



The **MORRIS**

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**SERVICE
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Diagnosing Engine Troubles—Symptoms Described

IT is hoped that the following notes on the diagnosis of engine troubles will be read through very carefully, and that notes will be made for ready reference, by the Repair Department staffs of our Dealers.

Unfortunately, we are continually brought into contact with cases where a tremendous amount of quite unnecessary work has been carried out on a car as the result of an incorrect preliminary diagnosis. The amount of expense and general dissatisfaction thus caused to owner, Dealer and manufacturer alike will be appreciated.

These notes have been prepared after very careful consultation between the various "running" departments at Cowley and the Engine Works. It is appreciated, however, that diagnosis in the most skilful hands is not always reliable, and whilst all the symptoms described may vary under differing combinations of circumstances, there is no doubt at all that if these notes are read through carefully and mastered a great deal of trouble will be saved all round.

May we take this opportunity of advising our Dealers to leave well alone, particularly in the cases of new cars, excepting of course the more serious kinds of knocks due to loose big-end bearings, etc., which, if unattended, may cause the crankshaft journals to become misshapen.

TROUBLE

(a) Loose starter chain: loose dynamotor drive sprocket: starter chain wheel sleeve a slack fit in pressure plate.

(b) Loose big-end bearing on journal.

(c) Loose little-end bearing.

(d) Connecting rod little-end fouling piston boss for the gudgeon pin.

(e) Piston slackness.

SYMPTOMS

In all cases a heavy rumbling noise is heard and a general lumpiness can be felt throughout the car when engine is idling. The trouble is accentuated by faulty carburation, causing the engine to hunt. A roughness is noticed in accelerating up to approximately 18 m.p.h. on top gear. Can be relieved at slow speeds by pressing the starter button.

Which of the three possible irregularities is actually giving rise to the above symptoms is best ascertained by the process of elimination. Oversize chain wheel sleeves are obtainable.

A rattle usually heard at speeds of between 25-35 m.p.h. when the accelerator pedal is half released, depending in intensity upon the amount of slackness. May be a heavy knock in bad cases. If engine is speeded up to about one-quarter ($\frac{1}{4}$) throttle with car at rest the noise will develop and can then be cut out by shorting the sparking plug of the cylinder concerned. When plug is released heavy knock will be heard. A knock from the big-end can be due to the brass shell oscillating around the crank pin. This is generally caused by the thin brass shims being sheared at the edges by the sharp edge of the shell when the cap is tightened, but it may occasionally be due to the shell bedding into the rod. In such cases there may be no up and down or sideways movement of the big-end at all, and to the casual observer it would appear to be quite free from knock, hence it is necessary to test for a partial rotary movement. A tapping noise at tick-over speeds, which does not cut out when the plug is shorted, may easily be mistaken for gudgeon pin knock and may be due to the above-mentioned loose big-end bearings. (See "Description of Piston types with notes on Connecting Rods 11.9 Engines 150050 . . ."—use of steel sandwich shims for big-end brasses.)

Usually heard at slow speeds only when the engine is idling with car at rest. A hollow sound, more pronounced on 13.9 engines. Cannot be cut out by shorting sparking plug, although tone is dulled down somewhat. In very bad cases it may be heard at speeds in excess of the normal tick-over.

If when little-end knock is diagnosed it is found on dismantling that only a small amount of play can be felt, look for the trouble as under paragraph (b). (Big-ends oscillating.) If gudgeon pins are fitted up tight to cure a mistaken little-end knock, troubles in other directions (such as piston clatter) may be expected.

It is a fact that quite an appreciable amount of slackness can exist between the gudgeon pin and its bearings in the piston and connecting rod without causing a knock.

N.B.—Suitable ranges of oversize gudgeon pins and special reamers and reaming fixtures are available—apply Service (Parts) Department.

Sounds rather like a tappet which has slacked back and is heard almost up to half throttle, with or without load. Shorting the sparking plug usually dulls the sound somewhat, but alternatively the effect may be to aggravate the knock.

When taken down evidence of actual touching should be looked for.

A knocking or rattling noise, depending upon the number of cylinders affected, heard particularly when opening up from cold. The sounds tend to go off gradually as the engine gets hotter and speed increases.

Piston slackness need never be suspected in new engines. (See sections g and f.)



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Diagnosing Engine Troubles—continued

(f) Piston tightness.

Causes a light clatter, resulting generally from bearing reaction consequent upon the presence of new and tight pistons or over-tight gudgeon pin fits. It is noticed at practically any speed, its intensity depending upon the degree of tightness.

In the case of new engines so-called "piston-slap" is nearly always due to piston tightness, which will depart when the engine has become properly run in. It is heard most distinctly when a new or refitted engine is pushed unduly. The withdrawal of existing pistons is a course to be greatly deplored, since it will be obvious from the above remarks that the trouble will only be aggravated. These symptoms are most pronounced on new cars, because the pistons have not been afforded a proper opportunity of bedding down. It is interesting to remark here that some of the so-called "dud engines" owe a great deal of their unfortunate reputation to the fact that they have been tampered with in their early life, and before a reasonable opportunity of settling down has been afforded. It is a definite fact that every Morris engine is carefully tested on the most up-to-date plant available, and there is no possible chance of an engine which is fundamentally faulty passing through.

(g) Blow-back past piston (a particular form of piston knock).

A sharp tap, either intermittent or constant at slow speeds, but continuous under load and particularly noticeable when picking up on top gear from a slow speed. Can be cut out absolutely by shorting the sparking plug of the cylinder concerned, thus relieving explosion pressure. Usually not heard over 30 m.p.h., and worst when engine is cold. This noise is due, in ninety-nine cases out of a hundred, to dry pistons. The truth of this statement can be proved by injecting oil into the cylinder affected, when the tap will almost certainly vanish.

On new cars the best course of action is to encourage continued running with the sump well over-filled. Also upper cylinder lubrication is recommended by the introduction of a little engine oil in the petrol. The oil supply from the main bearings, which lubricates the pistons, will increase as time goes on, and thus the above expedients may eventually be dropped. As in the case of piston tightness, we deplore the stripping of new engines for blow-back before at least 1500 miles have been covered, and cases of this kind cannot in future be treated under the guarantee. This ruling is made in the best interests of the future performance of the car.

(h) Main bearing loose.

Heard mostly at fairly high speeds when pulling hard—a low knock. Can be relieved by shorting the nearest sparking plug, and upon release of plug comes in again with a thump. Bad main bearing knocks can be heard at slower speeds under load, and can also be felt on the steering column. Main bearing knocks can also be heard when the engine is raced up with the car at rest.

The noises described above must not be confused with the noise made by a loose starter chain.

(i) End play on crankshaft.

A slight rumbling, which can be heard mostly when the engine is idling, and which can be steadied by slight pressure on the clutch pedal. In extreme cases pressure on the clutch pedal accentuates the trouble and causes quite a heavy knock at crankshaft speed—the result of a crankshaft web fouling a bearing block. Liners for the crankshaft front main bearing collars are available upon application to Service (Parts) Department, or the thrust collars can be white-metalled.

(j) End play on camshaft.

A clatter, varying in intensity according to the amount of end play in existence. Heard only when the engine is idling, and can be cut out by the pressure of a hammer shaft against the fan drive pulley. Take particular care when adjusting to allow the .003" end float which is absolutely requisite.

(k) Loose fan pulley, failing to pull up spacer on to timing wheel.

Practically the same noise as in the case of camshaft end play, but somewhat accentuated. Can be cut out by hammer shaft pressure. Usually the looseness can be felt by rocking the pulley circumferentially with the engine at rest.

(l) Ridges on cylinder walls at the top and bottom of piston ring travel.

The symptoms are very like those shown under the heading of "Piston Slackness." Usually, however, circumstances will suggest whether the clatter is the result of piston slackness or ridges in the cylinders. The latter may be anticipated on a fairly old car which has been refitted, although the ridges should have been relieved considerably by scraping or lapping during the process of overhaul.

(m) Tappet loose in guide.

Sounds like a slack tappet, and can be located by pressing each tappet in turn, with the engine running at a speed which causes sound to be most pronounced. Naturally, all tappets should be checked for clearance before test takes place. May be intermittent, due to the revolving action of the tappet.

(n) Valve squeak.

Intermittent chirp—may become continuous if acute, at valve opening intervals. Upper cylinder lubrication and squirting the stem with oil is recommended in such cases.





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The Engine and Gearbox Unit and Its Dismantling

INTRODUCTION

THE instructions given in the following pages are for the guidance of the repair man who proposes to attempt the task of overhauling the Morris engine and gearbox unit.

A thorough insight into the components and the methods of dismantling them is given so as to simplify as far as possible this task, and also to facilitate the ordering of any components which may need replacing.

For this purpose it has been found necessary to divide the instructions into three sections.

Section One

Instructions for dismantling various components with engine in position in the car, only those dismantling operations being described that can be carried out without the removal of the engine unit from the car.

Section Two

Instructions for removing the engine unit only, or both engine and gearbox together, from the car (see sheet 5).

Section Three

Instructions for dismantling unit completely; the engine unit not being assembled in the car, but mounted on a stand in a similar manner to that shown in one of the accompanying photographs (see sheet 10)

It will to some extent be necessary to overlap the various sections in order to give a complete description of certain of these operations. When this occurs cross references will be reduced to a minimum in order to obviate unnecessary delay in carrying out these operations.

The sequence of operations herein included is that which has been determined by practical experience to be the best, but it is, of course, impossible to lay them out in an absolutely rigid sequence.

SECTION ONE

THE DISMANTLING OF THE ENGINE WHEN ASSEMBLED IN THE CAR

Index

Ref. No.	1.	The crankshaft and flywheel sub-assembly.
" "	2.	The camshaft and camshaft gear.
" "	3.	The gearbox unit.
" "	4.	Sparking plugs.
" "	5.	The magneto.
" "	6.	The magneto drive gear and shaft.
" "	7.	The carburetter.
" "	8.	The fan sub-assembly.
" "	9.	The radiator hose to cylinder head.
" "	10.	The radiator hose to the cylinder block water flange.
" "	11.	The cylinder head.
" "	12.	The exhaust manifold.
" "	13.	The cylinder side plate.
" "	14.	The valves and valve springs.
" "	15.	Fan pulley and spacer.
" "	17.	The camshaft front cover.
" "	18.	The starting handle bracket.
" "	19.	The flywheel cover.
" "	20.	Gearbox cover, hand brake and change speed levers.
" "	21.	Dynamotor cover and dynamotor chain
" "	22.	The dynamotor.
" "	23.	Raise front end of car.
" "	24.	The sump sub-assembly.
" "	25.	Dipper trough, oil valve and starting handle.
" "	26.	The oilpump and cylinder block oil pipe.
" "	27.	The connecting rods and pistons.



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Engine Dismantling Instructions—continued

SECTION ONE

THE DISMANTLING OF THE ENGINE WHEN ASSEMBLED IN THE CAR

WHEN it becomes necessary to dismantle the engine and gearbox without removing the unit from the car, it must be remembered that it will be quite impossible to dismantle completely some of the components. The purpose of this section is to point out the various components which cannot be dismantled under these circumstances and to give detailed instructions in the case of those dismantling operations which it is possible to carry out.

The following parts cannot be dismantled without removing either the engine or gearbox units from car.

Ref. No. 1. **The crankshaft and flywheel sub-assembly.** To remove this sub-assembly without detaching the engine from the gearbox is impossible.

The crankshaft bearing caps, however, can be removed each in turn as long as two of the caps are fixed in place while the other is removed. This may be resorted to when the crankshaft bearings require tightening up temporarily (until such time as the bearings can be overhauled thoroughly as shown in section three, ref. No. 29).

Ref. No. 2. **The camshaft and camshaft gear.** It is impossible to remove these components until the engine has been removed from the car and detached from the gearbox. For further details see section three, ref. No. 89.

The Valve Tappets

These depend on the camshaft being removed, and so the remarks above apply here. For further details see section three, ref. No. 90.

Ref. No. 3. **The gearbox unit.** A certain amount of work may be done on this unit as it stands, such as removal of the flywheel cover, gearbox cover sub-assembly, dynamotor chain cover, dynamotor chain and the dynamotor itself, and provided that the rear axle is disconnected and run back out of the way a good deal of additional work may be undertaken, such as: Removal of the ball housing, stripping the universal joint, removal of the rear portion of the primary shaft with its gears, removal of the gear shifter shafts and shifter forks. Any further dismantling must be prefaced by removal of the gearbox from the car.

For all details of these operations see section three.

The remainder of engine and gearbox components can be dismantled while the engine and gearbox are in position in the car, as indicated in the following operations.

First of all the bonnet must be removed, and instructions for this operation will be found in section two.

Note.—When working on the engine (especially if it is intended to dismantle any of its parts) it is a wise precaution to cover the wings of the car, over the front wheels, with large sheets of brown paper or cloth. This will prevent the paintwork being soiled.

Ref. No. 4. **Sparking plugs.** The leads to the sparking plugs from the magneto should be checked to see that they are connected up in the correct order for firing (as will be found on the firing chart relating to the specific magneto installed). See also section three, ref. No. 67. The sparking plug can be unscrewed with a suitable box spanner and removed, together with the copper-asbestos washer underneath it.

Note the condition of the plugs; if dirty they must be cleaned. The points should be examined for the width of gap; this should be between .02 in. and .025 in. wide.

When ordering new plugs, the maker, type, number and reach should be quoted, also the thread, which is 18 mm. $\times$ 1.5 mm. pitch.

Ref. No. 5. **The magneto.** First disconnect the control rod at the universal joint; the magneto can then be removed exactly as described in section three, ref. No. 67.

With some types of magnetos it will only be necessary to slip the magneto breaker cover and base from off its spigot on the magneto, thus disconnecting the latter from the control rod or cable.

For the necessary adjustments of the magneto see the maker's instruction book or the Morris Manual covering this type of magneto.

Ref. No. 6. **The magneto drive gear and shaft.** To dismantle these components, first remove the magneto as shown above, then remove the cylinder side plate as described in section three, ref. No. 73.

The magneto drive shaft and gear can now be removed exactly as described in section three, ref. No. 75.

Ref. No. 7. **The carburetter.** Turn off the petrol tap from the tank. The throttle controls, slow running gear and accelerator pedal should now be disconnected from the carburetter.

Unscrew the petrol pipe union nut from the carburetter and proceed to remove the latter as described in section three, ref. No. 66.

Ref. No. 8. **The fan sub-assembly.** Disconnect the fan belt and remove the fan sub-assembly exactly as described in section one, ref. Nos. 69 and 70. If there is not sufficient room between the back of the radiator and the front of the fan to enable this to be done, remove fan lever stud (1725) by unscrewing it from the cylinder head, noting that it has a *left-handed thread*. When reassembling be sure that this stud is absolutely firm in the cylinder head.

Ref. No. 9. **The radiator hose to cylinder head.** First take care to drain the radiator by turning on the drain tap in the bottom tank.

Then, after completely slackening the hose clips, gently work the rubber hose off its joint on the cylinder head, at the same time slipping it farther along the joint pipe to the radiator. On no account should a screwdriver be inserted between the hose and the joint for the purpose of easing this operation, or the rubber may be split.



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Engine Dismantling Instructions—continued

Ref. No. 10. **The radiator hose to the cylinder block water flange.** See that the radiator has been drained by turning on the drain tap in the bottom tank. The hose may now be worked off the joint in a similar way to that previously described.

Usually, however, as the hose is so short, some difficulty may be experienced in detaching it from the joint. Should this occur, the best plan is to disconnect the water flange itself from the cylinder block (see section three, ref. No. 95), leaving the hose tight on the flange.

Ref. No. 11. **The cylinder head.** First remove the magneto leads from the plugs and the radiator hose from the cylinder head; also remove the fan sub-assembly. The cylinder head can now be removed exactly as described in section three, ref. No. 71.

Ref. No. 12. **The exhaust manifold.** This must first be detached from the exhaust pipe by unscrewing the exhaust pipe nuts. The exhaust manifold can then be removed from the cylinder block exactly as described in section three, ref. No. 72.

A word of warning is necessary about the reassembling of the exhaust pipe. When bolting up the exhaust pipe to the manifold, see that the lip on the end of the exhaust pipe is square with the flange of the manifold and the collar on the pipe. If this is not carefully done (and the lip is not square), when the bolts are tightened up the force exerted will crack the lip of the exhaust pipe and probably break it right off on the side where it is first gripped between the flanges. On later models a modified flange is fitted which reduces trouble from this source.

Ref. No. 13. **The cylinder side plate.** This can be removed exactly as described in section three, ref. No. 73.

Ref. No. 14. **The valves and valve springs.** The cylinder head and side plate must first of all be removed as described previously.

The valves and springs can then be removed in a similar manner to that described in section three. If any difficulty is experienced owing to the exhaust pipe being in the way, it may be removed.

Ref. No. 15. **Fan pulley and spacer.** Full instructions for this will be found in section three, ref. No. 88, when it is required to remove them.

Ref. No. 17. **The camshaft front cover.** (Adjusting camshaft for end play.) For adjusting camshaft for end play it is necessary to remove the fan pulley and spacer first and then to remove the camshaft front cover as described in section three, ref. No. 89. The remarks given there relative to end play in camshaft should be noted, and the necessary adjustment made by adding or taking away the brass liners as required.

Ref. No. 18. **The starting handle bracket.** In the new model sumps the above bracket can be removed from the front face as described in section three, ref. No. 78, and then be further dismantled as described in section three, ref. Nos. 79 and 80.

In the older models, the bracket is integral with the sump, and therefore the starting handle cannot be dismantled until after the sump has been removed from the cylinder block.

Ref. No. 19. **The flywheel cover.** It is necessary to remove the floorboards from the driver's seat before the flywheel cover can be removed. The purpose of the flywheel cover is to provide a means whereby the clutch may be inspected, and through the opening provided the clutch springs can be assembled or dismantled.

After having taken out the floorboards, remove the cover as described in section three, ref. Nos. 65 and 96.

Whenever this cover is removed be careful that no object drops through the opening which may injure the clutch beneath.

Ref. No. 20. **Gearbox cover, hand brake and change speed levers.** First of all remove the floorboards and disconnect the brake-rod from the arm.

The whole unit can then be removed as described in section three, ref. Nos. 101 to 104.

Ref. No. 21. **Dynamotor cover and dynamotor chain.** First of all remove the floorboards and proceed as described in section three, ref. No. 105. This will not be an easy proposition owing to the limited space in which it is necessary to work.

The dynamotor chain can be tightened or slackened by rotating the dynamotor in the slots of its housing in the gearbox, after slackening the bolts which hold it to the face. When readjusting the chain be particular that the degree of tightness is tested at various points in the chain, as wear is not always quite equal, and a chain adjusted to suit a slack place will be too tight when moved round.

Ref. No. 22. **The dynamotor.** Before removing the dynamotor one of the leads to the battery or accumulator must be disconnected and insulating tape wound round the end to prevent any accidental shorting across the battery. This will prevent a fire which might otherwise occur should any petrol be about.

The leads going to the commutator of the dynamotor must next be disconnected.

It will now be safe to remove the dynamotor as described in section three, ref. Nos. 105 and 106.

Note.—After reassembling the dynamotor be very careful to replace the leads on the distributor and on the battery terminals. On no account must the engine be run with the charging switch on until these connections have been made.



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Ref. No. 23. **Raise front end of car.** In order to carry out the remaining dismantling operations access to the underneath of the car is necessary. This is obtained without any trouble where a pit is available, over which the car can be wheeled. Where no pit is available the front end of the car must be raised.

First of all the water should be drained from the radiator and the oil from the sump.

Slip a stout rope through the front spring shackles to form a sling and raise the front end of the car to a convenient height by means of a pulley block and chain. Wedge the two back wheels with blocks of wood to prevent the car from slipping away and support the front axle on two stout wooden trestles, or in an emergency two empty casks may be used. Do not remove the sling, but let it just be relieved of the weight of the car, which should be on the wooden trestles.

Ref. No. 24. **The sump sub-assembly.** To prevent injury to the breather it is advisable to remove it from the engine as described in section three, ref. No. 76. When the sump has been drained and the end of the car raised as shown, remove the footboards by the driver's seat and light up the underneath of the car from an electric hand lamp. A naked light must never be used, owing to the danger of igniting the petrol vapour.

The weathershields must first be removed from beneath the sump and gearbox, and the bolts which hold the sump to the face of the gearbox should be unscrewed and removed.

One of these bolts may be screwed in again in order to support the sump after the bolts holding it to the cylinder block have been removed.

Two nuts which hold the sump at the front end of the engine are also left in place, and in this manner the sump is held at three points until ready to be removed. For convenience in unscrewing these two nuts the car is lowered to the floor and the nuts then removed. Then, holding the sump in order that it will not suddenly drop to the floor, take out the bolt which was left in the gearbox face; the sump can then be removed, taking care not to damage the oilpump.

See also section three, ref. No. 77.

Ref. No. 25. **Dipper trough, oil valve and starting handle.** After the sump has been removed as shown above, these parts can be removed as described in section three, ref. Nos. 79, 80, 81 and 82.

Ref. No. 26. **The oilpump and cylinder block oil pipe.** The sump, cylinder side plate, and magneto gear having been removed as described previously, these parts (oilpump and oil pipe) can be removed exactly as described in section three, ref. Nos. 87 and 94.

Ref. No. 27. **The connecting rods and pistons.** After the sump has been removed the front end of the car should be raised again if these parts are to be removed. When the car is securely propped up the connecting rods and pistons may be removed exactly as described in section three, ref. Nos. 84 and 85.

All that remains to be done now is to thoroughly inspect the crankshaft and camshaft bearings. If these require overhauling it is advisable to remove the engine and overhaul these parts as shown in section three.

*Continued*



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Engine Dismantling Instructions—continued

SECTION TWO

INSTRUCTIONS FOR THE REMOVAL OF ENGINE AND GEARBOX FROM THE CAR

Index

Ref. No. 28.	Drain the radiator.
" " 29.	Drain the sump and gearbox.
" " 30.	Remove the bonnet and floorboards.
" " 31.	Turn off the petrol.
" " 32.	Disconnect the leads from the battery.
" " 33.	Disconnect the carburetter controls.
" " 34.	Disconnect the magneto controls.
" " 35.	Raise the front end of the car.
" " 36.	Remove the oil tray clips and oil tray.
" " 37.	Remove bonnet side boards.
" " 38.	Remove the exhaust pipe from manifold and from the silencer.
" " 39.	Remove the starting handle bracket where possible.
" " 40.	Remove the engine arm bolt nuts.
" " 41.	Remove radiator bolts.
" " 42.	Remove the water flange from cylinder block.
" " 43.	Disconnect steering arm from steering box.
" " 44.	Lower the front end of the car.
" " 45.	Disconnect the radiator stay from the scuttle.
" " 46.	Remove radiator hose from cylinder head.
" " 47.	Remove the radiator.
" " 48.	Remove fan belt and fan sub-assembly.
" " 49.	Remove the breather.
" " 50.	Remove the sump.
" " 51.	Remove steering gearbox bracket bolts from cylinder block.
" " 52.	Remove steering box column unit.
" " 53.	Support the rear spring shackles.
" " 54.	Remove flywheel cover and clutch springs.
" " 55.	Remove the bolts holding gearbox to cylinder block.
" " 56.	Support the gearbox in position.
" " 57.	Remove the engine unit from car.
" " 58.	Disconnect the ball housing cover.
" " 59.	Disconnect the hand brake control rods.
" " 60.	Remove the gearbox cover unit.
" " 61.	Disconnect the clutch pedal from the clutch pedal hub.
" " 62.	Remove the engine and gearbox unit from car.

SECTION TWO

THE REMOVAL OF ENGINE AND GEARBOX UNIT FROM THE CAR

IN this section are described two operations, the first being the removal of the *engine unit only*, leaving the gearbox unit supported in the car frame; and the second being the removal of *the engine and the gearbox unit together*.

The following sequence is applicable to both these operations, excepting where the difference is pointed out in the various paragraphs.

Before commencing work it is advisable to cover the wings and other exposed parts of the coachwork with brown paper or a linen sheet. This will prevent them from being soiled.

Ref. No. 28. Drain the radiator. The engine may be started and warmed up preliminary to draining, as the warmth will dry out the jacket completely. Engine must be stopped before actually beginning to drain the radiator. Turn on the drain tap in the base of the radiator and drain the water into a $4\frac{1}{2}$ or 5 gallon container.

Ref. No. 29. Drain the sump and gearbox. See section three, ref. No. 64. Tins of sufficient capacity should be placed underneath to catch the oil. When full the sump contains 1 gallon and the gearbox 1 quart.

Ref. No. 30. Remove the bonnet and floorboards. While the radiator and sump are draining the following operations can be carried out. Unscrew the hinge rod bracket at rear end of hinge.

Then, lifting the rear end of the bonnet, slide it bodily towards the windscreen until the front end is quite clear of its housing in the radiator.

Help should be obtained to lift the bonnet off, otherwise the paint on the scuttle may be damaged.

The floorboards must be removed from the driver's seat. These, together with the bonnet, should be placed out of harm's way.



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Engine Dismantling Instructions—continued

Ref. No. 31. **Turn off the petrol.** When working on the car the petrol should always be turned off, and on no account should a naked light be used. Always, if possible, use an adequately protected electric hand lamp.

Ref. No. 32. **Disconnect the leads from the battery.** This should always be done when it is required to remove the gearbox with the engine.

The leads at the dynamotor end must be detached; and to prevent the danger arising of a "short" from the battery causing a fire the positive lead from the battery should be detached and bound with insulating tape.

When removing the engine only none of the leads need be removed, as they may be left connected up to the dynamotor. *Note.*—It is very important that these leads are replaced when reassembling the unit in the car, and on no account must the engine be started up and run with the "charging" switch on unless the battery leads are properly connected.

Ref. No. 33. **Disconnect the carburettor controls.** The controls which require disconnecting are the mixture control rod, accelerator pedal rod and the slow-running control rod.

The accelerator pedal and bracket may be removed if necessary on the older type models.

The carburettor need not be removed, but the petrol pipe must be disconnected by unscrewing the union nut at the base of the float-chamber.

Ref. No. 34. **Disconnect the magneto controls.** In some types of magneto it will be necessary to uncouple the control rod joint pin, while in other types the magneto contact breaker cover and base can be slipped off, with the controls from the magneto.

See also section one, ref. No. 5.

Ref. No. 35. **Raise the front end of the car.** Having thoroughly drained the radiator and sump, the front end of the car should be raised as described in section one, ref. No. 23. See that the front axle is securely supported by the wooden trestles as a precaution against accidents.

Ref. No. 36. **Remove the oil tray clips and oil tray.** These are fastened underneath the sump and gearbox. The various nuts, bolts and spring clips can be located by the help of an electric lamp.

Ref. No. 37. **Remove bonnet side boards.** These, on older models, are fastened by means of bolts to the chassis and the nuts must be unscrewed from underneath the car. Some difficulty may be experienced when unscrewing these owing to the heads of the bolts turning round in the top of the side boards. Before removing side boards examine their edges for additional screws holding the side wings to them. These are not standard, but cases have occurred where these screws have been put in in old cars to stop the wings from rattling and they will have to be removed before the side boards can be detached.

On later models metal bonnet side boards are fitted which are easily removed when required by releasing their fixing bolts.

Having removed the bonnet side boards put them away in a safe place.

Ref. No. 38. **Remove the exhaust pipe from manifold and from the silencer.** The exhaust pipe can be removed from the manifold as described in section one, ref. No. 12.

Then, by removing the retaining screw from the silencer, the exhaust pipe can be detached by sliding it out of its housing in the silencer. It can then be placed on the floor, clear of the engine and car.

Ref. No. 39. **Remove the starting handle bracket where possible.** In the new models the engine can be removed from the car without taking off the sump by detaching the starting handle bracket as described in section one, ref. No. 18.

Or alternatively—remove the bolts holding the sump to cylinder block and gearbox.

In the older models where the starting handle bracket is integral with the sump the engine cannot be removed from the chassis until the sump itself has been removed.

(a) All the joint bolts but one holding the sump to the gearbox should be removed, leaving that one in position as described in section one, ref. No. 24, to retain the sump in position until a later operation.

(b) When the bolts in paragraph (a) have been removed, unscrew and remove all the bolts holding the sump to the cylinder block, but leave the two nuts at the front end in position for removal at a later stage.

Note.—Where the new model sump is fitted to the engine, and it is required to remove the engine only, leaving the gearbox behind, it will only be necessary to remove the bolts given in paragraph (a) above. In all cases where the old model sump is fitted all the bolts in paragraphs (a) and (b) will have to be removed.

Ref. No. 40. **Remove the engine arm bolt nuts.** These nuts will be found underneath the car on brackets fixed to the chassis below the arms of the cylinder block. It will be necessary to use two spanners—one to hold the head of the bolt on the top of the arm to prevent it from rotating and the other to unscrew the nut underneath. To do this conveniently help will be required.

The nuts should be removed and the bolts left in place to maintain the alignment of the engine until such time as it is removed.

On later models fitted with resilient engine mountings the engine holding-down bolts should be left in position on the engine bearer arms.

Ref. No. 41. **Remove radiator bolts.** These are to be unscrewed from the radiator underneath the frame cross member to which it is bolted.



Continued

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Engine Dismantling Instructions—continued

Ref. No. 42. **Remove the water flange from cylinder block.** This can be done as described in section one, ref. No. 74. Or, if possible, the hose itself may be slipped off the flange, which may then be left bolted to the cylinder block.

Ref. No. 43. **Disconnect steering arm from steering box.** This is for the purpose of detaching the steering gear from the steering box, so as to facilitate the removal of the engine, as explained in a later paragraph.

First remove the split pin which locks the nut on the steering arm pinching bolts, then remove the nut and withdraw the bolt. Now tap the arm off the steering box cross-shaft. (This procedure is not necessary in the case of later models equipped with Bishop cam steering gear attached to the frame.)

Ref. No. 44. **Lower the front end of the car.** Remove the trestles which are placed under front axle and lower the car to the floor by means of the pulley block.

Ref. No. 45. **Disconnect the radiator stay or stays from the scuttle.** This is done by unscrewing the nut on the rear end of the stay rod from its bracket on the scuttle.

Ref. No. 46. **Remove radiator hose from cylinder head.** This can be done exactly as described in section one, ref. No. 10. Care must be taken, as the radiator is no longer held firmly in place by bolts.

Ref. No. 47. **Remove the radiator.** All connections and bolts which hold the radiator to the engine and car frame having now been disconnected, the radiator can be lifted out of the frame.

Ref. No. 48. **Remove fan belt and fan sub-assembly.** This can be done exactly as described in section one, ref. No. 8.

Ref. No. 49. **Remove the breather.** This is to protect it in those cases where the sump must be removed. In the new models where the sump is not removed the breather can be left in place.

See section three, ref. No. 76.

Ref. No. 50. **Remove the sump.** As already explained, this is not necessary in those models where the starting handle bracket can be removed.

In the other case, having removed most of the bolts previously, all that is now necessary to remove the sump is to unscrew the two nuts at the front end and remove the bolt which was left in position on the gearbox face.

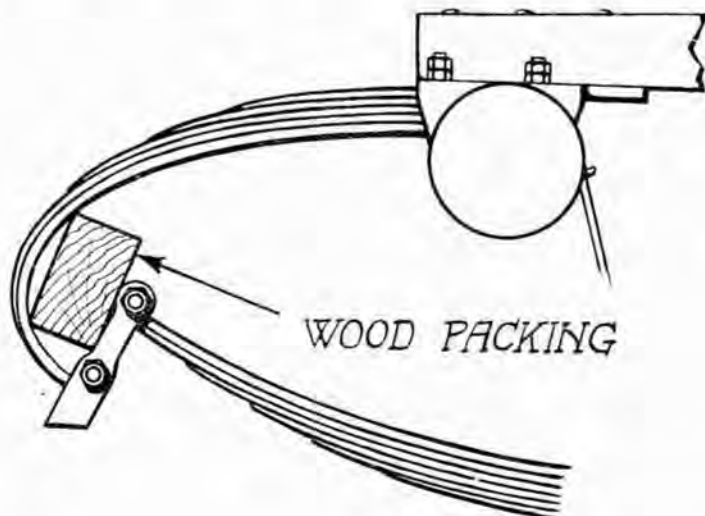
The sump will then easily be detached, care being taken not to damage the oilpump, which projects from under the cylinder block.

Ref. No. 51. **Remove steering gearbox bracket bolts from cylinder block.** These bolts are three in number, and two of them must be unscrewed and removed, while the third bolt should only be partly unscrewed, thus retaining the bracket in position until the engine is ready for removal. (This is of course modified on later models equipped with Bishop cam steering gear attached to the frame, in which case it is necessary to detach the steering gearbox bracket from the frame.)

Ref. No. 52. **Remove steering box column unit.** Unscrew the cap nut on top of the wheel and knock off the wheel with a wooden block so as not to damage the boss (or use a special steering wheel drawing tool), then remove the clip which fastens the column to the fascia board and, allowing for any horn wires which may be attached, remove the column bodily from the car and lay aside safely.

Ref. No. 53. **Support the rear spring shackles.**—*This applies to cars prior to 1927 only.*—When the engine is removed from the chassis, the weight of the car, instead of being evenly distributed over both front and rear wheels, will drop principally on to the rear springs. This will disturb the alignment of engine and gearbox, and, especially when engine only has been removed, will greatly hinder the reassembly of the engine and gearbox.

To prevent this difficulty, the rearmost shackles must be wedged securely with blocks of wood. This will then prevent the rear part of the body from falling down on to the springs. The sequence of operations up to the above (reference No. 53) is equally applicable to the removing of the engine only, or to the removing of the engine and gearbox together.



The method of supporting rear spring shackles.



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Engine Dismantling Instructions—continued

The sequence of operations must now be divided according to which unit is to be removed. First of all take the case where the engine unit only is required to be removed from the car.

Ref. No. 54. **Remove flywheel cover and clutch springs.** These can be removed exactly as described in section one, ref. No. 19, and section three, ref. No. 76.

This enables the flywheel of the engine to be disconnected from the clutch plates in the gearbox.

Ref. No. 55. **Remove the bolts holding gearbox to cylinder block.** Before the engine can be separated from the gearbox these bolts must be removed.

The bolts holding gearbox to sump should have been removed previously (see ref. No. 39).

Ref. No. 56. **Support the gearbox in position.** The rear shackles (on older models) having been firmly wedged with wood packing, place a gearbox anchoring jig in position—this can be done after the gearbox cover, with its change speed lever, etc., has been removed. This is needful, as the jig is coupled to the studs which normally hold the cover in place. Before actually placing the jig in place put on a sheet-metal cover to exclude dirt. This jig will support the gearbox in such a manner that the car can be wheeled about. This jig consists of a length of channel girder (such as an old frame side member) 27½ in. long, two studs and 12 in. of 1½ in. × ¼ in. angle iron. Two ½ in. clearance holes are drilled 9 in. apart, then four holes are drilled in the angle iron, two being ⅜ in. diameter at 4½ in. apart and two suitable for tapping ½ in. at 9 in. apart, all holes being equidistant from the centre. The angle iron is suspended from the girder by the two ½ in. studs 6 in. long. These studs are screwed for 3 in. and the other end only enough to allow of them being screwed into the tapped holes in the angle iron, being then welded in place. These studs should be flush on the underside of the angle iron. The channel bar is to lie across the car on the sides of the body or chassis if the body is removed.

The more securely the gearbox is held the easier it will be both to remove the engine unit from it and to replace it again when reassembling the engine to the car.

Much more difficulty will be experienced in reassembling the clutch drive pins on the engine flywheel into the corresponding holes in the clutch plates of the gearbox should the gearbox move out of alignment.

Ref. No. 57. **Remove the engine unit from car.** Before actually beginning to lift the engine away it should be ascertained that all smaller fittings are disconnected from the engine and that the motor is entirely clear for lifting. These fittings are: oilpipe to gauge—this should be carefully bent out of the way. Electric horn, if fitted to block or in the way, and any other fitting which it may be needful to remove. If the car is of 1927 or later date the front wings may require removal, as the front parts of the bonnet boards were formed in one piece with the wing valances on some models, and as these extensions overlap the front engine feet this removal becomes necessary.

Having completed all the preceding operations the engine can now be separated from the gearbox and removed from the car in the following way.

Before attempting this, help should be obtained, as it requires two men to do it easily.

First of all remove the engine feet bolt nuts. A strong rope must now be placed around the engine as near to the centre of gravity as possible, and made to sling on to the hook of a strong pulley block, which must be firmly attached overhead (on travelling ways if possible).

In those engines where the sump has been removed the sling should come around the crankshaft centre bearing, care being taken that it does not pull on the oilpump.

When all has been firmly secured, pull the chain of the pulley block until the sling is "taut." Now examine the sling again to see that it is clearing the oilpump, and then pull the chain of the pulley block until the engine is clear of the engine brackets, but *not* enough to disturb the alignment of engine and gearbox.

The engine must now be carefully pulled forward, thus breaking the engine and gearbox joint, and then pulled still more forward until the clutch drive pins are withdrawn from the clutch plates in the gearbox. Care must be taken to use as little force as possible so as not to strain the driving pins.

Now, by a combination of lifting and pulling, which is difficult to describe but fairly obvious when carrying out the operation, the engine unit is guided carefully under the scuttle and out of the car frame.

The engine can now be taken right off the car and lowered on to a suitable stand. Care must be taken not to lose the drive gear spigot bearing, which should be found at the front end of the clutchshaft.

The only operation which remains to be described now is that of removing the *engine and gearbox unit* from the car. The sequence of operations is as previously described up to paragraph ref. No. 53. From that point onwards proceed as follows.

Ref. No. 58. **Disconnect the ball housing cover.** Unscrew and remove the bolts and nuts which hold the cover to the universal joint ball housing; the ball housing cover will then slide along the torque tube to the rear. The gearbox is then free of the torque tube and ready to be removed as described in a later paragraph. Care should be taken to preserve any brass shims that there may be between the ball housing and the retaining ring, as any maladjustment will result either in slackness or tightness in the socket.

In the latter case the effect will be to tear out the studs securing the ball socket to the gearbox case—a matter of some seriousness.

On models fitted with the speedometer drive on the spherical housing this should of course be disconnected.





MODELS : MORRIS 11.9 H.P. AND 14/28 H.P.

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SHEET No. 9

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Ref. No. 59. **Disconnect the hand brake control rods.** Remove the joint pin from the hand brake lever arm and brake-rod after withdrawing its retaining split pin.

Ref. No. 60. **Remove the gearbox cover unit.** This can be done exactly as described in section one, ref. No. 20, and after removing it cover the parts thus exposed with a metal or cardboard cover. (Unless the gearbox cover is removed the gearbox cannot be withdrawn from under the scuttle.)

Ref. No. 61. **Disconnect the clutch pedal from the clutch pedal hub.** Before the gearbox can be withdrawn from under the scuttle, the clutch pedal must also be dropped right down. To do this unscrew the clutch pedal pressure stud nut and remove the pedal hub, as described in section three, ref. No. 112. In cars of 1927 and earlier type the brake-rod attached to the brake pedal must be detached, as in these cars the brake pedal is pivoted on the gearbox and not on the frame as in the later models.

Ref. No. 62. **Remove the engine and gearbox unit from car.** Remove the engine bolts from their holes in the engine arms and place the sling around the engine as described previously in ref. No. 57.

Then taking the weight of the unit on the sling by means of the pulley block, pull the engine forward until the ball housing cover at rear of gearbox is clear of the torque tube.

The engine and gearbox unit can now be withdrawn from the car in a very similar manner to that described in ref. No. 57, working it gently from underneath the scuttle.

Make certain that the leads from the dynamotor have been disconnected as shown in ref. No. 32 before attempting to withdraw the engine.

The engine and gearbox unit can now be removed from the car and lowered on to a convenient stand, care being taken not to damage the oilpump.

*Continued*



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Engine Dismantling Instructions—continued

SECTION THREE

INSTRUCTIONS FOR DISMANTLING ENGINE COMPLETELY.
ENGINE AND GEARBOX BEING ASSEMBLED TOGETHER, BUT NOT IN PLACE IN CAR

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| " " | 92. | Remove crankshaft and crankshaft gear. |
| " " | 93. | Remove crankshaft bearing blocks and bushes. |
| " " | 94. | Remove cylinder block oil pipe. |
| " " | 95. | Remove water flange. |
| " " | 96. | Cylinder block now completely stripped. |
| " " | 97. | Drain gearbox. |
| " " | 98. | Mount gearbox on stand. |
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| " " | 100. | Remove universal joint ball housing. |
| " " | 101. | Remove gearbox cover sub-assembly. |
| " " | 102. | Remove change speed lever. |
| " " | 103. | Remove hand brake lever. |
| " " | 104. | Remove brake ratchet. |
| " " | 105. | Remove dynamotor cover. |
| " " | 106. | Remove dynamotor and chain. |
| " " | 107. | Remove clutch hub. |
| " " | 108. | Remove clutch hub plate. |
| " " | 109. | Dismantle clutch hub plate and sleeve. |
| " " | 110. | Remove clutch thrust race. |
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| " " | 123. | Dismantle universal joint. |
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| " " | 126. | Gearbox is now completely dis |



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SECTION THREE

INSTRUCTIONS FOR DISMANTLING ENGINE COMPLETELY.
ENGINE AND GEARBOX BEING ASSEMBLED TOGETHER, BUT NOT IN PLACE IN CAR

Ref. No. 63. **Mount unit on a stand.** Engine and gearbox unit must be mounted on some sort of stand for dismantling purposes. This can be a strong wooden frame or box, but if much work has to be done a strong cast iron frame is to be preferred, furnished with apparatus for turning the unit over.

One of the Works assembly stands may be used.

Ref. No. 64. **Drain oil from sump and gearbox.** Thoroughly drain oil from the engine into tins or other suitable receptacles in order to prevent oil dripping on to the garage floor. This is done by removing the first three plugs which are found underneath the engine. The front plug or *filter gauze plug*, part No. 1132, and its *gasket*, part No. 1103. The second plug or *sump plug*, 1215, and *gasket*, 1216. The third plug or *first gearbox plug*, 1215, and *gasket*, 1216.

When thoroughly drained these plugs may be replaced. Do not remove the fourth plug at this stage.

Ref. No. 65. **Remove the gearbox unit.** Before removing the various bolts holding the gearbox unit to the engine the clutch springs must be removed from the clutch driving pins, which are fixed to the flywheel in the engine unit. So proceed as follows:

Using a $\frac{1}{2}$ in. Whitworth hexagonal spanner or the brace provided (M.567-26-31) remove the *flywheel cover bolts* (1122) and *spring washers* (1283).

Now remove the *flywheel cover* (1217), taking care not to injure the *gasket* (2370) which will be found underneath.

To preserve the gasket when removed, and all other gaskets for that matter, it is a good plan to hang them on the garage wall.

The clutch springs will be seen through the opening which is now uncovered, and these must be removed by means of the special tool provided for that purpose.

They are removed one at a time, each succeeding spring being brought into line by turning the flywheel over with the starting handle.

To use this tool (clutch spring compressor, 16958) place the slotted tube over the clutch spring in such a manner that the retaining pin is free to be released from its pin, through the slot. Now anchor the other end of the tool against the gearbox cover, close to the change speed lever, with the claw under the change speed lever cover. Now press down the toggle, when the clutch spring will be compressed and held firm, while the *clutch spring retainer pin* (1177) is removed (taking care not to drop it into the clutch chamber in the process).

Note.—That if lever type of clutch spring compressor is used the gearbox top sub-assembly will have to be removed to allow of its use.

The spring compressor is now released and the *clutch spring cap* (1176) and *clutch spring* (1786) removed from off the clutch drive pins.

Also it is advisable to replace the flywheel cover before any nuts and bolts, etc., have fallen into the clutch chamber.

Having removed all the clutch springs, proceed to unscrew and remove the two *gearbox nuts* (1127), the six *gearbox bolts* (1125) and the *spring washers* (1284), using a $\frac{5}{16}$ in. Whitworth hexagonal spanner or the brace box spanner (M.567-1 and 6).

The gearbox unit can now be removed from the engine and sump, taking care not to strain on the clutch drive pins in the flywheel or to damage the small tail bearing of the drive gear shaft which will be found on the front end of this shaft.

At this point the gearbox should be put aside after fitting a cardboard or sheet tin cover over the top face to prevent the entrance of anything which might injure the gearbox.

Ref. No. 66. **Remove the carburetter.** No controls being connected to the carburetter, all that is necessary is to remove the *carburetter stud nuts* (1127 and 1008) and the *spring washers* (1284), using a $\frac{5}{16}$ in. hexagonal spanner.

The carburetter can now be withdrawn from the *studs* (1117). The *carburetter gasket* (1098) should also be taken off and hung up in a safe place.

See that the carburetter studs are tight in the cylinder block.

Ref. No. 67. **Remove the magneto.** Before removing the magneto, note to which cylinder the various leads are attached, and if there are no indication marks on them, attach some identification mark to each lead, so that when reassembling they may be replaced correctly. This is rather important, for unless these are replaced in the correct order the timing of the spark will be wrong.

If changing over to a different make of magneto it will be necessary to refer to the firing diagram of that particular make, since magnetos vary in this respect.

After removing the leads from the sparking plugs (which should be left in the cylinder head) release the *magneto strap screw* (1891) and unscrew the two *coupling nuts* (1254) nearest to the engine and their *spring washers* (1281). Use a $\frac{3}{16}$ in. hexagonal spanner for this, cranking the engine over until the nuts are in a convenient position.

The magneto can now be removed, taking with it the flexible rubber *coupling disc* (1237) and the *magneto adjusting hub* (1066).

The magneto adjusting hub can be removed from the magneto spindle by unscrewing the nut and withdrawing the hub with a special withdrawing tool, C.A.1066/T3.



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Engine Dismantling Instructions—continued

Ref. No. 68. **Remove the magneto base plate.** Unscrew the *base plate bolts* (1068) with a $\frac{5}{16}$ in. hexagonal spanner or the brace (M.567-1 and 6). The *base plate* (1067) together with the *magneto strap* (2470) is now easily moved.

The *spring washers* (1284) should not be lost when removing bolts.

Ref. No. 69. **Remove the fan unit.** Uncouple and remove the fan belt. Using a $\frac{7}{16}$ in. hexagonal spanner, slacken off the *fan lever bolt* (1059), which will be found quite close to the cylinder head. The fan unit can be removed by sliding the clip off the stud in the cylinder head.

Ref. No. 70. **Remove component parts of fan unit.** This operation need not be carried out at this stage but can be done at any convenient time.

At the front of the fan will be found the *cap screws* (1200). Remove these with a $\frac{3}{16}$ in. hexagonal spanner or the brace spanner (M.567-26 and 30). The *fan cap* (1909), *fan gaskets (cap)* (1900) and the *fan blades* (1883) may now be removed from the *fan body*.

Note that the gaskets are of paper and placed one on each side of the fan blades.

Holding the fan spindle in lead vice jaws, unscrew the *fan castle nut* (1714), first removing the *split pin* (1288). It must be noted that the fan castle nut has a *left-hand thread* and that it can be removed with a $\frac{1}{4}$ in. Whitworth hexagonal spanner or the brace spanner (M.567-26 and 31).

Now remove the *fan retaining washer* (1911) and the *fan body* (1908) by sliding them off the *fan lever and spindle* (1907).

Inside the fan body will be found the *fan roller bearing* (1881), the *fan oil retaining bush* (1910) and the *fan spring retaining wire* (1912).

Ref. No. 71. **Remove the cylinder head.** First of all slacken off all the cylinder head nuts, working from the centre bolts outwards. It is important that each of these nuts be slackened a *quarter or half a turn* in the order indicated before removing any of them.

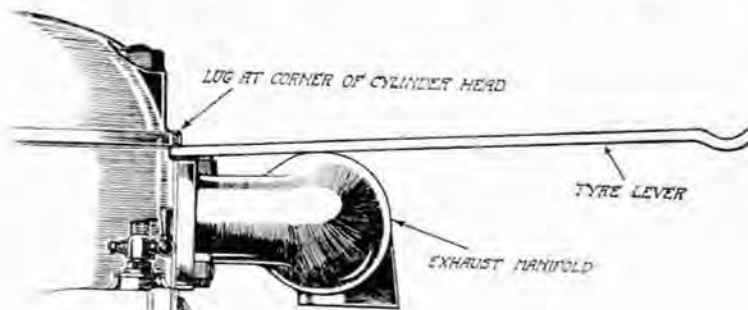
This is for the purpose of preventing internal strains being set up in the casting, as would be the case were one or two nuts still screwed down tight although the others have been removed.

Note.—When tightening up the cylinder head nuts on reassembling the engine the same sequence should be observed, viz. work from the centre outwards.



The order in which the cylinder head holding down nuts should be loosened and tightened up.

After *slacking off* the *cylinder head nuts* (1187) with box spanner CA.1043/T1 as described above, but before completely removing any of them, crank over the engine by turning the starting handle. If the sparking plugs have been left in the cylinder head the resulting compression will probably be sufficient to break the joint between the cylinder head and the cylinder block. Should the compression thus obtained not be sufficient to break the joint the cylinder head may be prised off with the help of a tyre lever or other blunt instrument. Place one end of the lever under the lug projecting from a corner of the cylinder head. Then, using the exhaust manifold as a fulcrum, press downwards on the free end of the tyre lever, which will break the joint on that corner. Repeat this operation on the other corner of the cylinder head and the joint will be broken sufficiently to remove the head.



How the tyre lever should be applied in order to break the cylinder head joint.

On no account should a screwdriver or other sharp instrument be driven between the joint, or the gasket will be entirely "scrapped."

Having now broken the joint, the nuts can be removed and the *cylinder head* (1944) lifted off the studs, together with the *magneto lead clip and ring* (1295 and 1296). To remove *fan lever stud* (1725) unscrew left-handed. Before removing gasket see that it does not cover any of the water channels, either in the cylinder head or in the cylinder block, as any restriction in the size of these channels prevents the full flow of cooling water and will tend to cause an over-heated engine.



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Engine Dismantling Instructions—continued

Now withdraw the *cylinder head gasket* (1099) very carefully from the studs, great care being necessary to lift it off evenly so as not to tear the holes in the gasket on the studs. Do not damage this gasket in any way, for unless it is absolutely flat a good gastight joint will be impossible to obtain when reassembling the cylinder head. After having removed the gasket it should be hung upon the wall of the garage to preserve it from injury.

In the cylinder head will be left the sparking plugs, which may now be removed with a box spanner if required. A small hexagonal headed bolt will be seen on the top of the cylinder head. This is the *cylinder head plug* (1603) and need not be removed. Underneath the plug head is the *copper asbestos washer* (1604).

This plug is provided for the purpose of testing the top dead centre of the piston to check the timing.

Note.—In the case of the 14/28 h.p. Morris-Oxford the cylinder head will be part No. 2490 and the cylinder head gasket will be part No. 2427.

Ref. No. 72. Remove the exhaust manifold. Unscrew and remove the seven *exhaust manifold nuts* (1052) with a 5/16 in. hexagonal spanner. The *manifold* (1719) can now be lifted off the studs, taking care not to damage the gaskets on the joint faces.

Before removing the gaskets examine the holes in them for alignment with the bores of the cylinder block and manifold. No restriction in the size of the bores is permissible, and any overlapping of the gasket should be remedied before reassembling the manifold. Any carbon deposits in the bores of the manifold, and those of the cylinder block, must be removed also.

Obstructions such as those outlined above will tend to cause an overheated engine.

Remove the *end gaskets* (1724) and *centre gasket* (1723) and examine the surface to see that they are perfectly flat, as this is essential if a good gastight joint is to be made. The gaskets can then be hung up out of harm's way.

The *exhaust manifold studs* (1717) should be absolutely tight in the cylinder block and should not be removed.

On the exhaust pipe flange of the manifold will be found the *exhaust pipe studs* (1119) and also the *nuts* (1605) and the *spring washers* (1284).

Note.—In the case of the 14/28 h.p. Morris-Oxford the exhaust manifold will be part No. 2488.

Ref. No. 73. Remove the cylinder side plate. Unscrew and remove the *nuts* together with the *fibre washers* (1729) and the *cylinder side plate* (1721) and then lift off its studs with the *cylinder side plate gasket* (1722). Care must be taken not to injure the gasket if a good oiltight joint is to be maintained.

The *cylinder side plate studs* (1054) should be tight in the cylinder block, the fibre washers and the wing nuts should be replaced on them for safety.

Note.—In the case of the 14/28 h.p. Morris-Oxford the cylinder side plate is part No. 2459.

Ref. No. 74. Remove the valves and valve springs. The springs must first be compressed with a valve spring compressor (1786/T501). One end of this tool is placed under the valve spring cap and the other end on the top of the valve to hold it on its seating while the spring is compressed. Now remove the *valve spring retainer* (1035) from its recess in the valve stem.

The spring can then be released from the compressor, and the *valve*, *valve spring cap* and the *valve spring* removed.

It must be carefully noted that the valves are numbered 1 to 8 from the front end, and they must be replaced in this order when reassembling them.

Before placing valves out of harm's way, examine each one for condition of its head and its seating in the cylinder block; also for the condition of the stem and its guide in the cylinder block.

Particular note should be taken of *carbon deposits* on the *exhaust* valve stems and on their guides in the cylinder block, as these may be preventing the valves from bedding down on their seatings.

These deposits must be removed before attempting to grind or face the seatings.

The *valve guides* are fixtures in the cylinder block and do not need to be removed.

In the case of replacements being required, special plant is necessary to broach out the guides and to press new ones in.

When reassembling the valve springs, special tools are provided (CA.1032/T1) which hold the spring compressed ready for assembling on the valves; or the same tool may be used as described in the dismantling operation.

Ref. No. 75. Remove magneto drive shaft and gear. The magneto and cylinder side plate must have been removed as described in the previous paragraphs (ref. No. 67 and ref. No. 73).

The *split pin* (1291), which will be seen in front of the magneto drive gear, must first be removed.

Now insert the pegs of the spanner CA.1061/T5 in the holes seen in the flange of the drive shaft. Hold this firm with one hand and remove the *magneto drive shaft nut* (1019) by means of box spanner CA.1019/T1.

Then remove the *washer* (1020) from the back of this nut.

With a lead or raw hide hammer gently strike the screwed end of the drive shaft until it is free of the drive gear. The *magneto drive shaft* (1061) and its *key* (1005), which is fixed in it, can then be withdrawn from the magneto end.

The *magneto drive gear* (1062) can now be removed from the valve cover side, taking care not to break the small oil pipe (branching from the larger one) which will be found quite close to this gear.

When reassembling this drive shaft and gear care must be taken to ensure that it is a *free spin* fit in the bush; at the same time there must be no shake endwise between the thrust faces of the drive shaft thrust washer and drive shaft gear.





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Engine Dismantling Instructions—continued

As long as there is no end play (end play here will cause an annoying knock when the engine is running) there may be a small amount of backlash between the teeth of the drive gear and those of the camshaft gear meshing with it.

If the *drive shaft thrust washer* (1064) is so worn as to permit end play it must be replaced and fitted, either by filing or by facing with the hand facing tool CA.1063/T5, until the above fit is obtained.

Driven in the cylinder block bore will be found the *magneto drive shaft bush* (1063) which is of *cast iron*. Do not remove this unless it is so worn that the drive shaft is too free a fit in the bore.

When replacing the new bush care must be taken that the oil holes in the bush come in line with the oil holes at the top of its seating in the cylinder block.

If these holes are accidentally placed downwards so that they are in line with the clearance holes in the bottom of this seating in the cylinder block no oil will reach the inside of the bushing, and consequently the shaft will seize up in its bearing through lack of oil.

The *magneto drive shaft cover* (1065) is a pressed steel cover, driven in the cylinder block at the magneto end of the above bearing. If oil is leaking here it may be that this cover has been inserted wrongly.

The slot on the inside edge of this cover should line up with the oil drain hole at the *bottom* of its housing in the cylinder block. If this is correctly placed and oil is still leaking the drain hole must be cleaned out and any obstruction removed.

Ref. No. 76. Remove breather cover and breather. This removal is necessary to prevent these parts from being injured during the subsequent operations, and especially when turning the engine over after the sump is removed.

The *breather cover* (1105) to which is fixed the *cover knob* (1613), *oil indicator spring* (1733), *oil indicator spring end* (1734) and the *oil indicator blade* (1735) can be lifted out of the breather.

Now unscrew the *breather* (1104), to which is fixed the *oil indicator tube* (1107), using the special brace M.567-18 or other suitable means, taking care not to damage the threads.

Ref. No. 77. Remove the sump sub-assembly. To prevent the oil from dripping out of the sump during this operation see that it has been thoroughly drained, as explained in the previous paragraph (ref. No. 64).

At the front end of the sump, but on the top face of the cylinder block, will be seen two *nuts* with screwdriver slots in them (part No. 1730).

These must be removed, using a long-handled screwdriver or the brace M.567-15 and 26. (Do not overlook these two nuts, or the sump cannot be removed, although all the bolts on the sump may have been unscrewed.)

We must now, for convenience in reaching the other bolts, turn the engine completely over on its stand. Where many engines have to be dismantled a special assembly stand, with means provided for easily turning the engine over, is essential, otherwise two men will be required for this operation.

It will now be necessary to remove the sump if it has not already been removed.

Having turned the engine over, remove the fourteen *joint bolts (short)* (1121) and the *joint bolt (long)* (1120) with their *spring washers* (1284). A 5/16 in. hexagonal spanner may be used or the brace box spanner M.567-1 and 6.

Now lift off the *sump sub-assembly* (1870), taking care not to damage the oilpump which projects from the cylinder block into the sump.

The *sump gasket* (1102) will now be seen on the joint faces, but, as it is only a paper gasket, may not be intact. Part may be found on the cylinder block and part on the sump face.

This is immaterial as long as the whole gasket is there, for on reassembling these parts an oiltight joint will be secured by brushing the faces with gold size or "Hermatite."

Ref. No. 78. Remove the starting handle bracket. On the older models this bracket is integral with the sump and therefore cannot be detached.

On the new models, however, it may be removed when required by unscrewing one *countersunk screw* (1943) with a screwdriver, and six hexagonal *bolts* (1095) with a 5/16 in. hexagonal spanner or brace spanner M.567-1 and 6.

Ref. No. 79. Remove starting handle and jaw. At the *rear* end of the starting handle bracket will be seen the *starting shaft jaw taper pin* (1082). This must be removed so that the *starting shaft jaw* (1087) can be withdrawn from the shaft. The *shaft jaw key* (1005) can then be removed.

At the front end of the bracket remove the *taper pin* (1082) from the starting handle. The starting handle sub-assembly, consisting of parts Nos. 1894, 1899, 1865 and 1866, can then be withdrawn from the shaft.

Ref. No. 80. Remove starting shaft. Remove the small *screw pin* (1896) from the nose of the *starting handle bracket* (1942).

The *starting handle shaft* (1893) will then slide out from the front end of the bracket, accompanied by the *starting handle bearing bush* (1895), the *catch pin* (1898) and *washer* (1897) and the *starting handle spring* (1089).

It is important to note that the operations described in the preceding paragraphs (ref. Nos. 78 and 79) must be carried out before the starting shaft can be removed.

Ref. No. 81. Remove dipper trough. Having removed the sump from the engine, the *oilpump dipper trough* (1109) is removed by unscrewing the four *bolts* (1122) with a brace spanner M.567-26 and 31.

These bolts together with their spring washers (1283) should be replaced in their holes in the sump after removing the trough.



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Engine Dismantling Instructions—continued

Ref. No. 82. **Remove sump oil valve.** This can be unscrewed complete with the peg spanner CB.1619/T1. The *split pin* (1287) can then be removed, when the *oil valve disc* (1620) will be easily withdrawn from the *oil valve body* (1619). When reassembling, note that the valve disc must be to the front to secure the correct action of the valve.

Ref. No. 83. **Remove sump oil retaining felt.** The *sump oil retaining felt* (2357) will be found assembled in the semicircular groove around the crankshaft rear bearing. This may be removed now, or left there until the rear bearing cap is to be removed.

Ref. No. 84. **Remove connecting rod piston sub-assembly.** The various connecting rods and pistons are all numbered according to the position of the cylinder bore in which they are assembled. These should be Nos. 1, 2, 3 and 4 from the front end of the cylinder block. Care must be taken when reassembling to replace these sub-assemblies in the same cylinder bores from which they were removed, otherwise trouble may occur through the parts not bedding down properly on the crankshaft pins and in the cylinder bores.

First rotate the crankshaft so that two of the connecting rods are in a convenient position for unscrewing the cap bolts.

Now remove the *cap bolt split pins* (1291) and unscrew the *cap bolt nuts* (1008), using box spanner CA.1015/T1. The *connecting rod cap* (1926) with the *bush* (1019) and the *oil dipper* (1925), fixed to it, can then be removed. The oil dipper must be examined when reassembling, care being taken that it is fixed firmly in place, with the oil pocket in the correct position, in order that it may pick up oil from the dipper trough as the crankshaft revolves.

(In the older patterns the oil dipper consists of a piece of sheet metal, which is removed when the cap bolts are taken off.)

Having removed the caps, the *plain steel liner* (1914) and the *forked steel liner* (1913) must be removed, together with the thin *brass liners* (1071).

These thin brass liners, or shims, are for adjusting the big-end bearing of the connecting rods, and so, before beginning to remove the caps, test this bearing for fit. The number of brass liners used on each bearing should then be noted, so that they may be replaced exactly in the position from which they were taken.

Having removed the above parts and placed them out of the way, the piston and connecting rod can be withdrawn from their cylinder bores by rotating the crankshaft to clear them.

Care must be taken when removing these parts that the piston rings are not damaged.

Having removed these, the caps, shims and nuts should be replaced on their *bolts* (1007) for safety.

Note.—In the case of the duralumin connecting rods which are supplied on the 14/28 h.p. Morris-Oxford the dipper is cast in one piece with the connecting rod cap, and the nuts are screwed on to the *studs* (2434) instead of bolts, with *washers* (2438) underneath them.

The following are also different in number : the *forked steel liner* (2475), the *plain steel liner* (2476) and the *brass liners* (2440).

Ref. No. 85. **To strip connecting rod piston sub-assembly.** It should be noted that this unit should be handled very carefully when holding same for this operation. A special fixture (CB.1926/F509) is supplied for holding the piston in the vice ; two pins, one on each jaw of the vice, grip the gudgeon pin at either end.

On no account should the piston (especially the aluminium piston) be itself gripped, or distortion will inevitably occur.

The *piston rings* (1011) should be removed by gently prising them open so as to insert three thin pieces of strip steel at equal intervals between the inside of the ring and the circumference of the piston. The rings will then easily be withdrawn along these strips.

A careful look-out should be kept for rings which are too tight or too loose in the grooves.

In fitting new rings be sure that they do not bind in the grooves in the piston, and when in the cylinder bore that there is sufficient clearance in the slots.

The slot in the top ring may have not less than 0.004 in. clearance and that of the lower ring between 0.001 to 0.004 in.

Any carbon deposits should be removed from the piston and rings.

Now, still holding piston in the fixture described above, unscrew the *gudgeon pin clamp screw* (1009) to release the grip of the small end of the connecting rod on the gudgeon pin.

Remove piston from the fixture and the *gudgeon pin* (1928) will easily be withdrawn from the *piston* (1947) and the connecting rod (1926).

Note.—The above parts are fitted to the 11.9 h.p. Morris-Cowley. In the case of the 14/28 h.p. Morris-Oxford the procedure will be similar, but the parts to be removed will have different part numbers as follows : *gudgeon pin* (2478), *piston* (2485), *connecting rod* (2484) and *piston ring* (2429).

Ref. No. 86. **Remove flywheel.** The *flywheel bolts* (1017) must be removed from the rear end of the flywheel, after first removing the *locking wire* (1024) which is threaded through the holes in the bolt heads. The box spanner CA.1017/T2 or the brace spanner M.567-1 and 5 will fit these bolts.

The *flywheel* (1707) can then be removed, bringing with it the *taper pins* (1111) which are driven through the flywheel into the flange of the crankshaft. The large end of this taper pin is in the flywheel.

Be careful not to damage the locating spigot when removing the flywheel and do not drop the flywheel on to the clutch drive pins, or the latter may be damaged.

The *clutch driving pins* (1174) are driven into the flywheel with the pins projecting to the rear. They may be driven out of the flywheel if required by striking the projecting pins with a lead hammer.

To ensure that the clutch corks do not wear away excessively examine the rear inside face of the flywheel where the corks engage ; this face must be smooth without any ragged tool marks.

When reassembling flywheel care must be taken that the rim of the wheel runs true on its spigot.



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Engine Dismantling Instructions—continued

Ref. No. 87. **Remove oil pump.** Before removing the nuts holding the oil pump body to the centre bearing block, disconnect the *front and rear oil pipe nuts* (1963) from their *unions* (1962) to the front and rear bearing blocks, using a 5/16 in. hexagonal spanner. Then disconnect *connecting pipe nut* (1961) from the *tee piece* (1956) on the front oil pipe and unscrew the *oil connecting pipe* (1957) from the cylinder block oil pipe, which is in the front end of the cylinder block joint face. (A 1/4 in. hexagonal spanner is required for this nut.)

The *oil pump stud nuts* (1254) and *spring washers* (1282) can now be removed with a 3/16 in. hexagonal spanner and the oil pump sub-assembly withdrawn from the *studs* (1014) in centre bearing block.

The *oil pump plunger* (1138) and the *oil pump plunger spring* (1137) can now be withdrawn from the *oil pump body* (1135).

Inside the oil pump plunger will be found the *oil pump seat* (1139) and *ball* (1279). These need not be removed, but may require cleaning in paraffin and should be carefully examined to make sure that the holes in the plunger have not been burred up, so reducing the passages and thus restricting the oil flow.

Inside the oil pump body will be found the *oil pump seat* (1140) and *ball* (1279).

The *oil pipes, front and rear* (1959 and 1958), together with unions and tee piece, are firmly fixed to the oil pump body and should not be disconnected.

Ref. No. 88. **Remove fan pulley and spacer.** Before removing the *fan pulley* and *spacer* as described in this paragraph the camshaft should be examined for its fit in the cylinder block.

The end play on the camshaft between the thrust face on the rear end of the camshaft front cover and the front face of the camshaft gear should not be excessive. The limit allowable is between 0.002 and 0.003 of an inch, and these sizes of feeler gauges should be able to be inserted between these thrust faces.

The fan pulley is built up of parts 1874, 1875 and 1876 and is assembled on the front end of the camshaft.

First of all remove the *split pin* (1291) and unscrew the *fan pulley nut* (1019) with box spanner CA.1019/T3, at the same time inserting a bar through the camshaft gear to prevent it turning while unscrewing the nut.

Now remove the *fan pulley washer* (1020) and the fan pulley should be easily withdrawn from the camshaft.

The *fan pulley spacer* (1022) can also be withdrawn from the camshaft front cover if the keyway in it is so placed as to slide over the *fan pulley key* (1005) in the camshaft.

Ref. No. 89. **Remove the camshaft and camshaft gear.** The running fit of the camshaft in the bearing of the cylinder block must not be too tight. The camshaft should be .003 in. smaller than its bearing at the front and .002 in. smaller than its bearing at the rear end. This clearance can be tested by inserting feeler gauges.

Also, before removing camshaft, look for the timing marks on the camshaft gear and crankshaft gear. Where these mesh will be found punch marks, one mark being on the space of the camshaft gear and the other on the tooth of the crankshaft gear.

Proceeding now to the removal of the camshaft, first remove the *camshaft rear cover screw* (1122) (using a 1/4 in. hexagonal spanner or brace spanner M.567-26 and 31) and their *spring washers* (1283). The *camshaft rear cover* (1027) and the *gasket* (1096) can then be removed.

This cover should always be replaced after reassembling the camshaft, although it is often forgotten, as it is not in a conspicuous position.

With the same spanner remove the *camshaft front cover bolts* (1122) and *spring washers* (1283). The *camshaft front cover* (1025) with the *front cover liners* (1026) can now be removed from the cylinder block. It is important that these liners are not damaged or lost.

Withdraw the camshaft from the camshaft gear with the camshaft gear extractor CA.1023/T2; two hooks in the extractor engage in the camshaft gear, and the screw is turned on to the end of the camshaft, thus pushing the shaft out from the gear.

If this tool is not available it should be possible to remove the camshaft from the gear by lightly striking the front end with a lead hammer.

On no account must a steel hammer be used, or the threads on the end of the camshaft will be ruined. It should be noted here that great care must be observed if the camshaft is to be removed with the oil pump in position, for unless the head of the oil pump plunger is held down while this operation is performed it may catch on the sides of the cams and the oil pump body may possibly become broken.

The camshaft must be withdrawn to the rear sufficiently to enable the *camshaft gear* (1858) to be removed. When this gear is removed the *camshaft* (1018) may be pulled forward and withdrawn from the cylinder block.

When reassembling this gear note that the small boss on it must be assembled frontwards, and the timing marks made to correspond with that on the crankshaft gear. If an incorrect clearance was present between the camshaft gear and its thrust face on the cylinder block it may be adjusted by either adding to or removing from the shims behind the flange at the front of the camshaft front cover. These shims, or *camshaft front cover liners* (1026), are .002 in. in thickness.

After the camshaft has been removed the *tappets* (1028) can be withdrawn from the guides by unscrewing and removing the *adjusting screw lock nuts* (1030) and the *adjusting screw* (1029). Two spanners (CA.1028/T1) are required for this. It is essential that for quiet running the tappets be a good fit in their guides.

The clearance between the top of the valve tappet adjusting screw and the bottom end of the valve stem should be adjusted when reassembling these parts.

Do not cut this clearance down too small when "running-in" a new engine. After it has been in use for some time the valves will bed down on their seating and thus reduce the clearance. (It is recommended to give .004 in. clearance on the inlet valves and .006 in. on the exhaust valves.)



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Engine Dismantling Instructions—continued

Ref. No. 91. **Remove the crankshaft bearing caps.** As the engine is turned upside down on its stand, the weight of the crankshaft is on the blocks which are fastened to the cylinder block.

It is important that the studs holding the caps and blocks should be firmly screwed to the cylinder block.

For this reason *it is the rule to re-drive the studs and thus tighten them on the blocks every time a nut is removed.*

Before removing the caps the bearings should be examined for any shake in the journals and any end play on the front bearing.

After the above parts have been investigated, commence with the centre bearing and remove the *split pins* (1290), then with the box spanner CA.1043/T1 unscrew and remove the *nuts* (1043).

The *centre bearing cap* (1039) (with bottom half of *white metalised bush* (1932) fixed to it with the *retaining screw* (1607) is now removed from off the studs.

Underneath the caps will be seen a number of liners, the total number of which should be noted, so that they can be reassembled correctly in place. These liners are *brass liners* (1938) and *steel liners* (1937). These can be removed with the caps to a safe place, or they may be reassembled on the studs when the crankshaft has been removed.

In a similar manner remove the *front bearing cap split pins* (1290), *nuts* (1043) and *cap* (1037) (with bottom half of *white metalised bush* (1930) fixed to the cap). The *brass liners* (1936) and *steel liners* (1935) should also be removed.

Now remove the *rear bearing cap split pins* (1289) and the *nuts* (1045) (using box spanner CA.1045/T1). The *cap* (2354) with bottom half of *white metalised bush* (1934) fixed to it with *retaining screw* (1607) can then be removed, with the *brass liners* (1936) and *steel liners* (1935).

If it is not intended to remove the bearing blocks all the studs should be tightened up as explained at the beginning of this paragraph.

It may be advisable here to give a hint on the reassembling of the caps. After the crankshaft has been scraped or otherwise fitted to the bearings, the correct number of brass liners are inserted to give the necessary fit, when the nuts are dead tight.

The split pins should then be inserted; which will be an easy matter if the split pin hole in the stud (which is usually indicated with a punch mark on the end of the stud) corresponds to a slot in the castle nut.

Should this not be the case, on no account slack the nut off in order to insert the split pin. If, however, the split pin slot does not come in line with the hole in the bolt the nut must be removed, and its underside filed slightly until the slot in the nut corresponds with the split pin hole in the stud when the nut is drawn up dead tight.

Provided no adjustment is necessary to the bearings, it will be found much easier to assemble the split pins if each nut is retained on the same stud from which it has been removed.

Ref. No. 92. **Remove crankshaft and gear.** The bearing caps having been removed, the *crankshaft* (1003), with its *gear* (1004), can be lifted out.

The crankshaft gear can be removed from the crankshaft by driving out the 10 mm. diameter *gear pin* (1092). This will shear the 3 mm. diameter pin fastener which is driven through it. (The parts of the *fastener* (1093) can then be removed and a new one driven in when reassembling.)

Withdraw the crankshaft gear from the shaft, using the withdrawing tool (CA.1004/T518).

This tool consists of a strong screw provided with a hole to take a tommy bar, and a strong hook piece which is placed at the back of the crankshaft gear. Then with the end of a screw against the front end of crankshaft turn the tommy bar in head of screw. This will withdraw the gear right off the shaft, disclosing the *crankshaft gear key* (1005) which is fixed in the crankshaft.

Ref. No. 93. **Remove the bearing blocks.** On the joint face of the cylinder block will now be seen the various crankshaft bearing blocks. These are all dowelled in place and fixed in firmly with studs. It is not advisable to remove these as any adjustment can be made by replacing the white metalised bushes only.

The various parts and their numbers are as follows:—

<i>Front bearing block</i>			...	...	...	...	...	...	...	1036
"	"	"	bush (top half)	...	...	...	...	...	...	1929
"	"	"	studs	...	...	...	...	...	...	1042
"	"	"	dowels	...	...	...	...	...	...	1113
<i>Centre bearing block</i>			...	...	...	...	...	...	...	1038
"	"	"	bush (top half)	...	...	...	...	...	...	1931
"	"	"	bush retaining screw	...	...	...	...	...	...	1607
"	"	"	studs	...	...	...	...	...	...	1042
"	"	"	dowels	...	...	...	...	...	...	1113
<i>Rear bearing block</i>			...	...	...	...	...	...	...	2353
"	"	"	bush (top half)	...	...	...	...	...	...	1933
"	"	"	retaining screw...	...	...	...	...	...	...	1607
"	"	"	stud	...	...	...	...	...	...	1044
"	"	"	dowels...	...	...	...	...	...	...	1112



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Engine Dismantling Instructions—continued

Ref. No. 94. **Remove cylinder block oil pipe.** This pipe (1957) is connected to the test cock above the magneto drive gear housing, and goes around the gear to the union with the oil pump connecting pipe in the joint face of the cylinder block. A branch pipe is securely fixed to it and supplies oil to the crankshaft gear.

To remove this pipe the connecting pipe mentioned above must first be disconnected as described in the previous paragraph (ref. No. 87).

Now unscrew the test cock (1225), removing with it the test cock washer (1297). The oil pipe union must now be pressed out of its seating, until completely free; then, rotating this end clear of the cylinder block casting, the whole unit, consisting of oil pipes (1220) and union (1955), can be withdrawn from its seating in the joint face of the cylinder block. If this operation is obstructed by the cylinder side plate stud nearest the pipe this stud may be removed.

A certain amount of care must be taken if this pipe is not to be damaged or broken during the removal.

Ref. No. 95. **Remove the water flange.** The water flange will be found at the front end of the cylinder block and ordinarily need not be removed. Sometimes, however, it is convenient to remove this, instead of uncoupling the hose, when the radiator is to be removed from the car.

With a 5/16 in. hexagonal spanner unscrew the water flange bolts (1095) and remove them, together with spring washers (1284).

The water flange (1945) and the red fibre gasket (1110) will then come apart.

Ref. No. 96. The cylinder block is now completely dismantled excepting for the various studs which are fixed to the different joint faces.

The cylinder block core hole plug (1056) is a fixture in the block and should not be removed. The part number of the cylinder block is CB.1718 for the 11.9 h.p. Morris-Cowley and CE.2425 for the 14/28 h.p. Morris-Oxford.

THE GEARBOX AND ITS DISMANTLING

Ref. No. 97. **Drain the gearbox.** The clutch housing portion of the gearbox should have been drained as described previously (ref. No. 64), but in addition, before attempting to dismantle the component parts of the gearbox, the thick oil from the gears should be drained. For this purpose unscrew the rear plug and gasket and also the plug and gasket from the filler pocket on the side of the gearbox. These plugs and gaskets are part numbers 1215 and 1216 respectively.

The oil, being thick, will not drain quickly, but if necessary it may be thinned with paraffin to make it flow more quickly.

It is a great convenience to have a large paraffin bath at hand for washing the various gears as they are dismantled.

Ref. No. 98. **Mount gearbox on stand.** The gearbox stand (CA.1143/F17) has been designed for this purpose, and the work of dismantling will be greatly aided by using one. If this is not available some kind of fixture is essential for the convenient handling of this unit.

Ref. No. 99. **Remove flywheel cover.** As detailed previously (see ref. No. 65).

Ref. No. 100. **Remove universal joint ball housing.** The housing joint cover (1257) will be found detached, as it is assembled in place only when the gearbox is in position in the car. The housing cover nuts (1126), spring washers (1283) and bolts (1258) should be in their holes on the flange of ball housing and need not be touched.

The ball housing (1256) itself is in two parts (top half and bottom half) and these must be detached by unscrewing the joint screws (1266) (with a 1/2 in. hexagonal spanner) and removing them with their spring washer (1283). Now turn to the flange of the ball housing which is fastened to the rear face of the gearbox, and unscrew the bearing retainer nuts (1127) and remove the spring washers (1284).

The ball housing can then be withdrawn from these studs (1159), which are fixed in the gearbox.

Ref. No. 101. **Remove the gearbox cover sub-assembly.** The gearbox cover (1754), to which is assembled the change speed and hand brake levers, is next withdrawn from the studs (1717) which are fixed in the top face of the gearbox. This is done by unscrewing the four cover nuts (1126) with the brace spanner M.567-26 and 31. The nuts, with spring washers (1283), should be replaced on the studs, after removing the cover and gasket.

Having removed the nuts lift the whole cover unit off its studs and remove the paper gasket (1227), being careful not to tear the gasket in the process.

Ref. No. 102. **Remove change speed lever.** The change speed lever is removed from the gearbox cover sub-assembly by unscrewing the cover screws on the top of the gearbox cover. These screws (1200) and spring washers (1281) will easily be removed with brace spanner M.567-26 and 30, and then the change speed lever (1197) withdrawn, together with the change speed lever cover (1198). On the lever is assembled the change speed lever knob (1201) and in the ball of the lever is driven the pin (1226). The cover can be removed from the lever if required by unscrewing the knob.

On the top face of the gearbox cover will be seen a paper gasket (1199). This should be preserved and replaced when reassembling the change speed lever.

In course of time the ball on the change speed lever may work too freely in its socket. To adjust this all that is necessary is to file the joint face over this spherical seating, so that the cover will grip on the ball.



Continued



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Engine Dismantling Instructions—continued

Ref. No. 103. **Remove hand brake lever and shaft.** The *hand brake lever* (2450) with the following parts assembled to it: *Brake lever trigger* (1777), *trigger pin* (1252), *split pin* (1287) and *washer* (1255), *brake ratchet pawl* (1757), *pawl rod* (2451), *pawl spring* (1251) and *washer* (1255) and *pawl rod split pin* (1286) can now be removed by driving out the *No. 3 taper pin* (1082) from the boss of the brake lever and the shaft on which it is assembled. When this pin is removed the brake lever will easily be withdrawn from the shaft. The hand brake lever being thus removed, take out the *brakeshaft key* (1005) and withdraw the *brakeshaft and arm* (1877) from its bearing in the gearbox cover.

The brake ratchet pawl, pawl rod spring and trigger can be removed by disconnecting the trigger from top end of lever. The whole of these parts will slide down the slot in the lever and can be withdrawn. The dismantling of these parts is then an easy matter and needs no description.

Ref. No. 104. **Remove brake ratchet.** The *brake ratchet* (1789) is simply bolted on to the side of the gearbox cover, and it is only necessary to unscrew the *bolts* (1245) with a 5/16 in. hexagonal spanner CA.1045/T1 or brace spanner M.567-1 and 6.

When reassembling see that the stop on the ratchet is placed at the front end.

Ref. No. 105. **Remove dynamotor cover.** Remove the *cover screws* (1122) and *spring washers* (1283), using a 1/4 in. hexagonal spanner.

The *dynamotor cover* (1776) should now be removed, taking care not to injure the *cork gasket* (1771) underneath the joint.

As the gasket and cover have been sealed with "hermatite" or gold size on the joint faces, some difficulty may be experienced in removing them. It may be necessary to use force, but on no account should any sharp instrument be driven between the joint; and, when striking cover with a hammer, take care not to hit it on the edges of the joint.

It is advisable to keep a spare gasket handy, as it is very important that a thorough oiltight joint be maintained here if the oil is not to leak from the gearbox.

Ref. No. 106. **Remove dynamotor and chain.** The chain should be disconnected by removing the split pin from the connecting link of chain. It is very important that this chain should be examined periodically for broken links. It is necessary also, when replacing chain, to see that both the split pin and the washer at the back of the split pin be replaced in the connecting link.

If this is not done the split pin may wear through and the connecting link come apart. This will cause great damage in the gearbox.

Having removed the chain, unscrew the bolts which hold the dynamotor in place. This can then be withdrawn together with the *dynamotor pinion* (1796) which is assembled on its spindle.

Ref. No. 107. **Remove the clutch plate hub.** In the centre of the clutch plates at the front end of gearbox will be seen the clutch plate hub. It is fixed on the taper shaft of the drive gear, and in front of it will be seen a small ball bearing, the *drive gear tail bearing* (1169).

Remove the *split pin* (1293) from the *clutch hub castle nut* (1172). The clutch hub nut can then be unscrewed with a 5/8 in. hexagonal spanner while at the same time holding the clutch hub steady by inserting pin spanner CA.1170/T503 over the splines. As the nut is unscrewed it will withdraw the tail bearing from the drive gear.

The *clutch nut washer* (1173) can also be removed. Before withdrawing the clutch plate hub, examine the plates to see if they slide freely along the splines of the hub. This is important to observe also when reassembling, as any stiffness in the sliding of these parts will impede the working of the clutch.

To ensure the correct reassembly of these parts, punch marks will be found on the faces of the hub and plates; the punch mark on the tooth of the hub should correspond with that on the space in the plates.

In assembling new plates care must be taken to fit them quite freely on the splines of the hub.

Having carried out the above inspection the *clutch plate hub* (1170) should be withdrawn by means of the special extractor CA.1170/T2.

The two small screwed pegs of the extractor are screwed into the holes in the face of the hub in such a way that they will both project equally from the face. This is to ensure a straight pull; for if one pin projects more than the other the pull will not be straight, and the pegs may be broken when tension is applied.

A piece of brass being inserted between the end of the drive shaft and the main screw of the extractor, turn the latter until the clamp is in tension on the ends of the drive shaft and heads of the small pegs in the hub.

A sharp tap with a lead hammer or wooden mallet will dislodge the hub from its taper seating and it can then easily be withdrawn, and the extractor removed.

The hub now being withdrawn, the *clutch hub key* (1171) must be removed from the drive shaft.

Ref. No. 108. **Remove clutch plate and sleeve assembly.** Before removing these parts from the chain sleeve they should be inspected for the free working of the splines. These splines must be a free sliding fit, as any stiffness here will prevent the easy operation of the clutch.

At the front end of the clutch plate sleeve and the chain wheel sleeve will be seen punch marks, which are there to ensure the correct reassembling of the parts. These marks indicate the splines which must engage together, to secure the original sliding fit.

If any new parts are being assembled here the identification punch mark should be added after the parts have been fitted together as indicated above.





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Engine Dismantling Instructions—continued

We would repeat that no tightness in the sliding of the above parts is permissible.

The *clutch plate and sleeve sub-assembly* can now be withdrawn from the *chain wheel sleeve* by pulling it forward with one hand and lifting the clutch pedal with the other, in such a manner as to disengage the clutch fork from the face of the clutch thrust race on the assembly.

Do not lift the clutch pedal too much, or the splines on the chain wheel sleeve may be damaged through the *back* of the clutch fork coming into contact with them.

Ref. No. 109. **Dismantle clutch plates from the above sub-assembly.** On the front of the clutch plate and sleeve will be seen three rings, which are held together by means of pins. The largest or driving ring is fastened to the clutch pressure plate, also by means of pins.

Commencing with these latter, which will be found on the outside of the corks, remove the three *clutch ring pin split pins* (1915) and then withdraw the *clutch ring pins* (1180) from the pressure plate and driving ring.

The *clutch ring separating springs* (1181), of which there are six (three on the outside and three on the inside), must not be lost during this operation.

All three rings will then come away from the pressure plate and sleeve, and can be separated from one another by withdrawing the *split pins* (1915) and *clutch ring pins* (1180) from the inside of the corks.

For the purpose of reassembling it should be noted that the *heads* of all the clutch ring pins are placed on the *front* faces of the rings.

The *clutch driving ring* (1178) is the largest in diameter and is assembled between the two rings having cork inserts. The two smaller rings, *clutch driven rings* (1179), have each 26 *corks* (1608) inserted in holes through their faces near their outer edges.

Another point to be noted when reassembling is that the separating springs must be replaced and the split pins in the ends of the six ring pins must be bent over to prevent them working out of their pins.

It is essential that the faces of the cork inserts should be *perfectly flat and parallel*, and free from imperfections.

It is not advisable to try to replace these corks individually; if replacement becomes necessary both rings and corks should be ordered already assembled, and disc ground to the requisite flatness.

Special plant is required for the efficient replacement of corks, which the average garage cannot be expected to possess. It should be realised that, for the clutch to work properly without slipping or spinning, these cork inserts must be absolutely flat and true and also the clutch driving ring between them.

It will be readily understood that the haphazard replacement of corks will almost certainly result in faulty clutch action.

Ref. No. 110. **Remove clutch thrust race from the sub-assembly in paragraph ref. No. 46.** The thrust race at the end of the clutch sleeve sub-assembly must be inspected periodically for wear.

It is advisable to draw the driver's attention to the importance of keeping the weight of the foot off the clutch pedal at all times except when actually declutching.

When the *footboards* are replaced carelessly the arm of the clutch pedal may foul on the slot in the board, and so prevent the pedal rising, even although the driver's foot may be completely removed. Care should therefore be taken, when the boards are put back, to see that the clutch pedal does not come in contact with any portion of the footboards.

To remove the clutch thrust race from the clutch plate sleeve a fixture is required which will hold the sleeve firm while the nut at the back of the race is removed.

This may consist of a base plate, bolted to the work bench, in which is fixed a spigot on which the clutch plate sleeve may be placed, while the whole is prevented from rotating by a pin being engaged in one of the holes of the flange of the clutch pressure plate.

The sleeve being thus firmly held, the *clutch race nut* (1761) is unscrewed by means of a pin spanner CB.1761/T2.

Considerable force will have to be used to unscrew this nut, for it is fixed firmly in place by means of "staking" punch marks in two places on the edge of the threads. The nut will possibly be considerably damaged and it is a wise precaution to obtain a spare one before attempting to remove it.

Having removed the nut (which has a right-hand thread) the *clutch thrust race* (1762) can be levered off the sleeve, using the same spanner that is used to remove the nut.

The *clutch pressure plate* (1759) and sleeve (1760) are riveted together and should not be dismantled. It is important, however, that the face of the flange be perfectly flat and smooth, and absolutely true with the bore of the sleeve.

Ref. No. 111. **Remove clutch pedal sub-assembly.** Now that the clutch plate and sleeve sub-assembly has been removed, proceed to cut and remove the *locking wire* (1212) which is inserted in the heads of the clutch fork screws and the key in the pedal shaft.

With a box spanner CA.1207/T1 remove the *clutch fork screws* (1207) from the clutch fork.

Then, holding the clutch pedal assembly outside the gearbox, withdraw the shaft on which it is assembled from its housing in the gearbox.

Should it be stiff to move, strike the inside end of the shaft with a hammer and punch, taking care not to damage the *clutch fork key* (1791) in the process. Care must also be taken not to damage the splines on the chain wheel sleeve with the back end of the clutch fork. The *pedal shaft bushings* (1209) should be left firmly fixed in the gearbox as the shaft is removed.





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Engine Dismantling Instructions—continued

Ref. No. 112. **Remove clutch pedal from the shaft.** In cars prior to 1927 the brake pedal is pivoted on the same shaft as the clutch pedal, and must first be detached. This is achieved by knocking out the taper pin No. 1282 and drawing off the collar No. 1211. The *clutch pedal* (1919) is held in place by means of the *pressure stud nut* (1187) on its *stud* (1210) through the slot in the clutch pedal hub.

To remove it, first slack off the *clutch pedal hub screws* (1204) with spanner (CA.1204/T1) and the *lock nuts* (1127) with a 5/16 in. hexagonal spanner. (These parts are left in the clutch pedal hub.)

Then, by unscrewing the pressure stud nut and removing it from its stud, the clutch pedal will slide off the shaft.

The clutch pedal consists of the stud (which is screwed and riveted), the *clutch pedal stop bolt* (1795) and *lock nut* (1127). In the other end of the pedal is clamped the *pedal pad* (1623) and *adjusting rod* (1920) by means of the *clamp screw* (1921), on which will be found the *clamp screw lock nut* (1127) and *spring washer* (1284).

Ref. No. 113. **Remove clutch pedal shaft from hub.** Remove the *taper pin* (1082) so that the *clutch pedal hub* (1203) may be withdrawn from the *clutch pedal shaft* (2452) in which is left the *key* (1005).

The pedal hub screws and lock nuts will be left in the pedal hub.

Ref. No. 114. **Remove clutch fork and shaft.** The *clutch fork shaft* (1782) must be driven from its housing in the gearbox with a hammer and punch, from the inside of the gearbox, care being taken to see that the *clutch fork shaft bush* (1209) is left securely fixed in the gearbox. As the shaft is driven out, part of the gasket on the dynamotor cover face will be withdrawn with it, adhering to the end of a cork, which has been assembled between the gasket and the end of the shaft.

This must be replaced when reassembling in order to make the gasket complete.

As the shaft is driven out, the *clutch fork* (1205) will be freed from it, and can then be removed.

The clutch fork should be replaced with the keyway end on the right-hand side of the gearbox (looking towards the engine).

Ref. No. 115. **Remove chain wheel sleeve.** The *chain wheel sleeve* (1763), to which is riveted the *chain wheel* (1787), can now be withdrawn from the drive shaft. Inside the sleeve are driven the *chain wheel sleeve bushes* (1764). These are cast iron and must be driven tightly in the sleeve and flush at either end of the bore. If the front bushing is driven too far up the bore, or if it is too long, the oil hole in the sleeve will be covered, thus preventing oil from reaching the bearings, with consequent risk of seizure.

The fit of these bushes on the drive shaft must be noted when reassembling. They must be a free spin fit, neither too tight nor too slack.

Ref. No. 116. **Remove the shifter shafts.** The *top and second gear shifter shaft* (1189) is on the left-hand side and the *low and reverse gear shifter shaft* (1191) on the right-hand side, looking forward towards the engine. (For reassembling it should be noted that the ball groove in the top and second gear shaft is 35.5 mm. from the retaining screw groove, and in the low and reverse gear shaft is farther back, being 59 mm. from the retaining screw groove at the front end.)

Both *retaining screws* (1192) must be unscrewed from the front, and the shafts driven out with a punch and hammer. Much force is not necessary for this.

When the shifter shafts have been removed the corresponding forks may be lifted out quite easily.

For the purpose of reassembling, however, it should be noted that the *top and second gear shifter fork* (1188) has the fork flush with the front end of the body, while in the *low and reverse gear fork* (1190) it is almost in the centre of the body.

In assembling these the slots in the body must come in line with the slot in the interlock bar when in neutral position.

The *balls* (1280) and *springs* (1193) are assembled in the drilled holes of the shifter fork body, and when removing the shifter forks care should be taken not to lose them.

Ref. No. 117. **Remove the interlock bar and ball.** These are inserted in slots on the top face of the gearbox, and may be lifted out after one shifter shaft has been removed. It should be noted that the slot for the neutral position of the change speed lever is nearest the rear end.

The *interlock bar* (1194) must have the *interlock ball* (1280) loosely assembled in the hole provided. It is important that this should not be lost; for this purpose the staking punch (CA.1194/T1) should be used to retain it in place (when liable to be lost), taking care not to punch the ball in too tightly.

Ref. No. 118. **Remove the sliding gear shaft and universal joint sub-assembly.** The *sliding gear shaft* and *universal joint* can be separated from each other when required, without removing the former from the gearbox. Usually, however, they are both withdrawn together from the gearbox and dismantled afterwards.

The *ball housing* and *retainer nuts* having been already removed (see ref. No. 100), the above sub-assembly can be withdrawn from the gearbox by means of the extractor CA. 1166/T515.

The two hooks of the extractor are placed around the universal joint ring, at the same time placing the extractor thrust rods against the rear face of the gearbox. Then, taking care that the thrust rods are clear of the brass retainer, turn the screw of the extractor with a tommy bar, and the sub-assembly will be drawn from the gearbox and sliding gears.



Continued



Date of issue: November, 1930

Engine Dismantling Instructions—continued

Ref. No. 119. **Remove the sliding gears.** The *top and second sliding gear* (1153) at the front, and the *low and reverse sliding gear* (1152) at the rear, can now be lifted from the opening in the top of the gearbox. Punch marks will be found on the splines of these gears to indicate the position of the corresponding spline on the sliding shaft, which is also marked.

This is to ensure the correct reassembling of the parts, as any error in replacing these in the exact position from which they were dismantled may prevent the splines sliding on each other with the necessary freedom.

When replacing new parts it is essential to obtain a free sliding fit on the above splines.

Ref. No. 120. **Remove drive gear sub-assembly.** Inside the front end of the gearbox will be seen the *bearing retainer bolts* (1163) which hold the above sub-assembly in position in the gearbox. These must first be removed with their *spring washers* (1284) by means of a 5/16 in. hexagonal spanner (M.567-1 and 6).

The *drive gear cover retainer* (1167), which is of pressed steel, can then be withdrawn by sliding it over the drive gear.

A stout rod should then be inserted from the rear end of the gearbox into the recess at the rear end of the drive gear, taking care not to injure the bushing. Striking this rod with the hammer will drive out the whole sub-assembly from the front of the gearbox.

Ref. No. 121. **Remove the layshaft gear.** The nut holding the layshaft in position will be seen inside the front of the gearbox.

The *split pin* (1291) must first be removed, and then, using the special box spanner (CA.1145/T1), the *layshaft nut* (1145) can be unscrewed.

The *layshaft* (1144) can be withdrawn with the special extractor CA.1144/T8, as follows:

Insert the extractor through the opening in the rear end of the gearbox, so that the small end fits over the threaded portion of the layshaft. (It is advisable to protect this thread with the cap provided (CA.1144/T10) to prevent injury to the threads.) The cupped end of the extractor should then be placed over the head of the layshaft, but not touching it, and bear on the rear face of the gearbox. By turning the screw of the extractor the layshaft is withdrawn from its housing.

The *layshaft gear* (1147) and the thrust washer can then be removed.

The purpose of the *thrust washer* (1146) is to take up the end play on the gear.

It is specially fitted by means of the hand facing cutter CA.1146/T1, so that it bears on the front end of the gear and is adjusted in thickness until the necessary clearance is obtained.

Inside the layshaft gear are driven the *layshaft bushes* (1148). These are of phosphor bronze, and oil holes are drilled in them in position with those in the gear. It is important that these oil holes should not be obstructed.

Ref. No. 122. **Remove reverse idler gear.** This is simply held in place by the reverse idler shaft, which is a drive fit in the gearbox. Only very seldom should it be necessary to remove it.

A special extractor CA.1151/T1 is used in a very similar manner to that used for removing the layshaft (ref. No. 121).

When the *reverse idler shaft* (1151) has been removed the *reverse idler gear* (1149) and its *thrust washer* (1228) can be withdrawn from the gearbox. Inside the gear will be seen the *bronze bush* (1150). This is simply driven in and the oil holes are drilled in position with those of the gear.

The thrust washer is faced to suit, with the hand facing cutter C.A.1228/T1, to give the necessary clearance at the front face of the gear.

Ref. No. 123. **Dismantle the universal joint.** To do this some means must be provided for holding the joint forks while unscrewing the bolts. Usually it is simply held in lead jaws in a vice. A better plan, but more expensive, is to hold the joint fork on a spigot, which fits in the splines.

The *universal joint ring lock nuts* (1254) with *spring washers* (1282) are first removed by means of the brace spanner M.567-26 and 30. The *universal joint ring screws* (1263) are then unscrewed, using the same spanner, when the two halves of the *universal joint rings* (1262a and 1262b) will come apart, together with the *rear universal fork* (1261).

On later models the speedometer drive worm must be withdrawn.

The *front universal joint fork* (1259) can now be removed from the square shaft on which it fits by removing the *split pin* (1291) and the *castle nut* (1260), using box spanner CA.1260/T1.

The front universal fork must be withdrawn from the sliding gear shaft by means of the special extractor CA.1259/T2.

Ref. No. 124. **Dismantle the sliding gear shaft.** The universal joints having been removed, the *sliding shaft ball bearing* (1157) can be removed from the *sliding gear shaft* (1156) by gently tapping the screwed end of the shaft on to a block of wood or lead. When reassembling this shaft it should be ascertained that no obstruction is present in the hole in the sliding gear shaft, otherwise no oil will be fed to the universal joint.

On no account must force be used, either for removing or assembling this bearing.

With the bearing will be withdrawn the *bearing retainer or housing* (1158) and on the front of this the *bearing guard* (1160).

The function of this guard is to prevent the gear oil from working out of the gearbox, and, to be efficient, must be as close as possible to the bearing retainer.

When withdrawing these, carefully note in what manner it has been assembled, so that it may be replaced in exactly the same way.



Continued



MODELS : MORRIS 11.9 H.P. AND 14/28 H.P.

No. OF SHEETS 23

SHEET No. 23

Date of issue : July, 1928

Engine Dismantling Instructions—continued

Ref. No. 125. **Dismantle the drive gear.** First of all some means must be provided to hold the sub-assembly firm against the pressure of the nut when unscrewing same.

One method is to place the gear teeth of the drive gear face downwards into a plate fixed to the bench, which has teeth cut in it to hold round the teeth of the external gear.

Then, with a special box spanner (CB.1750/T2) inserted in the slots, unscrew and remove the *drive gear bearing nut* (1784). It should be specially noted that this nut has a *left-hand thread*.

Once the nut is removed the *drive gear ball bearing cover* (1165) can be withdrawn and the *ball bearing* (1161) itself removed by tapping the small end of the shaft on to a block of wood or lead.

No force must be used either in removing or reassembling this bearing; in the latter case care should be taken that the nut is properly "staked" at the edge of the thread, as any slackening of the nut will result in a seized clutch.

The *bearing retainer* (1162) and the *bearing guard* (1164) will be withdrawn on the rear end of the ball bearing.

The purpose of the bearing guard is to prevent the gear oil from working through the bearing and should be as close as possible to the rear end of the bearing retainer. Inside the drive gear will be seen the *drive gear bush* (1155). This is of phosphor bronze and is simply driven in the drive gear, and the oil holes drilled in position.

Ref. No. 126. The *gearbox* (1753) has now been completely dismantled, the only parts left on it being the various studs on the joint faces and the clutch pedal bushes.

This completes the section, and in reassembling the various components the above operations should be reversed, at the same time taking care to observe the various precautions for reassembling outlined.



Date of issue : July, 1928

On the Subject of Clutch Spin

OWING to the design of the Morris clutch—with which is incorporated the dynamotor drive—the cause of clutch spin is not always easy to determine, even when dismantling the clutch unit with that idea in view. The following comments, however, will doubtless enable the average mechanic to master the situation.

Any one of the following points is in itself sufficient to cause clutch spin, and it is not therefore advisable to assume that all is in order because the trouble is not immediately apparent.

1. The corks which are bedded down under pressure and run in oil may act as suckers, with the result that when spring pressure is released the corks tend to adhere to the driving surfaces.
2. Little or no oil in the gearbox, rendering it easier for the layshaft to continue rotating when the clutch is thrown out.
3. Starter chain too tight, thereby causing splined sleeve to bind on clutch driving shaft.
4. Outer race of spigot ball race too tight in the flywheel, causing bearing to bind.
5. Inner race of spigot ball race too tight on clutch drive shaft, causing bearing to bind.
6. Clutch withdrawal fork bearing unevenly on the clutch thrust race, thereby causing a bias on the pressure plate.
7. Combined drive gear bearing nut and oil thrower of clutch drive shaft becoming unscrewed, due to allowing the car to run forward with reverse gear engaged, or vice versa.
8. Insufficient fore and aft movement on splined sleeve.
9. Buckled plates.
10. Varying lengths of clevis pins (measuring from clevis pin head to split pin hole).
11. Defective or broken separator springs.
12. Main clutch springs of varying length or uneven tension.
13. Plates binding on clutch hub.
14. Plates binding on flywheel driving pins.

Complaint No. 1.—This little difficulty—which rarely crops up—can be overcome by the addition of $1\frac{1}{2}$ mm. washers between the pressure plate and the split pins in the clevis pins.

In obstinate cases the clutch may need taking down so that washers can be applied to the other separating pins nearer the clutch hub.

Complaints Nos. 2 and 3. The remedy for complaints 2 and 3 is, of course, obvious.

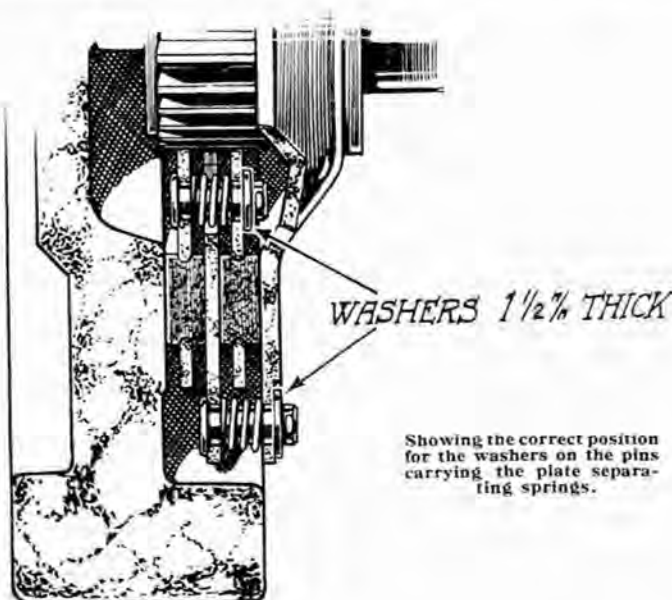
Complaints Nos. 4 and 5. When overcoming 4 and 5 it must be borne in mind that the spigot should not be eased, nor the race housing in the flywheel enlarged, to an extent which will render the ball race anything more than an easy push fit.

Complaint No. 6. No difficulty should be experienced in setting the clutch withdrawal fork to ensure even pressure on the thrust race.

Complaint No. 7. In the event of trouble from this cause, a cure will be effected (provided the irregularity is discovered in time to prevent damage to the gears) by tightly screwing the ring home and lightly centre-popping the end face of the clutch drive shaft at three points, spaced equidistant round its circumference.

Complaint No. 8. Trouble from cause No. 8 will rarely be experienced on account of the extreme care which is taken in the manufacture of Morris parts to ensure standardisation, but to remove all doubt it is well to adhere to correct engineering practice by fitting the clutch hub and noting the position it assumes before finally fitting the key. When the hub is correctly fitted it will permit of approximately $\frac{1}{8}$ " fore and aft movement of the splined sleeve.

Complaints Nos. 13 and 14. These items are worthy of careful consideration, since it is of the utmost importance that the process of easing the plates be carried out with extreme care owing to the danger of producing side play, which is neither conducive to silent operation nor long life.



Showing the correct position for the washers on the pins carrying the plate separating springs.

The Four-Throw Pump Camshaft on 11.9 and 13.9 Engines

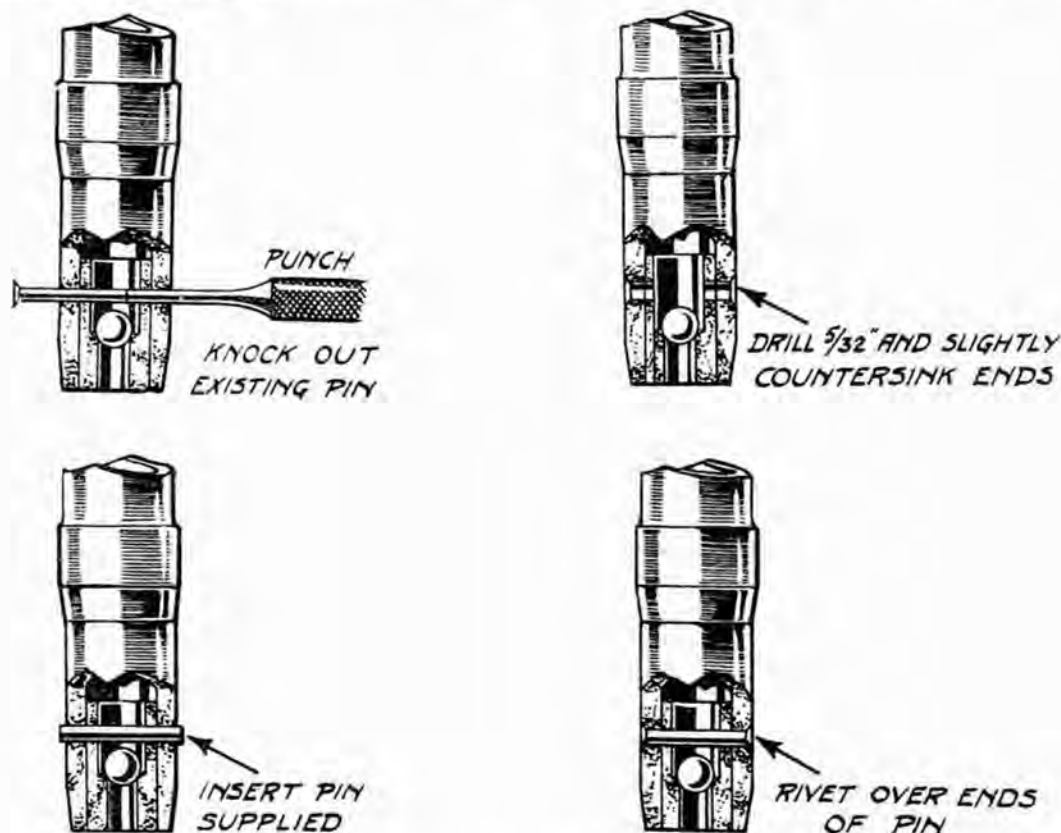
(1) On engine number 191680 and all succeeding engines (both 11.9 and 13.9) a new four-throw pump camshaft has been introduced. In place of the single eccentric which has driven the pump on preceding engines a boss on the camshaft is now ground so as to have four flattened surfaces, giving the oilpump four small pulsations per camshaft revolution instead of one large one. The result is a much better distribution of camshaft load as well as an increased and steadier oil supply.

(2) (Concerning engines numbered 191680 to 221401 only.) We consider it advisable to acquaint you of the possible development of a rather unusual trouble in the oilpumps of engines numbered as above.

It now transpires that, owing to the more rapid action of the ball valves in the pump plunger and pump body, there is a possibility of the oil outlet holes in the pump plunger piston becoming burred over, and the pump body seat retaining pin wearing excessively. The parts affected are—oilpump plunger, Part No. C.A. 1188, and oilpump seat pin lower, Part No. C.A. 1142.

This causes trapping of oil in the body of the oilpump as a result of the restriction of the oil delivery holes, and heavy stresses are set up. In extreme cases the oilpump body may be broken off at the attachment lug. It is almost certain, however, that before this happens the pump will become unduly noisy, this symptom being accompanied, in all probability, by lack of oil pressure in the main system, which will be shown on the oil gauge.

While we are confident that there is no cause for anxiety, we appreciate at the same time that oilpump trouble of any kind is highly undesirable, and we would ask you to give particular attention to any cases of oilpump failure or symptoms which may suggest that all is not well with the oil circulating system. In all cases suspected, the sumps should be dropped and the new type of plunger fitted. At the same time the 4 mm. silver steel retaining pin should be introduced into the oilpump body.



The process of inserting the 4 mm. silver steel retaining pin described graphically.

In the event of an engine sump being dropped for any reason, we deem it advisable that the oilpump plunger shall be changed. Until further notice, therefore, the plungers and pump body seat retaining pins on engines numbered 191680 to 221401 will be exchanged under the guarantee, the usual claim forms being utilised.

We are introducing immediately, commencing at engine No. 221402, a modified oilpump plunger, from which two sides of the bottom piston are cut away to allow the passage of oil, in place of the four small holes drilled in the earlier pattern plungers. To overcome possible damage to the oilpump seat pin we are fitting one of silver steel, 4 mm. in diameter, in place of the original 3 mm. mild steel pin.

If you will make arrangements to return all your existing stocks of oilpump plungers to the Service Department at Cowley replacements of the new pattern will be sent to you immediately.



MODELS : MORRIS 11.9 H.P. AND 14/28 H.P.

No. OF SHEETS 2

SHEET No. 2

*Date of issue : July, 1928***The Four-Throw Pump Camshaft—continued**

We ask you to give the above matter your very careful attention in order that risk of engine trouble through partial failure of the lubricating system may be reduced to the absolute minimum.

N.B.—May we emphasise the fact that trouble of the above kind can only occur on engines numbered 191680 to 221401.

(3) It is practically certain now that the vast majority of the oilpumps fitted to engines Nos. 191680 to 221401 have settled down and will not cause trouble, since the number of failures occurring to date represents but a very small percentage.

It is necessary, however, for us again to call your attention to paragraph No. 2, because certain of our Dealers seem to have overlooked the matter altogether, with the result that in some cases of failure the oilpump body only has been replaced, although, of course, the cause of the trouble has lain with the plunger. This has happened on a number of occasions, causing great dissatisfaction which could have been prevented had the Dealers concerned tackled the job properly at the outset. May we again emphasise the fact, therefore, that when an oilpump body breakage occurs on a car fitted with an engine in the above range of numbers the cause of the trouble is most probably to be found with the plunger. In addition, whenever an engine bottom case is taken down in the same range of engines we strongly recommend a change of oilpump plunger and pump body seat pin.

One other very important point. A number of Morris owners have been shown the foregoing Service Information when calling on certain Morris Dealers. This is very regrettable, since quite unnecessary anxiety has been caused to the owners concerned, and, as is natural, the information has been handed on, not only to other Morris owners but also to prospective users of Morris cars. We take this opportunity, therefore, of mentioning the fact that Service Information issued by us from time to time to our Dealers is of confidential nature and must be treated as such.

Circular Letter No. 49

Date of issue: April, 1929

Re-Lining Smith Shock Absorbers

BY arrangement with Messrs. Frank Smith & Co. (Elland) Ltd. it is now possible for us to issue repair outfits which will enable you to undertake the replacement of worn, broken or loose cork linings in the Smith type shock absorbers fitted to our productions.

Particulars are as follows:—

One set of four linings with glue powder, graphite grease and full instructions, "S" size, 8/-. (11.9 and 14/28 models.)

One set of four linings, two "S" and two "M," with glue powder, graphite grease and full instructions, "S A" size, 9/-. (Export only.) (56" track 11.9 and 14/28 models.)

One set of four linings with glue powder, graphite grease and full instructions, "M" size, 10/-. (15.9 Morris-Oxford and Morris Six.)

Less our usual discount on proprietary articles.

We shall look forward to receiving your order for a sufficient number of these sets to cover your Service requirements.

May we take this opportunity of emphasising the fact that the efficiency of the Smith shock absorbers is impaired by incorrect lubrication and destroyed in the event of the cork lining becoming loose in the bore of the lever? This latter point can be checked quite readily by watching the cork lining with cover-plate removed whilst a second party rocks the car. Correct lubrication in the later type shock absorbers is assured by occasional agitation of the special "Absordite" lubricant, with which they are packed, by means of the lubrication paddle.

Herewith we reproduce a copy of the leaflet of instructions which will accompany each outfit dealing with the re-lining process.

N.B.—The following paragraph applies, ordinarily, to Home Dealers only, although Export Dealers can avail themselves of the facilities if they wish.

In the ordinary way Dealers will doubtless issue replacement Service units from their stock as necessary, afterwards returning the originals to Messrs. Frank Smith & Co. (Elland) Ltd., Huddersfield Road, Elland, for overhaul—a course which is very greatly to be commended on account of the extreme care which must be exercised.

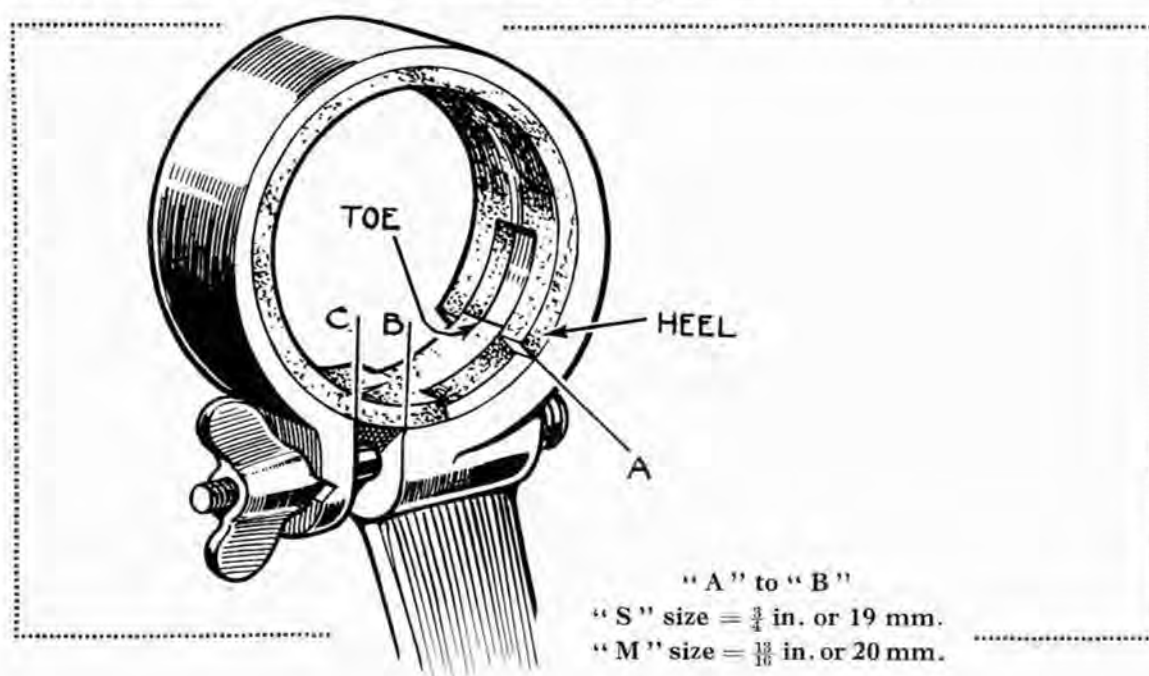
Messrs. Frank Smith & Co. (Elland) Ltd. have agreed to overhaul sets of four shock absorbers at the following prices:—

"S" size £1 7 0

"M" size £1 13 0

less a discount of 25 per cent. to Morris Distributors and Dealers.

However, we imagine Dealers will like to order one or two repair outfits as a stand-by.



METHOD OF FIXING LINING TO SMITH SHOCK ABSORBERS

1. **To prepare glue.** Empty glue powder on to a piece of paper. Using the glue powder tin as a measure, place one tinful of cold water in earthenware vessel and then add glue powder to the water, stirring all the time. Continue stirring for five minutes and afterwards allow to stand for fifteen minutes. Then add $\frac{1}{8}$ measure of cold water and mix thoroughly. The glue is now ready for use, and this amount will suffice for fixing four linings.
2. **To fix cork lining.** Clean the bore of lever thoroughly by first washing in petrol or benzol and then clean thoroughly with dry and clean emery cloth, so as to remove all traces of grease or dirt. This is important, and too much care cannot possibly be taken for this particular operation.



MODELS : MORRIS 11.9 H.P. AND 14/28 H.P.

NO. OF SHEETS 2

SHEET No. 2

*Date of issue : April, 1929***Re-Lining Smith Shock Absorbers—continued**

3. Measure off the distance "A" to "B" (see illustration and note dimensions given for "S" and "M" sizes respectively) and scratch a line at "A."
4. Insert cork lining exactly as shown in illustration and mark cork with pencil at "C." These two marks will greatly facilitate the placing of cork lining in correct position later on.
5. With a clean brush smear thoroughly with glue the bore of the lever from "C" right round to "A," leaving the small piece from "A" to "B" quite clean.
6. In a similar manner cover plain face of lining with glue right round, with the exception of the short piece from "A" to the pencil line at "C." The small piece from "A" to "B" must be carefully smeared with grease all over to prevent any possibility of adherence to the heel of the lining or the lever bore at "A" to "B." The toe of the lining slides with movement of the shock absorber, and must therefore be absolutely free.
7. Insert lining into lever so that the pencil mark on the side comes at "C" and heel at the line scratched at "A."
8. Spring the bore of lever open by inserting a screwdriver between "B" and "C" and fit lever, with lining in position, on to drum. Insert tension bolt and spring, tighten wing nut until the last or end groove is showing above coned face of lever. Allow to stand in a cool place for fifteen to twenty-four hours.
9. Take off drum, remove any surplus glue, removing with file any cork which is projecting beyond the face of the lever. Smear the friction face of lining with special graphited lubricant provided, ensuring that all the grooves are quite full. Reassemble, this time with the cover-plate (shock absorbers fitted with lubrication paddle should of course be packed with the special "Absordite" lubricant). Tighten wing nut down until second groove of visible brass adjuster is in line with bevel face. Work lever backwards and forwards on drum a few times before refitting to car.

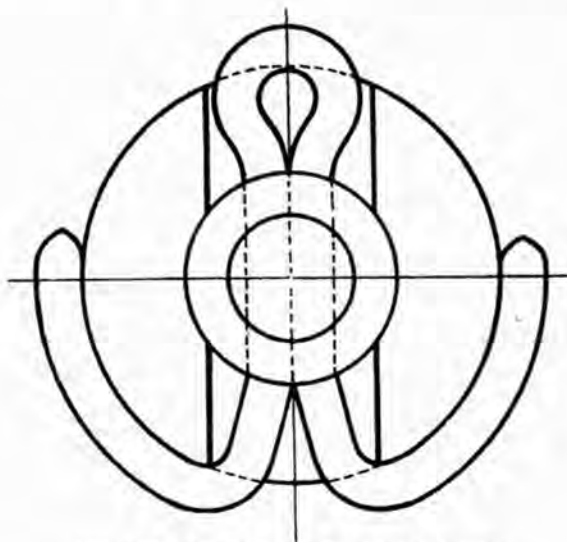
N.B.—Do not over-lubricate the old type shock absorber without lubrication paddle ; it impairs its efficiency.

*Date of issue : July, 1928*

Fitting the Split Pin to a Starter Chain Connecting Rivet

WE are taking this opportunity of bringing before your notice the following very important point in connection with the maintenance of Morris cars.

The diagram below is self-explanatory. Unfortunately, sufficient care is not always taken in fitting the pin correctly, with the result that there is a risk of the chain becoming disconnected.



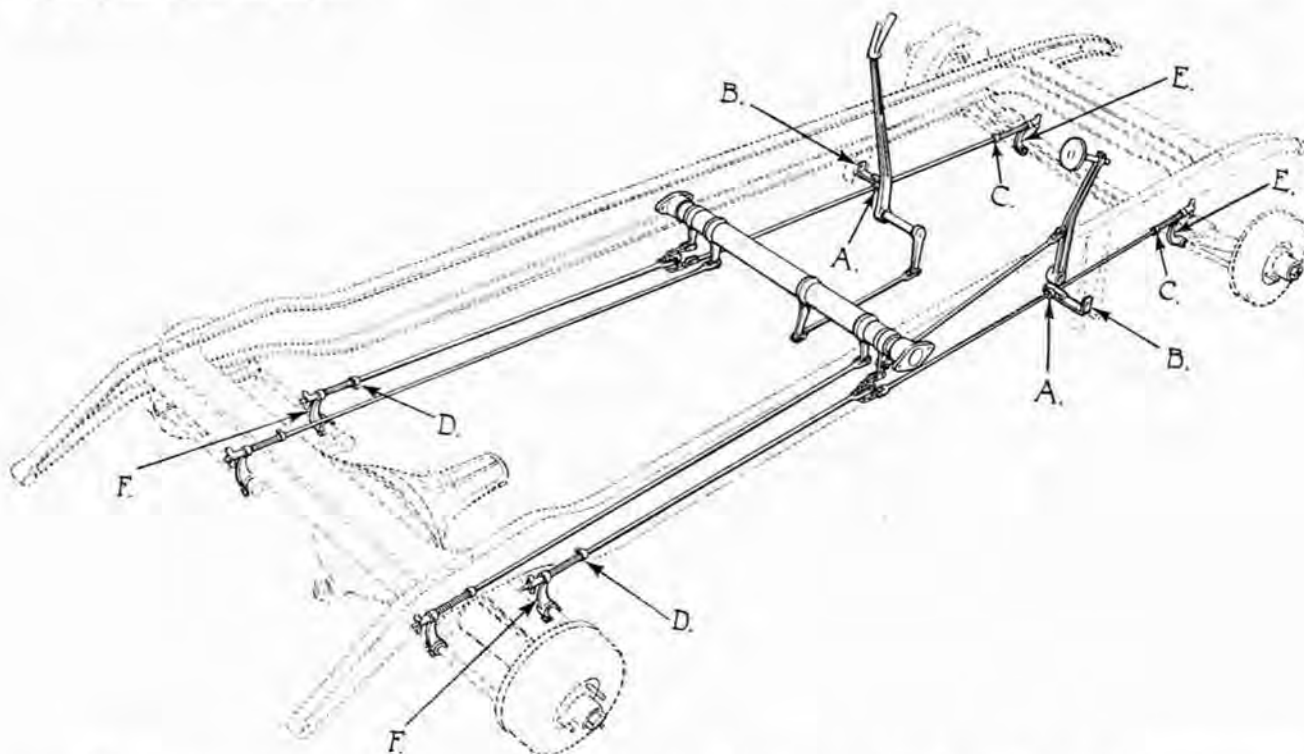
CORRECT METHOD OF FITTING SPLIT PIN TO
STARTER CHAIN CONNECTING RIVET



Adjustment of Chain Compensated Brake

WE give below a few simple points which should be borne carefully in mind when adjusting the chain compensated brakes fitted to 1928 model cars. For the sake of clearness a drawing of the brake gear assembly is shown herewith.

With this arrangement of chain compensation between front and rear brakes a few moments' consideration will suggest that unless the brake-shoe pull-off springs in front and rear brake-drums respectively balance one another the stronger set of shoe springs will tend to pull the other axle brake into action when releasing, through the medium of pull rods and compensator. For practical reasons the front-wheel brake-shoe springs exert the stronger releasing force, but in any case friction at various points plays a part, with the result that means have to be found to allow a ready release in both axles without the disadvantages mentioned above. This is arranged by the provided adjustable stops "A" (see illustration) on the pull rods to the front axle, which are so placed that they come against the steady brackets "B" immediately the front-wheel brake-shoes are just free of the drums, when the front brake-shoes are correctly adjusted. These stops should never need moving in ordinary brake adjustment, having been correctly set at the Works, but they play an important part and their particular function should be understood. Further stops "C" and "D" are provided on the front and rear axle brake gear pull rods respectively. These should be so adjusted that they cause the coil springs, against which they bear, to exert a reasonable pressure against the brake camshaft levers "E" and "F," thus keeping the notches cut in the levers in contact with the butterfly adjusting nuts. So much for the adjustment of the stops.



When commencing the equalisation of the brakes generally, it is essential, after jacking up both axles so that all four wheels are clear of the ground, to pay attention in the first place to the front-wheel brakes. It must be remembered that in order to bring the front axle brake-shoes into operation at all the rear axle pull rod adjusting butterfly nuts must be tightened up sufficiently to bear against the camshaft lever "F," but not enough to pull the stops "A" away from the steady brackets "B." After that, the front-wheel brake butterfly nuts are adjusted until the braking effect on both front wheels is similar. There remains then only the rear brake adjustment, which is carried out in the same way. If these instructions have been followed carefully the brakes are now properly adjusted and compensated. A practical test on a dry macadamised road, however, is advised, when wheel marks can be compared, for hand pressure on an individual wheel is not always a reliable test, especially with new brake linings which have not bedded down.

Other important general points to bear in mind are as follows:—

- Do not impose twisting stresses on the brake pull rods by attempting to turn the butterfly nuts on gritty and rusty threads. Occasional applications of paraffin and lubricating oils to the adjusting screw threads, particularly before brake adjustment, are advised. Any twisting of the pull rods is likely to damage the compensating gear chain.
- Do not attempt brake adjustment at any time before it has been ascertained that the whole of the brake gear is properly lubricated and perfectly free. In addition to the usual lubricating points there are the compensating sprocket bushed centres and the chains.
- Make sure that the brake-rod steadies are so adjusted that they do not pull the rods out of alignment.

N.B.—Should chattering occur when the brakes are applied, it can generally be entirely overcome by chamfering off the ends of the brake linings on any model irrespective of the year of manufacture. (See notes under "Brake Chatter.")

Assembling the Final Drive

THE following notes deal with the transmission of Morris cars (11.9 and 13.9 models) from the back of the gearbox to the rear road wheels. Fortunately, there is practically no trouble at all with this portion of the car's mechanism, which will explain the fact that many of our Dealers are still unfamiliar with details of its general arrangement. However, since mistakes are likely to prove somewhat costly to rectify, we feel that the subject will be of interest, and at the same time prove useful.

To simplify matters, we propose to deal with adjustments under the following three headings :—

1. The assembling and mounting of the propeller shaft.
2. The mounting of the drive gear and differential assembly in the differential carrier.
3. The final adjustment and correct meshing of the drive gear and bevel pinion.

1. The parts comprising the propeller shaft assembly are the propeller shaft (*a*), the propeller shaft thrust bearings (*b* and *c*), the propeller shaft journal bearing (*d*), the differential adjusting sleeve (*e*), the pinion bearing spacer (*f*), the spacer washers (*g*), the pinion bearing nut (*h*), the pinion lock screw (*i*), the pinion bearing lock wire (*j*), the drive pinion and castle nut, etc. (*k*), and the pinion oil retainer (*l*).

The pinion bearing nut (*h*) is threaded on to the propeller shaft (*a*), and screwed on to its thread almost as far as it will go. Thrust bearing (*b*) follows it, great care being taken to ensure that it is placed the right way round, the thrust being taken as shown by the arrows in Fig. 1.

A number of spacer washers (*g*) are then put on to the shaft, together with the differential adjusting sleeve (*e*) and the pinion bearing spacer (*f*). Thrust bearing (*c*) comes next, great care being taken again to assemble correctly to take thrust (Fig. 1.).

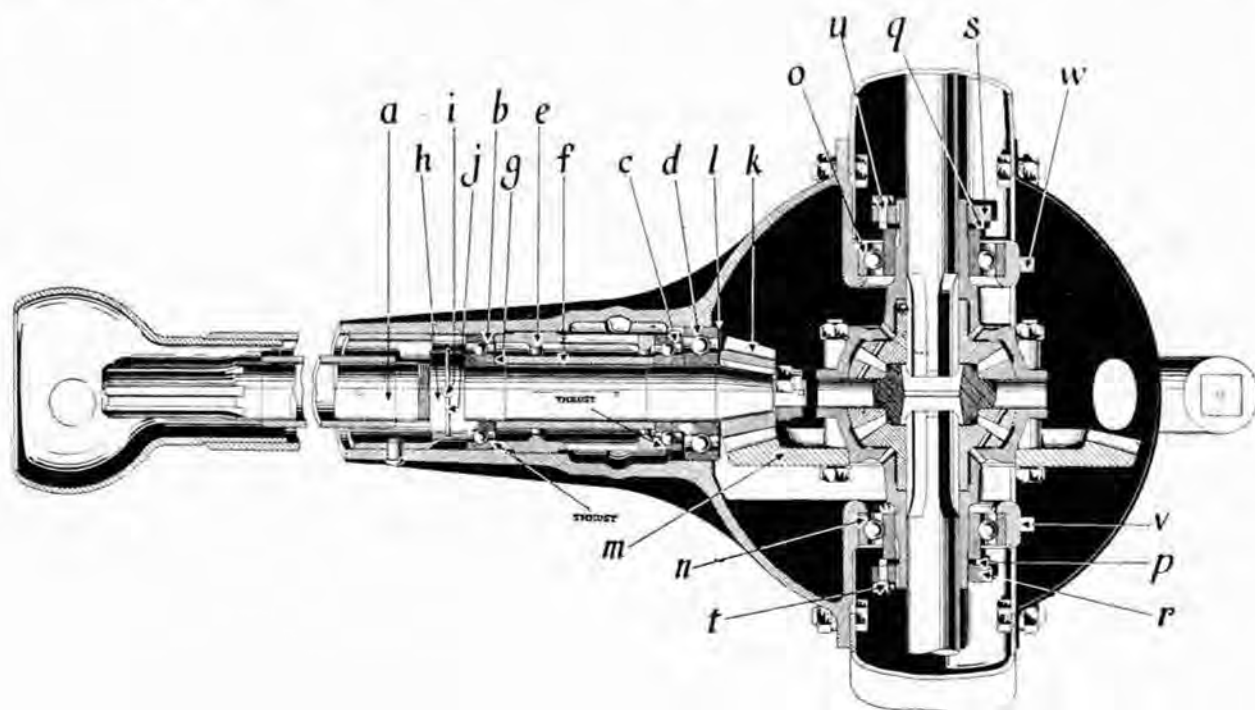


Fig. 1

Now follows journal bearing (*d*), oil retainer (*l*), and the drive pinion with key, etc. (*k*), the latter being drawn up tightly on to the taper by the castle nut. The bearing nut (*h*) is now screwed back until *b*, *f*, *c*, *d* and *l* are all tightly clamped together between the bearing nut (*h*) and the pinion (*k*), when the differential adjusting sleeve (*e*) should be just free to slide sideways by hand pressure. If the correct number of spacer washers (*g*) have been introduced between thrust bearing (*b*) and pinion spacer (*f*) the differential adjusting sleeve (*e*) will just slide as mentioned above. If the movement is free there are too many spacer washers (*g*), and if it is found impossible to move it at all there are insufficient spacer washers.

It will be gathered, therefore, that the correct spacing of the thrust bearings (*b* and *c*) is likely to prove a long and tedious process if the bevel drive pinion (*k*) has to be drawn up on the taper for each trial, after inserting or removing spacer washers (*g*). It is advisable, therefore, to use a bolt, as shown in Fig. 2, by means of which the correct number of washers required can be ascertained quickly. The thrust and journal bearings, spacer and differential adjusting sleeve are assembled in their correct order on the bolt, and are clamped up together by means of the nut. Washers (*g*) are added or removed until, with the nut tight, the adjusting sleeve (*e*) can be moved sideways by good hand pressure.

Date of issue: July, 1928

Assembling the Final Drive—continued

The various parts are then withdrawn from the bolt without disturbing their relative positions and are transferred to the propeller shaft (a). The drive pinion is then mounted and drawn on by the castle nut and is finally secured by a split pin. The pinion bearing nut (h) is now screwed down tightly, a drill is passed through the hole in this nut and bored five-sixteenths of an inch into the propeller shaft. Into the hole thus provided the pinion bearing lock screw (i) is passed and secured by the locking wire (j).

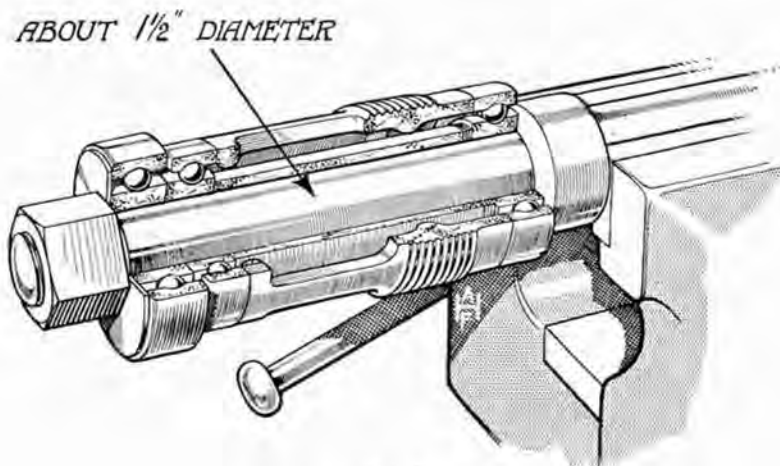


Fig. 2

N.B.—On repair work, when, in all probability, it will not be necessary to change the shaft, a scribe line should be drawn up from the centre of the hole in the shaft. It will be far preferable to drill another hole, located by this line, through the bearing nut (h) rather than in the shaft, which might be weakened seriously as a result.

Particular attention is drawn to the fitting of the drive pinion on the taper. Trouble will surely follow if the key is not a good fit or if the pinion is permitted to ride on the key instead of bedding down nicely on to the shaft. Another very important point is the *correct mounting of the thrust bearings*. These bearings are marked "Thrust" on the race faces where the thrust should be taken, and Fig. 1 shows them exactly as they should appear when in position. Note the prolonged inner races, which are somewhat exaggerated in the illustration for clearness.

The propeller shaft assembly is now passed into the torque tube and drawn up on the thread by passing a small lever through the lock plate hole, the end of which engages with the slots in the adjusting sleeve, until only the radius of the journal ball bearing (d) is visible. The final adjustment, if necessary, is left over until the drive gear and differential assembly are in place.

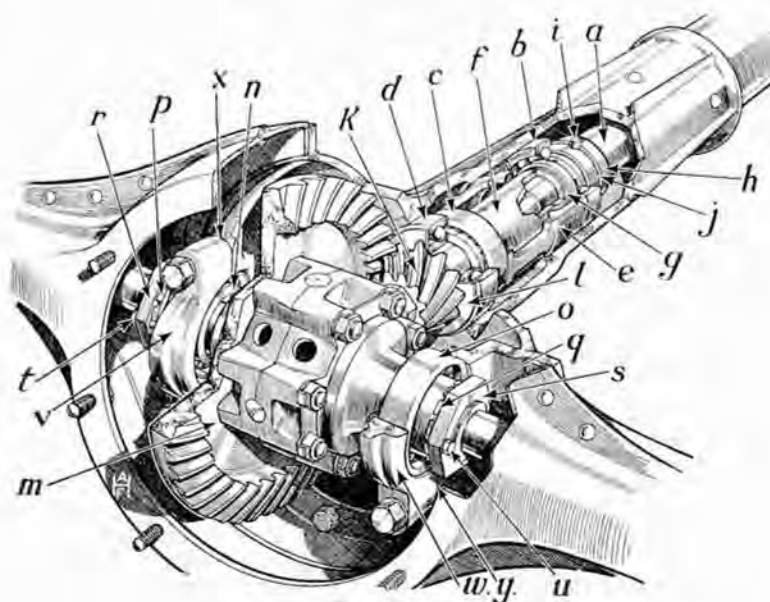


Fig. 3



Date of issue: July, 1928

Assembling the Final Drive—continued

2. The mounting of the drive gear and differential assembly in the differential carrier.

The parts comprising the assembly are the drive gear ready for mounting with the differential mechanism attached (*m*), the two differential bearings (*n* and *o*), the differential adjusting nut lock washers (*p* and *q*), the adjusting nuts (*r* and *s*), the lock screws (*t* and *u*), the differential cap assemblies (*v* and *w*) (see Fig. 3) and the differential dowel bushes (*x* and *y*). The differential bearings (*o* and *n*) are pressed on to the differential case spigots so that the protruding portions of the inner races face away from the body of the differential carrier (see Fig. 1) and are so placed that they will fit snugly into the machined recesses in the differential casing with the inner face of the outer race bearing hard against the shoulders of the recess. The differential cap assemblies (shoulders towards the centre of axle, *v* and *w*) are now mounted, care being taken to see that the four differential dowel bushes (*x* and *y*) are in place to locate the caps accurately and that there are the necessary four spring washers beneath the cap bolt heads. The caps are then tightened down.

The adjusting nut lock washers (*p* and *q*) are now threaded on to the differential case spigots, with the tongues engaging in the slots provided. The adjusting nuts (*r* and *s*) are screwed on, and the whole differential so set in the bearings that it is exactly equidistant from both ends. This should produce an amount of backlash between pinion (*k*) and the drive gear (*m*) that can be just felt when the drive gear is oscillated by hand, actually between .005" and .006". This amount of backlash often cannot be felt if the teeth are coated with gear oil, so that the parts should be quite clean before assembling. If this amount of backlash is not present the position of the drive pinion (*k*) should be adjusted by the slotted sleeve (*e*) as outlined in paragraph 3 until this clearance is obtained. It will be seen from the drawing that the drive gear assembly (*m*) can be drawn closer to the centre or set farther away by slacking off the L.H. adjusting nut (*r*) and tightening up the R.H. adjusting nuts (*s*), or vice versa. When the correct position has been finally determined by the insertion of suitable feelers between the bearings and the shoulder on the differential carrier, the adjusting nuts should be tightened up, one against the other, *but not unduly so*, since excessive tightening is quite unnecessary and will only induce rapid wear in the differential bearings (*n* and *o*).

The lock screws (*t* and *u*) are now passed through the nuts (*r* and *s*), and the latter are so adjusted until the spigots at the ends of the screws will freely engage with the castellations in the adjusting nut lock washers (*p* and *q*).

3. The final adjustment as to the correct meshing of the drive gear and bevel drive pinion.

As a general rule, if the above points have been carefully observed, the action of the bevel pinion and drive gear will be perfectly quiet under all conditions of load and on the overdrive, and no further adjustment of the bevel pinion will be necessary.

Supposing, however, that the axle is noisy on the drive, it is indicated that bevel and drive gear are meshing too deeply, and if noise is created on the overdrive then the two are not meshing deeply enough. In both cases it will be found possible, generally, to obtain all the necessary final adjustment by means of turning the differential adjusting sleeve (*e*) a slot or two to the right or to the left, according to whether noise is heard on the drive or the overdrive.

Before bolting the differential adjusting sleeve lock plate into position, about a pint of gear oil should be run into the cavity. Great care must be taken in replacing the locking plate so that the tongue is downwards. Only in very exceptional cases will it be found necessary to make any sideways readjustments of the drive gear assembly in order to obtain quiet running.

Lubrication of Propeller Shaft Thrust Bearings

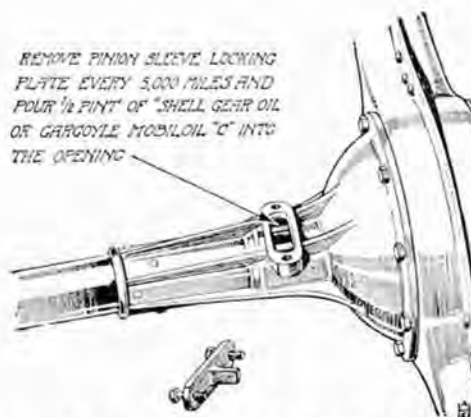
WE are including in all our instructional literature a recommendation that once every five thousand miles the differential sleeve lock plate, List Ref. No. 815, at the top of the differential casing should be removed and about half a pint of gear oil poured in. The accompanying illustration will show you exactly what this plate is and where it can be found. It can also be recognised by the fact that it bears the words "This side up" on it.

This additional lubrication recommendation is given to prevent any possibility of wear taking place on the propeller shaft thrust bearings.

We suggest that in order to avoid any possibility of flooding the brake-drums the rear axle filler-cap be removed 50 miles after the oil has been inserted and any surplus present allowed to escape.

It is also very important indeed that the car shall *not be moved* whilst the lock plate is off.

We shall be glad if you will kindly instruct your Repair Department to follow out this recommendation on cars that come into your shops for overhaul.



Lubrication of the thrust races taking the load from the driving pinion must not be overlooked. It is IMPERATIVE that the cover-plate be replaced with its tongue projecting inward and engaging with a slot of the pinion adjusting sleeve.



MODELS: MORRIS 11.9 H.P. AND 14/28 H.P.

No. OF SHEETS 1

SHEET No. 1

Date of issue: July, 1928

Taking Up Excessive End Play on Camshaft

EXCESSIVE fore and aft movement on the camshaft usually produces a metallic rattle when the engine is idling or when decelerating, but the best method of ascertaining what amount of end play is present is to remove the valve cover-plate and push the camshaft fan pulley backwards and forwards, at the same time noting the amount of fore and aft movement on the camshaft gear, a part of which is visible at the front end of the valve chamber. The correct amount of end play should be between .003" and .004" when cold. If it is found that there is an excessive amount of movement adjustment is necessary.

Great care must be exercised when taking up excessive end play on the camshaft if this adjustment is to prove successful. The operation is by no means a difficult one to carry out, but the important point to guard against is taking up all end play or so much that there is insufficient play after completing the adjustment.

The method of adjustment is to detach the fan belt and remove the camshaft fan pulley nut, after first taking out the split pin. Removal of the nut will be facilitated if a suitably cranked ring spanner is used. The pulley itself can then be withdrawn by inserting a hammer shaft between the boss of the pulley and cylinder block and pressing the former forward. *Do not lever against the outer edge of the pulley, otherwise it will become buckled.* The camshaft front end cover is now brought to view; this, as will be seen, is held in position by two bolts, and the removal of these two bolts will allow the end cover to be drawn forward clear of the camshaft. Between the cover and block will be found thin brass shims, each one of which is approximately .002" in thickness. One of these shims should be taken out and the end cover refitted. The amount of end play should then again be checked by pressing the camshaft gear backwards and forwards.

It is not possible, of course, to take an accurate check by the method described, but to the average mechanic the amount of fore and aft movement should indicate whether there is insufficient end play or otherwise.

In order that an accurate check may be taken the adjustment should be carried out when the engine sump is removed. It will then be possible to insert a feeler gauge between the rear or inside end of the camshaft end cover and the boss of the camshaft gear, but the gear should, of course, be pressed towards the rear before inserting the gauge. As previously stated, a clearance of between .003" and .004" should be allowed between the cover and the boss of the gear. If the removal of one shim is insufficient, then a further one or more should be taken out as required, refitting the end cover and checking the end play after the removal of each shim. Too much emphasis cannot be laid upon the importance of maintaining adequate clearance, otherwise there is a risk of a camshaft seizure, resulting in serious damage. After the correct clearance has been obtained the pulley and the fan belt can be refitted. *It will be noted that a slot is cut in the shank of the camshaft end cover. The cover should be fitted so that the slot is at the bottom.*



Date of issue : November, 1930

Points to be Covered in Periodical Inspections

Engine

1. Drain oil from sump, clutch chamber and starter chain compartment and refill to correct level with recommended oil.
2. Adjust tappets to give a clearance of .006". (Equal compression should be evident in each cylinder.)
3. Remove carburetter float-chamber and clean thoroughly with petrol. Test for flooding.
4. Examine engine for water, petrol or oil leaks.
5. Tighten down cylinder head and exhaust manifold nuts.
6. Adjust fan belt and examine blades for clearance.
7. Clean and adjust sparking plugs. (Test insulation for leaks while engine is ticking over.)
8. Inspect magneto points and distributor brush. Check timing, and correct if necessary.

Clutch and Gearbox

1. Adjust pedal to give a clearance of $\frac{3}{8}$ " from floorboards.
2. Adjust starter chain.
3. Drain oil from gearbox and refill to correct level.
4. Examine clutch inspection cover and dynamotor chain cover for oil leaks.
5. Oil universal joint ball housing with Enots oilgun.

Rear Axle

1. Drain off oil and replenish with $\frac{1}{2}$ -gallon gear oil. Add one pint to propeller shaft thrust races through the aperture exposed by removing the adjusting sleeve lock plate.
2. Rear axle housing filler plug vent should be cleared if obstructed.
3. Tighten rear spring "U" bolt nuts.
4. Oil spring seats.
5. Examine and adjust shock absorbers.
6. Oil all brake camshaft nipples and spring shackle bolts.
7. Check tyre pressures.
8. Fill hub caps with grease and replace.
9. Tighten road wheel nuts.

Front Axle

1. Examine track of front wheels (toe in should be $\frac{1}{8}$ " to $\frac{1}{4}$ ").
2. Tighten front spring "U" bolt nuts.
3. Jack up axle and oil thoroughly all steering joints together with spring shackle bolts.
4. Check steering gear for freedom.
5. Examine and adjust shock absorbers.
6. Remove hub caps, fill with grease and replace.
7. Check tyre pressures.
8. Tighten road wheel nuts.

These should toe inwards at the front $\frac{1}{8}$ " to $\frac{1}{4}$ ", both measurements being taken the same distance from the ground, preferably at axle height.

Steering and Controls

1. Tighten bolts securing steering gearbox bracket to engine or frame.
2. Examine blind washer at bottom of box (worm type boxes only). (May come loose.)
3. Oil box thoroughly.
4. Check end play on steering mast and adjust by nuts at top if necessary (worm type box only).
5. Examine and adjust, if necessary, magneto, carburetter and controls.*
6. Check slow-running control for correct functioning.

*The magneto control should be adjusted so that when the lever on the steering column is set to either the "advance" or "retard" position the cam-ring of the contact breaker will have its full range of movement.

In the case of S.U. carburetters the jet head should be brought into contact with the jet adjusting nut when the lever on the steering column is set to the weak position, and similarly in the case of Smith straight-through type carburetters, all air holes round the carburetter air-ring should be completely uncovered when the lever is gently moved to the weak position.





Date of issue : July, 1928

Periodical Inspection—continued

Hand and Foot Brakes

1. Oil thoroughly all working parts of brake gear mechanism, together with threads and adjusting nuts.
2. Examine brake-rod steady felt for alignment.
3. Jack up all wheels clear of the ground and carefully balance brakes.
4. Fill grease cups on Oxford models and fill domed dust caps with grease on Cowley models.

Lighting Set

1. Top up batteries with *distilled* water.
2. Examine cables for loose connections and tighten if necessary.
3. Smear battery connections with vaseline.
4. Check charging rate (not to exceed 8 amperes).
5. Pack dynamo end bearing with grease.
6. Test all switches for freedom and good contact.
7. Make sure battery is so located in cradle that it does not foul brake-rod.

Bodywork

1. Inspect door buffers and pack if necessary.
2. Oil door hinge pins, slam plates, catches, etc.
3. Test adjustable seats for freedom and lubricate if required.
4. Examine door locks for correct action.

Closed Models

5. Test windows for freedom of movement with absence of rattle.

Open Models

6. Check hood fasteners for alignment.
7. Fit sidescreens and adjust pegs and bushes if necessary. (These are eccentric and can be adjusted by turning.)

Accessories

1. Oil speedometer inner cable.
2. Test windscreen wiper and adjust if necessary.





On Petrol Consumption

THE following notes have been prepared for your guidance on this subject, and we ask you to deal with all excessive petrol consumption complaints on the lines indicated.

You will have noticed that we stress the advisability of using a wide tappet clearance. We have found that many clients pay little or no attention to the provision of correct tappet clearances, and we therefore very strongly recommend the provision of generous clearances to prevent the possibility of trouble arising through the valves riding. It should be borne in mind that once a valve gets burnt it will probably ride higher on the block seating, giving an impression of generous tappet clearance. It is necessary, therefore, to ensure ample clearance right from the very commencement of running after any attention to valves has been given.

It is very important to note, however, that on engine numbered 150,000 and all subsequent engines the cam-form has been slightly modified, giving a rather later opening and earlier closing of both inlet and exhaust valves. This particular valve timing is more foolproof, and a clearance of .003" all round will give results approximately the same as with the old cam-form having a tappet clearance of .008". It will be advisable, therefore, to ascertain the number of an engine before recommendations are made regarding tappet clearances. Even so, generous clearances are still recommended to ensure long valve life and maintenance of good tune.

The items which affect petrol consumption fall roughly under the following headings: 1. Carburation; 2. Ignition; 3. General tune of engine and chassis.

1. Carburation.—Smith Five-jet Carburetter. *N.B.*—Where the S.U. Carburetter is fitted omit this paragraph and read Service Information No. G/4.

The first point to be investigated here is the operation of the mixture control—the right-hand lever under the steering wheel. When in the "start cold" position this lever should move the shutter on the rotating ring of the carburetter so that it baffles completely two of the choke orifices and at the same time closes the extra air holes in the ring itself. This gives a very rich mixture for easy starting, and it is of vital importance to make sure that as the control lever is moved to the "rich" position all the choke orifices are unbaffled, and that when the lever is moved to the full extent of its travel—that is, in the "weak" or normal running position—all the extra air holes referred to above are also fully open. Owing to the fact that the control arrangement on Morris cars is not entirely rigid, the actuating lever should be moved gently and not snapped over. If the setting proves right for a gentle movement it will be right for all conditions, but it is possible to have the setting such that, whilst snapping the lever will give the correct result, a gentle movement will fail to produce sufficient motion to open the extra air orifices fully.

The size and arrangement of jets is, of course, important. New cars with stiff engines leave the Works with a rich setting. This can be cut down with advantage to petrol consumption and without loss of power when the engine has been run in and is free. The finer setting should be 16, 20, 15, 10 with the Morris-Cowley, and 16, 21, 15, 12 with the Morris-Oxford. These finer settings depend upon the closing of the extra air hole to No. 1 choke if the best results are to be obtained. This particular hole is the one nearest the float-chamber. (On later type carburetters this hole is omitted.) The jet setting supplied with a new car is 17, 20, 17, 10.

Too much emphasis cannot be laid upon the importance of intelligent use of the control lever when driving. There are three positions of the control lever: 1. "Fully strangled," for starting up from cold, in which two of the chokes are baffled and all extra air shut off. 2. "Rich," with all chokes open, but the extra air still shut off. 3. "Weak," with all chokes open and all extra air holes also open. The engine should on no account be allowed to run for more than one minute in No. 1 position or for longer than is absolutely necessary to warm the engine in No. 2 position. At all other times the control should be in the "weak" position. It is extremely bad practice habitually to richen the mixture in order to obtain extra power when hill climbing. There is a perfectly good gearbox provided to cope with such conditions. If there is bad hesitation or choking when picking up, suspect a choked jet or, very occasionally, a sticking auto-valve. The latter is caused by grit or some foreign substance under the valve, and may be obviated by careful cleaning. The valve is accessible upon removing the centre piece from the carburetter body.

One further important point in connection with carburation lies in the correct setting of the petrol level in the float-chamber. With the carburetter placed level, the height of the petrol should be approximately $\frac{1}{8}$ " from the top of the jets.

2. Ignition. Late ignition is a frequent cause of excessive petrol consumption. Make certain that the ignition control lever operates the magneto cam-ring over its full range. The timing should be such that on full "retard" the contact breaker points are just commencing to break with the piston on top dead centre. The driving position is, of course, full advance. Certain engines will take a greater degree of advance with beneficial results. Great care must be taken in applying this remedy, however, otherwise serious "pinking" may result if the car is used by an unskilled driver. Make sure that there is no binding between the ignition control rod and the carburetter control rod, inside of which it works. If there is any binding here the tendency is for the carburetter control to move to "rich" as the ignition is advanced, and vice versa.



*Date of issue : July, 1928***On Petrol Consumption—continued**

3. Tune of engine and chassis. Make sure that the engine and pistons are reasonably free from carbon and that the valves are all seating properly and gastight. A foul engine and leaky valves will render any petrol consumption test futile. Tappet clearances are very important indeed, and an improvement in petrol consumption can frequently be obtained by increasing their clearance from normal to .008". The normal .003" clearance is all right when a frequent check can be made, but it must be remembered that there is always a tendency for valves to settle down into their seatings as well as for the valve stems to elongate a trifle, the effect of which is to reduce tappet clearance. As a general guide, therefore, particularly in cases of excessive petrol consumption, we unhesitatingly recommend a clearance of as much as .008". A little extra noise will naturally result, noticeable only when the engine is idling, however, but in our opinion the maintenance of good engine tune over long periods, with reduced petrol consumption, makes the provision of a big clearance well worth while.

In addition to the above there are certain obvious points in connection with the chassis such as freedom of the brakes, correct alignment of the wheels, freedom of all bearings, etc., any or all of which tend to increase the normal load on the engine. We would strongly advise that none of the above points are assumed as being in order without a practical check.

In concluding, may we point out that a good average petrol consumption figure is often spoiled by a large number of short runs in the course of which the engine rarely attains a normal working temperature. Some form of radiator shutter or muff is very useful, particularly during the winter months, since this additional equipment will enable a driver more easily to maintain the normal running temperature, a point which is highly advantageous. Remember that a hot engine is more efficient than a cold one.



Date of issue: July, 1928

Oil Leakage

OIL LEAKAGE FROM ENGINE AND CLUTCH TO GEARBOX AND REAR AXLE

A LEAKAGE of oil from the engine into the gearbox and thence through to the back axle is indicated by excessive engine oil consumption and the level of oil in the gearbox and rear axle rising without replenishment from an outside source. It will also invariably result in reaching the rear brake-drums, due to the presence of an excessive quantity in the back axle.

In the majority of cases this irregularity is brought about by incorrect assembly of the drive gear cover retainer (Part No. C.A. 1167), which is located towards the rear end of the drive gear shaft and held in position on the clutch side of the gearbox casing by four equally spaced bolts. At the rear end of the drive gear shaft, and inside the cover, is a combined drive gear bearing nut and oil thrower (Part No. C.B. 1784). The function of this part will be described later. If the cover is examined it will be noted that it can be replaced in any one of four positions by reason of the fact that the securing bolts are set an equal distance apart. It is essential, however, that the cover be fitted in one particular position if the trouble under review is to be avoided.

Oil is fed to the drive gear shaft under pressure from the rear main bearing of the engine by means of a hole drilled in the crankshaft journal and drive gear shaft itself, and the oil reaches the outside of the latter immediately under the starter chain wheel splined sleeve. The oil then works out from the front and rear ends of the sleeve. In the case of the former it drops into the clutch compartment, whereas the oil coming from the rear end of the sleeve is thrown off by the combined bearing nut and oil thrower previously mentioned and drops inside the drive gear cover retainer. If no provision were made for the oil to drain out of the retainer it would pass through the drive gear bearing into the gearbox, and from the latter to the rear axle. A $\frac{1}{4}$ " hole is drilled in the retainer, however, to allow the oil to drain out, and it is of the utmost importance, therefore, *that this hole is at the bottom.*

N.B.—In recent productions the retainer is marked "TOP" to mitigate the possibility of error.

In quite a number of cases where the clutch and gearbox have been dismantled it has been found that the retainer has been reassembled with the drain hole at the side or at the top, with the result that oil which accumulates inside it cannot drain out, but passes through the drive gear bearing into the gearbox, and from the latter down the propeller tube into the back axle. Whenever trouble of this nature is experienced the position of the hole in the retainer should be examined and the retainer refitted, if necessary.

In isolated cases an oil leakage of this nature may be due to the combined drive gear bearing nut and oil thrower having slacked off, and it is as well to point out that this part has a *left-hand thread* and that on no account should the car be allowed to run forward with the reverse gear engaged, or vice versa, otherwise there is a tendency for this nut to unscrew. In the event of this contingency arising the remedy is to tighten up the nut to its fullest extent.

Another part which calls for examination is the automatic oil valve situated in the wall of the engine sump, between the flywheel housing and the crankcase. The function of this valve is to maintain a common oil level between engine and clutch under all normal running circumstances, and to prevent excess oil running back from the crankcase to the clutch when the car is ascending steep hills. If this valve sticks in the open position an excessive quantity of oil will pass into the clutch compartment when ascending a long hill, and, on the other hand, if it remains closed the oil which is forced from the rear main bearing—as mentioned earlier—cannot return to the engine sump. Consequently the level in the clutchcase becomes too high, and eventually rises to the height of the drain hole in the drive gear cover retainer, the latter becoming ineffective in consequence. To overcome this difficulty it is only necessary to make quite sure that the sump valve floats freely—it is *not spring loaded*—and that its seating is quite clean.

On a car which has had a considerable amount of use the passage of engine oil to the gearbox may be aggravated by wear on the drive gear bearing, and the obvious method of rectifying this is to fit a new bearing.

Occasionally the trouble may be caused by a porous or cracked wall in the gearbox casting between the clutch compartment and the front end of the gearbox. In such cases the remedy is to fit a new gearbox casting, unless the hole or crack is small, when aluminium welding or plugging may effect a remedy.

Summary

Cause	Remedy
1. Incorrect assembly of the drive gear cover retainer.	1. Refit retainer with drain hole at the bottom and make sure hole is clear.
2. Drive gear nut slacked off.	2. Tighten nut up fully (L.H. thread).
3. Sump valve sticking.	3. See that the valve disc slides freely; if damaged, replace.
4. Worn drive gear bearing.	4. Fit new bearing.
5. Cracked or porous partition between clutch and gearbox.	5. Welding or plugging may prove satisfactory if the hole or crack is small, but otherwise it is advisable to fit a new housing.

OIL LEAKAGE FROM GEARBOX TO CLUTCH AND ENGINE AND REAR AXLE

IN order to prevent oil escaping from the gearbox through the sliding gear shaft and drive gear shaft bearings a steel oil retaining washer is fitted to each of these shafts next to the ball bearing retainers.

Sometimes it is found that oil is leaking from the front end of the gearbox, via the drive gear shaft bearing into the clutch chamber and thence to the engine base. Alternatively, oil may find its way through the sliding gear shaft bearing at the rear of the gearbox, passing down the torque tube and so into the rear axle housing. As a result, this excess oil may eventually work out into the brake-drums and on to the shoes, causing the brakes to become ineffective.

The trouble is caused by the washers, previously mentioned, working away from the bearing housings. Obviously, to prevent the leakage it is necessary to restore them to their original position. This can be quite easily accomplished and does not involve any dismantling beyond the removal of the floorboards and the gearbox cover complete with the gear and hand brake levers. The gears should be left in the neutral position.



Continued

Date of issue: July, 1928

Oil Leakage—continued

Proceed by jacking up one of the rear wheels. It will be found, on rotating the wheel which is clear of the ground, that the sliding gear shaft also rotates.

The tools required are a small flat-ended pin punch and a light hammer. Whilst it is necessary to drive the washers right home, care must be exercised, as the application of too much energy in using the hammer will only cause the washers to become distorted, thus making matters worse and perhaps necessitating the dismantling of the gearbox in order that new washers may be fitted.

The next step is carefully to tap up the washer on the rear end of the sliding gear shaft into contact with the bearing retainer, i.e. towards the rear of the car. The shaft should be rotated by turning the road wheel during this operation in order to ensure that the washer is tapped up evenly all round.

Similar action is taken with the washer on the drive gear shaft at the front of the gearbox, this shaft being rotated by turning the starting handle.

On all later type gearboxes a spiral is cut across the face of the brass ball bearing retainers which has the effect of returning to the gearbox any oil tending to find its way between the bearing retainers and the steel oil retaining washers.

OIL LEAKAGE FROM THE MAGNETO DRIVE SHAFT

N.B.—Make sure first of all that the oil filler-cap attached to the dip-stick is quite clear of the oil filler itself by at least $\frac{1}{8}$ ". Lack of clearance here may cause the generation of crankcase pressure, which is sometimes responsible for the above trouble.

THE magneto should be removed, after which withdraw the magneto drive shaft. This latter operation is facilitated by using a special magneto drive shaft extracting tool (obtainable from the Service Department of these Works); the tool in question is No. ET371 in our list of service tools.

The pressed-steel oil retainer should now be removed. This latter component should be so positioned that the rectangular shaped slot is at the bottom, opposite the oil drainage hole drilled in the cylinder block. If it is out of position in the case under investigation this indicates a possible source of trouble.

The magneto drive shaft bush should be a good working fit, since a slack fitting bush will cause oil leakage. If a new drive shaft bush is fitted, it is suggested that tool No. ET379 is used to make the final cleaning up, necessary as the result of slight shrinkage of the bush in question as a result of its insertion.

It is essential that the oil drainage hole mentioned in the second paragraph should be drilled as vertically as possible through the casting. If this hole is too horizontal it will tend to catch the oil thrown off by the camshaft gear, with the result that it will not function as an oil drainer. The drilling of another oil drainage hole necessitates the removal of the magneto drive shaft bush.

In exceptional cases it may be advisable to provide extra drainage, in which case we recommend the drilling of a hole in the bottom of the drive shaft bush opposite and of similar diameter to that already provided at the top of the bush. This hole should be opposite the one drilled nearest to the magneto.

From $\frac{1}{4}$ " on the magneto side of the hole an oilway should be cut in the bush, shallow at first, but gradually deepening towards the other end, where it should run right off.

It will be noted on removing the drive shaft bush that there are two holes drilled in the bottom of the bush housing. These holes usually serve no useful purpose, but are there simply because it is impossible to drill the two top holes without passing through the casting. However, if the modification suggested above is effected, the hole drilled in the bottom of the bush housing, and nearest to the magneto, is now utilised for extra drainage.

OIL LEAKAGE FROM FRONT END OF CAMSHAFT

N.B.—Make sure first of all that the oil filler-cap attached to the dip-stick is quite clear of the oil filler itself by at least $\frac{1}{8}$ ". Lack of clearance here may cause the generation of crankcase pressure, which is sometimes responsible for the above trouble.

THE most prolific cause of an irregularity of this nature is the incorrect assembling of the camshaft front cover, whereby the oil return slot is mounted above instead of beneath the fan pulley spacer on the end of the camshaft.

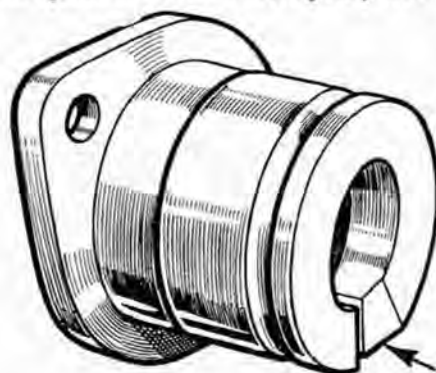
If an irregularity of this kind is found, oil leakage will almost certainly be cured by giving the cover a half turn, thus bringing the slot into its correct position. In those cases where it is found that the cover is correctly mounted we recommend the following points for investigation, and modification if necessary.

It is essential that the fan pulley spacer be clamped up tight when the castle nut at the front end of the camshaft is drawn right up. If the spacer is a trifle short so that the forward edge of the fan pulley does not protrude a little way beyond the end of the long parallel portion of the camshaft, over which the spacer is placed, the castle nut will tighten up without properly fixing the drive pulley and spacer; in consequence oil will percolate between the end of the spacer and the fan drive pulley boss and will be thrown off.

To rectify this, the centre of the washer behind the castle nut should be recessed so as to let it pass over the end of the shaft for a short distance, or in extreme cases a short section of an old spacer should be used on the end of the camshaft between the spacer and the fan drive pulley.

If it is found that the foregoing points are in order and oil leakage is taking place, we recommend that the oil groove in the spacer shall be deepened and widened. In addition, the oil slot in the camshaft front cover should be lengthened and chamfered off, so that the slot is longer on the inside of the cover than on the outside. Before reassembling, the forward end of the oil groove on the spacer should be neatly filled with solder, the filling being $\frac{1}{8}$ " long.

In isolated cases, by reason of faulty selection, the spacer may be found to be a very poor fit on the camshaft; in such cases a new spacer will be required,



CHAMFER

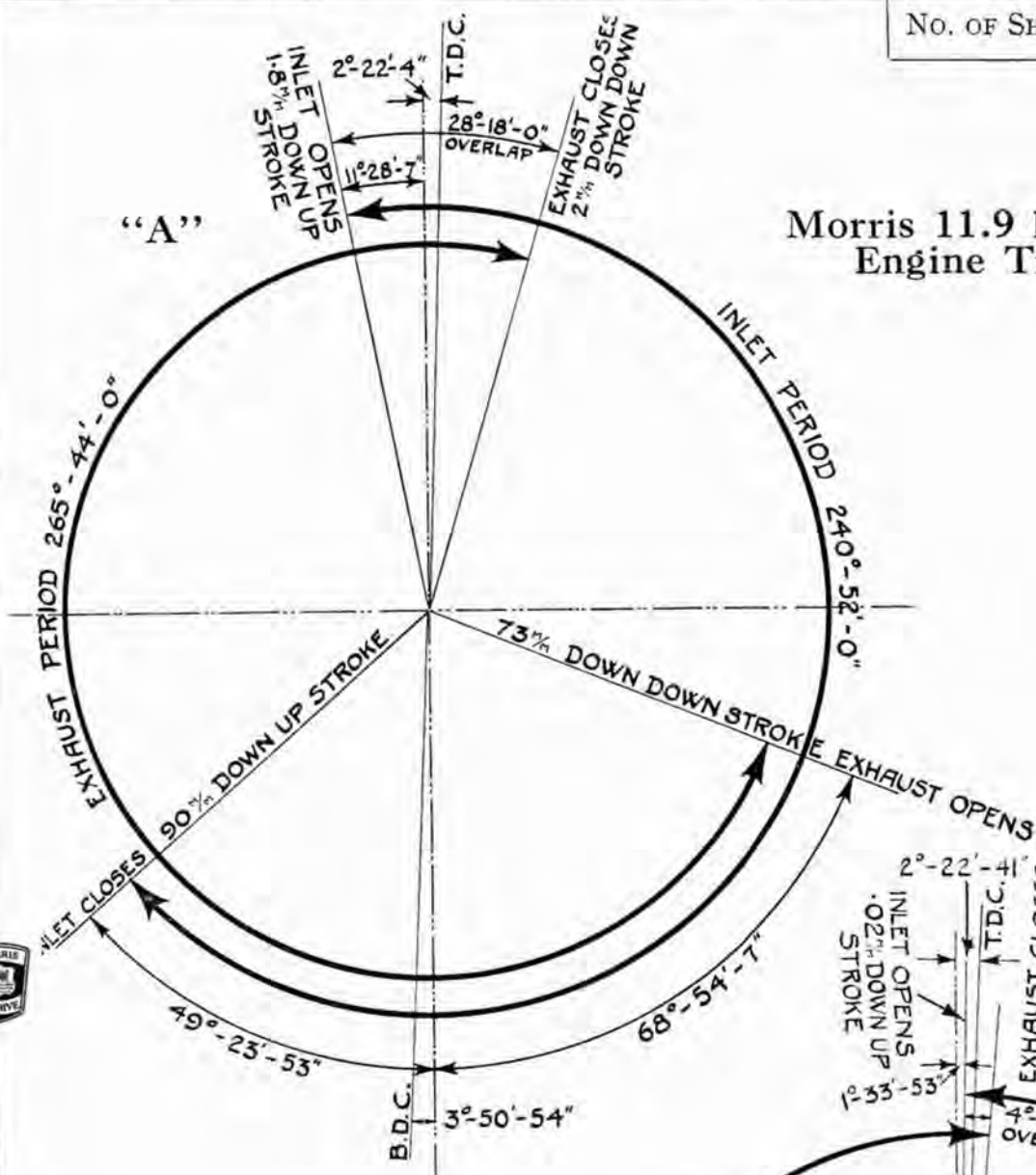


No. of SHEETS 1

SHEET No. 1

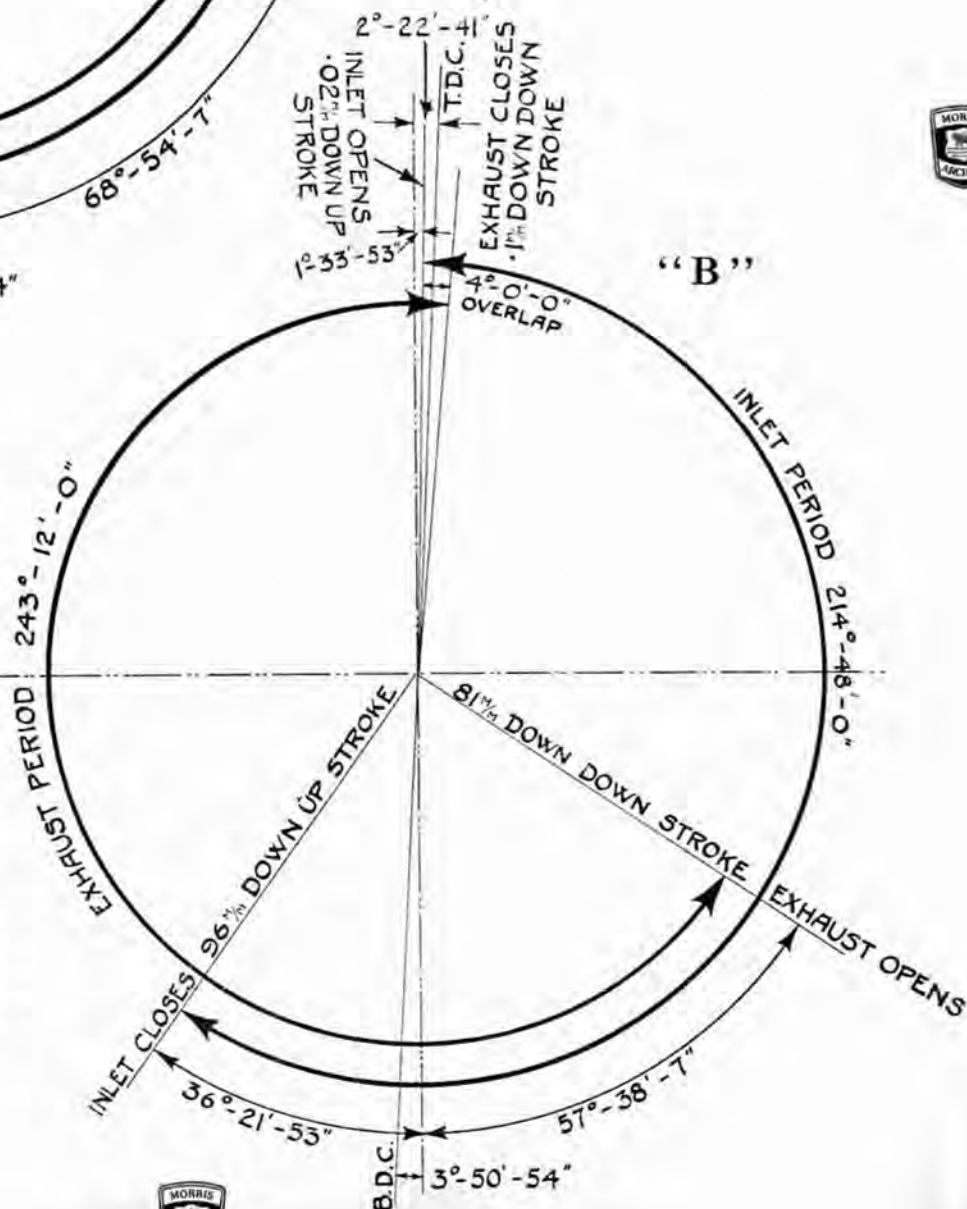
Date of issue: July, 1928

Morris 11.9 h.p. and 14/28 h.p. Engine Timing Diagrams



The diagram "A" shows valve periods with tappets set at .003 in. clearance, and diagram "B" the same camshaft with tappets set at .008 in. clearance. In both cases also, the piston movement is marked in millimetres, measured from the piston in its highest position. (This should not be confused with the vertical position of the crankshaft, because, while in a non-offset engine crank vertical is also top dead centre, in the case of offset bores the two points do not coincide, and also the piston downstroke is greater than the piston upstroke, for the same reason.)

When the large difference in the two diagrams made by so small a variation in tappet clearance is noted, it will be seen that great care is necessary in checking valve timing, and that the method and instruments used may make much more difference than actually exists in the camshaft itself, particularly at the top end of the stroke where the relation between piston travel and angular movement of crank is most deceptive.



Date of issue: July, 1928

SPECIAL WORKSHOP EQUIPMENT

Useful devices developed and used in our own repair shops that will help our Dealers in theirs

IT is proposed in this service information to deal with certain aspects of Morris Service and Repair Work with the idea that some of the methods suggested will commend themselves to Dealers. In the first place we wish to outline a few simple aids to Morris Repair Work in the way of special shop equipment additional to the range of standard tools. All of these are of a simple nature and easily constructed.

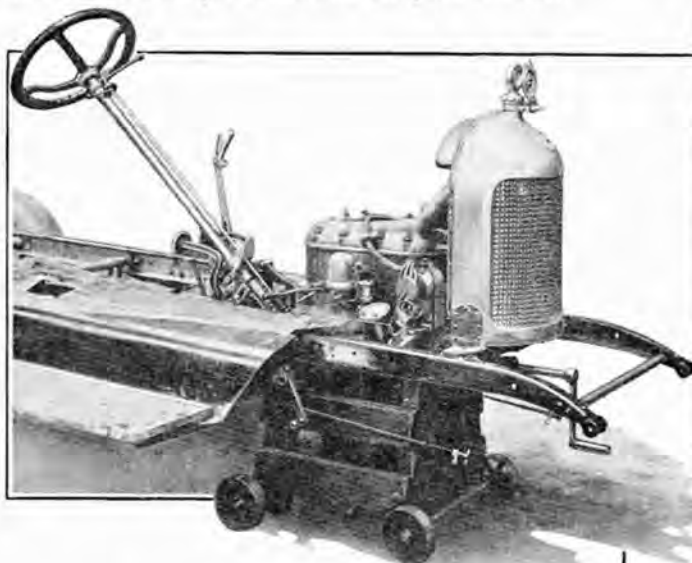


Figure 1.

A power unit carrier which is exceedingly useful in any repair job necessitating the removal of the engine from the frame. It can be slipped into position quite easily and will then take the weight of the power unit whilst the frame attachment bolts are removed. Being mounted on wheels it is mobile.

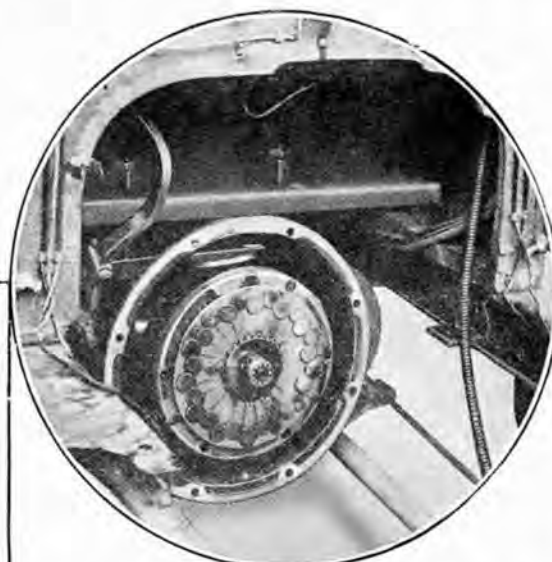


Figure 2.

A simple device for supporting the gearbox and clutch unit in position when the engine is removed. The two forward gearbox cover studs are used as a means of attachment.

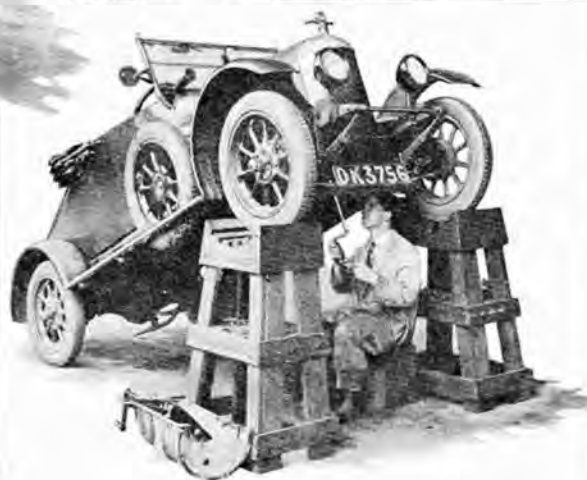


Figure 3.

Shows the front end of a car mounted on wooden stands. This arrangement is far preferable to the use of inspection pits, particularly for such jobs as big-end bearing adjustment.

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Special Workshop Equipment—continued

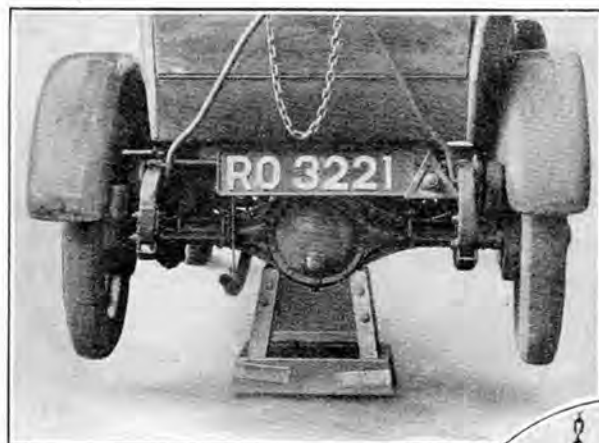


Figure 4.
Illustrating the use of a carrier which lifts the axle a few inches clear of the ground. It is useful for brake adjustments or for holding a back axle unit when stripping and rebuilding.

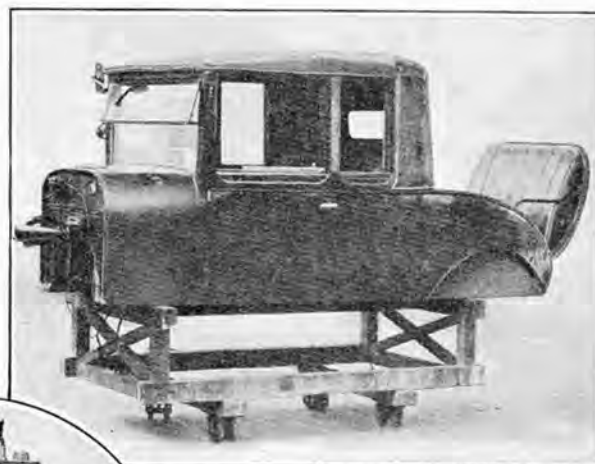


Figure 9.
The last illustration depicts a body carrier which is a useful addition to shop equipment and saves a great deal of heavy lifting. It is mounted on castors.

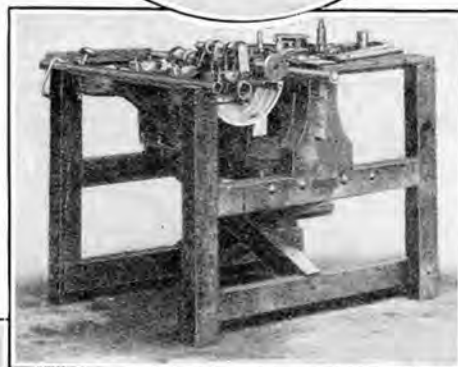
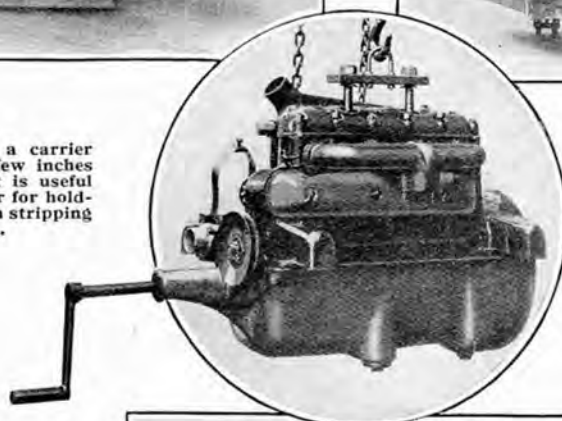
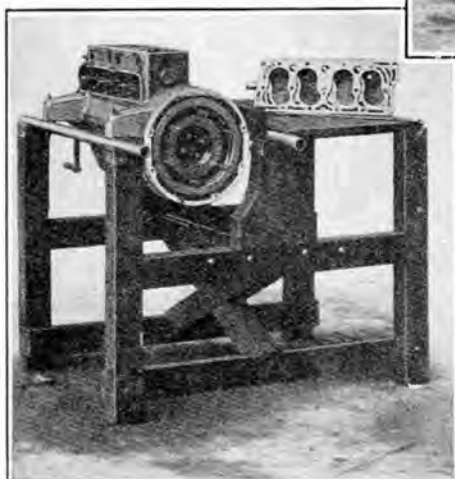
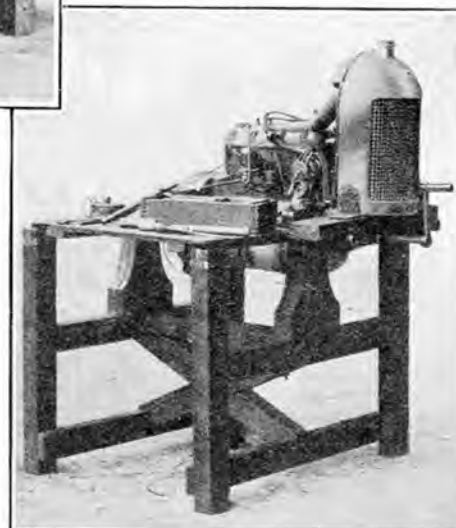


Figure 5.
A very simple engine-lifting device in use. Nos. 2 and 3 cylinder sparking plug holes being utilised for the attachment bolts.



Figures 6, 7 & 8.
A handy form of engine bench which facilitates very considerably the handling of an engine during overhaul. It will be noted that the cylinder block is bolted by the bearer arms to two stout steel tubes, the inner one acting as a fulcrum when turning the job over. The vacant space on the side is covered with a board for tools, etc. It will be appreciated that the complete job, from stripping to testing, can be carried out on this bench. When testing, a piece of board is passed across the bearer tubes to support the radiator, which is held in position by the water hose connections.





Date of issue: July, 1928

Special Workshop Equipment—continued

REAR AXLE JIGS

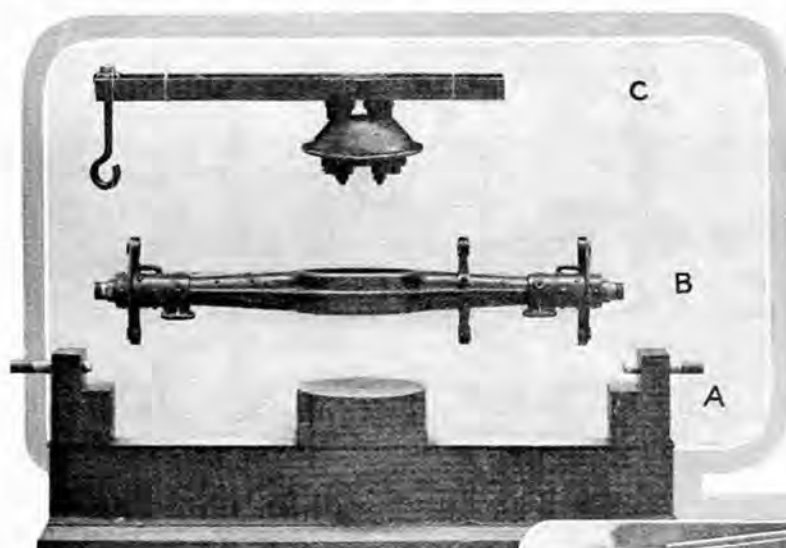
IT occasionally happens when a car has been in a severe accident that the rear axle casing becomes bent.

In doubtful cases where the damage is not visible test for this by measuring the width of track at back and front of rear wheels; if unequal, it shows that the casing is bent, assuming, of course, that both wheels are true. Also test by withdrawing the hub flanges and half axle shafts complete approximately three inches, or sufficient to remove inner ends of axle shafts from differential. Then replace them, and if they do not return to their positions easily and truly, obviously the casing is bent. It is assumed, of course, that the half axle shafts and hub flanges are true.

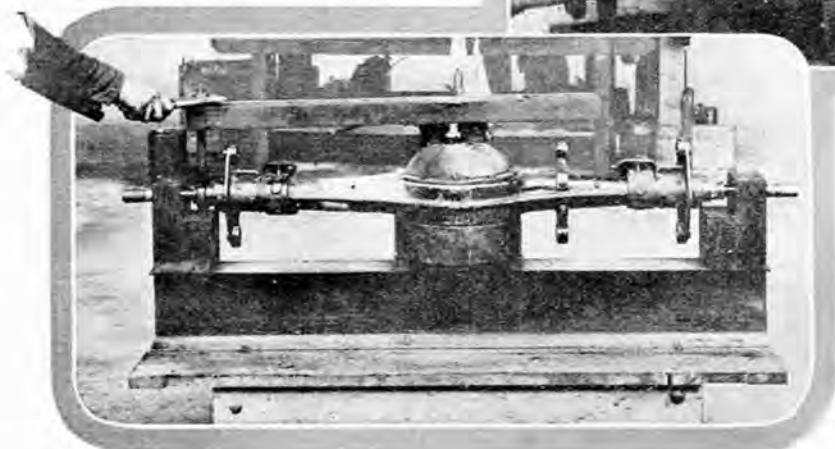
Dismantle casing and place on jig similar to jig "A" in the photograph, where the amount and position of inaccuracy can be noted. The picture of the jig explains itself, but note the locating peg in flange table and the sliding pins in end brackets. These pins should be $1\frac{1}{8}$ in. diameter, giving a clearance fit in the axle flange tube. When case is true both pins freely slide into ends of axle casing.

It is usually best to remove both brake camshaft bearing brackets in the side that is to be straightened, as "B," and then prepare a jig similar to "C." This jig is shown in position in the two lower photographs, and can easily be made with an old differential carrier, a length of girder and an eyebolt. The girder is bolted to the differential carrier, which has been suitably shortened, and the other end is drilled to take the adjustable eye bolt. This jig is fixed to the axle case by four bolts in the circular flange, and the adjustable eye bolt slips over the end of axle case and is used to pull the case into correct alignment, after it has been heated in a hearth as shown in middle photograph.

On no account is the axle case to be heated above a very dull red.



These three photographs show the best method of dealing with damage to the rear axle casing. Such is the infrequency of the task—it only becomes necessary after a car has been run into from the rear—that many Works' managers have little experience of carrying out the work expeditiously.



Date of issue: July, 1928

CHANGING A CHASSIS FRAME

All types previous to 1927

1. Remove all loose parts such as cushions, carpets, spare wheel, and petrol tin, sidescreens, etc.

2. Remove floorboards, bonnet, bonnet rod, bonnet boards, radiator, steering wheel, petrol pipe, throttle control rod, rear wings, battery, and free electric cables from running-board.

3. Disconnect windscreen wiper tube (carburettor end), speedometer drive (top end), oil pipe (front end), steering column dash bracket, and slide up column about eight inches.

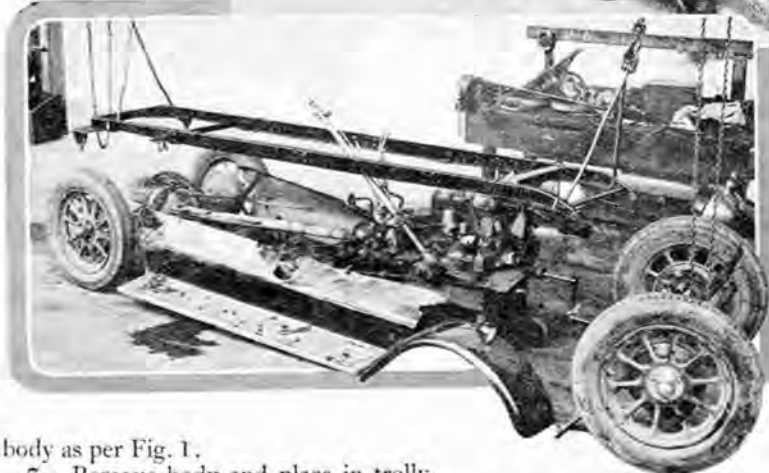
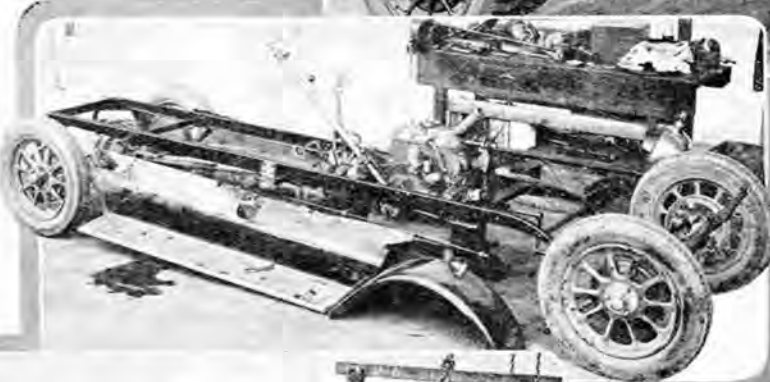
4. Disconnect electric wires at dynamotor, head-, side- and tail-lamps, magneto and electric horn (when horn is fitted on battery cover, free wires from valance).

5. Remove control rod assembly of dipping headlamps and all body holding-down bolts.

6. Be sure that all connections between body and chassis are disconnected and clear for lifting, then raise body sufficiently to enable two beams of wood three inches square and eight feet long to be placed beneath

on to a power unit carrier (as per Figs. 2 and 3, or use a suitable stand), but keep the lifting chain taut. Then remove engine tray clips from frame and engine bearer arm bolts.

11. Suspend rear end of frame sufficient to take the weight and remove all bolts holding front wings and running-board brackets to frame, and lower complete assembly to floor.



body as per Fig. 1.

7. Remove body and place in trolley.

8. Remove the following from chassis: speedometer cable, number-plates when fixed to frame, luggage grid or spare wheel carrier, headlamp brackets, brake cross-shaft assembly, f.w.b. compensating cross-shaft assembly, and brake pull-off spring clip.

9. Disconnect all shock absorbers from frame, f.w.b. rods at front axle end, steering lever drop arm, front end of exhaust pipe from manifold, and rear tail pipe from frame.

10. Raise front of chassis frame and remove front shackle pins and rear top shackle pins and then the front axle assembly should be removed. Now lower the chassis

12. Disconnect rear upper springs from frame and front lower shackle pins from rear springs, then remove shackles from suspension pins.

Type 1927

1. Remove all loose parts such as cushions, carpets, spare wheel, and petrol tin, sidescreens, etc.

2. Remove footboards, accelerator pedal, and tops of brake and clutch pedals, steering wheel, bonnet, radiator, petrol pipe, throttle control rod, rear wings and battery.

3. Disconnect main cable clips to body and ball housing, windscreen wiper tube (carburettor end), free from dash and tie to windscreen, speedometer drive (both ends), oil pipe (both ends), steering column dash bracket, and on Cowleys dash ventilator control. Dismantle instrument panel from fascia plate, and if care

is taken this need not be unwired, but wrapped in cloth to prevent damage and tied to metal dash frame.

4. Disconnect electric wires at dynamotor, head-, side- and tail-lamps, magneto, electric horn and dashlamp switch on Oxford models. If it is desired to remove instrument panel, disconnect all wires and remove panel. (See note No. 3.) In the case of saloon models, disconnect roof-light connection from instrument panel.

5. Remove fascia plate, dipping headlamp controlling lever and control rod assembly, all body holding-down bolts, including the six bolts which fix front of body to metal dash.

*Date of issue : July, 1928***Changing a Chassis Frame—continued**

6. Be sure that all connections between body and chassis are disconnected and clear for lifting, then raise body sufficiently to enable two beams of wood three inches square and eight feet long to be placed beneath body as per Fig. 1.

7. Remove body and place in trolley.

8. Remove the following from chassis : rear step bracket and number-plate when fixed to frame, luggage grid, spare wheel bracket when fixed, headlamp brackets, bonnet clips, brake compensating cross-shaft assembly, foot brake pedal with pull-off spring and clip. Tie all loose wires, speedometer cable and oil pipe to dash frame, and remove scuttle dash assembly from frame.

9. Disconnect all shock absorbers from frame, f.w.b. rods at front axle end, steering lever drop arm, front end of exhaust pipe from manifold, and rear tail pipe from frame.

10. Raise front of chassis frame and remove front shackle pins and rear top shackle pins and then the front axle assembly should be removed. Now lower the chassis on to a power unit carrier (as per Figs. 2 and 3, or use a suitable stand), but keep the lifting chain taut. Then remove engine tray clips from frame and engine bearer arm bolts.

11. Suspend rear end of frame sufficient to take the weight and remove all bolts holding front wings and running-board brackets to frame, and lower complete assembly to floor.

12. Disconnect the four top shackle pins of rear springs.

If the foregoing has been carefully followed in the order mentioned, the frame should now be completely stripped and ready for renewal. To fit the new frame, reverse the procedure.



Date of issue: July, 1928

ENGINE REMOVAL

Procedure to adopt when it is required to remove engine only from the chassis, leaving gearbox behind.
Models 11.9 h.p. and 14/28 h.p.

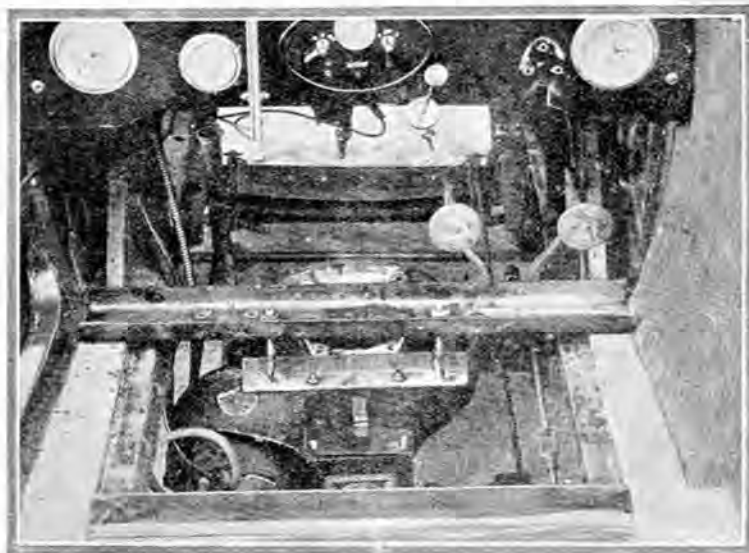
1. Drain off oil from engine and clutch and drain water.

2. Remove bonnet, *bonnet boards*, radiator, fan and belt, petrol pipe, spark plugs, brake and clutch pedal adjustable foot-pads, front floorboards, steering wheel, electric horn when fitted under bonnet, accelerator pedal and bracket when fitted on engine bearer arm.

It is also as well to remove both front wings to prevent them being damaged and to facilitate the removal of the front engine bearer arm bolts.

3. Disconnect oil pipe at front end, exhaust pipe at manifold joint, magneto switch wire at magneto end, ignition control, all carburetter controls, windscreen wiper tube, steering column, dash steady bracket, electric horn switch wire when on steering column.

Fig. 1. Showing girder in position and cover on gearbox.



Raising the Chassis

4. Raise front of chassis with lifting links and place stands, as shown in Fig. 3, under front wheels. Now remove engine trays, engine sump and steering column assembly. It is best to disconnect the steering drop arm at top end.

The chassis should now be lowered to the floor again.

Note.—This operation could also be executed by using a pit, but the above method is easier and quicker because the mechanic is working in a physically better position.

5. Remove clutch cover and gear lever cover assembly, then remove the clutch springs by using extractor "C," Fig. 2. Now fit a temporary sheet-metal cover over gearbox as shown by "B," Fig. 2. This prevents any foreign matter entering the box.

Making the Jig

6. The gearbox anchoring jig "A," Fig. 2, can now be fitted. This jig is a simple device, comprising a length of "U" section girder 27½ inches long (in this case a piece of an old chassis side member is used), two studs, and 12 inches of 1¼ by ¼ inch angle iron. Two ½ inch clearance holes are drilled in the girder 9 inches apart and equidistant from centre. Four holes are drilled in the angle iron, two being ⅜ inch diameter at 4½ inches apart and two suitable for tapping with ½ inch thread at 9 inches apart, both pairs of holes being equidistant from the centre.

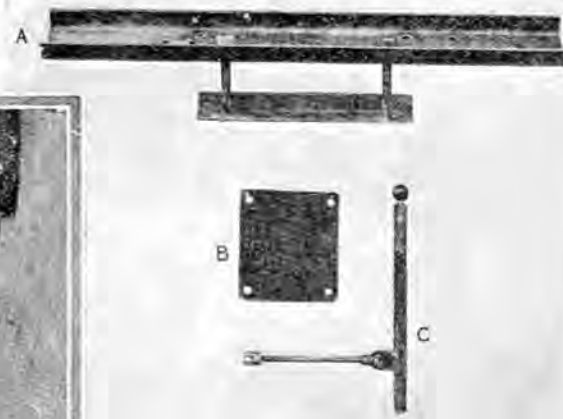


Fig. 2. A—Gearbox anchoring jig. B—Gearbox cover. C—Clutch spring extractor.

Suspension

The angle iron is now suspended from the girder by means of two ½ inch studs 6 inches long, one end of each stud being screwed to a length of 3 inches and the other ends screwed only sufficient to allow of them being fitted into the tapped holes of the angle iron and welded in position. The studs should be almost flush with the bottom of the angle iron in order that they clear the gearbox casing when the jig is in position.

As will be seen in Fig. 1, the girder rests in the sides of the body across the chassis, and the angle iron is fixed to the two forward studs on the top of the gearbox by nuts. When fitting the jig in position the nuts of the suspension studs should be adjusted to eliminate any play between the angle iron and girder. This jig can

Date of issue : July, 1928

Engine Removal—continued

also be used when the body is removed, in which case the girder of the jig rests directly on the chassis frame.

Note.—On models previous to 1927 a piece of tube or other suitable packing $1\frac{3}{4}$ inches in diameter should now be placed between the rear shackles and the hanger springs, as shown in Fig. 4, to prevent the front shackles of the rear springs turning over when the engine is removed.

The need does not arise for fixing the shackles on 1927 and later models.

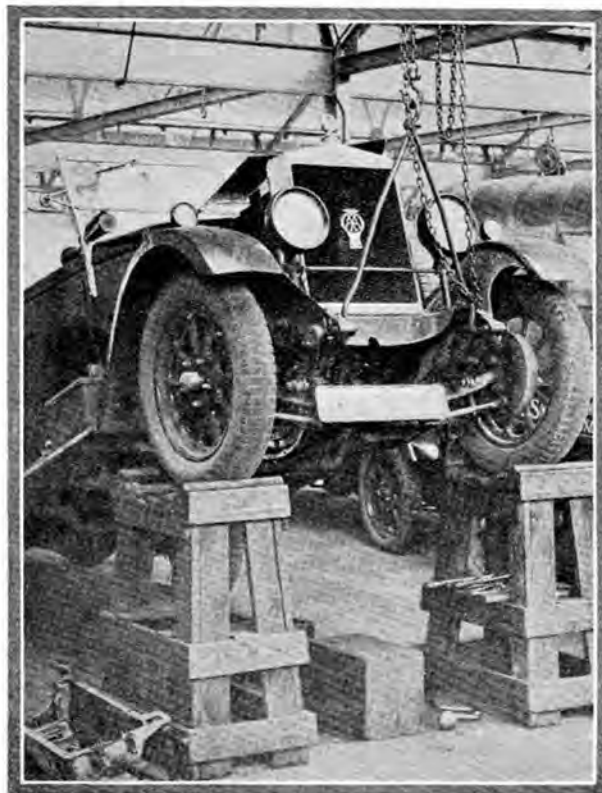


Fig. 3. The whole process is greatly simplified by hauling up the front of the car like this.

7. Remove the remaining gearbox to engine bolts and the nuts from engine bearer arm bolts.

8. Fit engine sling and connect to hoist and lift sufficiently to take the weight, then remove all bearer arm bolts. Now slide the engine forward sufficient to disengage the clutch pins and the engine can then be lifted out, but use care that the pump body is not damaged by contact with the chassis frame.

The engine may now be fixed to an engine stand, where it can be conveniently handled for overhauling or any other work for which it has been removed.

A simple engine sling is shown in Fig. 5 and a suitable engine stand in Figs. 6, 7 and 8 of Service Information No. CO/32.

Note.—Items italicised refer to models previous to 1927.

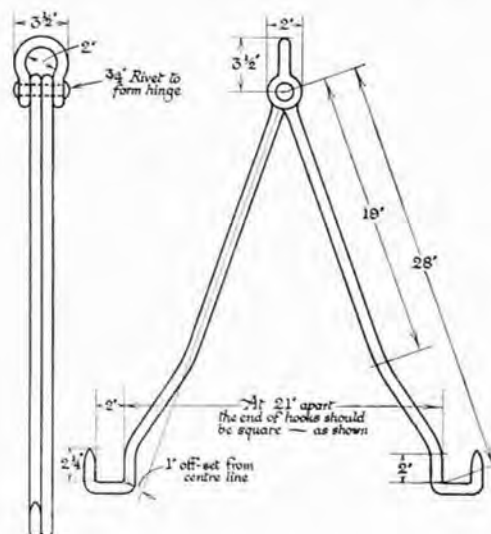


Fig. 5. Chasis lifting irons—made in $\frac{3}{4}$ " mild steel rod—showing more useful dimensions.

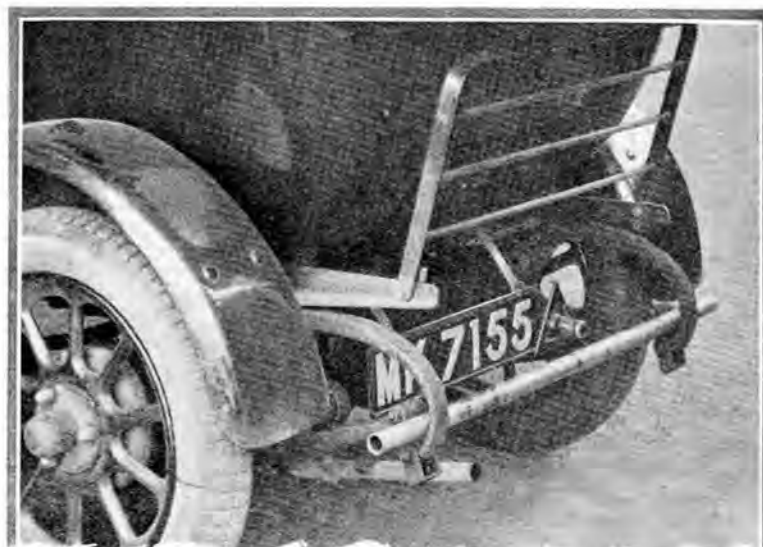


Fig. 4. This tube, to prevent the front shackles of the rear springs turning over, is only necessary on models prior to 1927.

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GEARBOX REMOVAL

Procedure to adopt when it is required to remove Gearbox only from the Chassis, models 11.9 h.p. and 14/28 h.p.

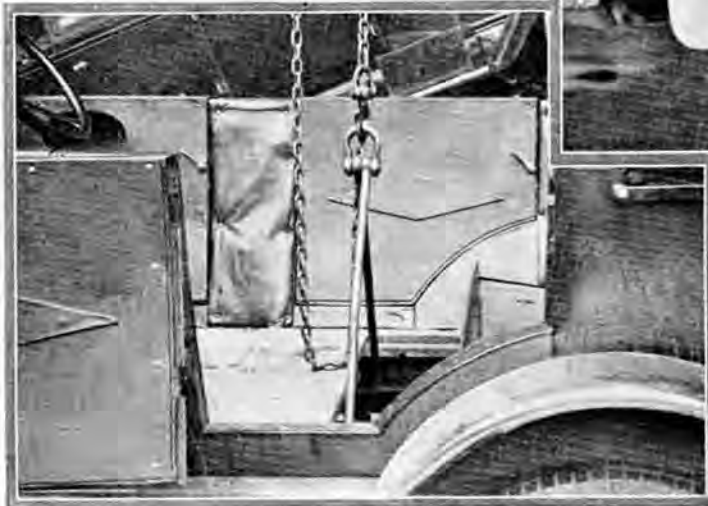
1. It is first of all necessary to remove the following: Front cushion, bonnet, front footboards, battery from 1927-28 models, oil from clutch and gearbox, clevis pins from hand brake lever rod and from all four rear brake-rods at points of connection to brake cross-shaft. Remove rear foot brake-rods from frame side member brake-rod steady brackets when fitted. On models where the foot brake pedal is mounted on clutch pedal shaft, remove clevis pin from brake pedal and the brake pedal stop bracket from frame.

Lifting Tackle

2. This completed, the rear of chassis should now be lifted by pulley blocks just sufficient to take the weight off the road wheels, and this is best accomplished by one of the following methods.

Open four-seater models. With hood down remove rear footboards and use lifting links on chassis frame.

Two-seater and any other models where the rear overhang of the body allows. The lifting links may be used on the rear dumb-irons as shown in the photograph, taking care that the hooks are placed beneath the bottom rivet head of the dumb-iron spring eye in order that the links do not slide up the dumb-irons when lifting. On similar models previous to 1927 the lifting links should be used on the rear upper springs.



In the case of four-seaters the floorboard is taken up and the links are attached to the chassis frame.

Saloon Bars

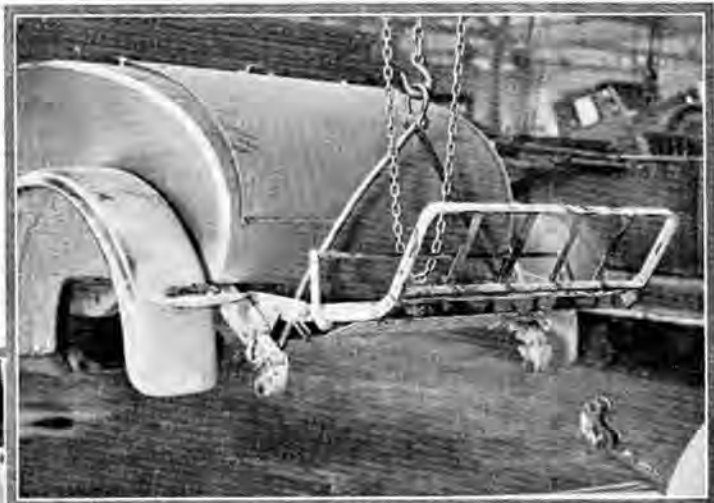
Saloons and other models where either of the above methods cannot be used. Two lifting bars are required. These bars can easily be made from 1½ in. round mild steel. One end of each bar should be shaped and in the opposite ends permanent eyes should be securely fixed as shown in Fig. 2. If more convenient, tubing or girder of suitable strength may be used instead of

round bar. A distance piece made of wood is also required, as shown in the two lower sketches.

In use the shaped ends of the bars are hooked over the top of the frame cross tube passing beneath the rear cross member (after having removed number-plate, when fixed on cross member) and the eyes of the bars are hooked to lifting links and separated by the wooden distance piece. (See Fig. 1.)

3. Disconnect the following: Rear shock absorbers, all wires to dynamotor and one battery cable on models where battery need not be removed. (See instruction No. 1.)

4. Remove the four rear spring shackle bolts, rear exhaust pipe and the ball housing flange bolts. The rear axle should now be moved back sufficient to disconnect the universal joint, after which the chassis



On two-seater models the links may be placed under the rear dumb-irons.

should be raised to allow of the rear axle being removed entirely from under the chassis; the latter may then be lowered to its natural level again.

5. Remove clutch inspection cover, gearbox cover assembly and all clutch springs, then place a temporary sheet-metal cover over gearbox to prevent any foreign matter entering. All gearbox to engine bolts and spring washers should now be removed, also the two nuts and spring washers from the two bolts which come through from each side of the cylinder block flywheel casing.

6. The gearbox is now ready for removal, and the easiest plan is for the mechanic to stand inside the frame, facing the engine, with one leg each side of the ball housing, then to take the weight and draw the gearbox straight back to disengage the clutch from the driving pins, taking care that the clutch driving pins are not bent by any side strain in the process. The box can then be lifted out and handed to someone outside the chassis.

Date of issue: July, 1928

Gearbox Removal—continued

Points in Reassembling

1. Both surfaces of gearbox to engine joint must be scraped clean and coated with a suitable jointing compound.

2. To facilitate the guiding of the clutch plates on the driving pins of the flywheel, when refitting the gearbox to the engine, a pilot stud about 4 in. long screwed into one of the top holes of the cylinder block will be found very useful. The gearbox is slid over this stud, which helps to take the weight while the clutch plates are placed in the correct position for sliding in the driving pins.

3. Before refitting the gearbox to the engine the clutch plates should be as forward as possible, i.e. with the front cork inset plate against the large clutch hub

rectified either by replacing the defective pin or inserting a washer behind the head of the pin or pins to the required thickness.

2. The drive gear shaft, it will be noticed, is drilled down its centre in order to deliver the engine oil pumped through the rear crankshaft journal to the clutch sleeve, in order to lubricate it. It is therefore essential that this hole be kept clean and free from any foreign matter while the unit is dismantled.

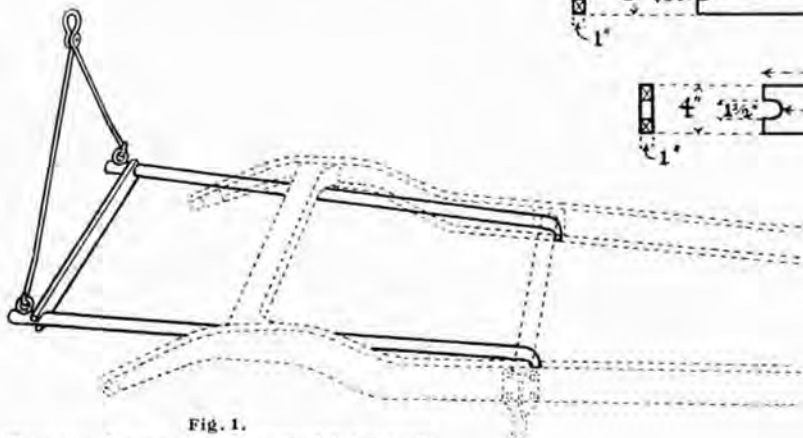


Fig. 1.

Lifting bars for use with saloon models are easily constructed from 1 1/2 in. mild steel.

washer, and the clutch pedal will then be well back. This is to prevent the rear clutch cork inset plate dropping off the rear of the clutch hub, with the natural result that the gearbox would not go home to its correct position.

4. Care must also be taken that the drive shaft spigot bearing enters truly into its housing in the flywheel.

5. Should it be necessary to remove any shim from the ball housing to take up play, the ball must be tested after final tightening of the housing flange bolts to see that it is perfectly free in its working movement.

6. In adjusting the clutch pedal be sure that there is a clearance of at least 3/8 in. between the footboard and pedal when the clutch is home.

7. Place oil in gearbox and clutch and see that engine oil is at its correct level. Brakes readjusted and all split pins fitted. Examine for any possible oil leaks.

CLUTCH AND GEARBOX REPAIRS

Special points to be noted

1. In fitting any new clutch plates, or in cases of "clutch spin" trouble, the plates should be examined to see that both clutch driven rings (cork inserted) are parallel to each other and that the clutch driving ring is parallel to the clutch pressure plate. If these rings are not parallel it is due either to one or more of the rings being buckled, in which case the buckled ring should be changed; or it may be due to separating pins of differing lengths, in which case this may be

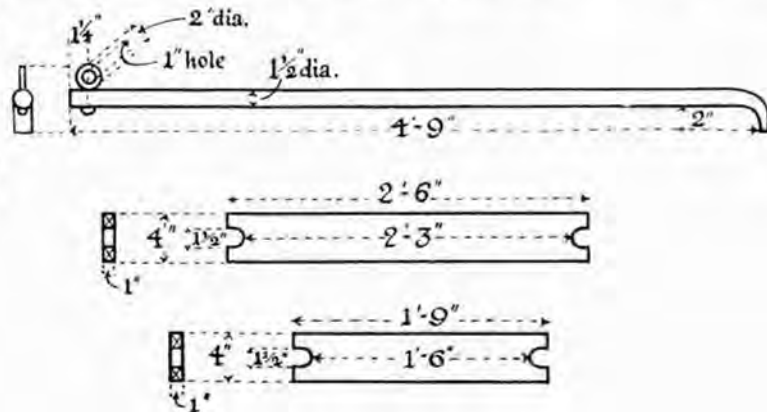
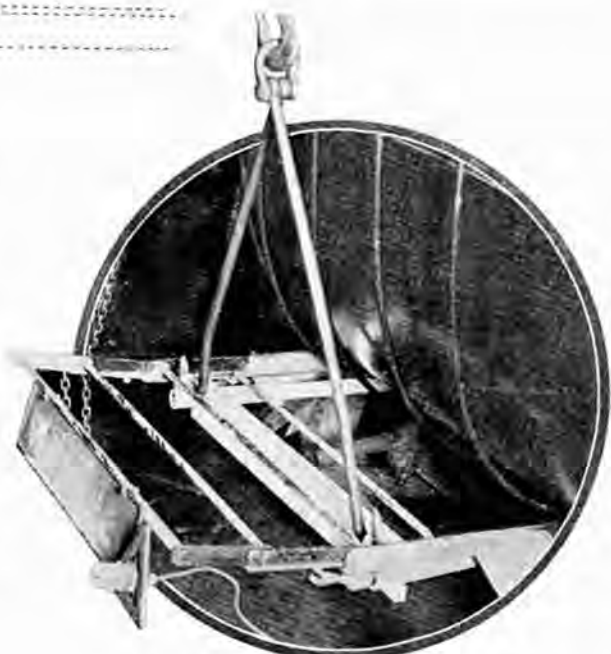


Fig. 2.

Dimensions of lifting bar and distance pieces. The larger distance piece is required for closed models for 1927 and 1928: the shorter for earlier cars.



Disposition of lifting bars and links on a 14/28 h.p. Morris-Oxford Saloon.

3. Examine clutch withdrawal race, drive gear bearing, spigot bearing and sliding shaft bearing to see that these are in good order.

4. The drive gear bearing nut should be examined to see that it is properly tightened on the shaft, as the clutch may become seized if this nut comes loose during running.

*Date of issue: July, 1928***Gearbox Removal—continued**

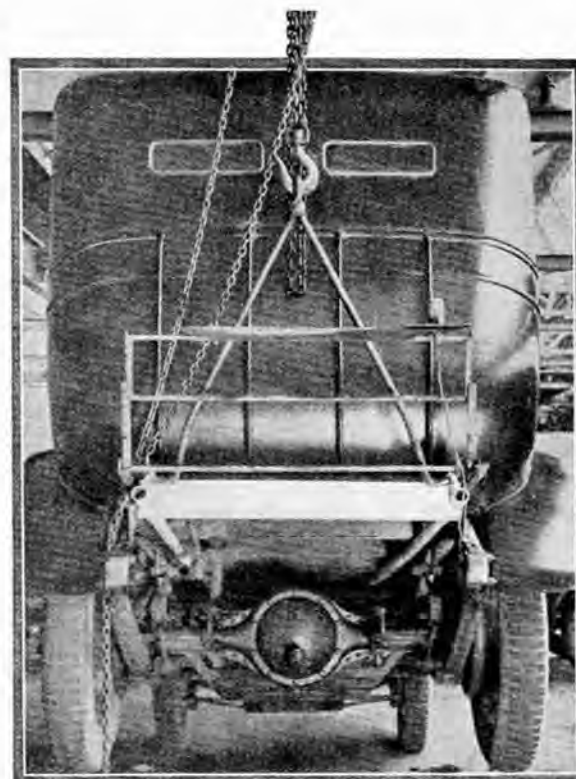
5. It is most important that the drive gear bearing cover retainer is fitted with the hole at the bottom. If fitted in any other position clutch oil will find its way into the gearbox and eventually into the rear axle.

6. In replacing the clutch pedal fork shaft (dynamotor end) see that the small cork is replaced, otherwise an oil leak will develop.

7. The drive gear bearing guard and sliding shaft bearing guard should possess only a running clearance with the respective bearing housings. If this clearance is wide the guards should be carefully closed against the bearing housings by tapping lightly around their outer edges with a suitable drift, otherwise gear oil may pass into the clutch chamber and the rear axle.

8. The sliding shaft is drilled down its centre so as to allow gear oil to pass through the spigot bearing to the universal joint, which it lubricates. See, therefore, that this hole is perfectly clear.

9. In cases where a heavy knock or lumpiness has been noticed when engine is idling, or a roughness experienced while accelerating up to approximately 18 m.p.h. on top gear, the trouble may be due to lateral play on the splines of the clutch pressure plate and starter chain wheel sleeve, providing the dynamotor sprocket is not slack on its shaft and the chain is correctly adjusted. Play on these splines only occurs after a considerable mileage, and even then only if the car has been subject to exceptionally hard going. For this reason it is a point which is sometimes overlooked by mechanics not too familiar with the transmission layout.



A rear view of the lifting bars and links, clearly demonstrating the simplicity of attachment.





Excessive Oil Consumption—11.9 h.p. and 14/28 h.p. Engines

EXPERIENCE has shown us that Dealers sometimes experience considerable difficulty in treating cases of excessive oil consumption, and frequently treatment involving unnecessary expense is indulged in. The following notes have been compiled, therefore, for their guidance.

1. We would emphasise the necessity of making absolutely sure that no leakage is taking place from the camshaft front cover, magneto cross shaft, engine sump, or starter chain, tappet and clutch inspection covers. In many instances, excessive oil consumption has been treated by fitting new pistons and other extensive work, when in reality external leaks have been responsible.

When examining for external leaks it is good practice to place clean paper on the floor underneath the power unit. The engine should then be run and allowed to warm up until the oil is perfectly fluid, bearing in mind that leakages might occur above the normal oil level, under which circumstances they would not be apparent with the engine at rest.

2. Make sure that the dipper tray does not fit too snugly against the walls of the engine sump, as oil which is thrown up by the big-ends will then merely drain back again into the tray and tend to cause flooding. There should be a gap of at least a clear $\frac{1}{8}$ in. all round the tray except at the back end under the rear main bearing. Commencing at Engine No. 273698 the rear of the tray has been specially modified to extend right up to the wall between the crank-case and clutch chamber.

3. Owners are advised in the *Morris Manual* to maintain the oil level in the engine sump at the "full" mark, as indicated on the dipper stick. It has been found, however, in certain instances, that a $\frac{3}{4}$ oil level has resulted in a marked decrease of oil consumption with no detrimental effects. This is explained by the fact that a lower oil level in the engine sump reduces surging of oil over the edges of the dipper trough.

4. Ascertain whether there is oil percolation from the engine to the gearbox, via the clutch chamber. This is shown by admixture of engine and gear oil in the gearbox.

Such percolation will reveal one of two irregularities or—in very rare circumstances—a combination of both.

(a) A blowhole, crack, or porous spot in the front wall of the gearbox.

(b) That the drive gear bearing nut immediately in front of the gearbox mainshaft forward ball bearing is not functioning correctly as an oil trap.

With regard to the latter, careful study of the sectional illustration of the complete power unit which figures in the *Morris Manual* will show the drive gear bearing nut screwed on to the gearbox drive shaft. This part is machined to a sharp edge and revolves with the shaft inside the drive gear bearing cover retainer, the latter being bolted to the gearbox. In the bottom of the retainer is a drainage hole. It will be understood that any oil collecting on the gearbox drive shaft, which tends to run along towards the gearbox, will be thrown off the rim of the drive gear bearing nut into the drive gear bearing cover retainer, and will drain back into the clutch housing through the drainage hole previously mentioned.

This successfully prevents the passage of oil from the clutch into the gearbox.

Occasionally, however, as a result of defective assembly or workmanship, the drive gear bearing cover retainer is placed incorrectly, so that the oil drainage hole comes either at the side or at the top. It has been found, but very rarely, that the hole in the shroud has not been punched out properly and that free drainage is therefore impeded.

The location of the drive gear bearing cover retainer may be ascertained by removing the clutch inspection cover and the plug under the starter chain trough. If a light is held over the clutch, the drainage hole can be seen on looking upwards through the plug hole in the base of the clutch chamber.

5. Assuming that the foregoing points are in order, the trouble may probably be due to oil passing the pistons. This condition is indicated by an excessively smoky exhaust, but it does not necessarily follow that new pistons or piston rings are required.

If, upon examination, it is decided that the condition of the cylinder bores is satisfactory, i.e. the taper does not exceed .004 in. and that the piston skirt clearances do not exceed .007 in., considerable benefit, if not total rectification of the excessive oil consumption, can be achieved by fitting a piston ring of the slotted type in either the second or bottom ring groove of each piston. When slotted piston rings are fitted it is necessary to drill four oil drainage holes $\frac{3}{32}$ in. in diameter through the piston walls at the back, in the centre of the ring groove. All oil drainage holes should be drilled at right angles to the piston face and slightly countersunk. (See illustration.)

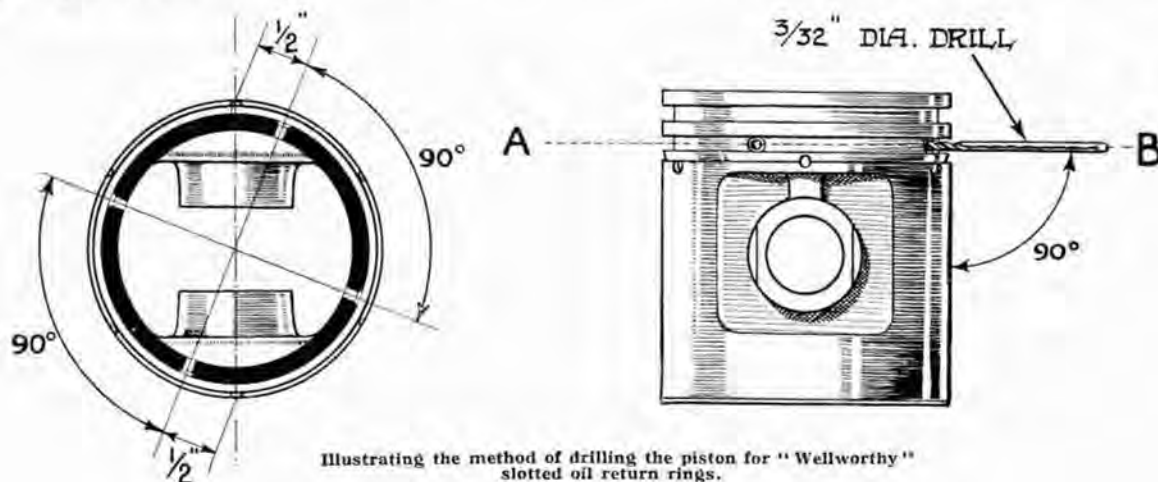
It should be noted, in ordering piston rings, that the special slotted type is referred to, the same as those fitted on the six-cylinder engines. When ordering these special rings, this particular type should be specified.



Date of issue: October, 1928

Excessive Oil Consumption—continued

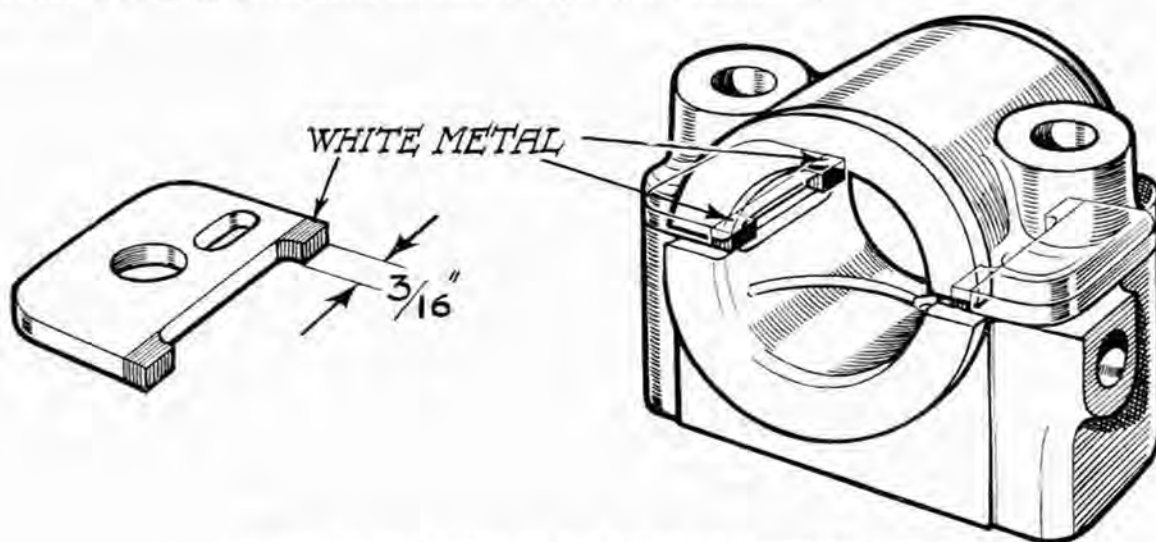
The actual position of the oil drainage holes is controlled by the type of piston. On those pistons where the gudgeon pin bosses are drilled with an oil supply hole from the groove under the bottom ring, the drainage holes should be drilled so that two of them are situated $\frac{1}{2}$ in. from the existing holes, and the remaining two are 90° to the holes just drilled. (See illustration.) When no oil supply holes are provided for the gudgeon pins, the four oil drainage holes in the piston ring groove can be drilled, two immediately over the gudgeon pin bosses and the other two at right angles to them.



Illustrating the method of drilling the piston for "Wellworthy" slotted oil return rings.

If new pistons are required on account of excessive skirt clearance, reference should be made to the "Morris 11.9 h.p. and 14/28 h.p. Service Information Manual" under CO/22 sheet 6. The bottom limits of piston skirt clearances should be used in view of the trouble undergoing rectification.

Having given the attention detailed above, the trouble should be overcome. If, however, after an extended test it is found that the oil consumption figure is still unsatisfactory, it will be necessary to take steps to restrict the flow of oil from the crankshaft main bearings. This is best accomplished by building up the edges of the main bearing liners with solder or white metal, so that they actually bear on the crankshaft. It will be observed that, in the ordinary way, there is a considerable gap between the two halves of the bearing, through which oil may pass readily. When the engine is running at speed, the oil is literally sprayed out from these points. By building up the liners as suggested, however, the escape of oil is restricted. Care must be taken to see that this building up is not carried too far, and we recommend metallizing a liner at each end of its inner face (that is, the part facing the crankshaft journal) for about $\frac{3}{16}$ in. to $\frac{1}{4}$ in., leaving the centre free. This method will prevent any tendency for the liners to act as wipers and will not detract from the efficient lubrication of the main bearings. (See sketch below.)



Excessive delivery of oil from the main bearings can be rectified by building up the ends of the inner faces of the liners with white metal as shown.



Date of issue : February, 1929

Oil Leaks from Engine Sump and Dynamotor Cover

WE give below a few points which should carefully be borne in mind when replacing the engine sump and dynamotor cover on the 11.9 h.p. and 14/28 h.p. model cars. As we receive a number of complaints regarding oil leakages after repairs, we fear that some of our Dealers are not yet familiar with the correct method of fitting these parts to ensure oiltight joints being made.

Engine Sump. When the sump is dismantled the faces of the cylinder block, clutch casing and sump should be cleaned thoroughly, and any traces of the old paper joint or jointing removed.

Secondly, a thin coating of gold size should be applied to the horizontal face of the sump, and the paper gasket placed carefully in position. The gold size will keep the gasket in place.

The vertical face of the sump, together with the clutch casing, should now be fairly well smeared with liquid packing, such as "Hermetite." We do not recommend white lead and gold size or similar mixtures, as they are liable to contain hard lumps.

When this has been accomplished the sump should be placed carefully in its position and held by inserting two bolts, finger-tight only, at the starting handle end, one on either side of the engine.

The next operation is to draw up the rear end of the sump by tightening, as hard as possible, the two bolts (one long and one short) immediately in front of the engine lugs on either side—those in closest proximity to the rear main bearing felt washer. After this, the two long bolts locating the clutch casing to the sump, at the bottom, should be inserted and also tightened up as hard as possible. If the two bolts first tightened, near the main bearing felt washer, are slackened off, and the remaining two locating the clutch casing to the sump inserted and screwed up hard, the rear face of the sump will be drawn firmly together, thus making an oiltight joint.

The remaining bolts on either side of the sump, together with the engine trays, should be replaced, one at a time, working from the rear of the engine towards the front.

Dynamotor Chain Cover. As a general rule, it is only possible to use the dynamotor cover gasket on two occasions, as continued tightening of the cover bolts compresses the gasket in the vicinity of the bolt holes, making the surfaces of the cork uneven.

To render a gasket serviceable for a second time, jointing should be used on one side only, and, as it is desirable to keep the gasket in position on the dynamotor housing when the cover is removed, the surfaces of the housing should be coated with a reasonable quantity of "Hermetite" jointing after all traces of the original gasket have been removed with a suitable scraper.

Before refitting the cover it is advisable to test both faces with a "straight-edge," as there is a possibility that the previous tightening of the bolts may have buckled the surfaces opposite to the bolt holes. Any high spots can be removed by the careful use of a hammer, after the opposite face has been placed hard against a flat surface. After this, the gasket should be carefully shaped round the cover, and held in position by inserting all four bolts. When refitting to the dynamotor housing, the two bolts facing towards the rear of the car will fall from their holes, but by this time the gasket can be held in position by pressing the cover firmly against the dynamotor housing. The two bolts towards the clutch and locating the shorter face of the cover should be inserted and tightened until the cover is drawn sufficiently into place to allow the remaining two bolts to be inserted and partially tightened.

All four bolts should now be tightened down a fraction of a turn at a time, when, if the outside edges of the cover (especially between the bolt holes) are tapped lightly with the ball peign end of a hammer, assistance will be given to the cover to sink or bed itself into the cork gasket.

The foregoing remarks will also apply when a gasket is being used a second time, but, in this case, it is permissible to coat both faces of the gasket and cover with "Hermetite" jointing.

Date of issue : December, 1929

Brake Adjustment on 1930 11.9 h.p. Morris-Cowley and 10-cwt. Light Van Models

ON and after Morris-Cowley Chassis No. 320377 and 10-cwt. Light Van Chassis No. 320736 all 48 in. track Morris-Cowley and Light Van models will be fitted with a modified type of hand and foot brake operating gear, which provides greater brake efficiency.

The brake cross shaft is carried underneath the chassis between two brackets, and operates on rollers at either end which revolve on pins located to the brackets. An Enots oil nipple is provided on each roller pin so that lubrication can be afforded to the bearing surfaces.

There is no brake compensating device between the front and rear axles, distribution of pressure being obtained by the use of double levers on the cross shaft.

Adjustment on each individual brake pull rod enables each pair of brake-shoes to be treated independently for balancing purposes, but, in addition, both the hand and foot brakes are provided with a main adjustment which will adjust the shoes on all wheels simultaneously. The advantage to be gained from this arrangement is that, after the liners have become bedded down to their drums and the brakes properly balanced, all further adjustment needed can be obtained by means of the main adjustment. This dispenses with the necessity for balancing on each occasion the brakes are taken up, and the balancing adjustment should last until the brake-shoes require re-lining.

The independent adjustment for each pair of shoes is obtained by screwing the operating rods, at the cross shaft end, into the yokes located on the cross shaft levers. Each rod is provided with a hexagon and a locking device in the form of a lock nut which bears against the yoke. The other end of each rod is passed through the fork joint, and is formed with a collar acting as a stop for the fork end, which is thus allowed to turn in the rod.

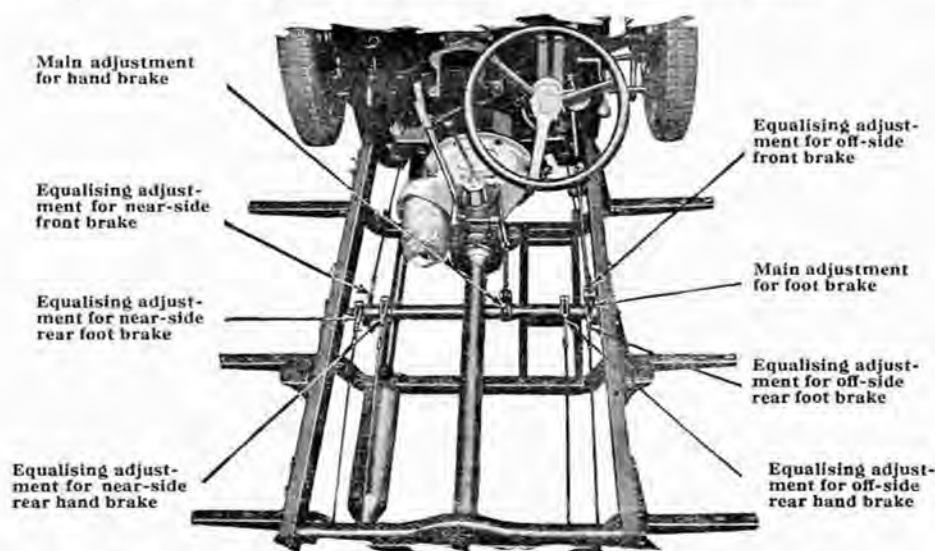
The main adjustment for both hand and foot brakes consists of a large wing nut fitted to the brake-rods leading from the foot pedal or hand lever to the cross shaft. A smaller wing nut on the inside of the rod, bearing against the cross shaft lever trunnions, provides a locking arrangement in both cases.

To balance, after re-lining, all four wheels should be jacked up until clear of the ground.

By slackening off the lock nuts the brake-rods can be turned by their hexagons until their respective set of shoes commence to bind in their drum. Sufficient braking pressure can then be applied to each wheel by tightening the main adjustment wing nuts. This will enable the operator to check again the individual adjustment for each wheel.

After balancing in this manner the final adjustment is obtained by slackening off the main adjusting wing nuts until the wheels are free to revolve, the foot pedal and hand lever having at least 1 in. travel before the shoes come into operation. The lock nuts should then be tightened up, after which the car may be given a road test on a dry macadamised surface, where balance can be finally checked by road surface marks.

Providing that the brake liners are well bedded down to their drums, once the brakes are properly balanced there should be no necessity to alter the independent adjustment until the liners are replaced.



Here are shown the adjustments provided on the Morris-Cowley brake gear. The equalising adjustments should only be used when the brakes are out of balance, the main adjustment being used on all other occasions. Before using the large main adjustment wing nuts, it is, of course, necessary to slack back the smaller locking wing nuts bearing against the other side of the trunnion pin.



MODEL : MORRIS 11.9 H.P. (1931)

No. OF SHEETS 4

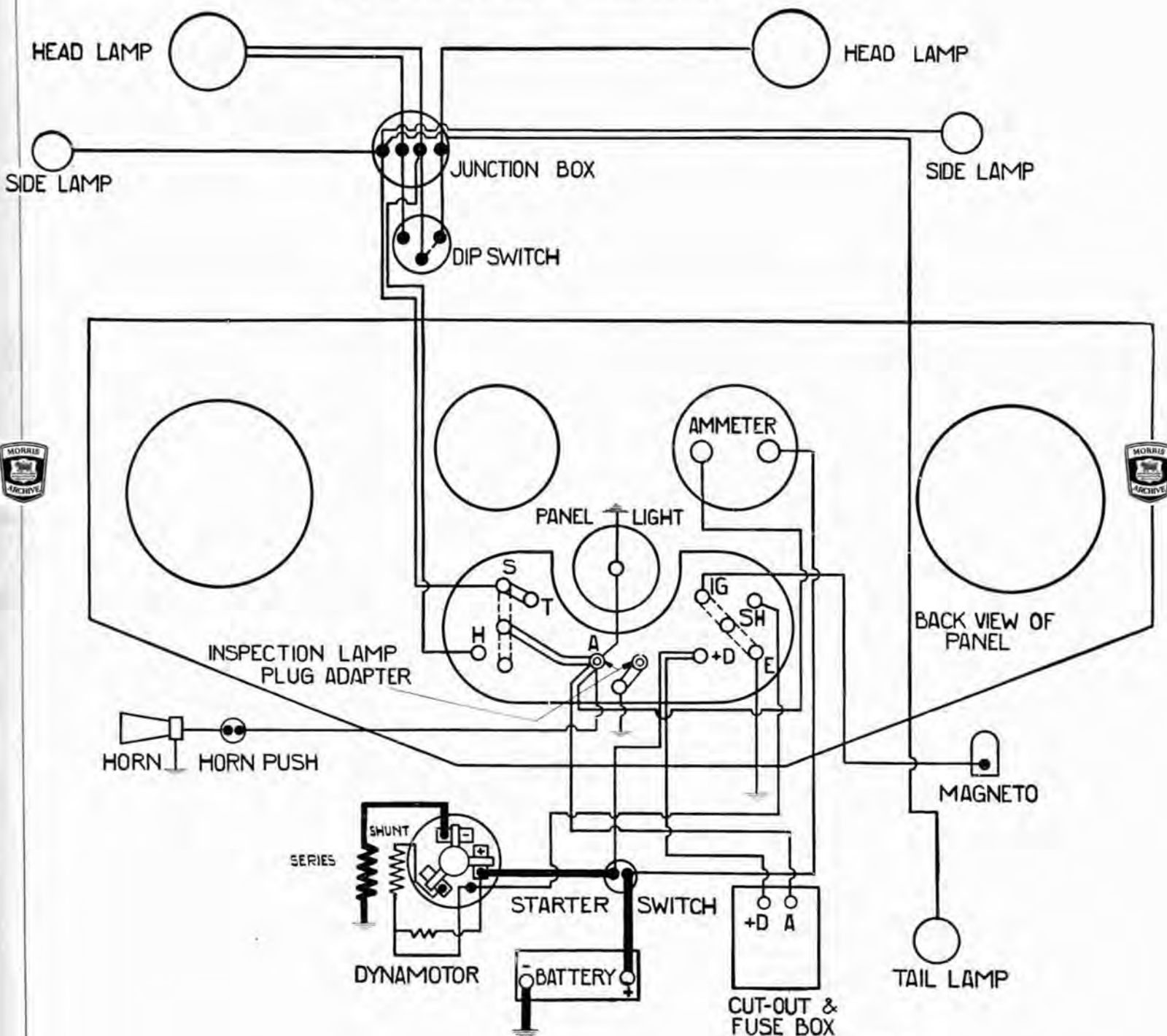
SHEET No. 1

Date of issue : January, 1931

Lighting and Starting System

WIRING DIAGRAM FOR 12-VOLT EQUIPMENT (EARTH RETURN)

FITTED TO 11.9 H.P. MORRIS-COWLEY CARS (1931)



Dynamotor - - - A900R
 Switch - - - SO5
 Cut-out - - - CF1

Particulars of Bulbs

Headlamps :- B.A.S. No. 1S.
 Side, tail and panel lamps :-
 B.A.S. No. 8S.



Continued



MODEL : MORRIS COWLEY (1932)

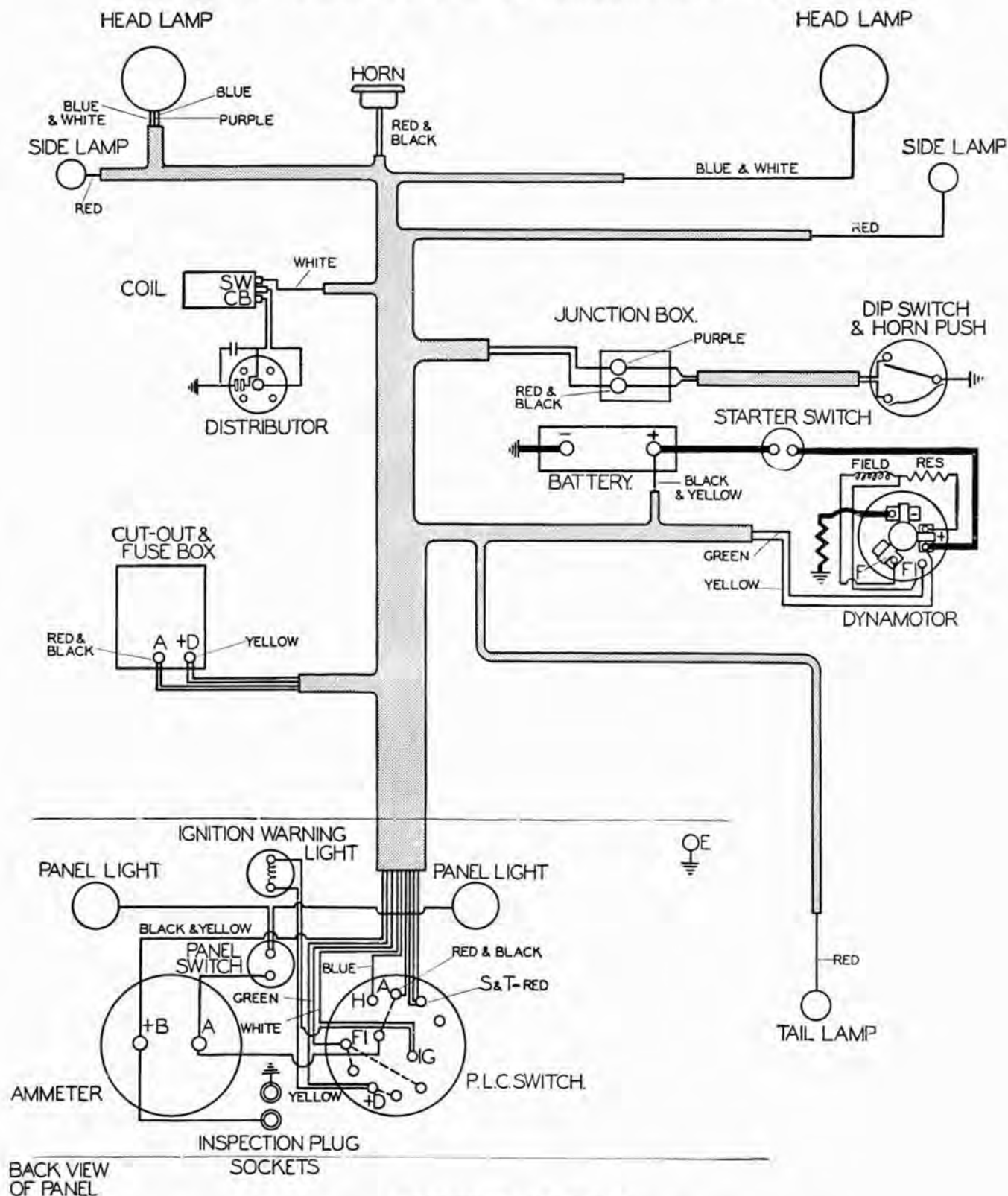
No. OF SHEETS 4

SHEET No. 2

Date of issue : February, 1932

Lighting and Starting System

WIRING DIAGRAM FOR 12-VOLT EQUIPMENT (EARTH RETURN)
 FITTED TO 11.9 H.P. & 14/32 H.P. MORRIS-COWLEY CARS (1932)



PARTICULARS OF BULBS

Headlamps	...	...	B.A.S.	No. 4S	12 volts	36 watts
Side, tail and panel lamps	...	...	B.A.S.	No. 10S	12 volts	6 watts
Ignition warning lamp	...	...	M.E.S.	No. 252	2.5 volts	.5 watts

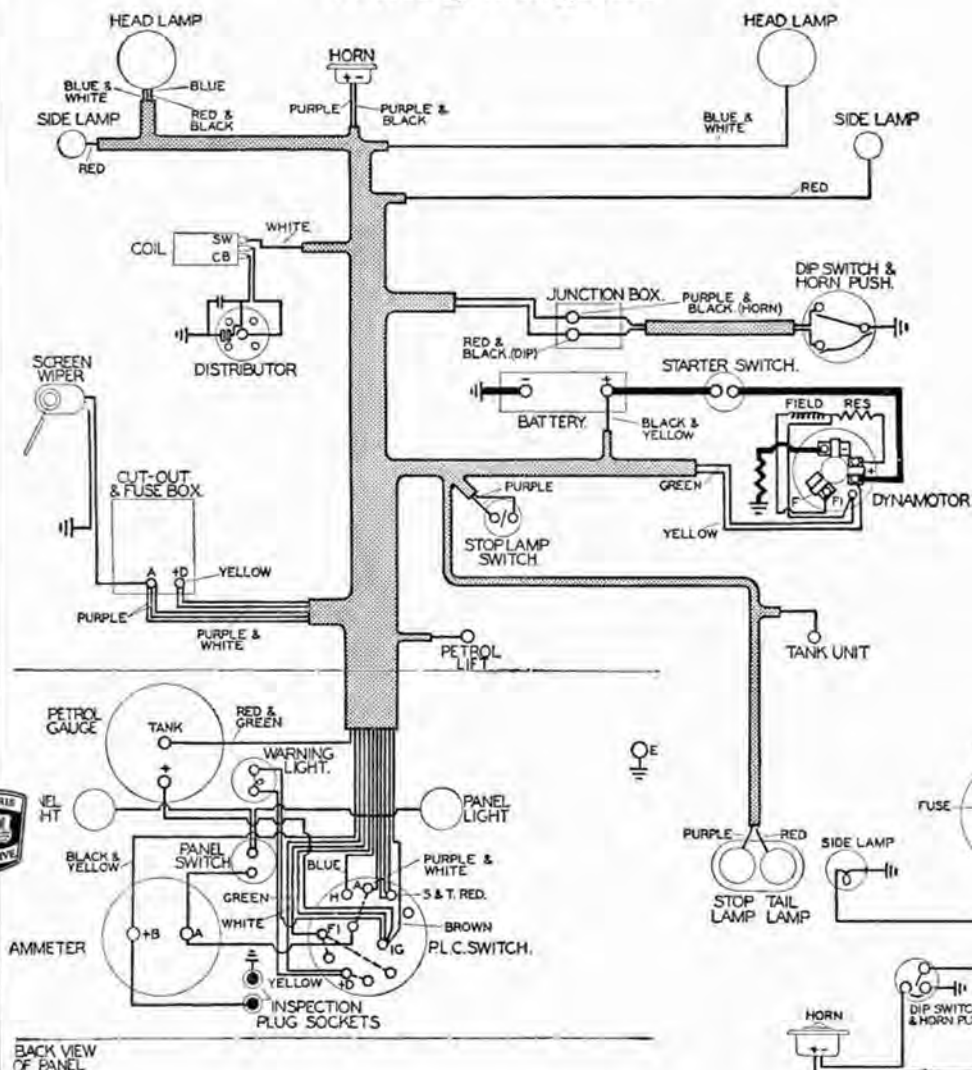


Continued



Date of issue : March, 1933

Wiring Diagram



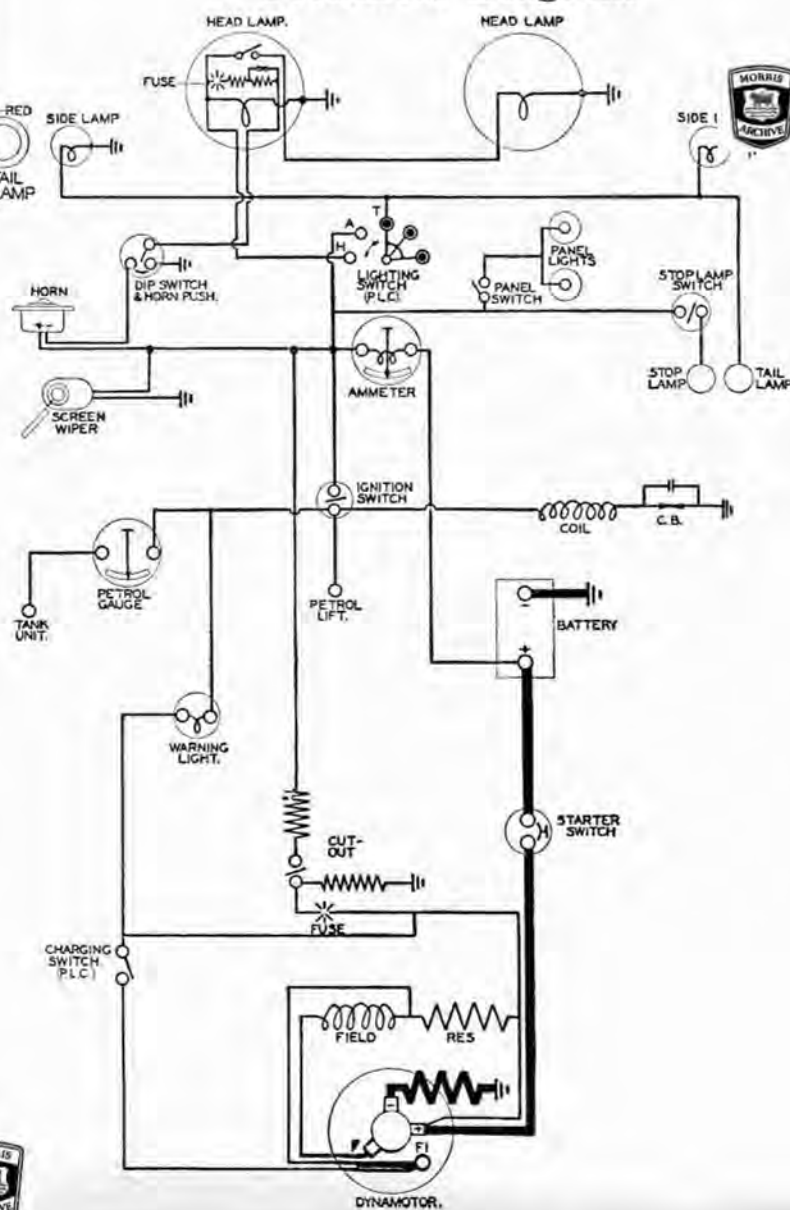
NOTE.—Shaded portions show where cables are braided together in a protective sheathing.

Colours indicate coloured sleeveings on ends of leads.

A fuse is housed in the cut-out unit for the dynamotor charging circuit.

Indication that it has blown will be that the ammeter will show no charge reading when the car is running under normal day-time conditions. Spare fuse strips are fitted to one of the fuse posts.

Technical Diagram



Data for Lucas Equipment

Dynamotor	...	...	...	A900R
Switch	...	...	...	PLC
Cut-out	...	...	...	CF1
Coil	...	...	...	Q12
Distributor	...	...	...	DJH4

Bulbs

Headlamp	...	...	...	B.A.S. No. 4S
Side, stop, tail and panel lamps	...	...	...	B.A.S. No. 10S
Ignition warning lamp	...	...	...	No. 252 M.E.S.

Fuses

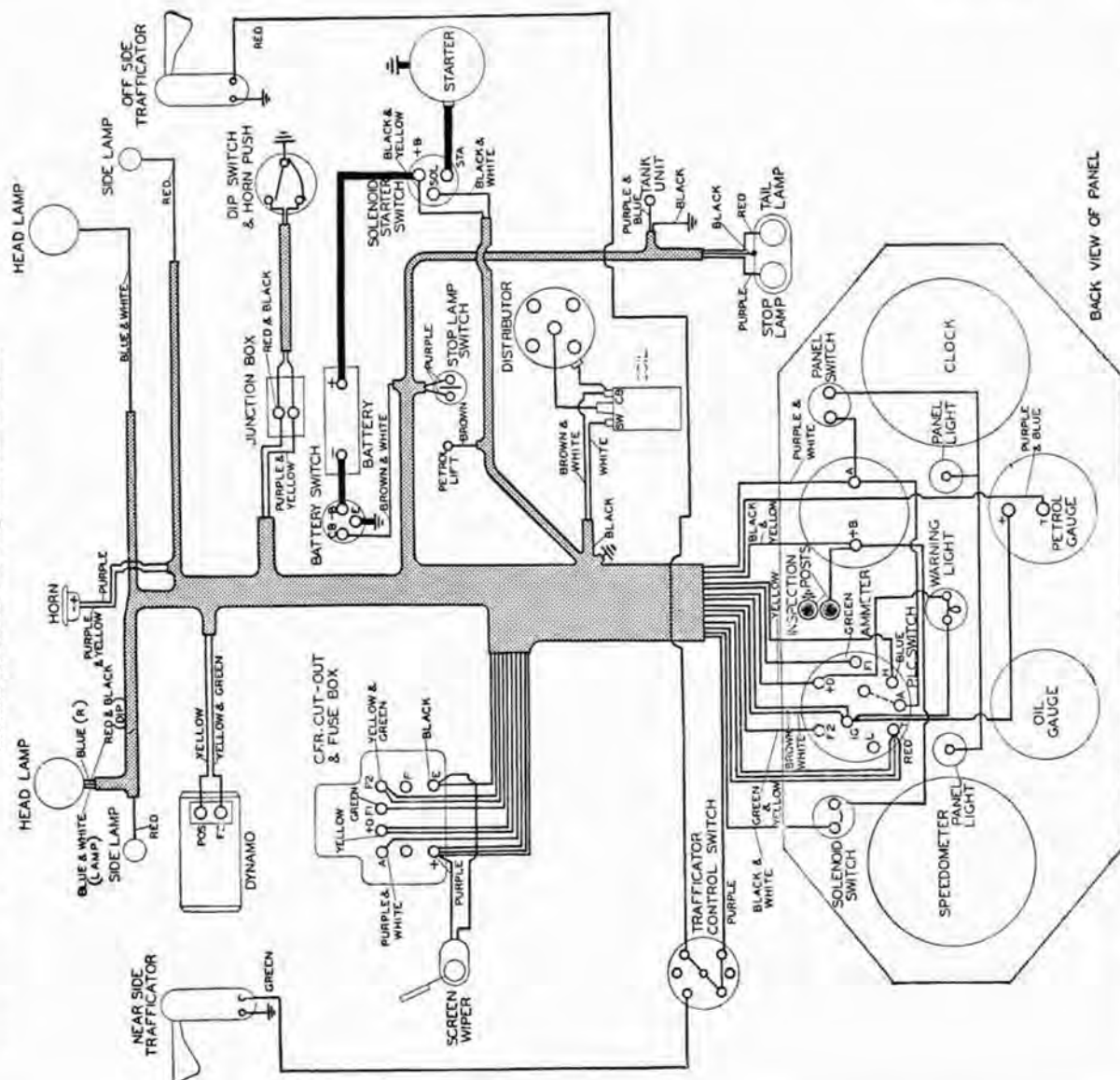
Dynamotor fuse in cut-out box (40 amp.)	...	...	...	No. L1898/4
(strip type)	...	...	...	FA5
Dipping reflector fuse (5 amp.)	...	...	...	



Date of issue: April, 1934

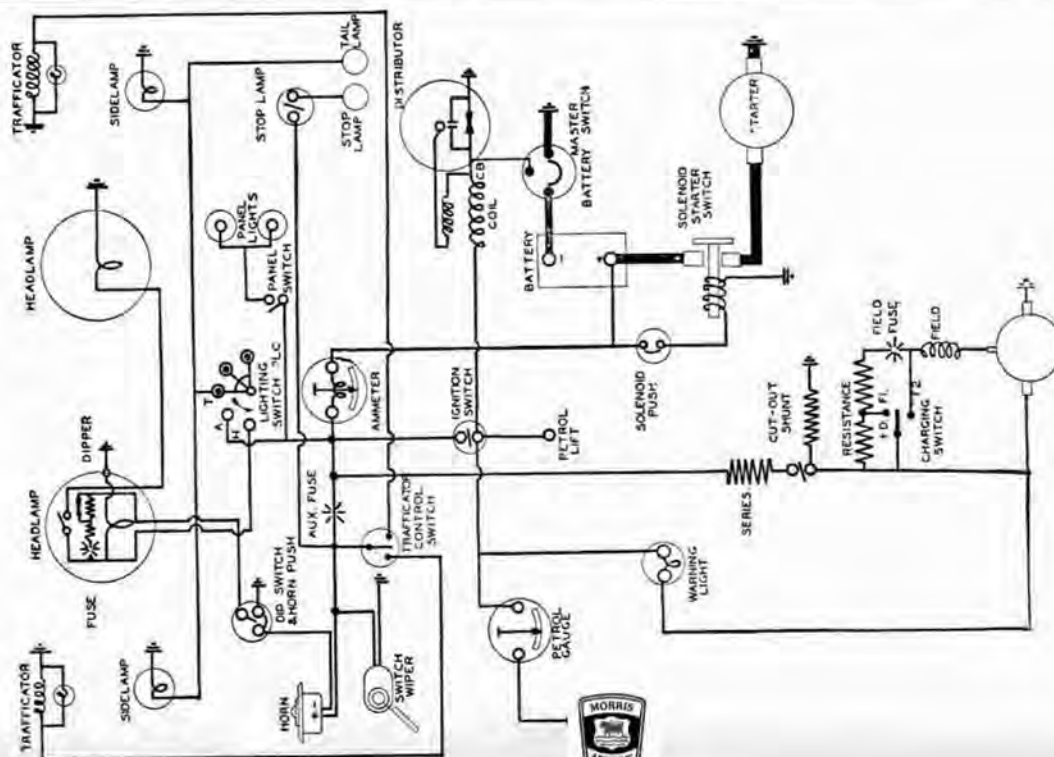
WIRING DIAGRAM

NOTE.—Shaded portions show where cables are braided together in a protective sheathing. Colour references indicate coloured sleeveings on ends of leads.



Data for Lucas Equipment		Bulbs	
Dynamo	... C45A	Headlamps	... BAS No. 4S
Starter	... M418A	Side, stop, tail and panel lamps	... BAS No. 10S
Switch	... PLC	Ignition warning lamp	... No. 252 M.E.S.
Cut-out	... CFR	Trafficators	... No. T120F
Coil	... Q12		
Distributor	... DJ4A		

TECHNICAL DIAGRAM



Wiring of Trafficators
On some equipment the Trafficators are wired in series with the ignition switch through a separate fuse.

Fuses	amp.
Dynamo field	... 3.75
Auxiliary accessories	... 25
Dipping reflector	... 5
Separate Trafficator (when fitted)	... 25

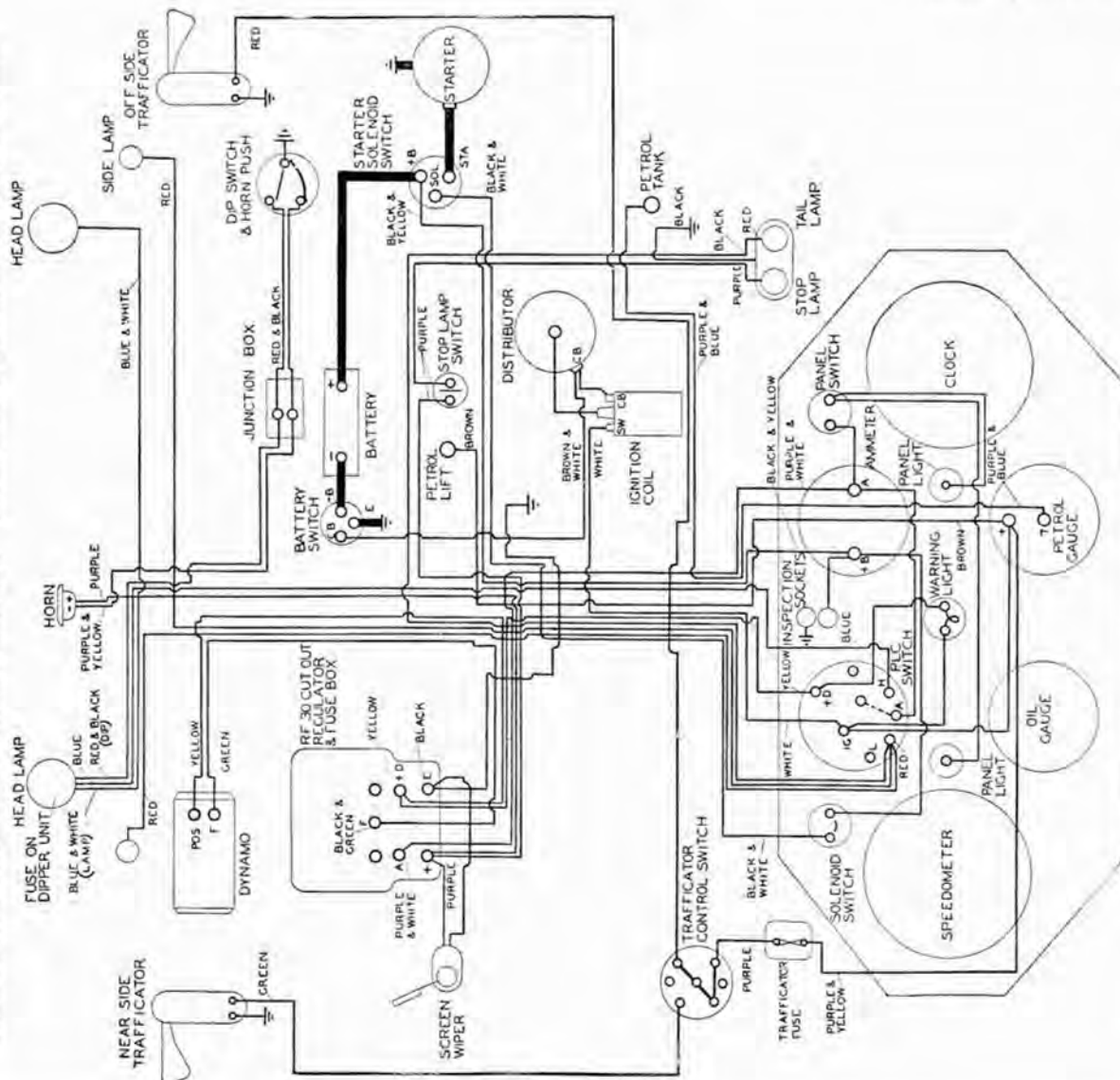




Date of issue : March, 1935

WIRING DIAGRAM

Cables are braided together in a protective sheathing. Colours indicate coloured sleeveings on ends of leads.



Particulars of Bulbs

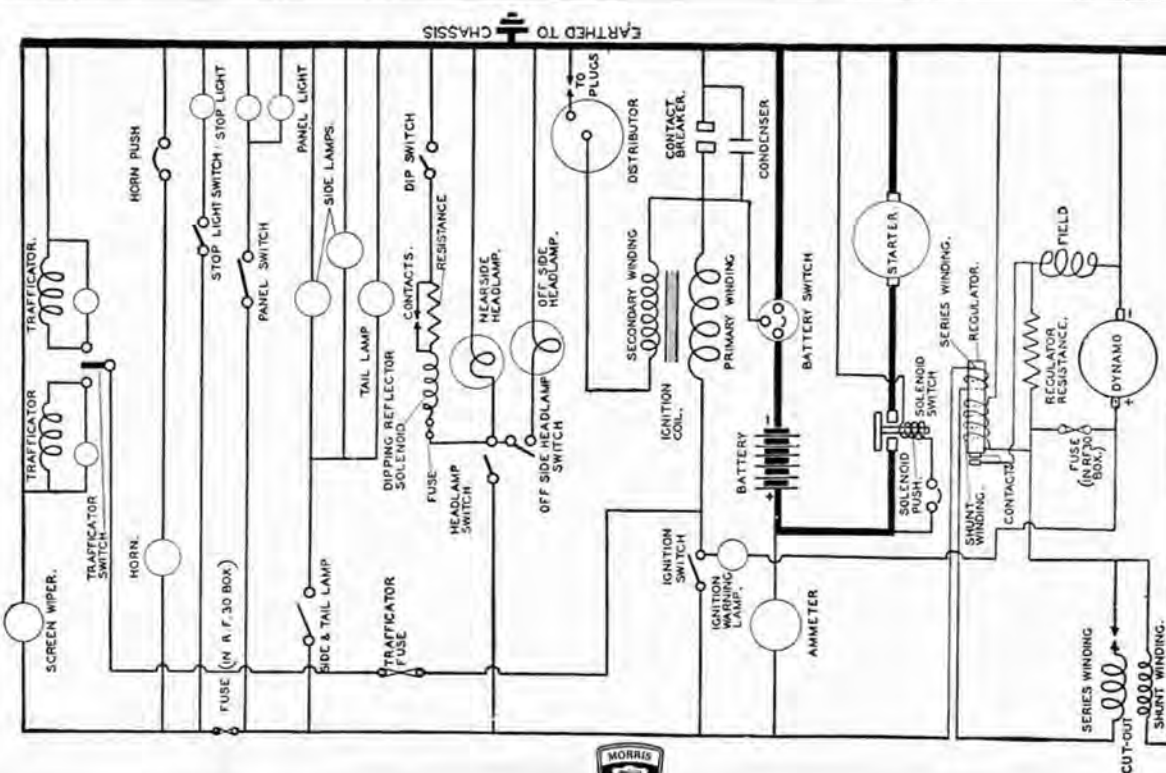
Headlamps	...	B.A.S. No. 4S
Side, stop, tail and panel lamps	...	B.A.S. No. 10S
Ignition warning lamp	...	No. 252 M.E.S.
Trafficators	...	No. T126F

Data for Lucas Equipment

Dynamo	...	C45H
Starter	...	M418A
Switch	...	PLC
Cut-out, regulator and fuse box	...	RF30
Coil	...	Q12
Distributor	...	DK4A (Twelve-Four)
	...	DK6A (Fifteen-Six)



TECHNICAL DIAGRAM



Fuses

Dynamo main	...	35 amperes
Auxiliary accessories	...	25 "
Dipper unit	...	6 "
Trafficators	...	25 "



Date of issue: January, 1931

Engine and Gearbox Overhauls

11.9 h.p. and 14/28 h.p. MODELS

WITH owners who use their cars continuously for business purposes the element of time is of paramount importance, and in order that Dealers may render prompt service on engine and gearbox overhauls for the above models we are prepared to forward immediately on receipt of order, quoting existing engine number, also chassis number, a thoroughly re-conditioned service engine and gearbox unit at standardised charges, as under, against the return of customer's own unit.

Many owners who use their cars for business purposes cannot conveniently afford to have their vehicles off the road during the time required to undertake a comprehensive overhaul, but by this scheme the exchange of a unit can be accomplished in approximately one day, as compared with five to ten days for the overhaul of the original unit. The charges are very moderate—the trade discount liberal—and the re-conditioned units can be thoroughly relied upon and will carry a six months' guarantee.

The exchange of units under this scheme only applies where a complete overhaul to both engine and gearbox is required, and units cannot be exchanged where only specified work is ordered.

We outline below detailed information concerning the scheme, which should be very carefully noted:—

(a) **Packing and Dispatch.** Orders for replacement re-conditioned power units should state existing engine and chassis numbers, and be sent to the Service Department, Morris Motors Ltd., Cowley, Oxford. All units will be dispatched immediately on receipt of order, per Goods Train, carriage paid, which will be chargeable.

Dealers should always await the arrival of the replacement unit and then transfer all external assemblies from the original unit to the replacement unit.

The original unit should then be sent in our packing case, bearing sender's name and address, per Goods Train, carriage paid, addressed to:—

Morris Motors Ltd.,
Service Department,
Cowley,
Oxford.

(b) **Constitution of Re-conditioned Unit.** Engine, gearbox, clutch, gear and brake levers, clutch pedal, camshaft, fan pulley, fan assembly, universal joint and starting handle, but **not** including magneto, dynamotor, carburettor or sparking plugs.

It will be readily realised that these latter parts should also be put into first-class condition if the best results are to be obtained from the engine, and, if necessary, should be sent to the manufacturers for overhaul.

(c) **Specification of Overhaul.** Completely stripping engine, clutch and gearbox, re-boring cylinders, fitting new pistons, rings and gudgeon pins, thoroughly re-conditioning and fitting new parts where necessary, re-assembling and testing.

All re-conditioned power units are modernised as far as is practicable.

(d) **Prices and Discounts.** At the time of dispatch these re-conditioned units will be invoiced, for record purposes only, at £48 for the 11.9 h.p. and £56 for the 14/28 h.p. units, less a discount of twenty-five per cent. to all Morris Distributors and Dealers, but the debit will be subsequently adjusted on the receipt by us of customer's original unit, as specified in paragraph (b), by the issue of a credit note for the difference between the said invoice figure and the standardised charges for these re-conditioned units.

The following standardised charges for re-conditioned units are subject to a discount of twenty-five per cent. to all authorised Morris Distributors and Dealers. Other traders will receive a discount of fifteen per cent.

	11.9 h.p.	14/28 h.p.
Complete overhaul as specified in paragraph (c) ...	£21 0 0	£22 0 0
In very special cases where cylinder block is found to be rendered scrap, due to accident, such as broken bearer arms, or frost, etc., necessitating renewal ...	£31 10 0	£33 0 0

(e) **Guarantee.** Every power unit re-conditioned by us under this scheme is covered by our usual guarantee but for a period of six months only.

Note.—Owners should be advised to notify the Registration Authorities and Insurance Companies of the change of engine numbers, and the chassis identification plate returned to us for exchange.





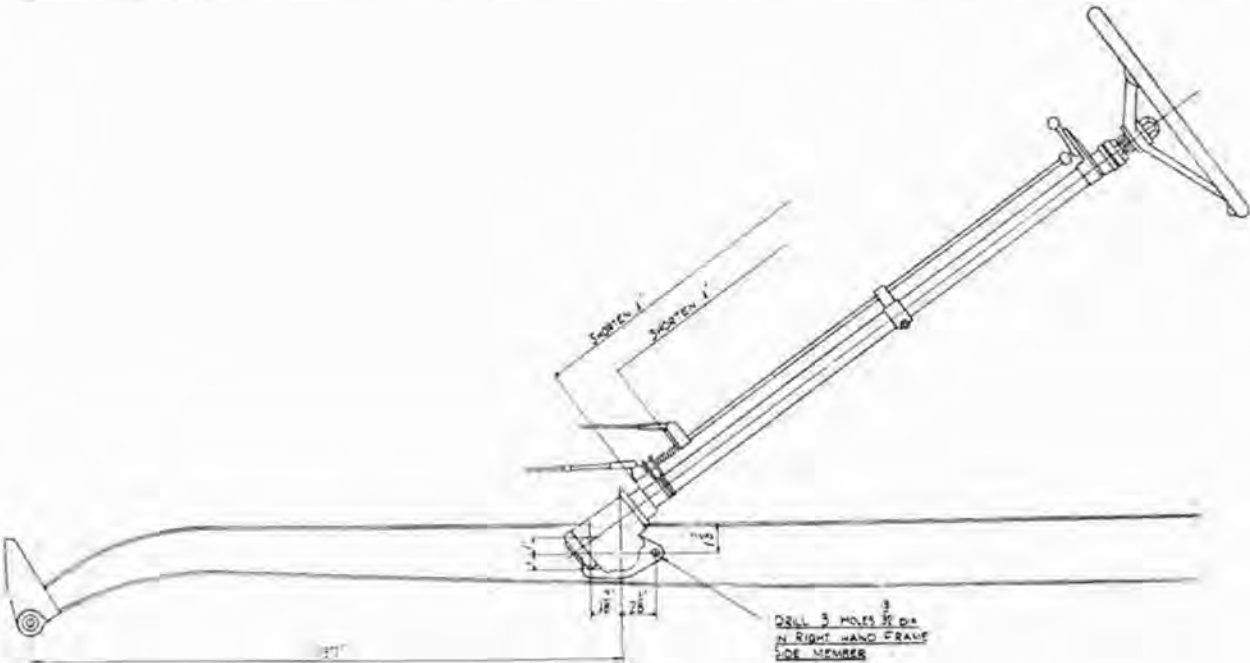
Date of issue : March, 1931

Bishop Cam Steering Gear Conversion Set

THE above conversion set, suitable for all 11.9 h.p. Morris-Cowley and 14/28 h.p. Morris-Oxford models from 1927 onwards, is obtainable from our Service Parts Department for the sum of £6 5s. 1d.

The set is supplied complete, less steering wheel and Lucas dual controls, since the original steering wheel is suitable for the Bishop cam gear, and the original dual controls can be made to fit by shortening each control at the lower end 1 in. In the case of the inner control, the flat will have to be extended this distance, and it will also be necessary to lengthen the slot in the outer control a similar distance.

After the original steering gear has been removed, and the three holes in the cylinder block plugged by means of suitable bolts, the steering gearbox bracket bolt holes can be drilled in the chassis side member as shown in the diagram hereunder.



*Date of issue : October, 1933*

Bishop Cam Steering Gear

THE Bishop cam steering gear as fitted to Morris Cowley cars is designed to give the maximum of service with the minimum of attention (apart from the usual lubrication). It is so constructed, however, that means of adjustment are provided for the compensation of any wear likely to develop in the course of time.

Although the various adjustments are comparatively simple to effect, they must be carried out correctly, and the following notes will, therefore, be found particularly useful when the occasion arises to execute either running repairs or a complete overhaul.

Dealing first with running adjustments when the steering gear is in place on the chassis.

If there be excessive play, ascertain the place or places at which slackness occurs. It may be any of the following :—

1. Inside the steering box.
2. Drop arm loose on splines.
3. Worn knuckle pins and bushes, or loose steering connections.

In this Sheet only No. 1 is dealt with ; the remedy for Nos. 2 and 3 being obvious.

If the play is located in the steering box, the front axle should always be jacked up until the wheels are clear of the ground, and the draglink disconnected from the steering drop arm. If the steering is now turned until it is in approximately the mid position, the movement of the outer end of the drop arm should not exceed $\frac{1}{8}$ in. Motion in excess of this amount can be eliminated by removing one or more shims from underneath the cover-plate on the side of the steering box. These shims are of three thicknesses, so that a very fine adjustment can be made. If too many shims are removed, the gear will become slightly stiff in the centre. This must not be permitted. The final adjustment should leave the gear with no appreciable play on the drop arm in the central position, but with a small amount at each end of the rocker-shaft travel.

If it is found that all the shims have to be removed, the conical peg in the rocker-shaft should be driven out, turned round 90 degrees, and refitted, when in all probability the whole of the shims can be reintroduced. If this is not the case, an oversize taper peg is required.

The following pegs are obtainable from our Service Parts Department :—

Standard
Part No. 40020

1st Oversize
Part No. 65472

Before the side cover-plate is finally bolted into position, it is advisable to ascertain that there is no end play on the steering column assembly. To do this, it is necessary to slacken off the adjustable steady bearing at the top of the column, when if end float is evident it will be necessary to remove the steering gear assembly from the car and carry out the adjustments which follow.

If no end play is present, the adjustable bearing should be screwed down until it just touches the balls, and slackened back one-sixth of a turn before tightening the lock nut. The result should be that the slackness in the threads has been taken up, but no crushing effect has been placed on the balls of the steady bearing. The thrust in both directions on the cam must be taken by the special thrust bearings situated inside the box and not on the steady bearing at the top of the column.

The cover-plate should then be replaced and the box filled with Morrisol "Sirrom" (Regd.) Brand Transmission Oil.

When connecting up the steering gear to the front axle again, care should be taken to see that the front axle itself is perfectly free, and that the drop arm is in the proper position to permit full lock in both directions ; the stub axles of the road wheels coming up against the stops provided on the front axle beam on both locks. The boss of the drop arm and the end of the shaft are marked with lines, and when these are placed opposite to each other the drop arm is in the correct position.

*Continued*



MODEL: MORRIS COWLEY (1933)

NO. OF SHEETS 2

SHEET No. 2

*Date of issue: October, 1933***Bishop Cam Steering Gear—continued**

If the gear has been entirely dismantled, or if it is necessary to eliminate play on the mast assembly, it should be reassembled in the following manner:—

After the parts have been carefully cleaned, it will be observed that there is a line scribed round that portion of the cam which is left in the mid position. This indicates the centre line of the cam path. A line will also be found scribed on the top of the boss carrying the rocker-shaft. The centre line of the cam must be placed opposite to the centre line scribed on the box. (See illustration.) The ball cages, complete with balls, should be inserted and sufficient shims placed on each end of the box, so that when the end cover is screwed tightly into position, the centre lines still coincide and all end play has been removed.

It is necessary to see that the top end of the column is running concentric with the tube before the top ball bearing is put on, and when adjusted in the manner previously mentioned the column should be perfectly free to be revolved with two fingers, and there should be no stiffness or lost motion in any position.

The rocker-shaft should be inserted in the box and adjustments made to remove end play in accordance with the previous instructions, care being taken to see that there is a good bearing between the outer face of the rocker-shaft and the inner face of the cover. When this has been done, the gear is ready for reassembling in the chassis.



Date of issue : October, 1933

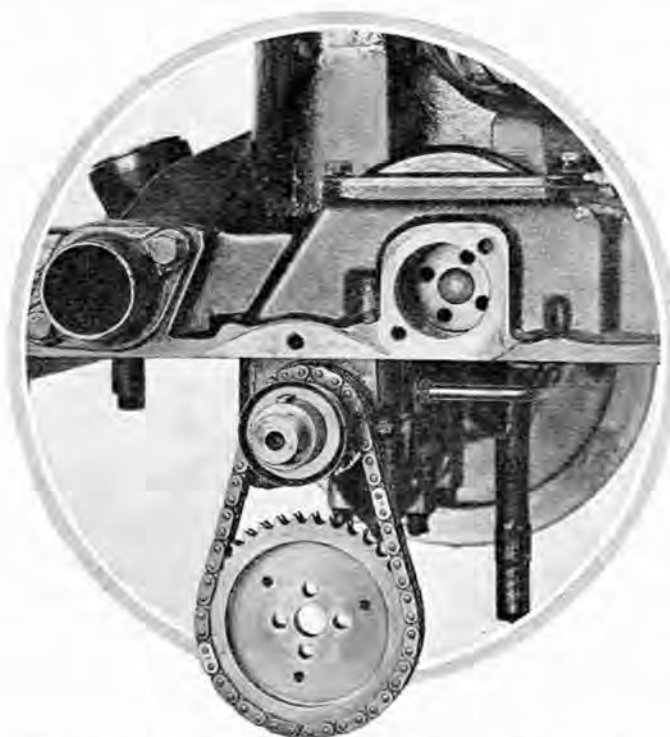
Removal and Replacement of Timing Chain

COMMENCING WITH ENGINE No. 435327

IN order to extract the timing chain, it is necessary, first of all, to remove the engine sump after the fan driving pulley and the oil retainer front cover have been dismantled.

Next remove the camshaft front cover, together with the timing chain inspection cover. This will expose the camshaft sprocket, which can be removed by extracting the four bolts locating it to the camshaft. The camshaft sprocket will now fall under its own weight, after which the chain can be taken away by lifting it over the crankshaft sprocket.

It will be found that a tooth on the crankshaft sprocket is marked with the letter "T." The crankshaft should be turned until this tooth comes to the bottom. Additionally, it will be seen that there are two bright links on the timing chain, and another tooth marked with the letter "T" on the camshaft sprocket.



When the four camshaft sprocket bolts are removed the sprocket will drop under its own weight.



Here is shown the correct position for the sprockets and chain to ensure correct timing.

Before replacing the timing chain, it should be doubled, bringing the two bright links together. This will give a longer and shorter portion of the chain.

With the shorter portion to the top, the camshaft sprocket should be added with the tooth marked "T" also to the top, registering with the bright link.

The chain, complete with camshaft sprocket, should then be passed over the crankshaft sprocket, making sure that the remaining bright link engages with the tooth marked "T" on the crankshaft sprocket.

After the camshaft sprocket has been lifted up and held against the camshaft, the crankshaft should be turned in a clockwise direction until the four bolt holes which are offset match up with the four tapped holes in the camshaft. The bolts with their spring washers should now be added. To check, the engine should be turned in the opposite direction, i.e. anti-clockwise, until the tooth marked "T" on the crankshaft sprocket, which should be engaging with the bright link on the chain, comes to the bottom. If the timing chain has been replaced correctly, the tooth marked "T" on the camshaft sprocket will be at the top, and again engaging with its corresponding bright link.

Date of issue : March, 1935

TAPPET LUBRICATION

1932-33 11.9 h.p. and 14/32 h.p. Morris Cowley Power Unit

(CHAIN-DRIVEN CAMSHAFT MODELS)

THE following modifications are recommended for all cases of complaints of noisy engines on the 1932-33 chain-driven camshaft models.

In the first place, in order to ensure adequate lubrication, it is essential to shorten the dipstick or oil level indicator by $\frac{9}{16}$ in. This is best done by unscrewing the spring cover and cutting off the amount stated by means of a hacksaw. The thread should be re-cut by using $\frac{3}{8}$ in. Whitworth adjustable dies, although if these are not available, $\frac{5}{16}$ in. Whitworth will be found suitable. A little solder may be used to prevent the spring and cover from unscrewing in service.



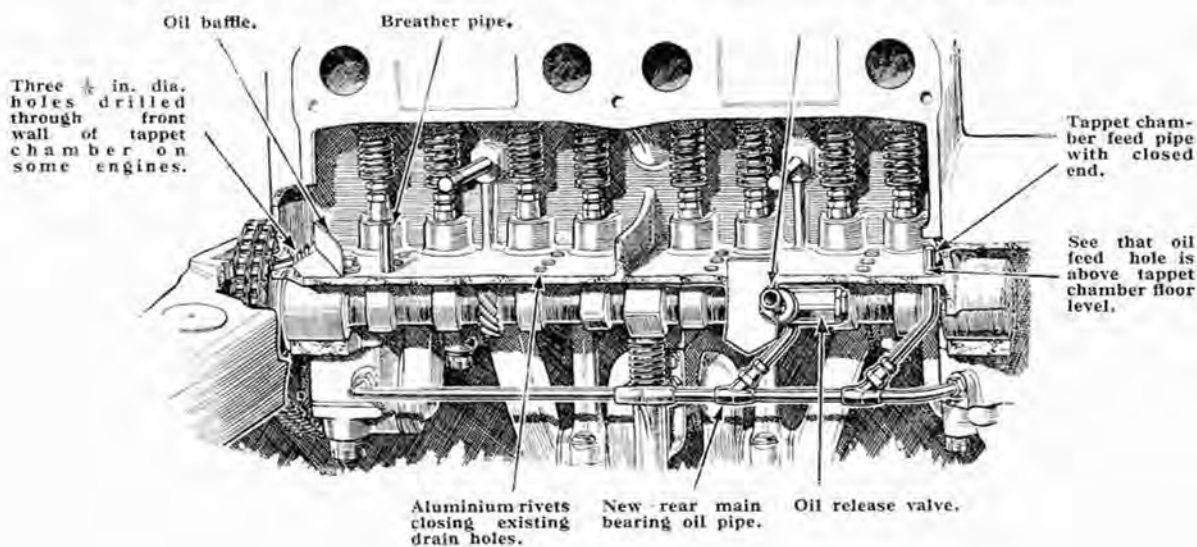
Three $\frac{3}{16}$ in. dia. holes drilled at BACK of oil filler in position shown just below inner rib.

It should be noted that when the dipstick is modified, it should measure exactly 10 in. long, when the cover and spring have been removed.

To prevent crankcase condensation, three $\frac{3}{16}$ in. diameter holes should be drilled through the back of the oil filler, immediately below the rib for the spring cover on the dipstick.

The accompanying sketch will give details concerning the method for obtaining a definite oil supply for the tappets and timing chain to prevent noise and timing chain stretch. The parts required are :—

1 Breather Pipe	...	...	...	...	...	...	Part No. CE2656
1 Baffle	...	...	...	...	...	...	CE2657
1 Tappet Feed Pipe	...	...	...	...	...	...	CE2658
1 Rear Main Bearing Oil Pipe	...	...	...	...	...	...	CE2659
1 Oil Release Valve	...	...	...	...	...	...	SA126
12 Aluminium Rivets	...	...	...	...	...	...	CA208



Continued

*Date of issue : March, 1935***Tappet Lubrication—continued**

On engines before Engine No. 429321 it will be necessary to drill three $\frac{5}{16}$ in. diameter holes through the front wall of the tappet compartment, penetrating through at the back of the camshaft sprocket. To do this it is necessary to remove the engine sump, so that the timing chain and sprocket can be removed from the camshaft. By taking away the exhaust manifold the holes can be drilled either by an ordinary hand or electric brace. Care should be taken to see that the inside hole is not started too close to the cylinders, otherwise there is the danger of penetrating the water jacket. On engines after the Engine Number quoted, an elongated slot is provided in the casting process.

The next operation lies in plugging all the drainage holes in the tappet compartment with aluminium rivets, except the outside one of the front row, which must be suitably tapped to take the vent pipe.

A $\frac{1}{2}$ in. diameter hole must now be drilled through the floor of the tappet compartment at the rear, so that the tappet oil pipe can be passed through from the rear main bearing oil pipe. This hole is drilled from below. Additionally, another hole must be drilled through the floor of the tappet compartment, at the front end, and tapped $\frac{1}{2}$ in. B.S.F. to take a suitable bolt to locate the oil baffle in position. A spring washer should be used on the bolt.

The oil pump can now be assembled with the modified rear bearing pipe, and the existing oil gauge connection changed for the oil pump release valve. This valve is designed to blow off at 10 lb. per square inch. The tappet feed pipe can then be placed in position, and the union nut tightened up, taking care to see that the $\frac{3}{4}$ in. hole in this feed pipe is above the level of the floor of the tappet chamber.

It should be noted that all the foregoing operations can be carried out without removing the engine from the frame, or withdrawing the camshaft. On engines after Engine No. 429321 it is unnecessary to remove the timing chain and sprocket.

With the introduction of the foregoing modification it will be seen that a positive oil feed is taken into the tappet compartment to supply an oil bath, the overflow from which passes back to the sump through the holes or slot in the front wall, providing additional lubrication for the timing chain.

As the air cleaner head is connected to the back of the tappet chamber, air will be drawn through the three holes drilled in the oil filler, via the vent pipe in the tappet compartment.

For cases of complaint of rough or noisy engines at speed, it is recommended that the cylinder head be changed for one of the non-turbulent pattern.

All the parts referred to are obtainable from our Service Parts Department.

