 42. On all pistons split skirt must face engine camshaft.

Position each piston-ring gap one-quarter of a turn from the next and the piston is ready for insertion in the cylinder bore. Piston-ring clamps are available through the various accessory factors and may be fitted over the piston rings to facilitate entering them into the cylinder. If you do not possess such a tool take great care to compress each ring in turn so that it enters the bore properly. There is a tendency for the rings to overlap the piston and they break easily.

With pistons correctly inserted apply a film of oil to the big-end bearings. Couple them up to the crankpin making sure the cap is fitted in its original location. Install a new locking tab beneath the head of each bolt but before finally locking the head of the bolt with the tab turn the engine. If the engine is stiff and if this stiffness can be removed by loosening these big-end bolts, then there is some incorrect assembly and you must not proceed further until the cause has been found.

Crankshaft main bearings are of similar type to the big-end bearings and although it is possible to remove them if you consider these bearings need attention you would be well advised to leave this to your Austin dealer.

Note that the oil holes (10, Fig. 39) must always face away from camshaft side of engine.

Ensure that the holes line up with corresponding holes in shell bearings to allow free passage of oil.

Each connecting rod is numbered and each half is also numbered. The numbers must be towards the camshaft. These numbers appear on split sides of connecting rod small ends.
CHAPTER VIII

CARBURETTOR

IF THE AVERAGE OWNER has cause to complain of erratic or unsatisfactory running, without further ado or logical reason he usually blames it on the carburettor. This may be due in part to the fact that as it is relatively easy to adjust, unskilled alterations are often the cause of bad performance. If the complaint is analysed, however, the carburettor is rarely to blame. 'Fiddling' with the adjustments can upset both ignition and valve setting.

Provided that periodic attention as described in this chapter is carried out, unsatisfactory running is generally traceable to some other cause than the carburettor. It is an accurate metering instrument designed by experts and any attempt to improve its efficiency usually results only in loss of performance.

How the Zenith Operates

The Zenith carburettor (Model No. 26 VME) (Fig. 43), as fitted to the A35, is of the down-draught type. It is so called because air enters at the top, travels vertically downwards through the choke, taking with it into the induction manifold a correctly proportioned quantity of petrol. Apart from being an efficient type of carburettor it automatically provides a correctly proportioned mixture through all ranges of throttle openings.

Fuel drawn from the tank by the pump (Chapter IX) is supplied to the carburettor float chamber. This contains a float and needle-valve mechanism to ensure a constant petrol level irrespective of the varying proportions of petrol that may be used by the engine according to the particular throttle position.

The carburettor also contains main jet, compensating jet and slow-running jet. Once engine speed has risen sufficiently, main, compensating and slow-running jets supply the necessary fuel in correct proportions up to full throttle. The slow-running jet, in operation only when throttle is nearly closed, is responsible when engine is 'ticking-over'. As speed increases and main jet takes over, slow-running jet cuts out automatically.

As has been explained already, when starting from cold, choke on dashboard is pulled so as to close air intake. This action causes throttle to open slightly by means of interconnection rod (4, Fig. 44). Most of the depression caused by rotation of engine is concentrated on progression, slow-running, and emulsion block outlets (1, 2, and 6). Very little air enters at this stage, and so mixture is rich as is desirable when starting from cold.

When the engine fires, a heavier depression is created on the engine side of strangler flap (3). As this is held closed only by automatic spring tension it now is caused to open and close rapidly by engine pulsations. In consequence, a mixture weaker and of greater volume is provided, thus ensuring a good engine speed until normal working temperature is attained.
Choke may be released gradually until it can be returned to its closed position, when strangler flap will be fully open.

For normal operation when throttle is closed and engine is 'ticking-over', petrol/air mixture is supplied from slow-running jet (9). Depression will be concentrated on slow-running outlet (2) and in turn will be directed to slow-running jet (9) where there is a fall in depression controlled by adjustment of air-regulating screw (5).

Petrol will be drawn from well beneath slow-running jet (12). At throttle edge is a further outlet (1) where depression will be concentrated. When throttle is opened from idling position a progressive get-away from slow-running is assured. On throttle being opened further, depression will be concentrated on nozzle (6) of emulsion block projecting into narrowest part of choke tube. The result is that petrol can be drawn from passages (7 and 13), because a ready reserve of petrol must be available for instant acceleration.

The eventual source of petrol supply is through main and compensating jets (15 and 16). When petrol in well (12) has been consumed, and as top of well is open to atmosphere, jet (15) becomes air-bled. Petrol issuing from main jet (16) will meet emulsified petrol from compensating jet in a common channel (7) thus tending to break-up petrol from main jet. Supply from both sources will then be drawn into choke tube from emulsion block nozzle.

As soon as petrol in float chamber sinks below a predetermined level, float will fall and permit needle to drop from its seating (10) and allow petrol to pass through seating into chamber.

Adjustments

Slow-running adjustment, when engine is out of gear—sometimes known as 'idling'—is obtained by means of throttle-stop screw (6, Fig. 43) and air-regulating screw (3). The former determines degree of slow-running and enables throttle position for idling to be adjusted. To increase slow-running speed this control must be turned clockwise. If turned in opposite direction, it will give slower 'tick-over'. If engine is inclined to 'hunt' when running slowly, mixture is too rich and must be weakened by turning air-regulating screw in an anti-clockwise direction. This will cause a reduced depression on slow-running jet resulting in a reduced output.

If weakness at slow-running speeds is suspected, then air-adjustment screw should be turned in a clockwise direction. This will reduce air leak at screw to give a greater depression on slow-running jet.

If the carburettor is old, it is impossible to have good slow-running. It must be remembered that there are factors other than carburettor that influence slow-running. These include joints that are not air-tight, worn valve guides, valves not seating, ignition over-advanced, and incorrect setting of sparking plug points. Once carburettor has been correctly adjusted, however, no attention should be necessary for many thousands of miles.

It may be here mentioned that slightly weaker carburettor settings may be found necessary on cars used in hot climates. Alternatively, slightly richer settings (larger jets) may be used in cold climates.
Dismantling

No working parts of the Zenith carburettor are subject to derangement by wear. All fuel is filtered, thus eliminating any possible source of trouble. In addition, air is cleaned by having passed through air filter.

Grit or water may enter the passages should filters or bowl not have been cleaned and drained often enough.

Water in petrol can give trouble unexpectedly because it will not pass through the small orifices and so, being starved of petrol, the engine misfires or stops.

Sometimes, therefore, it may be necessary to dismantle or clean the carburettor but the design is such that those parts requiring attention are readily accessible. Before dismantling, ensure that your hands and bench are thoroughly clean. If possible dismantle over a metal tray or some similar clear surface so that, if you are unfortunate enough to drop any small part, it may be retrieved.

Float chamber (27, Fig. 45) should be disconnected by unscrewing securing bolts (3) and with float (33) removed to a safe place. Remove main and compensating jet plugs (24 and 26), both of which are located on underside of float chamber. Main compensating jets may be unscrewed by using squared end of one of the float chamber retaining bolts.

Slow-running jet (36 inset) and screw over capacity well (37) may also be removed from float chamber.

Next, unscrew the five set screws (18) securing emulsion block (19) to float chamber, taking care not to damage joint washer (20).

Hold carburettor firmly in one hand and with the help of a suitable spanner remove needle seating (21) and washer (22).

Remove strangler flap (2) by unscrewing the two screws (1), allowing strangler spindle (30) to be withdrawn after unhooking strangler spring (31).

The strangler flap is bevelled along its two rounded edges, consequently special care should be taken before removing it. It can be fitted correctly only one way. Correct position of strangler spring should also be noted with reference to strangler lever (28).

The inter-connection rod (8) should now be disconnected from its upper end.

A clip (29) holds strangler lever in position. Undo this and strangler lever will slip off along with its spring (32), the correct assembled position of which should be noted.

With throttle (15) closed, also note relative positions of floating lever (9) and interconnecting rod assembly and throttle lever (10). Also note the way in which the bevelled edges of the throttle fit in the bore of carburettor body. Alternatively observe the position of dimples on the throttle.

Unscrew the two throttle fixing screws (14) and withdraw throttle. The spindle (13) can then be taken out with
floating lever, inter-connecting rod assembly and throttle lever, leaving spring washer (r2) and nut (r1) in position.
Take out throttle stop screw (r7) and its spring (r6). Also remove air-regulating screw (6) together with its spring. When detached screw (7) will allow choke tube (4) to be taken out.

Reassembly
Reassembling the carburettor is straightforward if the dismantling process is followed in reverse. If old or damaged, change joint washer (34) between float chamber and carburettor body. Ensure that float is replaced with side marked ‘top’ uppermost.
It is best to leave emulsion block in position, for it is unlikely there will be cause to remove this at any time.

Cleaning Jets
Flush chamber with petrol and clean jets by blowing through them—either with a tyre pump or with the mouth—in reverse direction to fuel flow. Do not use wire for probing them or you may enlarge the carefully calibrated orifices or cause a burr that will partially block them.
Having thoroughly cleaned float chamber and passages, replace jets. Before doing so, however, ensure that the fibre washers are correctly positioned and in good condition. Re-install float with the mark ‘top’ uppermost.
Before positioning carburettor, operate hand primer lever on pump to ascertain that petrol passes freely through needle valve. If it does not, see ‘Petrol Supply Failure’ on page 120.

Incorrect Mixture
For all positions of the throttle above that for idling the carburettor setting is predetermined by the sizes of the main jet, compensator jet and choke tube. Owners sometimes try to fit smaller jets in an attempt to obtain better fuel consumption but by unduly weakening the mixture such experiments give rise to overheating often causing the exhaust valves to burn. In addition, loss of power is experienced necessitating a wider throttle opening and usually an increased fuel consumption. Standard sizes:

- Choke tube: 22 mm. with third bar. Main jet: 80.
- Compensating jet: 57. Slow-running jet: 50. Incidentally, all jet sizes are clearly marked on the jets—the higher the number, the larger the jet.
An incorrect mixture is either too weak or too rich. If too weak the engine runs erratically when idling and tends to stop suddenly. ‘Spitting back’ through the carburettor is a symptom of a restricted jet, weak mixture, faulty ignition, or sticking valves.
If the mixture is unduly rich the engine after a while will tend to choke itself to a stop. On accelerating it will hesitate before clearing itself and again running evenly.
Lack of acceleration may be due to faulty slow-running adjustment, retarded ignition or heavy carbon deposits in cylinder head. Other causes are faulty fuel supply, dirt in carburettor, partially blocked jets, engine not correctly timed, indifferent compression, sticking or badly-seated valves.
High fuel consumption may be due to any one, or a combination, of the following: Over-rich mixture. Dirty air cleaner. Excessive vibration on engine mountings. Flood-ing carburettor. Incorrect jets. Leaks in fuel supply line. Strangler-flap partially closed.

Punctured Float
A punctured float is rare. It can be verified by shaking the float, when the petrol inside can be heard splashing about. It is better to replace a leaky float for any attempt to solder the leak will increase the weight thus causing the level to be raised giving rise to increased consumption.
If it is essential to effect a first-aid repair, however, immerse the float in boiling water to evaporate the petrol. This will escape from the puncture in the form of bubbles of petrol vapour. Once the petrol has been eliminated the float may be soldered by applying the thinnest possible film of solder carefully restricted to the actual area of the leak. You can test the efficiency of the repair by again immersing the float in boiling water and this time no bubbles should escape.
If at any time you remove the carburettor, always ensure that the gasket between its flange and the inlet manifold
is in good condition. Remember also that the suction-pipe joint to the distributor must be kept airtight.

When the carburettor has been adjusted it is usually found that the ignition setting also can be adjusted with advantage, particularly in the case of a reconditioned engine that is now run in. For instructions on adjusting the ignition see page 174.

**Air Cleaner**

The air passing into the carburettor is cleaned so that no grit or dirt enters the engine. This not only tends to increase engine life but also to reduce the deposit of carbon. A further important point is that the filter element, being wetted with oil, permits the air to become impregnated with finely divided oil particles so assisting efficient lubrication. A final but important point is that the cleaner itself acts as an effective silencer by eliminating carburettor noises.

One of two types of air cleaner may be fitted. The normal air cleaner is of the oil-wetted type (Fig. 46) and is fitted to cars for the Home Market. Apart from regular cleaning, it requires no attention.

The oil bath type of air cleaner (fitted to cars for the Export Market) should be dismantled, cleaned and filled with oil up to the arrow mark every 1,000 miles. In countries with a heavily dust-laden atmosphere cleaning should be carried out at more frequent intervals.

To remove either type of air cleaner, slacken its clamp bolt, disconnect the breather pipe and lift it off.

The oil bath air cleaner is dismantled by releasing the wing nut. The strainer then can be lifted out. Rinse strainer in petrol and clean oil retainer. Allow strainer to drain and dry before new oil is poured in up to the correct level, and the cleaner reassembled.

The cleaner used in the Home Market should be cleaned every 6,000 miles. If operated in very dusty conditions the cleaner should have attention more often. At the point where the cleaner joins the carburettor is a clamp bolt. If this is loosened it will allow the cleaner to be detached from the carburettor.

Pour a little petrol into a suitable shallow container and insert the cleaner vertically so that the end having the gauze will be swilled in it. By briskly moving the cleaner in the petrol, you can wash away any grit and dust. Set the cleaner aside to dry and when thoroughly dry pour engine oil over the gauze and allow any surplus to drain away before refitting the cleaner to the carburettor.
CHAPTER IX
FUEL PUMP

THE FUEL TANK—capacity 52 gallons—is situated under the floor of luggage compartment. As it is at a lower level than the carburettor, which is mounted on near side of engine, it is necessary that fuel should be supplied by pressure. This is effected by a mechanically operated pump bolted on left-hand forward side of engine crankcase, with inlet pipe from rear tank. A lever is fitted to enable carburettor to be primed by hand, should float chamber become empty due to evaporation. If petrol appears to be leaking from edge of diaphragm, tighten cover screws alternately. Sometimes such leakage may actually come from one of the pipe unions causing fuel to run down to pump and collect around diaphragm flange.

The pump mechanism is so arranged that when the float chamber is full and the needle valve closed the pressure set up in the pump prevents the diaphragm from moving and supplying further petrol although the operating arm may continue working.

The pump (Fig. 47) is similar in action to an ordinary plunger pump except for the fact that the plunger in the latter is replaced by a flexible diaphragm of large diameter. As the cam moves the rocker arm outwards, it brings the diaphragm downwards thus creating a vacuum in the sediment chamber and drawing fuel from the tank through the inlet valve. As the cam turns, the rocker arm moves inwards causing a diaphragm to rise by the action of the compression spring beneath it. This forces fuel through the outlet valve, since the inlet valve is now closed against its seating to which it is held by a small compression spring.

Before it can enter the diaphragm chamber, fuel must pass through a fine filter gauze (10, Fig. 47). This should be examined and cleaned if necessary every 2,000 miles.

Access is gained by removing dome cover, after unscrewing retaining screw, when filter gauze itself may be lifted off its seating. Clean it with air from a tyre pump, or with petrol. At the same time, clean out sediment chamber. On replacement do not overtighten filter-cover retaining screw but tighten only sufficiently to ensure a fuel-tight joint. Fit a new cork gasket under filter cover and make certain that fibre washer has been replaced under head of retaining screw when refitting cover. Check all pump-mounting set-screws and petrol pipe unions for tightness.

FIG. 47.—A SECTION THROUGH FUEL PUMP

1 Diaphragm Pull-rod, and 2 Spring. 3 Diaphragm. 4 Pump Chamber. 5 Sediment Drain Plug and 6 Chamber. 7 Inlet Union. 8 Delivery Valve and 9 Port. 10 Gauze Filter. 11 Cork Sealing Washer. 12 Inlet Valve. 13 Camshaft Eccentric. 14 Camshaft. 15 Anti-rattle Spring. 16 Connecting Link. 17 Rocker Arm and 18 Pivot Pin

The inlet and outlet spring-loaded valves are so arranged that they permit fuel to pass only in one direction. The inlet valve faces upwards, and the delivery valve downwards. Upward movement of the diaphragm can only force petrol through the delivery valve, raising it to allow petrol to escape past it on its way to the carburettor. On the other hand, when the diaphragm is drawn downwards the delivery valve moves downwards against its seating whilst the inlet valve opens and allows petrol to be drawn from the tank by suction. From this it should be clear
that fuel is supplied to the carburettor by an up-and-down movement of the diaphragm and this alternately causes the inlet and delivery valves to function.

The pump rocker arm may continue to operate even when the float chamber is filled and virtually no fuel is being demanded. When the float chamber is filled the float rises to close the needle valve, thus cutting off any further supply of fuel. The next downward movement of the diaphragm draws a further supply from the tank to the pump. This supply cannot be pumped into the carburettor, since the needle valve is shut. The diaphragm of the fuel-pump inlet is held downwards unable to force the fuel past the needle valve of the carburettor. Thus the rocker arm of the pump merely rises and falls within the lower slotted link of the diaphragm assembly. As soon as the carburettor requires more fuel, and when the needle valve opens, the diaphragm will rise thus forcing the petrol into the float chamber.

Once the diaphragm has risen sufficiently the rocker arm, through its linkage, will again draw it down. According to the requirements of the float chamber so will the diaphragm rise. Thus it will be seen that the diaphragm can be held down by back pressure in the pipe leading to the carburettor. When further supplies of fuel are required, however, the compression spring will move the diaphragm upwards to supply the additional fuel. The rocker arm then draws down the diaphragm and the pump re-charges itself from the fuel tank. As long as the engine is running a supply is always available to maintain a constant level in the float chamber through the medium of the needle valve.

A small compression spring holds the rocker arm in a continuous contact with the camshaft. The rocker arm carries the link for the fuel-pump diaphragm.

From the above description it will be seen that the fuel pump is automatic in action and simple in operation. As long as the filter is kept clean and any sediment is periodically drained from the sediment bowl, the unit will function indefinitely.

As mentioned earlier, the fuel pump is provided with a lever for priming purposes. If the carburettor float chamber is not full a slight pumping resistance is felt before the lever reaches its stop. This resistance ceases when the chamber is full. To test the pump in position, switch off the engine and disconnect the fuel pump at the carburettor end leaving a free outlet from the pump. On turning over the engine by hand there should be a well defined spurt of fuel at every working stroke of the pump—that is, once every two revolutions of the engine.

One important point must not be overlooked. The hand-priming lever cannot operate the diaphragm if it is held down by the cam having moved the rocker arm outwards, thus drawing it down. If this is so, although the hand-primer lever can be operated, it will not be felt to move the diaphragm downwards. Thus, it will be necessary to turn the engine approximately one full revolution, so bringing the cam clear of the rocker arm and allowing the diaphragm to return to the uppermost position.

It will be understood that the hand-primer lever will not
operate the diaphragm if the float-chamber needle valve is
closed, for the back pressure in the petrol pipe naturally will
hold the diaphragm in the lower position.

**Fuel Supply Failure**

Should the engine stop because the pump has not main-
tained the correct level in the float chamber, ascertain that
there is fuel in the tank. Even if the gauge indicates that
this is so it is as well to make a positive check by dipping
a clean rod or stick into the tank to ascertain that fuel is
actually there. Elementary as this advice may seem it is,
nevertheless, a fact that garage breakdown vehicles have
responded to calls for help when all that was wrong was
that the fuel tank was empty. Sometimes fuel gauges
become deranged and in consequence give an incorrect
leading. It is a wise precaution always to carry a spare
rod of petrol in the boot—even if only to help the other
fellow sometimes!

If it is established that there is fuel in the tank, the
quickest method of checking the faulty component is to
disconnect the fuel pump from the carburettor at the float
chamber unit. Test the flow from the fuel pump by turn-
ing the engine as suggested on page II. Should fuel be
reaching this point it is obvious that the stoppage must
be in the carburettor. In this case, cleaning it with special
attention to the needle valve will probably rectify matters.

Suppose you find that the carburettor is all right and
assume the fault lies somewhere else. It may be that fuel
is not being discharged from the pipe you disconnected
from the pump. Disconnect the pipe from the pump again
and turn the engine in case there is some blockage in the
pipe itself. If again there is no petrol temporarily re-con-
nect the fuel pipe to the pump. Place your mouth over
the end and find out if you can suck fuel through. Should
there be an obstruction clean the filter and sediment cham-
ber of the pump, as previously described. On the other
hand, if you can draw petrol—remembering that as it has a
most unpleasant taste you should avoid taking a mouthful
—it will probably mean that one of the pump valves is not
seating correctly.

Alternatively, the diaphragm may be punctured or—a
very rare occurrence—the diaphragm spring has broken.
This can usually be noticed when the engine is turned, for
the characteristic breathing sound will not occur at the
inlet orifice because the diaphragm will not be actuated
correctly.

In either case, open up pump chamber (4, Fig. 43) to
disclose filter screen. Wash out sediment bowl and clean
filter as already instructed.

A syringe may be used to force fuel to delivery and inlet
(8 and 12, Fig. 47) valves to remove any grit that may be
preventing a proper seating.

If the pump continues to refuse to function when assem-
bled, and the diaphragm screws are tight, see if the various
union nuts are tight. An air leak on the suction side of
the pump could prevent the pump from working.

If you again cannot draw petrol through after cleaning
the filter and re-assembling the pump, disconnect the main
pipe to the pump. Apply suction to the end of it, and if
there continues to be no response it probably is due to an
accumulation of fluff or dirt drawn into the pipe from the
tank. It may be this encumbrance can be cleared by
blowing down the pipe. Remember, however, that whilst
you may clear the pipe temporarily the dirt remains in
the tank so that the trouble may recur at any time. In
such a case the tank should be drained and cleaned at the
end of your journey and any fuel remaining should be
filtered.

**Leaking Fuel Pump**

An important point to remember is that leakage is
usually evidenced only when the engine is running or has
stopped. It is only under these conditions that the pump
is known to be primed. Although fuel may be seen to be dripping from the pump
this is not necessarily proof that the pump itself is at fault.
The golden rule in diagnosis is: 'Never jump to conclu-
sions.' First wipe the exterior of the pump carefully with
a rag and see whence the fuel is coming. The leak may be
due to a loose pipe connection or—should the pump cover
have been removed—from the gasket fitted between the
cover and body, or from the gasket beneath the bolt head.
If necessary the engine may be started to ascertain that the pump itself is primed.

Another possible source of leakage is at the screws holding the sediment chamber to the lower chamber. Should they have loosened fuel may escape at this face joint between the upper and lower surfaces. If so, they should be screwed up, preferably tightening them diagonally to ensure even pressure.

It sometimes occurs that after prolonged service the diaphragm leaks at the centre. Naturally, there is some flexion at this point but usually any leakage is evidenced by air entering on the suction stroke, thus causing the pump to take a considerable time to prime itself. In any case, with leakage at this point the outlet pressure would be somewhat reduced.

Do not attempt to replace the diaphragm as this operation requires detailed knowledge of the pump assembly. Apart from anything else, unskilled replacement may cause the pressure developed by the pump to be increased. This would result in the carburettor flooding or having an increased fuel consumption; diaphragm life may be reduced. Your Austin dealer can usually give you quick service for this component.

**Fuel-tank Contents Gauge**

The fuel contents gauge on the instrument panel, which shows you how much petrol is in the tank, operates electrically through an ingenious float device.

The indicator hand on the gauge is moved by an electric current, the movement being controlled by the amount of current. The greater the amount of current passing through the gauge, the more will the indicator needle move between the limits of 'Empty' and 'Full'. Although the current consumption is extremely small, the gauge is so wired that it is in use only when the ignition is on. Reference to Fig. 49 shows the working principle of the electrical circuit.

In the fuel tank is a small cylindrical float attached to the end of an arm that pivots in the die-cast body of the unit. Attached to the arm is a sliding contact lever bearing against the electrical resistance that forms the rheostat. As the level in the fuel tank rises the float varies the resistance and the amount of current flowing through the meter dial on the dash. The meter contains two small electromagnets consisting of coils with soft-iron cores. The variable current flowing through these coils alters the magnetic field and controls the position of the needle.

This type of gauge is extremely simple and should give no trouble but if there is any intermittent operation it may be due to a broken wire or to a loose connection. Should this be suspected, examine the wire and make sure that the terminal is clean before finally tightening it. Failure due to the float leaking or to the mechanism sticking is extremely rare.

It is important to note that in no circumstances must the resistance coil in the tank unit, nor the winding in the instrument-panel gauge, be tested by applying full battery voltage to them or damage will be caused to the installation. If you suspect an electrical fault in either, you will be well advised to get your Austin dealer to check them over for you.

If you suspect that the float of the tank unit is leaking, it may be removed from the well at the rear of the top face of the tank. Disconnect the wire from the tank unit but take care it is not allowed to short-circuit on any metal part or there may be damage should the ignition be on.

The face of the tank is protected by a rubber cap and this must be removed to gain access to the six retaining screws. When they are withdrawn the unit may be removed.
Take care not to bend or strain the float arm other than as it is when supplied or its correct movement between the limits of its travel may be affected. The float arm is provided with top and bottom stops to prevent the contact arm overrunning the resistance.

Should the gasket be damaged when replacing the tank unit fit a new one and reconnect the gauge wire terminal. The cover plate should then be replaced and secured with the screws around its edge. See that the gasket fitted to the cover plate is in good order for this prevents dust or dirt from working its way into the interior of the car.

CHAPTER X
COOLING SYSTEM

THE ENGINE OF THE A35 is water-cooled, sealed and pressurized. This pressure raises the boiling point of the coolant (water) to 224°F. A pressure relief valve, located in the radiator filler cap, opens at approximately 4 lb. per sq. in. pressure. The cooling system includes a centrifugal water pump driven by a triangular V belt from the generator. The spring-loaded carbon-type gland requires no adjustment. A thermostat is fitted at water outlet on cylinder head to assist rapid warming up—a very desirable feature (Fig. 50).

A useful fitting as an extra is an interior heater for the car. Connected to the cooling system, it is mounted on the engine bulkhead and incorporates a core through which hot water from the engine can be circulated.
A small electrically-driven fan is fitted to the heater unit so that warm air can be circulated through the car body. The method of operating the heater fan is to turn the control switch situated to the centre of the instrument panel in a clockwise direction (5, Fig. 2). The heater installation is dealt with later in this chapter.

Any petrol engine becomes hot in use because the petrol/air mixture when ignited develops intense heat. Unless this is dissipated normal lubrication would become impossible for the oil film would break down resulting in metallic seizure. Cooling is effected by passing water through the radiator and circulating it around the cylinders. The water passes down through the core of the radiator to a tank at the bottom, thence through a connecting hose to the pump. From here it circulates around the cylinders to find its way through passages into the cylinder head, then around the exhaust ports, etc., finally to reach the header tank at the top of the radiator by way of the upper connecting hose.

As soon as the engine is started the pump, driven by the V belt, circulates the water through the system assisting the natural tendency of the water to follow the course described above, for hot water rises and cool water falls. The heat transferred to the water from the engine is dissipated by the current of air through the radiator by the forward progress of the car, assisted by a two-bladed fan mounted on an extension of the pump shaft and situated immediately behind the radiator (3, Fig. 51).

**Thermostat**

To ensure maximum engine efficiency it is essential to keep the operating temperatures of the engine within certain limits. This is done by the thermostat, located in the water outlet at the front of the cylinder head (2, Fig. 51).

The thermostat consists of a metallic bellows filled with a volatile liquid that controls a mushroom valve. When the engine is cold, this valve is closed, a by-pass being fitted to allow for slight circulation. On starting the engine, the flow of water to the radiator is temporarily restricted, resulting in a rapid increase in the water temperature in the power unit. The heat of the water in contact with the bellows causes the valve to open gradually through expansion, ultimately allowing full flow to the radiator.

The thermostat is detachable so that should occasion arise it can be removed from its housing and the hose reconnected. This avoids laying up the car.

If the thermostat is tight there are two holes on the top that may be utilized to ease it from the casting.

When the system has been completely emptied, it is essential to wait a minute or two after refilling before finally topping up, to allow air to escape through the thermostat valve.

The thermostat is set by the manufacturers to open at 158° to 167°F and it cannot be altered. When decarbonizing it is desirable to test the thermostat by immersing it in water that has been raised to the requisite temperature. If the valve fails to open a new unit should be fitted.
Overheating

If you are in doubt as to what is the normal temperature of the cooling water, let us explain that there are two extremes to avoid. The cooling system may become so hot that the water boils and this is always a sure sign that there is something wrong. The other extreme is not so readily ascertainable because there is no visible sign. It is when the system is too cool or the engine temperature insufficiently high to effect carburation, since perfect vaporization will not take place unless a certain minimum temperature has been reached. Heat from the engine is required to vaporize the mixture completely and if this is not achieved partly vaporized petrol may dilute the lubricating oil on the cylinder bores. Should this oil become thinned it loses some of its effectiveness and fails to prevent cylinder-bore wear. Most cases of this occur when the engine is first started and usually are aggravated by excessive use of the choke—therefore, the shorter the warming-up period the better.

Perhaps at some time you become aware that the radiator is boiling. Should such a high temperature be reached do not immediately unscrew the filler cap. If you do this you run the risk of severe scalding, when the boiling water clouds of steam gush out like a fountain. Switch off the engine at once. There is little else you can do but wait until the water has cooled off.

As a rule the average owner takes the cooling system 'on trust'. This state of affairs usually remains until the engine boils—a positive indication that something is wrong. The engine is sound-insulated from the interior of the car and the shield also keeps out smells. Thus, it is not easy to determine whether the engine is running too hot by the 'smell' of heated machinery. There are, however, certain indications that can be used as guides. A sudden tendency to 'pink' often is the first sign of an overheated engine, although this may be due to some condition other than water boiling in the radiator. By the time the water begins to boil, steam passing through the overflow pipe is not visible to the driver.

If it is considered that 'there's a smell of hot engine', and if you think it is a long time since the radiator was filled, or if there is any other reason for it, have a look to make sure.

Another point to be underlined is: Do not fill up the radiator with cold water if it is overheated. Adding water—even hot water—to an engine that has boiled away most of its water can often cause a cracked cylinder block. If you must get on the road again in the shortest time possible and there is some water in the cooling system, start the engine and add water carefully so that it is prevented from entering the block and causing local contraction. The water-pump will help in this direction but it is always best to play for safety and wait until the engine has cooled off.

So much for the results. Now to discover what caused the boiling and how to prevent a recurrence. The following queries are tabulated and if you go through them the cause should be discovered. Do not be tempted to stop as soon as you think the answer has been found but work through the questionnaire in case more than one cause is applicable.

(1) If you use a radiator muff or blind, has it been thoroughly furred? Is it open enough?
(2) Are running conditions unusual in that there may be a heat wave, a full load, a long incline, or a following wind?
(3) Is the hand-brake partly on or are the brakes sticking or binding so that more power is required to drive the car?

These queries can be quickly checked by stopping the car on level ground and trying to push it along. If this can easily be done and if it runs for a little distance freely then the brakes—or any stiffness in the transmission—can be eliminated.

(4) Does the engine seem to be 'pulling'? If not, perhaps the ignition advance mechanism is not working efficiently. This operates automatically but if for some reason or other it does not give the full range of advance then the engine will lose power and will overheat due to the retarded ignition setting.

(5) Test the compression by turning the engine with the starting-handle. Should the compression of one or more cylinders be weak then the engine may be the root cause of overheating. The valves may be leaking.

(6) If the fan-belt slips the ignition warning light may glow erratically since the generator—being driven from the same belt—will be affected too. The water-pump is
also driven from the fan-belt so that a slack belt may thus affect both fan and pump. But do not decide to eliminate this trouble by having the belt too tight. If this is done, not only will the belt wear quickly but the pump, dynamo bearings and fan-shaft will be heavily loaded. Increased wear will be the inevitable result. The belt should be sufficiently tight to allow it to be moved laterally about 1 in. in each direction.

To make adjustment, slacken bolts and raise or lower generator until desired degree of tension is obtained. Then securely lock generator in that position (see Fig. 52).

(7) A choked silencer or exhaust pipe may cause overheating and loss of power. This can usually be traced by listening to the exhaust note. If it seems to have a muffled hiss rather than a clear ‘beat’ then an additional check would be to disconnect the silencer and ascertain if the engine has more power without it. Do not be tempted to test the car on the road, however, for then people other than the neighbours may have something to say!

(8) Front wheels that are ‘toed in’ or ‘toed out’ too much can cause considerable resistance to forward motion as also can any stiffness in the gearbox or rear axle. A quick check for transmission stiffness is to raise one wheel at the rear—with the car suitably blocked up so that it cannot move in either direction—and turn the wheel with the handbrake off. It should be quite free to turn. If it is stiff this may be due to dragging brakes or to some other misadjustment.

(9) The cooling system may be blocked in one or more of its passages. Where possible clean rain water should be used and this should be filtered when the radiator is filled so that leaves and other foreign bodies are excluded. To a greater or lesser extent tap water possesses undesirable salts that form scale on the inside of the system. For this reason it is best to use only soft water such as rain water.

Rubber hose occasionally tends to shed its inner surface and can obstruct the flow of water particularly since all water has continually to pass through hoses at the top and bottom of the radiator.

**Cooling System**

**FIG. 53.**—RADIATOR

1. Overflow Pipe. 2. Filter Cap. 3. Bonnet Catch
Heater and Demister

The Smith built-in heating and demisting unit (optional extra) utilizes the cooling-system water to heat air for circulation in interior and to windscreen for demisting and defrosting. The engine thermostat maintains a temperature of 158° to 167° F. in cylinder block and since the thermostat enables the engine to warm up very rapidly heat is available for the interior soon after starting.

The heater consists of electrically driven booster fan, bolted on left-hand side of engine bulkhead. It draws air through front grille and forces it along a large diameter flexible pipe into heater unit also situated on bulkhead.

Here it passes through a water-heated radiator into a distribution chamber where shutters, operated from heater control panel, regulate its flow into interior of car.

Even without the fan switched on, air will be forced into car and on to windscreen due to car’s motion providing that the appropriate shutter in heating and demisting unit is open. At low vehicle speeds, and particularly if maximum heating or ventilation is required, the fan should be switched on. If necessary, air supply to interior can be entirely shut off—as, for instance, when in dense traffic—to prevent entry of exhaust fumes, dust, etc.

The heating and demisting unit is controlled by two levers operating in a quadrant mounted beneath instru-
Care of the Radiator

If the radiator is topped-up when necessary no particular care is required except periodically to inspect the hoses and clamps to make sure that they have not become loose so allowing water to seep through.

Some owners are quite happy on inspecting the water level when the engine is hot. A different story is told, however, when they look at it with the engine cold for then the water has contracted and the level has gone down. On refilling it to the top some misgiving is felt when next it is found that still more water is required. What is not realized is that if it were checked ‘hot’ then the normal level would be reached, for only the surplus is lost down the overflow.

In summer it is good practice to examine the radiator grille to see that it has not collected myriads of insects or leaves. This state of affairs restricts the amount of air passing and so may give rise to overheating.

Every 12,000 miles the system should be flushed out. Open the drain taps and drain off the water from the radiator and cylinder head. If anti-freeze is used keep the water. After all the water has run out carefully probe the tap orifice with a piece of wire. If the outlet has become blocked with sediment this action will clear it. Make sure that the radiator drains fully.

Allow a continuous stream of water from a hose to flush out the system keeping the radiator drain tap open. If the water is discoloured continue flushing until the water comes out clear. Do not forget to replace the anti-freeze solution if this was originally in the system. If you feel there may be some sediment or foreign matter filter the water when you pour it back.

The capacity of the cooling system is 8½ pints.

Frost Precautions

If the temperature falls sufficiently, the cooling water will freeze. In doing so it may set up sufficient pressure to split the cylinder block, cylinder head or radiator. The result of this can be expensive and it is well worth while to take trouble—either by draining the cylinder block and radiator or using anti-freeze—to prevent this calamity from occurring. The cost of anti-freeze solution is so small, compared with the repair bill that can result from a ‘freeze-up’, that no motorist need feel that he is embarking on an expensive precaution.

The effect of the anti-freeze solution is to lower the temperature at which the water will freeze. If you follow the makers’ recommendations you will have adequate protection against any normal frost.

A point to note is that when a heater is fitted, draining the cooling system in frosty weather may not prevent the heater radiator from freezing since it will trap a proportion of the cooling water. The use of an anti-freeze solution is the only safe precaution in such circumstances.

There are several paraffin or petrol heating lamps on the market that operate on the principle of the miner’s lamp. These can be used under the bonnet to prevent the temperature from falling unduly. Electric heating devices—either
of the plug-in immersion type or direct-heat applications—are also available. Whilst these are effective, you may find that freezing can occur before the car returns to your garage. Therefore, the use of an anti-freeze solution does seem to offer the best answer to the problem.

Although anti-freeze is entirely harmless to the cooling system, it is important that the cylinder head be firmly bolted down to prevent any leakage into the engine. Should this occur, the engine oil properties will be destroyed.

Should you decide to rely on draining the system, there are some points to observe. First, ensure that the system has been drained completely. Probe the taps when the water has stopped issuing from them in case there is a blockage. Also bear in mind that there are two taps and both must be opened—one at the bottom of the radiator and the other on the left-hand side at the centre of the cylinder block (Figs. 55 and 56).

Drain the system only when the car is on level ground otherwise some water may be trapped. Even a little water left at the bottom of the cylinder block or radiator may do considerable damage if it freezes.

Finally, when you have drained the system, place the filler cap or some other indication on the driver’s seat as a reminder that there is no water in the system. You may not forget but someone else otherwise might not know. The engine can only be run for a very short time without water before extensive (and expensive) damage results.

This does not necessarily apply to you, of course, but people have been known to fill the system with one of the taps open! Since you can fill the radiator more quickly than the taps can empty it, this may not be noticed when replenishing.

Frozen Radiators

A frequent cause of mystification to owners is why the water sometimes boils in frosty weather. On examination, they find the radiator is covered with icicles indicating that the bottom tank, and probably the hose as well, is frozen solid. The natural query is: ‘How can it boil if it’s frozen?’ Or it might be asked: ‘If it’s frozen, why doesn’t the boiling water melt the ice?’

Look at it this way. Suppose it is freezing hard and that the car has been standing in the wind without anti-freeze or without being suitably protected. The water freezes. The driver starts the engine and drives away. The engine rapidly warms up and hot water passes into the radiator. Since the lower tank—and possibly also the connecting hose—has frozen normal circulation cannot take place. The engine soon boils the water pocketed in the

cylinder jackets. This heated water cannot be circulated through the radiator and the fan blades also minimize any possibility of the existing ice contained in it from thawing.

A point to note is that should the system freeze in very frosty weather the pump impeller may become immovable. The fan-belt can become rapidly worn should the engine be started with the impeller thus frozen.

If boiling does occur stop the car as soon as it is known for continual boiling can cause damage. Do not take off the radiator cap at once (see page 228). Allow the engine to cool and—should there be no radiator muff—make a temporary shield across the bottom of the radiator core with a newspaper. This will prevent the cold air cooling or freezing the water in the bottom tank. Then refill with water, taking care not to pour in cold water in considerable
volume if the engine is still hot for this may start a distortion crack.

Allow the engine to run at a steady 'tick-over' for a little time when it is probable that sufficient heat will be transmitted through the radiator to cause the ice to melt. If it does not do so an effective method is to place rags against the part of the system still frozen and keep them soaked with boiling water.

CHAPTER XI

TRANSMISSION

THE CLUTCH OF THE A35 is simple yet robust in construction and its adjustments have been reduced to a minimum. Provided a few elementary precautions are followed no trouble should be encountered. If wear occurs in course of time it will be necessary to remove the engine unit. This job is best left to your Austin dealer who has the necessary specialized tools and equipment for the work.

The clutch is of the single dry-plate type with two renewable facings, one each side of the disc. An ingenious system is used whereby the disc carrying its faced linings is connected to its hub. This drives the main shaft of the gearbox through a system of thrust springs thus ensuring a smooth cushioned drive (Fig. 57).

This disc is mounted on, and is free to slide on, the first motion shaft of the gearbox, the front end of which is carried in the centre of the crankshaft flange in a bush. When the disc is rotated it also rotates the first motion shaft through the splines on which it is mounted. The front side of the disc can be pressed into contact with the machined face of the flywheel. From this you will see that if the disc be pushed strongly enough against the flywheel it will drive through the gearbox. If there is no pressure against it, the flywheel will turn whilst the first motion shaft and the disc remain stationary. The bush carrying the front end of the first motion shaft turns with the crankshaft.

A pressure plate is used to transmit the drive from the engine to the clutch disc. This consists of a cast plate, roughly the same size as the facing on the clutch disc. It is mounted in a cover, with six compression springs between the cover and pressure plate. When the cover is bolted to the flywheel the clutch disc is tightly gripped between the flywheel face on the one side and the pressure plate on the other.
There are three hinged levers so mounted that when their inner ends are pressed towards the flywheel their outer ends move rearwards. Hinged on suitable brackets fixed to the cover, they move the pressure plate rearwards so freeing the clutch disc from the flywheel and pressure plate. The clutch is then 'out'.

The three release levers are connected to a suitable release plate and when the clutch pedal is depressed it moves forwards a release bearing. This in turn forces the levers inwards, freeing the clutch as already described.

The three levers are accurately set with reference to one another. The release bearing requires no lubrication and thus, apart from lubricating the clutch-linkage joints, the only attention likely to be required is that of adjusting the free travel of the clutch pedal.

You will remember being advised never to place the foot on the clutch pedal except when using it. Continuously resting your foot on this pedal can have two bad results: (a) It brings into contact the release bearing with the release plate and so causes this to wear unduly; (b) a certain definite pressure is required to be transmitted to the clutch disc to assure a solid drive. Foot pressure on the clutch pedal can reduce the grip on the clutch disc and thus it may slip. Any clutch slip is undesirable because extreme local heat is rapidly generated and the working surfaces of the clutch disc can overheat or even burn out. Clutch slip is easily recognizable when present. Usually, it is noticed that any sudden acceleration on the top gear causes the engine to speed up without any corresponding rise in road speed.

In extreme cases the engine may 'race' on approaching a slight gradient. Great difficulty may occur in starting off on bottom gear because the drive will not take up, the engine appearing to have no connection with the transmission even when the clutch pedal is fully back. From this you will see that there is considerable loss of power and speed.

Even if some slipping has taken place and you adjust the clutch pedal, the heat that was generated might have distorted the working parts of the clutch so that it may no longer give satisfactory service.

Insistence on clutch-pedal adjustment is made here
because it is most important to preserve the correct setting. Insufficient free movement means that the release bearing may be rubbing all the time the engine is running. If of sufficient degree, it may prevent full spring pressure being placed on the clutch and this will then slip.

Even with the pedal fully depressed excessive free movement may prevent the clutch from freeing fully. This will prevent the gears being engaged readily because they are not completely isolated from the revolving engine. Apart from difficult and noisy gear changing actual damage to the gear-teeth may result.

Some drivers do not appreciate the necessity of changing to a lower gear if the engine speed falls unduly. Or they slip the clutch as, for instance, to enable them to surmount a slight hill in top gear. This is bad practice. By slipping the clutch under these conditions, considerable horse-power is transmitted but the drive is not solid. Great heat is generated and if persisted in this practice will cause damage to the clutch.

**Clutch Adjustment**

In course of time the clutch pedal will require adjustment. This is a normal condition because as the clutch facings wear the pressure plate moves forward. This reduces the clearance between the fingers and thrust plate until in extreme cases all free pedal movement has been taken up.

Clutch-pedal adjustment, a perfectly straightforward operation, is carried out as follows:

Press the pedal down until you feel it engage the thrust plate. The free movement should be \(\frac{3}{8}\) in. between the pedal in its normal position when fully released and when it is felt to touch the release mechanism. It is a simple matter to measure directly the free movement by placing a rule against the clutch-pedal pad with the other end resting on the floor-board parallel to the direction of travel.

From underneath the car on the right-hand side you will see the clutch-pedal linkage as shown in Fig. 58. Adjustment is achieved by altering the effective length of the rod between the end of the clutch pedal shaft and clutch-operating lever, 4. To adjust this length, slacken the lock nut at the end of the clutch-operating rod and either lengthen or shorten it so that there is the requisite pedal movement of \(\frac{3}{8}\) in. The adjustment should be such that it allows this free movement to be felt by the pressure of one finger on the clutch pedal.

**Gearbox and Synchronizing Unit**

It has already been explained that the engine can develop power only when turning at a certain minimum number of revolutions per minute. The gearbox is a device that allows the engine to run sufficiently fast to develop enough power for the work it has to do. Suppose you have reached a hill that your car cannot climb in top gear. By engaging a lower gear the engine will revolve faster thus developing more power. Although, because of the
reduction in the gearbox, your road speed will not be so
great, there will be ample power to surmount the gradient.
If not, then the next lower gear is engaged to give even
more power than in third gear.

The gearbox of the A35 is mounted integral with the
clutch housing and is operated by remote control (see
Fig. 59).

![Fig. 59.—ENGINE AND GEARBOX (OFF-SIDE)
1 Filler Cap. 2 Generator Oilings Point. 3 Dipstick. 4 Oil Filter. 5 Sump and
6 Gearbox Drain Taps](image)

**General Description**

As long as the gearbox is correctly lubricated with the
recommended grade of oil at the specified period as described
in Chapter XIII (actual lubricant advised is shown on
the lubrication chart) no appreciable wear of any working
parts will occur. Should damage arise through accident
or abuse, your Austin dealer should be permitted to carry
out the overhaul for you. Apart from the specialized tools
required, the gearbox itself cannot readily be removed
from the chassis with such equipment as the average owner
is likely to have available. In view of these remarks it is
not proposed to deal with dismantling and overhauling
the gearbox but instead to describe its general lay-out and
the way in which the synchronizing unit works. With a
knowledge of what takes place when gear changes are
made we are better able to appreciate the necessity for
care in changing gear.

The synchronizing device, which enables a noiseless gear
change to be made, is a feature that sometimes tempts
owners to change down at unnecessarily high speeds. This
not only throws heavy stresses on the whole transmission
but your passengers are liable to be jerked violently for-
ward. If they do not directly blame your driving methods,
perhaps they may suggest that the car is faulty.

The four-speed gearbox of the A35 is of conventional
design in that power from the engine is transmitted through
the clutch to the first motion shaft. This drives the lay-
shaft gears revolving whenever the engine is running with
the clutch engaged. There are also three other gears, the
third and second of which have constant-mesh wheels of
the helical type as are those of the gear driven by the
first motion shaft. At the extreme rear end of the lay-
shaft is the combined first and reverse gear but this is of
the straight-toothed type.

It is well to explain here that the helical type of gear
assures most complete silence in operation. This will be
understood when it is seen that the application of power
through the gears is over the surface of more than one
tooth at a time. By these means continuous transmission
of power is secured. On first and reverse gears straight-
toothed gear wheels are used and they are not so silent.

A moment's reflection may prompt you to wonder if end-
thrust is not caused by the helical teeth. It is a fact that
considerable end-thrust is caused but it is taken care of
by plain thrust-washers at each end of the shaft.

The main or third motion shaft carries three gears. The
third and second are of the helical type and mesh with
their fellows on the layshaft. These gears on the mainshaft
are not free to slide along it but rotate on suitable bushes.
At the rear end of the mainshaft is first gear. It has
straight teeth splined to the mainshaft and is able to slide
feel a slight resistance as this clicks into neutral or into the particular gear engaged. This is caused by the plunger entering the location in the selector shaft. It is the pressure set up by the plunger that retains the particular gear in mesh. You will now appreciate the necessity for always moving the gear lever fully into position, otherwise the drive will not be taken on the whole width of the engaging teeth and these, therefore, may be damaged. Also, there will be a considerable tendency for the gears to fly out of mesh.

The gear-change lever mechanism is correctly set when the car is assembled at the works and should not normally require any adjustment.

Top Gear

When top gear is engaged the drive is direct. That is to say, the top-gear synchronizing device locks the gearbox mainshaft to the first motion shaft so that they revolve at the same speed. The gears on the layshaft, however, are driven by the constant-mesh gears and in turn rotate third and second gears on the mainshaft although these latter transmit no drive to it, merely revolving idly.

Third Gear

When the gear lever is moved into the third position the synchronizing device moves rearwards locking the third gear to the mainshaft. It will be seen that when the first motion shaft is turned the constant-mesh gears revolve, the drive now being taken to the layshaft gears. These turn somewhat more slowly because of the existing gear reduction. As the third gear is formed integral with the layshaft it also revolves, driving the corresponding third gear on the mainshaft. This is slightly larger and as has just been explained now turns the mainshaft due to the engagement of the dogs or coupling teeth. From this you will see that the mainshaft is turning slightly slower than the first motion shaft, because of the combination of gears brought into use. The front end of the mainshaft is free to turn in the first motion shaft because a bearing is provided at this point to allow for such movement.

Gear Selection Mechanism

At the side of the gearbox there are three shafts known as selector shafts. Mounted on each is a selector fork the forked end of which enters an annular groove in the sliding gear or coupling sleeve with which it is associated. Top and third selector fork has three positions—forward to engage top gear, middle or neutral position, and rearward to engage third gear.

The first and second gear selector also has three positions moving forward to engage second gear, neutral position in the middle and rearward to engage bottom gear. The reverse gear selector has two positions: neutral and reverse when moved forward.

Ignoring reverse for the moment, each selector fork has a spring-loaded steel plunger that can enter any one of the three notches machined in the selector shaft along which it slides. From this you will see that once it has been moved so that the plunger enters the location or notch the spring-loaded plunger will retain the fork in place.

Each selector shaft is moved by the gear-lever bottom extension. This is free to move sideways and also backwards and forwards. Thus, it can engage the machined slot in any one of the three selector forks.

The reverse gear selector fork similarly has a spring-loaded plunger. Since it is merely necessary here to provide for neutral and reverse gear positions, however, there are only two locations in the shaft.

As you move the gear lever into or out of neutral you
Second Gear

On the lever being moved down to the second-gear position when moved rearwards it engages the selector that is connected to the synchronizing device for second-gear engagement. This similarly locks the second gear to the mainshaft so that when the gear is rotated it transmits the drive to this shaft. The application of power is similar to that existing when third gear is engaged except that the gear reduction is greater. So, for a given number of revolutions of the first motion shaft the mainshaft rotates through a proportionately greater number of revolutions as compared with third gear.

Bottom Gear

Moving the gear lever forward to the first-gear position slides the bottom gear into mesh with its corresponding gear on the layshaft thus providing the lowest ratio of the forward speeds. The drive is similar to the preceding one except that gear reductions between bottom gear on layshaft, and that on mainshaft, are much greater.

Reverse Gear

Reverse gear is engaged by lifting the knob of the gear lever upwards against the spring pressure allowing it to be moved through the gate, and then rearwards bodily into the reverse-gear position. By moving it rearwards this moves the reverse idler gear into mesh with the bottom gear wheel splined to the mainshaft thus turning the mainshaft. With this difference the transmission of power is as in the previous case.

The reverse gear on the layshaft drives the idler gear, and this in turn drives the bottom gear on the mainshaft. A few moments' thought will soon show you that it is the idler gear connecting these two together that enables them to turn in the opposite direction.

You will see that on all the intermediate gears so far considered two pairs of gears have been used to transmit power—the constant-mesh gears and the two third-speed, or two second-speed, or two first-speed pairs of gears, as the case may be. This always causes the mainshaft to turn in the same direction as the first motion shaft. In the case of reverse gear, however, the drive is taken through the idler gear and it is this that reverses the direction of movement.

Interlock Mechanism

A flat plate hinged at the front end is mounted above the selector shafts and so shaped as to allow the lower end of the gear lever to pass through into the slots in the selector forks. The purpose of this device is to prevent more than one selector being moved at a time. As the gear lever is moved sideways to engage the particular selector required, the plate also moves blocking the other two selectors and preventing them from moving.

For gear ratio tables see page 154.

Synchronizing Unit

So far we have not considered how this very simple, yet effective, device operates.

Let us first deal with the synchronizing device fitted between top and third gear. This consists of an outer ring having a circumferential groove in which the selector fork fits. Internal tongues engage the corresponding outer grooves or ‘splines’ on a hub sliding along the mainshaft but always keyed to it so that it will transmit the drive. This inner hub has a cone face machined in each end at such an angle that it fits closely a correspondingly machined extension formed on the face of the top and third gears. The outer ring is held in a central position on the hub by a series of spring-loaded balls.

As has already been explained, the selector fork is engaged in the outer ring. This, however, is free to rotate because the groove is continuous. When the gear lever is moved, say, to top-gear position, the fork presses the outer ring towards the top gear on the first motion shaft. The inner hub will also move with it because the spring-loaded balls apply sufficient frictional grip, for they rest in indentations machined in the outer ring.

When both hub and ring have moved a certain distance, the inner cone of the hub will be pressed into contact with the outer cone on the first motion shaft applying a considerable braking effect. This is not only because they are a good fit but also because they are pressed into contact
by the pressure of your hand on the gear lever through the medium of the spring-loaded balls. These tend to hold the inner hub and outer ring in the same relative position.

This spring pressure has been carefully designed so that the speeds of the first motion gear and hub are synchronized. When this has been achieved—and it only takes a fraction of a second—the continued pressure of your hand on the gear lever overcomes the spring pressure. It moves the outer sleeve forward along its splines engaging the external splines machined on the top gear. This then gives a solid drive from top gear on the first motion shaft and through the outer ring to the hub. As this is splined to the mainshaft it rotates with it.

When you change down into third gear, moving the gear lever forward first slides back the outer ring to its normal central position on the hub. Here it is held by the spring-loaded balls and they again enter the location provided for them.

Continued pressure on the gear lever moves the inner hub and outer ring rearwards. Here the cones in the hub and on the third-speed gear are brought together by pressure applied through the friction set up by the spring-loaded balls in their indentations. In a similar manner the speeds of these two gears are synchronized, the outer ring then moving further rearwards where it engages corresponding outer splines. They thus effectively lock the third-speed gear to the mainshaft so that they turn as one.

Although this description makes it apparent that 'a lot is going on', actually synchronization takes place extremely rapidly. It is this positive means of bringing the two different speeds of the gears together that enables noiseless gear changing to be made at the will of the driver.

In changing gear, therefore, all that is necessary is to de-clutch and move the gear lever to the desired position. A little thought will show that on being pressed together the two engaging cones apply the necessary braking effect to ensure a silent change.

Rear Axle

The rear axle of the A35 is of sturdy construction utilizing robust, well-designed parts the result of long experience (Fig. 60). Provided it is lubricated regularly with the correct grade of oil it will give long service. It is unlikely that you will find it necessary for any overhaul to be carried out provided normal care is taken. If it is necessary for it to be dismantled for any reason, however, it is best to have this done by your Austin dealer who has the necessary specialized equipment for handling the job. Considerable care is necessary to obtain the correct running adjustment of the various working parts and unskilled reassembly will probably result in a noisy rear axle with a reduced life. A few notes as to its construction and operation may be of interest, for when its construction is understood the need for normal maintenance will be more readily appreciated.

The housing, which carries the crown wheel and differential assembly at the centre, is mounted on top of the road springs so giving a low riding position to assist stability. Bolted to the front face of the axle casing is a cast-iron housing in which is mounted the pinion with its bearings, also the crown wheel and differential unit.

Both crown wheel and pinion are of the spiral bevel type, used because not only is the tooth form strong but the transmission of power is delivered through more than one tooth at a time. This has the additional advantage that a silent drive results.

The differential is of the single spider type with the differential wheels splined to the axle shafts. These can therefore be removed without its being necessary to dismantle the whole axle.

Each outer end of the axle housing is machined to carry the brake-plate and road-wheel ball-bearing. This ball-bearing is pressed into the hub and held in place by a suitable lock nut. A feature is that the rear brake drum can be removed for brake-shoe inspection without its being necessary to remove the hub. This point is dealt with more fully on page 76.

All parts requiring lubrication are provided with suitable ducts and passages, oil being circulated by rotation of the
crown wheel as the car runs along the road. As the whole power of the engine can be delivered through the crown wheel and pinion very heavy loading can be placed on the teeth. Consequently, if the oil level is allowed to fall unduly a sufficient quantity of oil will not reach these highly stressed parts. If the oil level is maintained at the filler plug orifice, however, there need be no fear that the working parts will be inadequately lubricated.

**Universal Joints and Propeller Shaft**

The axle is rigidly bolted to the rear springs. Although these are so designed as to resist the turning effort caused by the axle drive it will be obvious that inequalities in the road surface cause the axle to rise and fall. Thus, as it is not possible to provide a rigid connection between gearbox and rear axle a propeller shaft is used. It has a universal joint at each end to allow the drive to be transmitted from the gearbox to the bevel pinion of the rear axle despite the fact that they are not in line (3, Fig. 86).

As the axle moves up and down its distance from the gearbox varies. Provision has been made for this movement, the front end of the propeller shaft being free to slide in splines machined on the end of the mainshaft.

The propeller shaft itself is tubular, a form of construction that is strong yet light. The universal joints are of the metallic needle-roller bearing type (6, Fig. 60a).

**Lubrication**

Every 1,000 miles the working parts of the two universal joints should be lubricated with oil.
At the front end there is one lubricator on the spider itself, the other being at rear (4 and 5, Fig. 60a). It may be necessary to move the car a little to bring these two lubricators into view. For access to the lubricator at the rear end the same remark applies if it cannot at first be seen.

It is good practice to check the bolts at the rear end of the universal joint and also those of the propeller shaft to ensure that none of these have worked loose. The fitted tab washers should be bent aside when you are checking the nuts.

Do not forget to tap these tab washers firmly against the flat of the nuts after they have been tightened.

**Gear Ratios**

<table>
<thead>
<tr>
<th></th>
<th>Ratios</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>3.628 : 1</td>
<td>16.507 : 1</td>
</tr>
<tr>
<td>Second</td>
<td>2.374 : 1</td>
<td>10.802 : 1</td>
</tr>
<tr>
<td>Third</td>
<td>1.412 : 1</td>
<td>6.425 : 1</td>
</tr>
<tr>
<td>Top</td>
<td>Direct</td>
<td>4.35 : 1</td>
</tr>
<tr>
<td>Reverse</td>
<td>4.664 : 1</td>
<td>21.22 : 1</td>
</tr>
</tbody>
</table>

**CHAPTER XII**

**ELECTRICAL SYSTEM**

The electrical system plays an important part in any car. It provides the means of igniting the petrol/air mixture, and current for the lamps, wiper, horn, trafficators, fuel gauge, oil-pressure warning light, starter motor, car heater and radio.

This electrical energy comes from a battery but—since this would soon become discharged—a generator driven from the engine provides the means of keeping it continuously charged. The charging rate is automatically controlled through a regulator unit. Considerable care in design relieves the owner of practically every responsibility except that of periodically topping up the battery and lubricating a few accessible points.

Whilst fully prepared to carry out mechanical adjustments the average owner is apt to regard the electrical system as a complicated collection of wiring the mysteries of which he prefers to leave alone. The present-day electrical system is extremely reliable but if you are prepared to appreciate the working principles involved then you are more likely to be able to correct any fault that may develop. Better still, you may be able to forestall trouble.

With the exception of the high-tension current for the sparking plugs, the lighting circuits and other accessories all operate on a low-tension current. There is no possibility, therefore, of the inquisitive owner receiving a shock except from the high-tension wires of the ignition system and even this, disconcerting as it may be, is not harmful. It should be realized that whilst the various circuits may be protected by fuses, damage can be caused by a short-circuit or haphazard tinkering with the wiring. The purpose of this chapter is to give an indication of the working principles of the system and advice on trouble-finding should this become necessary.

The wiring system is earthed. That is to say, since
a circuit has to be completed before a component will work, a single wire is connected to it—through the appropriate switch or control—and the 'earth' is through the metal parts of the car. Current is always considered to flow from the positive pole to the negative pole so the positive terminal of the battery is connected to 'earth'. One of the advantages of this arrangement is that corrosion at this terminal is much reduced.

There are two characteristics of any electrical system—the voltage or 'pressure' at which current is supplied and the amperage or 'measure' of the amount of current flowing in the circuit. All electrical equipment on the Austin A35 is designed to work at 12 volts pressure.

If the ignition warning light does not go out when the engine is speeded up then something is wrong and the matter should be investigated. The fault should be traced and corrected or the battery will be steadily discharged. Some owners fear that should this happen the car will be immobilized until another battery is obtained. This is not so, however, for even with a completely discharged battery a restart can be made if the car is pushed or towed at sufficient speed for the generator to 'cut-in'. Enough current will then be supplied for the ignition system to work, and provided the engine is kept running above this speed for a short time the battery will soon be partially charged. It is desirable, however, to have it fully recharged by your dealer as soon as possible.

If you are so unfortunate as to find the battery practically discharged one morning—perhaps because you have left the lights on all night—it is generally possible to start on the handle. In such cases, using the starter motor may exhaust the battery to such an extent that the ignition coil has not sufficient current to provide a spark.

These tips may prove useful to you at some awkward moment.

**Wiring**

What makes any car wiring rather forbidding to the average owner is the apparent multiplicity of wires bound together in 'looms' and appearing to have numberless connections. Actually, the wiring is quite straightforward and can be traced by studying the wiring diagram (page 220).

As an additional help, the various wires are identified by tracers or distinguishing colours as shown in the panel, bottom left (page 22x).

There is little the owner need do, so far as maintenance is concerned, except to see that all connections are kept clean and tight and that wires do not become chafed so cutting the insulation and causing a short-circuit. The various wiring looms are carefully secured by suitable clips and trouble from this source is unlikely. If there is a short-circuit the fuse usually 'blows'. The mere replacement of the fuse is not sufficient, however, and it will probably fail again unless the cause is found and rectified.

The cable concerned should be taped until a more permanent repair can be made. A roll of insulating tape is a useful stand-by in the tool kit.

Never tolerate a fault anywhere in the electrical system for, apart from the inconvenience of the engine suddenly going 'dead', the complete failure of the lighting system at night can give you some anxious moments.

**Cut-out and Regulator Unit**

Electricity provided by the generator is stored in the battery. Although it is convenient to use this word,
electricity is not really stored. Chemical changes occur whereby current can be drawn at such times as required whether or not the generator is in use.

If the generator was connected directly to the battery there would be occasions when it could not charge at low speeds. A device, known as the cut-out, automatically connects the generator when the charging rate has risen sufficiently. It also dis-connects it when the engine is running slowly or has stopped. This is necessary for the battery would soon discharge itself through the generator windings. A unit known as the voltage or current regulator is also connected in the wiring system.

The cut-out consists of two concentric windings mounted in the control box (Figs. 61 and 62). Each is of different size and of a different magnetic characteristic. They are placed near a pair of contacts kept apart by means of a light spring and normally separated when the generator is stationary. As the speed increases, current flows through the field winding. When the voltage has risen sufficiently for the battery to be charged, the contacts close and current then flows around the other winding. This latter winding consists of larger diameter wire and has the effect of augmenting the force that holds the contacts together.

Now, assume the generator speed gradually falls until a point is reached where its output balances the current ready to flow in the opposite direction from the battery. With any further decrease in speed the battery would discharge itself through the generator. The moment current begins to flow from the battery through the cut-out to the generator, however, the magnetic effect holding the points together is reversed. The points then separate and the battery becomes isolated from the generator until such time as its speed increases once more and it can then be charged.

From this you will see that the cut-out acts automatically and requires no attention by the driver.

If, at any time, the owner accidentally presses the contact points of the cut-out together with the engine stationary they will immediately hold together, current then passing from the battery to the generator. This condition must not be allowed to continue otherwise the battery will be discharged and the generator harmed. Should the cut-out points be so pressed together all that is necessary to release them is to prise them apart with the thumbnail.

**Voltage Regulator**

The operation of the voltage regulator is somewhat complicated. Broadly speaking, if a resistance is connected in series with the field winding of the generator, the output is reduced. In the voltage regulator this is automatically brought about by a pair of contacts that open and close with great rapidity, providing the correct resistance to regulate the current to the desired amount.

Thus output of the generator is controlled by the regulator according to the load on the battery and its state of charge. When the battery is discharged a high output is given so that it receives a rapid re-charge thus restoring it to a normal state in the shortest possible time.

Alternatively, should the battery be fully charged, the generator will give only a 'trickle-charge', sufficient to maintain it in a reasonably good condition without over-charging it.

The regulator enables the generator to give the high output immediately after starting-up to restore the energy...
taken from the battery. After about 30 minutes’ running, the output of the generator is decreased to the steady normal rate of charging.

The regulator unit is extremely reliable and, in fact, is sealed by the makers. It should never be altered by the owner. Should it be necessary at any time to adjust it, accurate instruments are required as well as detailed knowledge of its construction. In your own interest you will be well advised to let your Austin dealer attend to it in case of need, or take it to a Lucas Service Station.

Generator

The generator is of the plain two-brush, two-pole, shunt type, its characteristics being a rising voltage with an increase in speed. It consists of an armature with commutator, field-magnet system housed in a yoke (cylindrical frame), and brush gear (Fig. 63). Armature shaft is supported in a ball-race carried in driving-end bracket and a plain bearing in commutator-end bracket.

Output depends on strength of magnetic field and speed at which armature rotates. As any variation of speed causes a change of output, and since the generator is driven at varying speeds, it is necessary to provide means to control output. This is done by varying the strength of the magnetic field, current value being controlled by voltage regulator as already described.

Testing the Generator

The only rotating part in the generator is the armature. This is a drum-shaped spindle wound with a series of coils, the ends of which are connected to a number of copper contacts in circular form and known as the commutator. All current generated in the armature is collected from the commutator by two carbon brushes. These are pressed into contact with it and lead the current to the electrical system.

It sometimes happens that the generator will not charge even after the commutator has been cleaned (see page 164). Consequently, the anxious owner will wonder where the fault really lies. This is where a test lamp is of help. (See page 192, ‘Fault-finding and Testing’.)

Disconnect the two terminals from the generator, the yellow wire being connected to the main brush terminal and the yellow with green tracer to the field terminal. The terminals are of different size to ensure correct replacement. (See page 192 for instructions regarding correct refitting.) Temporarily connect together the two terminals on the generator, earth one wire of the test lead and connect the other to these two bridged terminals. Use a bulb of at least 36 watts for this test.

Start the engine and then very gradually increase the speed, when the lamp should light and its brilliance increase with rise in speed. As the generator output is not controlled when thus connected, take care not to burn out the lamp. If the lamp lights brightly then the generator is in order, but if only a dim light can be obtained at any speed then there is probably some fault in the windings and you should let your Austin dealer handle its repair for you.
Maintenance

It has already been stated that the only moving part in the generator is the armature that rotates on two bearings. The front bearing is packed with grease at the Works and requires no further attention. The rear bearing is a porous bronze bush. The lubricator provided for this bearing consists of a felt pad pressed into contact with the bush by a light spring. At the rear of the bearing in the centre, is a small hole into which a few drops of S.A.E.30 engine oil should be inserted every 6,000 miles. Do not over-oil, however, for excess lubricant may find its way to the commutator causing the brushes to stick, and then the generator may fail to charge (Fig. 96).

If generator refuses to cut in—a fault indicated by ignition warning lamp remaining ‘on’—the fault may be with the commutator and brushes. It will be necessary to remove the generator and partly dismantle it.

Disconnect one terminal of the battery and then disconnect the generator terminal connectors by pulling them out of the locations in which they are a push fit.

Loosen the three bolts holding the generator to its bracket and to the adjusting link to allow the fan-belt tension to be released. Then, remove all three bolts and lift the generator away from the engine.

Fully unscrew the two bolts passing through the generator body; when these have been withdrawn the commutator end-plate can be detached. When it is removed it will bring with it the two brushes in their mounting brackets. Take care not to lose the distance-washers fitted on the armature shaft between the commutator and the bush in the end-plate.

The commutator surface should be bright. If it is not, it should be cleaned. Before doing so it is as well to see if the two brushes are quite free in their holders, for if they stick the commutator begins to ‘burn’ due to the sparking that takes place.

Test the brushes by gently pulling the flexible connectors fitted on each. It should be possible to pull them back against the spring tension and on releasing them they should return (Fig. 64). If they feel stiff, draw them carefully out of their holders using a piece of bent wire in the form of a hook to hold the spring clear of the brush. Wipe them with a petrol-damped cloth.

If the commutator is dirty it may be cleaned with glass paper. **Do not use emery cloth.**

When all dirt has been removed refit the brushes so they are the same way round as originally. They ‘bed in’ to the commutator and if replaced half a turn round relative to their holders they will not make efficient contact until some distance has been covered.

![Fig. 64—Generator Brush Gear](image-url)

Temporarily raise the brushes sufficiently in their holders otherwise they may foul the commutator when the end-plate is refitted. The brushes may be wedged most conveniently for the purpose by engaging the springs with their sides.

After ensuring that any washers originally fitted on the armature shaft are in place, enter the end-plate on to the shaft so that the generator mounting-bracket holes are in line. As the two through-bolt holes are drilled on the diameter, the end-plate could be refitted half a turn out.

When the commutator has entered between the two
brushes fit the springs on top of each brush in the normal manner, push the end-plate right home and secure it with the two bolts.

Reassemble the generator to the engine taking care to install the fan-belt over the pulley and to adjust its tension before finally tightening the bracket-mounting bolts.

Replace the two terminal connectors and refit the battery cable connection.

The generator should now charge satisfactorily.

If there are signs that the commutator is blackened and despite cleaning, as described above, still will not charge it is best to have it checked by your Austin dealer.

Battery

The battery, one of the most important components on any car, is composed of six cells each of 2 volts and connected together by lead straps so that it builds up into a 12-volt unit. Each cell contains positive and negative plates immersed in a solution of sulphuric acid and distilled water known as the electrolyte. The plates are divided by insulator separators (Fig. 65).

Should the battery be removed at any time it is important that the terminals are correctly reconnected. The terminal posts are of different sizes and are usually marked + and -. It will be found that the positive post (the former) is slightly larger than the negative, to prevent any incorrect connection on replacement. A battery can be ruined by connecting the positive cable to the negative terminal.

There is a tendency to neglect battery maintenance probably because ‘it must be all right for it is working’.

The prime necessity is to add distilled water to the six cells at least every month. Tap water should not be used for ‘topping up’ for it contains iron and certain detrimental salts. A supply of distilled water sufficient for a year’s attention can be obtained for a shilling or two, therefore do not be tempted to ruin an expensive battery.

Buy a bottle of distilled water from your chemist or service station and keep it in the garage for regular use.

A useful accessory is a hydrometer specially calibrated for car-battery use and obtainable through your usual stockist (Fig. 66). It serves two purposes—to add water to the individual cells—so preventing spilling liquid on the cell tops—and to ascertain if the specific gravity of the electrolyte is correct.
Consider first the question of liquid on top of the cells. Never allow the tops of the cells to be wet. Remember that sulphuric acid in the electrolyte will attack metal. Consequently, if the battery is over-filled the terminals will corrode and the battery tray will be eaten away.

The normal specific gravity of a charged battery is approximately 1:280 to 1:300 but as it becomes discharged the gravity can fall to 1:100, when it is practically 'flat out'.

Checking the gravity is not difficult. Unscrew the filler cap, insert the hydrometer and draw some of the electrolyte into the glass tube by compressing and releasing the rubber bulb. Allow the float to be freely suspended (Fig. 66) but make sure it is clear of the sides of the glass tube. Then note the figure that is level with the liquid; this is the specific gravity reading. It is important to ensure that the reading of each cell is approximately equal; also that the level in each cell is the same.

If one cell has a lower reading than the others, it can be corrected by drawing off as much fluid as possible and adding sulphuric acid of 1:350 s.g. If the cell cannot be corrected by several such additions it may be that there is a short-circuit and the battery should be tested by your Austin dealer or local Lucas service station.

Similarly, if one cell appears to require topping up more frequently than any of the others, examine the battery case for it may be that there is a crack through which the electrolyte is leaking away.

The routine maintenance required is given below but there is another point that should be mentioned. This is to make sure the battery is not allowed to become loose in its container. Do not overtighten the securing clamps, however, for the case may be cracked by so doing. On the other hand, if it is not sufficiently tight the case may move and chafe and possibly damage the cable insulation.

Maintenance

Unscrew the cell plugs monthly and examine the electrolyte level. Top up if necessary, as instructed above.

Never hold a lighted match over the cell tops to ascertain the level. The gases given off by a charged battery are inflammable and can explode—in some cases they have blown out the cell tops and caused injury to the unfortunate person who received the acid in his face. If you have no inspection lamp use a torch, although the battery is very accessibly mounted beneath the bonnet.

The electrolyte should be level with the top edge of the separators. Do not be tempted to 'save topping up next month' by putting in too much distilled water for when the battery 'gasses' the level rises. If the cells are over-filled the surplus will find its way into the battery compartment, rusting and corroding everything it touches.

Never add anything but distilled water unless it is necessary to correct the gravity, by adding acid as described above. With normal gassing the electrolyte merely becomes more concentrated but is restored to normal by the addition of distilled water. Adding acid will progressively strengthen the acid solution and becomes increasingly harmful to the plates.

When checking the level in the cells you may find that no liquid is visible. In this case, inspect at more frequent intervals for it may be that the car is being used to an extent that causes a greater-than-usual electrolyte loss.

Partly dry cells become damaged for two reasons: (a) the paste of which the plates are formed tends to become dislodged unless covered with acid; and (b) only the area actually immersed in acid is capable of being charged. Thus, if the cell is half empty the charging rate automatically becomes doubled, and this is not good for the plates.

Keep the positive and negative terminals clean and protected from corrosion with a film of petroleum jelly. If necessary, disconnect the terminals, and clean the posts and the insides of the terminal clamps. Securely tighten the bolts after replacement. As a very heavy current is taken by the starter motor, dirty terminals prevent it operating efficiently. See that the earth connection from the positive terminals to the chassis is clean and that the bolt is tight.

Owners sometimes wonder if frost can damage their batteries should the electrolyte freeze. In England, a fully-charged battery with electrolyte of the correct gravity will not be affected by the severest frost. In cases where the battery is fully—or nearly fully—discharged and where the frost is severe, it is possible for the
electrolyte to freeze. This usually means a split container. With the electrical system on your Austin A35 the battery in normal use should be kept efficiently and automatically charged by the compensating voltage system.

Should your car be out of use for any length of time, the battery will rapidly deteriorate if left discharged. It becomes ‘sulphated’ and in extreme conditions will not hold its charge. It is good policy, therefore, to let your Austin dealer have your battery, arranging for it to be given a monthly charge. This will keep it in good condition until you require it again.

**Ignition System : Coil and Distributor**

The ignition coil is a sealed self-contained unit requiring no attention for there are no moving parts in it. Apart from keeping the terminals tight and the insulated end clean, you can forget it completely.

By a process known as induction, the ignition coil steps up the primary 12 volts supplied by the battery to approximately 12,000 volts. This high-tension current jumps the sparking-plug gap of the correct cylinder to which it is supplied by the rotor of the distributor.

Any electrical breakdown in the ignition coil is extremely unlikely provided it is kept clean as described above.

The contact-breaker in the distributor opens the contact points, when a high-tension current is generated in the secondary coil. This causes a spark to occur at the plug points and this spark fires the charge already drawn into, and compressed in, the cylinder. The contact-breaker is driven from the engine and is timed for the spark to occur when each piston is at the top of the compression stroke. On the distributor cap, which is made of an insulating material, are five high-tension cables—one connected to each sparking plug and a centre cable with a carbon brush contact inside the cap and resting on an insulated arm called the ‘rotor’. The other end of this fifth cable is connected to the coil. Inside the cap are four metal contacts to each of which a high-tension cable is connected.

The rotor is mounted on the distributor shaft and turns so that its outer end passes the four high-tension contacts with very little clearance.

The electrical-circuit operation, then, is that the contact-breaker points open at a predetermined instant producing the high-tension current. This is led from the coil where it is generated along the cable to the centre contact in the distributor cap. From this point it passes to the rotor through the carbon brush resting on it. The rotor has a metal strip across which the current is led to the appropriate contact. This contact is connected by a high-tension cable to the sparking plug of the particular cylinder then due to ‘fire’.

The high-tension brush at the centre of the cap is of a special type, in that a suppression resistor effect is provided. This eliminates wireless and television interference. It should be noticed that there is no external suppressor fitted in the centre H.T. lead and there should be no necessity to fit an external suppressor in the lead. If the distributor is of an early type and does not incorporate a suppressor at the brush location, then an external suppressor could be fitted. However, the combination of the existing suppressor at the brush and an additional external suppressor might result in difficult starting or misfiring.

The mechanism of the distributor is quite simple and incorporates two devices for varying the time at which the contact points are to be separated. The contact points consist of one known as the ‘fixed’ or ‘adjustable’ contact, the other mounted on an arm insulated on one end and linked to a spring that presses it against the fixed contact (Fig. 67).

A small fibre tongue is provided on the moving contact so that as the four lobes of a cam mounted on the distributor shaft rotate it is successively separated from the fixed contact. This produces the high-tension current and correspondingly a spark at the plug points.

The reason for the necessity of altering the ‘timing’ (i.e. the period of the occurrence of the spark relative to the piston travel) is not always understood.

Assume the spark occurs at top dead centre—the position of the piston when it has reached the extreme limit of its upward travel—the corresponding position in the other direction being known as ‘bottom dead centre’. This timing will be satisfactory when the engine is running slowly but since the engine speed can increase up to say 3,500 r.p.m. unless there is a means of ‘advancing’ the
FIG. 67.—DISTRIBUTOR TYPE DM4PH4

A Contact Points. B Condenser. C Contact Adjusting Screws. D Micrometer Adjuster. E Cam and Drive-shaft Oilig Point

timing, the piston would be so far down its stroke at the greater r.p.m. that much power would be lost before the mixture has fully ignited. Accordingly, an ingenious device, known as the centrifugal advance mechanism, is incorporated so that with increase in engine speed the spark automatically is made to occur earlier. In actual fact, with the engine running fast the spark occurs considerably before the pistons have reached top dead centre. Owing to the limited time available, however, the mixture is not fully ignited and therefore is not ready to do useful work until the pistons just commence to descend, thus ensuring efficient operation.

The advance mechanism consists of two spring-loaded weights normally held inwards. As engine speed increases they tend to fly outwards and this tendency is utilized by linking them to the distributor shaft so that it turns relative to its driving shaft and advances the ignition.

At first sight this arrangement would appear ideal. But so anxious are the designers to obtain thoroughly efficient operation that they have incorporated a vacuum timing control. Under conditions of sudden acceleration from relatively slow engine speeds there may be a tendency for the ignition suddenly to advance due to the change of depression in the manifold. The vacuum timing control, working off this depression, controls the speed of ignition advancement in relation to the throttle opening until the depression is constant. Directly the engine speed has risen sufficiently, the timing control provides the correct range of advance.

There is one other important component in the distributor known as the condenser but this is a self-contained unit having no moving parts. It is electrically connected in parallel with the contact points and reduces any sparking that otherwise would occur and could soon burn the points.

Maintenance

As with all other mechanisms, the distributor requires regular lubrication. It is provided with suitable lubricators and the slight attention required is easily carried out.

Every 1,000 miles remove the distributor cap, by springing aside the two retaining clips. Take off the rotor arm. Apply two or three drops of thin machine oil adjacent to the head of the screw inside the mounting carrying the rotor. A small passage is provided to conduct the lubricant to the surfaces needing it (Fig. 68). Smear the cam lobes with a film of petroleum jelly. Do not apply an excess otherwise it will be flung off the cam when the engine is running and may reach the contact points. Oil or grease on the contact points is detrimental and may cause erratic running or even complete failure.

Since the spark has to be delivered to the correct cylinder,
when replacing the rotor note that there is a register to ensure it is replaced correctly. Due to its specially-designed shape the cap cannot be replaced incorrectly.

Lubricate the spindle on which the moving contact arm is mounted. The contact-breaker arm must be raised to

allow grease to be applied but do not finger the contact point or allow grease to reach it.

The moving contact may be freed by first unscrewing the nut holding the low-tension cable to the terminal. Loosen nut adjacent to insulated collar and slotted end of spring may then be detached from bolt.

When replacing the lightly greased contact on its pivot, insert the slotted end of the spring between the squared end of the bolt and the insulator. Tighten the nut and check that the spring and contact are correctly aligned. The flat insulated washer fitted beneath the contact on the pivot must not be omitted.

The distributor mechanism should be lubricated. Access is obtained through a small hole drilled in the base. Lubricate sparingly, but avoid excess oiling.

**Replacing the Plug Leads**

If the plug leads are removed at any time, and if they are not numbered or marked to ensure correct replacement, proceed as follows:

Unscrew the sparking plug from No. 1 cylinder (i.e. that nearest the radiator). Press the thumb over the hole and turn the engine by the starting handle until you feel air blowing past your thumb. This shows that the piston is rising on the compression stroke.

Another method of ascertaining approximately top dead centre position on No. 1 cylinder compression stroke, is to remove the valve-chamber cover. Move the engine nearly half a turn after the inlet valve has closed. The inlet valve for No. 1 cylinder is No. 2 from the front.

To establish the exact position of the piston, insert a stiff piece of wire in the sparking-plug hole and slowly turn the engine. The wire, suitably bent to rest on the top of the piston, will indicate when the piston is at its topmost position.

With the engine set by either method, approximately on top dead centre firing position on No. 1 cylinder, proceed as follows.

Remove the distributor cap and ascertain to which contact the rotor arm is pointing. Replace the distributor cap, noting the terminal socket concerned. Insert the plug lead connecting No. 1 cylinder to this terminal socket. Follow around the distributor cap in an anti-clockwise direction, looking down on top of the cover, and insert the plug lead for No. 3 cylinder. Next to this, again moving in an anti-clockwise direction, fit No. 4 plug lead. Lastly, fit the lead to No. 2 cylinder. Since the rotor turns in an anti-clockwise direction it will be realized that the firing order is 1, 3, 4 and 2.

If the distributor has been removed, re-time by turning the engine so that No. 1 cylinder is on the compression stroke. (The method of doing this is described at the top of previous page.)

Next, check that the contact-point gap is correct. If not, reset as described above.

With the rotor pointing towards No. 1 cylinder contact, the points should just be about to open. If this is not so, loosen the clamp bolt, which is on the same side as the starter motor, so that the distributor body can be turned to obtain this setting. Lock the clamp bolt securely when set.
FIG. 70.—TRIMMING-UP CONTACT POINTS
To adjust contact-breaker points turn engine over until contacts are fully open. Then slacken screw (1) and insert screwdriver in slot (2). Move plate until gap between contacts is \(0.014\) to \(0.016\) in. \((356\) to \(406\) mm.\). When setting is correct, tighten locking screw and re-check gaps.

The contact-breaker points should be cleaned every 6,000 miles. It may be found that they have become dirty or have worn unequally—usually one develops a peak, the other a corresponding hollow. The most satisfactory way to correct this unevenness is to remove the contacts, loosening both terminal nuts on the bolt that holds the contact spring. The spring may then be disconnected from the bolt—the end is slotted—and the contact drawn off its pivot. Take care not to lose the flat insulated washer fitted on the pivot between the moving contact and the base. If required, the other contact can be removed by unscrewing its two adjacent screws and lifting it away from the base.

To restore the points to their original condition use either a fine carborundum stone (Fig. 70) or one of the special

**Modifications to Distributor**

On later models a modified distributor is fitted (Fig. 69).
files that may be obtained for the purpose. Very fine emery cloth may also be used. Clean away any grit or grease after facing the points, the aim being to leave them dead flat and true with one another. Remove the minimum possible from the points. Replace and readjust.

**Ignition Timing for Grades of Petrol**

To obtain correct ignition timing, set No. 1 piston at t.d.c. on its compression stroke, with valves 3 and 4 ‘rocking’. This position is indicated when the 0° pointer (Right, Fig. 71) corresponds with groove in crankshaft pulley. Then, rotating crankshaft backwards bring groove into line with 5° pointer. This is of assistance when setting correct amount of advance for commercial type fuel, the advised setting being 6° before t.d.c.

With premium grade fuels follow the same procedure except that crankshaft, after being positioned at t.d.c. on compression stroke of No. 1 cylinder, is rotated backwards until the groove in crankshaft pulley corresponds with the 10° pointer (Fig. 71). This assists when setting correct amount of ignition advance for premium fuels, the advised setting being 12° before t.d.c. As there will not be any pinking to serve as a warning when premium fuel is used, it is most important that this setting is strictly adhered to.

Now, remove distributor cover and slacken pinch bolt in clamping plate. With rotor arm pointing to position of No. 1 electrode in distributor cover, rotate casing until contact breaker points begin to open. This instant may be determined exactly with the aid of a small bulb in a battery circuit. Hold one lead to earth and the other at condenser terminal. The light will go out at the instant that gap opens and the spark is then correctly timed for all cylinders.

Finally, tighten pinch bolt, refit distributor cover and test car on the road. Any further adjustment may be effected on the vernier adjusting screw (Fig. 67). The engine should pink slightly under load at 10 to 30 m.p.h. in top gear with accelerator pressed down. If pinking is violent, or continues after 30 m.p.h., ignition should be retarded. Conversely, if there is no pinking, or if it dies out early, ignition should be advanced.

**Road Test of Ignition Timing**

With the gradual formation of carbon in the engine, thus increasing the compression, it may be found necessary to retard the ignition timing slightly. This may be done by turning the knurled knob of the micrometer adjustment as required—clockwise to retard and anti-clockwise to advance (E, Fig. 68 or 5, Fig. 69).

To make a road test, the easiest method is to use the timed acceleration procedure. This will require a stopwatch and someone to help you. Take the car to a stretch of road that is de-restricted, free from side turnings, and preferably not downhill or this would affect the characteristics of ignition advance.

Timed acceleration runs are necessary. All should be taken in the same direction and over the same stretch of road, and under similar conditions. Have the car running in top gear at a speed just below 20 m.p.h. Then the accelerator pedal should be pressed fully open and speedometer carefully observed by the helpful friend with the stop-watch.

Directly the speedometer needle is on ‘20’, the stop-
watch should be started, and stopped at an agreed maximum speed—i.e. 50 or 60 m.p.h. Under the whole of this part of the test the accelerator must be fully open.

On achieving the desired maximum speed reading on the speedometer stop the stop-watch. Note the time as accurately as possible. Go back and repeat this test with the ignition advanced a little more. If the recorded time is less than previously, continue testing and advancing the ignition until no improvement in acceleration time is obtained.

Obviously, if the ignition is further advanced but the time taken to accelerate between the set figures increases, it means that the engine is over-advanced and is not giving its maximum performance.

It is not necessary to time up to speeds of 50 or 60 m.p.h. Some drivers—particularly those who own a new car—may wish to restrict road speeds. Accordingly, acceleration times may be taken between 20 and 30 m.p.h. No doubt this will commend itself within areas restricted by speed limits. The important point to observe is that when testing between 20 and 30 m.p.h., the ‘stop’ and ‘start’ times must be taken with great accuracy. When testing up to say 60 m.p.h. an error of a second will not proportionately affect the result so much as it would do when testing up to 30 m.p.h. where it could represent a large proportion of the time involved.

If by this method the car is set to run on standard fuel then it will run equally well on a premium-grade fuel, but the additional benefit the better-grade fuel can confer will not be obtained. The moral is, of course, to reset the ignition so that the premium-grade fuel may be utilized to the best advantage.

Conversely, if the car has been set to use a premium-grade fuel, but a standard grade fuel is constantly used, the engine will probably be rather over-advanced and should be reset or somewhat harsh and possibly inefficient performance will result.

Sparking Plugs

Although an insignificant accessory to look at, the sparking plug is most important. Plugs have to operate under high temperatures, must be of suitable reach for the plug points to be in the best position for igniting the mixture, and must not be so cool as to permit oil to collect on them or so hot as to cause pre-ignition. Obviously, the correct type of plug is necessary and you will be well advised to use the type recommended by the Austin Motor Co. Ltd. This is the Champion N5, long-reach type.

No plug has an indefinite life and on an efficient engine, particularly when it is not a large one, the owner is well advised to consider renewing plugs that have exceeded 10,000 miles. Often erratic running and bad starting can be traced to plugs, the useful life of which has been exceeded.

Periodically remove the plugs at least every 6,000 miles and clean the points of any carbon by brushing them with a type of brush known as a ‘file card’. Should the plugs have to be cleaned internally, this is most easily done by washing them out thoroughly in petrol. If they do not respond to this treatment let your Austin dealer clean them for you on his sand-blast. This will only cost you a few pence and the points can be set, tested under pressure, and a report given on their condition.

Remember that a plug is vulnerable and can be damaged by over-tightening or by accidentally hitting the insulator. Finally, do not be tempted to use plugs without their gaskets. You cannot get a perfect seal and not only will compression be lost but also there will be an air leak so that the mixture will be upset on the induction stroke.

Plug Adjustment

Having cleaned the plugs, test the gap at the points. The gap should be .025 in. (.64 mm.) (A, Fig. 72). The plug gap is very important and any wide variation as between the four plugs on the engine can make even slow running impossible.

If it is necessary to adjust the gap, never bend the centre electrode. If the gap must be adjusted, bend the electrode fitted to the plug body. Many plugs have been ruined by owners bending the centre electrode resulting in either loosening it in the insulator or cracking the insulator. In either case the plug soon becomes faulty.

Always keep the plug insulators, the leads, and the distributor cap free from dust and dirt. In damp weather moisture can collect on this film of dust making starting
difficult because the high-tension current tends to short-circuit to earth rather than spark at the plug points.

**Tracing Ignition Troubles**

If the ignition is carefully maintained, as described in the preceding pages, you should have no unforeseen delays due to breakdown. But as any complicated piece of mechanism is liable to develop some slight defect it may be well to consider what minor difficulties may arise and how to correct them.

Ignition trouble usually falls under two heads: complete stoppage or intermittent firing.

Suppose the car, otherwise running perfectly, suddenly stops. The following test should indicate the quickest way of finding where the trouble lies.

Leaving the ignition switched on, disconnect the low-tension cable at the side of the distributor. Touch the bare metal of the cylinder block with it, when sparks should be seen. If you cannot get any sign of current on this wire there may be a dirty or loose connection or, indeed, a broken wire that will have to be located. Test the low-tension circuit generally by seeing if the headlamps will light.

If current is reaching the low-tension feed, reconnect it and make sure the rocker arm is free to move. It is rare for it to stick but it may have stuck open. If so, remove the arm, clean the bush inside, lightly oil its pivot and replace it. If the arm is free, check the gap, adjusting if necessary. See that the points are clean and flat.

If the points are in order, disconnect the centre wire from the distributor cap and hold it about \( \frac{1}{2} \) in. from the cylinder block. With the points normally touching separate them by pressing them apart. This should cause a spark from the high-tension cable to the block. If no spark is forthcoming then the coil is probably at fault.

If a spark is produced, refit the cable to the cap, replace the cap and test the sparking-plug leads by turning the engine and holding them one at a time about \( \frac{1}{2} \) in. from the cylinder block. Should no spark be visible from any, then there may be a short-circuit in the rotor or distributor cap.

Misfiring is not always easy to trace being generally due to some condition such as dirty contact points, weak spring, stiff rocker-arm action, short-circuiting due to dirt on the distributor cap or rotor, sticking valves, obstructed petrol supply, or carburettor misadjustment.

A broken wire is not always easy to trace owing to many being bound together in the looms. If found and accessible, obviously a temporary repair may be made by baring the ends of the wire and twisting them together. But, in such a case, as the system is an 'earth return' do protect the joint with insulation tape.

Additional causes are loose wires and connections or dirty and maladjusted plugs. Normally the high-tension cables, although well protected, might develop a short-circuit if the insulation has perished. This possibility should not be overlooked.

Remove the plugs, clean and test as already suggested.
The only satisfactory test for a plug is when it is under pressure. Although a plug may spark perfectly when tested out of the engine it does not follow that it will spark in the cylinder when under compression.

Fuses

The wiring diagram (see page 220) indicates the positions of fuses, mounted in the control box, that protect various circuits. The 50-amp. fuse marked A1-A2 protects the various accessories wired up in such a manner as to work independently of the ignition switch. The radio, interior light and horn are covered by this same fuse.

The fuse A3-A4 is included in the circuit for those accessories that operate only when the ignition switch is on. Under this heading come the petrol gauge, windscreen wipers, stop lamps and flashers. The fuse protecting these is, however, a 35-amp. one.

Although the fuses are interchangeable, the fusing value of the individual unit is indicated by the colour of the paper strip inserted in the glass tube. As an additional safeguard the fuse identification is printed on the paper strip.

Starter Motor

The starter motor is a self-contained unit bolted to the engine on the off side and directly connected to the battery by a heavy cable (Fig. 73). It is controlled by a switch on facia panel. When switch is operated the motor turns and revolves the engine through the medium of the starter-drive.

Although simple in operation, the starter-drive mechanism is not always clearly understood. This ingenious device is illustrated in Fig. 74.

The splined shaft adjacent to the flywheel carries a sleeve fitting closely to the splines. It has a spiral thread on which slides a small pinion that can engage the flywheel. A strong compression spring is fitted between this sleeve and the shaft end to act as a cushion against sudden shock when the pinion begins to turn the engine.

Directly the switch is operated the armature and shaft rapidly spin; but the pinion, being freely mounted on the spiral thread, remains stationary. Therefore, it is drawn along the spiral sleeve into mesh with the ring gear of the flywheel so that when the engine fires the pinion is driven at a faster rate than the armature. Consequently it is thrown out of mesh along the spiral threads of the sleeve. When the starter motor switch is released the motor stops, the pinion being still out of engagement with the flywheel. From this it will be obvious that its operation is simple and automatic.

Do not use the starter switch when the engine is running or the pinion may be brought into contact with the flywheel teeth to cause damage.

Two things are essential for correct working: (a) the starter pinion must be free from oil and dust since its operation relies on its being able to move on the sleeve;
(b) the battery must be sufficiently charged for the starter motor to operate quickly enough for the pinion to slide along the sleeve into mesh with the flywheel.

**Starter Pinion Jamming**

It sometimes happens that the pinion jams in mesh with the flywheel. Should this occur there are two ways of freeing it. One is to engage top gear and then rock the car backwards and forwards when the pinion may be freed. It is important that, if this method is employed, the ignition should be switched off and that the hand-brake is released. The second method, which may be adopted if the first is not successful, is to detach the small cap pressed over the rear starter-motor bearing housing. On removing this it will be seen that the shaft has a squared end on which a spanner may be fitted and so the shaft may be turned (Fig. 75).

As the normal direction of rotation of the squared end of the shaft is anti-clockwise, turning it clockwise may free the pinion. Should the shaft continue to prove obstinate it may be necessary to undo the bolts securing the starter motor to the engine but this is rarely required.

**Electrical System**

If it is found that the pinion fails to engage and it is known that the battery is fully charged, then the starter motor should be removed and the pinion and sleeve washed in paraffin to obviate any tendency for them to stick. They must not be oiled. If the starter motor is removed it is best to disconnect the battery to avoid any possibility of a short-circuit.

The switch contacts are of large area and with normal use should not require to be cleaned, but the armature commutator may become dirty or the brushes stick, in which case they may be cleaned as in the case of the generator (see page 162). It should be noted that the slots in the commutator are not undercut, as in the generator.

The bearings of the armature shaft, being of the oil-less type, do not require lubrication.

The starter motor and switch are fully capable of starting the engine under normal circumstances but in severe weather, or if a thick grade of oil is in use, heavy loading results. Under cold starting conditions the wise owner will first free the engine by using the starting handle. Such consideration will result in increased life so far as the battery is concerned.

**Horn Adjustment**

Provided it is securely mounted the horn requires little attention. The wiring circuit is fed through a fuse and should the horn fail the fuse should be inspected. Erratic operation may indicate the need for adjustment. It may be of help first to check the horn switch.

Using the test lamp (described on page 192) check if current is reaching the horn terminal when the button is pressed. If the lamp glows when thus tested, then the trouble is in the horn itself. The contacts should be cleaned and readjusted as described below. If the lamp does not light there is a broken connection at some point in the circuit.

The horn switch is accessible by carefully prising the retainer ring out of the centre of the steering-wheel hub, when the contacts will be disclosed.

Loose mounting can affect the note emitted by the horn but if it is found that the condition is associated with the instrument itself means for adjustment is provided.
It is best to remove the fuse when adjusting, for otherwise it may inadvertently be blown should the adjustment be screwed down too far. Take care to keep the terminals of the horn from touching the chassis when disconnected or a short-circuit may result. Adjusting does not control the pitch or note of the horn but is provided as a means of compensating for any wear that may arise in use.

First loosen the locknut in the centre rear of the horn body. Then turn the adjusting serrated screw in an anti-clockwise direction so that the contact points are fully separated. This can be checked by moving the adjustment a little at a time until on pressing the horn button it will not sound. Then turn the adjusting screw six notches in the opposite direction, to bring the contact points closer together. Securely lock the setting with the locknut.

**Lamps and Wiring**

The wiring is well insulated and firmly held by clips to prevent it chafing but it is advisable to inspect the various leads from time to time. Any part of the insulation that appears to be damaged should be bound with insulating tape. Points where rubbing is sometimes liable to occur are where the cables for the headlights and sidelights pass underneath the mudguards to the lamps. If the headlamps or sidelamps flicker take immediate steps to find the reason and put it right. The sudden failure of one or both headlamps when you are driving fast at night can be awkward—to say the least.

**Headlamps**

As the headlamp bulbs are of the ‘pre-focused’ type there is no adjustment provided for moving the bulb relative to the reflector. If the instructions are carefully followed the best optical setting will be obtained.

Double-filament bulbs are fitted, these having a current consumption of 42 watts in the straight-ahead position and 36 watts when dipped.

**Replacing Head and Sidelamp Bulbs**

Undo the securing screw at the bottom of the rim that fits around the headlamp glass (Fig. 76). This rim can then be removed by lifting it away, detaching it first at the bottom and disclosing a rubber dust excluder. When this has been carefully detached, the screws controlling the 'beam direction' will be visible. Do not attempt to turn any of these screws or the adjustment will be affected. Adjusting the headlamps is dealt with below.

Press the light unit inwards against the spring pressure at the same time turning it to the left, or anti-clockwise.

![Fig. 76. - Headlamp Glass Assembly](image)

1. Vertical Adjustment Screw. 2. Rubber Dust Excluder. 3. Front Rim. 4. Rim Securing Screw. 5. Horizontal Adjusting Screws

This will allow light unit to be removed from the body as the heads of screws can then pass through the slotted holes. All that is necessary to gain access to the headlamp bulb is to turn the back-shell in an anti-clockwise direction (as viewed from the back) when it can be drawn off and the bulb detached from the holder.

After installing the replacement bulb of the required type (as described on page 186) and noting that a register ensures the bulb taking up its correct position, refit the back-shell. Take care that the spring-loaded screws retaining the light unit have their springs behind the flange and their heads in front.
The side lamp bulbs are accessible after slackening the screw at the back of the side lamp body. When this has been loosened the front rim and bulb holder may be withdrawn as an assembly.

**Headlamp Alignment**

Headlamp beams must be aligned when the car is empty and standing on level ground, 25 ft. from a blank wall and squared-up to it. The wall should be in semi-darkness and of a suitable colour so that the bright spots of headlamps may be clearly seen. For headlamp alignment chart giving the setting dimensions, see Fig. 77.

It will be necessary to detach headlamp rim, after which vertical and horizontal adjustment screws may be turned as required to adjust headlamp beams to conform with dimensions given in the illustration. It will be found convenient to shield the beam of one light, whilst working on the other. When this particular headlamp beam is correctly set, it should be obscured whilst the other is adjusted.

A point should be marked on the wall in line with centre of bonnet. Two crosses should be drawn on the wall 29\(\frac{1}{2}\) in. above ground level and 42\(\frac{1}{2}\) in. apart, measured equally about the centre point (see B and A respectively, Fig. 77). Switch on headlamps and adjust if required, until centre of each circle of light coincides with centre of its respective cross.

Remove headlamp rim. Note that the two screws (one each side) control the 'sideways' movement (D, Fig. 78). To move the beam to the left it is only necessary to screw in that screw a little at a time until the desired result has been obtained. To move the beam to the right, turn the right-hand screw in the direction, normally required to tighten.

Should it be necessary to raise or lower the beam, turn the screw at the top of the light unit (C). Screwing this in will raise the beam; unscrewing it will lower it.

It will be found most convenient to shield the beam of one lamp whilst working on the other. The car should be on level ground when setting the beams.
FIG. 78.—HEADLAMP UNIT
A Light Unit. B Backshell. C Vertical and D Horizontal Adjustment. E Bulbholder. F Dust Excluder

Stop and Tail Bulb Replacement
Should it be necessary to replace the stop- or tail-lamp bulb, access is obtained by removing the lens. The rubber ring has a double lip. By pulling back the outer lip, the rim can be detached. The inner lip, which secures the lens, will then be disclosed and can be drawn back to free the lens (Fig. 79). The bulb can then be detached.

It will be seen that the bulb has offset securing pins to ensure it is fitted the correct way round. The stop/tail-lamp bulb is of the double-contact type, the cap providing the earth return.

Replacing the Number-plate Lamp
To change the number-plate lamp bulb all that is necessary is to unscrew the securing screw in the middle of the cover (Fig. 80). In detaching this cover take care not to damage the sealing-washer fitted around it.

It is usually helpful to clean this lens inside and outside when thus removed, permitting maximum number-plate illumination. The lamp bulb is of the 6-watt type.

FIG. 80.—NUMBER-PLATE ILLUMINATION

Flasher Unit
The flasher unit is contained in a small cylindrical metal container, one end of which is rolled over on to an insulated plate carrying the mechanism and three terminals. The unit depends for its operation on the linear expansion of a length of wire becoming heated by an electric current flowing through it. This actuating wire controls the movement of a spring-loaded armature attached to a central steel core and carrying a moving contact.

This actuates a warning lamp indicating that flasher unit is functioning correctly. It also gives warning of any bulb failure occurring in the external direction-indicator lamps. The warning lamp is located on the facia and is incorporated in the indicator switch.
Instrument-panel Lights

The instrument-panel bulbs are held in a holder. This is a ‘push-fit’ in a mounting behind the dash-board. When replacing these lamps do not pull the holder out of its position by the cable or this may break. Grasp it with the fingers and draw it out of its location.

Ignition-warning Lamp

The bulb is screwed into a holder to remove which all that is necessary is to pull it gently from its mounting behind the panel. Do not attempt to draw it out by pulling the terminal wire or this may be damaged.

Fault Finding and Testing

A useful accessory for the owner who is prepared to do the small routine checking that is occasionally necessary is a test lamp. This is simply a lamp holder with two lengths of wire that may be as long as is convenient.

By ‘earth ing’ one wire and touching the other on the ‘feed’ of the suspected component it can be ascertained if current is available at the point being checked. It should be noted, however, that the earthed wire must be placed on bare metal and not on paint, which is an insulator.

The method of use is as follows:

Suppose the horn will not work. Test by earthing one wire of the test lamp and connect the other to the horn terminal that has the brown and green wire connected to it. This is the ‘feed’. The lamp should light showing there is current at that point. If it does not, check the fuse and the various connections for a break or loose contact.

If it does light, earth the horn terminal having the single brown and black wire and the horn should sound. If it now works the fault is in the switch or the lead to it from the horn. If it does not sound the fault lies in the horn. Possibly the contacts are dirty or require adjustment.

CHAPTER XIII
LUBRICATION

TWO THINGS will probably impress themselves on your notice—the continual advice to use the correct grade of a good quality lubricant and the considerable discrepancy in price as between expensive and cheap oils on the market. A knowledgeable friend often shows his admiring audience how to test a sample of oil by dipping his finger in it and rubbing it between finger and thumb to determine its oiliness, body quality, etc. Such tests in the modern oil refinery require expensive instruments as well as skilled technicians to carry out with certainty.

It is true to say that you never get ‘something for nothing’ and for the sake of a slight saving in the initial cost of oil, considerable expense may be caused due to some breakdown of the oil film under heavy-load conditions. Apart from the damage that can occur to the engine itself there is also the possibility that there may be a breakdown on the open road necessitating the services of a breakdown wagon to tow the car to a service station.

The main difficulties that confront the oil refiners are these: (a) when the engine is cold the oil must not be too thick to flow readily under pressure to the bearings, nor must it make the engine too stiff to turn; (b) when the engine has warmed up the oil must not thin out to such a degree that it will allow the heavily stressed working parts to come in metallic contact with one another nor, under these conditions, must it form carbon particles or sludge; and, finally, (c) it must retain its lubricating qualities for a considerable length of time bearing in mind that it may be diluted, particularly in winter, with petrol that reaches the sump under cold starting conditions. Cheap oils are generally unsatisfactory under at least one of these headings, and it should be remembered that as your Austin A35 engine will revolve at speeds in excess of 4,700 r.p.m. the oil film must not break down under the bearing loads resulting.
Thus, it is a wise policy always to buy a good grade of well-known branded oil and having made your choice to use always the same maker's product. Follow the instructions with regard to periods at which the oil should be changed and conscientiously work to the rule. Lubrication periods have been determined after considerable research and experience to ensure satisfactory performance and long life of the working parts. It is up to you to do your share by seeing that the various points are given regular attention.

Choice of Lubricants

The colour or appearance of an oil at atmospheric temperatures gives no indication as to its efficiency under operating conditions. Owners are advised to use only officially recommended lubricants as listed on page 217. It is appreciated that in some remote areas these oils may not be available, in which case only good quality oils conforming with S.A.E. numbers listed should be used.

The letters S.A.E., followed by a number, constitute a classification of lubricant in terms of viscosity or fluidity. For instance, a low S.A.E. number, indicating that it is of low viscosity, means that it flows more readily than oil with a high viscosity rating. It will be appreciated, therefore, that oil with a low S.A.E. number is essential if easy starting is to be obtained in cold weather. On the other hand, in hot weather a higher viscosity oil is desirable in order to keep oil consumption within normal limits.

Even the best oils become contaminated in time with unburnt fuel, carbon, metallic particles, and moisture. It is most important, therefore, that oil is changed at recommended mileages.

Upper Cylinder Lubrication

Use of upper cylinder lubricant is desirable at all times, but most particularly during the running-in period of a reconditioned engine. See page 217 for recommended brands.

Multigrade Motor Oils

In addition to recommended lubricants, multigrade oils, as produced by oil companies shown on the list, may be used for all climatic temperatures unless your engine is old and in poor mechanical condition. Some brands are more expensive than recommended motor oils because of their special properties and greater fluidity at low temperatures.

Engine Lubrication System

Oil for the engine is carried in the sump bolted to crankcase. A pump, driven by skew gears from camshaft, delivers oil under pressure to various bearing surfaces. Delivery is by way of an oil gallery running along right-hand side of engine to three main bearings and thence, through drilled passages in crankshaft, to big-end bearings. Passages in engine block also conduct oil to the three camshaft bearings.

As already explained, a warning light is connected to oil gallery so that the driver can readily see whether oil pump is functioning correctly. If this light flashes, particularly when rounding corners, check oil level. Never allow engine to run unless absence of warning light shows the system to be working satisfactorily.

The cylinder walls and gudgeon pins are normally lubricated by oil flung off the big-end bearings, but to ensure thorough lubrication there is a small jet hole in the top half of each connecting-rod big-end bearing (10, Fig. 39).

The camshaft timing chain is lubricated by oil fed to it from the gallery via the front camshaft bearing. This bearing has a passage communicating with the forward end on which the camshaft timing wheel is mounted. A number of slots cut in the camshaft thrust washer allow oil to reach the wheel. Centrifugal force then carries the oil outwards to the chain keeping the links and rollers in a well-lubricated condition.

Lubrication for the overhead-valve gear is provided by leading oil at a reduced pressure from one camshaft bearing through a drilled passage to the valve-rocker shaft. Each rocker is drilled so that not only is each bearing lubricated at the point where it moves on the rocker shaft but the spherical end, which is carried in the push rod, floats on a film of oil delivered under pressure. Not only is wear arrested but quiet operation is assured by this means. Surplus oil returns to the sump.

Immediately above the gudgeon pin each piston carries an oil-control or scraper ring, slotted around its circumference.
The oil it collects is free to pass through corresponding holes in the piston ring groove and so back to the sump.

Points at which there could be oil leakage are situated at each end of crankshaft. At front end adjacent to pulley is a felt oil retainer fitted into a groove and embracing the circumference of the crankshaft. Immediately behind this is a thrower, the purpose of which is to fling off by centrifugal force any oil that tends to work its way along the crankshaft. At rear end of crankshaft there is another thrower to prevent oil from escaping past rear main bearing. Apart from needless waste, it is important to keep oil from the working faces of the clutch otherwise it would slip when under load.

**Full-Flow Oil Filter**

Before reaching the engine bearings the oil is passed through an oil filter of the full-flow type (Fig. 81). Its element consists of a star formation of special quality felt selected for its filtering properties. Oil is passed to the filter from the pump at a controlled pressure of 60 lb. per sq. in. Obviously, some pressure will be lost in this process and the loss becomes greater as the element becomes contaminated by foreign matter removed from fuel oil.

A balance-valve is provided to guard against the possibility of filter becoming completely choked and thereby preventing oil from reaching the bearings. This balance-valve is set to open when there is an oil pressure difference of 15 to 20 lb. per sq. in. as between inside and outside of filter element. It is non-adjustable. When the valve is open, un-filtered oil by-passes element and reaches bearings at a reduced pressure of approximately 35 lb. per sq. in. Therefore, to ensure that only filtered oil is supplied it is essential that element should be renewed at 6,000 miles, or when oil pressure gauge indicates that a change is necessary by a fall in pressure.

**Regularity of Engine Lubrication**

It is important that the sump of a reconditioned engine should be drained and refilled with new oil after the first 500 miles. Inevitably, minute particles of foreign matter, fluff, etc., will circulate with the oil as the new engine is run in. Once these particles have been drained off and the bearings have become highly polished, the clean new oil will keep the working surfaces in good condition. After this initial draining period the oil should be changed after the next 3,000 miles. Thereafter, change it every 3,000 miles and replace the filter unit at approximately 6,000 miles, as mentioned above. The drain plug is located at rear right-hand extremity of sump (5, Fig. 59). Care should be taken to ensure that no dirt or grit enters sump when replacing the plug. Capacity: 6 pints.

Check oil level daily by means of dip-stick (Fig. 6). This will give you an accurate indication of its condition as well as its quantity. If there are signs that the oil is becoming dirty—for instance, if water is present—the sump should be drained and refilled with clean oil. A new element should be fitted at the same time (see next page). Should you have to replenish the sump the few shillings spent on clean oil is far more economical than attempting to make do with dirty oil, bearing in mind the cost of any repairs that might easily be caused by a breakdown in the lubricating system.
Renewing Filter Element

First drain filter by removing centre fixing bolt from base of container (Fig. 81). With bolt removed it will be necessary to support container by hand, until all oil has drained away. Withdraw container complete with element, slide out element, and—using a non-fluffy cloth—thoroughly clean container internally of all foreign matter that has been trapped. Insert a new element and, holding centre fixing bolt in position against bottom of container, fill with new oil. Now, still holding bolt in position, locate it in filter head casting and tighten sufficiently to make an oil-tight joint. Then top-up sump with oil. Make sure that no fibres from the cleansing operation remain in the container before inserting the new element.

This is the only attention likely to be required but it is important to note that filter container should not be removed other than for fitting a new element. To disturb it invites the hazard of added contamination from accumulated dirt on outside of filter entering container and of this being carried to bearings on restarting engine.

Start the engine and allow it to tick over steadily, at the same time carefully examining the connection for any signs of oil leakage. Even a slight leakage of oil can account for considerable loss, bearing in mind that this leakage will occur during the whole time the engine is running. It is well worth while to make sure that the work has been done satisfactorily before taking the car on the road again. Make certain that all mounting bolts are tight.

Sump Removal and Oil-pump Maintenance

The full-flow filter will keep oil clean for a considerable time, and it is not normally necessary for sump to be dropped and oil-pump filter cleaned.

Should there be any marked decrease in oil pressure, shown by oil-pressure light glowing, it may be that oil has been diluted somewhat. Refilling with correct grade of oil may restore pressure. On the other hand, there is the possibility that pressure-release valve is held partly open due to intrusion of particles of foreign matter. Instructions for cleaning this pressure-release valve are given on page 201.

Supposing that these points have been checked and that the pressure remains below normal, oil-pump filter may have become choked. To remedy this it will be necessary to remove sump. There is nothing particularly difficult in this operation but take care to refit it correctly, otherwise oil leakage may occur and besides being messy oil loss in such circumstances can be expensive.

If you decide to do the work yourself it will be helpful first to raise the car at the front on suitable solid packing to give more room in which to work. Take care to chock rear wheels and also to apply handbrake to prevent car moving off supports whilst you are underneath it.

Unscrew drain plug at rear of sump and allow oil to escape, not forgetting that there will be approximately 6 pints in the sump (Fig. 59). Place a temporary support under sump itself and then undo securing bolts. The sump is secured in position by thirteen set-screws with washers. A nut and bolt—with flat and spring washer—on left-hand side beneath fuel pump holds petrol drain pipe by means of a suitable bracket.

When all screws have been removed hold sump with one hand, remove temporary support and then carefully lower sump. If at first it will not drop downwards out of position, ease it away carefully at each side but take care not to damage sump face.

Having lowered the sump, the oil strainer or filter will be disclosed. It can be washed without further dismantling. It will be found more convenient to unscrew and remove the bolt that passes through the centre of the oil-strainer body (7, Fig. 82) after which the bottom cover can be taken away and cleaned. The gauze on the oil-strainer body can then more easily be cleaned for you can now get at both sides of it. Do not use a rag, use a brush.

There are two things to watch when replacing the bottom cover. A distance piece (2, Fig. 82 is fitted between bottom cover and top of oil-strainer body, the bolt passing through the centre of it. The purpose of this distance piece is to prevent the oil-strainer body from being unduly compressed and distorted when the bolt is tightened up. The other important point is that the bottom cover must be so fitted that the solid segment is towards the pump body. It will be noticed that there is a small tongue formed on the cover and that it engages with a corresponding slot machined to
receive it in the body. When the bolt has been passed through the bottom cover, through the distance piece and top of the strainer body, enter next the lock washer and secure the bolt with the nut.

**Replacing Sump**

When all parts have been cleaned ready for reassembling carefully inspect the sump gasket. If it is found to be damaged fit a new one, otherwise oil leakage will occur when engine is running. Clean off any remains of old sump gasket that may be adhering to either sump flange or crankcase face as these can prevent a proper joint being made. Use correct cork gaskets and if necessary replace also the square-section cork strips, one on each front and rear main-bearing cap.

Refit the sump with the stepped part to the front. Note that the sump bolts must have the spring washers next to their heads. The location of the nut and bolt has already been described.

Enter all bolts before starting to tighten them, then do so gradually preferably tightening diagonally so that the sump is evenly drawn up into position.

Make sure that the sump drain plug is in its place and fully tightened. Lower the car and refill the sump with oil to the 'full' mark on the dip-stick. It is a good plan to allow the engine to idle for a few moments whilst you look carefully for any signs of oil leakage. Since the normal oil level is below the sump flange oil leakage can only occur when the engine is running and oil is splashed over the inner surfaces.

**Oil-pressure Release Valve**

This spring-loaded valve is so designed that undue oil pressure—as, for instance, when the engine is cold and the thick oil tends to increase the pressure—can open it allowing oil to escape back into the sump to prevent the pressure rising excessively, as has been explained above.

As already mentioned, it may happen that a small particle of foreign matter lodges on the conical seating and partly holds the valve open, causing a somewhat lower oil pressure than normal. If it is suspected that this
has occurred all that is necessary is to clean it. Unscrew the hexagonal-headed plug in the side of the cylinder block situated towards the rear of the right-hand side of the crankcase, so releasing the spring. By inserting a suitable probe the relief valve can be withdrawn from its housing. Carefully clean the parts and examine the seating of valve and cylinder block.

When reassembling (Fig. 83) enter the valve conical face end first followed by the spring. Two fibre washers must be fitted over the threads of the valve plug otherwise an oil leak may occur.

Valve-rocker Shaft
Due to the oil filtration arrangements it is unlikely that there will be any deposits to obstruct the oilways. It is worth noting that the rocker shaft, which is drilled and fed with the oil under pressure for lubricating each rocker bearing, can be cleaned if desired. Each end of the shaft is plugged, one end having a threaded plug secured by a cotter pin (A, Fig. 84). To clean the shaft the cotter can be withdrawn and the plug unscrewed giving access to the shaft itself.

Gearbox Lubrication
The working parts of the gearbox are lubricated by 'splash'. Provided that the correct level of a good grade of gear oil is maintained, it will give long service since the oil is circulated automatically to the various parts needing lubrication. If the oil level is allowed to fall unduly, wear and consequential damage can result. On the other hand, if the gearbox is overfilled, apart from possible loss at the rear, oil may work through to the clutch giving rise to clutch slip or uneven engagement.

It is normally only necessary to check the oil level every 1,000 miles or at monthly intervals.

FIG. 84.—SHOWING SCREWED PLUG (A) THAT FACILITATES INTERNAL CLEANING OF SHAFT

FIG. 85.—ENGINE AND GEARBOX (NEAR-SIDE)
1 Gearbox Filter Plug. 2 Drain Plug. 3 Cylinder Block Drain Tap

Remove the rubber plug on the left side of the gearbox cover to disclose beneath it the filler plug (1, Fig. 85). Wipe away any mud or dirt around the plug and then unscrew it. Always take great care to prevent particles of grit from reaching the working parts.

Check the level when the gearbox is warm after a run. Not only does the oil run out quicker when warm but it will carry with it the fine particles of foreign matter suspended
in it. The drain plug is in the bottom of the gearbox housing on the right-hand side (2, Fig. 85). The oil should be at the level of the bottom threads of the plug hole. If it is not, bring it to this level. Take care not to be misled by any froth. Replace the plug securely and re-insert the rubber plug in the gearbox covering.

Every 6,000 miles the gearbox should be drained and flushed out by pouring in about a pint of flushing oil. Remember to replace the drain plug temporarily. The engine should then be turned several times with the car jacked-up and the gears in to circulate the flushing oil. After this has been done remove the drain plug and allow the gearbox to drain completely. Refill to the bottom of the filler plug orifice as previously described. The oil capacity is approximately 2½ pints.

**Fig. 86.—Rear Axle**


As in the case of the engine use only good quality gear oil of the correct grade. The heavy bearing loads and the pressures developed between the gear teeth soon cause the film of a poor quality lubricant to break down. The use of too thick an oil can cause undue drag on the gear wheels and make gear changing difficult.

The clutch itself is of the dry-plate type and requires no lubrication, nor does the clutch release.
The shock absorbers are of the hydraulic type (Fig. 89) and require 'topping up' from time to time. Unscrew the filler plug fitted at the centre of the cover but before doing so carefully wipe away all traces of mud and dust so that none enters when the plug is unscrewed. A special hydraulic fluid is used and on no account should engine oil or grease be used. Quite apart from any unsatisfactory operation that may result, the working parts of the shock absorbers will be damaged due to the heavy loading to which they will then be subjected.

The steering gearbox needs only to be kept 'topped up' to the level of the filler-plug orifice situated on the top centre of the box (Fig. 90).

The upper end of the steering-column shaft may be lubricated with a few drops of light machine oil in the hole in the steering-wheel hub near the column. A felt
w, enter inside the column itself to retain the lubricant.

**Fig. 89.**—**SHOCK ABSORBER AND STABILIZING BAR**
1 Stabilizing Bar. 2 Shock Absorber. 3 Shock Absorber/Axle Link

**Summary**

The following list gives the points requiring attention at the various periods. Work through this list regularly and systematically so that no detail is overlooked.

**Daily:** Check engine oil level and fuel tank contents. See that there is sufficient water in the radiator.

**Weekly:** Tyres: Check pressures—not forgetting the spare wheel, otherwise you may find this is flat when you want it urgently. It is advisable also to remove any flints, nails etc., that may have become embedded in the treads. For tyre pressures see page 38.

**Every 1,000 Miles**

*Rear Spring Shackles:* One each side. Lubricate with oil gun. Do not attempt to add penetrating oil or lubricating oil to any of the spring eyes of shackles except those mentioned in this section.

*Front Suspension:* Lubricate with oil gun the lower arm joints where they join the swivel axle (Fig. 21). There is a lubricator on each side.

*Swivel Axles:* If the car is jacked up when lubricating
Swivel axles: The oil will more readily penetrate to the thrust surfaces, assuring easy steering and reducing wear to a minimum. Each swivel axle has two lubricators (Fig. 90). The upper one is readily visible but the lower one is opposite the compression spring and should not be confused with that of the lower arm joint.

**Steering Connections**: Lubricate with oil gun the five steering connections—on the front end of the double lever, at the rear, on the left-hand end of the cross-tube, on the idler shaft, and on the idler-shaft to steering-arm joint.

A lubricator is also fitted on the right-hand side at the connection of the cross-tube and steering-arm joint.

**Braking System**: Lubricate with engine oil the handbrake control, brake-pedal linkage, and joints (Figs. 91 and 92).

**Carburettor**: Lubricate the various connections using engine oil as necessary.

**Clutch Pedal**: Lubricate the linkage points with oil gun (Fig. 58).

**Gearbox**: Check oil level, topping up as required.

**Rear Axle**: Check oil level, topping up as necessary.

**Steering Column**: Insert a few drops of light oil to the upper steering-column bearing through the hole provided in the steering-wheel hub. A felt washer retains the lubricant added. Wipe away surplus to prevent it reaching your gloves or clothes.

**Braking System**: Test brakes and adjust if required (see pages 74–5). Apply oil to brake-balance lever on the rear-axle housing at the right-hand side. Lubricate hand-brake pivot bearing, also brake-pedal pivot.

**Battery**: Add distilled water to battery as required (see page 165).

**Hydraulic Brake Tank**: Inspect and if necessary add fluid to bring it to correct level (see Fig. 26, page 70). Do not add anything except the recommended fluid or the braking system may be deranged.

### Steering Idler

On no account should steering idler be overlooked (Fig. 93). Lack of lubricant may cause a serious breakdown due to the added load imposed on the steering-box.
Steering Connections

Apply oil gun to steering cross-tube nipples (2, Fig. 94) and to the steering side tube nipples (3 and 4) and top of steering idler by filler plug (A, Fig. 93).

Propeller-shaft Universal Joints: Lubricate at each end of universal joint. It may be necessary to move car slightly so that lubricator can be reached (5, Fig. 60a).

Front Hubs. After 6,000 miles unscrew hub cap and re-charge with grease. It is important that hubs are not over-greased. Some models have a knock-in cap and this must be levered off to enable grease to be applied.

Rear Hubs. These do not require any attention for they are packed with grease on assembly at the works.

Every 6,000 Miles

Air Cleaner: Remove air cleaner by loosening clamping bolt and connection to valve chamber cover. When removed rinse louvred end in petrol and when dry add clean engine oil to gauze mesh. Allow any surplus oil to drain off before replacing (see page 114). Make sure connection to valve chamber cover is correctly made.

Sparking Plugs: Remove and clean (for further instructions see page 178).

Distributor: Remove distributor cap and detach rotor to which add a few drops of thin oil at the screw (Fig. 68). A duct will allow this oil to lubricate the bearings. Apply a smear of engine oil to distributor cam. Test contact points for free movement and lubricate contact pivot, but do not allow any lubricant to reach points. Add a few

Every 3,000 Miles or Monthly

Engine: Drain off old oil in sump and refill with new oil of the correct grade.

Fan-belt: Check tension and adjust if necessary as described on page 130.

Oil Sump and Pump Strainer: Remove and clean as described on page 198.

Oil Filter: Replace unit as described on page 196.
drops of oil at contact-breaker base hole through which the shaft passes to lubricate advance mechanism.

**Fuel System**: If necessary clean petrol-pump filter (see page 121) and filter incorporated in carburettor inlet union. If there is any accumulation of dirt, clean jet. Also clean out pump sediment chamber and carburettor float chamber.

**Gearbox and Rear Axle**: Drain and refill with fresh oil (pages 202-4).

**Water Pump**: Lubricate with oil gun at plug (Fig. 50).

**Shock Absorbers**: Examine rear and front shock absorbers. Top up if necessary. The design of filler plug is such that provided fluid reaches bottom of orifices correct level is obtained when plug is refitted. Sufficient space for expansion under working conditions is automatically achieved.

**Generator Bearings**: Apply a few drops of engine oil to commutator-end generator bearing through the oil hole provided in the housing (Fig. 95).

---

**Fig. 95.—Generator Lubrication**

Wick Lubricator. 2 Spring. 3 Adjuster Screw

---

**LUBRICATION**

**Contact-breaker**: Clean points and check setting (see page 174).

**Distributor Micrometer Scale**: Check timing and adjust micrometer scale if necessary.

**Every 12,000 Miles**

**Cooling System**: Flush out entire system by opening the two drain taps—one at the bottom of radiator and the other on right-hand side at rear of cylinder block. Turn on also heater-water control valve. Flush out system with hose, keeping water flowing until it emerges clean. When refilling take care system is filled completely as there may be a tendency for an air lock to form at thermostat valve. Note that heater will not fill until engine has been started (see page 134).

**Speedometer Drive**: Disconnect cable from speedometer head and pull inner cable out of its casing. Apply light grease to cable and replace, turning it to facilitate entry at the gearbox end. It is important that drive is not over-lubricated otherwise damage will be caused if lubricant finds its way to speedometer head. When fully inserted the squared end should be approximately \( \frac{3}{8} \) in. above the casing.

**Engine**: Loss of power or pinking may indicate the need for decarbonizing. For further details, see page 83. Check valve clearance as described on page 96.

**Oil Gun**

The oil gun (Fig. 96) consists of the body in which is the necessary piston to force the lubricant out through the telescopic end; the cap, which prevents the lubricant from escaping; and the telescopic ram end itself. The last mentioned when pressed on to the lubricator forces lubricant to the working surface of the particular bearing. The adaptor is screwed on when the rear axle and the steering box are to be lubricated.

To fill the gun unscrew the cap, press the leather piston down if necessary, then add sufficient lubricant for three-quarters of its capacity.

The gun, which is designed on the hydraulic principle, can develop considerable pressure when the telescopic ram is
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<td>Mobiloil A</td>
<td>X-100 30</td>
<td>Castrol XL</td>
<td>Esso Extra Motoroil 20W/50</td>
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<td>Mobiloil 10W</td>
<td>X-100 10W</td>
<td>Castrol Z</td>
<td>Esso Excepe Compound 90</td>
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Transmission | Energol SAE 30 | DUCKHAM'S 'NOL Thirty' | Mobiloil A | X-100 30 | Castrol XL | Esso Excepe Compound 90 |

Rear Axle, Steering Box, and Water Pump | Energol EP SAE 90 | DUCKHAM'S Hypoid 90 | Mobiloile GX 90 | Spirax 90 EP | Castrol Hypoy | Esso Excepe Compound 90 |

Oil Nipples | Energol EP SAE 140 | DUCKHAM'S NOL EP 140 | Mobiloile GX 140 | Spirax 140 EP | Castro Hyper | Esso Excepe Compound 140 |

Front Wheel Hubs | Energol EP SAE 20W | DUCKHAM'S L1B.10 Grease | Mobilgrease M.P. | Retinax A | Castrol Chassis L.M. | Esso Multi-purpose Grease H |

Distributor and Oil Can | Energol UCL | DUCKHAM'S 'NOL Twenty' | Mobil Handy Oil | X-100 20/20W | Wakefield Everyman Oil | Esso Handy Oil |

Upper Cylinder Lubrication | Energol UCL | DUCKHAM'S Addict Liquid | Mobil Upper Lube | Donax U | Wakefield Castrol | Esso Upper Cyl. Lubricant |

Rear Axle and Steering: For temperatures below 10° F. (−12° C.) use SAE 93 Hypoid Lubricants. For high temperature climates use the grease as shown for hubs can be used. Use Genuine Lockheed Brake Fluid only. Use Armstrong's Super Thin Shock Absorber Oil.
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