The MORRIS EIGHT

SERIES "E"

SERVICE INFORMATION

III

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MORRIS

Service Information

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Power Unit Data

ENGINE (FOUR-CYLINDER, SIDE-VALVE)

Treasury rating	8.057 h.p.
Bore	57 mm. (2.24 in.)
Stroke	90 mm. (3.54 in.)
Cubic capacity	918.636 c.c. (56.7 cu. in.)
Compression ratio	6.5—1
Power output...	29.6 b.h.p. 4400 r.p.m. (Peak)
Firing order	1, 3, 4, 2
Tappet clearance	.017 in. hot
Ignition	Coil. Fully automatic
Ignition setting	T.D.C. Points .012 in. clearance
Distributor	Type A.110
Sparking plugs	14 mm. $\frac{1}{2}$ in. reach Champion L.10
Crankshaft	Three bearing. Counterbalanced
Pistons...	Aluminium alloy. 3 ring
Piston clearance	.06 mm.
Sump oil capacity	6 pints
Lubricating system	Pump, pressure fed
Oil pressure release	60 lb.
Cooling system	Thermo-syphon
Water capacity	15$\frac{1}{2}$ pints (8.8 litres)
Clutch	6$\frac{1}{4}$ in. dry plate

GEARBOX

Four speeds and reverse. Synchromesh 2nd, 3rd and top

Gearbox ratios :	1st ...	3.95—1
	2nd ...	2.30—1
	3rd ...	1.54—1
	4th ...	1 —1
	Reverse ...	3.95—1
Oil capacity		1$\frac{1}{2}$ pints

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Decarbonising and Valve Grinding

THE Series "E" 8 h.p. engine does not present any particular difficulty in the decarbonising and valve grinding operations, particulars of which are outlined below.

1. Raise the bonnet of the car and, as a safety measure, secure it with a suitable piece of cord in the open position to some convenient point.

2. Drain the water from the cooling system by means of the drain tap located on the near-side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is used it should be drained into a suitable container and carefully preserved for future use.

3. Disconnect the positive cable from the battery by slackening the $\frac{1}{4}$ in. pinch bolt and remove the cable lug from the battery terminal post.

4. Release the clips from the top water hose and separate the hose from its connections.

5. Disconnect the low-tension wire from its terminal on the side of the distributor. Remove the $\frac{1}{4}$ in. dynamo belt tension adjusting bolt and plain steel washer, and release the belt from the fan pulley.

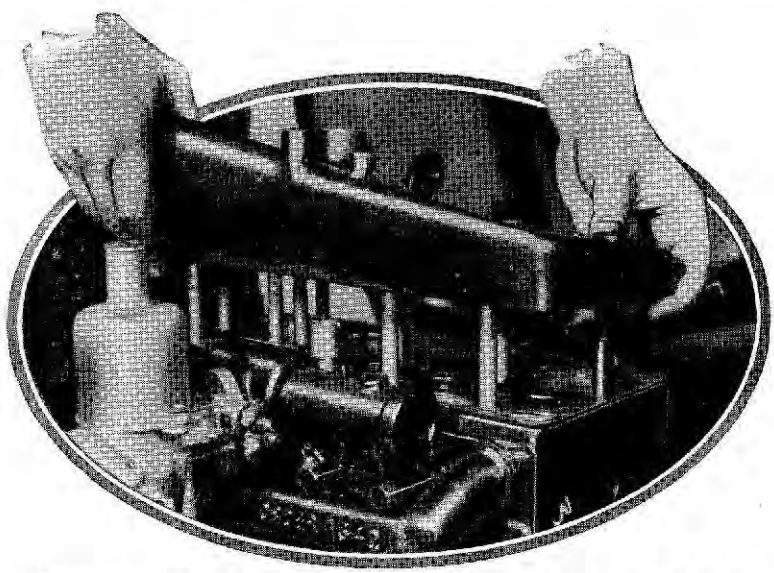
6. Remove the two $\frac{1}{4}$ in. bolts, nuts and spring washers locating the dynamo to its cradle, after which the dynamo, with its wires attached, may be laid in the tool tray.

7. Disconnect the high-tension leads from the sparking plugs and coil. Extract the lock wire from the dowel bolt locating the distributor clamp plate assembly to the cylinder head and remove the bolt. If the pinch bolt on the clamp plate assembly is not disturbed the ignition setting will not be altered. The distributor assembly may now be withdrawn from the cylinder head.

8. Remove the throttle control bracket from the cylinder head by undoing the $\frac{1}{4}$ in. set screw with shakeproof washer, and release the control from the carburetter throttle lever by slackening the $\frac{3}{16}$ in. nut.

9. Detach the air intake silencer bracket from the cylinder head by unscrewing the $\frac{3}{16}$ in. bolt equipped with a spring washer, and remove the air silencer by slackening the screw in the clip retaining it to the air intake pipe. The air intake pipe may now be removed from the carburetter by disconnecting the throttle return spring from the pipe and unscrewing the two $\frac{1}{4}$ in. fixing bolts with spring washers.

10. Undo the thirteen $\frac{5}{16}$ in. cylinder head stud nuts, slackening each half a turn at a time until they are quite free. This will avoid any tendency for the head to distort. Observe that the engine earthing cable is located under the rearmost nut. The cylinder head may now be lifted clear of the studs and placed aside for cleaning. Extract the distributor drive spindle from its housing.



The cylinder head can easily be lifted from the studs in the manner indicated.

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Decarbonising and Valve Grinding—*continued*

11. Raise the near-side front wheel clear of the ground and remove the wheel. Place a suitable stand under the front axle. Remove the wing valance inspection cover by undoing the three $\frac{3}{16}$ in. fixing bolts equipped with spring washers.

12. Disconnect the mixture control from the carburetter and separate the carburetter from the manifold.

13. Release the exhaust pipe from the manifold by removing the two $\frac{5}{16}$ in. bolts, nuts and spring washers, observing that a copper-asbestos washer is fitted between the exhaust pipe and the manifold flanges. Remove the manifold by undoing the four $\frac{1}{4}$ in. fixing stud nuts.

14. It is recommended that as much of the carbon deposit as possible is cleaned off the piston crowns, top of the cylinder block and exhaust ports before detaching the tappet cover and extracting the valves. This reduces the risk of foreign matter finding its way into the tappet chamber and thence into the engine base.

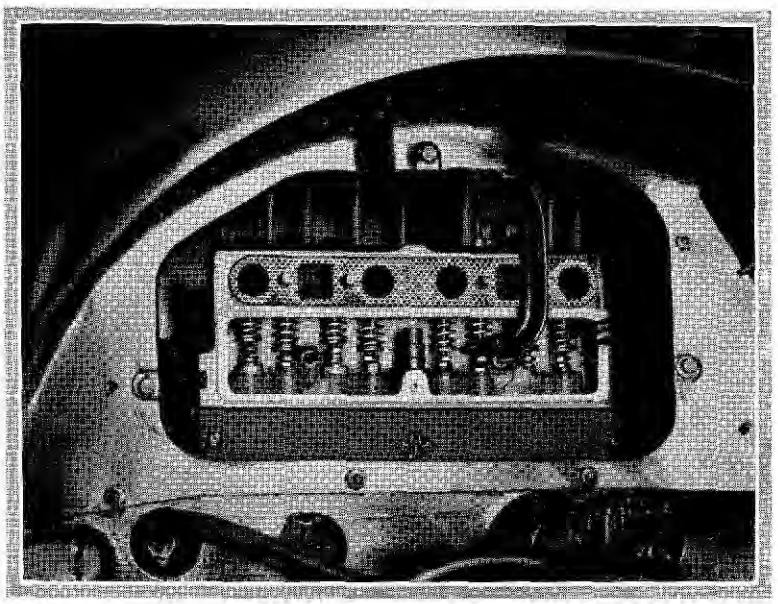
15. Where special equipment is not available for the purpose of decarbonising it will be necessary to scrape the carbon deposit from the piston crowns, etc., using a dull instrument such as a blunt screwdriver. Before commencing this operation the waterways and distributor drive housing should be plugged with clean dusters.

16. Slacken the $\frac{3}{16}$ in. pinch bolt in the clip locating the fume pipe to the tappet cover and remove the $\frac{3}{16}$ in. bolt, nut and spring washer from the pipe bracket on the clutch housing and detach the pipe. Undo the two wing nuts on the tappet cover fixing studs and withdraw the cover, observing that a fibre washer is fitted under each wing nut.

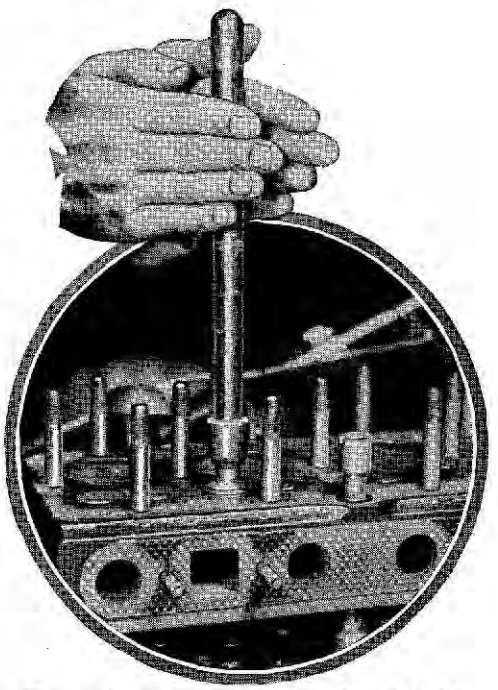
17. Remove the tappet cover gasket, noting that the two small holes are located at the bottom.

18. Before extracting the valves it is advisable to plug the two holes in the floor of the tappet chamber with clean rag to exclude the possibility of the cotters dropping into the engine base.

19. The valve cotters may now be extracted with the aid of the valve spring compressor, Part No. 38378. When the valves and springs are withdrawn the carbon deposit may be cleaned from the valve ports, and all traces of carbon removed by compressed air, or by the use of a pair of household bellows. It should be noted that the valve springs are of the variable pitch coil pattern and they should be refitted with the close coils upwards.



This illustrates the method of extracting the valve spring cotters by the use of the special extractor, Part No. 38378, through the opening in the wing valance.



The special suction type valve-grinding tool in use. The use of a light spring under the valve head greatly facilitates the grinding-in process.

Continued

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Decarbonising and Valve Grinding—*continued*

20. The valve guides, etc., should be examined for wear, and any necessary replacements installed. Each valve must be thoroughly cleaned and carefully examined for pitting, as it is useless to grind-in valves in a pitted condition. These should be refaced with a suitable grinder or, alternatively, replacements should be fitted.

21. It is likewise inadvisable to grind valves to seats which show signs of pitting or unevenness. The valve seats may be trued by the use of a special cutter, Part No. 65925. When using this tool, care should be exercised to remove only as little metal as necessary to ensure a true surface.

22. All valves, when fitted at the Factory, are numbered on their heads from one to eight, and should be replaced in the corresponding valve ports, No. 1 valve being fitted to the port nearest to the front of the engine. When replacement valves are fitted they should be numbered to denote to which port they belong. The tappet head must be slackened back three or four turns before commencing to grind in the valves, and care must be taken to see that the tappet for the valve being ground-in is on the back of its cam. Fine or medium grade carborundum paste only should be used to grind-in the valves. A light coil spring placed under the valve head will assist considerably in the process of grinding. The valve face should be lightly smeared with carborundum paste and then ground to its seat, using the suction grinder, Part No. 66893. The valve should be reciprocated on its seat and occasionally allowed to rise by the pressure of the light coil spring. This assists to spread the paste evenly over the valve face and seat. It is only necessary to carry out the grinding operation until a dull matted surface is produced on the valve seat and face.

23. On completion, the valve seat and ports should be cleaned with paraffin, and when dry thoroughly cleaned by compressed air. The tappet chamber must also be thoroughly cleaned. The valves must also be washed in paraffin, and all traces of carborundum paste removed.

24. The valves, springs, collars and cotters may now be replaced and the tappets reset to .017 in. clearance, making sure that this adjustment is carried out when the tappet is on the back of the cam.

25. This is best done by carrying out the adjustment in the following order, which avoids turning the engine round more than is necessary :—

Adjust No. 1 tappet with No. 8 valve fully open.
" " 3 " " " 6 " " "
" " 5 " " " 4 " " "
" " 2 " " " 7 " " "
" " 8 " " " 1 " " "
" " 6 " " " 3 " " "
" " 4 " " " 5 " " "
" " 7 " " " 2 " " "

26. The cylinder head is next given attention. The sparking plugs must be removed, cleaned and adjusted. The carbon deposit is scraped from the combustion spaces and the head thoroughly cleaned in paraffin, and when dry, again cleaned with compressed air.

27. The cylinder head gasket should be examined carefully and if damaged in any way it should be replaced by a new one. No jointing is required with a new gasket.

28. The gasket should be guided over the cylinder head studs evenly to avoid damage.

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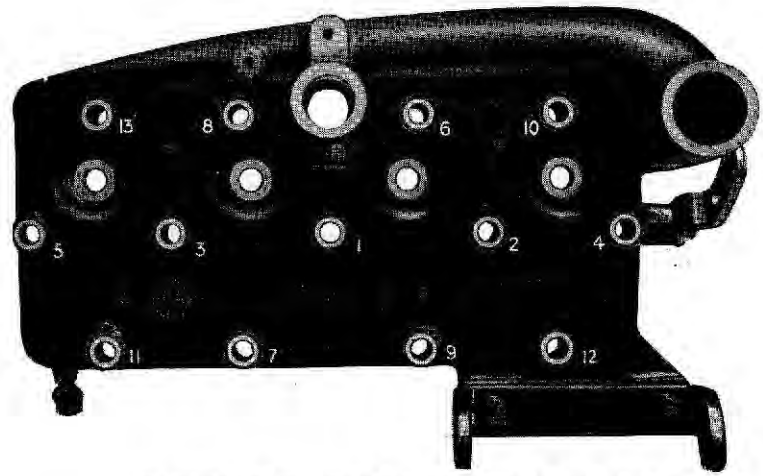
Decarbonising and Valve Grinding—*continued*

29. When refitting the cylinder head, to ensure the correct alignment of the distributor with its drive shaft, it is essential to use the special cylinder head distributor shaft alignment gauge, Part No. 39387.

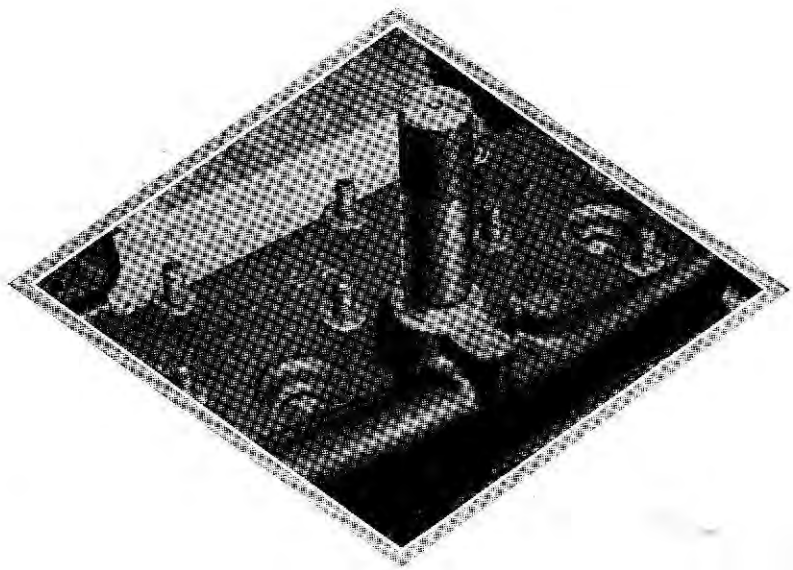
The tool engages with the distributor housing in the cylinder head and the distributor drive shaft housing in the cylinder block. When the cylinder head stud nuts have been tightened in the order shown in the illustration the tool is extracted and the distributor drive shaft dropped into position.

Reassembly of the remaining parts takes place in exactly the reverse order to that of dismantling.

30. When the engine has been run and properly warmed up the cylinder head nuts should again be tightened in their proper sequence.



Indicating the sequence in which the cylinder head stud nuts should gradually be tightened.



An alignment gauge, Part No. 39387, is essential when replacing the cylinder head.

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Removal of Engine Base and Dismantling of Oil Pump

WHEN giving attention to the internal parts of the engine, without its removal from the frame, it is necessary to raise the front of the car to enable the sump to be extracted, if a ramp or inspection pit is not available.

1. The sump is located by twelve bolts and spring washers. The two bolts at the front and the two bolts at the rear of the engine base are equipped with $\frac{3}{16}$ in. hexagon heads and the remainder with $\frac{1}{4}$ in. hexagon heads. The bolts are inserted from the underside of the sump flange, with the exception of two, these being placed at either side of the oil pump housing, and are screwed in from the top.

2. To remove the sump, raise the front of the car with lifting tackle so that the full weight of the front axle is suspended on the front springs. This will afford sufficient clearance between the axle beam and the engine base for the latter to be extracted, after the sump bolts have been removed.

3. When replacing the sump particular attention must be given to the fitting of the sump gasket and the cork seal for the rear main bearing cap, to ensure that no leakage of oil will occur between the sump and the clutch chamber.

To Dismantle the Oil Pump

1. The oil pump assembly is extracted by removing the two $\frac{3}{16}$ in. bolts and spring washers locating the pump to the crankcase and easing the pump downwards. This is accomplished without interference with the ignition timing.

2. The pump hood is detached by extracting the split pin from the fixing stud at the bottom of the pump assembly and removing the $\frac{3}{16}$ in. nut, plain steel and double coil spring and fibre washers. A fibre gasket is fitted between the pump hood and body, and if this is found damaged it should be replaced with a new one.

3. To gain access to the pump gears undo the four $\frac{3}{16}$ in. bolts with spring washers, and remove the pump base. When the filter gauze is withdrawn the gears may be extracted.

4. The oil feed from the pump is taken via the pump drive spindle housing on which is mounted the oil pressure release valve. If it is desired to give attention to the release valve this may be removed by extracting the lock wire and unscrewing the release valve plug, when the spring, spring pad and ball may be extracted.

5. It should be observed that the pump base is fitted with the hood locating slot facing to the near-side of the engine. The hood is next assembled so that its intake faces to the off-side of the engine (i.e. at right-angles to the crankshaft), when the assembly is refitted to the engine.

6. When offering up the pump assembly care must be exercised to see that the slot in the pump drive spindle is set to engage with the tongue on the distributor drive gear which, in this instance, is not offset.

Date of issue: July, 1939

Removal and Replacement of Timing Chain and Camshaft

THE removal of the camshaft can be accomplished without removing the engine from the frame. It is, however, necessary to remove the sump in accordance with the details given in Service Information Sheet SE/4.

1. Raise the bonnet of the car and, as a safety measure, secure it with a suitable piece of cord in the open position to some convenient point.

2. Drain the water from the cooling system by means of the drain tap located on the near-side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is used, it should be drained into a suitable container and carefully preserved for future use.

3. Disconnect the positive cable from the battery by slackening the $\frac{1}{4}$ in. pinch bolt and remove the cable lug from the battery terminal post.

4. Release the clips from the top and bottom water hoses and separate the hoses from their connections.

5. Detach the radiator mask by removing the packing strip from under the bonnet webbing at the top and undo the two countersunk-headed, metal-threaded screws and nuts and spring washers, locating the radiator core to the mask. Undo the ten $\frac{3}{16}$ in. set screws equipped with spring washers and plain steel washers, locating the radiator mask to the front wing valances.

6. Undo the $\frac{5}{16}$ in. lock and flange nuts with plain steel washers from the two radiator foundation studs which pass through the front chassis cross member and remove the radiator.

7. Disconnect the low-tension wire from its terminal on the side of the distributor. Remove the $\frac{1}{4}$ in. dynamo belt tension adjusting bolt and plain steel washer, and release the belt from the fan pulley.

8. Remove the two $\frac{1}{4}$ in. bolts, nuts and spring washers locating the dynamo to its cradle, when the dynamo, with its wires attached, may be laid in the tool tray.

9. Disconnect the high-tension leads from the sparking plugs and coil. Extract the lock wire from the dowel bolt locating the distributor clamp plate assembly to the cylinder head and remove the bolt. If the pinch bolt on the clamp plate assembly is undisturbed the ignition setting will not be altered. The distributor assembly may now be withdrawn from the cylinder head.

10. Remove the Bowden wire throttle control bracket from the cylinder head by undoing the $\frac{1}{8}$ in. set screw with shakeproof washer, and release the control from the carburetter throttle lever by slackening the $\frac{3}{16}$ in. nut.

11. Detach the air intake silencer bracket from the cylinder head by unscrewing the $\frac{3}{16}$ in. bolt equipped with a spring washer, and remove the air silencer by slackening the screw in the clip retaining it to the air intake pipe.

12. Raise the near-side front wheel clear of the ground and remove the wheel. Place a suitable stand under the front axle.

Remove the wing valance inspection cover by undoing three $\frac{3}{16}$ in. fixing bolts equipped with spring washers.

13. Disconnect the mixture control from the carburetter and separate the carburetter from the manifold.

14. Detach the exhaust pipe from the manifold by removing the two $\frac{5}{16}$ in. bolts, nuts and spring washers, observing that a copper-asbestos washer is fitted between the exhaust pipe and the manifold flanges.

15. Release the engine from its forward rubber mountings by removing the two $\frac{5}{16}$ in. nuts, plain steel washers and spring washers. Raise the front of the engine with suitable lifting tackle until the fan pulley can be extracted without fouling the front chassis cross member.

16. Undo the $\frac{5}{8}$ in. starting handle dog nut and remove the dished washers, observing that the dished portions face towards the pulley. Withdraw the pulley from the crankshaft.

17. Remove the timing cover by undoing the four $\frac{1}{4}$ in. fixing bolts and spring washers from the front of the cover, and the two $\frac{1}{4}$ in. set screws and spring washers from the back of the near-side engine bearer. Remove the dished oil thrower washer from the front of the crankshaft, noting that it is fitted with its flange facing towards the timing cover.

18. Tap back the lock washer from the $\frac{3}{8}$ in. set screw, locating the camshaft sprocket, and remove the screw, together with the lock washer and plain steel washer.

19. The timing chain and sprockets are now extracted by easing each chain wheel forward, a fraction at a time, with suitable small levers.

20. Remove the cylinder head by unscrewing the retaining stud nuts.

21. Raise the engine valves from their seatings as far as possible and secure them in the open position with suitable wooden wedges, as illustrated overleaf.

22. Remove the sump by unscrewing its attachment bolts.

23. Extract the distributor drive gear dowel. This is equipped with a 5 mm. tapped hole into which a 5 mm. screw may be entered to enable the dowel to be withdrawn. Alternatively, a small extractor can be made, as illustrated.

24. The distributor drive gear is now eased upward and extracted from the top of the cylinder block.

25. The tappets are now raised to their fullest extent, and the camshaft eased out from the front of the engine. The tappets may then be extracted if required. When new tappets are fitted they should be fitted so that they fall in their guides under their own weight, when lubricated with oil.

Continued

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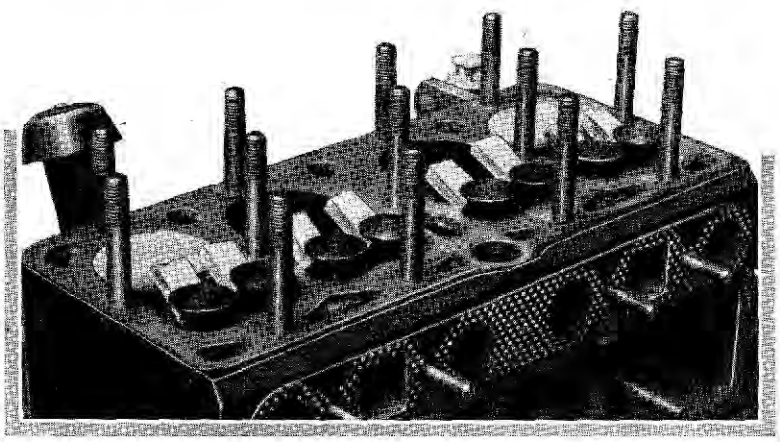
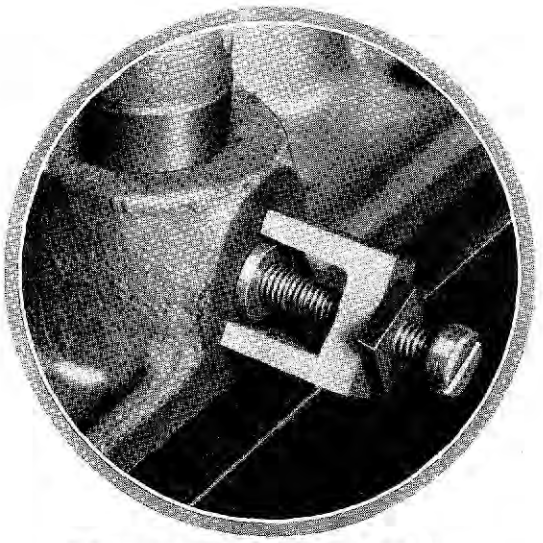
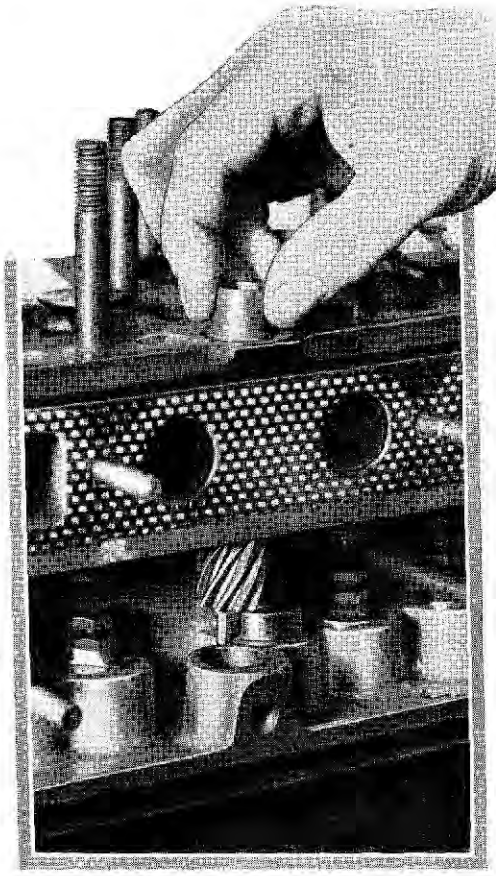
Removal and Replacement of Timing Chain and Camshaft—*continued*



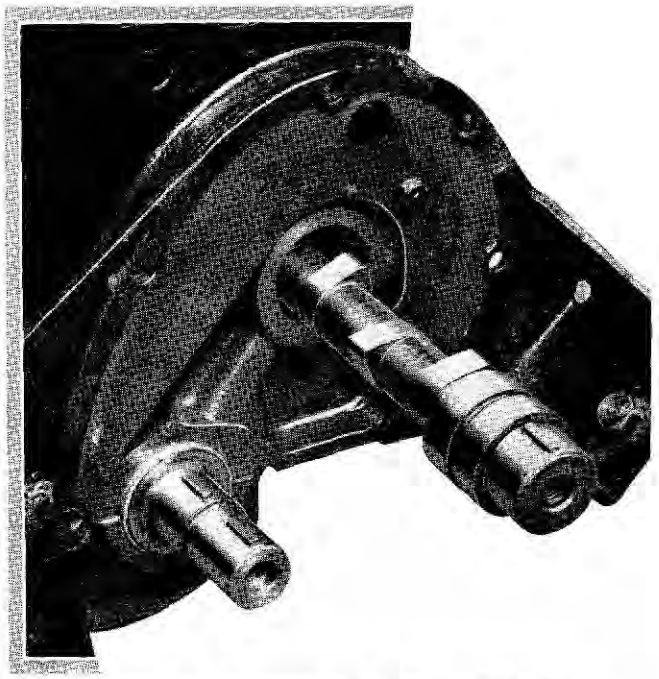
The valves are held in the open position by inserting blocks of wood under the heads.



A simple extractor can be made to withdraw the distributor drive spindle dowel.



The distributor drive gear is withdrawn upwards through the cylinder block.



The camshaft is withdrawn from the front of the engine.

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Removal and Replacement of Timing Chain and Camshaft—*continued*

Reassembly

After the camshaft has been replaced, set it with its keyway at 7 degrees before T.D.C., and the crankshaft with its keyways dead vertical at the top.

Double the timing chain, bringing both bright links together. This gives a long and short portion of the chain at either side of the bright links.

With the short portion of the chain in the operator's right hand, add the crankshaft sprocket with the tooth marked " T " facing away from the operator to the bottom bright link.

Add the camshaft sprocket with the tooth marked " T " facing in the same direction to the top bright link.

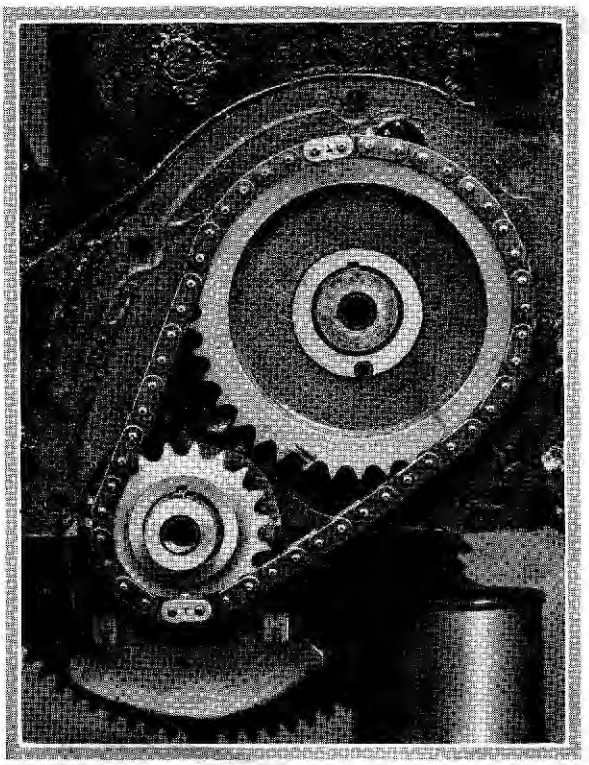
When replaced to the engine the bright links and the marked teeth should take up a position similar to that shown in the illustration.

The engine valve timing is such that the inlet valves open 8° B.T.D.C. and close 52° A.B.D.C. The exhaust valves open 52° B.B.D.C. and close 20° A.T.D.C.

Set the oil pump shaft so that the slot points to the 12 o'clock position, i.e. at right-angles to the camshaft. Insert the gear with the tongue at the top pointing at 11 o'clock, observing that the tongue is offset and the widest portion is directed to the rear of the engine. Care must be exercised to see that the dowel hole in the distributor drive gear bush is lined up to correspond with the hole in the cylinder block.

The gear is then pushed home, when the tongue at the top will take up a position at 1 o'clock. If the distributor drive shaft and the distributor are then offered up it will be found the rotor points between the 7 and 8 o'clock position and the engine is correctly set for firing on No. 4 cylinder. It should be noted that the distributor drive shaft has its slot offset, the larger portion facing towards the rear of the engine. The distributor is set with its points just opening at T.D.C.

Reassembly of the remaining parts is carried out in the reverse order to that of dismantling.



This clearly shows the position of the marked teeth on the sprockets and bright links on the timing chain when set correctly for the replacement of the timing chain.

Date of issue: July, 1939

Replacement of Main and Big-End Bearings

THE replacement of both main and big-end bearings is a comparatively simple operation on the Series "E" 8 h.p. engine, and can be carried out by the removal of the sump and without withdrawing the engine from the frame. Detachable bearings are used both for the mains and big-ends.

1. It is essential that worn bearings should not be adjusted, but should be replaced with new parts. Additionally, if the crankshaft journals are found to be in a worn condition, it is advisable to fit a service re-ground crankshaft, complete with main and big-end bearings, as supplied from the Works.

2. Both the main and big-end bearings are located in position by a small tab on one side of each half bearing. The bearings are fitted so that the tabs come on the same side of the bearing housing, as shown in the illustration.

3. To detach the big-end bearings extract the split pins from the big-end bolts and undo the $\frac{1}{4}$ in. nuts. Remove the connecting rod caps, and extract the bearings. Care should be exercised to see that the bearing journals, etc., are thoroughly cleaned before installing new bearings. No scraping is required as the bearings are machined to give the correct clearance of .002 in.

4. The main bearings should be dealt with one at a time. Detach the main bearing caps together with the bottom half main bearings. The top half of the bearings are extracted by rotating them round the crankshaft in the direction of their locating tabs, using a small grub screw placed in the crankshaft oil feed hole. The replacements are fitted in a similar manner, first inserting the plain side of each bearing into its housing.

5. In the case of a run bearing it is always advisable thoroughly to clean out all the oil ways in the crankshaft and block, wash out the engine base with paraffin, and remove the pump cover to ensure that no particles of white metal are left in the lubricating system.

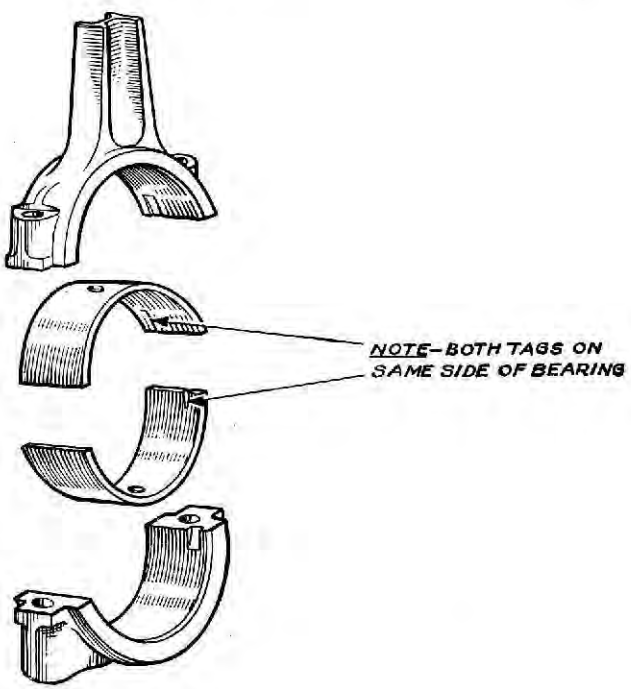
Extracting the Piston and Connecting Rod Assemblies

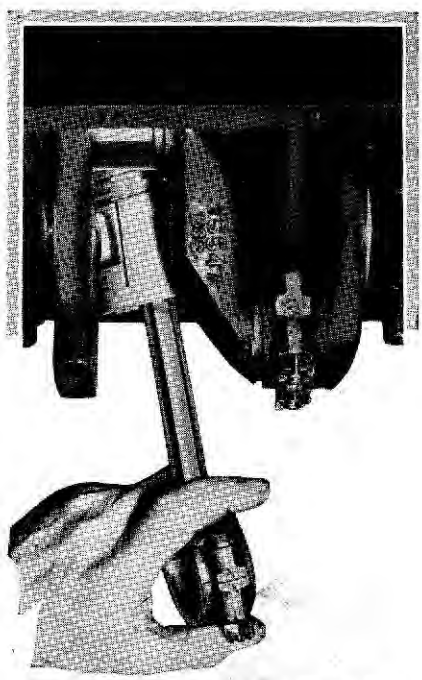
EXTRACTING the piston and connecting rod assemblies does not present any difficulty if care is exercised when withdrawing the pistons from the cylinder bores.

1. Release each connecting rod in turn from the crankshaft by extracting the split pins from the big-end bolts and undoing the $\frac{1}{4}$ in. nuts. Separate the bearing caps from the connecting rods. It is advisable to replace the caps and bearings on the rods, keeping each to its own particular assembly. It will be observed that the connecting rods and caps are numbered to correspond with their respective cylinders and should be replaced accordingly. No. 1 cylinder is that nearest the radiator.

2. The connecting rod and piston assembly is then drawn downwards and, to avoid damage by the crankshaft webs, the crankshaft is slowly rotated as the piston is extracted from its bore. Similar care must be exercised when replacing the parts. Observe that the gudgeon pin clamp screws face away from the camshaft.

3. An ample chamfer is given to each cylinder bore to facilitate the refitting of the pistons and rings, and no difficulty should be experienced in this direction. Reassembly is carried out in the reverse order to the above.





Showing the position of the crank web to enable the piston to be withdrawn.

Date of issue: July, 1939

Removal of the Engine from the Frame, leaving the Gear Box in Position

THERE is no serious difficulty in removing the engine, leaving the gearbox in the frame, if the work is carried out in accordance with the following details. It is not necessary to remove the bonnet, but as a safety measure it should be safely secured in the open position.

1. Drain the water from the radiator by means of the drain tap located in the near-side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is used it should be drained into a suitable container and carefully preserved for future use.

2. Detach the radiator mask by removing the packing strip from under the bonnet webbing at the top and undo the two countersunk-headed metal-threaded screws and nuts and spring washers locating the radiator core to the mask. Undo the ten $\frac{3}{16}$ in. set screws equipped with spring washers and plain steel washers locating the radiator mask to the front wing valances.

3. Release the clips on the top and bottom water hoses and separate the hoses from their connections.

4. Undo the $\frac{5}{16}$ in. lock and flange nuts with plain steel washers from the two radiator foundation studs which pass through the front chassis cross member and remove the radiator.

5. Disconnect the battery by slackening the $\frac{1}{4}$ in. pinch bolt and removing the positive cable lug from the battery terminal post.

6. Detach the air silencer complete with the air intake pipe by undoing the $\frac{3}{16}$ in. bolt, nut and spring washer from the air cleaner support bracket and the two $\frac{1}{4}$ in. bolts with spring washers locating the air intake pipe to the carburetter flange. Release the throttle return spring from the air intake pipe.

7. Disconnect the throttle and mixture controls from the carburetter and release the Bowden throttle control from its steady bracket on the cylinder head by undoing the $\frac{1}{8}$ in. fixing bolt.

8. Release the flexible petrol pipe from the pump and detach the carburetter from the manifold.

9. Disconnect the high-tension cable from the coil and the low-tension cable from the distributor. Remove the two leads from the dynamo, noting that the yellow wire goes to the terminal nearest the off-side. Detach the starter cable from the switch on the scuttle dash by undoing the $\frac{5}{16}$ in. terminal bolt with spring washer. Remove the earth cable from the cylinder head.

10. Disconnect the oil gauge pipe from its connection on the cylinder block. Remove the two $\frac{5}{16}$ in. nuts, bolts and spring washers from the exhaust manifold flange and remove the flange gasket.

11. Remove the front floor mat by extracting the press pins, and the near-side front seat by undoing the two wing bolts locating the seat to the floor of the car. The off-side seat is removed by releasing the catch and sliding the seat forward clear of the runners.

Continued

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Removal of the Engine from the Frame—*continued*

12. Detach the gear lever knob by slackening the $\frac{1}{4}$ in. lock nut and remove the gearbox rubber cowl.

13. Remove the off-side and near-side floorboards by undoing the four countersunk-headed metal-threaded fixing screws equipped with dished washers.

14. Release the off-side toeboard by undoing the six countersunk-headed metal-threaded fixing screws and washers, and detach the headlamp dip switch from the board by undoing the two round-headed metal-threaded screws.

15. The near-side toeboard and gearbox shield assembly is removed by undoing the six countersunk-headed and one round-headed metal-threaded fixing screws and washers.

16. Undo the seven $\frac{1}{4}$ in. bolts equipped with spring washers locating the clutch casing to the flywheel housing.

17. Slacken the gearbox rear flexible mountings on the cross member by unscrewing the stud nuts four or five turns.

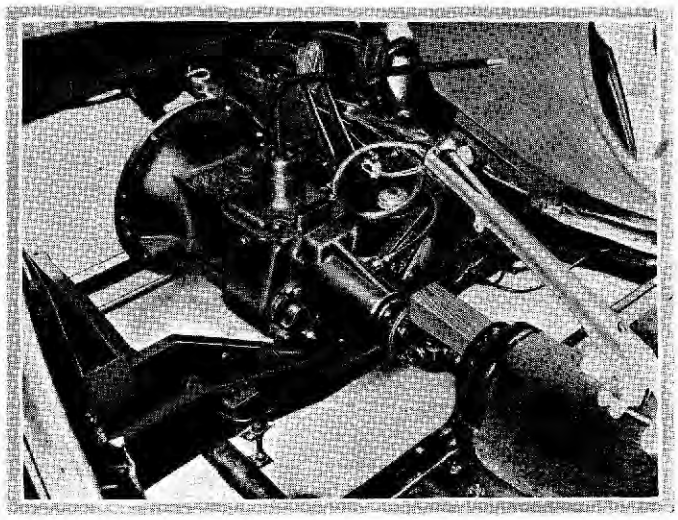
18. To prevent the gearbox from dropping when it is released from the engine, place a suitable wooden taper block between the propeller shaft and the floor support stay. (See illustration.)

19. Support the engine with suitable lifting tackle. If a lifting ring is employed it should be screwed into No. 3 sparking plug hole.

20. Remove the $\frac{5}{16}$ in. nut with spring washer and plain steel washer from each front engine mounting.

21. The engine may now be raised and carefully manoeuvred forwards clear of the car.

When replacing the engine in the frame it will be found helpful if a second operator raises the front end of the gearbox by exerting downward pressure on the gear lever. This will assist in aligning the gearbox drive shaft with the clutch and flywheel.



A wedge-shaped block of wood is placed in the propeller shaft tunnel to support the gearbox and prevent it falling forward.

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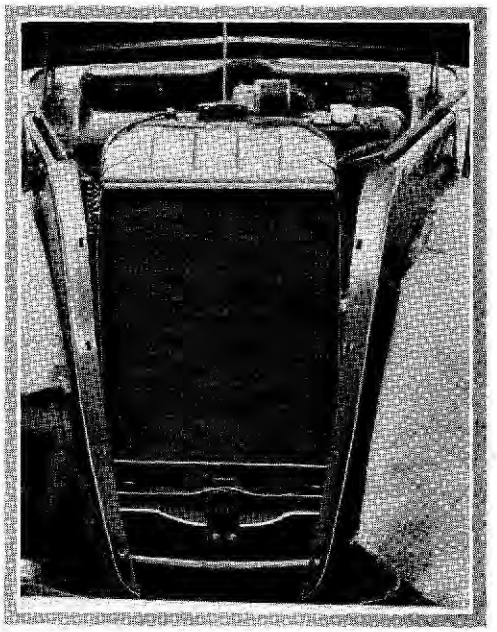
To Remove Power Unit from the Frame

THE removal of the power unit does not present any serious difficulty if the operations are carried out in the following sequence. It is not necessary to remove the bonnet, but as a precautionary measure it should be safely secured in the open position.

1. Drain the water from the radiator by means of the drain tap located in the near-side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is used it should be drained into a suitable container and carefully preserved for future use.

2. Detach the radiator mask by removing the packing strip from under the bonnet webbing at the top and undo the two countersunk-headed metal-threaded screws with nuts and spring washers locating the radiator core to the mask. Undo the ten $\frac{3}{16}$ in. set screws equipped with spring washers and plain steel washers locating the radiator mask to the front wing valances.



Showing the radiator mask removed leaving the centre in position.

3. Release the clips on the top and bottom water hoses and separate the hoses from their connections.

4. Undo the $\frac{5}{16}$ in. lock and brass nuts with plain steel washers from the two radiator foundation studs which pass through the front chassis cross member. Remove the radiator.

5. Disconnect the battery by slackening the $\frac{1}{4}$ in. pinch bolt and remove the positive cable lug from the battery terminal post.

6. Detach the air silencer complete with the air intake pipe by undoing the $\frac{3}{16}$ in. bolt, nut and spring washer from the air cleaner support bracket and the two $\frac{1}{4}$ in. bolts with spring washers locating the air intake pipe to the carburetter flange. Release the throttle return spring from the air intake pipe.

7. Disconnect the throttle and mixture control from the carburetter and release the throttle control from its steady bracket on the cylinder head by undoing the $\frac{1}{8}$ in. fixing bolt.

8. Release the flexible petrol pipe from the pump and detach the carburetter from the manifold.

9. Disconnect the high-tension cable from the coil and the low-tension cable from the distributor. Remove the two leads from the dynamo, noting that the yellow wire goes to the terminal nearest the off-side. Detach the starter cable from the switch on the scuttle dash by undoing the $\frac{5}{16}$ in. terminal bolt with spring washer. Remove the earth cable from the cylinder head.

10. Disconnect the oil gauge pipe from its connection on the cylinder block. Remove the two $\frac{5}{16}$ in. nuts, bolts and spring washers from the exhaust manifold flange and remove the flange gasket.

11. Remove the front floor mat by extracting the press pins and the near-side front seat by undoing the two wing bolts locating the seat to the floor of the car. The offside seat is removed by releasing the locating catch and sliding the seat forward clear of the runners.

12. Detach the gear lever knob and remove the gearbox rubber cowl.

13. Remove the off-side and near-side floorboards by undoing the four countersunk-headed metal-threaded fixing screws with washers.

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To Remove Power Unit from Frame—*continued*

14. Release the off-side toeboard by undoing the six countersunk-headed metal-threaded fixing screws and washers, and detach the headlamp dip switch from the board by undoing the two round-headed metal-threaded screws.

15. The near-side toeboard and gearbox shield assembly is removed by undoing the six countersunk-headed screws equipped with dished washers and one round-headed metal-threaded fixing screw.

16. Disconnect the speedometer cable from its drive at the rear of the gearbox, and the earth wire by undoing the $\frac{1}{4}$ in. stud nut at the rear of the gearbox, replacing the nut to avoid its possible loss.

17. Extract the split pin from the clevis pin locating the clutch operating chain to the clutch operating lever.

18. Remove the gearbox cover, care being exercised to ensure that the three selector lock balls and springs are not lost in the process. Place a protecting cover over the gearbox to exclude any foreign matter.

19. Undo the two $\frac{5}{16}$ in. stud nuts with shakeproof washer locating the near-side and off-side flexible mounting brackets, and remove the brackets.

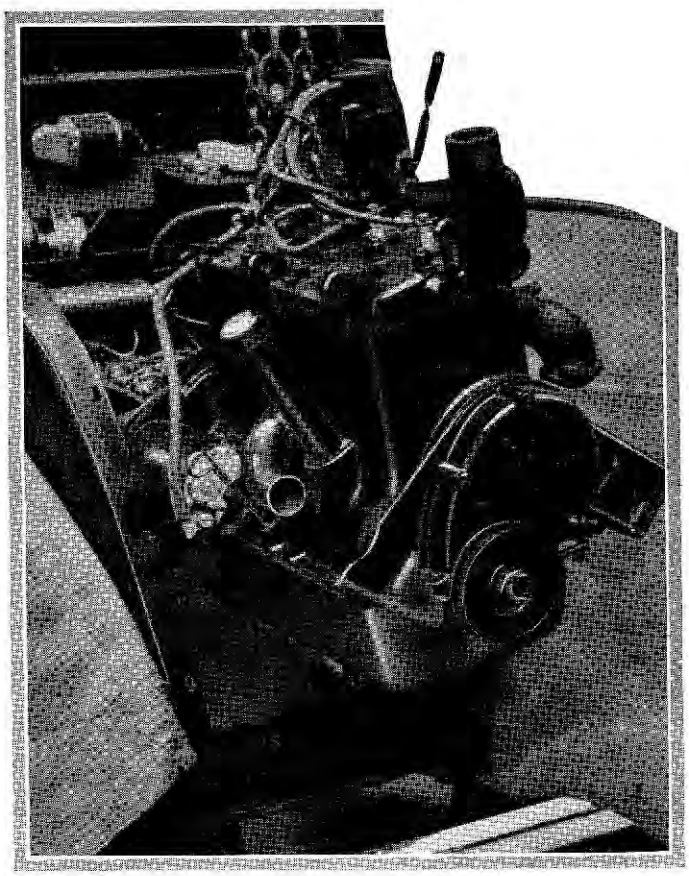
20. Extract the split pins from the four $\frac{1}{4}$ in. bolts on the front universal joint driving flange and remove the bolts and nuts.

21. Support the engine with suitable lifting tackle. If a lifting ring is employed it should be screwed into No. 4 sparking plug hole.

22. Remove the $\frac{5}{16}$ in. nut with spring washer and plain steel washer from each front engine mounting.

23. The power unit may now be raised and manoeuvred forward clear of the car.

Reassembly is carried out in the reverse order to that of dismantling.



Showing the power unit in the process of being removed from the frame.

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Complete Dismantling of Engine

(POWER UNIT OUT OF THE FRAME)

AFTER the power unit has been removed from the frame, in accordance with the details furnished in the Service Information Sheet No. SE/8, it should be placed on a suitable stand and dismantled in the following order.

Separate the gearbox from the engine by removing the seven $\frac{1}{4}$ in. bolts and spring washers locating the clutch casing to the flywheel housing.

Detach the clutch pressure plate from the flywheel by unscrewing the six $\frac{1}{4}$ in. set screws equipped with spring washers, giving each a fraction of a turn at a time until the spring pressure is released. This will also release the clutch driven plate. Note—When reassembling the clutch the driven plate must be held in alignment with the clutch aligning tool, Part No. 39371.

Disconnect the high-tension leads from the sparking plugs. Extract the lock wire from the dowel bolt locating the distributor clamp plate assembly to the cylinder head, and remove the bolt; the distributor assembly may now be withdrawn from the cylinder head.

Undo the thirteen $\frac{5}{16}$ in. cylinder head stud nuts, slackening each half a turn at a time until they are quite free, as this will avoid any tendency for the head to distort. The cylinder head and gasket may now be removed and the distributor drive shaft extracted from its housing.

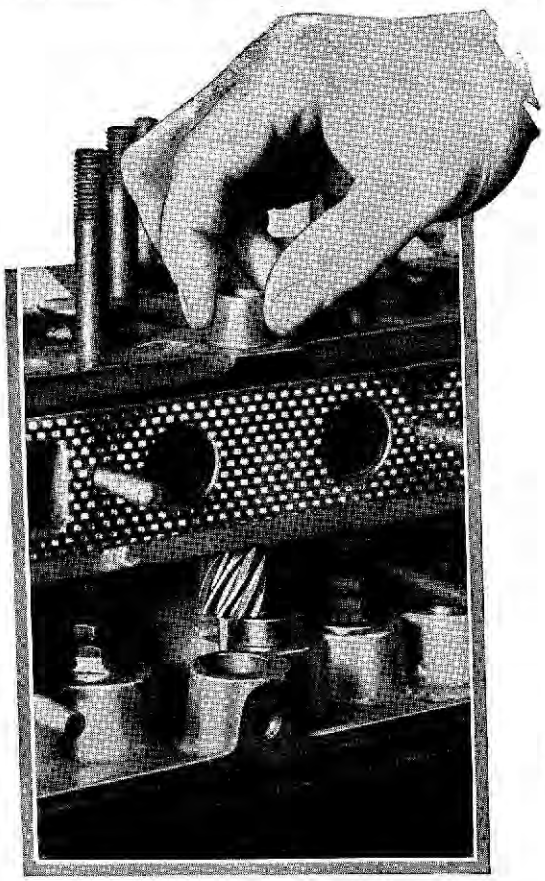
Detach the induction and exhaust manifold by undoing the four $\frac{1}{4}$ in. fixing stud nuts and remove the manifold gasket.

The tappet cover and fume pipe, together with the cover gasket, are next removed by undoing the two locating wing nuts, equipped with fibre washers. The fume pipe may be disconnected from the tappet cover by releasing the $\frac{3}{16}$ in. pinch bolt in the retaining clip. Observe that the tappet cover gasket is fitted with the two small holes at the bottom.

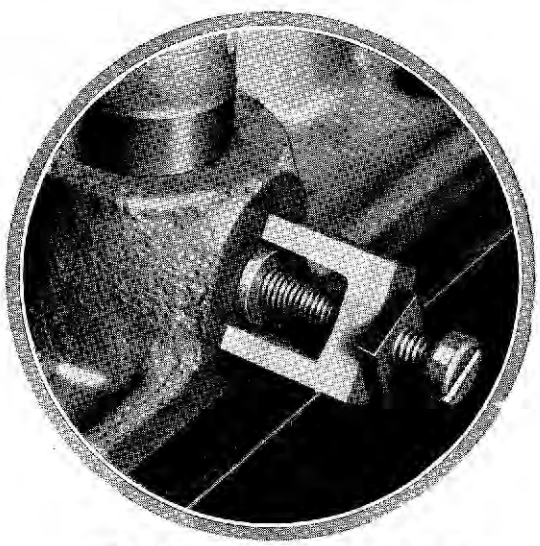
The valve cotters are next extracted with the aid of the valve spring compressor, Part No. 38378, and the valves and springs removed. Note that the valves are numbered to denote to which port they belong and should be replaced accordingly, No. 1 valve being fitted to the port nearest to the front of the engine. If new valves are fitted they should be numbered to denote to which port they belong. The valve springs must be refitted with the close coils next to the cylinder block.

Extract the distributor drive gear dowel. This is equipped with a 5 mm. tapped hole into which a suitable screw may be entered to enable the dowel to be withdrawn. Alternatively, a small extractor can be made up, as illustrated.

The distributor drive gear is now eased upward and extracted from the top of the cylinder block.



Left: The distributor drive gear is withdrawn upwards through the cylinder block.



Above: A simple extractor can be made to withdraw the distributor drive shaft dowel.

Continued

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Complete Dismantling of Engine—*continued*

The starter motor is removed by undoing the two $\frac{5}{16}$ in. fixing bolts with spring washers, and the water inlet pipe released from the cylinder block by removing the two $\frac{1}{4}$ in. fixing bolts and spring washers. A gasket is fitted between the pipe flange and block.

Undo the $\frac{5}{8}$ in. starting handle dog nut and remove the dished washers, observing that the dished portions face the fan pulley. Withdraw the pulley from the crankshaft.

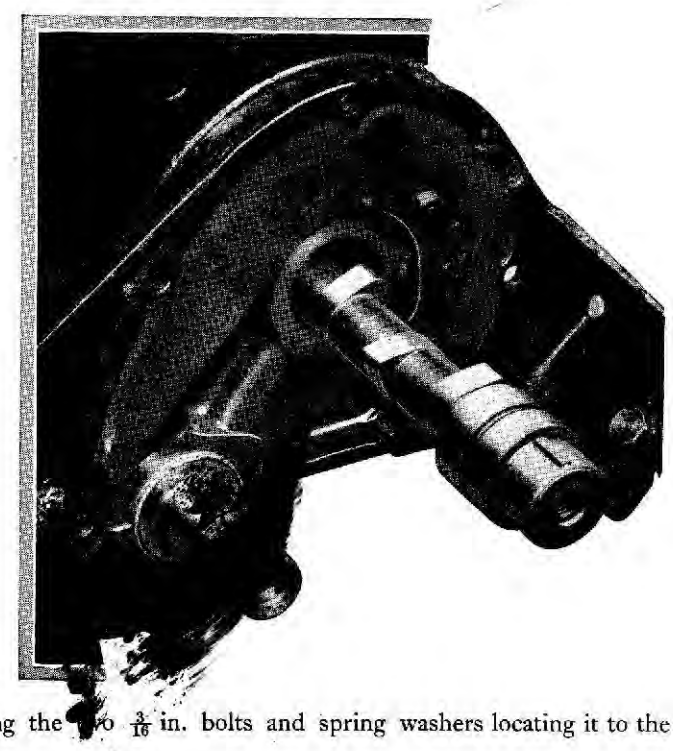
The engine should now be turned upside down on the stand, and the engine base removed by undoing the twelve fixing bolts equipped with spring washers. The two bolts at the front and the two bolts at the rear are equipped with $\frac{3}{16}$ in. hexagon heads, and the remainder with $\frac{1}{4}$ in. hexagon heads. The bolts are inserted from the underside of the sump flange, with the exception of two, these being placed at either side of the oil pump housing, and are screwed in from the top.

Detach the timing cover by undoing the four $\frac{1}{4}$ in. fixing bolts and spring washers from the front of the cover and the two $\frac{1}{4}$ in. set screws and spring washers from the back of the near-side engine bearer. Remove the dished oil thrower washer from the front of the crankshaft, noting that it is fitted with its flange facing towards the timing cover.

Tap back the lock washer from the $\frac{3}{8}$ in. set screw retaining the chain wheel to the camshaft and remove the screw, together with the lock washer and plain steel washer.

The timing chain and sprockets are now extracted together by easing each chain wheel forward a fraction at a time with suitable small levers.

The camshaft is taken out from the front of the engine, after which the tappets can be removed from their guides.



The camshaft is removed by withdrawing it from the forward end of the engine.

The oil pump assembly is detached by removing the two $\frac{3}{16}$ in. bolts and spring washers locating it to the crankcase.

Separate the bearing caps and half bearings from the connecting rods, replacing the caps and bearings, keeping each to its own particular assembly. It will be observed that the connecting rods and caps are numbered to correspond with their respective cylinders and should be replaced accordingly. No. 1 cylinder is at the front of the engine.

Continued

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Complete Dismantling of Engine—*continued*

The pistons, complete with connecting rod assemblies, are then withdrawn from the cylinders, the crankshaft being rotated slowly as each piston is extracted, to avoid damage in manipulating it past the crankshaft webs. Similar care must be exercised when replacing the assemblies. Observe that the gudgeon pin clamp screws face away from the camshaft.

The next step is the removal of the flywheel. To do this it is necessary first to remove the rear main bearing cap and bottom half bearing.

Using a suitable pin punch, drive out the two flywheel locating dowels toward the rear of the engine, care being exercised not to damage the oil return thread and thrower on the crankshaft.

Remove the four $\frac{5}{16}$ in. flywheel fixing bolts after extracting the lock wire.

Detach the flywheel from the crankshaft flange by tapping it toward the rear of the engine, using a copper-headed hammer for this purpose and slowly rotating the crankshaft so that the flywheel is driven off evenly.

The crankshaft may now be removed by detaching the centre and front main bearing caps.

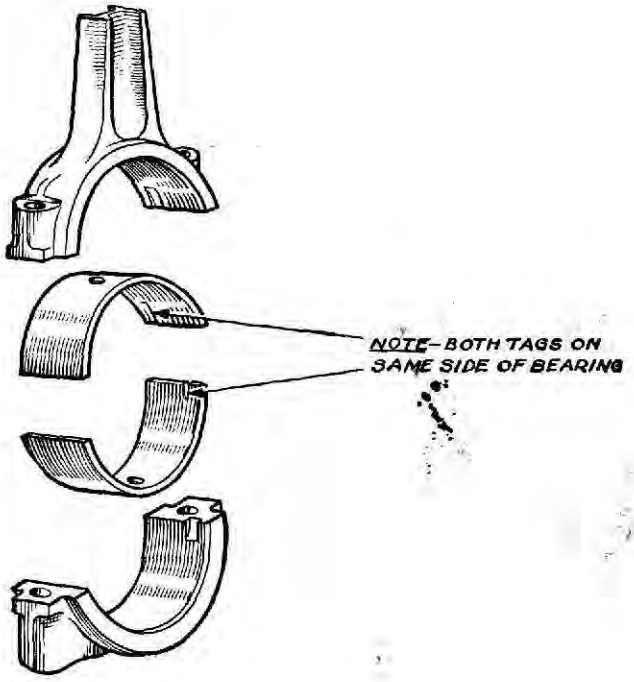
It should be noted that on both the main and big-end bearings the locating dowel takes the form of a tab on one side, where the half bearings butt together, and both dowels are located to the same side when the bearing is assembled. (See illustration.)

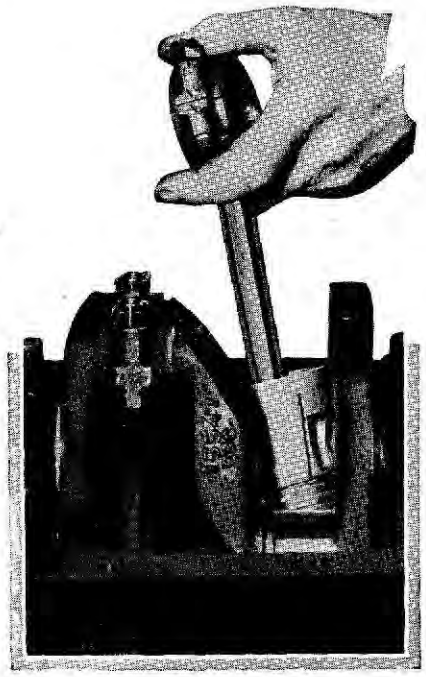
If the block is to be returned to the Works for reboring, all cylinder head and main bearing studs should be removed.

Reassembling is carried out in the reverse order to the above.

When refitting the cylinder head, to ensure the correct alignment of the distributor with its drive shaft, it is essential to use the special cylinder head distributor shaft alignment gauge, Part No. 39387.

The tool engages with the distributor housing in the cylinder head and the distributor drive shaft housing in the cylinder block. When the cylinder head stud nuts have been tightened the tool is extracted and the drive shaft dropped into position.





Showing the position of the crank web to enable the piston to be withdrawn.

Continued

Complete Dismantling of Engine—*continued*

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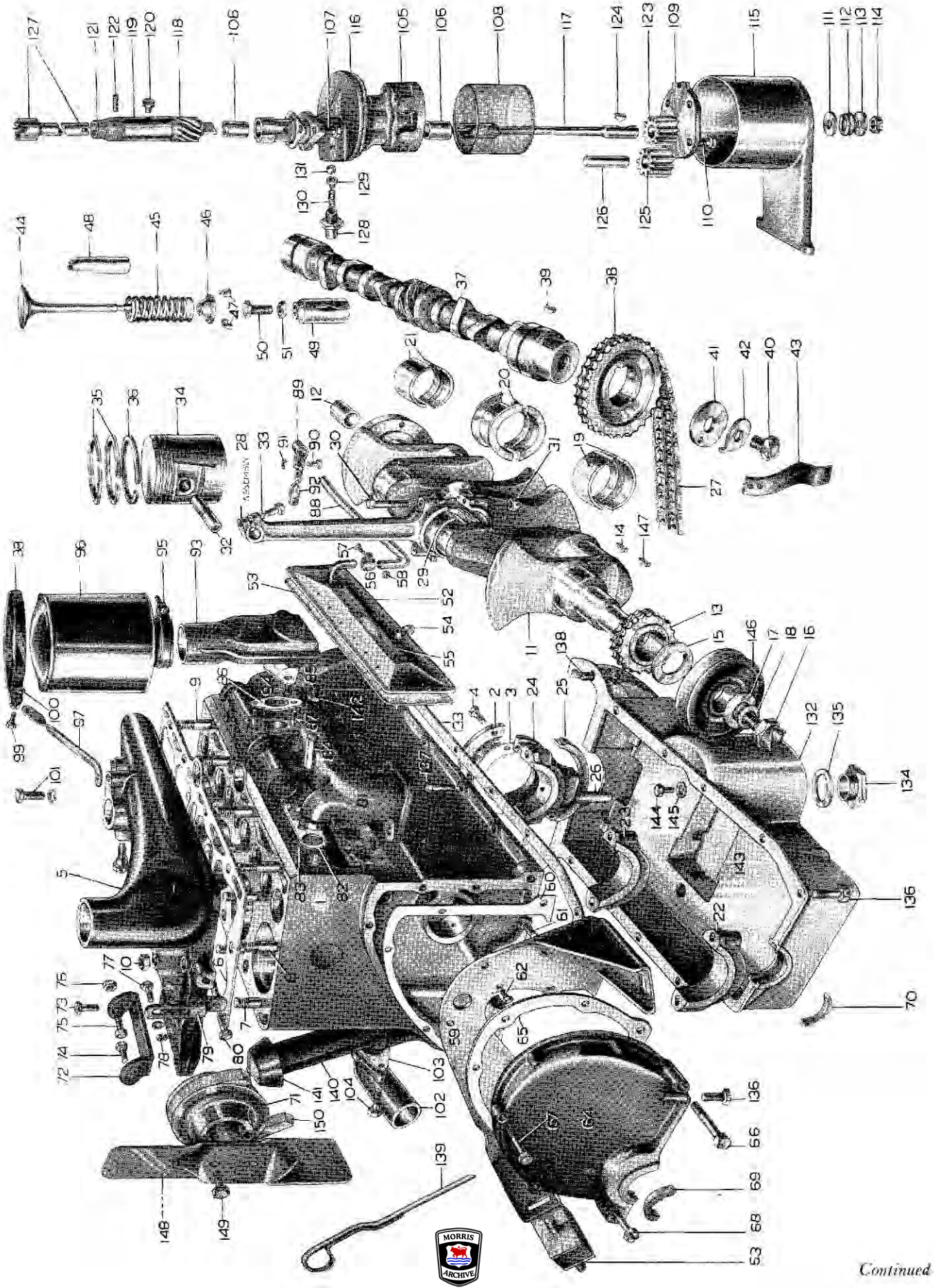
Engine



Continued

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Complete Dismantling of Engine—*continued*

Parts and Part Numbers

Illus. No.	DESCRIPTION	Part No.
	CYLINDER BLOCK AND HEAD	
1	CYLINDER BLOCK (with pistons, rings and gudgeon pins)	SA1501/6
2	Oil seal cover	X15484
3	Oil seal cover gasket	X15008
4	Oil seal cover bolt	X15009
5	CYLINDER HEAD	X15549
6	Gasket	X15567
7	Stud (short)	X15568
8	,, (medium)	X15020
9	,, (long)	X17207
10	Stud nut	QA11123
	CRANKSHAFT	
11	CRANKSHAFT	X15547
12	Bush (drive gear)	OA10633
13	Gear	X15025
14	Gear key	JA5255
15	Oil thrower	X15027
16	Nut	X15029
17	Nut washer	X15424
18	Nut shim	X15030
19	Bearing (front)	SA1537/4
20	,, (centre)	SA1537/5
21	,, (rear)	SA1537/4
22	Bearing cap (front)	X15561
23	,, ,, (centre)	X15561
24	,, ,, (rear)	SA1526/1
25	Bearing cap seal (rear)	X15038
26	Bearing cap drain pipe (rear)	X15205
27	Chain (timing)	X15047
	CONNECTING RODS, PISTONS AND RINGS	
28	CONNECTING ROD assembly	SA1507/2
29	Bush	X15555
30	Cap bolt	RA12022
31	Cap bolt nut	CB2094
32	GUDGEON PIN	RA12023
33	Clamp screw	RA12024
34	PISTON with rings and gudgeon pin	SA1508/6
35	Ring (top)	X15672
36	,, (bottom)	X15673
	CAMSHAFT, VALVES AND TAPPETS	
37	CAMSHAFT	X15161
38	Gear	X15044
39	Gear key	JA5255
40	Thrust screw	MA3536
41	Thrust screw washer	X15168
42	Thrust screw lock washer	X15169
43	Thrust spring	X15170
44	VALVE	X15048
45	Spring	X15608
46	Spring cap	X15165
47	Spring cap retainer	X15166
48	Guide	X15167
49	TAPPET	X15612
50	Adjusting screw	CA69
51	Adjusting screw lock nut	CA70
52	Cover	X15597
53	Cover gasket	X15598
54	Cover stud wing nut	X15006
55	Cover stud washer	LA7088
56	Breather elbow clip	X15252
57	Breather elbow clip bolt	QA11252
58	Clip bolt nut	CA1254
	FRONT ENGINE SUPPORT AND TIMING CASE	
59	FRONT BEARER PLATE	X15301
60	Gasket	X15011
61	Bolt	X15012
62	,, (small head)	X15336
63	FRONT SUPPORT BLOCK	84686
64	TIMING CASE	X15554
65	Gasket	X15057
66	Bolt (long)	X15058
67	,, (short)	X15059
68	,, (slotted head)	X15186
69	Packing (top)	X15191
70	,, (bottom)	X15060
	DYNAMO FIXING AND PULLEY	
71	Dynamo pulley	X15391
72	Dynamo bracket	X15588
73	Dynamo bracket bolt	JA5052
74	Dynamo swivel bolt (front)	CA1123
75	,, ,, ,, (rear)	51588
76	Dynamo swivel bolt nut	CA1126
77	Dynamo bolt (adjusting)	JA5052
78	Dynamo bolt nut	CA1126
79	Dynamo link	X15589
80	Dynamo link bolt	OA10077
	EXHAUST MANIFOLD	
81	MANIFOLD	SA1509/6
82	Gasket	X15351
83	Stud	LA7085
84	Stud nut	LA7084
85	Gasket (carburetter)	3791
86	,, (carburetter) (Hallite)	X15615
87	Stud (carburetter)	MA3662
	Stud nut	CA1254
	FUME PIPE	
88	VENT PIPE	82029
89	Clip	82030
90	Clip bolt	66835
91	Clip bolt nut	EZ503
92	Support	X15401

Continued

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Complete Dismantling of Engine—*continued*

Parts and Part Numbers—*continued*

Illus. No.	DESCRIPTION	Part No.
	CARBURETTER PIPE AND AIR SILENCER	
93	PIPE.....2-seater and Tourer	X15585
93	Ditto ..... Saloons	X15644
94	Bolt.....	CA1122
95	Clip.....	X15587
96	SILENCER.....2-seater and Tourer	X15586
96	Ditto ..... Saloons	X15647
97	Support.....2-seater and Tourer	X15649
97	,, ... Saloons	X15646
98	Clip .....2-seater and Tourer	X15648
98	,, ... Saloons	X15645
99	Clip bolt (to support).....	LB7905
100	Clip bolt nut.....	CA1254
101	Bolt (to cylinder head).....	JA5384
	WATER INLET PIPE	
102	PIPE.....	X15509
103	Gasket.....	X15582
104	Bolt.....	JA5052
	LUBRICATION SYSTEM	
	OIL PUMP assembly.....	SA1510/2
105	Body with bushes.....	SA1511/1
106	Body bush.....	X15075
107	Body bolt.....	JA5003
108	Body gauze.....	X15626
109	Body cover.....	X15572
110	Body cover bolt.....	JA5117
111	Body cover stud fibre washer.....	X15620
112	Body cover stud spring washer.....	X15580
113	Body hood plain washer.....	X15440
114	Body cover stud nut.....	JA5663
115	Body hood.....	X15577
116	Body hood gasket.....	X15578
117	Shaft.....	X15505
118	Shaft gear.....	X15080
119	Shaft bush.....	X15081
120	Shaft bush dowel.....	X15082
121	Shaft connection.....	X15083
122	Shaft connection pin.....	LA7086
123	Gear (driver).....	X15078
124	Gear key.....	JA5255
125	Gear (driven).....	X15076
126	Gear pin.....	X15077
127	Distributor shaft assembly.....	SA1544/1
128	Release plug.....	X15091
129	Release pad.....	X15601
130	Release spring.....	X15093
131	Release spring ball.....	CA1280
132	SUMP.....	SA1535/1
133	Gasket.....	X15285
134	Drain plug.....	X15267
135	Drain plug washer.....	CA1216
136	Bolt (to block) (short).....	X15268
137	,, (to block) (medium).....	X15507
138	,, (to block) (long).....	X15269
139	Oil level indicator.....	X15628
140	Oil filler.....	SA1512/3
141	Oil filler cap (with sleeve and washer)	SA1513/2
142	Oil test union.....	X15257
143	Tray.....	X15508
144	Tray bolt.....	JA5384
145	Tray washer.....	LA7087
	STARTING HANDLE	
16	Dog.....	X15029
18	Dog shim.....	X15030
	FAN	
146	Pulley (crankshaft).....	X15435
17	Pulley washer.....	X15424
147	Pulley key.....	JA5255
148	Blade.....	X15055
149	Blade bolt.....	CA1122
150	Belt.....	X20383

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To Remove Gearbox and Dismantle Clutch

WHEN removing the gearbox the engine should be supported at the rear end with suitable lifting tackle.

1. Remove the front floor mat by extracting the press pins and the near-side front seat by undoing the two wing bolts locating the seat to the floor of the car. The off-side seat is removed by releasing the catch and sliding the seat forward clear of the runners.

2. Detach the gear lever knob by slackening the $\frac{1}{4}$ in. lock nut and remove the gearbox rubber cowl.

3. Remove the off-side and near-side floorboard by undoing the four countersunk-headed metal-threaded fixing screws which are equipped with dished washers.

4. Release the off-side toeboard by undoing the six countersunk-headed metal-threaded fixing screws and washers and detach the headlamp dip switch from the board by undoing the two round-headed metal-threaded screws.

5. The near-side toeboard and gearbox shield assembly is removed by undoing the six countersunk-headed and one round-headed metal-threaded fixing screws and washers.

6. Disconnect the speedometer cable from its drive at the rear of the gearbox and the earth wire by undoing the $\frac{1}{4}$ in. stud nut at the rear of the gearbox, replacing the nut to avoid its possible loss.

7. Extract the split pin from the clevis pin locating the clutch operating chain to the clutch operating lever.

8. Remove the gearbox cover by undoing the four $\frac{1}{4}$ in. stud nuts with spring washers, care being exercised not to lose the three selector lock balls and springs in the process. Place a protecting cover over the gearbox to exclude any foreign matter.

9. Extract the split pins from the four $\frac{1}{4}$ in. bolts on the front universal joint driving flange and remove the bolts and nuts.

10. Remove the two $\frac{1}{4}$ in. nuts with spring washers and plain steel washers from the studs locating each gearbox flexible mounting to the chassis cross member.

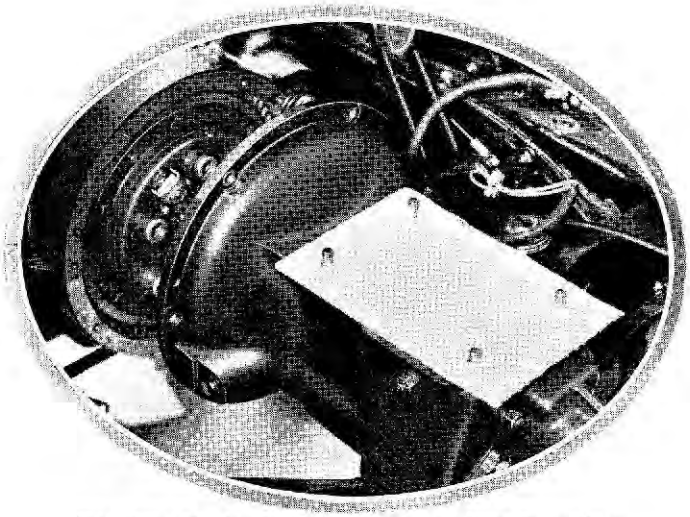
11. Unscrew the two $\frac{5}{16}$ in. nuts with shakeproof washers locating the near-side and the two $\frac{5}{16}$ in. bolts with shakeproof washers locating the off-side flexible mounting brackets to the rear of the gearbox.

12. Undo the seven $\frac{1}{4}$ in. bolts equipped with spring washers locating the clutch housing to the flywheel housing. Separate the gearbox from the engine by easing it gently to the rear, when it may then be lifted clear of the car.

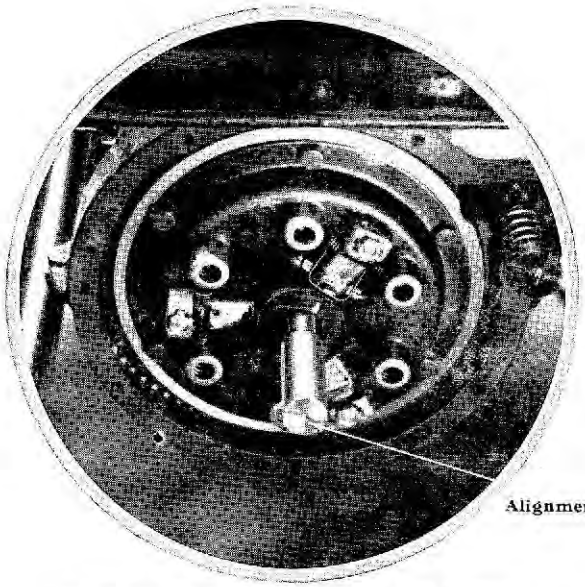
To Dismantle the Clutch

DETACH the clutch pressure plate from the flywheel by unscrewing the six $\frac{1}{4}$ in. set screws and spring washers, giving each a fraction of a turn at a time until the spring pressure is released. This will also release the clutch driven plate.

When reassembling the clutch the driven plate must be held in alignment with the clutch aligning tool, Part No. 39371.



This shows the gearbox being withdrawn from the engine.



Alignment tool.

When reassembling the clutch the use of a special alignment tool is necessary.

Continued

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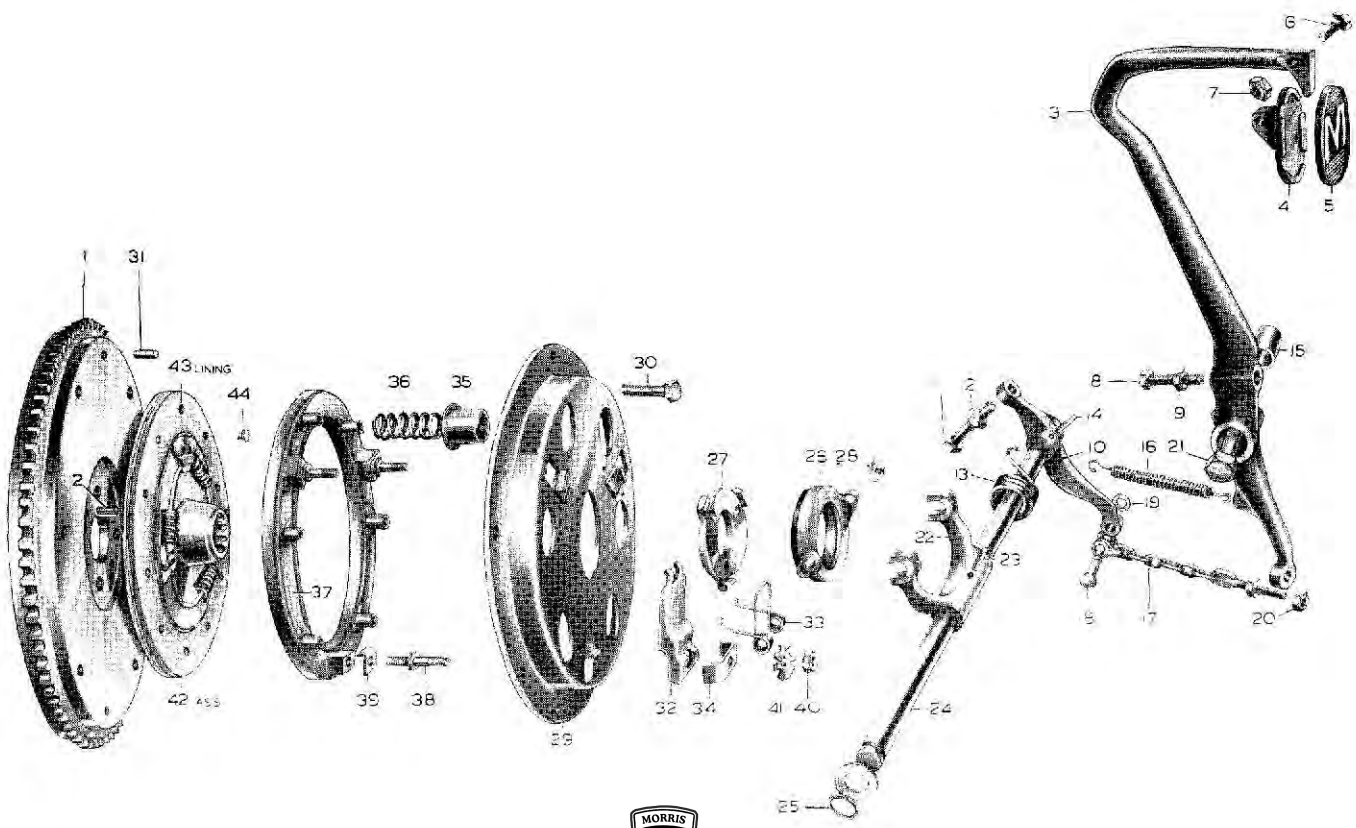
To Dismantle the Clutch—*continued*

Parts and Part Numbers

Illus. No.	DESCRIPTION	Part No.
	FLYWHEEL	
1	FLYWHEEL (with starter ring)	SA1519/2
2	Taper pin	X15102
	CLUTCH	
3	PEDAL	X15602
4	Pad	X15670
5	,, (rubber)	53160
6	Pad bolt	JA5052
7	Pad bolt nut	CA1126
8	Stop bolt	X15632
9	Stop bolt locknut	X22687
10	Lever	X15603
11	Lever stop bolt	X22832
12	Lever stop bolt lock nut	X22687
13	Lever spring	X15605
14	Lever taper pin	X15109
15	Bush	84642
16	Pull-off spring	80494
17	Link	84640
18	Link pin	81326
19	Link pin washer	7651
20	Link nut (to pedal)	EZ504
21	Bolt (to frame brace)	39191
22	FORK	X15111
23	Taper pin	X15109
24	Shaft	X15604
25	Shaft circlip	X15263
26	Thrust ring assembly	SA1523
27	Thrust plate	X15225
28	Thrust ring retaining wire	X19367
29	COVER-PLATE assembly	SA1522/1
30	Bolt (to flywheel)	CA1122
31	Dowel	X19237
32	Lever	X15227
33	Lever spring	X15229
34	Lever anchor plate	X15233
35	Thimble	X15220
36	Spring	X15221
37	PRESSURE PLATE	X15219
38	Stud	X15234
39	Stud lock washer	X15235
40	Stud nut	X15232
41	Stud nut lock washer	X15231
42	DRIVEN PLATE assembly	SA1524
43	Lining	X15210
44	Lining rivet	X15211



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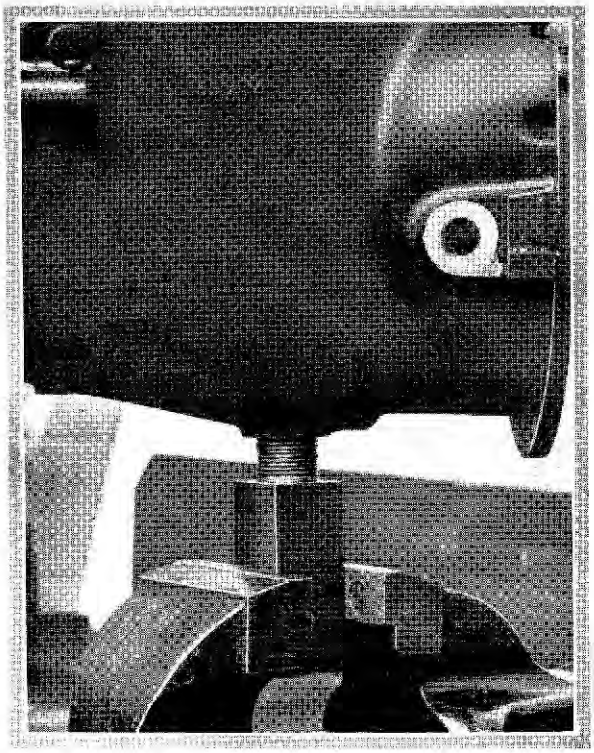
To Dismantle the Gearbox

WHEN dismantling the gearbox it will be found advantageous to support it in a vice by means of a piece of steel bar approximately 1½ in. square by 5 in. long, this being suitably machined and threaded at one end (30 mm. × 2 mm. pitch thread) to enable it to be screwed into the gearbox drain plug hole. (See illustration.)

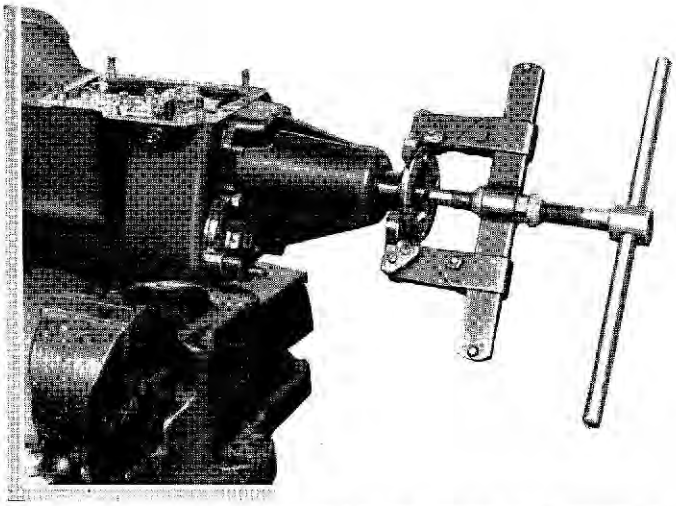
Remove the circlip at the near-side of the clutch operating fork shaft and the ¼ in. adjusting screw and lock nut from the clutch operating lever.

Release the clutch operating lever return spring and remove the clutch thrust pad by extracting the two retaining springs.

Extract the clutch fork locating taper pin, driving this upward by inserting a suitable pin punch through the clutch housing drain hole. The clutch operating fork shaft may then be tapped out, with the aid of a suitable drift, towards the off-side.



A plug threaded into the drain plug hole is used to locate the gearbox in the vice.



The type of extractor recommended for the removal of the propeller shaft flange.

Detach the gearbox drive gear bearing oil seal cover from the front of the gearbox by removing the three $\frac{3}{16}$ in. fixing bolts, observing that the two top bolts are equipped with spring washers and the bottom bolt with a plain copper washer.

Extract the split pin from the ½ in. nut, retaining the driving flange at the rear of the gearbox mainshaft, and remove the nut and plain steel washer. Using a suitable extractor, withdraw the driving flange. (See illustration.)

Release the speedometer drive housing from the rear of the gearbox by removing the four ¼ in. nuts and spring washers from their locating studs. Note that a paper gasket is fitted between the joint faces.

A felt oil retaining washer is fitted behind the mainshaft rear bearing at the rear of the speedometer drive housing. If a replacement is being fitted, it is essential to see that the outer edge of the washer goes right home in the recess provided.

Note that a pen steel washer is fitted in the register for the gearbox mainshaft bearing at the forward end of the speedometer drive housing.

Remove the bearing guard, noting that the dished portion goes towards the bearing. Using a suitable extractor, withdraw the bearing from the rear end of the mainshaft and remove the distance piece, speedometer drive gear and shim.

Continued

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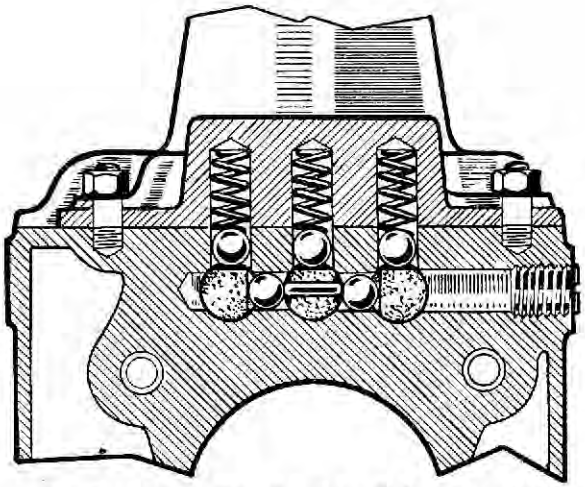
To Dismantle the Gearbox—*continued*

Extract the lock wire from the six square-headed screws locating the gear shifters, etc., to the selector shafts, and remove the screws with the special spanner, Part No. 16563.

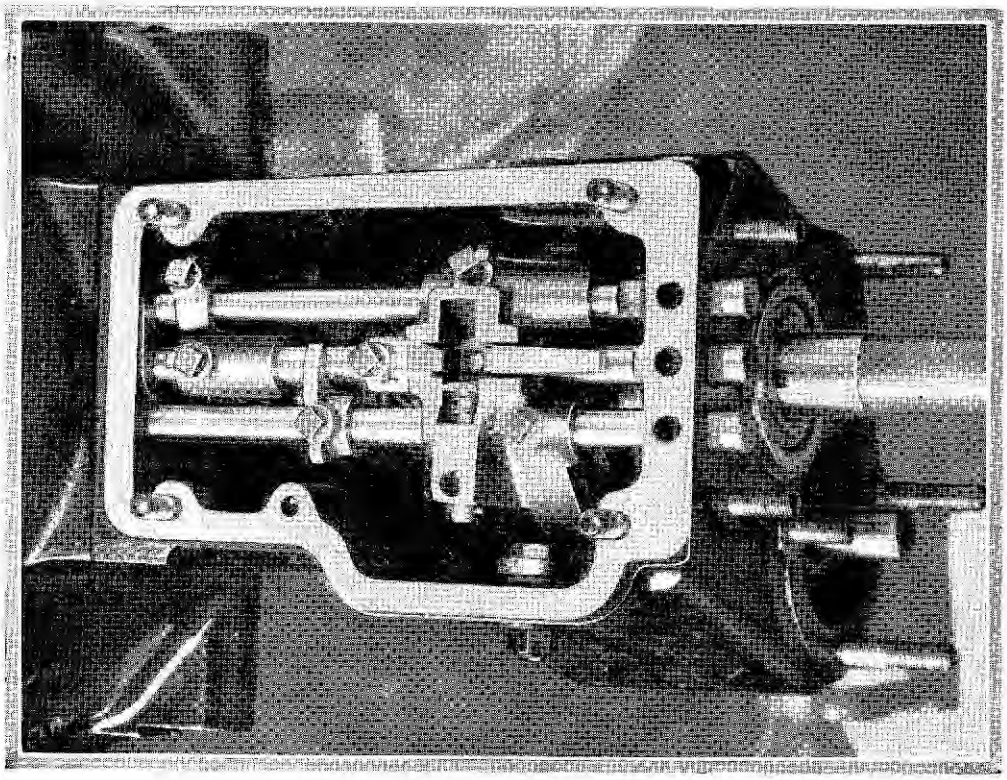
Withdraw the selector shafts one at a time, exercising care not to lose the lock balls in the process. Reference to the illustration will show the position of the various lock balls and springs. The gear shifters may now be extracted. Particular note should be made of the correct location of the gear shifters, etc., on the selector shafts as illustrated.

Remove the $\frac{3}{16}$ in. layshaft spindle dowel bolt located in the base of the gearbox casing at the rear. Using a suitable copper or brass drift, extract the spindle, tapping it from the forward end, allowing the layshaft gear unit to drop to the bottom of the gearbox.

With a copper or brass drift gently tap the rear end of the gearbox mainshaft forward, which will, in turn, drive the gearbox drive gear assembly from its housing.



This illustrates clearly the position of the selector lock balls and springs.



The positions of the selectors and stops are here clearly shown.

The gearbox mainshaft ball bearing is now gently tapped from its housing towards the rear of the gearbox, using a suitable copper or brass drift, and the bearing withdrawn from the shaft. The mainshaft, complete with gears, is now extracted from inside the gearbox as illustrated. The layshaft gear unit, which has a thrust washer fitted at either end, may now be removed.

Extract the split pin from the $\frac{1}{4}$ in. bolt and undo the bolt and nut locating the reverse gear shifter to the side of the gearbox. The reverse gear can then be removed from its spindle. The spindle is extracted by removing the $\frac{3}{16}$ in. dowel bolt from the near-side of the gearbox and gently tapping the spindle from the forward end, using a suitable copper drift for the purpose.

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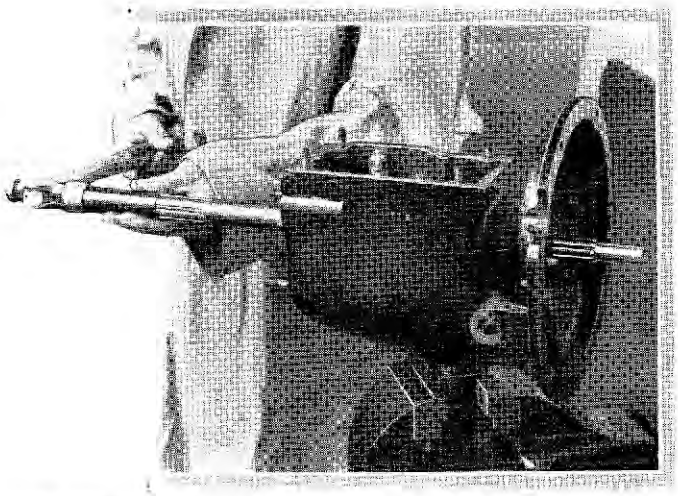
To Dismantle the Gearbox—*continued*



The drive gear assembly is withdrawn from its housing by tapping gently the mainshaft forward, using a suitable hollow drift.

Showing the method whereby the sliding shaft assembly is removed.

Dismantling the Gearbox Mainshaft Assembly

TO dismantle the gearbox mainshaft assembly withdraw the top and third gear synchromesh hub from the forward end of the shaft; observing that the plain side of the hub faces to the rear of the gearbox.

Remove the third speed gear collar by pressing down the spring-loaded locating plunger and rotate the collar until the male splines register with the female splines on the shaft. The third gear may now be withdrawn from its bush. Care must be exercised not to lose the plunger and spring.

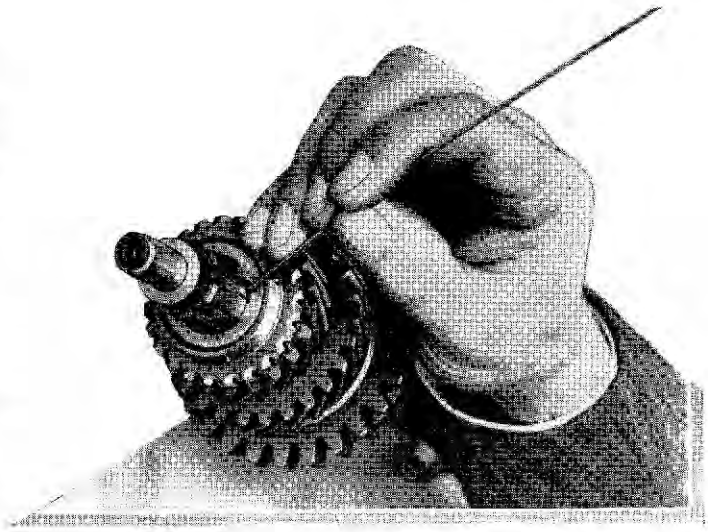
In order to remove the second gear and the second gear synchromesh hub unit, it is necessary to extract the third and second gear bush from the shaft. Remove the circlip which is fitted on the mainshaft at the rear of the second gear synchromesh hub and ease the hub back as far as it will go.

The mainshaft is then placed in a press with the second speed gear supported by suitable steel packings and the shaft pressed downwards in order to extract the bush together with the gear from the forward end of the shaft. Reference to the illustration will demonstrate how this operation is carried into effect.

To remove the second gear synchromesh hub unit, extract the second speed gear collar by pressing down the spring-loaded locating plunger and rotate the collar until the male splines register with the female splines on the shaft. The synchromesh hub may then be withdrawn from the shaft.

If it is necessary to separate the striking dog from either synchromesh hub and cone assembly, in order to retain the six balls and springs which are located in each hub, the assembly should be covered with a suitable duster.

The illustration shows the method of replacing the balls and springs by the use of broken hacksaw blades which are tapered at the ends.



Showing the second gear spring-loaded locating plunger.

Continued

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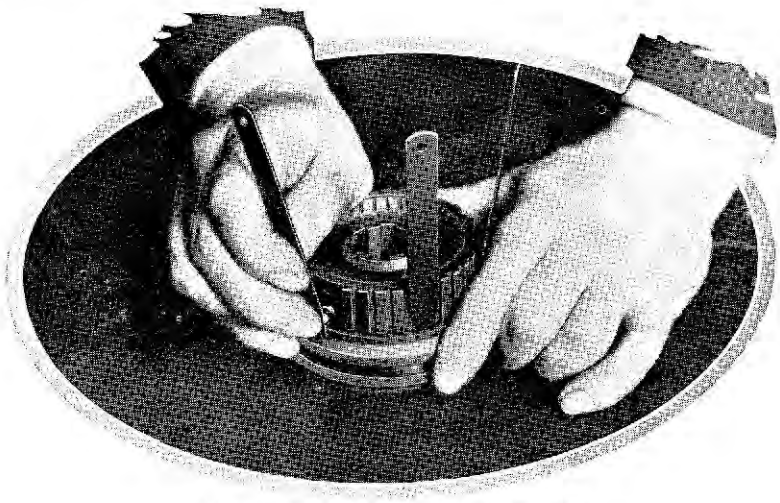
To Dismantle the Gearbox—*continued*



The method of reassembling the synchromesh hub assembly in order to keep the locating balls and their springs under control.

Points to observe on Reassembling

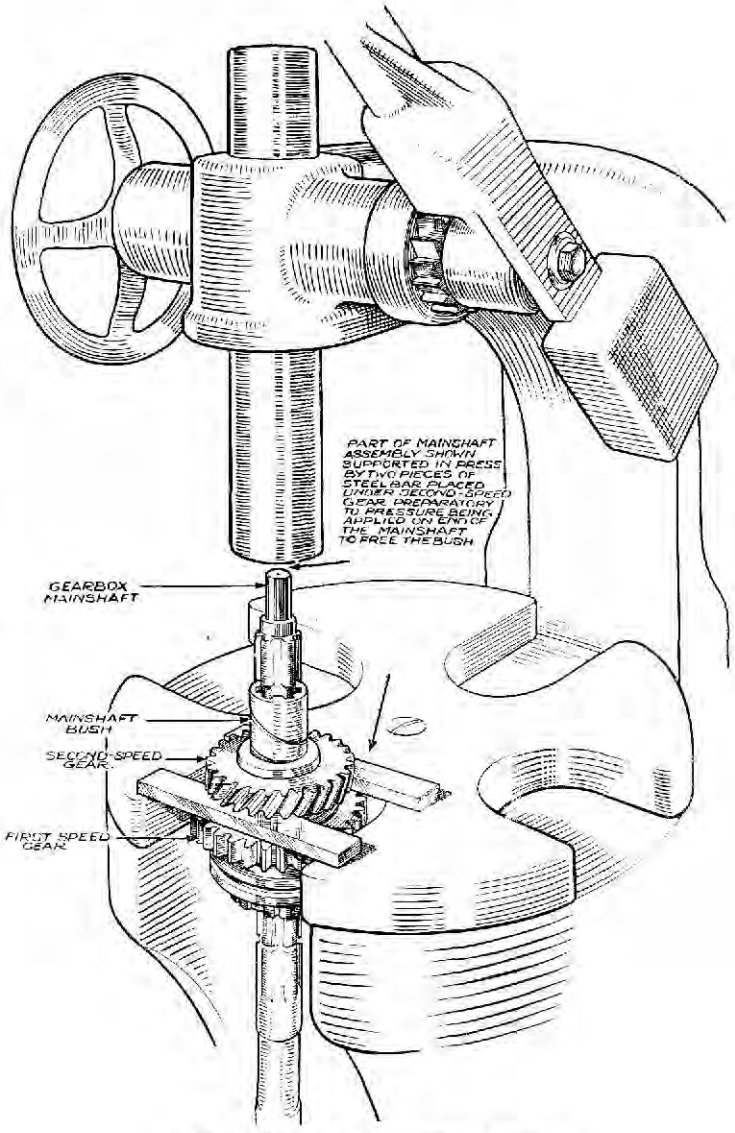
Refit the reverse gear and shifter first.

The layshaft gear unit, together with a thrust washer at either end, is next placed in position on the bottom of the gearbox. The layshaft spindle is not fitted until the mainshaft assembly and drive gear have been installed.

The mainshaft is entered into the gearbox casing and the drive gear fitted in position complete with bearing and the bearing front cover replaced. The mainshaft bearing is now located in its housing at the rear of the gearbox.

When fitting the layshaft spindle, raise the layshaft gear unit with a suitable tapered mandrill and enter the spindle from the rear of the gearbox. Care must be exercised to see that the dowel bolt hole in the spindle is lined up to correspond with the bolt hole in the gearbox casing.

The remainder of the reassembly is carried out in the reverse order to that of dismantling.



The mainshaft is withdrawn from the second gear bush in the manner illustrated.

Continued

To Dismantle the Gearbox—*continued*

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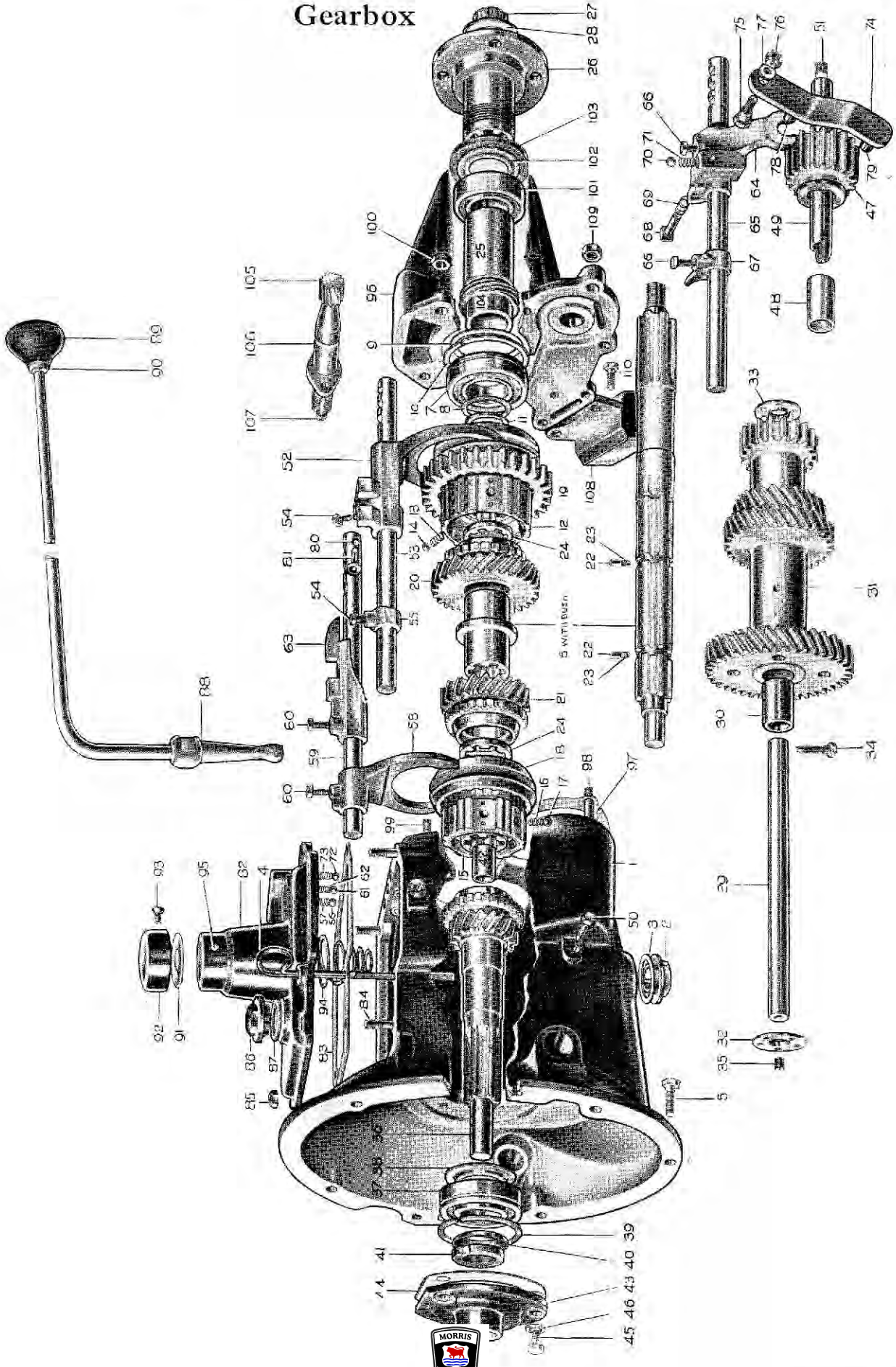
Gearbox



Continued

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To Dismantle the Gearbox—*continued*

Parts and Part Numbers

Illus. No	DESCRIPTION	Part No.
	GEARBOX	
	GEARBOX assembly	SA1516/8
1	Casing	SA1514/3
2	Drain plug	CA1215
3	Drain plug gasket	CA1216
4	Oil level indicator	X15017
5	Bolt (to block)	CA1258
6	MAINSHAFT (with bush)	SA1531/2
7	Bearing	X15625
8	Bearing plate	X15518
9	Bearing guard	X15624
10	Bearing circlip	X15517
11	Circlip	X15120
12	Sliding hub (1st and 2nd)	X15493
13	Sliding hub spring	X15669
14	Sliding hub ball	X15173
15	Sliding hub and cone assembly (top and 3rd)	SA1503/1
16	Sliding hub spring	X15127
17	Sliding hub ball	X15173
18	Striking dog	X15124
19	1st speed gear	X15560
20	2nd speed gear with cone	SA1543
21	3rd speed gear	X15490
22	Plunger	MA3756
23	Plunger spring	MA3757
24	Thrust washer	X15178
25	Distance piece	X15522
26	Universal joint flange	X15545
27	Universal joint flange nut	X17356
28	Universal joint flange washer	QA11200
29	LAYSHAFT	X15523
30	Bush	X15182
31	Gear unit with bushes	SA1517/1
32	Thrust washer (front)	X15524
33	,, (rear)	X15525
34	Screw	X15135
35	Plug	X15188
36	DRIVE GEAR (with bush)	SA1521/1
37	Bearing	X15625
38	Bearing guard	X15119
39	Bearing circlip	X15517
40	Bearing tab washer	X15182
41	Bearing nut	X15181
42	Spigot bearing	X15075
43	Oil seal cover	X15513
44	Oil seal cover gasket	X15514
45	Oil seal cover bolt	X15175
46	Oil seal cover plain washer	X15273
47	REVERSE GEAR (with bush)	SA1515/1
48	Bush	X17342
49	Shaft	X15527
50	Shaft screw	X17346
51	Shaft plug	LA7395
52	FIRST and SECOND GEAR SHIFTER	X15531
53	Shaft	X15666
54	Shaft screw	MA3641
55	2nd speed gear stop	X22851
56	Ball	CA1279
57	Ball spring	X15668
58	THIRD and FOURTH GEAR SHIFTER	X15529
59	Shaft	SA1545/1
60	Shaft screw	MA3641
61	Ball	CA1279
62	Ball spring	X15668
63	Selector	X15634
64	REVERSE GEAR SELECTOR	X15533
65	Shaft	X15667
66	Shaft screw	MA3641
67	Shaft steady	X22850
68	Plunger	X17186
69	Plunger spring	MA3645
70	Plunger ball	CA1279
71	Plunger ball spring	MA3643
72	Ball	CA1279
73	Ball spring	X15668
74	REVERSE GEAR SHIFTER LEVER	X15536
75	Pin	X17350
76	Pin nut	JA5088
77	Pin washer	X15176
78	Pin (centre)	X15535
79	,, (bottom)	X15537
80	INTERLOCK BALL	CA1279
81	Pin	MA3648
82	COVER	X15538
83	Gasket	X15539
84	Stud	CB1717
85	Stud nut	CA1126
86	Plug	SA1340
87	Plug gasket	CA1216
88	CHANGE SPEED LEVER	SA1532/1
89	Knob	QA11672
90	Knob lock nut	MA3654
91	Felt washer	X22672
92	Felt washer retainer	X22673
93	Felt washer retainer screw	X22674
94	Supporting spring	X22676
95	Snug	X22852
	SPEEDOMETER GEARS	
96	CASING	X15540
97	Gasket	X15541
98	Stud (long)	X15542
99	,, (short)	CB1717
100	Stud nut	CA1126
101	Bearing	QA11033
102	Bearing guard	X15119
103	Bearing felt washer	X19147
104	GEAR	X15543
105	PINION	X15544
106	Bearing	X20517
107	Bearing screw	CB1979
	REAR ENGINE MOUNTING	
108	MOUNTING RUBBER	84637
109	Nut (to engine)	EZ510
110	Bolt (to speedometer casing)	66841

Date of issue: July, 1939

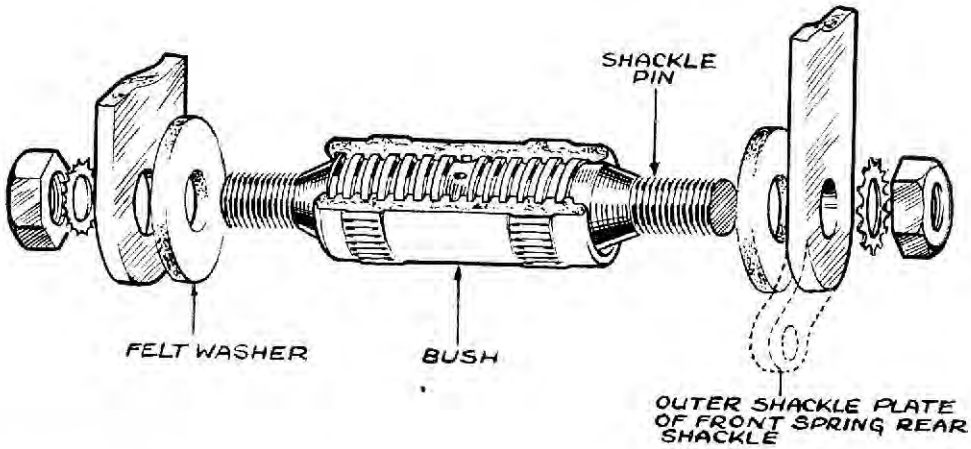
Replacement and Adjustment of Spring Shackle Pins and Bushes

BOTH front and rear springs are fitted with Silentbloc bushes at the forward end and fibre washers are placed either side of the spring eye. In the event of side play developing at this point the fibre washers should be renewed.

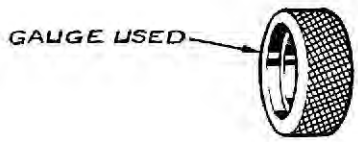
At the rear end of the front springs, the shackle pins have a screw thread cut on their bearing surface and are screwed into threaded bushes. Each rear spring rear top shackle is located to the frame by a high tensile steel bolt, equipped with nut and shakeproof washer. The bolt is supported in two special rubber bushes mounted in the rear spring hanger bracket. The bottom shackle is attached to the spring by a screwed type shackle pin.

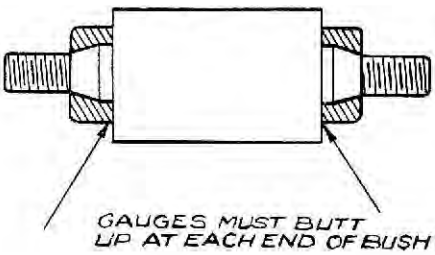
1. When fitting new shackle pins and bushes, or fitting replacement springs, it is essential to see that the shackles are adjusted in the correct manner, and for this purpose two shackle pin gauges (Part No. 67800) are required.

2. Apply a little lubricant to the shackle pin before it is screwed into its bush. Place one gauge on the taper at each end of the shackle pin and adjust the pin in the desired direction until both gauges butt on either end of the shackle pin bush.



3. The felt washers are then placed in position, followed in turn by the shackle plates, shakeproof washers and shackle pin nuts. (See illustration.) As a precautionary measure see that the shackle pin nuts are free on their threads so that the pin will not rotate when the nuts are fitted.





4. New springs are supplied fitted only with the Silentbloc bush, as in most instances the screwed bush will be found serviceable. It will be necessary, therefore, to remove the bush from the old spring, using a suitable extractor to avoid damage to the thread.

5. The bush may be fitted into the spring eye with a suitable press, or in a vice. A special tool (Part No. 67849) is required for extracting and fitting shackle pin bush[illegible] spring brackets.

Date of issue: July, 1939

To Remove the Radiator Core

IT is unnecessary to detach the radiator mask when removing the radiator core.

1. Drain the water from the radiator by means of the drain tap located in the near-side of the radiator bottom tank. If Bluecol or other anti-freeze mixture is used, it should be drained into a suitable container and carefully preserved for future use.

2. Release the clips on the top and bottom water hoses and detach the hoses from their connections.

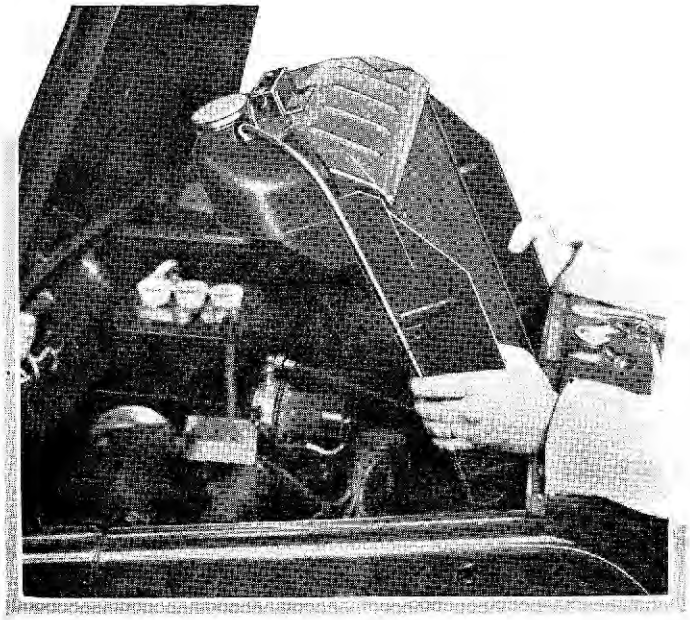
3. Disconnect the low-tension cable from the distributor.

4. Detach the dynamo and fan assembly from its bracket by removing the two $\frac{1}{2}$ in. dynamo fixing bolts, nuts and spring washers and $\frac{1}{4}$ in. dynamo adjusting nut, bolt and spring washer. The dynamo may now be laid in the tool tray, leaving its wires attached.

5. Undo the $\frac{5}{16}$ in. lock and brass nuts with plain steel washers from the two radiator foundation studs which pass through the front chassis cross member.

6. Remove the packing strip from under the bonnet webbing at the top of the radiator mask and undo the two countersunk-headed metal-threaded screws with nuts and spring washers locating the radiator core to the mask.

7. The radiator core may now be extracted by easing the top towards the rear of the car and lifting upwards as illustrated.



The radiator core can be withdrawn, leaving the mask in position on the chassis.

Date of issue: July, 1939

To Remove the Steering Wheel and Balance the Self-Cancelling Trafficator Switch

THE removal of the steering wheel and the balancing of the self-cancelling trafficator switch is quite straightforward if carried out in accordance with the following instructions.

1. Disconnect the positive battery terminal by slackening the $\frac{1}{4}$ in. pinch bolt and removing the cable lug from the battery terminal post.

2. Separate the four wires which lead from the centre of the steering column from their snap connectors coupling them to the harness cable. Unsolder and remove the four end caps from the wires.

3. Withdraw the rubber sheathing from the cable and unscrew the brass hexagon nut at the bottom of the steering gearbox. Carefully ease the bottom end of the stator tube upwards through the olive nipple. When released, the stator tube and switch assembly can be pulled upwards into the body of the car 2 in. or 3 in.

4. Slacken the cheese-headed clamp screw locating the base plate of the combined horn push and trafficator switch assembly to the stator tube, when the switch assembly complete with its harness cable may be withdrawn.

5. Push the stator tube back into the steering mast and remove the steering wheel retaining nut, using a $\frac{9}{16}$ in. box spanner.

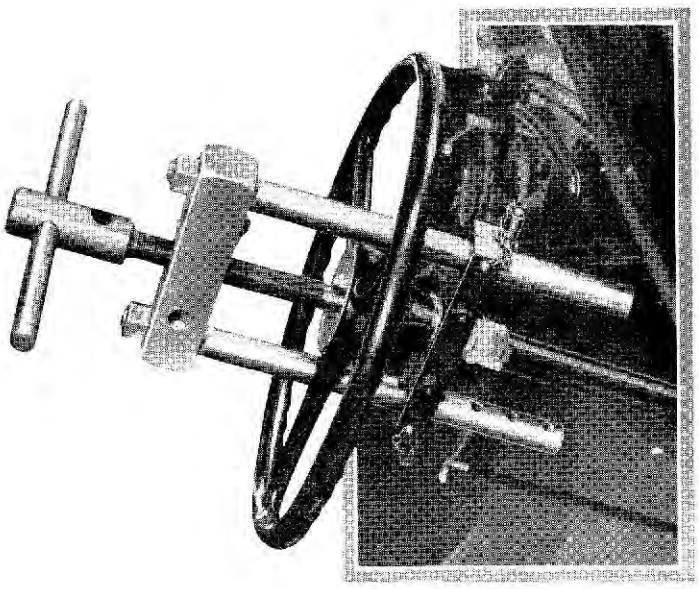
6. The steering wheel may now be withdrawn with the aid of the steering knuckle pin extractor, Part No. 55418, and the special attachment, Part No. 56052. (See illustration.)

7. When reassembling, a draw wire will be required to pull the harness cable downwards through the stator tube.

8. To balance the trafficator self-cancelling switch, set the front road wheels to the dead straight ahead position. The trip ring, located in the bowl of the steering wheel, should now be adjusted so that the knock-off cam is positioned at the bottom of the wheel (six o'clock position). This is effected by releasing the lock screw, the head of which protrudes through the side of the bowl of the wheel, and moving the trip ring to the required position and then tightening the lock screw.

9. The switch assembly is now mounted in position on the stator tube, and the clamp screw tightened. With the trafficator switch operating lever pointing to the top of the steering wheel (twelve o'clock position) the stator tube and switch assembly is pushed home. Care must be exercised to see that sufficient clearance is given to prevent the base plate of the switch assembly fouling the steering wheel.

10. The olive nipple is now placed over the lower end of the stator tube, where it projects through the bottom cover of the steering gearbox, and the brass hexagon nut tightened on its sleeve. During this operation an assistant should hold the switch assembly to prevent it moving from position.



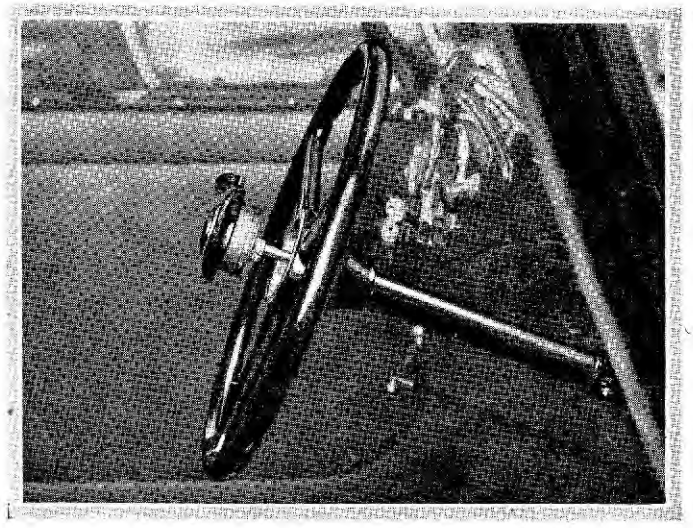
The steering wheel is removed by the aid of the steering knuckle pin extractor, Part No. 55418 and attachment Part No. 56052.

Date of issue: July, 1939

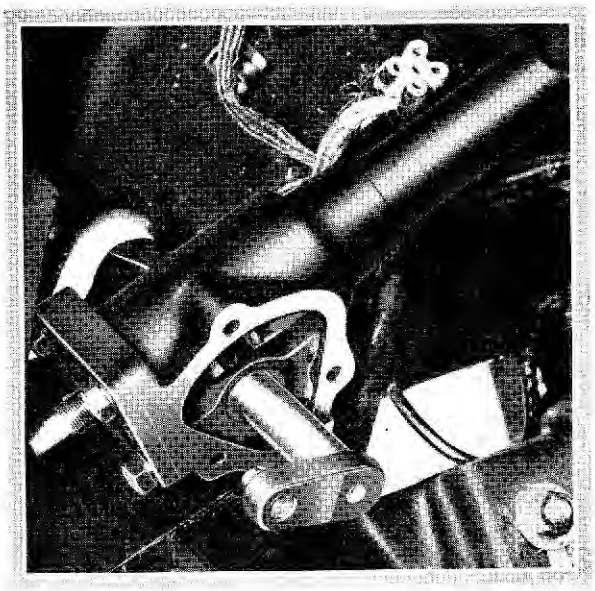
To Remove the Steering Column and Steering Gearbox Assembly

NO difficulty will be experienced in the removal of the steering column and steering gearbox assembly if the work is carried out in accordance with the following details.

1. Disconnect the battery by slackening the $\frac{1}{4}$ in. pinch bolt and removing the positive cable lug from the battery terminal post.
2. Drain the radiator by means of the drain tap located in the near-side of the radiator bottom tank. If "Bluecol" or other anti-freeze mixture is used, it should be drained into suitable container and carefully preserved for future use.
3. Release the clips on the top and bottom water hoses and separate the hoses from their connections.
4. Detach the radiator mask by removing the packing strip from under the bonnet webbing at the top of the mask and undo the two countersunk-headed metal-threaded screws with nuts and spring washers locating the radiator core to the mask. Undo the ten $\frac{3}{16}$ in. set screws, equipped with spring washers and plain steel washers, locating the radiator mask to the front wing valances.
5. Undo the $\frac{5}{16}$ in. lock nuts and brass flange nuts with plain steel washers from the two radiator foundation studs which pass through the front chassis cross member. The radiator may now be removed.
6. Disconnect the four wires leading from the bottom of the steering column to the harness cable, by separating them from their snap connectors. Unsolder the nipples from the wires and withdraw the rubber sheathing.
7. Unscrew the brass hexagon nut at the bottom of the steering gearbox and gently ease the bottom end of the stator tube upward through the olive nipple. When clear, the stator tube and switch assembly can be pulled upwards into the body of the car 2 in. or 3 in.
8. Slacken the cheese-headed clamp screw, locating the base plate of the combined horn push and trafficator switch assembly to the stator tube, when the assembly complete with harness cable may be withdrawn.
9. Push the stator tube back into the steering mast and remove the steering wheel retaining nut, using a $\frac{9}{16}$ in. box spanner.
10. The steering wheel may now be removed with the aid of the steering knuckle pin extractor, Part No. 55418, and the special attachment, Part No. 56052.
11. Release the bracket locating the steering column to the glove tray by undoing the two $\frac{3}{16}$ in. fixing bolts and nuts equipped with spring washers.
12. Remove the accelerator Bowden wire control bracket from the steering column by undoing the $\frac{3}{16}$ in. clamp bolt, and the accelerator pedal and bracket assembly by removing the two $\frac{5}{16}$ in. nuts and spring washers on the pedal bracket locating "U" bolt.
13. Raise the off-side front wheel clear of the ground and remove the road wheel. Withdraw the drop arm from the steering gearbox rocker-shaft by extracting the $\frac{1}{4}$ in. pinch bolt with nut and spring washer.
14. Remove the electric horn by undoing the $\frac{5}{16}$ in. fixing bolt, nut and spring washer.
15. Undo the two $\frac{5}{16}$ in. bolts and nuts with spring washers locating the steering gearbox to the front dumb iron.
16. Remove the steering gearbox cover complete with shims and paper gasket by undoing the three $\frac{1}{4}$ in. bolts with spring washers, catching the oil in a suitable container. Extract the rocker-shaft, exercising care not to lose the felt oil-retaining washer fitted on the rocker-shaft on the outside of the steering gearbox.
17. The steering gearbox and column assembly is now pushed towards the interior of the car until the steering gearbox is clear of the Lockheed brake pipe, when the assembly may be lowered between the chassis side member and engine. The assembly is then extracted from under the front of the car.
18. When refitting the drop arm, care must be taken to ensure that the mark on the rocker-shaft comes directly in line with the mark on the drop arm.



This clearly shows the position of the combined horn and trafficator switch clamp screw.



Showing the rocker-shaft partly withdrawn.

Continued

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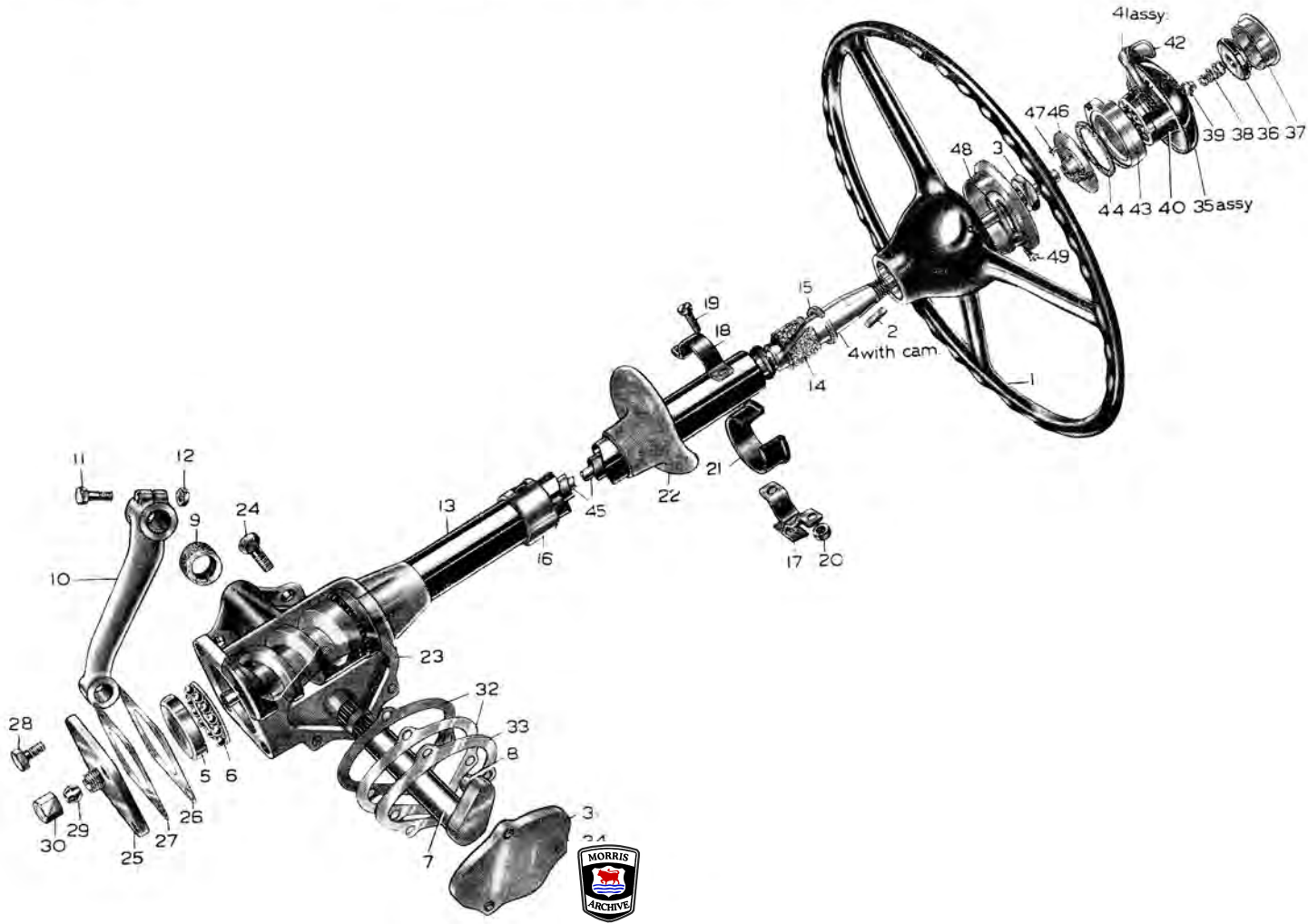
To Remove the Steering Column and Steering Gearbox Assembly—*continued*

Parts and Part Numbers

Illus. No.	DESCRIPTION	Part No.
	STEERING	
1	WHEEL	84201
2	Key	19835
3	Lock nut	84107
4	MAST with cam	39138
5	Ball cup for cam	37491
6	Ball cage with balls	37490
	Ball	35935
7	ROCKER-SHAFT with peg	38144
8	Peg	37621
9	Felt washer	81879
10	DROP ARM	84866
11	Clamp bolt	54627
12	Clamp bolt nut	EZ504
	Clamp bolt shakeproof washer	55458
13	COLUMN TUBE	39139
14	Felt bush (top end)	65154
15	Felt bush retaining ring	65155
16	Oil filler clip	67528
17	Bracket	106094
18	Bracket clamp	106095
19	Bracket clamp bolt	66835
20	Bracket clamp bolt nut	EZ503
21	Bracket clamp packing	106089
22	Ferrule	84329
23	STEERING BOX	39137
24	Bolt (to frame)	4993
	Bolt nut	EZ510
25	Bottom end cover	67525
26	Bottom end cover shim .0024"	38149
26	" " " " .005"	38150
26	" " " " .010"	38151
27	Bottom end cover gasket	38152
28	Bottom end cover bolt	54515
29	Olive	67529
30	Olive nut	67530
31	Side cover	37483
32	Side cover shim .0024"	37484
32	" " " .005"	37485
32	" " " .010"	37486
33	Side cover gasket	37487
34	Side cover bolt	54515
	HORN PUSH AND TRAFFICATOR CONTROL	
	CONTROL assembly	39248
35	Top cover assembly	67639
36	Horn push button	67741
37	Horn push button retainer	67742
38	Horn push button spring	67743
39	Horn push button spring spacer	67744
	Horn push contact assembly	67640
40	Indicator switch base assembly	67641
	Indicator switch rotor assembly	47466
41	Indicator switch lever assembly	67642
42	Indicator switch lever knob	67084
43	Indicator striker ring	67645
44	Striker ring felt	67646
45	Stator tube	39249
46	Stator tube clamp plate	67647
47	Clamp plate bolt	67704
	Cable	66990
48	Locating ring with screw	67755
49	Locating ring screw	41530



Date of issue: July, 1939

To Remove the Instrument Panel

ACCESS to the instruments, windscreen wiper assembly and windscreen control is obtained by detaching the instrument panel from the facia board.

1. Disconnect the battery positive terminal by slackening the $\frac{1}{4}$ in. pinch bolt and remove the cable lug from the battery terminal post.

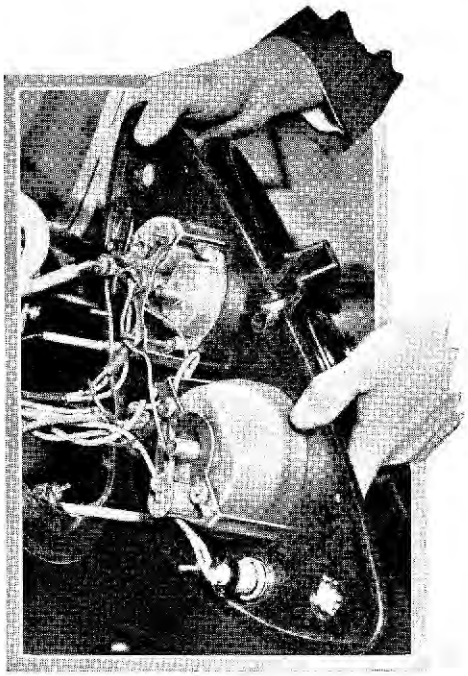
2. Release the starter switch Bowden control from the coupling located on the scuttle, immediately above the toeboard, by undoing the $\frac{1}{8}$ in. set screw. Detach the mixture control from the carburetter.

3. Disconnect the speedometer outer cable from the speedometer together with the oil gauge pipe from the gauge.

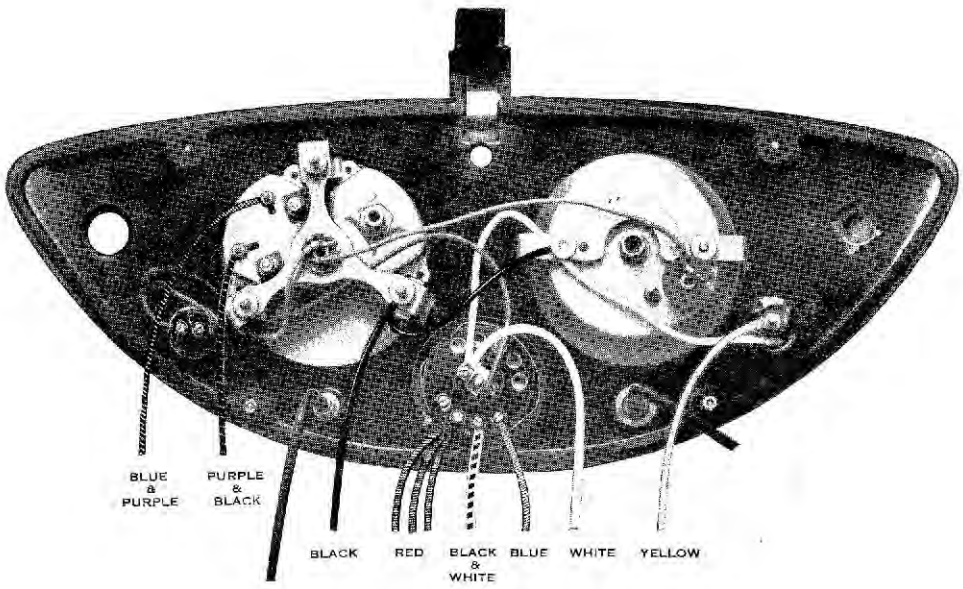
4. Remove the windscreen wiper bakelite handle by unscrewing the small grub screw locating it to its spindle. Undo the retaining screw in the centre of the windscreen control operating handle and extract the handle from its spindle.

5. Undo the two metal threaded screws at the top of the instrument panel and the two small hexagon nuts located behind the panel at the bottom.

6. The instrument panel can now be pulled out from the facia board. The operations necessary to remove the various instruments are obvious and do not present any difficulty.



Showing the instrument panel removed from the facia.



The electrical connections are here clearly shown.

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Removal of Windscreen Wiper Assembly

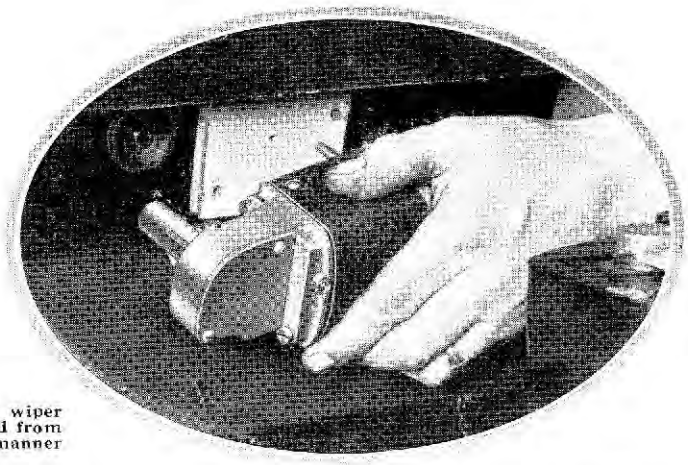
REMOVE the two $\frac{1}{8}$ in. nuts with plain steel washers and rubber washers from the windscreen wiper motor foundation studs on the inside of the scuttle. Disconnect the two wires from the windscreen wiper motor, noting that the green and purple lead goes to the terminal nearest to the scuttle. The motor may now be removed by easing it away from the scuttle as illustrated.

Detach the wiper blade and arm from its spindle by slackening the cheese-headed locating screw and withdraw the rubber sealing ferrule.

The drive spindle is released from its bracket by removing the two round-headed metal-threaded fixing screws with spring washers, and the wiper blade spindle and switch assembly by removing the two round-headed metal-threaded fixing screws and spring washers. Both spindles, complete with connecting link, may now be extracted. Note the green and purple wire goes to the top, and the black wire to the bottom terminal clip of the switch.

The connecting link may be detached by removing, in their respective order, the split pin, flat steel washer, spring and felt washer. Note that a felt washer is placed both sides of the connecting link.

When reassembling, care must be exercised to locate the wiper blade and arm correctly on its spindle, observing that it is parked to the "off-side" and should be clear of the lower edge of the windscreen when in the "park" position.



The windscreen wiper motor is detached from the dash in the manner shown.

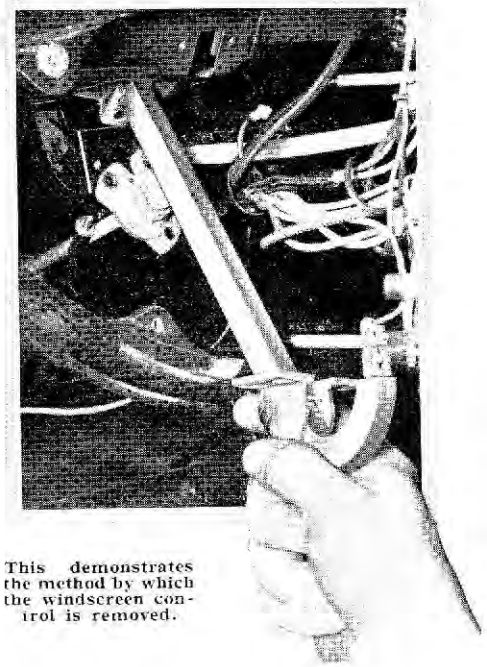
Windscreen Control

THE windscreen control mechanism is removed by first undoing the cheese-headed set screw which locates the control chain to the lug at the bottom of the screen.

Remove the four round-headed metal threaded screws with spring washers and plain steel washers, attaching the rear end of the control to the lower screen rail reinforcement, and the two $\frac{1}{8}$ in. bolts, nuts and spring washers locating the forward end of the control to the scuttle.

Release the windscreen wiper drive spindle from its bracket by removing the two round-headed metal-threaded fixing screws and spring washers, and allow the spindle to drop to give clearance to the forward end of the control as it is extracted. (See illustration.)

The holes at the rear of the control, through which the four round-headed metal-threaded fixing screws pass, are elongated to provide for correct alignment, and this should be checked before the screws are finally tightened.



This demonstrates the method by which the windscreen control is removed.

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Removal of the Body from the Chassis

1. Remove the front seats and rear seat cushion and squab. The latter is located by three round-head wood screws which are accessible from inside the luggage boot.

2. Take out the carpet mats, noting that the front seat steady clips must be removed by undoing the two countersunk-headed metal-threaded screws in each, before the rear carpet mat can be extracted. It is recommended that the electrical details are dealt with next.

3. Disconnect both cables from the battery by slackening the $\frac{1}{4}$ in. pinch bolts and removing the cable lugs from the battery terminal posts. Observe that the positive terminal is connected to earth. Remove the battery by undoing the two $\frac{1}{4}$ in. fixing bolts, equipped with double coil spring washers.

4. Disconnect the petrol pump feed pipe by undoing the $\frac{5}{16}$ in. union nut and detach the pump from the scuttle by removing the two $\frac{3}{16}$ in. fixing bolts and spring washers. Release the white wire from the insulated terminal and the black wire from the terminal on the body of the pump, when the pump may be allowed to rest on top of the engine.

5. Detach the coil from the scuttle by removing the two $\frac{3}{16}$ in. bolts, the top one being equipped with a nut and spring washer. The lower bolt, to which the engine earth cable is located, screws into a clinch nut and is equipped with a spring washer. Disconnect the high-tension lead from the centre terminal, and remove the two white wires from the terminal marked "S.W." and the brown and white wire from the terminal marked "C.B."

6. It is not necessary to disconnect the various wires from the junction and control box. This may be removed from the scuttle by undoing the two round-headed metal-threaded fixing screws. Note that a rubber washer is fitted on each screw between the base of the control box and scuttle.

7. Disconnect the starter cable, and also the battery cable together with the yellow and black wire from the starter switch by undoing the two $\frac{5}{16}$ in. terminal bolts equipped with spring washers.

8. Remove the two leads from the windscreen wiper motor, noting that the green and purple wire is attached to the terminal nearest to the scuttle. Pull the two wires through from inside the scuttle and release the black wire which is located to one of the chassis identification plate fixing screws.

9. The instrument panel must now be removed and the wires connected thereto released. Disconnect the speedometer outer cable from the speedometer together with the oil gauge pipe from the oil gauge and release the pipe from its connection on the cylinder block. Withdraw the pipe from the scuttle.

10. Release the mixture control from the carburetter by slackening the $\frac{3}{16}$ in. nut locating the Bowden cable to the jet operating arm and slacken the $\frac{1}{8}$ in. pinch bolt locating the outer cable in its steady bracket.

11. Disconnect the starter switch operating Bowden control from the coupling located on the scuttle, immediately above the toeboard, by undoing the $\frac{1}{8}$ in. set screw.

12. Remove the windscreen wiper bakelite handle by unscrewing the small grub screw locating it to its spindle. Undo the retaining screw in the centre of the windscreen control operating handle and extract the handle from its spindle.

13. Undo the $\frac{1}{4}$ in. nut and round-headed metal-threaded screw locating the harness cable clip to the underside of the toolbox.

14. The instrument panel may now be detached from the facia board by undoing the two raised-head metal-threaded screws at the top of the panel and the two small hexagon-headed nuts located behind the panel at the bottom (see illustration).

15. Extract the wires from their respective terminals as follows:—

1 yellow wire to ignition warning light
1 black wire to speedometer support frame
1 white wire to centre terminal of switchbox
1 blue wire to the first or right-hand bottom terminal
1 black and white wire to second terminal
3 red wires to third terminal
} These connections are all on the switchbox.
The fourth terminal is left blank.
2 black wires to the instrument support frame
1 purple and blue wire to the top petrol gauge terminal
1 purple and black wire to the bottom petrol gauge terminal.

The remaining wires are left in position on the panel. The connections referred to above are looking at the back of the instrument panel. Reference to the illustration will show the exact position of each wire.

16. Detach the wiper blade and arm from its spindle by slackening the cheese-headed locating screw and withdraw the rubber ferrule. Release the wiper spindle and switch assembly from its bracket by removing the two round-headed metal-threaded fixing screws and spring washers. Unsolder the wires from the switch terminal clips, noting that the green and purple wire goes on the top and the black to the bottom.

17. The harness cable and the speedometer cable are now withdrawn from the scuttle towards the engine.

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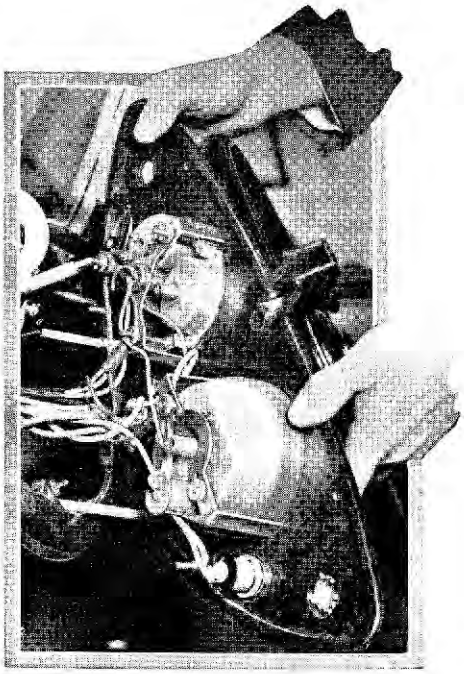
Removal of Body from Chassis—*continued*

18. Separate the two trafficator wires from their snap connectors located under the rear off-side floorboard. Remove the protecting cover from the top of the floorboard and draw the wires up into the interior of the body.

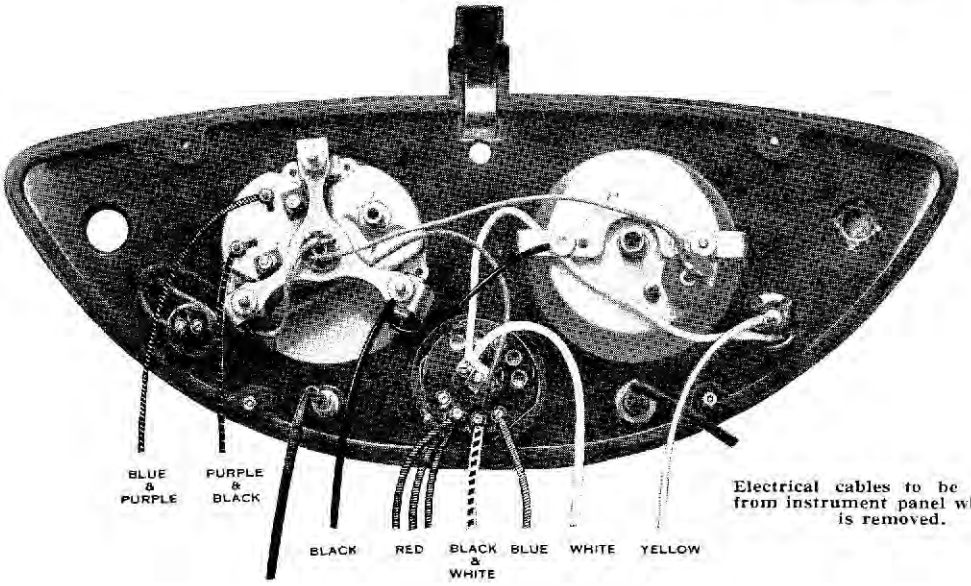
19. Disconnect the wires from the tail and stop lamp, observing that the purple wire is attached to the stop, the red wire to the tail, and black wire to the earth, terminal clips. This completes the dismantling of the electrical equipment as far as is necessary.

20. Remove the bonnet by unscrewing the two $\frac{3}{16}$ in. fixing bolts equipped with spring washers locating each hinge to the bonnet, and put in a safe place.

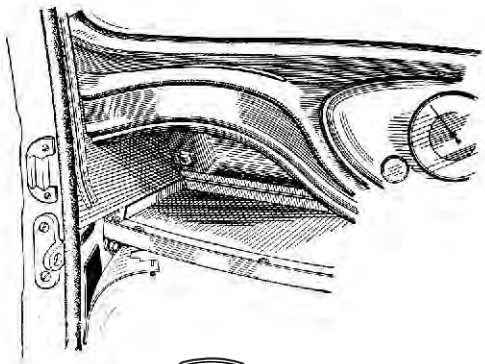
21. Release the glove tray front rail by removing the two $\frac{3}{16}$ in. nuts, bolts and spring washers from the steering column steady bracket. Remove the raised head fixing screw and nut from the glove tray centre support bracket. Extract the seven bifurcated rivets attaching the glove tray floor to the front rail. Undo the round-head metal fixing screw and spring washer and the $\frac{3}{16}$ in. bolt, with spring washer, locating each end of the rail to the body side. Ease back the trim panel at each side and remove the rail.



Showing the instrument panel removed from the facia.



Electrical cables to be detached from instrument panel when body is removed.



This clearly illustrates the position of the glove tray rail fixing screws.

Continued

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Removal of Body from Chassis—*continued*

22. Detach the gear lever knob, first slackening the $\frac{1}{4}$ in. lock nut, and remove the gearbox rubber cowl.

23. Remove the near-side and off-side floorboards by unscrewing the four countersunk-headed metal-threaded fixing screws equipped with spring washers. Release the rexine draught strip from the body side member.

24. Release the off-side toeboard by removing the six countersunk-headed metal-threaded fixing screws together with the dished washers and detach the foot dip switch from the board by undoing the two round-headed metal-threaded fixing screws.

25. The near-side toeboard and gearbox shield assembly is detached by undoing the six countersunk-headed and one round-headed metal-threaded fixing screws and dished washers.

26. Remove the small metal plate covering the aperture under the steering column at the bottom of the scuttle by undoing the two countersunk-headed metal-threaded fixing screws equipped with dished washers.

27. Extract the three $\frac{1}{4}$ in. bolts, nuts and spring washers locating the scuttle side panel to the bonnet valance on each side, and the four $\frac{1}{4}$ in. bolts and plain washers securing the rear half of the front wings to the body.

28. To remove the rear bumper bar, detach the small metal plates covering the rearmost bumper bracket bolt holes. Reference to the accompanying illustration will explain the location of the plates, which are attached by two countersunk-headed self-tapping screws. The bumper brackets are located on each side by two $\frac{3}{8}$ in. bolts and nuts, equipped with spring washers, which should be removed with a suitable box spanner. The bumper is then extracted from the rear.

29. Unscrew the eight countersunk-headed metal-threaded screws locating the body to the top face of each frame side member, and the three countersunk-headed metal-threaded screws and two $\frac{3}{16}$ in. bolts locating the body to the rear frame cross member. (See illustration.)

30. Remove from each side the eight $\frac{3}{16}$ in. nuts and bolts with spring washers and plain washers passing through the chassis frame side members. These are located under the body sills and rear wheel arches.

31. Release the petrol tank filler neck by slackening the connecting hose clips inside the luggage boot and extract the neck from the boot side.

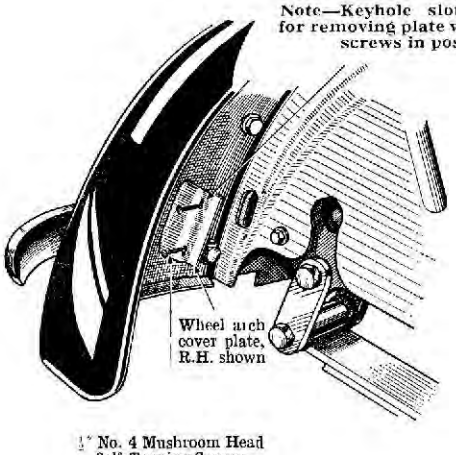
32. The removal of the rear wings is not essential but is recommended to avoid damage.

33. The body is now ready for removal and the rear end should be raised to enable the insertion of a suitable lifting pole over the centre of the rear wheels.

34. Raise the front end of the body and place a second pole between the body and chassis just to the rear of the hand brake lever bracket.

35. Four men are required to lift the body clear and walk with it backwards clear of the chassis. (See illustration).

36. Reassembly is carried out in the reverse order to that of dismantling, but when the body is replaced make sure that the scuttle side panels go right up to the bonnet valances, and replace and tighten the three nuts and bolts on each side first.



1" No. 4 Mushroom Head Self-Tapping Screws

Continued

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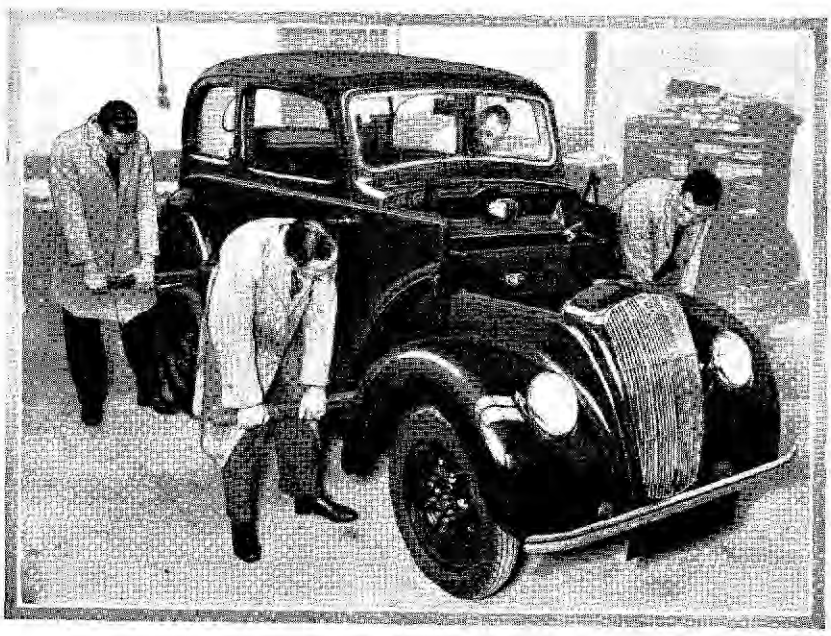
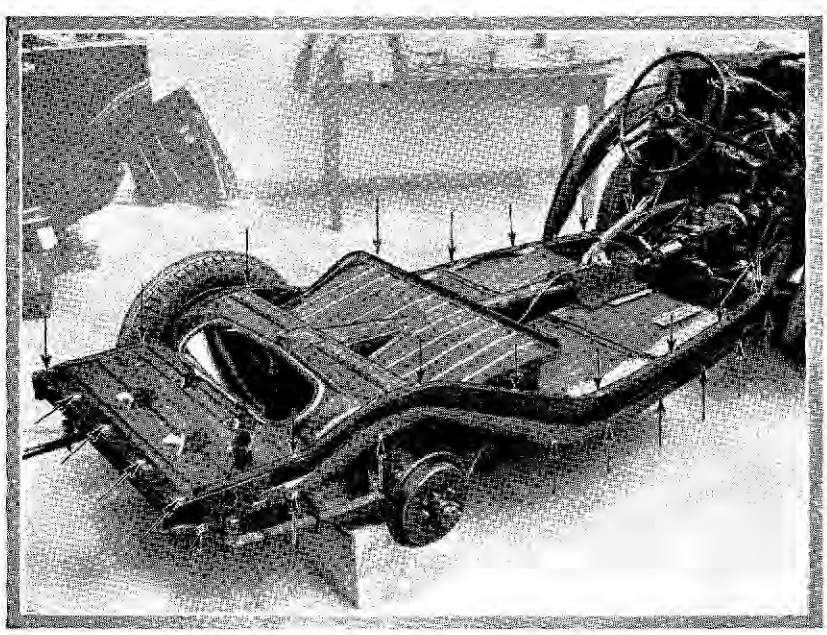
Removal of Body from Chassis—*continued*



Four men are required to lift the body with suitable poles in the positions illustrated.



The arrows indicate the positions of the various body bolts.

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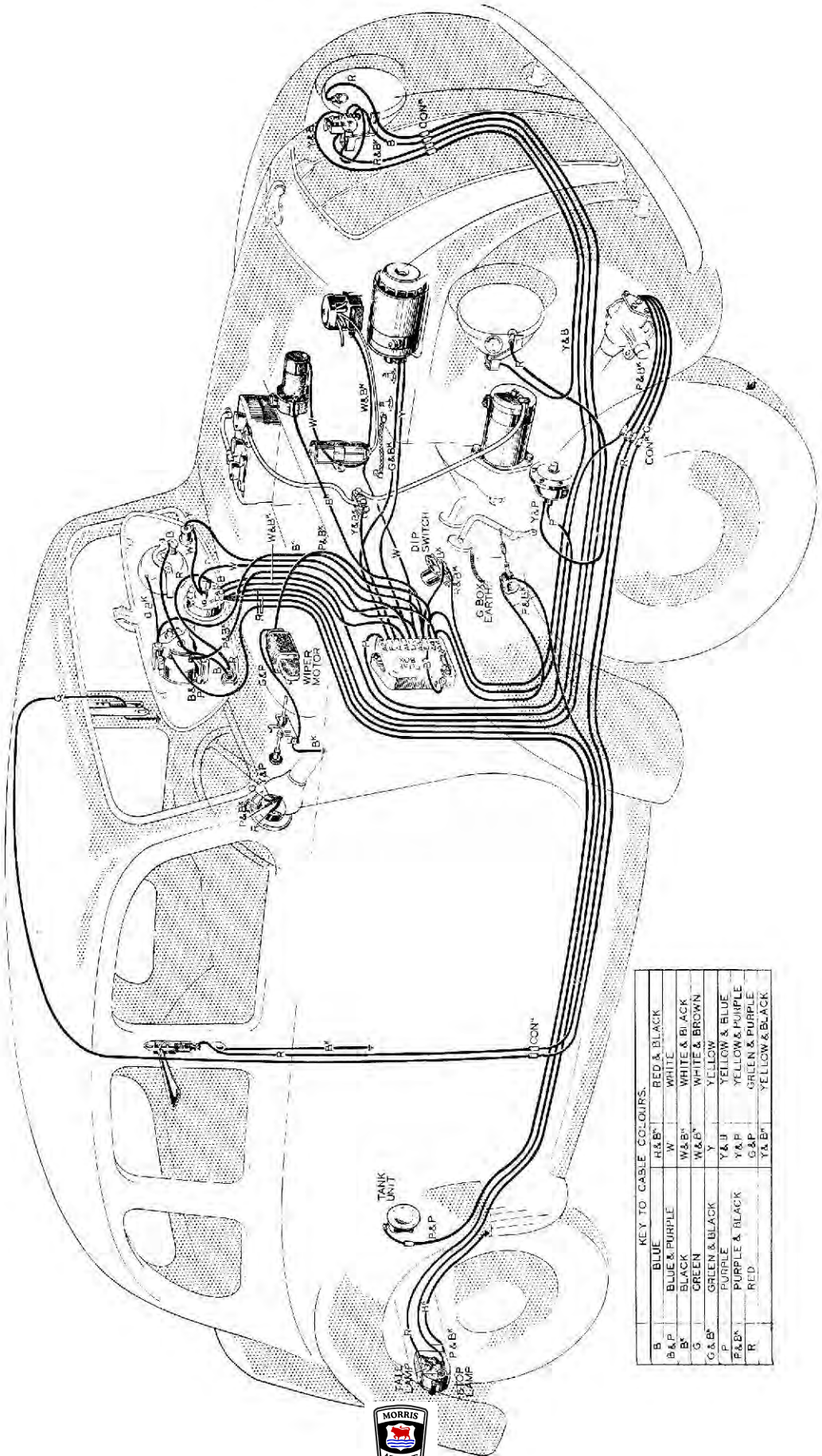
Wiring Diagram



Date of issue : July, 1939

Electrical Equipment—Maintenance Instructions

DYNAMO

Compensated Voltage Control Types

COMPENSATED voltage control type dynamos operate in conjunction with a regulator which automatically varies the dynamo output according to the load on the battery and its state of curve.

The regulator also incorporates a temperature compensation which adjusts the setting to suit climatic conditions, and which also causes the dynamo to give a controlled boosting charge at the beginning of a run.

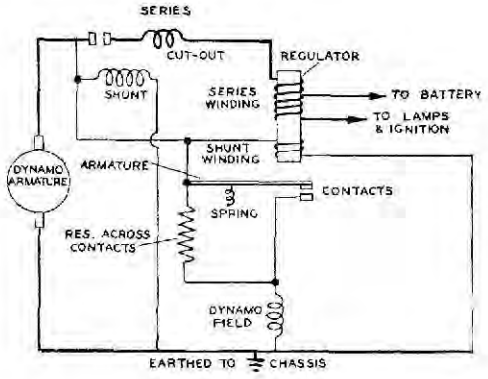
The regulator is combined structurally with the cut-out. The regulator and cut-out are, however, electrically separate, employing separate armatures, though they possess field systems which are common over a portion of the magnetic path.

The windings consist of a voltage winding connected directly across the dynamo and two current windings, one of which carries the full current from the dynamo to the battery, while the other winding carries the current of the lighting, ignition and accessory loads. These coils assist each other in energising the magnet system and thus in effecting movement of the armature.

When the dynamo voltage reaches a value determined by the state of charge of the battery, the magnetic field due to the voltage winding becomes sufficiently strong to attract the armature. This causes the contacts to open, thereby inserting the resistance in the field circuit. This reduction in field current lowers the dynamo voltage, and this, in turn, weakens the magnetic field due to the voltage coil. This allows the armature to return to its original position, thus closing the contacts, so that the voltage returns to the predetermined maximum. The cycle is then repeated, and the armature is set into vibration.

As the speed of the dynamo rises above that at which the regulator comes into operation—about 20 m.p.h.—the amplitude of vibration increases and the periods of interruption increase in length, with the result that the mean value of the dynamo output undergoes practically no increase once the operating speed has been attained.

The series windings provide a compensation on this system of control, for if the control were arranged entirely on the basis of dynamo voltage there would be a risk of very seriously overloading the dynamo when the battery was in a low state of charge, particularly if the lamps were simultaneously in use. Under these conditions the dynamo would be forced to give an output to bring the voltage of the system up to the same value as if the battery were in its normally fully charged condition, and this, with a battery of low internal resistance would necessitate an extremely heavy current far beyond the normal capacity of the machine. The series winding assists the voltage coil, so that when the dynamo is delivering a heavy current into a discharged battery the regulator comes into operation at a somewhat reduced voltage, thus limiting the dynamo output accordingly.



REGULATOR TYPE LRT9.

Continued

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TO LOCATE AND REMEDY CHARGING TROUBLES
(Compensated Voltage Control Dynamo)

Symptoms		*Possible Causes*
Battery in low state of charge.	Dynamo giving low or intermittent output, indicated by ammeter giving low or intermittent charge reading when car is running steadily in top gear with no lights on.	Broken or loose connection in charging circuit. Battery needs attention. Commutator dirty. Commutator worn. Brushes sticking. Brushes worn. Brush springs weak. Brushes not bedding. Regulator out of adjustment.
	Dynamo not charging, indicated by ammeter not showing charge reading when running steadily in top gear with no lights in use.	Broken or loose connection in charging circuit. Battery needs attention. Commutator dirty. Brushes worn. Brushes lead broken. Regulator out of adjustment. Cut-out damaged. Cut-out contacts dirty. Dynamo field coils damaged. Armature damaged.
Battery overcharged, shown by burnt-out bulbs and very frequent need for "topping-up."	Dynamo giving high output, indicated by ammeter giving high charge reading.	Regulator out of adjustment.

ADJUSTMENT OF THE REGULATOR
(Regulators Type LRT9)

When to Adjust

The regulator is carefully set before leaving the works to suit the normal requirements of the standard equipment and in general it should not be necessary to alter it. If, however, the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, it may be advisable to check the setting and if necessary, to re-adjust.

It is important, before altering the regulator setting, when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to dynamo belt slip occurring.

Before any attempt is made to adjust regulators, the operator should examine the dynamo commutator and brushes, make sure that the driving belt is tight, and check over the equipment for loose connections, blown fuses, etc. Accessories should not be switched on during the checking or adjustment.

It will be understood that the adjustment is determined on open circuit, i.e. with no battery or load in circuit. Adjustment should not be made unless the open circuit figures are outside those given.

Continued

Date of issue: July, 1939

Adjustment of the Regulator—*continued*

How to Adjust

Withdraw the cables from the terminals marked "A" and "A1" in the cut-out and regulator unit and join them together.

Connect the negative lead of voltmeter (see Sheet No. 21 for details of a suitable instrument) to the "D" terminal on the dynamo, and connect the other lead from the meter to the dynamo end bracket or some other convenient chassis earth.

The regulator incorporates a thermostatic compensation, one of the functions of which is to adjust the setting of the regulator according to the temperature, and this must be taken into consideration when making adjustments. Adjustment must be made with the regulator cold, i.e. immediately on starting the engine, and the atmospheric temperature must be noted by means of a thermometer.

Slowly increase the speed of the engine until the voltmeter needle "flicks" and then steadies; this should occur at a voltmeter reading between the limits given below for the particular temperature of the regulator.

Atmospheric Temperature	*Regulator Setting (6-Volt)*
10°C.	8.3—8.6 volts
20°C.	8.2—8.5 volts
30°C.	8.1—8.4 volts
40°C.	8.0—8.3 volts

If the voltage at which the reading becomes steady occurs outside the limits, the regulator must be adjusted.

Shut off the engine, release the lock nut holding the adjusting screw, and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn and then tighten the lock nut.

When adjusting, do not run the engine up to more than half throttle, as while the dynamo is on open circuit it will build up a high voltage if run at a high speed, and so a false voltmeter reading would be obtained.

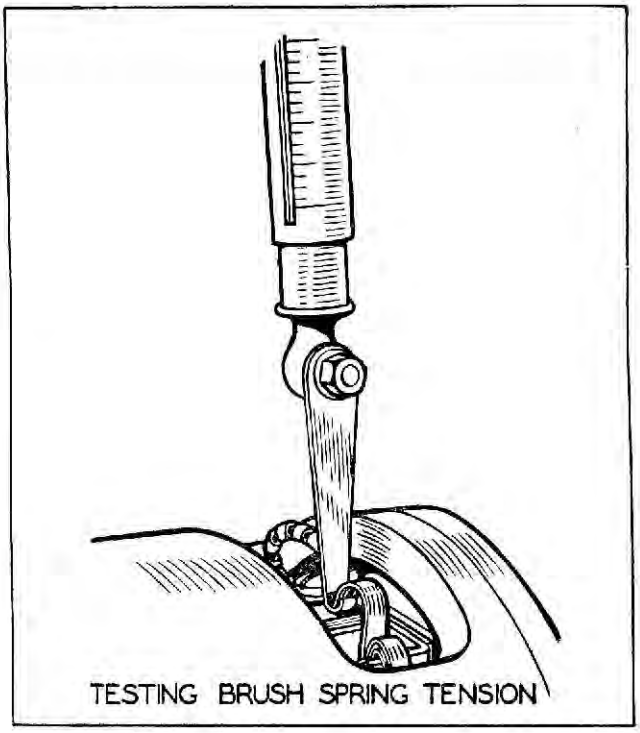
DYNAMO

Sticking Brush

Test by holding back the brush spring and moving the brush in its holder. If the brush tends to stick, remove it and clean with petrol.

Brush Spring Weak

Test by a small spring scale. The correct spring tension is 15—25 oz. If the tension is low, fit a new spring.



TESTING BRUSH SPRING TENSION

Continued

Date of issue: July, 1939

Dynamo—*continued*

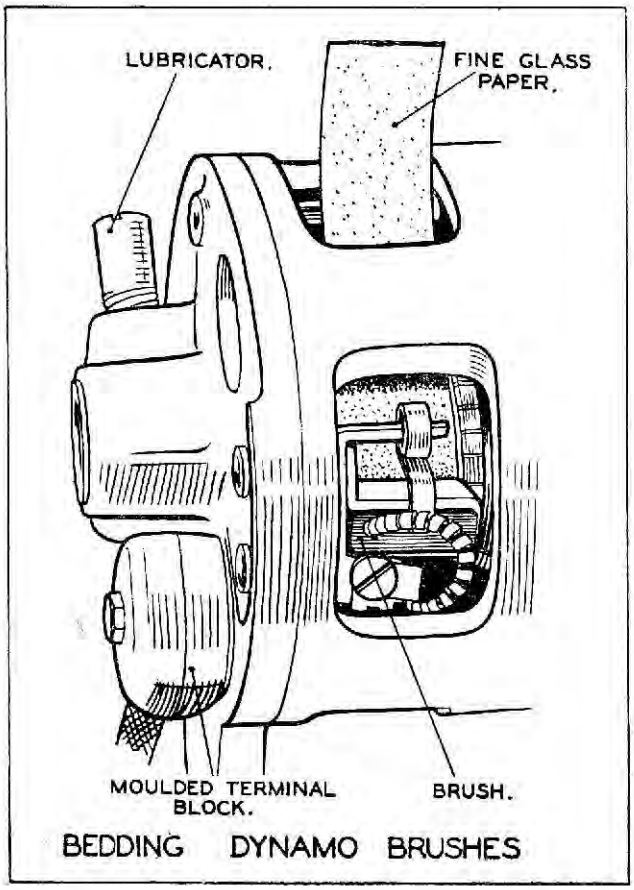
Brushes Worn

If the brushes have worn to such an extent that they do not bear properly on the commutator they must be replaced.

Remove dynamo from engine.
Withdraw dynamo cover band.
Remove screw securing eyelet on end of lead from brush.
Hold back brush spring and remove brush from its holder.
Place new brush in holder and gently lower spring.
Secure eyelet on end of brush lead in original position.
Bed the brushes to the commutator.

Bedding Brushes to the Commutator

The surface of the brush in contact with the commutator must present a uniformly polished appearance. Brushes must be bedded to the commutator as follows :—



BEDDING DYNAMO BRUSHES

Pass a thin strip of very fine glass paper between the commutator and each of the brushes so that the abrasive surface is towards the brush faces. Turn the armature in its normal direction of rotation for a few minutes and then remove the glass paper. Wipe away carbon or sand paper dust after the operation. It is best removed by blowing the dynamo out with a pump or compressed air with the machine in motion.

After several days' running the brush gear should again be examined, and any carbon dust wiped away. At the same time the dynamo output should be checked.

Dirty or Greasy Commutator

A commutator in good condition will be smooth and free from pits or burned spots.

Clean the commutator with a cloth moistened with petrol. If this is ineffective, carefully polish with a strip of fine glass paper. Pass the glass paper round the commutator and draw it backwards and forwards while the armature is slowly rotated.

Continued

Date of issue: July, 1939

CONTROL BOX

Model RF91

This unit houses the cut-out and dynamo voltage regulator (see illustration) together with two fuses.

The fuses incorporated in this unit protect the auxiliary accessories (i.e. the electric horn, windscreen wiper, etc.).

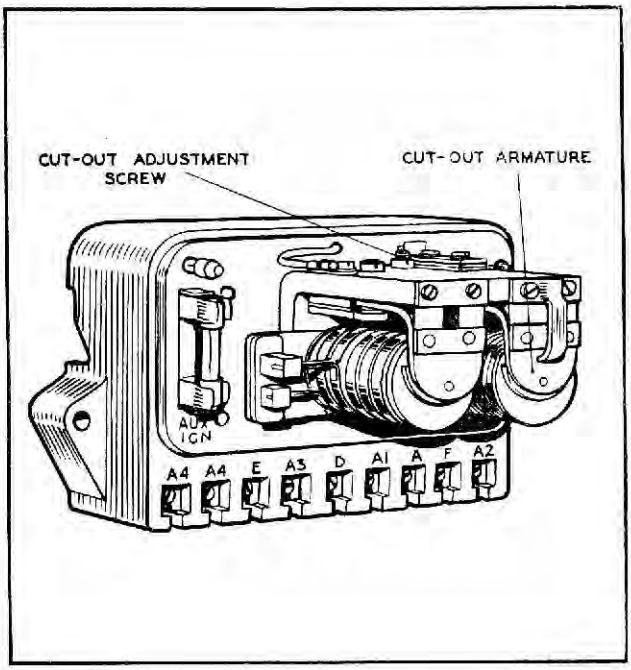
Fuse Marked "AUX"

This fuse protects the accessories which are connected so that they operate whether the ignition switch is on or off.

Fuses Marked "AUX IGN"

These fuses protect the accessories which are connected so that they operate only when the ignition is switched on (e.g. stoplamp, "Trafficators," etc.).

The Cut-out



The cut-out is an automatic switch connected between the dynamo and the battery. It acts as a valve, allowing the flow of current from the dynamo to the battery only. It closes when the dynamo is running fast enough to charge the battery and opens when the speed is low or the engine is stationary, thus preventing current flowing from the battery through the dynamo windings.

The switch consists of a pair of contacts which are held open by a spring and closed magnetically. When the engine is stationary or running slowly the contacts should be open.

There are two windings on the cut-out core—a shunt winding of many turns of fine wire and a series winding of a comparatively few turns of thicker wire. Whenever current flows in either winding, the core becomes a magnet, the strength of which depends upon the amount of current flowing.

The shunt coil is connected across the dynamo terminals. When the car is starting, the dynamo voltage rises with the engine speed, until the electro-magnet is strong enough to overcome the spring tension and close the contacts. Current from the dynamo will now flow through the series coil to the battery. The series coil also causes a magnetic pull which adds to that of the shunt coil, so that the contacts are firmly closed and cannot be separated by vibration.

When the car slows down the dynamo voltage decreases until it is lower than that of the battery, i.e. below 12 volts. Current will now pass through the series winding in the reverse direction, i.e. from the battery to the dynamo. This will cause the partial demagnetisation of the cut-out core, allowing the spring to separate the contacts and so open the charging circuit.

Earthing of Cut-out

See that the terminal marked "E" in the cut-out and regulator unit is connected to an earthing point on the chassis. Check by means of a circuit tester. (See "Testing Procedure," Sheet No. 21.)

If, after carrying out the preceding examination, the cut-out is still unsatisfactory, it is probable that the fault lies in the windings, and a replacement cut-out must be fitted.

Fuses

A blown fuse indicates a fault in the unit it protects or in the wiring, and the trouble must be rectified before the fuse is replaced. Do not try to rectify the fault by fitting a fuse of higher value or by wrapping a length of copper wire around the fuse clips—this may cause serious trouble.

Carefully check the wiring and tape any lead which is badly worn or chafed.

If it is suspected that the fault lies in the accessory itself the unit must be examined and the fault remedied as described in the appropriate section.

Continued

Date of issue: July, 1939

Starter

THE starter motor is a relatively high speed motor with a drive which consists essentially of a pinion which engages with a toothed ring on the flywheel of the engine.

The pinion which is mounted on a threaded sleeve takes its drive through splines on the shaft. The sleeve, however, is mounted so that it can move along the shaft against a compression spring so as to reduce the extent of the blow at the moment engagement takes place.

When the starter switch is operated the rotation of the armature will screw the pinion along the sleeve to mesh with the flywheel teeth.

As soon as the engine starts firing, it will drive the flywheel faster than it is being driven by the starter. This will cause the pinion to screw back along the sleeve and so draw out of mesh with the flywheel teeth.

Symptoms	*Possible Causes*
Starter lacks power or fails to turn engine.	Engine abnormally stiff. Loose or broken connection in starter circuit. Battery needs attention. Brushes sticking. Brush springs weak. Brushes worn. Brushes not bedding. Commutator dirty. Commutator worn. Pinion jammed in mesh with flywheel. Starter shaft bent.
Starter operates but does not crank engine.	Pinion tight on screwed sleeve. Flywheel teeth worn or burred. Main spring broken. Pinion damaged.
Noise from starter pinion when engine is running.	Pinion restraining spring weak or broken.
Starter does not operate.	Battery needs attention. Broken connection in starter circuit or faulty switch. Armature faulty. Field coils earthed.
Rough or noisy engagement.	Flywheel teeth worn. Main spring broken. Pinion worn or damaged.

Engine Abnormally Stiff

If the starter appears sluggish, or will not turn the engine, before examining the starter, check that the engine is not abnormally stiff by cranking by hand. Engine stiffness may be due to wrong grade of oil.

Pinion Tight on Screwed Sleeve

May be caused by dirt or other foreign matter on the sleeve. Wash away dirt with paraffin and afterwards give the sleeve the merest trace of thin machine oil. Another possible cause may be the jamming of the pinion restraining spring.

Pinion Jammed in Mesh with Flywheel

Free the pinion either by turning the squared end of starter shaft, at commutator end, by means of a spanner or by engaging top gear and rocking the car backwards and forwards.

Flywheel Teeth Worn

In the event of the flywheel teeth becoming worn or burred the flywheel or flywheel ring must be replaced.

Continued

Date of issue : July, 1939

Starter—*continued*

Pinion Worn or Damaged

If the pinion is found to be worn or damaged, it is essential that it is replaced together with the screwed sleeve.

To fit these parts, dismantle the drive as follows :—

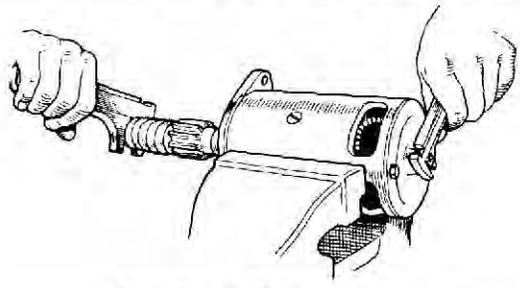
Remove cotter pin from the shaft nut at the end of the starter drive.

Hold the squared end of the starter shaft at the commutator end by means of a spanner and unscrew the square shaft nut. Note that the nut is left-hand threaded.

The various components of the drive can now be withdrawn from the shaft.

Main Spring Broken

This is probably caused by an engine backfire. Check timing to prevent the trouble occurring again. To fit a new spring, dismantle the drive as described.

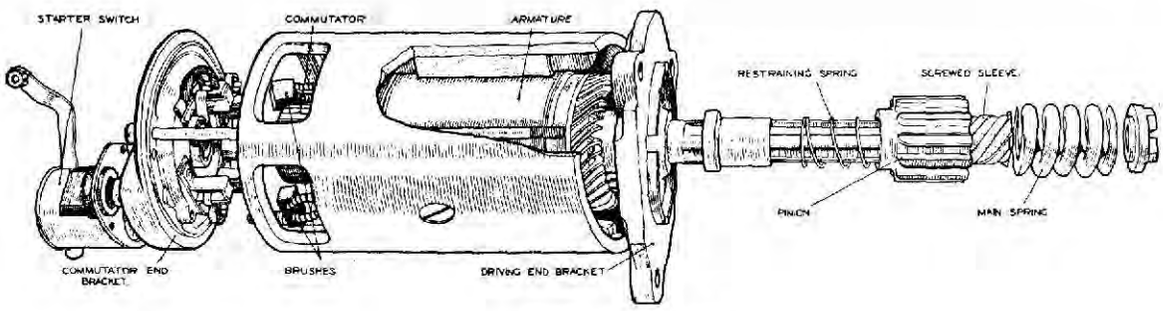


DISMANTLING STARTER DRIVE

Pinion Restraining Spring Weak or Broken

To fit a replacement spring, dismantle the starter drive as described.

To remove the switch from the starter, first disconnect the earthing lead from the battery. Then unscrew the bolt clamping the starter cable and withdraw the screws securing the switch.



STARTER TYPE M418G.

Continued

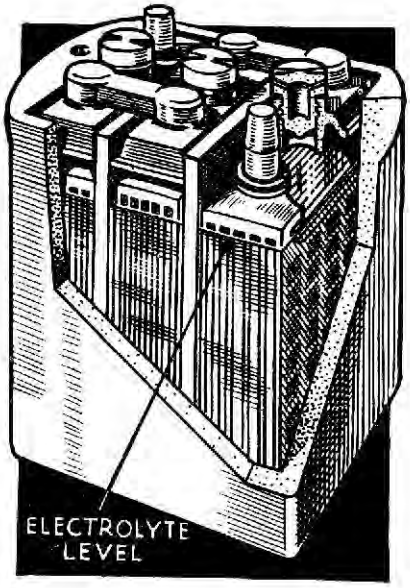
Date of issue : July, 1939

Battery

Constructional Features

THE moulded case of the battery is divided into a number of compartments known as cells– there are three cells in a 6-volt battery.

In each cell there are two groups of plates—the negative and the positive. A separator, made of either wood, threaded rubber or ebonite, is fitted between each of the plates to prevent them from touching and causing a short circuit. Each group of plates is connected to a terminal post which projects through the cell lid. The groups are connected in series—that is, the negative group of one cell is connected to the positive group of the next and so on. In the top of each cell there is a vent plug which allows the escape of gases evolved during charging, and gives access for topping up the electrolyte.



Adopt the following procedure when examining a battery :—

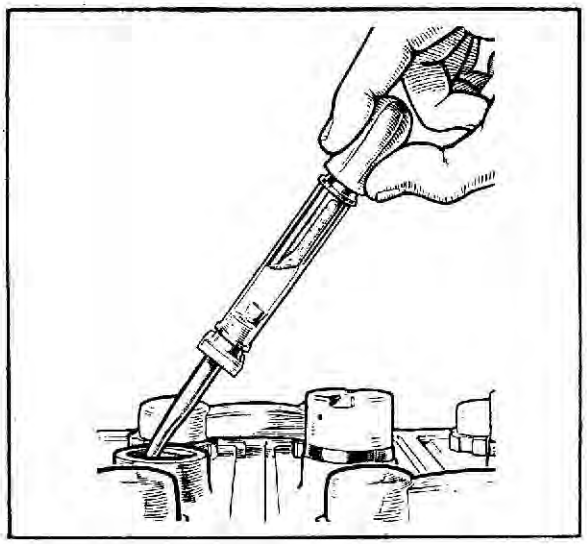
Vent Plugs

Remove the vent plugs and see that the ventilating holes in each plug are quite clear. Remove any dirt by means of a piece of wire. A clogged vent plug will cause the pressure in the cell to increase due to the evolution of gases during charging, which may cause damage. Make sure that the rubber washer is fitted under the vent plug, otherwise electrolyte may leak on to the top of the cell.

Level of Electrolyte

Examine the level of the electrolyte in each cell. The height of the electrolyte should be level with the tops of the separators. If necessary, top up the cells with distilled water. A hydrometer can be utilised as shown.

Remember, it is only the water which evaporates, *not* the acid. If any acid is spilled, it should be replaced by sulphuric acid solution diluted to the same specific gravity as the acid in the cells. This is measured by the hydrometer.



Continued

Battery—*continued*

Battery Top

The top of the battery must be kept clean and dry. An accumulation of dirt and moisture will cause a leakage path between the battery terminals which may slowly cause the battery to become discharged.

Battery Terminals

If the terminals are badly corroded, clean away the corrosion with dilute ammonia and smear the terminals with vaseline (not grease). Also examine the connections; see that the terminal bolts are spanner-tight.

Earthing Connection

Check that the bolt securing the earthing lead from the battery to the chassis is tight.

Hydrometer Test

If a cell is in a serviceable condition the specific gravity of the acid in it will rise during a charging period, until the cell is fully charged, when it will remain unchanged.

When a cell discharges, its specific gravity falls continuously.

The hydrometer readings of the specific gravity of the electrolyte give a valuable indication of the condition of each cell. The specific gravity readings and their indications are as follows:—

1.285—1.300—Fully charged.
About 1.210—About half discharged.
Below 1.150—Fully discharged.

These figures are given assuming the temperature of the electrolyte is about 60°F. For fuller particulars regarding temperature corrections, see the first charge instructions.

The specific gravity reading of each cell should be approximately the same. If one cell gives a reading which is very different from the rest it may be that acid has been spilled or has leaked from this particular cell, or there may be a short circuit between the plates. In this case the battery should be sent to a Lucas Agent, who has the necessary equipment to make a thorough examination and to repair the battery.

When taking specific gravity readings examine the condition of the electrolyte in the hydrometer. It should be reasonably clear. If it is very dirty it is possible that the plates are in a bad condition.

Heavy Discharge Test

Press the pointed prongs of the tester firmly against the positive and negative terminals of each cell. This causes a heavy current to pass through the shunt and a reading will be given on the voltmeter (approximately 1.4 when the battery is fully charged and 1.2 when about half charged). The procedure is to maintain contact for about six seconds. If the voltage reading is steady during this time, the battery is in a healthy condition and should respond to recharging.

If, on the other hand, the voltage reading rapidly falls away the battery needs attention and should be given a charging cycle.

Charging Battery from an External Source

If the previous tests indicate that the battery is merely discharged and the acid level is correct the battery must be re-charged from an external supply. Charge the battery at the 10-hour rate with a constant current. That is, a 50 ampere-hour battery should be charged at five amperes for ten hours. During the process of charging the specific gravity of the electrolyte should rise to its maximum value and then remain steady.

Reconditioning the Battery by "Cycling"

If the battery does not respond to a freshening charge it should be put through what is known as a "cycle." That is, charge the battery as described in previous paragraph, and discharge it at the 10-hour rate, until the voltage of each cell is about 1.8, i.e. with a 50 ampere-hour battery it must be discharged through a 5 ampere load (lamp bulbs may be used as the load). The time taken for the battery to discharge should be seven to eight hours. If the battery discharges in a shorter time, repeat the charging and discharging cycle. If the efficiency of the battery is not improved by this process, there is probably an internal fault and the battery must be replaced.

Continued

Date of issue: July, 1939

Coil Ignition Equipment

THE coil ignition equipment consists essentially of a coil and a combined contact breaker and distributor.

The coil consists of an iron core, around which are wound the primary, or low-tension, and the secondary, or high-tension, windings. The duty of the coil is to convert the battery voltage of six into something of the order of at least 6000 which is required to form a spark across the plug points. When the ignition switch is on, current flows from the battery through the primary winding. This current is interrupted by the contact breaker, causing a high voltage to be induced in the secondary winding.

The distributor moulding is provided on the inside with metal inserts which are in contact with the high-tension cables connected to the sparking plugs. The centre terminal of the distributor moulding is connected on the outside to the high-tension terminal of the coil and on the inside it is connected by means of a carbon brush contact to a rotating distributor arm. This arm is provided at its outer tip with a metal electrode, which, when the arm rotates, passes very close to the metal inserts. The high-voltage current passes from the rotating electrode to the distributor segments and from here to the sparking plugs.

Symptoms	*Possible Causes*
Engine misfires or performance is poor.	Sparking plugs dirty, or gap incorrect. Sparking plugs defective. Loose connection in low-tension wiring. Contact breaker out of adjustment. Dirty or pitted contacts. Contact breaker spring weak. High-tension cables cracked or perished. Distributor moulding tracked. Automatic advance mechanism stiff.
Engine will not fire.	Battery needs attention. Sparking plugs dirty or gap incorrect. Sparking plug defective. Broken or loose connection in low-tension wiring. Contact breaker out of adjustment. Dirty or pitted contacts. Distributor moulding tracked. Condenser not functioning.

Sparking Plugs Dirty or Out of Adjustment

In service the plug electrodes burn away, causing the gap length to increase, and imposing a greater load on the ignition equipment. When this happens the electrodes must be adjusted to their original setting, .025 in. Any oil or carbon must be wiped away.

Sparking Plug Defective

The conditions under which the sparking plugs function are so strenuous that there is a gradual deterioration of the plug which may eventually lead to complete breakdown, in which case the high-tension current may leak across the insulation of the plug. It is recommended that the plugs should be replaced every 10,000 miles as this will ensure that the maximum power and speed are obtained.

Continued

Date of issue: July, 1939

Coil Ignition Equipment—*continued*

Contact Breaker Out of Adjustment

The contact breaker gap must be .010 in.—.012 in. To check, turn the engine until contacts are fully opened. Insert feeler gauge between contacts. If gap is correct, the gauge should be a sliding fit. To make the adjustment, keep the engine in the position to give maximum opening of the contacts, and slacken the two screws securing the contact plate until the plate can just be moved. Move the plate, using the screwdriver as a lever, until the gap is set to the thickness of the gauge. Tighten the screws after the adjustment.

The variation in gap setting is usually caused by undue wear of contact breaker heel—caused by lack of cam lubrication.

Contact Breaker Points Dirty or Pitted

The contacts must be kept clean and free from oil or grease. To clean the contacts, remove the contact breaker levers as follows :—

Unscrew the nut securing the end of the contact breaker spring.

Remove the nut together with the spring washer.

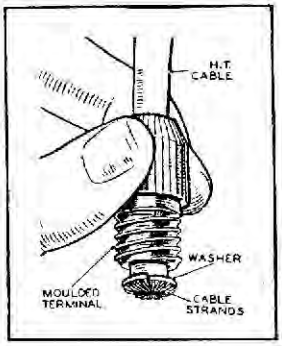
Remove the metal bush.

Lift the contact breaker lever off its bearing.

Polish the contacts with a fine oilstone, working with a rotary motion.

Contact Breaker Spring Weak

After very long service, the contact breaker spring may weaken slightly, causing misfiring to occur at very high speeds. Test the tension of the contact breaker lever by means of a small spring scale. The correct spring tension is 20—24 oz. If necessary, reset the spring by bending or fit a replacement contact set.



High-Tension Cable Cracked or Perished

Any cables showing signs of perishing or cracking must be replaced. Use 7 mm. rubber-covered ignition cable. Thread the cable through the knurled moulded nut, bare the end of the cable for about $\frac{1}{4}$ in., thread the wire through the metal washer provided and bend back the strands. Finally screw the nut into its terminal.

Automatic Advance Mechanism Stiff

Poor engine performance can sometimes be traced to seized or sluggish working of the automatic advance mechanism, and cases have been located where this has been due to lack of lubrication.

As some confusion appears to exist with regard to the method of lubricating this mechanism, the correct procedure is given below.

About every 3000 miles :—

(1) Withdraw the moulded rotor arm and, without removing the screw which is then exposed, add a few drops of thin machine oil (this lubricates the camshaft).

(2) Remove the moulded base held in position by two screws and adequately lubricate the weights and toggles with thin machine oil.

Care should be taken when refitting the moulded base to ensure that it is fitted exactly as removed, otherwise it may be reassembled 180° out.

These instructions are in addition to the normal lubrication of the distributor shaft, cam and contact breaker pivot.

To render the mechanism accessible, proceed as follows :—

Remove distributor moulding.

Pull off the rotor arm.

Remove the two screws securing the contact breaker base and lift it away from the distributor body.

Examine the advance mechanism ; any signs of rusting must be wiped away, and the toggles and pivots on which the weights move must be lubricated. The cam must move freely on its spindle. If necessary, lubricate all bearings with a good grade engine oil.

Continued

Date of issue: July, 1939

Coil Ignition Equipment—*continued*

Condenser

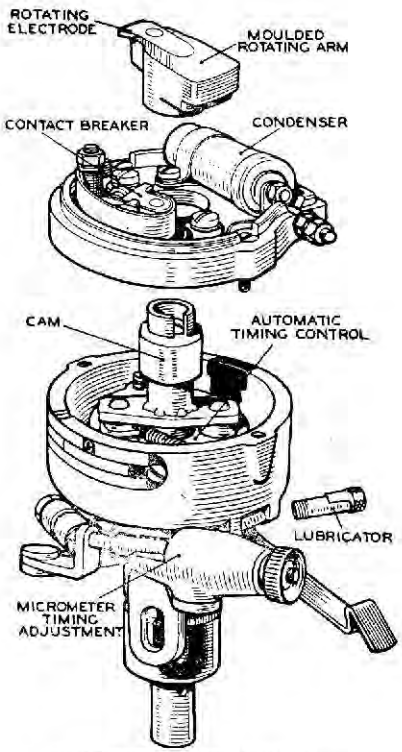
Before suspecting the condenser as being the cause of the trouble, carefully check that the connections to it are tight, as service experience shows that the majority of condensers returned as faulty are found, on test, to be quite satisfactory. If the insulation of the condenser breaks down, it will either cause an open circuit with excessive burning of the contacts or will provide a continuous path for the primary current to the coil. This will cause the failure of the ignition, as the current will not be interrupted when the contact breaker opens. The simplest way of checking the condenser is to substitute temporarily one known to be satisfactory. This checks the condenser under working conditions.

Lubrication

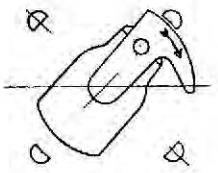
Distributor Shaft. Add a few drops of thin machine oil through oiler every 1000 miles.

Cam. Give the cam a smear of a good grade heavy engine oil every 3000 miles.

Contact Breaker Pivot. Every 5000 miles place a spot of oil on the pivot on which the contact breaker lever works.



DISTRIBUTOR TYPE DKH4A—6. ANTI-CLOCKWISE ROTATION



FOUR CYLINDER DISTRIBUTOR ANTICLOCKWISE ROTATION VIEWED FROM DRIVING END

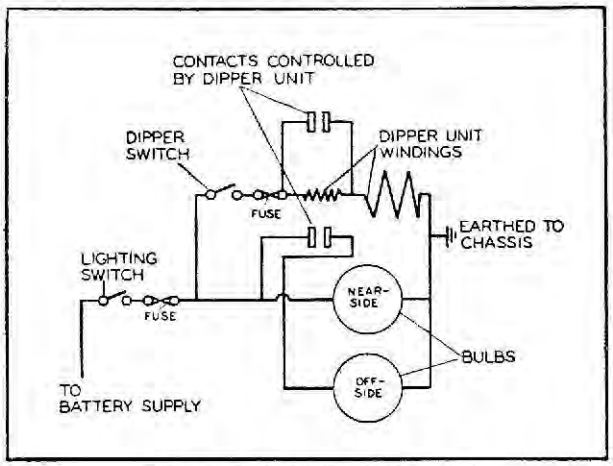
Date of issue: July, 1939

Lamps

THE headlamps are provided with "dip and switch" reflectors, in which the near-side headlamp reflector dips and the off-side lamp is simultaneously switched off.

The dipping of the headlamp beam is effected by a movement of the reflector. This is pivoted on ball bearings in a fixed rim which is in turn secured to the headlamp body.

The movement of the reflector is controlled by a solenoid mounted on a bracket astride the back of the reflector. When the current is switched on, the plunger of the solenoid pushes a bracket on the underside of the bulb holder, thus tilting the reflector to the dipped position. As the plunger reaches the end of its travel, it is arranged so that a high-resistance winding is brought into the circuit, thus reducing the operating current for retaining the reflector in the dipped position to a fraction of an ampere. When the current is switched off, the reflector is returned to its normal position by means of a spring.



"DIP & SWITCH" REFLECTORS

Symptoms	*Possible Causes*
Lamps give insufficient illumination.	Battery needs attention. Headlamps out of alignment. Bulbs out of focus. Bulbs discoloured through use. Reflectors dirty.
Lamps flicker.	Loose connection in lamp circuit or lamps not earthed properly.
Lamps do not light.	Battery needs attention. Loose or broken connection in lamp circuit or lamps not earthed properly. Bulbs blown.
Dipping reflector fails to operate.	Loose or broken connection in circuit of dipper unit. Dipping reflector sticking. Dipping reflector fuse blown.
Dipping reflector does not remain in dipped position when operated, or reflector oscillates.	Loose or broken connection in circuit of dipper unit. Contacts on dipper unit out of adjustment.

Bulbs Out of Focus

For the best results, the filament of the bulb must be as near as possible to the focus of the reflector.

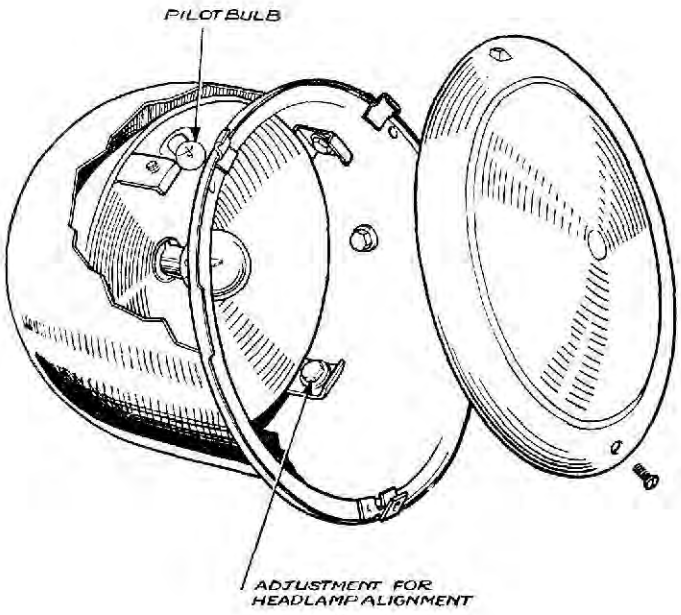
Before the lamps are dispatched from the Works, the bulbs are correctly focussed. Provided that the correct genuine Lucas bulb is fitted as a replacement, the setting should not be disturbed. If a Lucas bulb is not available or if the setting has been tampered with, the lamp may be refocussed as follows :—

Cover one lamp while testing the other.

Remove lamp front and reflector and move the bulb backwards or forwards in the alternative positions until the best results are obtained. After each adjustment, note the effect with the front refitted.

Date of issue: July, 1939

Lamps—*continued*



Bulbs Discoloured through Use

After the bulbs have been in service for a considerable time they may become blackened. This will reduce the amount of light given by the lamps, and when the bulbs are found to be in this condition they should be replaced.

Reflectors Dirty

The reflectors are protected by a fine transparent, colourless covering. This enables finger marks, etc., to be removed with a soft cloth or chamois leather without affecting the reflecting surface. Do not use metal polishes.

Bulbs Blown

When after long service it is necessary to replace a bulb, fit a bulb of the same voltage and wattage as that originally used. The bulb must have a high efficiency and must focus in the reflector. Cheap and inferior replacement bulbs often have the filament of such a shape that it is impossible to focus correctly; for example, the filament may be to one side of the axis of the bulb, resulting in loss of range and light efficiency.

Genuine spare bulbs should be fitted as then these problems will not arise.

Dipping Reflector Sticking

The trouble may be due to any of the following causes:—

(a) Cables fouling reflector. Re-arrange the cables and keep them away from the reflector. The lead to the bulb holder must be flexible so as to enable the reflector to move freely.

(b) Pivot bearings tight. Apply a drop of thin machine oil to the bearings on which the reflector rocks.

(c) Plunger of dipper unit sticking. Apply the merest smear of thin machine oil to the plunger.

Dipping Reflector Fuse Blown

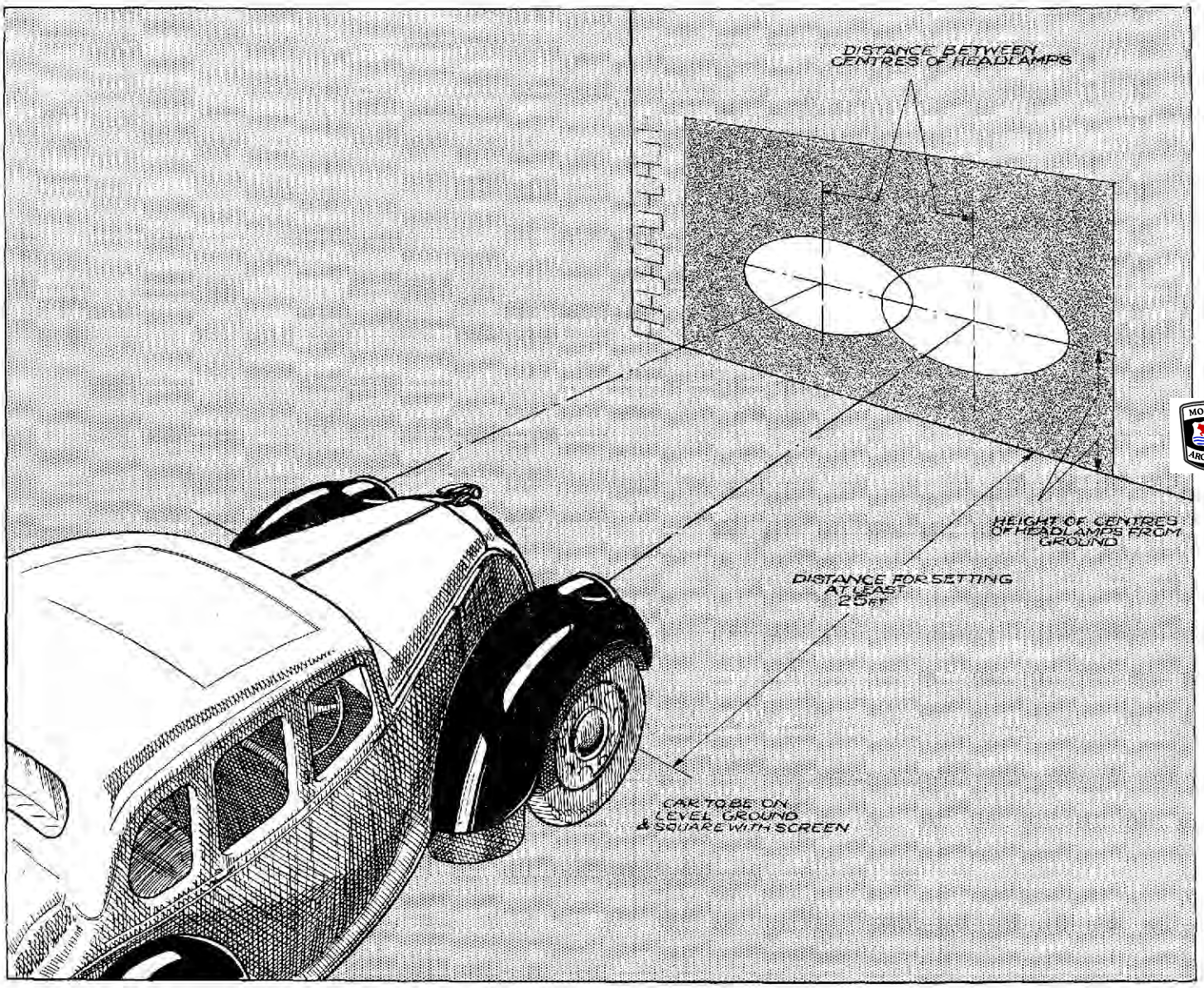
This is probably caused either by the reflector sticking or by a faulty connection in the wiring of the reflector. Rectify the defect before replacing the fuse.

Switch Contacts on the Dipper Unit Out of Adjustment

If the contacts nearest the fuse, which bring into circuit the high-resistance winding, get out of adjustment due to damage or long service, the dipping reflector will tend to oscillate when operated.

When the plunger is drawn fully into the solenoid, the gap between the switch contacts should be .010 in. to .018 in. The gap setting may be adjusted by means of the pin, at the end of the plunger, which is caulked during assembly, as normally adjustment is not required.

Lamps—*continued*



Date of issue: July, 1939

"Trafficators"

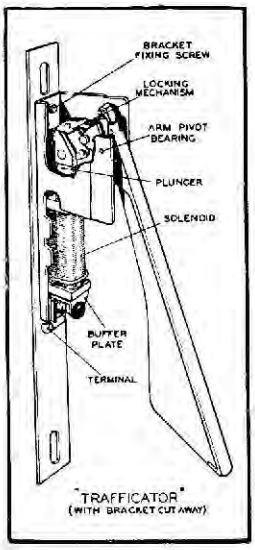
Symptoms	*Possible Causes*
"Trafficators" do not operate.	Loose or broken connection in the wiring. Fuse blown. Arm fouling bodywork. Buffer plate bent. Lack of lubrication. Internal fault.
"Trafficators" do not lift to full extent or do not fall completely home when switched off.	Arm fouling bodywork. Lack of lubrication. Buffer plate bent.
Bulb does not light.	Bulb blown. Loose or broken connection in bulb circuit. Bulb not earthed efficiently.

Fuse Blown

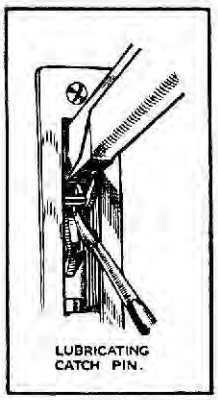
Examine the wiring and the "Trafficators" for evidence of a short circuit which may have caused the fuse to blow. Rectify the trouble and replace the fuse.

Loose or Broken Connection in Wiring

Check the wiring from the fuse to the switch and from the switch to the "Trafficators" (see "Testing Procedure," Sheet No. 21). Tighten all loose connections.



"TRAFFICATOR" (WITH BRACKET CUT AWAY)


LUBRICATING CATCH PIN.

Arm Fouling the Bodywork

This may be due to either the "Trafficator" being badly fitted or to the arm being distorted by striking some object. If the "Trafficator" has been badly fitted slacken the screws securing the "Trafficator" and move it until the arm operates freely. When the correct position has been obtained, secure the "Trafficator" by tightening its fixing screws.

The screws securing the escutcheon plate must be slackened and the plate centralised so that the arm can operate freely.

Lack of Lubrication

If the action of the "Trafficator" becomes sluggish, it should be lubricated as follows:

(a) Add one or two drops of thin machine oil to the catch pin between the arm and the operating mechanism.
(b) Give the inside of the bracket where the plunger bears a slight smear of high-melting-point grease. Do not use ordinary grease, which, when warm, may run into the solenoid core and cause the plunger to stick.
(c) Add one or two drops of thin machine oil to the pivot bearing of the "Trafficator" arm.

Continued

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Trafficators—*continued*

Buffer Plate Bent

If the plate carrying the rubber buffer is too far forward it will prevent the arm falling completely home; if it is bent back too far it may cause the locking mechanism to become jammed. Bend the plate to its original position, i.e. so that the arm falls fully home and is locked, and also so that the arm operates freely.

Bulb Blown

After long service the bulb may need replacement. To remove the bulb, withdraw the screw on the underside of the arm and slide off the metal cover plate. To replace the cover plate, slide it on in an upwards direction so that the side plates engage with the slots on the underside of the spindle bearing. Finally secure the cover plate by means of its fixing screw.

Loose or Broken Connection in Bulb Circuit

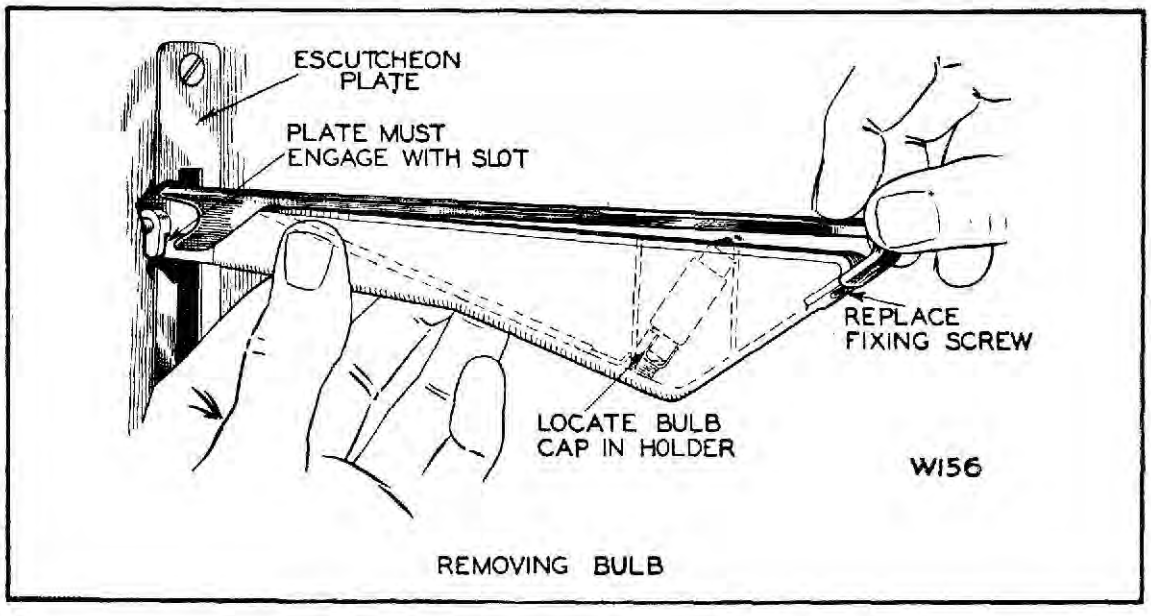
Examine the connectors from the terminal on the "Trafficator" to the bulb holder. If necessary, re-solder any connection which may be loose.

Bulb not Earthing Properly

The cap at one end of the bulb must make contact with the metal cover. Check that the spring pressure is sufficient and that the inside of the cover where the bulb makes contact is clean and free from tarnish. With "Trafficators" having a black enamelled cover, make sure that the ends of the cover which locate at the pivot end are clean and free from enamel.

Internal Fault

If, after the above procedure, the "Trafficators" are still inoperative, the "Trafficators" should be replaced.



REMOVING BULB

Continued

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Windscreen Wiper—Type SW4

THE wiper motor is of the shunt wound type with a single field coil, and is mounted on the engine side of the dash. Incorporated with the motor is a reduction gearbox which takes the drive to a continuously rotating final shaft; this shaft from the motor unit to the driving mechanism incorporates a rubber coupling. A crank on the end of the shaft is connected by links to two clutch boxes on the screen rail which transmit motion to the wiper spindles. The switch is incorporated with one of the clutches. The action of pulling out and turning the knob puts the blade on to the screen, engages the dog clutch and switches on the motor.

If the wiper fails to operate or operates unsatisfactorily, proceed as follows: -

Ascertain if the battery is supplying current to the wiper by switching on and noting if the ammeter responds. Examine the fuse protecting the wiper. If it has blown, examine the wiring for evidence of chafed leads or short circuits. If, on replacing the fuse, it blows again, momentarily connect the motor directly to the battery and see if wiper then operates satisfactorily.

Symptoms	*Possible Causes*
Wiper takes no current.	Loose or broken connections. Switch out of adjustment.
Field current only (approximately .8 amp.).	Brush levers stiff. Commutator dirty. Armature damaged.
Current more than normal (over 3 amps.).	Mechanism binding. Armature bearing binding. Commutator shorted. Armature damaged.

Loose or Broken Connections

Examine connections from supply terminal in junction box to the motor, from the motor to the switch, and also examine the earthing lead from the switch. Replace any leads which are badly worn or chafed. If necessary, fit protective tubing over the leads in the position where the original leads became chafed.

Switch Out of Adjustment

Remove the metal switch cover plate which is secured by two screws. Observe whether the switch contacts are opening and closing with the movement of the control knob, and also whether the contacts are clean. The switch contacts should open just as the driving clutch disengages. If necessary, bend the switch blade to obtain this condition.

After resetting the switch, see that the contacts are effectively open when the wiper spindle is in the parked position.

Commutator Dirty

Remove the commutator end bracket by unscrewing the two countersunk screws and the screw with the barrel head. Clean the commutator by means of a cloth moistened with petrol. Carefully remove any carbon dust from between the segments of the commutator. In reassembling, take care that the end bracket is lined up so that the armature rotates freely.

Brush Levers Stiff

If the brush levers are stiff on their pivots they should be freed by working backwards and forwards by hand and by applying a trace of thin machine oil.

Mechanism Binding

Remove the metal facia covering the driving links. Observe whether the links are fouling any part of the bodywork and also observe whether the swinging cranks on the clutch mechanisms behind the control knob are clearing the clutch body at each end of the stroke.

Armature Bearings Binding

This may be due to lack of lubrication. Lubricators are provided on the motor unit through which a small quantity of a good grade thin machine oil may be applied. Ascertain that a blow on the motor end bracket has not thrown the bearings out of line.

A screw and lock nut are provided in the commutator end bracket to take up the end thrust of the armature. Under normal conditions this should not require adjustment.

Armature Damaged

If after following the preceding examination the wiper still does not operate, or its performance is unsatisfactory, the fault may be due to the armature. Check the armature by substitution, and, if necessary, fit a replacement armature.

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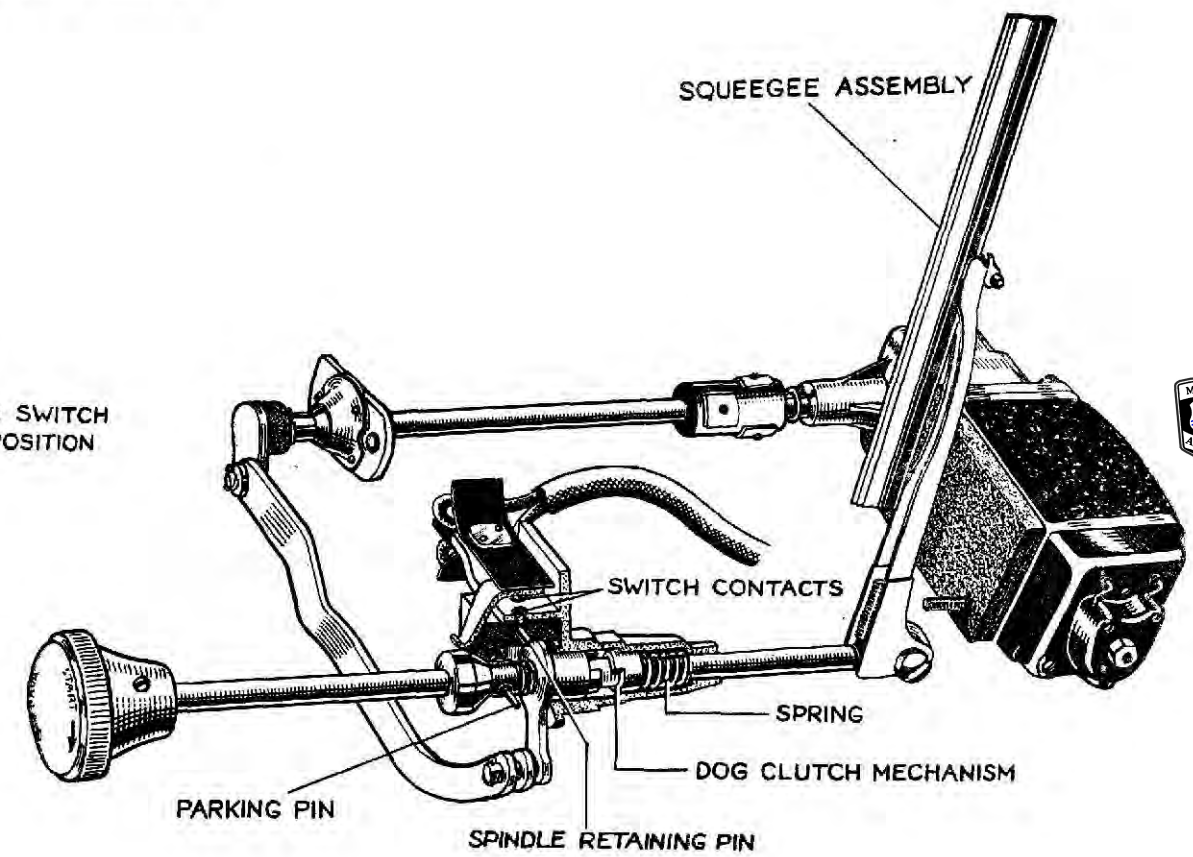
Windscreen Wiper—*continued*



WINDSCREEN WIPER SWITCH SHOWN IN PARKED POSITION

Continued

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Testing Procedure Tools and Instruments

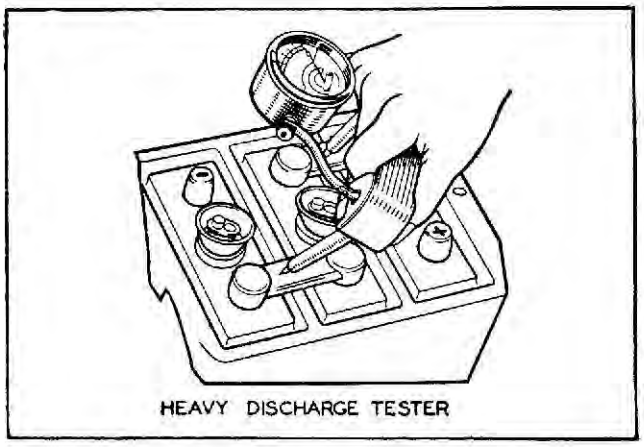
Instruments and Testing Appliances

THE following equipment is required to carry out the tests and adjustments given in the foregoing sections.

Voltmeter for checking circuits and testing or adjusting dynamo voltage regulators. This should be a high-grade moving coil instrument, reading 0—20 volts, with an open scale so that fractions of a volt can be read.

Ammeter for checking dynamo output and current consumption of various units. The instruments should have a scale reading of 0—30 amperes.

Hydrometer for testing the state of charge of the battery. This consists of a graduated float and a bulb syringe having a glass body. It enables a sample of the electrolyte in each cell to be drawn up into the syringe, its specific gravity read on the float, and returned to its original cell. The float must not stick to or touch the side of the hydrometer body while tests are being made. The correct reading is given by the lowest graduation which is cut by the surface of the electrolyte.



HEAVY DISCHARGE TESTER

Heavy Discharge Tester, comprising a high-grade moving coil centre-zero voltmeter calibrated 2—0—2 volts (in graduations of one-tenth of a volt), having a shunt resistance for currents of the order of 100 amperes. Mounted on a heat-resisting insulated handle and having pointed prongs which can be firmly pressed against the positive and negative poles of each cell.

Spring Balance, 0—4 lb. graduated in ounces, to check contact breaker spring tension and dynamo and starter brush pressures.

Date of issue: July, 1939

TESTING PROCEDURE

When servicing electrical equipment it must be remembered that in the majority of cases it is useless merely to replace a unit that has failed, without first discovering the cause of the failure.

The various units of the electrical equipment are connected together by cables which are bound together in a protective sheathing. The cables are coloured so that they can be identified on referring to the wiring diagrams. The diagrams show the external wiring and indicate exactly how the equipment is connected. They also show the internal wiring of the units, so that the routes of circuits, as they are called, taken by the electric current through them, can be followed.

Earthing of Battery

The equipment is wired on what is known as the earth return system that is to say, one path for the current between the battery, dynamo and the various units is via the car frame or chassis. One terminal of the battery is earthed by taking a lead from it to a bolt on the chassis. It will be noticed that it is the positive terminal that is earthed. This has several advantages over the former practice of earthing the negative side of the system: the working conditions for the ignition equipment are less strenuous, there is less burning away of the distributor electrodes, and, in addition, there is less corrosion of the battery terminals.

Importance of Good Earths

A number of the electrical units, such as lamps, which do not depend upon a definite earthing lead, are earthed to the chassis via their fixing bolts. In the event of faulty operation of these units, check that fixing bolts are tight, and that there is a good metallic contact, free from paint, enamel or other insulating material, between the body of the unit and the chassis.

An earthing lead is fitted between the engine and chassis. See that both ends are tightly clamped.

Checking Battery Charging Circuit (Compensated Voltage Control Dynamo)

If a fault in the charging circuit is suspected, refer to the wiring diagram and, with the aid of a voltmeter (0—20 volts) fitted with two insulated leads, the ends of which are provided with clips, proceed as follows:—

(1) Check that the dynamo is connected correctly—that is, the yellow lead to the terminal marked "D" and the green and black lead to the terminal marked "F."

(2) Disconnect these leads and join the two terminals with a short length of wire. Clip the negative voltmeter lead to one of these terminals, and clip the other to a good earthing point on the dynamo yoke, and start the engine, taking care not to increase the speed excessively. If no reading is given on the voltmeter, the fault lies with the dynamo.

(3) If a voltmeter reading is given, remove the wire joining the dynamo terminals, remove the voltmeter, and re-connect original leads to correct terminals.

(4) Check the dynamo open circuit voltage. If the regulator is not functioning properly, it must be replaced.

(5) Examine the lead (green and black) from the dynamo to the terminal marked "F" on the cut-out and regulator unit. See that the lead is intact and that the terminals are tight. If these are in order, see that the resistances on the underside of the cut-out and regulator unit are undamaged and in good contact with their holders.

(6) Check the main charging circuit with the voltmeter while the engine is running at normal speed.

Lead (yellow) between dynamo and cut-out and regulator unit. Connect voltmeter to cut-out and regulator unit terminals marked "D" and "E." No reading indicates faulty lead or loose connections.

Cut-out and regulator. Connect voltmeter to cut-out and regulator unit terminals marked "A" and "E." No reading indicates that fault lies in cut-out or series winding of regulator.

Lead (white and purple) between cut-out and regulator unit and ammeter. Connect voltmeter to terminal on ammeter and earth. No reading indicates faulty lead or loose connections.

Ammeter. Connect voltmeter to ammeter terminal (yellow and black lead) and earth. No reading indicates fault in ammeter.

Lead (yellow and black) between ammeter and starter switch. Connect voltmeter between starter switch terminal and earth. No reading indicates faulty lead or loose connections.

Examine lead from starter switch to the battery. Check the earthing lead from the battery to the chassis and also the lead from the engine to the chassis. Make sure there is no paint or foreign matter between the lead and the chassis.

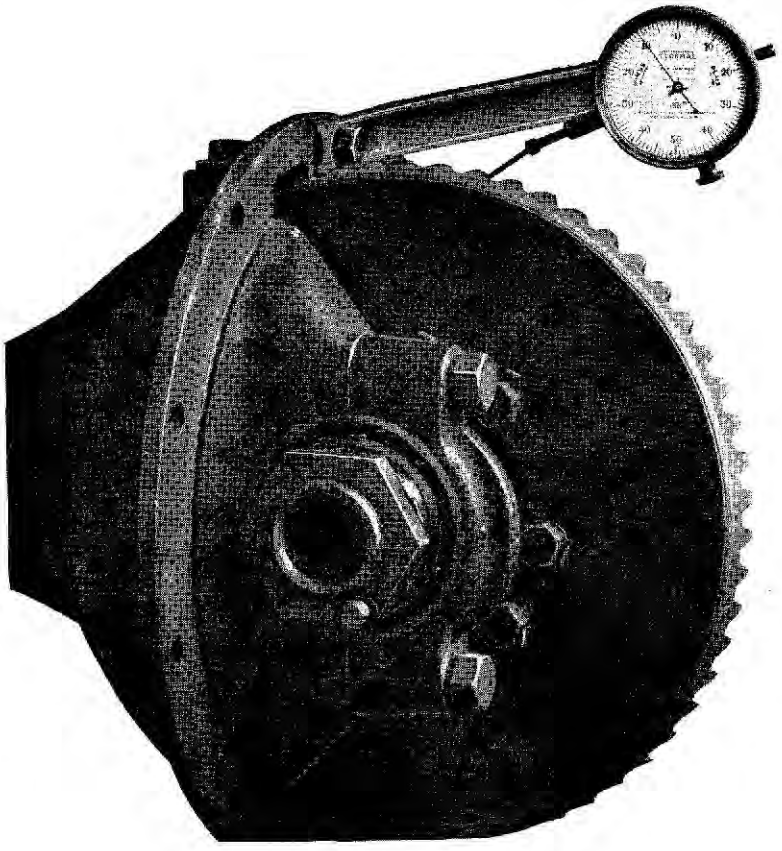
Date of issue: January, 1946

Gear Meshing—Rear Axle

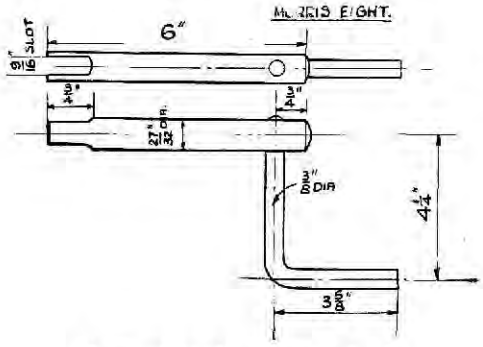
THIS Sheet is prepared to deal solely with the correct and recommended method of adjusting the rear axle gears on the Series "E" Morris Eight to obtain quiet running and durability.

After the differential assembly has been removed from the car, and the gears stripped and thoroughly cleaned, the crown wheel assembly, complete with differential cages and bearings, should be mounted to the differential carrier or front cover, taking care that both bearings are firmly set against their shoulders in the casing and caps before the cap bolts have been tightened. It is always advisable to check this point by tapping gently the outer rings of the differential bearings with a suitable punch, until they are heard to strike against their shoulders.

The differential cage adjusting nuts should now be tightened until all side play has been eliminated, but at the *same time the bearings are not nipped.* When finally adjusted, the crown wheel assembly should spin quite freely on its bearings, without any signs of tightness. Any further adjustment to gain the correct amount of backlash will be made by slackening off one nut a given amount and tightening the other a similar amount, at the same time assisting the assembly to move in the bearings by giving the caps a smart blow from a hammer.



To check the backlash accurately a clock gauge should be employed mounted on the differential casing in such a way that its indicator spindle is at right angles to the tooth face.



The crank handle recommended for turning the crown wheel assembly.

After the drive pinion assembly has been added, and the sleeve adjusted to give a dead flush tooth at the toe, the crown wheel assembly should be set in the manner described to give a backlash *of not less than* .008 *in. and not more than* .010 *in.* This point should always be checked by a clock gauge in the manner illustrated.

Using a suitable cranking handle—see illustration—the crown wheel assembly should be turned in both directions, and the position of the drive pinion altered in and out until the quietest running position of the gears is obtained. Needless to say, if it is found necessary to adjust the pinion in, to obtain quiet running, it will be necessary to re-position the crown wheel assembly to increase the backlash to the correct limits, and vice versa if it is found that the quietest running position is obtained by bringing the drive pinion assembly out.

Continued

Date of issue: January, 1946

Gear Meshing—*continued*

The final adjustment is now made by taking a marking of the teeth, using red lead mixed with engine oil. Approximately a dozen crown wheel teeth should be lightly coated, and again the crown wheel assembly turned in both directions by the suitable cranking handle.

Reference to the illustrations below will show the correct marking required when the assembly is tested without load on the bench. It will be appreciated, of course, that when mounted in the car the marking will travel up towards the full length of the teeth without creeping over the heel, which would, of course, produce very noisy operation.

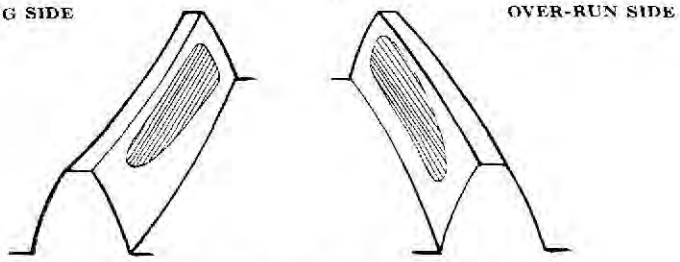


Fig. 1. Shows the correct marking on the crown wheel teeth when the gears are tested on the bench without load. If the marking shows higher on the driving side, this can be corrected by adjusting the pinion towards the crown wheel and readjusting the crown wheel for backlash. If the marking shows high on the over-run side of the teeth, the pinion should be taken away from the crown wheel, and the backlash reduced to not less than .008 in.

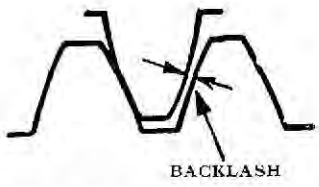


Fig. 2. Shows the backlash, which should not be less than .008 in. nor greater than .010 in.

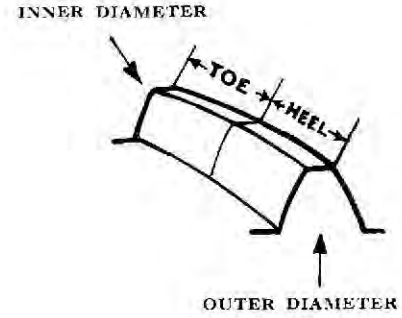


Fig. 3.

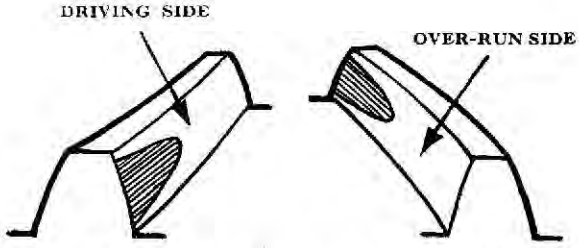


Fig. 4. Shows a heel and toe bearing, which is definitely wrong. To obtain correct marking (Fig. 1) adjust pinion towards crown wheel and set crown wheel away from the pinion to restore backlash .008 in. to .010 in.

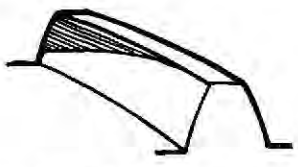


Fig. 5. This marking is incorrect and is caused by the pinion being too far into mesh with the crown wheel. To correct, adjust pinion away from crown wheel and reset backlash.