SERVICE
INSTRUCTION MANUAL

STANDARD
CARS

STANDARD MOTOR COMPANY, LIMITED
CANLEY WORKS - - - COVENTRY

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FOREWORD

THIS Service Manual which deals with our 1935 models, is offered to our Agents in its present form owing to there being continuity of programme and very few alterations between the 1934 and 1935 models.

It should be used in conjunction with the 1934 Service Manual, as instruction in greater detail is embodied in that publication, especially in regard to Service Adjustments.

We trust that this Manual will be as beneficial to our Agents in the servicing of Standard Cars as our previous one, and desire to thank those Agents of ours who have forwarded to us information which we have been able to use.

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EXCESSIVE PETROL CONSUMPTION.

When excessive petrol consumption is experienced, it has to be remembered that this trouble can be caused by any one of the following conditions :—loose joints or connections, grit on needle valve seating, punctured float, petrol level too high, too much fuel pressure, late ignition timing, engine out of tune, carburetter flooding, incorrect jet setting, clutch slip or brakes binding and these various points have to be examined with a view of ascertaining the cause of the trouble.

In our 1934 Service Manual, most of the items mentioned above have been dealt with in detail and in this connection we would refer you to Pages 13 and 14 when dealing with this complaint.

Never estimate the petrol consumption from supposedly accurate quantities delivered from petrol pumps, as these are oftentimes subject to appreciable errors. A calibrated test tank should be obtained and a definite test should be made over a known mileage in average country with a measured quantity of petrol. The longer the test, the more accurate will the reading be, assuming a non-stop run. Before starting out on test, the speedometer trip should be set to zero and the owner of the car persuaded to accompany the driver so that he may actually be a witness of the results obtained. Many owners welcome this, as it makes them feel that efforts are being made to give them satisfaction.

When the results obtained while using a test tank are found to be different when petrol is being supplied by the fuel pump, it is an indication that the fuel pressure is too high or that the carburetter needle valve is vibrating on its seating through the vibration set up by the engine.

To reduce the fuel pressure, additional joint washers should be obtained and inserted between the flange of the fuel pump and the crankcase. This shortens the stroke of the fuel pump operating lever, consequently the pressure of the fuel delivered by the pump is appreciably less.

Should this adjustment fail to effect any improvement in the consumption of the petrol, it may be advisable to fit a size smaller needle valve, i.e., 1.5 m/m. as owing to the buoyancy of the float in the carburetter, the smaller needle valve is held more securely on its seating than the larger one, i.e., a greater pressure is required to open it. It is inadvisable to carry out any adjustment to correct excessive petrol consumption until the car has covered at least 1,000 miles, as consumption is usually above normal when the car is brand new owing to the high internal resistances set up in the various units.

Many engines will show better petrol consumption figures when a size smaller main jet is fitted in the carburetter, but the mistake is often made when this smaller jet is fitted too soon, that is, before the engine is "run in." The result of this is that the owner experiences a considerable loss in power and reverts to the original jet setting. Had the fitting of this jet been delayed until all the working parts of the machine were free, the result of loss in power would be less noticeable, while the petrol consumption would be considerably improved. In any case, should a size smaller main jet be fitted and the loss of power be experienced from the engine, before replacing the original main jet, try fitting a size smaller choke tube, as experience shows better petrol consumption figures are obtained under these conditions without any appreciable loss of power. Always make sure too, that the carburetter controls are working correctly and that the throttle does not stick in a partially open position.

It is a very common complaint to find also that the idling speed of the engine is far too high.

Ignition timing also should carefully be checked and this should be as far advanced as possible without knocking being experienced in the engine.

Before taking the car on the road, jack up the road wheels to make sure that the brakes are not binding. Moreover check for clutch slip, for under these conditions, petrol consumption is bound to be excessive.

OIL LEAKS FROM ENGINE.

When oil leaks are experienced from the engine, 1934/35 models, it may be either of a serious nature resulting in heavy loss of oil, or may be of the irritating kind which deposits oil on the garage floor or the carriage drive when the car is stationary. Many owners express displeasure about the latter, even though the oil loss may be of no great importance.

The usual places from which oil may leak out, if the engine is neglected, are as follows : valve cover plates, engine sump, oil pump and pipe connections, 9 h.p. ; rear main bearing, 9 h.p. ; rear camshaft bearing, 9 h.p. ; and aluminium gallery plates, 10 h.p., 12 h.p., 16 h.p. and 20 h.p. machines.

In our 1934 Service Manual, these items have been dealt with, see Pages 14, 15 and 16. However, since that was written, we recommend that the fixing bolts which retain the gallery plates in position, should be periodically examined for tightness, as it is found that they have a tendency to become loose with the result that oil leaks out between joint faces. Quite an appreciable amount of trouble has been experienced in this connection and a modified gasket or joint washer has been obtained. This is thinner than the original and is subjected to a lesser degree of compression, so that the tightness of the bolts now remain more constant than when the original type washer was fitted.

Oil leaks too, are sometimes experienced through the oil running along the outside of the fixing bolt and dropping on to the ground from underneath the head of the bolt. This should only occur where the copper washer is either defective or missing.

Also on certain 1935 machines, the bracket carrying the A.C. oil filter is retained in position by two front gallery plate fixing bolts and it is necessary that there should be two copper washers on each of the two bolts. One washer has to be on either side of the A.C. filter bracket.

Owing to difficulty being experienced in obtaining access to the fixing bolts with the ordinary open ended spanner, a special crank spanner with an hexagon head is being provided by the Service Department and these may be obtained on application to the Service Department, London, or the Spares Department, Coventry, at a cost of **3/6** nett each. When tightening these gallery plate fixing bolts, it is necessary to ensure that they are adequately tightened and carefully observe that the washer underneath the head of each bolt is fully compressed, as on occasion it has been discovered through the bolt being slightly too long, it has been bottoming in the bolt hole provided in the crankcase and whilst apparently tight, was doing little towards holding the gallery plate in position. In the event of this being experienced, the bolt should be extracted and shortened as necessary.

Should trouble still be experienced in obtaining an oil tight joint, the gallery plates should be removed and carefully examined, as no doubt they will be distorted. They must either be trued up or else replaced with cast iron ones, which can be obtained on application to our Service Department.

Concerning the question of oil leaks from the valve cover plates, this is sometimes contributed to by the owner of the car overtightening the two nuts which retain the plates in position. These plates are slightly "dished" and when the nuts are tight, the plates straighten out and act on the nuts in a manner similar to a spring washer. This prevents the nuts coming undone but if the nuts are overtightened, the plates become buckled with the result that oil leaks out. The remedy in this case is to remove the valve cover plates and straighten them or replace with new ones. With regard to oil leaks from the sump, this very rarely occurs unless the fixing bolts have been insecurely tightened or if the sump has been taken down and replaced without the metal straps which support the sump flange. However, it is well worth while to make sure that these bolts are tight. On Sports models where aluminium sumps are fitted, an occasional complaint is received of oil leakage through a crack appearing in the sump. This, of course, can only be corrected by replacing the aluminium sump with a new one.

Another point of oil leakage is the timing cover where it is possible for oil to leak out through the aperture in the cover, through which is inserted the boss on the fan pulley. If the cover is out of centre with the boss of the pulley, contact is made between the two parts and oil leaks out. The remedy here is to centralise the cover with the fan pulley boss.

Lastly, there is the question of oil leakage from the flexible pipe which connects the engine to the oil pressure gauge. This flexible pipe sometimes punctures or gets frayed through there being a rubbing contact with some metal part of the chassis. Should this happen, the only remedy possible is to fit a new oil pipe.

This pipe, by the way, has also been responsible for the creation of a humming noise experienced from the engine. Of recent date, however, a modified form of pipe has been introduced which corrects this complaint of noise and is also likely to be more reliable from the point of view of oil leaks.

OIL LEAKS FROM GEARBOX.

In the event of a complaint being made of oil leakage from the gearbox by the Owner of a 1935 Standard Model, reference should be made to the 1934 Service Manual, Pages 36—38 for its correction.

Attached to the front and rear covers of the gearbox casing, are oil retaining washers known as super oil seals. These are housed in a metal sheath and the sheath itself is a tight fit in the covers to prevent the washers from rotating with the shafts. These washers are made of leather, the centres of which are extended in the form of a lip around which is placed a circular coil spring or band. The purpose of the coil spring, is to keep the lip of the washer in close contact with the shafts in the gearbox and thus prevent oil from leaking out.

Occasionally, in assembling the gearbox, the washer may become rucked. This applies especially to the front one where a form of guide is required to prevent the sharp edges of the splined pinion shaft damaging the lip of the washer when the gearbox is being assembled. The guide which is used, is a steel bar which is formed in a taper, the outside diameter at the largest end being slightly greater than the diameter of the constant pinion shafts.

A hole is bored in the centre of the steel bar, equal to the diameter of the spigot end of the constant pinion shaft and this bar is placed on the end of the constant pinion shaft, and the front gearbox cover complete with oil retaining washer is inserted over the steel bar and pushed into position at the front end of the gearbox.

At the rear of the gearbox, no special precaution is necessary in connection with the fitting of replacement super oil seals with the exception of ensuring that the metal sheath containing the washer is not distorted unduly. To obtain the best results from this type of oil retaining washer, experience shows it is advisable before fitting a new washer that it be inserted in hot oil, as this makes the leather more pliable, with the result that the lip of the washer is retained more positively against the shaft by the action of the spring band. On the 1934 type gearboxes, it was discovered that owing to there being a right-hand oil scroll on the spindle of the speedometer driven gear, oil was being continually forced out of the gearbox, with the result that the gearbox was being emptied in approximately four hundred miles.

To correct this, the spindle of the speedometer driven gear had to be altered so that the oil scroll had a left-hand rotation instead of right hand. This arrangement operates as an oil retaining device and prevents the passage of oil out from the gearbox at this point.

Oil leaks from the lid of the gearbox were sometimes experienced especially on the early 1934 models. The point where the oil emerged was between the domed portion of the gearbox lid and the lower end of the change speed lever.

An elongated hole is formed in the change speed lever at a point just inside the gearbox lid and oil used to build up in this elongated

hole so that with the continual rocking of the change speed lever, the oil would work its way up and out of the gearbox.

A modification to the lever was carried out to prevent this. This modification consisted of two grooves extending downwards on the change speed lever from each end of the elongated hole or slot. This eliminated oil leakage from this point by preventing the oil building up in the elongated hole.

On the 1935 models, these modifications previously mentioned, have all been incorporated. The only oil leakage likely to be experienced would be due to a defective or damaged oil retaining washer. At the same time, it is necessary to ensure that the oil level in the gearbox is not too high and that the correct grade of oil is being used.

OIL LEAKS FROM REAR AXLE.

On the rear axle of the 1934/35 models there has been introduced a cast-iron pinion housing, instead of the aluminium casting, as had previously been used. The reason for this is that the iron casting produces a much stiffer casing than the aluminium and eliminates thereby the possibility of distortion of the pinion housing. With the aluminium type of housing, there is undoubtedly a reduction in weight in comparison with the iron type, but in rear axles of comparatively small dimensions the saving of weight is not an advantage, as an aluminium housing is liable to distortion. It is therefore advantageous to use an iron type of pinion housing but experience shows that the temperature of the oil and the air inside the axle is higher when the iron type casing is used.

This increase in temperature causes a greater expansion of the air in the axle casing and results in an internal pressure being set up and the oil is forced out of the front of the pinion housing. To obviate this, a breather which is in the form of a copper pipe was inserted on a plate, which is held on the top of the pinion housing by two studs. This allows the axle to "breathe" and keeps the air pressure inside the axle within reasonable bounds.

In the event, therefore, of oil leaking out from the front of the pinion housing on the 1934 models, the first step towards the correction of the trouble should be the insertion of a copper pipe in the plate previously mentioned on the pinion housing.

This copper pipe has now been incorporated on the 1935 rear axle units and is a small pipe about $\frac{1}{8}''$ diameter. The copper pipe is inserted vertically in the plate and is then bent over in the form of a single coil.

A point of importance here, is to ensure that the bend of the pipe is always towards the offside of the car, for if it is turned in the other direction, the rotation of the pinion shaft tends to eject oil out through the copper pipe.

In the event of this leakage at the front of the pinion housing still persisting after a copper pipe has been installed, it will be necessary to unscrew the bronze collar at the front of the pinion housing and insert therein a new felt washer.

There are also instances where oil leaks out from the centre of the axle casing along the shafts towards the brake drums and road wheels and the first thing to do when dealing with a complaint of this kind, is to check the oil level in the unit to ensure that it is not overfilled.

Assuming that the oil level is correct, the axle shaft and hub should be withdrawn from the axle casing on that side where the oil leak is present and the oil retaining washer replaced.

This washer is referred to as a super oil seal and is contained in a metal sheath, which in turn is a tight fit in a recess provided at the end of the axle casing.

The original washer has to be ejected complete with metal sheath and the new one inserted. Care should be taken to ensure that the metal sheath containing the new washer is not buckled and it will also be found advantageous to soak the oil retaining washer in hot oil before fitting it in the axle casing.

This washer is made of leather and has an extension or lip which is surrounded with a coil spring band. This coil spring keeps the

lip of the washer in contact with the revolving shaft.

When replacing the axle shaft in the axle casing, a check should be made for excessive end play on the shaft in question. This should be limited to .006″ and shims are provided for the purpose of carrying out the necessary adjustment, for if the axle shafts have excessive end float, this often results in oil being forced out from the axle casing.

Where difficulty is experienced in overcoming this complaint, it is necessary to check the axle shaft for truth for in the event of it being bent, the eccentric rotation of the shaft is likely to promote oil leakage from the axle.

In very difficult cases where all these aforementioned points have been checked and found correct, it has been necessary to remove the pinion housing and differential assembly complete from the axle and check the crown wheel and differential assembly for end play between the bearing supporting this part of the unit.

The crown wheel and differential should revolve freely without any appreciable side play. Where side play is present, this motion set up results in oil being forced out along the axle shaft. In conclusion, it is important to observe that when a new super oil seal washer is being fitted, that the lip of the washer is facing towards the centre of the axle.

EXCESSIVE OIL CONSUMPTION.

Improvement in engine design which has taken place in recent years, has resulted in increased engine speed so that an oil supply at high pressure has been necessary for the lubrication of the main and big end bearings.

It is therefore more important nowadays to ensure that the big end and main bearings are a proper fit, otherwise you have large quantities of oil exuding out from the bearings and being thrown up by the revolving crankshaft on to the cylinder walls. This excess of oil being delivered to the cylinders often results in excessive oil consumption, through oil being forced up past the piston rings into the combustion chamber.

It is therefore necessary when dealing with a complaint of this kind to remove any slackness which may exist in the fit of the main and big end bearings.

Another point which is important is with regard to the "running in" of the engine when new, as any tendency to overdrive the car may result in seizure of the aluminium pistons in the cylinders.

Should this occur, the pistons become scored and the scraper rings in particular become solid in the ring groove.

If the scraper ring is inefficient or has seized in the ring groove, the result will be that the oil consumption in that engine will be excessive.

Some of the engines on the early 1935 models had a tendency to excessive oil consumption and it was considered advisable to improve the efficiency of the scraper ring.

A new type of scraper ring was evolved which exerted a high radial pressure on the cylinder walls. The fitting of this ring proved so successful that it is now incorporated in all machines now leaving the Factory. Should, therefore, excessive oil consumption in the engine be experienced on the early 1935 model, the pistons should be extracted and the new type of scraper ring fitted.

If, upon dismantling, the pistons are found to be scored, it will obviously be necessary to replace the pistons as well, as it would be idle to expect satisfactory results with the pistons in that condition.

Excessive wear in the cylinders is also a cause of excessive oil consumption and it is usually advisable when this complaint arises, to measure up the cylinders with an internal micrometer. Should the wear in the cylinders be .006″ or more, the cylinders should be rebored and oversize pistons fitted.

An exception to this however, applies to old engines where the cylinder wear may be very great and the owner of the car is unwilling to expend the necessary sum in reboring, by fitting a set of Wellworthy Simplex Rings.

One ring is fitted to each piston, being placed in the centre ring groove.

The ring groove has to be machined to take this piston ring and if satisfactory results are to be obtained, it is necessary that the ring be a tight fit in the groove of the piston and inserted in the manner described by the manufacturer. (Fitting instructions are issued with each set of Simplex Piston Rings.)

With regard to 1934/1935 machines, it occasionally happens that owing to a leakage of oil from the gallery plates on the nearside of the crankcase, the owner complains of excessive oil consumption and in the event of a complaint of this kind arising, the obvious thing to do is to check up for external oil leakage before any dismantling is done to the engine concerned.

Attention should be given to the aluminium gallery plates to ensure that there is no oil leakage at that point.

The valve cover plates enclosing the valve tappet gear should also be scrutinized to ensure there is no leakage there.

The plates in question are slightly "dished" and straighten out under the tightening of the nuts which retain them in position, thereby making an oil tight joint in conjunction with the type of joint washer in use.

Overtightening of the retaining nuts, however, results in the plates becoming buckled so that oil leaks out in consequence.

Referring to the oil leaking from the gallery plates, this is sometimes caused by the plate distorting and no matter how good a joint washer may be, oil leakage is bound to occur. The plates must be removed and refaced or replaced with cast iron ones. Attention should also be given to the bolts which hold the gallery plates in position, to ensure that oil is not leaking along the bolt or that the bolt is not bottoming in the holes provided so that the plates are not being securely held in position.

Furthermore, attention must be given to the washer underneath the head of the bolt and so far as those models are concerned where the A.C. oil filter bracket is retained in position by the two front bolts, a copper washer should be placed on either side of this bracket on each bolt.

Another point which should be observed is that the oil pressure is not exceedingly high. On all models with the exception of the "Nine," oil returns through the by-pass to the sump under pressure. The return hole is placed on the nearside of the crankcase, just below the camshaft level. This hole is baffled or masked to ensure that the oil will not be directed on to the crankshaft, but it sometimes happens when the oil is returning under pressure, the splash area created is fairly extensive and a certain portion of this oil gets on to the crankshaft where it is whipped up into the cylinders and thus causes excessive oil consumption.

Experience shows that sometimes by reducing the oil pressure, beneficial results are obtained.

The A.C. oil filter has on a few occasions, leaked at the seam and as this is usually caused by the holding bracket being bolted up too tightly, care should be exercised in erecting the filter in position. Lastly an examination of the sump bolts should be made to ensure that they are tight and that the joint washer is perfectly sound.

ENGINE MISFIRING.

The causes of engine misfire are so numerous that a process of elimination should be adopted for the correction of this complaint.

Fundamentally, it can be stated that the trouble is either in the engine unit, the carburation system or the electrical system.

With regard to the engine unit, the misfire would be caused by loss of compression in one of the cylinders, through the valve sticking or prevented from closing by incorrect tappet adjustment, or through the valve and valve seat being burned or pitted.

To ascertain whether the trouble is confined to the engine, the crankshaft should be turned with the aid of the starting handle and the compression of each cylinder checked.

If the compression is found to be good on each of the cylinders, then obviously the trouble is not in the engine, but is confined to either the carburation or the electrical system.

If the misfire occurs at wide open throttle when the car is ascending an incline at speed, it may be due to a restriction in the petrol supply or alternatively by the sparking plugs being incandescent.

As it is much quicker to check the sparking plugs, these should be examined and if the centre electrode of one of the plugs is much lighter in colour in comparison with the others it does as a rule indicate that the plug in question has been incandescent and is responsible for the misfire.

It will, therefore, be necessary to replace this plug with another. If, on examination, the plugs are found to be in good order, attention must be given to the petrol supply system, as there is undoubtedly a restriction in the petrol supply.

This is likely to be found either in the pipe line leading from the petrol pump to the tank, or in the petrol tank itself.

To clear out the petrol line, disconnect the pipe from the petrol pump and also from the petrol tank and force air under pressure through the pipe line.

Should this adjustment fail to produce satisfactory results, it will be advisable to remove the petrol tank from the chassis and thoroughly clean out.

On occasion it has been discovered that small particles of solder have come loose from the lining of the petrol tank and have lodged in the pipe line creating a restriction in the petrol system.

If trouble is still being experienced through insufficient petrol being supplied to the carburetter, it may be necessary to make an examination of the petrol pump and replace it with a service unit if it is found to be defective.

After checking the engine and the carburation system, attention should be given to the electrical equipment and an endeavour should be made to locate the cylinder in which the misfire is occurring.

A quick way of doing this is to earth the electric current from all but one of the sparking plugs, so that the explosion takes place on one cylinder only. It will be necessary to increase the engine speed so that the engine will operate on one cylinder without stopping.

The sparking plug on each of the cylinders can be tested in this way when a misfire can be located through the engine stopping.

Another way of testing for misfire is by means of the Neon pencil which, if connected to the sparking plug, shows a flash of light every time a spark occurs at the sparking plug electrodes.

Having located the misfire to a particular cylinder in the engine, the trouble can be said to be due to either the engine or the ignition.

Turn the engine by means of the starting handle and check for compression in that cylinder.

If this is found to be correct, the cause of the misfire will be found between the sparking plug and the distributor cover.

Check the sparking plug, the high tension lead and connections and the distributor cover.

Examine the cover for traces of a crack extending from one electrode to another, or tracking from one electrode to another, or if moisture is present inside the cover, this will cause a spark to occur in the wrong cylinder.

Remove any traces of carbon dust by wiping the interior of the distributor cover with a cloth moistened in petrol. Any signs of tracking or burning will indicate that a new cover is required for the distributor.

Check the contact breaker points to make sure that they are not burnt or dirty. If they are badly burned, new contact breaker points should be fitted, or alternatively, if they are merely dirty, they should be cleaned with a piece of fine emery paper or a special file.

The extent of the gap of the contact breaker points should be checked to ensure that this gap is not too wide. The width of the gap should be from .015″ to .018″ and should be equal to the thickness of the gauge usually supplied by the manufacturers. Should the misfire only occur at high engine speeds, there is a possibility of the coil breaking down through the high tension current on the secondary winding jumping across to earth on

the primary winding. This can only be corrected by fitting a new coil.

Sometimes, misfire is caused by a fracture in the wire on the high tension lead, even although the rubber covering of the lead shows no signs of cracking. This applies to the high tension lead connecting the coil and distributor.

When dealing with a complaint of this kind, all the high tension leads should be examined and replaced as necessary. Particular care should be given also to all connections for tightness, as a loose connection will undoubtedly cause a misfire.

Another cause of misfire and one which is sometimes difficult to trace, is a defect in the cylinder head gasket, so that connection is made between two cylinders. When this occurs, the mixture, instead of being compressed in the combustion chamber, is forced into the next cylinder, and when the spark occurs there is very little mixture left in the cylinder to burn.

This is sometimes located when the engine is turned with the aid of the starting handle, as a loss of compression is noticed on two cylinders.

The remedy is to remove the cylinder head and replace the defective gasket with another.

In the event of the jet setting being altered so that jets are fitted which are smaller than required for that particular engine, an excessively weak mixture is produced thereby and causes a backfire in the silencer on sharply accelerating the engine.

Care should be taken therefore to ensure that the jet setting recommended by the manufacturer is maintained in the carburetter.

Another cause of backfire in the carburetter on sharply accelerating the engine is late ignition timing and as there is a possibility of fire occurring at the carburetter under these conditions, it is imperative that it should be corrected as soon as possible and the ignition advanced to the right position. For further information on engine misfiring, see 1934 Service Manual, Pages 18, 20 and 25.

DIFFICULT STARTING.

Difficult starting is a trouble which is, as a rule, only experienced during the cold winter mornings and it is more prevalent when the car is new owing to the general tightness of the engine and the high demands which are therefore made upon the battery for turning the engine.

This trouble would not occur if the car was run for a sufficient time each day to enable the dynamo to make good the loss from the battery caused by starting. What happens is that every day, a little more is being taken from the battery so that sooner or later it arrives at a condition when there is insufficient voltage to turn the engine. Trouble in starting is experienced therefore, until the battery is once more re-charged.

Another factor responsible for difficult starting in the winter, is the use of an oil which is too thick and offers a higher resistance to the rotation of the crankshaft when the oil is cold. It is therefore important to ensure that the correct grade of oil is being used in the engine and one which is recommended by the manufacturers.

The best oils, from a point of view of starting in cold weather, are **Mobiloil A., Castrol C. W.,** or **Single Shell.** The operation of starting on 1934/35 models, has been simplified by the use of self-starting type carburetters. All that the owner of one of these machines has to do to start the engine is to switch on the ignition, pull out the carburetter control on the instrument panel and press the starter switch when the engine should start.

It is necessary, however, that the engine should be in good tune and that the controls of the carburetter are properly set.

The mixture necessary for starting the engine is supplied by an additional mixing chamber added to the carburetter.

The suction of the engine is concentrated in this chamber when the starter control on the instrument panel is operated and the butterfly valve is in a closed position. It is therefore inadvisable when starting an engine from cold, to open the throttle, as satisfactory results will

only be obtained if the throttle is kept in a closed position.

Attention should also be given to the sparking plugs, for as the gap between the electrodes becomes wider, greater difficulty is likely to be experienced in starting the engine.

On all models, with the exception of the "Nine," the output of the dynamo is controlled by the voltage in the battery and as the battery voltage falls, so does the dynamo output increase.

In theory, this is ideal, but it is found that many owners neglect the battery with the result that the plates become sulphated thereby setting up a high resistance in the circuit resulting in a low charge rate from the dynamo and the battery fails to hold its charge, resulting in difficult starting being experienced.

Under those circumstances, satisfactory results will only be obtained by the battery being reconditioned.

In old machines where the engines are out of tune through general wear and tear, sticking or burnt valves, dirty or defective plugs, broken high tension leads or defects in the electrical installation, difficult starting is likely to be experienced during cold weather and the only recommendation here is that the engine should be overhauled and re-conditioned if satisfactory results are to be obtained.

Occasionally, one may find that the fault is in the starter motor, the commutator of which may have become dirty, or bad contacts through the high tension lead being loose, or through one or more brushes sticking in their holders.

Under these circumstances, the starter motor should be removed and the necessary adjustment carried out.

In conclusion, if the engine is kept in reasonably good condition, and the battery is fully charged, together with the correct grade of oil being used in the engine, no difficulty should be experienced in starting provided the carburetter controls are set correctly.

ENGINE NOISES.

A noise which is very often experienced in the modern type of engine is a piston knock inside the cylinder and this is generally referred to as piston slap. Briefly it means that the clearance between the piston and the cylinder walls is excessive although the amount of excess may be only a few thousandths of an inch.

Piston slap itself is not a serious complaint, but is sometimes irritating to the owner of the car owing to the noise which it creates. As a rule, it is caused by general wear and tear and is corrected by fitting a new set of pistons. The fitting of new pistons alone in an old engine is not always sufficient for the correction of this complaint, for if the wear in the cylinders is .005″ or more, the cylinders should be rebored and oversize pistons fitted. These can be obtained from our Spares Department in oversizes of .005″, .010″. .015″ and .030″.

In comparatively new cars, piston slap is sometimes experienced through the machine being over-driven during the early stages of its life, with a result that the pistons seize and become scored.

The remedy is to remove the scored pistons and replace them with new ones.

As the wear in the cylinders is not likely to be of any magnitude, the fitting of new pistons of standard size should be sufficient for the correction of the complaint.

To avoid this happening, great care should be taken to ensure that the engine is properly "run in" before high speeds are attempted on the road.

Another noise experienced in the engine is known as gudgeon pin tap and gives off a sound which is similar to that which is produced by piston slap.

This tapping sound is produced through the gudgeon pin being a loose fit in the small end of the connecting rod or in the holes provided in the piston.

As a rule the fitting of new gudgeon pins is sufficient to remove the noise.

In older type models, a small end bush was provided which was replaceable in the event of wear taking place. This, however, does not apply on the 1935 connecting rods, for if the gudgeon pin is slack in the small end of the duralumin connecting rod, it can only be corrected by fitting either a new connecting rod or an oversize gudgeon pin. These oversize pins are being supplied by our Spares Department for this purpose.

With regard to the fit of the gudgeon pin in the connecting rod, it is essential that the pin should be a tight fit when the connecting rod is cold and a sliding fit when the connecting rod is heated to a temperature equal to that which operates normally in the engine.

A good plan when fitting gudgeon pins is to insert the connecting rod in boiling water or hot oil then reamer the connecting rod so that the gudgeon pin is a sliding fit in the hot connecting rod.

Another point in the engine where noise is occasionally experienced, is from the tappet mechanism which operates the valves.

The tappets are made of cast iron, the bases of which are chilled to make them hard for the purpose of reducing wear to a minimum. They are housed in a guide block in sets of four so that in a four-cylinder engine there are two guide blocks and in a six-cylinder engine, three guide blocks.

The fit of each tappet in the guide is a sliding one and it is essential that there should be no rock or side movement of the tappet in the guide block, or noise is likely to be experienced.

Inserted in the top of each tappet is an adjusting screw with a lock nut to prevent the screw from moving.

The clearance between the tappet and valve, which should be .004″ when the engine is cold, is obtained by means of the adjusting screw and these screws are made of nickel-chrome steel and are case-hardened so that the surface of the screw is very hard.

Owing to the hammer action of the valve stem on the tappet adjusting screw, this hardening of the screw is necessary to ensure that the clearance between the valve and the tappet will remain correct for a lengthy period of time.

Sooner or later, however, the action of the valve creates a pit on the head of the adjusting screw so that the clearance between the valve and the tappet is considerably increased, thus resulting in noise from the tappets. To correct this, the tappets will have to be removed from the engine and new adjusting screws fitted. Also in addition, the clearance between each valve and tappet has to be re-set so that it is .004″.

Before replacing the tappets and tappet guides in the engine, a check should be made with regard to the fit of the tappets in the guides, for if one or more of the tappets are loose in the guides, new tappets should be obtained. If the new tappet itself is loose in the guide, this will indicate that a new guide block is required, as wear has occurred on the original.

If work is carried out along those lines, there is no reason why noise from the tappets should not be eliminated.

A method which is used successfully for the location of a noisy tappet is to run the engine at idling speed with the valve covers removed, place a finger on the base of each tappet in turn exerting a sidewards pressure. When pressure of this nature is imposed on the tappet which is noisy, the noise either becomes accentuated or disappears. When the tappet which has created the noise has been located, the guide block carrying that tappet can be removed from the engine and the necessary replacement effected. On the 9 h.p. machines occasionally noise is experienced from the chain tensioner which is affixed to the timing cover and controls the slackness in the timing chain. The machine, however, has usually covered a very large mileage before a knock is experienced.

When the timing cover is removed for examination, it is found that one or perhaps both of the coil springs attached to the main flat spring of the tensioner, has come adrift or has broken and necessitates the fitting of two new coil springs. In addition, however, the

timing chain should be renewed, as the original trouble with the tensioner is brought about by an excessively slack timing chain. If the coil springs only are replaced, further trouble is likely to be experienced with the chain tensioner.

Experience shows that it is always advisable to replace the timing chain if trouble is encountered with the chain tensioner.

On the 1934 9 h.p. machines, there were several cases of the front bearing in the fan assembly collapsing. Sometimes this was due to owners neglecting to lubricate the fan assembly, but there were cases where the failure was brought about through the dynamo pulley being out of alignment with the fan pulley. As the original ball races were designed to deal with radial loads only, the misalignment of the two pulleys created a thrust on the fan bearing which sometimes broke down. In view of the possibility of this, a modification was carried out to the ball race which is now designed to take thrust loads as well as radial loads and at the moment, this trouble has been practically eliminated. It is, nevertheless, important that in the event of bearing failure in the fan, to correctly re-line the dynamo and the fan pulley after replacing the necessary bearing.

To facilitate the alignment of the dynamo pulley with the fan pulley, the two bolt holes in the bracket which carries the dynamo should be enlarged in diameter so that a slight movement of this bracket on the fixing studs can be obtained.

Another important point is the length of the tubular distance piece between the two races in the fan assembly, for should this distance piece be too long, the tightness of the nut on the fan spindle which holds the races in position, would exert a thrust on the centre of the front bearing which would bring about its failure.

To check this, mount the two races on the spindle without the hub of the fan and then measure the distance between the two races. This distance should equal the length of the tubular distance piece and if the distance piece is longer, it should be machined accordingly.

Sometimes a drumming noise is heard from the engine, noticeable particularly at low engine speeds, and this may be caused by the boss of the fan pulley fouling the timing cover.

The noise may be removed by slackening off the timing cover fixing bolts and centralising the cover with the boss of the fan pulley.

When this noise is experienced, it is often accompanied by oil leaks from the front of the engine through the aperture in the timing cover.

The oil pipe from engine to gauge would also be responsible for a drumming noise being experienced through the pipe vibrations synchronising with the impulses of the plunger in the relief valve. This hum is sometimes removed by putting a set in the "solid end" of the pipe close to the gauge.

Another recommendation is to remove the felt from the pipe at the clip which retains it in position on the underneath side of the instrument panel and replace this felt with rubber.

Furthermore, reducing the oil pressure or even increasing the oil pressure thereby altering the impulses of the relief valve plunger sometimes eliminates the noise. On certain machines, however, the noise does not yield to any of these adjustments and eventually a new flexible pipe has to be fitted. Recently a modified form of flexible pipe has been produced and is giving very satisfactory results. These are obtainable on application to our Service Department and the fitting of this improved flexible pipe should be adopted in the event of being unable to eliminate the noise by adjustment.

BIG END BEARING FAILURE.

The failure of one or more big end bearings in any Standard engine of recent design, is due to one thing only and that is, lack of lubrication. It is quite possible that there may be sufficient oil in the engine and that the pump itself is working satisfactorily, but there is no doubt that when a bearing fails, there is insufficient oil at that particular bearing and the absence of oil may be brought

about by a restriction in the oiling system. Should a bearing fail, it is not sufficient to simply replace the bearing and remove all traces of white metal from the interior of the engine, the oil pump should be checked and the oiling system as a whole carefully examined, as it is important that the cause of the failure be ascertained and the necessary steps taken to prevent a recurrence. On the 9 h.p. machines, the oil pump is mounted on the nearside of the crankcase high above the oil level and in conjunction with the pump, a suction pipe is used in which is placed a ball valve to prevent the pump loosing its priming when the engine is stationary.

If the ball valve is defective or dirty on the seating, or excessive play in the pump spindle, there is a possibility of the oil draining out of the pump back into the sump, so that when the engine is once more re-started, there is no oil pressure and unless this is noticed immediately, one or more big end bearings and perhaps main bearings, will fail.

To prevent the possibility of loss of priming, all models with the exception of the "Nine," have the oil pump mounted on the underneath side of the crankcase and submerged in the oil which is in the engine sump so that no priming is ever required and the possibility of loss of priming being entirely out of the question.

Surrounding this oil pump there is a filter of very ample proportion which has to be cleaned out every 10,000 miles to ensure that there will be no restriction of the oil flowing to the pump through the filter being excessively dirty.

On the 9 h.p. machine, the filter surrounds a suction pipe and each time the oil is drained from the sump, the filter can be cleaned before replacing.

When replacing the filter which is attached to the sump plug, care should be taken to see that the joint washer on the plug is present, as by replacing it without the washer, the bottom of the plug approaches closer to the bottom of the suction pipe with a possibility of a restriction being set up to the oil flowing to the pipe.

If the sump should be dented inwards so that the sump plug approaches closer to the suction pipe, this will also restrict the passage of oil and result in a considerable reduction in pressure.

Incorporated in the oiling system on the 9 h.p. machines is a relief valve which consists of a spring loaded ball and the tension of the spring is regulated by means of an adjusting screw. This relief valve is situated on the body of the oil pump.

If low oil pressure is experienced, attention should be given to this ball valve to ensure that there is no dirt on the seating or that there is no flat on the ball, as through low oil pressure, there is a possibility of bearing failure.

On those models where the pump is submerged in the sump, there is a vertical shaft driven from the camshaft of the engine which drives the pump and the distributor.

The action of driving this shaft tends to force it upwards so that if there should be excessive end play present on the distributor rotor shaft, or if the distributor body is allowed to move slightly out from the bracket which retains it on the cylinder head, the vertical shaft is likely to emerge from the pump and lose contact, with the result that the pump would cease to operate and oil would no longer be in circulation.

It is important therefore that these various points should receive examination whenever failure of the big end bearings occurs.

Sometimes, the failure of a bearing is brought about through there being insufficient oil in the sump and this may be caused by excessive oil consumption or an external leakage of oil. In this connection, attention should be given to the aluminium gallery plates on the nearside of the crankcase of all models with the exception of the "Nine" and to the valve cover plates where leakage of oil may occur through lack of attention.

On certain 9 h.p. engines, the failure of No. 3 big end bearing has occurred when driven at high speeds after a comparatively

large mileage has been covered. We are of the opinion that the cause of this failure is due to a leakage of oil from both the front main and front camshaft bearing.

This excessive loss of oil from these bearings, possibly due to wear, results in No. 3 big end bearing having insufficient lubrication.

What is now being done to overcome this condition is to continue the oil passages right through the crankshaft so that No. 3 bearing will also receive lubrication from No. 2 in addition to that which is being supplied from No. 4.

Any machine which suffers from a repetition of this bearing failure, should have the crankshaft drilled to conform to the latest specification and re-balanced.

MAIN BEARING FAILURE.

Main bearing failure like big end bearing failure is caused by lack of lubrication of the bearing. It may be caused by a restriction in the oil passage of the bearing in question or complete failure of the oiling system. It is therefore important that the cause of the failure should be ascertained and the necessary steps taken for its correction.

When a main bearing fails on either a "Sixteen" or "Twenty" model, it means the engine has to be entirely removed from the chassis, for the necessary work to be carried out. One reason for this is the almost impossibility of fitting a main bearing from underneath the engine.

Another reason is that when a main bearing fails on either of these two models, the crankshaft whips so that even although it were possible to fit a new main bearing in position, the vibration from the whipped crankshaft would be so intense that in the end it would have to be dismantled.

We therefore recommend that as soon as it has been ascertained what main bearing has failed, that the engine be removed entirely from the chassis, turned upside down, the crankshaft removed and the necessary bearing fitted.

It is also essential that the crankshaft be placed between lathe centres and re-straightened. This can be carried out quite easily by the aid of a pinch bar and a block of wood as a fulcrum.

In cases of bearing failure, it cannot be too highly stressed the importance of thoroughly overhauling the oiling system so that possibility of a recurrence is eliminated.

ENGINE OVERHEATING.

Loss of water from radiator. Since the advent of the water pump, now incorporated on all models with the exception of the "Nine," very few complaints of overheating has been experienced, but when it arises, it is more often than not due to loss of water from the engine.

This loss of water may be the result of a leak from the radiator or connections, or from a loose cylinder head.

If the radiator should develop a leak during the period of time covered by the guarantee, we would recommend that a replacement radiator be obtained from our Service Department rather than the original radiator be repaired. Our reason for this is that very often repairs which are carried out to radiators prove unsatisfactory so that a replacement radiator has eventually to be obtained. When the defective radiator is returned to our suppliers for replacement under guarantee, our claim is often rejected on the grounds that the radiator has been damaged by an inefficient repair.

Water leak from pump assembly. Occasionally, loss of water from the engine is experienced through leakage from the pump assembly and the cause of this is either that the face of the carbon thrust block is scored, or that the pin which holds the driving collar on the spindle in the pump has sheared. This should easily be detected for if the bonnet is raised there will be obvious signs of a leakage from the pump. The pump of course, will have to be dismantled and if the face of the carbon thrust block is scored, a new one should be installed, whilst if the leakage is caused by the

failure of the driving collar pin, a new pin will have to be fitted.

Care should be taken when fitting a new carbon thrust block to see that it is a tight fit in its housing and that it is right "home" in the recess provided so that the face of the block is square with the angled face of the driving collar.

If any signs of wear are noticeable on the pump spindle, it will be advisable to replace it with another and an examination of the bearings which carry the spindle should be made to see that the spindle is a good fit in the bearings. A point of great importance in connection with dismantling and re-assembling of pump assemblies is to ensure that they are re-assembled in their original position, otherwise the assembly will be out of balance, creating heavy vibration in the engine at speed.

Each fan assembly has to be balanced and to facilitate this operation, a circular piece of metal with an elongated slot acts in a manner similar to a balance weight and is bolted to the fan blades.

This balance weight is placed in such a position that it assures the assembly is in a state of balance and when the correct position has been determined, a small hole is drilled through the balance weight, the fan blades and into the body of the pump so that it will ensure that the unit is still in a condition of balance on re-assembling these parts, if the three holes are in correct alignment with each other.

Ignition Timing. Late ignition timing is also a case of the engine overheating and it is generally known that if the engine is allowed to operate at idling speed with the ignition retarded, the temperature will gradually rise until the water in the radiator boils.

The reason for this is owing to the mixture being ignited late, less of the fuel energy is converted into work and thus more energy in the form of heat passes into the cooling water, consequently the temperature of the engine rises.

The ignition timing should therefore be checked and if it is found to be late, it should be advanced to conform to the recommendations of the manufacturer. A rough guide is to advance the ignition as far as it will possibly go without creating "pinking" or roughness in the engine.

Ignition Timing 1934 Models	Ignition Timing 1935 Models
9 h.p., 10 h.p. and 12 h.p. 17° before T.D.C. or 7/64 Piston Travel.	All Models Set to fine at Top Dead Centre.
16 h.p. and 20 h.p. 14° before T.D.C. or 5/64 Piston Travel.	

Defective Thermostat. On the 1934 models, a thermostatically controlled valve was placed in the water circulating system. This valve was of the butterfly type and opened and closed under the influence of a by-metal strip according to whether the engine was hot or cold. Some owners in the winter months emptied the water from their radiators overnight and it was discovered that the radiator could apparently be filled up with a lesser quantity of water. When the engine was started up, it was noticed that the temperature very quickly rose until the water in the radiator was boiling, when the engine had to be stopped and allowed to cool down. An investigation revealed that when the water was drained away from the radiator over-night it was replaced by air and on refilling in the morning, the inflowing water endeavoured naturally to eject the air in the water jackets of the cylinders. This air was forced upwards, but was trapped by the butterfly valve and created a pressure on the valve.

When the engine was started up, the water and air in the cooling system expanded under the influence of heat and the pressure became greater thus overcoming the action of the by-metal strip which was endeavouring to open the valve.

As the water was not circulating, it will be fairly obvious why overheating was taking place.

The recommendation here is that in machines where that type of thermostatically controlled valve is incorporated, it is advisable to open the valve by hand to allow the air to escape when filling a radiator which has been completely emptied.

Loss of water from loose cylinder head. When a complaint is received from an owner of a Standard car that the radiator has emptied whilst covering a short distance of ten miles causing the engine to overheat, and upon examination, no external leakage can be discovered, it is an indication that either the cylinder head is loose, or the cylinder head gasket defective.

When the head is loose or the gasket defective, gas under pressure is forced into the water jacket from each explosion that occurs in the combustion chamber. This pressure in the cooling system forces water to the top of the radiator where it flows out through the overflow pipe and so on to the ground.

This action continues all the time the engine is running so that in a very short space of time there is practically no water left in the radiator, consequently overheating is experienced.

To correct the complaint, the cylinder head holding down nuts should be first of all tightened and the radiator filled with water.

If cold water only is available, the engine must be allowed to cool down before it is introduced into the radiator.

Having tightened the cylinder head nuts and the radiator filled with water, the engine should be run at idling speed with the radiator cap removed. On sharply accelerating the engine, water will be ejected from the top of the radiator if the gasket is in a defective condition. Should this occur, the cylinder head and gasket must be removed and the gasket replaced with a new one.

If no trace of the defect can be found with regard to the gasket, an examination of the cylinder head should be made for distortion, as there is a possibility of this having occurred, especially if the cylinder head is an aluminium one.

On 1934 Sports models, an aluminium cylinder head was fitted to all engines, and on certain machines the holding down nuts were chromium plated and had a domed head. Under each nut was placed one plain steel washer, but it was found necessary to fit two washers, as there was a possibility of the studs bottoming in the nut before the nut was really tight so that the cylinder head was insufficiently tightened. This is a point to which attention must be given when dealing with complaints that may arise through the cylinder head being loose.

DISTORTED CYLINDER HEAD.

In recent years, the fitting of aluminium cylinder heads has become increasingly popular. Owing to the aluminium head having higher thermal efficiency than the cast iron one, the designer of the engine is able to increase the compression ratio thereby improving the performance of the engine as a whole, without that roughness which might occur with the iron type of cylinder head.

Unfortunately, the aluminium head distorts more easily and greater care is required in tightening up the cylinder head nuts to ensure that they are evenly tightened, so that the possibility of distortion is reduced to a minimum.

Each year however, a certain number of aluminium cylinder heads are distorted and then returned to the manufacturer with a claim for free replacement under guarantee.

The fault however, is due to the mechanic in the workshop who has removed the head from the engine whilst in a very hot condition.

The head, whilst hot, is then placed on the bench which has usually an uneven surface and as it cools down, distortion occurs.

Had the engine been allowed to cool down with the cylinder head bolted in position, the possibility of the head distorting would have been very remote.

Another trouble which is occasionally experienced with the aluminium cylinder head is the bronze inserts which carry the sparking

plugs, coming loose, or unscrewing from the head on extracting the sparking plugs. Here again the trouble is caused by an effort being made to remove the plugs whilst the engine is hot.

The bronze inserts which are screwed into the head, are retained by a dowel pin and under the influence of heat, the aluminium expands and the bronze inserts are no longer a tight fit in the head so that when the sparking plugs are unscrewed, the resistance of the dowel pin is overcome and the inserts emerge from the cylinder head with the sparking plugs.

To prevent this, the sparking plugs should not be extracted from an aluminium cylinder head until the engine has cooled down.

CYLINDER HEAD CRACKED.

If a crack appears in a cast iron cylinder head, it may be due to either a flaw in the casting or a defective cylinder head gasket.

In either case, the trouble can only be corrected by fitting a new cylinder head.

With regard to a flaw in the material. This very seldom happens, and it has been found that in almost every case, where a crack develops in the cylinder head, it is caused by the gasket being defective.

Many owners and mechanics also, contribute towards this trouble by continuing to use the same gasket every time the cylinder head is removed. The continued use of an old gasket results in it becoming dead hard, so that there is no resiliency left in it, and the heat of the engine causes the asbestos packing to powder and comes away from the gasket where the bolt holes are situated.

When the head has been replaced and the bolts tightened up, the fact that there is no asbestos packing around one or more of the bolts causes that part of the cylinder head to be forced down towards the cylinder block and consequently cracks the cylinder head.

Sometimes, under these conditions, the head does not crack, but the metal of the cylinder block around where the bolt is screwed down into it, gets pulled upwards towards the cylinder head, often causing cracks to appear on the adjacent valve seats with detrimental results to the engine as a whole.

To prevent the possibility of this, a new gasket should be used each time the cylinder head is removed for decarbonization.

BURNT VALVES.

The cause of an exhaust valve burning in the modern car engine, can be said to be due to either weak mixture or the valves sticking through the presence of carbon, or the valve prevented from closing by incorrect tappet adjustment.

There is a certain type of owner who endeavours to obtain as many miles as possible to the gallon of petrol and who cuts down the carburetter jet setting as much as possible. This results in a very weak mixture with combustion at very high temperature.

In time, wear takes place on the valve stems and valve guides so that the mixture becomes weaker still through the introduction of additional quantities of air into the cylinders through the valve guides.

The temperature of the combustion rises to a higher degree with the result that in time one or more of the exhaust valves burn.

As this trouble often occurs after the engine has been decarbonized, it will obviously be necessary to renew the valve guides and the valves if the same carburetter jet setting is being maintained.

To guard against the possibility of valves burning, it is essential that the jet setting recommended by the manufacturer should be maintained in the carburetter.

Should the valve burn through the tappets being incorrectly adjusted, thus preventing the valve from closing properly, the adjustment of the tappets will have to be attended to, and after fitting the new valves the clearances between the tappets and valves should be adjusted to .004".

In very old engines where a repetition of valve burning is experienced, an examination should be made of the water jacket adjacent to the valve seat which is burnt, to ensure that there is no scale formation or restriction in the water passages.

In addition, careful examination should be made of the valve guides, valve stems and induction manifold to ensure that there is no leakage where air can be induced into the engine on the suction stroke.

LOW OIL PRESSURE.

The pressure registered by the oil gauge is not an indication of the efficiency of the oil pump, but is a measure of the resistance in the circuit.

When the engine is in a new condition, the pressure recorded is usually comparatively high owing to the fact that all the bearings in the engine are tightly fitting.

During the normal operation of the engine, wear occurs and oil is thus allowed to escape from the bearings, which results in a reduction in the pressure recorded on the gauge.

Before this happens, the machine of course will have to cover a very large mileage. It is however, very unlikely that any improvement with regard to the oil pressure will be obtained by fitting a new oil pump if the main and big end bearings are in a very slack condition.

On the engines fitted to the 16 h.p. and 20 h.p. machines which have seven main bearings and six big end bearings, the oil pressure recorded when the oil is warm will be very little indeed if the main and big end bearings are not a good fit.

In the oiling system at present used on all Standard cars, there is what is known as a relief valve incorporated. This valve consists either of a spring loaded ball or plunger, the tension of the spring being varied by an adjusting screw. It is placed in the pressure side of the system and the spring tension is adjusted so that the ball or plunger is lifted off its seat when the pressure in the system reaches a certain standard. At this point, oil is allowed to escape through the by-pass back into the sump and prevents the pressure from unduly building up.

Should the relief valve be defective through having dirt on the seating or a flat on the plunger or ball so that oil is allowed prematurely to escape through the by-pass, the pressure recorded will be low and should it be lower than that required for normal running condition, examination should be made of the relief valve to ensure that it is in good order and that the spring tension is adequate to produce the pressure required.

Another condition which produces low oil pressure is a low oil level in the sump and this may be brought about by a leakage of oil from the engine or through excessive oil consumption.

The oil level should therefore be examined when a complaint of this kind is experienced.

Furthermore, the engine must be examined for leakage having special regard to the aluminium gallery plates on the nearside of the engine and the valve cover plates also.

On the 9 h.p. machine, there is attached to the sump plug a filter which surrounds the suction pipe which descends into the sump. The clearance between the sump plug and the lower end of the suction pipe has been reduced to a minimum to combat the effects of the oil surging in the sump during varying road conditions. If the sump plug is brought closer to the suction pipe such as would occur if the plug were replaced without the usual joint washer, or if the sump were dented inwards, the result would be that the pressure recorded would be very small owing to the restriction of the oil passing up the suction pipe.

Care should therefore be taken to see that when the oil is drained from the sump, the plug is replaced with the usual joint washer in position.

NO OIL PRESSURE.

Whenever it is observed that no pressure is being recorded on the oil gauge, the engine must be immediately stopped or extensive damage is likely to occur to the engine. If the

oil pressure gradually falls whilst the car is being driven on the road, and the pressure recorded is below the normal, or if the pressure fluctuates, the car should be stopped and an examination made of the engine.

The most likely thing responsible for this condition is a leakage of oil, and attention should therefore be directed to the aluminium gallery plates on the nearside of the crankcase and the fixing bolts retaining the plates in position should be adequately tightened up. An examination should also be made of the oil level in the sump and the sump replenished as necessary.

On all models with the exception of the "Nine," there is a vertical drive shaft connecting the oil pump and distributor. This shaft is driven from the engine camshaft and if no oil pressure is being recorded whilst the engine is running, it will most likely indicate there is either no oil in the sump or that the vertical driving shaft has emerged from the recess in the driving gear. This is only possible when there is excessive end play on the distributor rotor spindle and can be corrected by eliminating the excess play from the distributor.

On all gear type pumps, there is a tendency for the pump to lose its priming and to prevent this possibility, many designers are arranging the pump position so that the pump itself is submerged in the oil in the sump. Under these conditions loss of priming is entirely out of the question.

On the 9 h.p. machines, however, loss of priming is possible as the pump is mounted high on the nearside of the crankcase and works in conjunction with the suction pipe which descends into the sump. Embodied in the suction pipe is a ball valve which is placed there to prevent oil draining away from the pump when the engine is stationary and thereby loses its priming. On rare occasions, it is possible for small particles of grit to find its way on to the seating of the ball valve when the engine has come to rest so that oil drains away from the pump.

Too much end play of the gears in the pump body will also cause this loss of priming through air finding its way into the pump as the oil drains out. This, of course, can only occur if the ball valve in the suction pipe is defective.

This loss of priming is rarely experienced and only in the Summer time when the weather is very warm and the oil temperature rises above normal.

It is usually experienced through the driver stopping for half an hour or more and when re-starting the engine, there is no oil pressure. Under these circumstances, all that is necessary to do is to re-prime the pump with oil and the machine will function as usual.

It is most important, however, that the engine should be stopped immediately when this loss of pressure is experienced or extensive damage is likely to occur.

LACK OF FUEL AT THE CARBURETTER.

The symptoms of lack of fuel at the carburetter is loss of power accompanied usually by backfire in the carburetter. These symptoms are produced when the car is ascending an incline at speed with wide open throttle. Sometimes the cause of this lack of fuel is a restriction in the petrol supply through particles of white metal coming adrift from the inside lining of the petrol tank. These particles of metal which are loosened by vibration are drawn up into the pipe line where they build up and eventually restrict the supply of petrol.

The remedy where this trouble is experienced is to disconnect the pipe line from the petrol pump and from the petrol tank and force air under pressure through the pipe line, when the particles of metal will be ejected.

Should this fail to achieve satisfactory results, the petrol tank must be removed from the chassis and thoroughly cleaned out.

An examination should also be made to see that the pipe line or tubing is not bent or kinked, for if so, it will be necessary to replace the pipe with a new one. If the inlet pipe to carburetter is pushed too far into the union,

LIST OF CARBURETTER SETTINGS 1934/1935

MODEL	SOLEX TYPE NO.	Choke Main Jet	Pilot Jet	Jet Cap	Starter Assembly
R 9 H.P.	Thermostarter	23			
Thermostarter	30THG	110 x 58	050	14 x 120-3	5.0GA : 115GS
R 9 H.P.	Self-starter	23			
Self-starter	30BFHG with volume control screw	110 x 58	050	14 x 120-3	4.5GA : 115GS
R 9 H.P.	do.	23	050	14 x 120-3	4.5GA : 115GS
Self-starter and		110 x 58			
A.C. air silencer					
10 H.P.	Self-starter	24	050	14 x 300	4.5GA : 120GS
(Burgess silencer)	30BFHG	112.5 x 57s			
R 10 H.P.	do.	24			
(A.C. silencer)		110 x 57s	055	14 x 140	4.5GA : 120GS
12 H.P.	do.	26			
(Burgess silencer)		125 x 57s	055	13 x 300	4.5GA : 120GS
12 H.P. Sports	do.	23			
(2 carburetters)		115 x 51k	070	15 x 300	2.5GA : 90GS
12 H.P. Sports	do.	23			
(A.C. silencer)		105 x 51k	070	15 x 300	2.5GA : 90GS
R 12 H.P.	do.	26			
(A.C. silencer)		120 x 57s	050	14 x 300	4.5GA : 120GS
R 12 H.P. Sports	do.	—	—	—	—
(2 carburetters)					
16 H.P.	Self-starter	27			
(Burgess silencer)	35-40FHG with volume control	135 x 57s	065	15 x 300	4.5GA : 140GS
R 16 H.P.	do.	27			
(A.C. silencer)		130 x 57s	055	15 x 300	4.5GA : 140GS
20 H.P.	do.	28			
(Burgess silencer)		135 x 57	065	15 x 300	5.0GA : 145GS
R 20 H.P.		—	—	—	—
(A.C. silencer)					

CARBURETTERS & SETTINGS FOR S.S. CARS

M 30 20 H.P.	1934 single carburetter	30 choke	76 x 2 Main	185 x 2 Power
M 28 20 H.P.	1934 twin carburetter	30 choke	70 x 3 Main	130 x 4 Power
M 28 20 H.P.	1935 twin carburetter	30 choke	70 x 3 Main	150 x 2 Power
M 30 16 H.P.	1934 single carburetter	30 choke	76 x 2 Main	185 x 2 Power
(Old type induction pipe—28 choke, same setting.)				
M 28 16 H.P.	1934 twin carburetter	27 choke	70 x 3 Main	130 x 4 Power
M 28 16 H.P.	1935 twin carburetter	28 choke	70 x 3 Main	150 x 2 Power

the clearance between the pipe and carburetter filter is reduced and this quickly becomes choked up by foreign matter in the petrol.

It is also important to see that the connections at each end of the pipe are tight, for if they are loose, it permits the ingress of air which affects the working of the petrol pump. The efficiency of the pump depends upon a vacuum being created in the pump chamber and if air leaks are present, the output of the pump will be considerably reduced.

On the body of the fuel pump itself, there are situated two bronze plugs which have to be securely tightened down on the C. & A. joint washers. It is necessary that the joint washers should be in good order so that there are no air leaks present at these points.

An examination of the filter in the pump should also be made and also the carburetter filter, for if these are dirty, it is possible for the petrol supply to be unduly restricted.

One other point which may require attention is that of the valves in the petrol pump, for if they are warped or have dirt on the seating, it will prevent the non-return valve from functioning correctly and consequently some of the petrol in the pump chamber will be ejected back towards the petrol tank instead of to the carburetter on the operation of the diaphragm, resulting in lack of fuel at the carburetter.

To examine the valves, the two valve plugs should be removed, taking care of the small coil springs which surround the extension of the plugs. The valves can be removed and the seating cleaned or the valves renewed as necessary.

As the symptoms produced by restricted petrol supply are similar to those produced by incandescent sparking plugs, it is obviously desirable that an examination of the sparking plugs be made in the first place, as in the event of the plugs being at fault, it will prevent work which is unnecessary being carried out to the carburation system.

VIBRATION FROM THE SILENCER.

On several of the R12 1935 Models, a vibration was experienced which was traced to the silencer. In order to overcome this, a modification to the exhaust system was effected. On Page 49 is a sketch showing details of this alteration and it will be noticed in place of the fixed exhaust pipe from engine to silencer, a portion is now cut out from the existing pipe and replaced with a flexible pipe (Detail No. 41917).

The method of carrying out the necessary alteration is as follows :—Slacken off front end of exhaust pipe from manifold. Remove pipe from silencer (silencer to remain in position). Cut off portion of exhaust pipe sufficient to take flexible portion (Detail No. 41917). Fit flexible portion to pipe and silencer, utilising clip detail No. 40561. At the same time, it will be noticed from the drawing that a new bracket (detail No. 42098) and a new rubber mounting (detail No. 42150) are to be fitted. The new parts as required may be obtained from our Service Department.

STARTER CONTINUALLY ENGAGING.

An automatic starting device is incorporated on the 1934 and 1935 models, with the exception of the " Nine," which is known as the Lucas **Startix.** This device is found very useful, especially on cars which have a freewheel installed, for, should the engine stop whilst freewheeling, the Startix will automatically engage the starter motor and re-start the engine.

In the event of the starter having a tendency to keep on engaging with the flywheel, it indicates that either the Startix box is wrongly adjusted, the dynamo is not charging or the resistance in the cut-out has broken down.

Generally however, it is the dynamo which is at fault as the winding of the Startix is so arranged that the output of the dynamo energizes the inner winding of the trip coil, which in turn, pulls in a plunger. When this plunger is operated, it breaks the main starting

circuit and so switches off the starter. However, if the dynamo does not charge, the Startix will continually operate the starter and will continue to do so until the dynamo is adjusted so that it once more generates current.

Should the dynamo be in good condition, the trouble is likely to be due to the resistance in the cut-out having broken down, as it is very seldom that the adjustment of a Startix requires alteration after it has been set at the Factory. Assuming that such is the case, the remedy would be to fit a replacement unit. When dealing with this complaint examine the dynamo wires to ensure that they are not broken or detached from the dynamo.

SPINNING CLUTCH.

The clutch at present fitted to all **1935** Standard Models is of the dry single plate type and is known as the Borg & Beck.

It consists of a flywheel with a ground surface and a pressure plate of cast iron, the surface of which is also ground.

The pressure plate is attached to a steel casing or cover. In this cover is housed six coil springs and the usual toggle levers, of which there are three in number.

Mounted on the gearbox primary shaft is a steel centre plate with a fabric lining riveted to each side. This plate is gripped between the ground faces of the flywheel and the pressure plate under the influence of six coil springs when the clutch is engaged. Placed on the end of the three toggle levers is a circular plate known as the throw-out plate and when the clutch pedal is operated, it brings into contact with this plate a carbon block, known as the clutch throw-out block. The reason for fitting this block is to avoid grease or oil getting into the clutch assembly, a possibility which occurs when a withdrawal thrust race is being used. The clearance between the carbon thrust block and the throw-out plate should be $\frac{1}{16}''$ when the adjustment of the pedal is correctly carried out and moreover, as this clutch is of the self-compensating type, no other adjustment is provided.

Should the clearance between the carbon block and the throw-out plate be excessive, it will be necessary to push the clutch pedal almost to the floorboards before the clutch is disengaged.

Should trouble be experienced with the clutch spinning, an examination should be made first of all of the clearance between the carbon block and the throw-out plate and also with regard to the free movement of the clutch pedal. This movement should be approximately $\frac{3}{4}''$ in a forward direction from its position of rest against the toe-board.

Should the clutch be spinning through there being excessive movement of the clutch pedal, adjustment must be carried out to reduce this to the limits already specified.

If oil, grease or paraffin be allowed to enter the clutch, trouble will also be experienced with regard to spinning.

To correct this, the clutch will have to be dismantled and thoroughly cleaned out. Moreover, should oil be leaking from the front of the gearbox or from the rear of the engine, the necessary steps should be taken to correct this, otherwise, the same trouble will be experienced when the clutch is re-assembled again.

SLIPPING CLUTCH.

When clutch slip is experienced on a **1935** machine it is either caused by grease or oil getting in the clutch, or the friction elements have worn out. Before the latter occurs, however, the car would have covered a very large mileage but in either case, it will be necessary for the unit to be dismantled for examination.

If the fabric elements on the centre plate are worn, a new centre plate should be fitted and the unit re-assembled. If, however, the trouble is caused by the presence of oil, investigation should be made with a view of tracing the source from which the oil comes. It may come from the front of the gearbox or from the rear of the engine and if satisfactory results are to be obtained, this leakage must be stopped.

Slip can also be caused through lack of clearance between the carbon block and the throw-out plate and if this condition is present, adjustment should be made on the clutch operating pedal by means of the nuts provided.

If the clutch is heavy to operate, there is a remote possibility of slip through stiffness in the clutch toggle mechanism. This can only be eradicated by dismantling the unit entirely and inserting graphite grease on the toggle bolts and levers.

FIERCE CLUTCH.

When the Borg & Beck clutch is fierce in its operation, it is usually a sign that oil or grease is present in the unit. The clutch therefore has to be dismantled, thoroughly cleaned out and the leakage of oil stopped at its source.

If the clutch is heavy in its operation, this may cause the clutch to be fierce, therefore when the unit is dismantled, the fulcrum of each of the three toggles should be lightly smeared with graphite grease to ensure that when the clutch is re-assembled it is once more light in action.

CLUTCH HEAVY TO OPERATE.

With reference to complaints of heavy clutch movement, the following information is relative to the causes and effects that will be noticed when dealing with this trouble, also the correct method of procedure in disposing of complaints registered under this heading.

It must be explained that normally the clutch action is very light, so that where a complaint is dealt with for heavy clutch, or clutch spinning, the symptoms are easily determined by the feel of the clutch, by depressing the clutch pedal. The action can be described as "tight" or "spongy," this is the result of the clutch release bearing (or thrust block) acting as an abrasive. The dust spraying on to the clutch toggles and set pins causes them to seize in the release lever plate assembly.

A change has been made in the composition of the material used in the clutch release bearing, the new type bearing being of a much harder substance and in every case where it is necessary to dismantle the clutch assembly for any cause whatever, the revised type thrust bearing must be incorporated.

When ordering supplies of the later pattern bearing, the revised Detail Nos. must be quoted, these are as follows :—

10 h.p. and 10/12 h.p. Detail No. 40107. New type.

16 h.p. and 20 h.p. Detail No. 40032. New type.

The procedure for removing the clutch unit is as follows :—Remove front carpets, rubber cover to gearbox, floorboards, and toeboards, remove clutch and brake pedals, detach free-wheel control from gearbox, detach also clutch tension rod and withdrawal cable from clutch cross shaft, disconnect propeller shaft at gearbox end, undo castellated nuts from rear bearer, remove breather pipe from engine, remove starter motor, remove clutch bell housing bolts, place a block of wood between fish plate and engine sump and insert jack under wood block, jack up engine and gearbox until the fan blades are just touching the radiator block, it will then be possible to withdraw the clutch bell housing and gearbox.

This will leave the clutch assembly exposed, proceed by removing six studs which secure clutch to flywheel then remove clutch assembly and dissemble unit complete.

Ease off release lever pins and eye bolt assembly which is located on the pressure plate. It may be noticed that the release lever plate has become burred, if this is the case, file off any burrs that are evident, remove withdrawal fork or bearing cup assembly located in the clutch bell housing, press out existing thrust block, fit new type thrust block (or graphite release bearing).

Re-assemble the whole as described.

It is however essential that the release bearing plate, clutch pressure plate and driven plate are kept free from oil and grease.

It will be found that the nuts and release levers are numbered 1, 2 and 3 and when re-assembling, they should be placed in their respective positions, the split pins to be an easy push fit.

CLUTCH RATTLE.

On several of the early 1935 9 h.p. machines, a rattle from the clutch was experienced. This occurred on acceleration from a low car speed in top gear.

Investigation showed that the three coil springs mounted radially on the clutch centre plate were too weak and allowed the hub of the centre plate to work loose.

A modified type of centre plate was introduced which gives very satisfactory results and should be employed if this trouble is experienced.

This plate is identified by the yellow paint marking on the three coil springs.

Should this trouble be experienced therefore, the unit must be dismantled and the modified type of plate fitted.

CLUTCH WITHDRAWAL SHAFT SEIZED.

If the lubrication of a machine should be neglected, there is a possibility that the clutch withdrawal shaft may eventually seize in its bearings.

In the event of this happening, the engagement of the clutch will be jerky in action causing fierceness and shudder and also slip.

The remedy is to free the shaft which can sometimes be done without removing the gearbox from the chassis by saturating the end of the rod and bearings with a mixture of paraffin and oil and operating the clutch pedal freely.

If this fails to produce satisfactory results, the gearbox has to be removed and the clutch withdrawal shaft extracted, eased and then re-assembled.

FRACTURE OF THE CLUTCH COMPENSATING RODS.

When an engine is held in a chassis on rubber mountings, a link has to be interposed between the chassis frame and the clutch unit so that there will be no disengagement of the clutch or variation in clutch engagement when the engine moves on its rubber mounting.

This consists of two rods extending backwards from the clutch assembly and connected to a lever system which pivots round a bolt on the chassis frame. This linkage device permits the engine to move in all directions without adversely affecting the clutch operation. Conversely, when the clutch pedal is operated, the engine is not moved on its mounting because of the "Push and Pull" action of the linkage. When the clutch pedal is depressed, the lower of the two rods is in extension whilst the upper one is being compressed. A few cases of fracture or bending of the top rod has occurred through the clutch becoming heavy to operate and the trouble will only be eradicated by dismantling the clutch unit and easing the operating mechanism. If the fractured rod alone is replaced there is a possibility of there being a recurrence of the trouble. It is therefore advisable that the clutch be dismantled and the necessary work carried out to make it operate freely.

GEARBOX

Difficult Gear Change. On the 1934 and 1935 machines, a synchro-mesh type of gearbox was introduced with very satisfactory results. The use of this gearbox simplified the gear change to a considerable extent so that even a novice would experience little difficulty in making the necessary gear change.

In the event of a complaint of difficult gear changing being made, the first thing to test for is a spinning clutch through the clutch pedal adjustment being incorrect.

On the 1934 machines, a cable was introduced on the clutch operating mechanism and it was found on some cars that this cable had stretched so that the clutch pedal had to be

pushed right down to the toeboards before the clutch was free, even then, there were traces of clutch spin as the clutch was not fully disengaged.

Adjustment of the pedal is all that is required to put this matter right and if the nuts are tightened up so that the free movement of the pedal from the toeboard is restricted to $\frac{3}{4}''$, no more difficulty with gear change should be experienced.

Cones Seized in Gearbox. With this type of gearbox, it is possible, if the car is driven badly, for seizure of the synchronizing cones and cups to occur. This can only happen when the car is brand new and when the change down is made at a very high car speed, or there is a delay in engaging gear.

In the event of this seizure taking place, it will assist matters if the car is allowed to stand for a while so that the oil and working parts of the gearbox be allowed to cool down.

To free the cone and cup which has seized, put the handbrake in the "on" position and depress the clutch pedal, then start up the engine. Now pull the change speed lever back to neutral, or as near neutral as possible, so that there are no gears engaged and the only parts in contact are the cone and cup. Now accelerate the engine and let the clutch in sharply, when the cone and cup which has seized should separate.

It may, however, be necessary to do this more than once before the results desired are achieved.

To prevent the possibility of seizure recurring the cones and cups should be lapped together, the procedure for which is as follows: With the engine operating at idling speed and the handbrake in the "on" position, push the change speed lever either forward or backward as required, just far enough for the cone and cup to contact, but without actually engaging the gear. Do not keep the cone and cup in contact for too long a period, but rather move the change speed lever like a pendulum in, out, in and out for a few minutes. This action will smooth out any irregularities between the angled faces of the cones and cups and no further trouble of this kind need be anticipated.

Should difficulty be experienced in disengaging the cones by the methods previously outlined, the lid of the box should be removed and the parts concerned separated with the aid of a soft drift.

If a very bad seizure has occurred which necessitates dismantling the gearbox for the purpose of freeing the cone and the cup, the surface of the cone may probably be found roughened or picked up by the seizure. This can be smoothed out by means of a carburundum stone and prior to re-assembling the parts, the cone and cup may be lapped together with the aid of fine carburundum paste. This paste would, of course, have to be carefully removed before re-assembling the parts, otherwise it might cause trouble in the gearbox.

Bad Synchronization of Gears. Occasionally a complaint may arise that the synchronization of the gears is not too good so that a quiet change of gear cannot be obtained. Very often this is caused by bad driving on the part of the owner or through the clutch spinning. (Remedy for the latter previously outlined.)

Sometimes, this bad synchronization of the gears may be due to irregularities between the cone and cup angles and it has been found that excellent results are obtained by lapping the cone and cup together with the gearbox in position in the manner we have previously mentioned.

After the machine has covered a very large mileage, there is a possibility that the synchronization of second gear may have deteriorated. The cause of this is probably due to loss of spring pressure concerning the six coil springs on the synchronized sleeve. The remedy in this case would be to dismantle the gearbox and replace the six springs with new ones.

Jumping out of Third Gear. The selector rod mechanism on this type of gearbox is housed in the lid of the box and the usual method of location, i.e., spring loaded plungers, is employed.

The tension of the springs operating on the plungers is regulated by the screwed plugs of which there are three in number, and it is the aim of the designer to make the gear change as light as possible.

It so happens however, that if the spring tension is insufficient, there is a possibility of the gear becoming disengaged when the car is driven on the road. This condition can be corrected quite easily by increasing the tension of the coil springs. The tension may be increased by screwing the plugs further down in the gearbox lid.

Failure to Engage Second Gear. If it is found necessary to dismantle the gearbox and on re-assembling it is discovered that it is impossible to engage second speed gear, it indicates that the second speed gear on the lay shaft is only half in mesh. This is due to faulty assembling, as the operator concerned has failed to assemble the gearbox with the various gears in perfect alignment. The unit has, therefore, to be completely dismantled and rebuilt again.

On assembling this gearbox, the cluster gear or lay shaft has to be inserted first of all, then the main shaft assembly built up in place, after that, the cluster gear is slightly raised from the floor of the box for the purpose of inserting the shaft or spindle which carries this gear assembly. If the gearbox is to work correctly, the three sets of gears, the constants, thirds and seconds have to be in true alignment with each other, otherwise trouble will be experienced with the gearbox.

Failure to Engage Reverse Gear. The reverse gear on the present type of gearbox is mounted on a spindle of $\frac{5}{8}''$ diameter. This gear is comparatively long and has a bronze bearing or bush in the centre. Owing to the small tolerance allowed between the spindle and the bush in the gear, there sometimes occurs partial seizure during cold weather through oil being thick in the bearing.

Owing to the high leverage imparted through the medium of the change speed lever, the gear can be forced from the bush or bearing under these conditions. This permits the gear to drop on the spindle so that it is no longer in alignment with its mating gear and engagement is almost impossible.

The remedy is to remove the rear cover from the gearbox and fit a new gear and new spindle if the latter is required.

Generally, the original spindle may be used after the bush has been forced off it, but a new gear must of necessity be employed.

Before re-assembling, it is advisable to see that the gear can slide freely on the shaft or seizure might possibly occur again.

On all models, with the exception of the "Nine," a freewheel device is fitted and it is occasionally possible, when driving with the freewheel in operation, to bring the car to rest so that, if requiring to immediately reverse, the engagement of reverse gear will be impossible unless the car is moved forward a little way. The reason is, when the car comes to rest, the teeth of the two gears which comprise the "fixed gear" drive, are in alignment with each other so that they will not engage when the change speed lever is operated to obtain reverse gear. The teeth are specially backed off to obviate this trouble, but occasionally it happens that the backing off is insufficient. It is therefore inadvisable when driving on the freewheel to bring the car to rest close up against a wall, as difficulty in engaging reverse gear may be experienced.

To obviate this, "fixed gear" should be engaged before the car is brought to rest, when no difficulty in obtaining reverse will be found. When reverse gear is engaged, the action of the selector rod in addition to engaging reverse gear, is to push the "fixed gear" along the main shaft into engagement against the resistance of a spring loaded plunger or rod.

On very rare occasions, difficulty in obtaining reverse gear may be experienced through a burr on the main shaft holding up the sliding gear.

Attention might also be given to the spring loaded plunger to ensure that there is no possibility of jamming occurring at this point.

Oil leaks from Gearbox Lid. At the lower end of the change speed lever just inside the gearbox lid, an elongated hole is provided.

Through this hole passes a $\frac{3}{16}''$ bolt which retains the steel domed cover to the aluminium gearbox lid.

The rotational movement of the gears in the box throws the oil in an upward direction and it has a tendency to accumulate in the elongated slot in the lever.

The rocking movement of the change speed lever passing through neutral from low to the high gears and vice versa, results in some of this oil being forced out through the top of the gearbox lid and this was a condition which was experienced on the early 1934 machines when this gearbox was first introduced. Since then, a modification in the form of oil drain grooves has been placed at each end of the elongated hole thereby preventing the oil accumulating and so eliminating a leakage of oil at this point.

Oil leaks from Gearbox, front and rear. On certain 1934 machines, oil was discovered leaking out from the front or rear of the gearbox and in some cases, from both of these points.

It was eventually decided that this was caused by an inefficient breather which was placed on top of the gearbox lid. Owing to the fact that there were additional working parts in the gearbox and that it was housed in position between cross members which shielded it to a certain extent from the currents of air underneath the car, the temperature of the gearbox became higher than usual. This caused the air in the box to expand to a greater degree setting up an internal pressure, which resulted in oil being forced past the oil retaining washers. To prevent this, a modified form of breather is now incorporated on all models with satisfactory results.

A good grade engine oil should be used in the gearbox such as **Mobiloil BB., Castrol X.L.** or **Triple Shell.** It is very important however, that the oil level should be correct and should just cover the gears on the layshaft assembly. If the oil level is above this, There is every likelihood of oil being forced out from the gearbox.

At the front and rear of the gearboxes, there is an oil retaining washer which is the most efficient of its kind. It is known as a super oil seal and is a leather washer with a protruding lip, around which is placed a coil spring band. The washer is housed in a metal sheath which should be a tight fit in the housing provided in the front and rear covers.

The extending lip of the washer should always point inwards and in the event of a new washer being installed, it is advisable to soak the washer in hot oil for at least two hours. This treatment makes the leather washer very pliable and responds more freely to the action of the coil spring, contracting the lip of the washer on the revolving shaft.

At the rear of the gearbox no special precaution need be taken in the event of fitting a new one other than that which has already been specified, but at the front, there is a possibility of the lip of the washer becoming rucked when placing the front cover in position through contacting with the splined end of the pinion shaft.

A metal or wooden guide can be machined to facilitate the passage of this washer along the shaft, but an alternative is to wrap some brass foil around the sharp edges of the splines so that the washer may pass over without damage.

When replacing the front cover, it is important that the slot provided in the register machined in the cover face is at the bottom as it provides an oil drain and prevents oil building up at that point.

Oil leaks from Speedometer drive. If it is found that the gearbox oil level is falling at a very rapid rate so that it becomes empty after 400 miles have been covered, it indicates that there is a leakage of oil from the speedometer drive in the gearbox. This is only likely to occur on certain 1934 machines where the oil scroll provided on the spindle of the driven gear had a right-hand rotation.

This oil scroll ensured that the spindle would be adequately lubricated by carrying oil along the scroll. So efficient did this prove that oil was being forced out of the gearbox at

a fairly rapid rate. To correct this condition, the spindle of the speedometer driven gear had an oil scroll with a left-hand rotation which acted in a manner similar to an oil retaining device thus preventing a leakage of oil from the speedometer drive.

As previously mentioned, this condition is likely to be experienced only on 1934 machines and in the event of it happening, application should be made to the Service Department for a modified type of speedometer driven gear.

REAR AXLE.

Noise from Rear Axle. On all models, the final drive is by crown wheel and pinion and the rear axle unit conforms to a semi-floating type.

Very little difference exists between the 9 h.p. unit and those which are fitted on the larger models other than that of dimension.

The axle on the 20 h.p. is, however, slightly different to the others, as the pinion housing is made up of two parts and the adjustment of the pinion in relation to the crown wheel is by means of shims.

On all the others, the adjustment provided is through the medium of two screwed collars placed in the pinion housing. (For details of this adjustment see Page 41 of the 1934 Service Manual.)

In an endeavour to ensure that each axle would be quiet under ordinary running conditions, the pinions and crown wheels are lapped together in pairs before they are assembled in their respective axle casings. Before the lapping in process, they are fixed in a pre-determined position in relation to each other. It is therefore very important that when they are assembled in the axle unit, they are placed in the same position in relation to each other as that which occurred during the lapping process. Even slight variation of this position is likely to produce noise from the axle and in the event of this being experienced on a car which is new, adjustment of the pinion by means of the screwed collars provided in the pinion housing should be tried. Furthermore, should the pinion be too deeply in mesh with the crown wheel, this will also be responsible for causing noise in the axle.

To carry out the adjustment of the pinion, proceed as follows :—Remove the split pin and extract from the front of the pinion housing the pin and lock plate which prevents the bronze bearing adjuster from moving and slacken off the bearing adjuster. Then from the top of the pinion housing remove the small flat plate which carries a stop peg, when access to the internal screwed collar can be obtained.

A suitable lever should be inserted through the aperture provided engaging with the castellations of the internal collar and this collar should be moved one castellation towards the offside of the car. Next, re-tighten the bronze bearing adjuster at the front of the pinion housing and replace both locking plates.

The car should now be taken on the road to ascertain if any improvement with regard to noise has been effected. If no improvement is experienced, the same procedure should be adopted, and the internal collar rotated to the extent of another castellation in the same direction, i.e., towards the offside of the car.

A further road test should be tried and if there is still no improvement, further adjustment to the internal collar should be made, but with the opposite rotation, that is, towards the nearside of the car, but on this occasion, the collar should be rotated to the extent of three castellations which would be one castellation to the nearside from the original position of the collar.

The rotation of the internal collar to the nearside means that the pinion is being brought closer into mesh with the crown wheel and great care must be exercised in this connection, for if the pinion is brought too deeply into mesh, it may result in serious damage occurring inside the unit.

It is advisable when carrying out adjustments of the pinion with regard to the crown wheel, that the initial adjustment is always taking the pinion away from the crown wheel.

In the event of the axle still being noisy after adjustments have been carried out, communication should be made with the Service Department who will either supply a replacement pinion housing assembly or a complete new axle unit. Before doing so, however, an examination of the hub bearings should be made, as there is a possibility that the cause of the noise may emanate from one or other of the hub bearings. Should either of these bearings be found pitted or defective in any way, they should be replaced with new ones. Many parts of the car are neglected so far as lubrication is concerned, but the chief of which would appear to be the rear hub bearings. This is probably accounted for by the fact that the hub cap of the road wheel has to be removed before access can be obtained to the grease nipple and whilst the housing holding the hub bearing contains a good quantity of grease, it will not last for ever. Moreover, apart from the question of lack of lubrication there is also the fact that the grease in the bearing deteriorates and eventually the bearing overheats and becomes noisy. Attention should, therefore, be given to the lubrication of the hub bearings every 2,000 miles.

Pinion Shaft Floating. On some of the 1934 machines, a knock was experienced on the pinion shaft after a large mileage had been covered. This was noticed when taking up the drive from stationary or on sharply reversing.

It was caused by the pinion floating in its housing and was brought about by the tubular distance piece which is placed between the two bearings on the pinion shaft being hammered up. Since then, the thickness of this distance piece has been increased so that there is little possibility of the trouble being experienced on the 1935 models.

Loose "U" Bolts. A similar type of knock however, can occur if the "U" bolts retaining the axle to the rear springs become loose and attention must be given to this point immediately should this knock appear.

Excessive Axle Shaft End Play. At each end of the axle casing, there are placed a number of shims for the purpose of facilitating the assembly of the axle shafts so that these shafts have .006″ end play. This end play is found necessary to prevent overloading of the hub bearings and to allow for expansion under heat, etc.

In the event of the end play being excessive, it also permits movement in a vertical plane and a hammer action is created on the bearing each time the car strikes a pothole.

The noise of this hammering should be audible to the driver of the car and attention should be directed to it at the earliest possible moment, for, if it is allowed to continue, the bearing will eventually fail.

It is, however, very rare that this condition is experienced, but in the event of it arising, it can be adjusted quite easily by extracting one of the shafts and removing the necessary number of shims so that when the shaft is replaced, the end play is approximately .006″

Rear Axle Spring Platform loose. The spring platform on the present type of rear axles is welded to the axle casing and if the car is driven extensively with the axle "U" bolts in a loose condition, additional stress will be transmitted to the spring platform which may eventually come adrift.

In the event of this condition arising, a new axle casing should be obtained, unless facilities are available for re-welding the spring platform. It must, however, be pointed out that care should be taken in re-positioning the spring platform on the axle casing, for any variation of its original position, will, in all probability, cause the welding to break down again. Experience shows that if the rear axle "U" bolts are kept tight, there is very little possibility of this failure taking place.

Oil leaks from Pinion Housing. Within the last two years, motor car designers have come to the conclusion that no advantage is obtained by making the rear axle pinion housing from aluminium, for the saving in weight is off-set by the possibility of distortion, especially when the unit is of comparatively small size. It is therefore more advantageous

to use iron castings for the pinion housing which produces greater rigidity.

The use of the iron casting however, reduces the thermol efficiency, and the temperature, especially inside the axle, is higher than what would be the case if an aluminium housing were employed.

The result of this is, that through the increased expansion of the air inside the pinion housing, there is a possibility of oil being forced out past the washer at the front of the housing unless a breather is fitted.

On all 1935 machines, there is incorporated a breather in the form of a copper pipe. This pipe is attached to a plate on the top of the pinion housing and is bent in the form of a "U." This bending of the pipe reduces any tendency for the oil to be thrown out through the pipe, but in this connection, it is necessary that the bend should be towards the offside of the car and not the nearside. If the bend is to the nearside, it is found that oil can be thrown out more readily from the rotation of the pinion shaft than if the bend of the pipe is in the opposite direction.

In the event of oil leaking out from the front of the pinion housing past the felt washer which is installed there, the first thing which should be done is to fit a breather if one is not already provided, as in many cases this is all that is required for the correction of this trouble.

Should the fitting of a breather fail to correct the oil leakage, then the bronze collar, known as the bearing adjuster, at the front of the pinion housing should be extracted and a new felt washer be inserted in the recess provided in the collar and the collar replaced.

A check should also be made of the oil level in the unit, for if this is unduly high, there is no doubt that oil will leak from out of the axle.

Oil leak to Brake Drum. The most common cause of oil leak from the rear axle on to the brake drum and putting the brakes out of action, is through overfilling with oil.

On most types of axles will be found an oil level plug above which the oil level should not go. If an excessive quantity of oil is placed in the rear axle so that the oil level is above the oil filler plug, there is little doubt that oil will leak out along the shafts and into the brake drums.

When dealing with a complaint of this kind, it is advisable first of all to check the oil level and if the quantity of oil in the axle is excessive the excess should be drained off until the level is at its correct position. The road wheels and brake drums should be removed and the brake shoes and brake drums thoroughly cleaned. Petrol should be used in this cleaning process and not paraffin, which has a detrimental effect on the linings of the brake shoes. If the brake shoes have become soaked in oil, new linings will have to be fitted if satisfactory results are to be obtained.

If oil still leaks out from the axle after the level has been corrected, the axle shaft should be withdrawn and a new washer fitted in the end of the axle casing.

This washer is similar to that employed in the gearbox and is known as a super oil seal. It is a leather washer with a protruding lip around which is placed a coil spring band. The washer itself is retained in a metal sheath to prevent it spinning with the shaft.

When fitting a new washer, a washer complete with sheath has to be installed.

The old one can be cut out and a new one inserted. Care, however, should be taken when inserting a new washer that the protruding lip of the washer is facing towards the centre of the axle casing and that the metal sheath is a tight fit in its housing and is not unduly distorted.

It will also be advantageous if the washer is soaked in hot oil prior to fitting, as it will make the leather more pliable and will conform more readily to the action of the spring band contracting on the shaft.

Before replacing the axle shaft, it should be examined for truth, as a shaft which is bent will revolve eccentrically, thereby enlarging the aperture in the washer.

This effect upon the washer will, undoubtedly, contribute towards the oil leaking out and satisfactory results will not be obtained unless the shaft is true.

When re-assembling the shaft in position, a check should be made of the end play present on the shaft and if this is found to be more than .006″, it should be reduced to that amount.

Provision for this adjustment is made by placing a number of shims at the end of the axle casing and in the event of end play being excessive, the necessary thickness of shims should be removed for its correction.

If, despite these adjustments, oil is still inclined to leak out from the rear axle, the unit should be dismantled and an examination for side play made of the crown wheel and differential assembly. The crown wheel and differential should revolve freely on the bearings provided without any appreciable side play.

If the adjustment is incorrect so that side play of the crown wheel and differential is present, it will have a tendency to cause oil to be forced out along the shafts to the brake drums and this movement should be restricted to the very minimum. Actually, no appreciable side play should be present, but the crown wheel assembly must be able to revolve freely on the bearings provided, otherwise the bearings will be overloaded and eventually break down.

If adjustment is carried out on the lines previously mentioned, there is no doubt that this oil leakage will be eliminated.

FRONT AXLE AND STEERING ASSEMBLY.

Excessive Tyre Wear. Owing to the excellent acceleration and braking provided by the modern motor car and the fact that the new type non-skid road surfaces are much rougher, is responsible for a general tendency towards increased tyre wear. This is understandable and quite natural, in view of the road conditions required for the modern car.

Some cars, however, have excessive tyre wear at the front, particularly on the nearside tyre, and when it occurs, the rate of wear is so great that a tyre can be ruined in a comparatively short space of time. Many owners contribute to this tyre wear by driving the car for long periods and possibly at high speeds, with low tyre pressures, and it cannot be too strongly emphasized the importance of maintaining in the tyres that pressure which is recommended by the manufacturers.

As soon as it is noticed that uneven wear is taking place on the nearside front tyre, an examination should be made of the front axle and steering gear to ensure that everything is in its proper order and that the tyre pressures are that which are recommended in the Instruction Book.

Another cause of this tyre wear is the track of the front wheels being incorrect.

The correct setting is for the front wheels to "toe-in" at the front $\frac{1}{8}$″. This is a setting which is provided by the manufacturer when the car is new and experience shows that it is the best setting for all Standard cars.

Sometimes when an effort is being made to turn the car on the road, one of the front wheels comes in contact with the kerb. This is a thing that happens almost every day and generally no damage occurs. It is, however, possible to strike a kerb with sufficient force to buckle a wheel, or to bend one of the steering arms extending backwards from the stub axle and which carries the track rod. If this happens, the rate of tyre wear will be excessive and in the event of it arising, an examination must be made to ensure that the track is correct and that the road wheels themselves are not buckled to any extent.

A road wheel can run out of truth $\frac{1}{8}$″ and still be up to standard, as that is the tolerance which is allowed by the manufacturer.

Another cause of excessive tyre wear at the front is the front shock absorbers being out of balance and this is a point also which should receive attention when dealing with a complaint of this kind. Normally the adjustment of the shock absorbers is carried out by the manufacturers so that the lever arm moves

through an arc of 100 degrees during a given number of seconds and it is arranged that each pair of shock absorbers fitted to the various machines should have the same resistance in the unit and that the lever arm should take the same time whilst moving through the same distance. If, therefore, one of the shock absorbers looses its efficiency, the resultant action created at the front of the car is likely to allow undue oscillation of the front wheels.

It is therefore necessary to check the front shock absorbers when excessive front tyre wear is experienced. There is a rough and ready way of adjusting the balance of both front shock absorbers and that is as follows—run the car on a ramp or over a pit and disconnect the lower end of the link arm from the front axle on each of both front shock absorbers, then push the lever arms of the shock absorbers upwards as far as they will go and grasping firmly a lever in each hand, lift the weight of the body from off the ground. This weight transmitted to the lever arms of the shock absorbers will cause the arms to move downwards to a certain distance and if these units are properly balanced, both lever arms will move down through the same distance in the same time. If it is found that one of the shock absorbers has comparatively no resistance in the unit, it will be advisable to replace it with another one. If, however, it is a question that the adjustment has been altered on one of the shock absorbers so that the resistance in the unit has been considerably reduced, the best way to re-gain that efficiency and balance is by removing the filler plug from that shock absorber which is doing its work, then turn the adjusting screw downwards to the fully closed position counting the number of turns in doing so. Then bring the adjusting screw back to its original position and adjust the other shock absorber so that it has the same number of turns back from the fully closed position.

If after carrying out this adjustment it is still found that the shock absorber is inefficient and out of balance with the other, then it should be removed from the chassis and returned to the manufacturers for reconditioning or replacement.

Another condition which contributes towards excessive front tyre wear is a very flexible axle beam and where this is noticed and the tyre wear is excessive, the rate of tyre wear can be reduced by increasing the amount of "toe-in" at the front of the front wheels to approximately double the usual recommendation of the manufacturers.

On **Standard** cars for instance, the recommendation for the correct track setting is, front wheels "toeing in" $\frac{1}{8}''$.

Where a very flexible beam is experienced, the toe-in of the front wheels would be $\frac{1}{4}''$.

Whilst it has been pointed out the conditions which will cause excessive tyre wear on a car which is comparatively new, it has also to be remembered that should there be wear or any slackness in the steering or front axle system, it is likely to cause a condition conducive to excessive tyre wear.

Excessive play on Steering Wheel. (Marles Weller). The Marles Weller steering is of the cam and lever type, or, as the manufacturers sometimes describe it—a cam and follower. The cam is circular, very much like a worm and is mounted on a steel shaft. At each end of the cam in the steering box, two races are assembled supporting the cam. At the top end of the column, a long felt bush is situated and acts in a manner similar to a bearing by supporting the inner steering shaft. This shaft should be able to rotate freely without any end play and to achieve this object, a number of shims are interposed between the lower face of the steering box and the cover which is bolted to the box at that point.

Passing vertically through the box and supported by two bronze bearings, is a rocker shaft, the top end of which is cranked to support the follower by means of a bronze bush inserted in the rocker shaft. The follower is formed like a steel plunger and has two flats milled at its lower end. On each of these flat surfaces on the follower, two recesses are provided into which are inserted half steel balls or hemispheres. The flat surfaces of the hemispheres are in contact with the faces on the cam so that owing to the very small frictional

area, little effort is required to operate this steering gear.

Through this small frictional contact, there is a possibility that in the event of excessive play developing on the steering wheel, it is due to wear of the hemispheres and can be corrected by fitting new hemisphere, in the follower.

When the steering gear is assembled as new, the four hemispheres are lapped in with the cam until there is .0015″ side play. This amount of side play is equal to ½″ free movement of the steering wheel and any movement in excess of this ½″ may be considered to be excessive.

When fitting new hemispheres, it is recommended that two new ones should be fitted only in the first place, for in the event of there being no wear on the cam faces, the fitting of four new hemispheres might conceivably make the steering gear tight.

Owing to the different dimensions which it is possible to obtain with regard to hemispheres when ordering new ones, it is important that the commission number of the car be quoted.

All 1934 models were fitted with the Marles Weller steering gear, but on the 1935 machines only the 12 h.p., 16 h.p. and 20 h.p. have this steering assembly. To fit new hemispheres in the Marles Weller steering box, there is no necessity to remove it from the chassis. All that is required is to disconnect the drop arm from the rocker shaft, remove the steering box lid, extract the rocker shaft complete with follower and hemispheres and renew as necessary.

A point of importance is that under the lid of the steering box will be found a shim which is .015″. No effort should be made to remove this shim or to replace it by a thinner one, as it is essential to the smooth working of the steering gear that it be inserted under the steering box lid. The presence of this shim allows the follower to move vertically and compensates for any irregularities that may exist with regard to the cam face.

Stiff Steering (Marles Weller). Stiff steering, as a general rule, is brought about by neglect of the lubrication of the swivel pins and steering connections and this is the first point which should receive attention in the event of this stiffness arising.

It is very important, especially with regard to 16 h.p. and 20 h.p. models, that all the steering connections are kept adequately lubricated.

With regard to the steering box itself, provided it is kept filled with oil, there is very little possibility of stiffness being experienced from that part of the unit especially when the car is new.

Wear, however, is bound to occur in time and after a large mileage has been covered, there is certain to be some wear on the two bushes which support the rocker shaft. This allows the rocker shaft to cant slightly when under load and friction between the top of the rocker shaft and the steering box lid is likely to occur.

The extent of this friction on the lighter cars is very apparent but with regard to the 16 h.p. and 20 h.p. there is a possibility that it may cause the steering to become stiffer.

The remedy is to fit new bushes in the steering box and possibly a new rocker shaft.

Under the lid of the steering box, there is placed a shim. The presence of this shim is to allow for any irregularities that may exist on the cam faces and in the event of its removal, it will certainly stiffen up the steering gear. There appears to be a tendency among certain repairers to correct slackness in the steering box by the removal of this shim, but the only result obtained is that of providing a stiff steering. Under no circumstances therefore should this shim be removed, for if slackness is present in the steering gear due to wear, the correction can only satisfactorily be carried out by replacing the parts which are worn.

Squeak from Steering Box. When wear occurs on the bushes supporting the rocker shaft so that the shaft cants and contacts with the lid of the box, this friction results in the oil film being removed from the lid which

eventually becomes dry and squeak occurs. If the steering box is filled to the top with oil, the possibility of squeak will be considerably reduced through oil being continually splashed on the underneath side of the lid, but in any case, the correction of squeak in the event of it arising, is to fit new bushes and possibly a new rocker shaft.

Steering Gear Jammed. Many owners personally attend to the lubrication of their machines and they have a natural desire to remove the lid of the steering box to inspect the quantity of oil which is in it and also to see the action of the steering gear.

After the lid of the box has been removed, the steering wheel is rotated and the follower rises vertically and looses contact with the cam in the steering box. This movement of the follower permits one or more of the hemispheres to drop out of position and lodge in the bottom of the box. This may be quite unknown to the owner of the car, who, on replacing the lid, may find additional free movement present on the steering wheel, but the serious aspect of the situation is that there is a possibility of the steering gear jamming solid so that should it occur whilst the car is about to turn a corner at speed, the consequences may be very serious. It is therefore important that when the lid of the steering box has been removed, no effort is made to turn the steering wheel until the lid has been replaced on the box.

Loose Stub Axle. Attached to each end of the axle beam by means of a swivel pin, is a stub axle to which the steering box is connected by means of rods.

It is necessary, if satisfactory steering is to be obtained, that there should be no undue play on the stub axle bushes.

In the event of being able to "rock" the stub axle or move it vertically up and down, it will indicate that new stub axle bushes and possibly swivel pins will be required as wear has occurred on the originals.

To dismantle the stub axle, remove the road wheel and brake drum, then the hub and extract the bolts holding the brake assembly to the flange on the stub axle and remove it. Next withdraw the cotter pin which passes horizontally through the end of the axle beam. The swivel pin may now be ejected by driving it out in an upward direction, then the track rod can be disconnected from the stub axle steering lever and the bushes forced out from the stub axle and new ones inserted. After insertion of the new bushes, it will be necessary that they should be reamered to suit the swivel pin so that when the stub axle is re-assembled, it will rotate freely around the pin without any up or down movement.

In the event of being able to "rock" the stub axle, an examination should be made concerning the fit of the swivel pins in the axle beam itself. This pin should be a tight fit in the axle and should it be free to move, it means that the diameter of the hole in the beam is too large and it has either got to be closed up and reamered again to suit, or else a new beam has to be obtained. This condition is sometimes experienced on a comparatively new car.

An examination with regard to this should be made before deciding to fit new swivel pins and bushes.

Loose front hub. When a front hub is correctly assembled, the amount of end play should be approximately .002″ and anything greater than this amount is excessive.

Too much play on a hub results in unsatisfactory steering accompanied by excessive front tyre wear. Should the steering therefore be unsatisfactory, an examination of the front hubs should be carried out and the end play limited to the amount previously specified. On the other hand, care should be taken when re-assembling the hub to ensure that it is not assembled too tightly, as an excessive load, particularly on the front bearing, results in it overheating and breaking down. Bearings which fail under these circumstances are not replaced under Guarantee by the manufacturers. Similar remarks apply to a bearing which fails through lack of lubrication and it is, therefore, important that the lubrication of the front hub bearings should not be neglected or failure is bound to occur.

PRE-SELECTIVE GEARBOX.

Slip. When the pre-selective gearbox is fitted to a Standard car, certain alterations are made to the usual specification, the chief of which is that the original type clutch is dispensed with, as the drive for 1st, 2nd, 3rd and reverse gears are obtained by the contraction of brake bands on the annulii of the epicyclic gearing in the box.

These brake bands are usually lined with Ferodo, a bonded lining, which gives very satisfactory results over a considerable mileage. Like all linings of this nature however, wear eventually occurs and the efficiency of the brake bands become impaired. To compensate for this wear, an automatic adjustment is incorporated which rotates the adjusting nut and the position of the brake band in relation to the drum remains constant throughout. Occasionally, especially when new, the initial rate of wear in the lining is greater than the rate that the automatic adjustment operates, so that slip is sometimes experienced on certain gears. To correct this, the gear in question should be engaged with the engine stationary and the clutch pedal operated briskly up and down, when the slip should be eliminated. Normally, this is all that is required to deal with this slip, but in the event of this adjustment failing to overcome the trouble, the leverage operating on that brake band should be increased.

To increase the leverage, the following adjustment should be carried out :—

(1) Unhook the spring from the pillar which encircles the automatic adjusting nut.

(2) Undo the adjusting nut one complete turn by the aid of a $\frac{7}{16}''$ B.S.F. bolt and locknut.

(3) Slacken off the locknut on the spear headed adjusting screw and turn the screw inwards from half a turn to two complete turns, when the locknut should be tightened.

(4) Replace the end of the spring on the pillar from which it was removed and after engaging that gear (with the engine stationary) pump the pedal up and down briskly.

This adjustment increases the force which contracts the brake band on the annulus of the epicyclic gear, thereby increasing its efficiency.

Should the adjustment fail to produce satisfactory results, it will mean in all probability that the gearbox has to be dismantled and new linings fitted.

Fierceness. On certain cars where the pre-selective gearbox is installed, fierceness is experienced on the lower gears, such as 1st and reverse. This is only present when the car is moved from stationary, as once it is on the move, the fierceness is no longer apparent.

This "grabbing" action is often caused by the brake being too efficient and is sometimes corrected by reducing the magnitude of the force operating on this brake.

To achieve this, it is necessary to reduce the leverage and the adjustment for this is as follows :—

(1) Slacken off the locknut on the spear headed adjusting screw of the gear in question and screw it outwards from half a turn to two complete turns, then after re-tightening the locknut, pump the clutch pedal up and down.

This pumping of the pedal together with the adjustment of the spear headed screw, results in the automatic adjusting nut being tightened down so that the lever bar does not rise so high in its lift and therefore reduces the leverage on that particular assembly.

This produces a much smoother application of the brake and eliminates the "grab" or fierceness which was previously present.

The minimum adjustment of a spear headed screw is half a turn out, and the maximum should not be greater than two complete turns.

If this adjustment fails to produce satisfactory results, the oil should be drained from the gearbox and replaced with an oil known as **Motorine "D" de Luxe.** This oil produces a greater initial slip than the original and is very often sufficient to overcome the fierceness complained of.

Sticking in Top Gear. The top gear engagement in the pre-selective type of gearbox is by means of a cone clutch incorporated in that unit.

Occasionally, this cone sticks in and fails to disengage, especially when the car is brought to rest whilst top speed gear is engaged.

If the driver of the machine would engage neutral whilst the car is on the move and prior to coming to rest, this sticking in of top gear would not be experienced.

An adjustment for this peculiarity is recommended by the manufacturers of the gearbox and this adjustment consists of partially slipping the top speed clutch with the handbrake in the "on" position. A certain amount of intelligence should, however, be displayed in carrying out this, as the lining of the cone clutch may quite conceivably be burned out or considerably damaged if this slipping is carried to excess. The adjustment to decrease the leverage (see "Fierce Engagement") can often be carried out with satisfactory results and it would perhaps be advisable to try this adjustment before slipping the clutch.

Failure to engage Top Speed Gear. It is very important when a pre-selective gearbox is fitted to a car, that the control lever for engaging gear adjacent to the steering gear is synchronizing with the camshaft lever on the gearbox casing, or difficulty will be experienced in engaging one or more of the gears.

It sometimes happens when rear road springs of a high camber are fitted, that this synchronization between the two levers is lost through the road springs settling down. Under these circumstances the gear engagement which appears to be most affected is that of top gear and the method which is recommended for its correction is as follows :—

(1) Place the car on a level surface.

(2) With the engine stopped, select and engage one of the gears.

(3) Detach from the camshaft lever on the gearbox the rod connecting with the control on the steering wheel.

(4) Carefully place the camshaft lever so that the spring loaded ball is in the correct recess on the segment in accordance with the gear engaged.

(5) Re-affix the connecting rod to the camshaft lever and adjust the rod for length by means of the screwed yoke, until the hole in the yoke is in line with the hole in the lever, then insert the link pin.

After this adjustment has been effected, no difficulty should be experienced in engaging any of the gears, as it will be found that the camshaft lever is now synchronized with the lever on the steering wheel control.

Failure to drive car on any gear. When a replacement gearbox unit of the pre-selective type has been installed in a car and it is found that the gearbox apparently fails to transmit the drive on the various gears being engaged, this would indicate that the "clutch pedal" controls are incorrectly assembled and that the pedal is being fouled by the toeboard.

Before the drive is transmitted through the gearbox, it is necessary for the "clutch pedal" after being depressed, to travel backwards to the limit of its movement.

If the controls between the pedal to the gearbox are incorrectly adjusted so that the pedal is fouled by the toeboard, this will be responsible for failure of the gearbox to transmit the drive.

The remedy will be fairly obvious and quite elementary and the correction of this condition may be obtained by removing the operating lever from its shaft from the gearbox and replacing it in a fresh position on the splined shaft so that when either 1st or reverse gears are engaged, there will be a little backlash between the pedal and the toeboard.

This backlash will increase in amount as the higher gears are engaged and will be at its maximum when in neutral. If, however, there is only a little backlash present on the pedal when top speed gear is engaged, there will be insufficient clearance on the pedal for the lower gears so that slip will be experienced or perhaps total failure to engage the gears in question.

"Clutch Pedal" too heavy. Pre-selective. Where the pre-selective gearbox is fitted to a car which is owned and driven by a lady, the operation of the clutch pedal is sometimes found to be too heavy. To lighten the action of the clutch pedal, it is necessary to withdraw the set screws holding the bracket which supports the operating shaft to the gearbox casing.

After these set screws have been withdrawn, the bracket can be swung aside and access obtained to the aperture in the casing covered by the bracket. Just inside the aperture will be found the end of a rod with a castellated nut which is split pinned in position. This split pin should be removed and the nut unscrewed a little and the split pin replaced.

The bracket which has been detached, should now be re-affixed to the gearbox and the car tested on the road.

The more the nut on the rod is unscrewed, the lighter will the clutch pedal action become, as the spring pressure is being reduced.

Whenever this adjustment has been carried out, the car should be carefully tested on the road on all gears and every care taken to ensure that there is no slippage taking place.

Should slip be experienced on one or more of the gears, it means that either the spring pressure has got to be restored again to its original, or else the leverage operating on the gear assemblies have to be increased (for this adjustment see "Slip").

This adjustment for lightening the operation of the "clutch pedal" is one which should only be adopted as a last resource, owing to the tendency to cause slip when one or other of the gears is engaged.

If this slippage is allowed to go on unchecked for any period of time, it will, in all probability, result in the burning out of the brake linings necessitating the gearbox being entirely dismantled for the necessary reconditioning to take place.

BENDIX BRAKES.

Brakes Inefficient. The most common cause for brakes becoming inefficient is the natural one that in time the brake shoe linings wear.

When this occurs, the clearance between the shoe and the drum becoming greater produces a less efficient action by the brake, and the greater the amount of wear, the less efficient the brakes become.

On each shoe assembly there is provided an adjustment for restoring the efficiency of the brake by opening the shoe until the clearance between the shoe and the brake drum is similar to the original when the car was new. This clearance amounts to .008″ measured at both ends of each shoe lining, between the shoe and the drum.

Generally, however, all that is necessary to do when the brakes become inefficient is to carry out the adjustment provided on each assembly.

To simplify matters, the original adjustment of the brakes can be carried out in the following manner :—

(1) Place the handbrake in the "off" position.

(2) Turn the adjuster of each shoe assembly until the shoes open and bind the drums.

(3) Come back six notches on the front shoe adjustment and eight notches on the rear shoe adjustment.

Finally a road check is advisable to ensure that the brakes are balanced.

Should the car have covered a large mileage so that the brake linings are practically worn out, this adjustment may not effect any improvement. It will, therefore, be necessary to fit new shoes which have been lined and specially ground to fine limits, so that the best results may be obtained. This adjustment previously outlined, applies to those assemblies which are fitted on the 1935 "Nine" and "Ten" models.

Eccentric Stop Adjustment. 12 h.p., 16 h.p. and 20 h.p. On the larger machines, there is an additional adjustment consisting of an eccentric stop, which takes the form of a cam and supports the top shoe of each brake assembly. It is placed through a hole in the backing plate and is prevented from turning by tightening the locknut.

Owing to the increased size on these larger models, there is a tendency for the shoes to hang down so that the lower shoe rubs on the brake drum.

The insertion of this stop underneath the top shoe prevents this possibility however, and keeps the relationship between the shoe and drum constant whilst the brakes are in the "off" position.

When these brakes become less effective through wear of the shoe linings, the efficiency of the brakes can once more be restored by operating the eccentric stop.

To do this, slacken off the locknut and rotate the eccentric stop in a forward direction, as this action lifts the top shoe and brings it closer to the drum. The rotation of this eccentric stop should be continued until the top shoe contacts with the brake drum, when the stop should be slackened off just a little to permit the brake drum to revolve without contacting with the shoe, when the lock nut on the eccentric stop should be re-tightened.

The original brake shoe adjuster should then be rotated until both shoes bind hard against the drum when it should be slackened off six notches on the front and eight notches on the rear brakes.

Brake Knock. Difficulty experienced with the Bendix Brake is more often than not due to neglect of the lubrication. The conduits which carry the brake cables are packed with grease sufficient for 10,000 miles running, after that, they should be disconnected and fresh grease forced into the conduits on those models that have no grease nipple provided.

Most 1935 machines have this grease nipple so that adequate lubrication can now be inserted without the necessity of dismantling the cable.

This neglect of the lubrication causes the cables to stick in the conduits so that the primary shoe does not return to its position of rest on the anchor pin when the brakes are "off." When this happens, a terrific knock is experienced from the brakes when they are brought into operation. The action is so powerful that the car may dart across the road and even if the action is not particularly violent, it is almost impossible to get a balanced brake under these conditions.

Seized Cross Shaft. Another point which also requires examination is the brake cross shaft to which the cables are attached. This cross shaft has been known to partially seize in the bearings so that similar symptoms were experienced as occurred when the cable was sticking in the conduits.

When the cross shaft seizes and does not return freely to the "off" position, the primary shoe does not come back to rest on the anchor pin in the assembly. Under these circumstances, the rocker shaft bearings should be cleaned with a wire brush which has been saturated in a mixture of paraffin and oil and every effort made to ensure that it is free to revolve in the bearings.

Cable Adjustment. To obtain the best results from the Bendix Brakes, it is very important that the cables are correctly adjusted and great care is taken with regard to this operation when the car is assembled as new.

It is very seldom that any alteration to the cable adjustment be necessary and generally speaking, it is inadvisable for any alteration to be made to the cable unless the operator concerned is fully familiar with this brake mechanism.

On rare occasions, a car may be found which, although comparatively new, is giving trouble through the adjustment of the cables being incorrect and in the event of a case of this description arising, the following procedure should be adopted for its correction :—

(1) Put the handbrake in the "off" position.

(2) Disconnect each of the four cables from the brake cross shaft by withdrawing the various link pins.

(3) Screw up the adjuster on each brake assembly until the shoes open and positively bind the drum.

(4) Pull the cables towards the cross shaft and adjust them for length by means of the screwed yokes, so that when the hole in the yokes are in line with the hole in the brake cross shaft levers, the link pins can then be inserted.

(5) Slacken off each of the two adjusters on the front of the car six notches and eight notches on those at the rear, when it will be found that a very efficient brake will be obtained, provided the various brake shoe assemblies are in good condition.

Oil in Brake Shoes. When brakes are found to be inefficient and there is indication of oil on the brake shoes, it will be impossible to obtain satisfactory braking whilst the shoes are in an oily condition.

If it is a question that oil is leaking out from the rear axle casing and finding its way on the brake drums, it will be necessary for this to be corrected before any adjustment can be carried out on the brakes.

If only a small quantity of oil is present in the brake drum, it may be possible to once more attain an efficient brake by removing the oil, and if so, this oil should be removed with the aid of petrol and not paraffin, as the latter has a detrimental effect upon the lining of the shoes.

Should, however, the shoes be saturated with oil, new shoes complete with linings should be obtained, for experience shows that once this type of lining becomes impregnated with oil, it is of very little use afterwards so far as braking is concerned.

In addition to replacing the shoes, the necessary adjustment should be given to the rear axle to overcome the leakage of oil, or defective braking will once more be experienced.

On the **16 h.p. Avon,** 1935 model, there is fitted a brake assembly identical to that which is used on S.S. Cars. These assemblies are inter-changeable, but owing to varying wheel-base lengths, different mounting holes are provided on the backing plate.

Those which should be employed on **Avon** Cars are indicated by the letter "A" and the letter "S" indicates the holes required on S.S. machines. The important point here is that if the holes with the letter "S" are engaged on mounting the brake assembly to an **Avon** car, there is bound to be difficulty experienced with the brakes, owing to the short length of cable. Under these conditions, a very violent action may be experienced in the brake assemblies, sufficient sometimes to smash the brake shoe.

Great care should therefore be taken when erecting an assembly of this kind to see that the correct holes are employed.

LUVAX SHOCK ABSORBERS.

In recent years, considerable improvement has been effected in the springing of the modern motor car and it is generally known that with the perfectly sprung car the amount of movement due to road irregularities transmitted to the passengers is reduced to a minimum. The increasing road speeds available with modern cars renders the attainment of this ideal a matter for extensive technical work, and from a practical aspect, certain changes are very apparent by the large majority of cars using hydraulic shock absorbers.

Hydraulic Type. Advantage is taken of the incompressible nature of liquid, thus rendering the damping capacity both smooth and progressive. With Luvax, the action is progressive to an infinite point, due to the constant orifice method control. The efficiency never varies, all working parts being totally enclosed in oil, a reserve supply being available thus reducing the attention to a minimum. Other advantages include a large angular movement giving a high damping capacity, silence in operation, constant capacity in all weather and conditions, etc.

The variety and degree of control it is possible to obtain by hydraulic methods are very wide in their scope and it is interesting to note the changes made on Standard cars.

In 1931. Single acting on all models fitted with Luvax.

In 1932. Single acting on all the 20 h.p.

Double acting on all 9 h.p. and 16 h.p.

In 1933. Double acting on all models.

In 1934/35. Double acting on all models.

The difference in spring design accounts for the gradual change from single to double acting, the increased length and more flexible nature of the latest springs necessitating more damping in both directions. It is in this respect that the constant orifice principle of control employed by Luvax wherein the amount of damping increases with the speed of the blow, has great advantages over alternative arrangements, wherein the orifice is varied either by providing a spring release loaded valve or other methods. With the constant orifice, full advantage is taken of the hydraulic law that the resistance increases proportionately to the square of the blow.

1933 Type	S.A.	Timing		1934 Type	Timing	1935 Type	Timing
L.9.	2RAV4—5	6S	Front	2RAV4—5	8S	4RAV6	8S
,,	2RAV4—5	10S	Rear	2RAV4—5	8S	4RAV6	8S
L.12.	2RAV4—5	6S	Front	Not Made.			
,,	2RAV4—5	10S	Rear	,, ,,			
B.9.	AV4/LH—RH	6S	Front	,, ,,		4RAV6	8S
,,	AV4	8S	Rear	,, ,,		4RAV6	8S
B.12.	AV4/LH—RH	6S	Front	,, ,,			
,,	AV4	8S	Rear	,, ,,			
10 H.P.	Not Made		Front	2RAV4—5	8S	4RAV6	8S
,,	,, ,,		Rear	2RAV4—5	8S	4RAV6	8S
12/4 &	,, ,,		Front	AV10/LH—RH	6S	AVR10	6S
12/6	,, ,,		Rear	AV10/LH—RH	10S	AV4	10S
16 H.P.	AV4/LH—RH	6S	Front	AV10/LH—RH	8S	AVR10	8S
,,	B1	8S	Rear	B9	8S	BR9	8S
20 H.P.	BV4	8S	Front	BV10	8S	BVR10	8S
,,	B1	10S	Rear	B9	10S	BR9	10S

In principle, all types of Luvax shock absorbers incorporate their many desirable features, but the construction is subject to variation as follows :—

A, AV, B and BV types. The circular working chamber with the rotor in position is divided into two by the reacting block which accommodates the adjustable constant orifice, and in the case of a single acting unit, the non-return ball valve. In operation, the side of the reacting block to which the rotor vane is moving, is the high pressure and its opposite the low pressure.

Incidentally, the work absorbed by the fluid in its enforced passage through the reacting block valves is represented by its temperature rise which is well in excess of any normal atmospheric reading and due to this characteristic, the action is constant, irrespective of the outside temperature changes. This quality is double ensured by the presence of an outer jacket of fluid carried as a reserve in the

recuperator chamber, encircling the working chamber and between the two, valves and air passages are provided, at the lower and upper points which automatically make good the loss of any fluid or allow for the escape of any air, into or from the working chamber.

Adjustment is made by means of a screw valve, the head of which is revealed by the removal of the filler plug. Turning in a clockwise direction restricts the area of the constant orifice or vice versa, thus increasing or decreasing the setting. This adjustment is extremely sensitive, and if making adjustments, these should not exceed a quarter of a turn before trying the effect of each on road test.

Fluid. The correct fluid level is to within $\frac{3}{4}''$ of the top on A and B types, but providing the level is not allowed to become so low as to expose the recuperating valves at the lowest point in the chamber, damage is not likely to ensue. Luvax fluid for "topping up" purposes is supplied in special tins containing one pint, which amount is sufficient to fill completely four A type units, or alternatively, the recuperator chambers of four B type units.

POSSIBLE TROUBLES.

Leaks may emanate from one or all of the following three points—Cover, Gland, Base.

Cover leaks are due invariably to overfilling and the remedy is obvious.

Gland leaks may be due to dry conditions, entry of grit, or presence of foreign matter and overtightening of the cap which will result in rapid wear of the rotor spindle. Gland leaks with new cars are likely to be due to the gland ring not having "bedded in" and reasonable time should be allowed for this process before attempting to rectify.

On those units which are fitted to the 1935 machines there has been incorporated a modified form of gland washer which consists of "a tight rubber" forced over the spindle and into the housing provided in the body of the unit. This arrangement has proved very satisfactory and despite the fact that no adjustment is provided, very little oil leakage is experienced at this point. In the event however of it arising, the unit should be returned to the manufacturers for re-conditioning.

Leakage from the base can be rectified efficiently at the Works and it is not advisable to attempt to rectify matters in any other way.

R.A. Types. With these types, the working and recuperator chambers are housed in approximately the lower and upper halves of a single outer casing. The recuperator chamber is assembled into the outer case and is provided with four ball type valves which are specially constructed to perform the double action of recuperation. This chamber occupies the position of the reacting block of other types and the transfer passage between the high and low pressure sections of the working chamber, is between the rotor stem and the inside of the recuperator chamber, and for this purpose, this side of the chamber is of a flexible nature.

Due to the construction described, it is interesting to note that whilst the angular movement of the lever arm is ample for all requirements, it is not as extensive as that available with the A and B types. In this respect, care should be taken when assembling RAV4 and 5 type units.

These have an inclined base making them right and left hand and if they are fitted in their wrong places, the rotor vane may come in contact with the recuperator chamber. Another feature is the presence of free movement due to the ripple action of the recuperator valves, and this should not be confused with air in the working chamber.

Fluid. The correct fluid level with RA type units is to within $\frac{1}{4}''$ from the top of the recuperator chamber, and one pint of Luvax fluid is sufficient to refill entirely four of these absorbers.

POSSIBLE TROUBLES.

Apart from leaks at the base and gland, already described, and which apply generally here, the only other point is the filler plug. This may primarily be due to overfilling, but should it continue after checking the level, it is possibly due to a breakdown in the recuperating valves and should be returned to the Works for attention.

Before concluding the question of general troubles, the presence of free motion in the action of the RA type has been mentioned, and if it is the opinion that the trouble is more serious (e.g. air in the working chamber which cannot be expelled by refilling and operating), the valves may have become clogged and ceased to function, which trouble may be experienced on all types, and in such cases a repair at the Works will be necessary.

Entry of road grit, etc., when "topping up" accounts for such trouble.

POSSIBLE SERVICE COMPLAINTS.

Loose Lever Arms. Trouble of this nature indicates a harsh or overloaded setting and should be attended to accordingly. Also make sure that the respective flats on cotter and spindle have been in correct engagement. Lever arms should not be too tight a fit on the spindle, to avoid the latter possibility, and when fitting a cotter, care should be taken not to produce a clearance between the bore and diameter of the arm and spindle on the arm side, or that the shoulder of the cotter at the screwed end does not protrude through the lever arm boss. In the latter case, the flat on the spindle is probably worn and to rectify this, an oversize cotter will be required. Such cotters are available to the following part numbers :—

9011/30 for A and RA types
9012/30 for B types

and it is essential that none other than these are used for the purpose outlined. They are machined specially and case-hardened and the use of any normal standard type cotter will not give satisfactory service.

Lever Arms. Breakages of this part are a sure sign that the setting needs attention and before fitting a replacement, check this to the best of your ability making sure that there is nothing wrong with the action of the unit. On early models, these arms were of lighter section than those at present produced, but the increased section is not connected with an increase in strength, which has been found to be the conclusion drawn in certain instances. The steel used in the varying sections is of different nature, that at present in use being to facilitate cranking and when correctly normalised, the ultimate strength is approximately equal.

Timing. When checking the timing, the question arises as to what this actually consists of. A mechanic who is engaged on this class of work regularly, can often gauge the timing very closely by hand operation, but some brief details of how the units can be set will be useful no doubt.

A vertical plate suitably drilled to take all fittings is mounted to enable a weight to be hung from a suitable lever on the rotor spindle. Rigid stops are provided which limit the arc of movement to 100° (i.e. 50 degrees above and below the horizontal). The time taken (expressed in seconds) for a fixed load to operate the absorber through this angle is fixed by the Experimental Department of the makers concerned, in conjunction with J. Lucas Limited, which is taken at an oil temperature of 65° F.

The standard loads used for this purpose are as follows :—

For A and RA types	100 inch lbs.
For B types.	200 ,, ,,

Balancing. More important if anything than obtaining the correct setting, is to be certain that the units are balanced correctly, failing which, unsatisfactory results will follow. To check this definitely, the unit must be removed from the car and timed individually. This, however, is not always possible (customer in hurry, etc.) and to check the

balance approximately, get the car over a pit, and disconnect bottom pins. Next, with lever arms in similar position and taking hold of an arm in each hand, lift yourself clear of the ground for a couple of seconds and release hold simultaneously. Then note if either of the arms has moved through a smaller angle than the other and if so, balance that one to suit.

The use of Luvax fluid is essential for "topping up" purposes to ensure the correct working of these absorbers, the main reasons for this being :—

That the change in viscosity over a large range of temperatures is as near constant as it is possible to produce.

There are no solids (i.e. fats etc.) in suspension likely to clog or congeal the automatic valves. Its capacity to stand up to continual "hammering" and retain its initial viscosity over very extensive periods. Its high viscosity giving large damping capacity in relation to the size of the unit.

Excessive body roll on corners. Whenever it is found that the body rolls excessively when turning corners, especially at speed, it is an indication that the shock absorbers are out of adjustment. An examination should be made of these units to ensure that each one is working correctly and that there has been no failure of any of the units.

An examination of the oil level should be made and if there are any traces of oil leaks at the rear of the instrument, it should be returned to the manufacturers for re-conditioning.

Attention should also be directed to the lever arms on the shock absorber spindle to ensure that the cotter pin is tight and there is no lost movement between the spindle and the lever. The connecting links and rubbers should also receive attention for in the event of there being lost movement between the axle and the shock absorbers, it will result in excessive body roll.

Car wanders on road. When it is found that a condition of instability is experienced at the front of the car when driving at speed, the most likely cause for this is that the shock absorbers are out of balance, and it is towards these units that attention should first of all be directed when this condition arises.

The operation which has been previously referred to (see "Balancing") should be carried out and if adjustment fails to correct the balance of these units, the defective ones should be removed and returned to the manufacturers for repair.

ROAD SPRINGS.

Car down on offside. It has been observed that on certain 12 h.p. 1935 machines there is a tendency for the car to list to the offside and when this condition arises, the following modification should be adopted for its correction :—

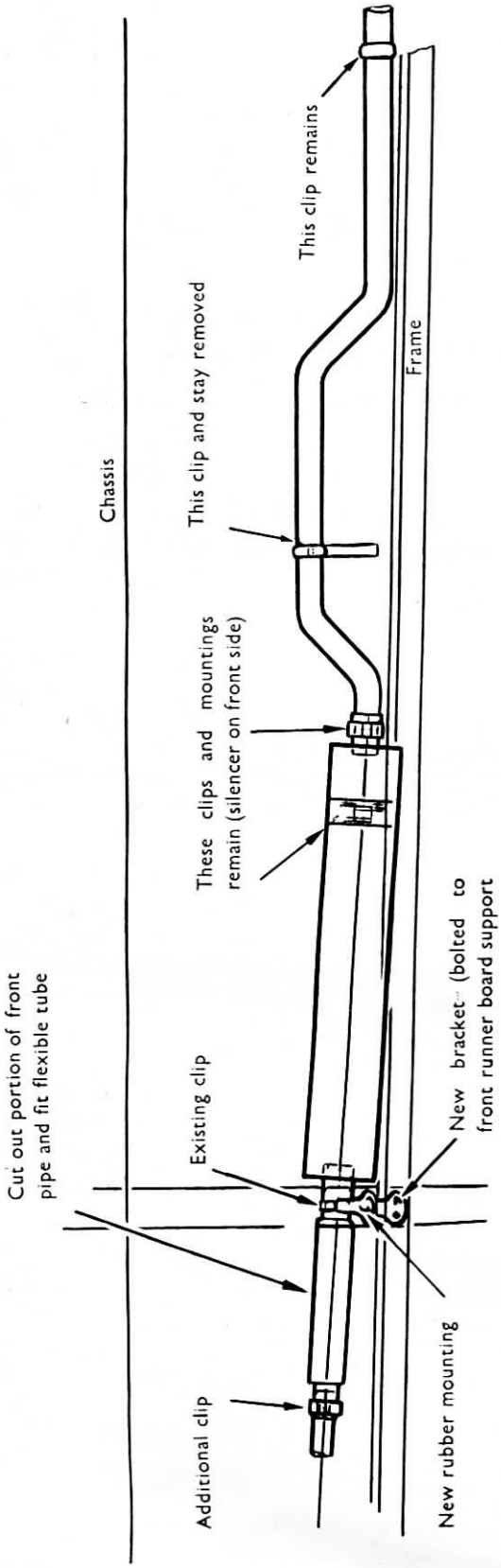
No. 3 leaf from the bottom of the nearside rear spring to be removed and scrapped (see sketch showing details of this alteration). No alteration whatever has to be carried out to the offside spring. This removal of the spring leaf from the nearside rear road spring compensates for the additional loading to which the offside spring is subject and the result is that the car no longer leans towards the offside.

Bump from rear springs, 9 h.p. and 10 h.p. On the 9 h.p. and 10 h.p. machines, the chassis frames are what is described as being "underslung." This means that the frame passes beneath the rear axle instead of the usual orthodox method of going above the axle.

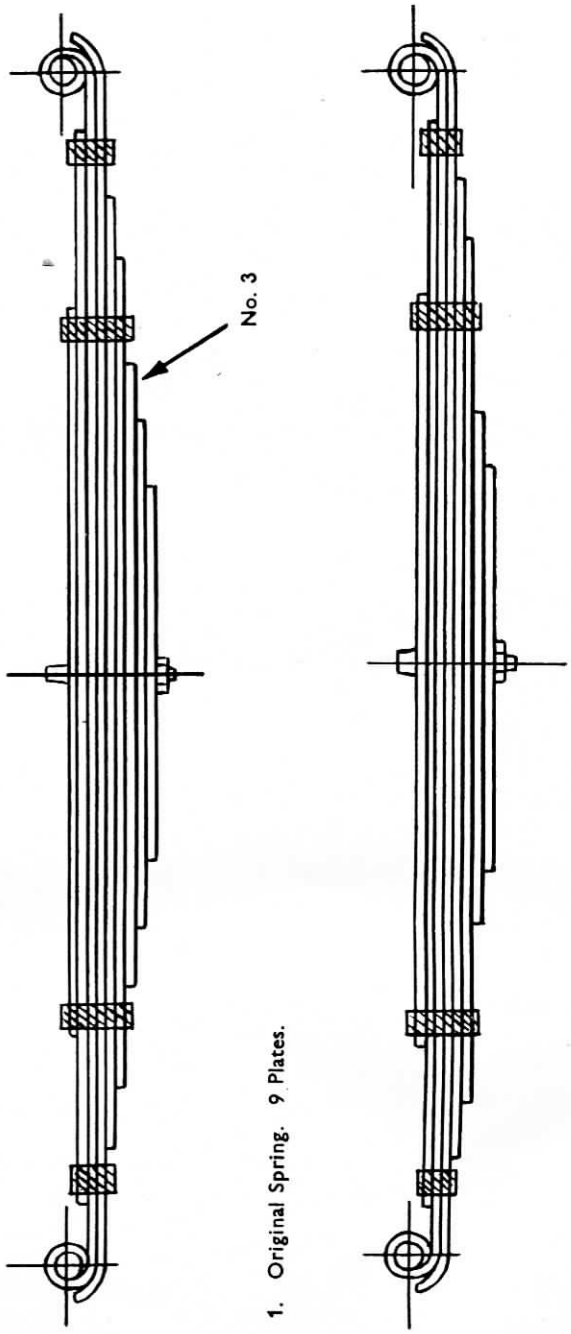
When the frame passes beneath the axle casing, the amount of clearance between the casing and the frame is comparatively little, especially if only one person is in the car and under certain road conditions, it is possible for the frame and the axle casing to make contact with each other.

To prevent the possibility of this, rubber pads are placed on the chassis frame, but despite this, a bumping sound has been

MODIFICATION TO EXHAUST SYSTEM R 12 H.P.



MODIFICATIONS TO R 12 H.P. REAR SPRINGS.



1. Original Spring. 9 Plates.

2. For N.S. Spring remove Plate No. 3. 8 Plates.

experienced on some machines through contact between the frame and axle. To remedy this, it has been found necessary to increase the clearance between the axle and frame by the following modification to the rear road springs—Remove the bottom spring leaf from each rear spring and place it on top of the spring with the camber the reverse way. It is not necessary to remove the springs in question, as the operation of carrying out the modification is as follows :—jack up chassis frame, remove rear wheel and loosen "U" bolts. It will then be necessary for the rear axle to be jacked up to give sufficient clearance between the top leaf of the rear spring and the axle. A cramp will be required to keep the leaves from springing apart.

The bottom leaf should then be placed on top of the top spring with the camber reversed, then the centre bolt should be refitted.

Fitting of replacement road springs. All road springs fitted to Standard cars have incorporated in the spring eyes a fitting known as a silent block bush.

Both rear springs have silent block bushes in each spring eye, but the front road springs have a silent block bush in the rear eye of the spring only, for in the front, there is incorporated the original bronze bush.

The reason for fitting the bronze bush at the front of the front spring is the fact that it is accessible for lubrication and moreover provides a degree of stability which would be absent were a silent block bush used at this point.

With regard to fitting a replacement road spring, there are certain precautions which have to be taken in this connection. These precautions consist of seeing that the rubber of the silent block bush is in its **neutral** position when the shackle pins are finally tightened up. This neutral position is when the weight of the body is on the road springs.

The procedure would be, in the event of fitting a replacement road spring, for the original one to be removed and the new one then attached to the chassis frame by means of shackle bolts, but before tightening these bolts, the weight of the body should be allowed to come down on the spring and then only should the shackle bolts be firmly tightened. As the rubber in the silent block bush moves radially to compensate for spring movement, it is essential that this radial movement of the rubber should be equal in both directions and it is therefore necessary to ensure that the silent block bush is in what may be described as the neutral position when the shackle bolts are finally tightened.

Loose road wheels. Occasionally, we receive notification either from an agent or from an owner of a Standard car, to the effect that one of the road wheels has been discovered to be in a loose condition so that the bolt holes have become elongated.

An examination usually reveals the fact that the wheel in question has, since leaving the Works, been removed, generally by the owner for the purpose of lubricating the hub bearing and on replacing the wheel, the wheel nuts have been insufficiently tightened so that the wheel has eventually become loose.

If the car is driven for any distance with a loose wheel, there is a grave possibility of it coming right off and the importance of adequately tightening the wheel nuts cannot be too highly stressed. Moreover, care should be taken to ensure that when replacing the hub nuts the threads on the studs are not damaged or stripped, as in this event, the wheel is bound to come loose sooner or later.

A loose road wheel, however, can very quickly be detected by the driver of the car, for on sharply accelerating or decelerating, a knock should be experienced from the wheel, which when detected should receive immediate attention.

COACHWORK.

Door check strap broken. The replacement of a door check strap, especially on the front doors, is a comparatively simple matter.

To obtain access to the fixing screws on the centre door pillar, it is necessary to insert a

lever beneath the trimming strip on the centre pillar and force it upwards about 1″ when it can be swung aside. The screws retaining half of the broken check strap can be undone and that part of the strap removed. The other portion of the check strap, which is behind the door trimming piece, can be extracted by the removal of three wood screws, which secures the lower end of the trimming piece on the door. On removal of the broken check strap, a new one can be inserted, secured in position and the trimming pieces on the door and the centre pillar then replaced in position. On the rear doors, the operation of replacement is not quite so easy, as the check strap in the door is placed behind the door lock plate and it is necessary for this plate to be withdrawn before the check strap can be removed.

The operation necessary is as follows :— Remove both interior door handles by pressing backwards the spring loaded cups on the spindle behind the handle. This will disclose a hole with a retaining pin, which should be driven out and the handle can be removed.

The door trimming piece has now to be withdrawn and this can be achieved by removing the three fixing screws at the lower end of the trimming and then forcing the trimming piece upwards about half an inch, when it can be lifted away.

The polished metal frame around the window and the door capping rail should next be removed, then withdraw the screws holding the lock plate to the framework of the door, when the broken portion of the check strap in the door can be removed and the new one inserted. The other half of the broken check strap is secured by metal screws behind the trimming on the rear quarter panel and this trimming has to be undone before access can be obtained.

When the two halves of the check strap have been removed, the new one can be secured in position and the various parts on the door and quarter panel replaced.

As the check strap passes through a slot in the metal framework of the body, it is advisable when a check strap breaks, to examine the slot to ascertain if there are any sharp edges which may contribute towards cutting the strap and in the event of such being the case, the metal at that point should be smoothed out with a file to reduce the cutting action as much as possible. At one end of the strap there is placed a piece of metal which acts as a stop and controls the extent to which the door may be opened. Occasionally, on 9 h.p. machines, a knock or rattle is experienced through this metal piece vibrating against the body. In cases of this kind, the noise may be eliminated by placing a piece of rubber around the metal stop or binding it with a piece of adhesive tape.

Roof leaks at centre. To prevent water entering the roof of a car, a drain channel is formed at the front and extends backwards on both sides to a point beyond the opening in the roof.

The rear portion of the roof is covered with a fabric material which is waterproof and the two tab ends of the metal channelling overlaps this fabric material and is bedded down with a composition known as Dum Dum putty to make a watertight joint.

If insufficient care is taken in making this joint, it will not be watertight and consequently water will enter the car at that particular point.

The remedy is to remove the sliding roof and withdraw the three screws from the tab end of the metal channel and force the end upwards, then insert between the fabric at the end of the channel, some form of sealing compound and re-screw the tab end of the channel back in position.

The end of the channel should be gently tapped with a light hammer so that it is as flat as possible.

If water is entering at one point only, say the offside of the car, then the tab end of the channel on the offside should only be adjusted. No useful purpose will be served by altering the one on the nearside if it is already watertight.

Water leaks at front. Sometimes water enters through the tab end joint and runs forward to the front of the car underneath the metal channel and drips down close to the windscreen.

This happening is likely to be very deceptive, as a considerable amount of time may be spent in examining the roof of the car at the front for the purpose of tracing the water leak, whereas it is really entering the tab end joint of the metal channel at the centre of the roof.

As this is the most likely point for leakage to occur, attention should be directed first of all to the joint formed by the tab ends and if there is any doubt, the joint should be re-made in the manner previously described (see "Roof leaks at centre").

Occasionally however, the water leak at the front of the roof may actually be caused by a track in the weld of one of the front drain cubes of the metal channel. Where this happens, it necessitates the removal of the metal channel and re-welding, or alternatively, replaced with a complete new one.

Another point where water can enter the front of the car is where the two front drain tubes are soldered to the body panel. Over the end of each of the two front drain tubes, there is placed a chromium plated cover and owing to wind pressure which is created at the front of the car when the car is on the move, it is necessary that there should be no opening adjacent to the drain tubes, for water would be forced into the interior of the car. It is for this reason that the end of the tubes are soldered to the body panel, but on rare occasions, this solder has been known to break away and form a crack through which water has been forced by the pressure of air.

Where a condition of this kind arises, the chromium plated cover should be removed from the end of the drain tubes and the joint between the tube and the panel refilled with solder.

Just above the windscreen at the front of the car there is a metal strip mounted horizontally, which is bedded down on a sealing compound and bolted in position.

If sufficient care is not taken in inserting sufficient sealing compound to make a good joint, it is possible for water to enter the car through this medium.

In the event of it occurring, the metal strip should be removed and the joint re-made with some form of sealing compound.

The composition which is used at the Factory in this connection, is known as Dum Dum putty and a quantity of same may be obtained on application to our Spares Department.

Roof leaks at rear. Placed in a horizontal position at the rear of the fixed portion of the roof are two drain tubes, one at each side.

These drain tubes are similar to those at the front with the exception that each one is retained in position by three wood screws. The end of the pipe which is held by means of screws, is placed on top of the fabric material which covers the rear portion of the roof, and it is important that the joint between the two should be perfectly watertight, and here again the use is made of Dum Dum putty.

Should water enter the interior of the car at a point adjacent to where either of these rear drain tubes are secured, an examination must be made of the joint between the drain tube and the fabric material of the roof and every effort made to ensure that it is perfectly watertight.

The sliding portion of the roof is itself very seldom affected in connection with leaks, but occasionally it is discovered that for some reason or other, one or more of the wood screws which holds the sliding roof rails in position are missing so that water enters the interior of the car through the holes provided for the missing screws.

Should either of the rails of the sliding roof be removed, they should on being replaced, have a layer of some sealing compound between the fabric cover and the metal rail, as this is a further precaution against water entering the interior of the car.

Windscreen leaks. The most common cause of water entering the car through the

windscreen is due to the rubber edging being dislodged or having deteriorated.

Attention should therefore be given and new rubber fitted if necessary.

Care should be taken to see that the piece of rubber placed at the top of the screen is sufficiently long so that there are no appreciable gaps at the screen pillar through which water can be forced into the car.

There is a tendency also for the side rubbers on the windscreen frame to be forced downward from the hinge, so that a gap is present between the rubber and the hinge at that particular point.

With the latest type of windscreen wiper which is fitted on the 10 h.p., 12 h.p., 16 h.p. and 20 h.p. machines, there is a possibility on closing the windscreen to trap one of the windscreen wiper blades so that the screen does not close properly and might conceivably become distorted. Care should therefore be taken when closing the windscreen to provide against this possibility.

On rare occasions, it may be discovered that water enters between the glass and the windscreen frame and it can be corrected in some cases by the use of putty being inserted between the glass and the frame.

In the event, however, of this being unsuccessful, the glass should be removed from the frame of the screen and refitted, or alternatively, a new windscreen complete should be obtained from the Service Department.

Water enters through cubby holes. When water enters the cubby holes, or pockets, in the dash panel, the first point which should receive attention is the fit of the "manhole" examination covers on the dash board extension. As there is a possibility of a certain amount of water penetrating through the rear bonnet hinge and then running down the dashboard extension, it is necessary that the "manhole" cover joint should be watertight or water will enter the cubby holes.

Another point is the joint between the dash panel and the extension of the dash. This is built up of a series of spot-welds and occasionally a gap will be found between the points where spot-welding has taken place.

In the event of there being a heavy rainfall, it is possible for water, which may get underneath the bonnet, finding its way through the gap in the joint between the dash panel and its extension. The remedy would be to close up the gap either by hammering, soldering or welding, whichever is most convenient.

On the 1935 models, complaints of this kind are comparatively rare, but on the 1934 machines, this complaint was more common owing to the type of bonnet hinge then in use. With the old type of hinge, water was able to pass freely through it, so much so, that in heavy rainfall, the amount of water accumulating around the sparking plugs was sufficient to short circuit the ignition and thereby stop the engine.

The new type of hinge which is now in use is practically watertight and very few complaints of this nature are experienced.

The remedy with the old type of hinge to prevent water entering is to weld the open part of the hinge on the underneath side of the bonnet, thereby preventing the passage of water through it.

Draughts through doors. To prevent draughts entering the car, draught strips consisting of rubber-covered material are placed at the top and sides of each door and special care is taken with regard to the fit of the floorboards, carpets, etc., to prevent draughts coming in that way. Where the pedals pass through the toeboard, rubber covers are provided to reduce the inlet of air to a minimum.

Should draughts, therefore, be experienced in the car, attention should be directed to the fit of the draught strips, floorboards, rubber covers, etc. It is, however, important that the draught strips at the sides and top of the doors should be as close up to the doors as possible when the doors are in the closed position.

Should they be fitted in such a manner that they are held away from the door, draughts are bound to be experienced in the car through that particular point.

Badly fitting doors. The fit of the doors has a considerable bearing upon draughts being experienced in the car, for in the event of the doors being out of centre with the aperture provided in the body frame, there is likely to be a larger gap than required at one side of the door.

Occasionally, the fact that the door is out of its correct position is due to a distorted hinge, especially the lower one, and attention should be given to this point in the event of a door not hanging correctly.

Dovetail housing adrift. This distortion of the lower door hinge allows the door to "drop" and the male dovetail on the door contacts heavily with the dovetail in the door pillar when the door is closed.

This additional stress imparted to the dovetail housing, which is spot-welded in the door pillar, results in the fracture of the spot-welding and the dovetail housing comes adrift.

To correct this matter, it is necessary that the dovetail housing must be replaced in its original position and clamped there whilst three holes are drilled through the door pillar and the flange of the dovetail housing.

The housing is then bolted to the door pillar with the aid of a $\frac{3}{16}''$ countersunk head set screw and then the parts on which the paint-work has been affected, touched up with a brush. Two screws are placed through the lower flange of the housing and one in the centre of the upper flange.

Rattle from doors. When the dovetail housing comes adrift, it ceases to support the door in a vertical plane and the result of this is that additional strain is imposed on the hinges supporting the door, which either distorts or squeaks, or becomes stiff in operation. Moreover, noise or rattle is likely to be experienced from the door when the car is driven under ordinary road conditions.

The remedy is to re-weld the dovetail housing in position (see "Dovetail housing adrift"). There is also a chatter set up from the dovetails when the dovetail box becomes dry.

When the car is new, the dovetail box is packed with a quantity of graphite grease and whilst some of the grease remains in the box, no noise from the dovetails is likely to be experienced. In the event, therefore, of chatter from the dovetails being set up, it can be corrected by the insertion of a small quantity of graphite grease in the dovetail box.

As wear eventually occurs on the door lock striking plates, it results in a rattle from the door lock. An adjustment to compensate for this wear is provided on the doors, but errors with regard to this adjustment are often made.

The adjustment consists of rubber buffers which are adjustable and the striking plate which is also adjustable, and it is a mistake to only adjust the rubber buffers outwards when rectifying a door rattle. By adjusting the rubber buffers in this manner, the door is being forced away from the dovetail support and whilst the rattle may be temporarily cured, it is likely to recur after a short time. The best way to carry out the adjustment is to first of all, slacken off the screws holding the striking plate in position and push the plate inwards to a certain extent and then tighten the fixing screws. If the door is then closed, it will be ascertained whether the striking plate is pushed in too far by the fact that the lock will not engage and the plate will have to be brought back again sufficient to allow the bolt to engage with the striking plate. The point to aim at is, that when the door is closed, the striking plate has been moved forward sufficient to enable the door bolt to engage with it but without rattle, then the rubber buffers can be brought out just enough to cause a certain degree of pressure between the bolt of the lock and the striking plate.

Windows will not wind. The improvement which has taken place in recent years with regard to the ease of operation in winding the front windows, has been brought about by the incorporation of a two-point lift in the winding mechanism. Nevertheless, the entry of grit, etc., in the window guides results eventually in the "wind-up" of the windows becoming stiff. To correct this, the insertion

of a little French chalk in the window guides is recommended.

If stiffness of the winding mechanism is caused by wear of the window guides, it will be necessary to re-pack the guides or renew them. Furthermore, there is a possibility of the teeth on the winding gear becoming burred or damaged causing stiffness thereby. In cases of this kind, the winding mechanism should be removed and replaced with a new one.

Windows rattle. When the windows rattle in their guides, it is an indication that the windows have too much free movement and are not supported rigidly enough. To eliminate this, the guides can be packed out or replaced with new ones, according to what is required.

On 9 h.p. machines, this rattle can often be corrected by providing additional fixing screws or pins to the window guides, as owing to the very large windows employed, the guides eventually "move" and allow the windows to rattle.

A further precaution against window rattle is the insertion of a piece of velvet-covered rubber beneath the door capping rail. This rubber is held in contact with the glass and prevents window movement.

In the event therefore of a window rattle, the first thing which should be done is to re-affix this piece of rubber so that it is pressing hard against the glass. Furthermore, on the framing of the door, there is placed a circular rubber disc which contacts against the outside portion of the glass and also helps to prevent rattle.

It may be necessary, in the event of this rattle arising, to pack out this small rubber disc, so that it makes positive contact with the glass.

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