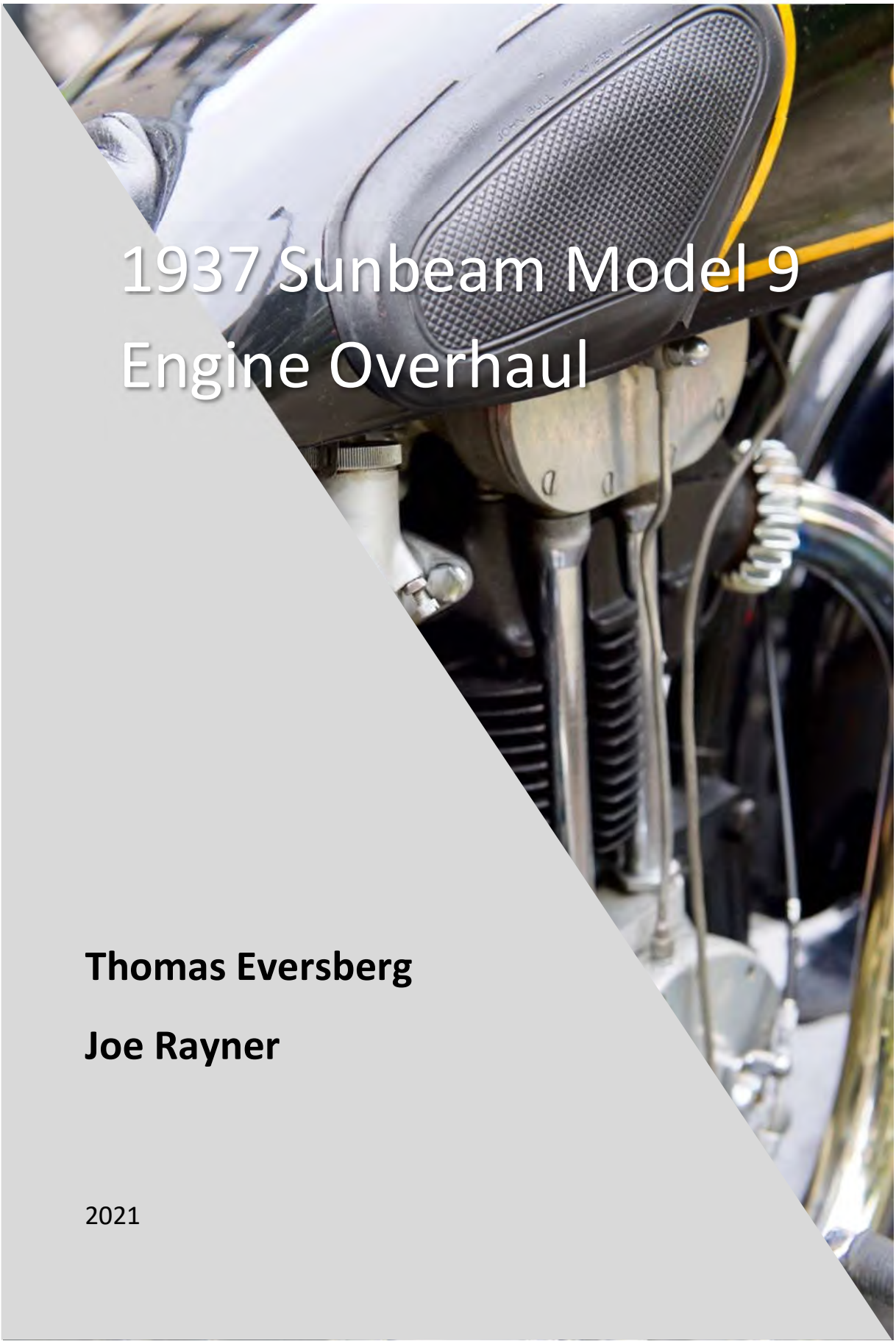


1937 Sunbeam Model 9 Engine Overhaul

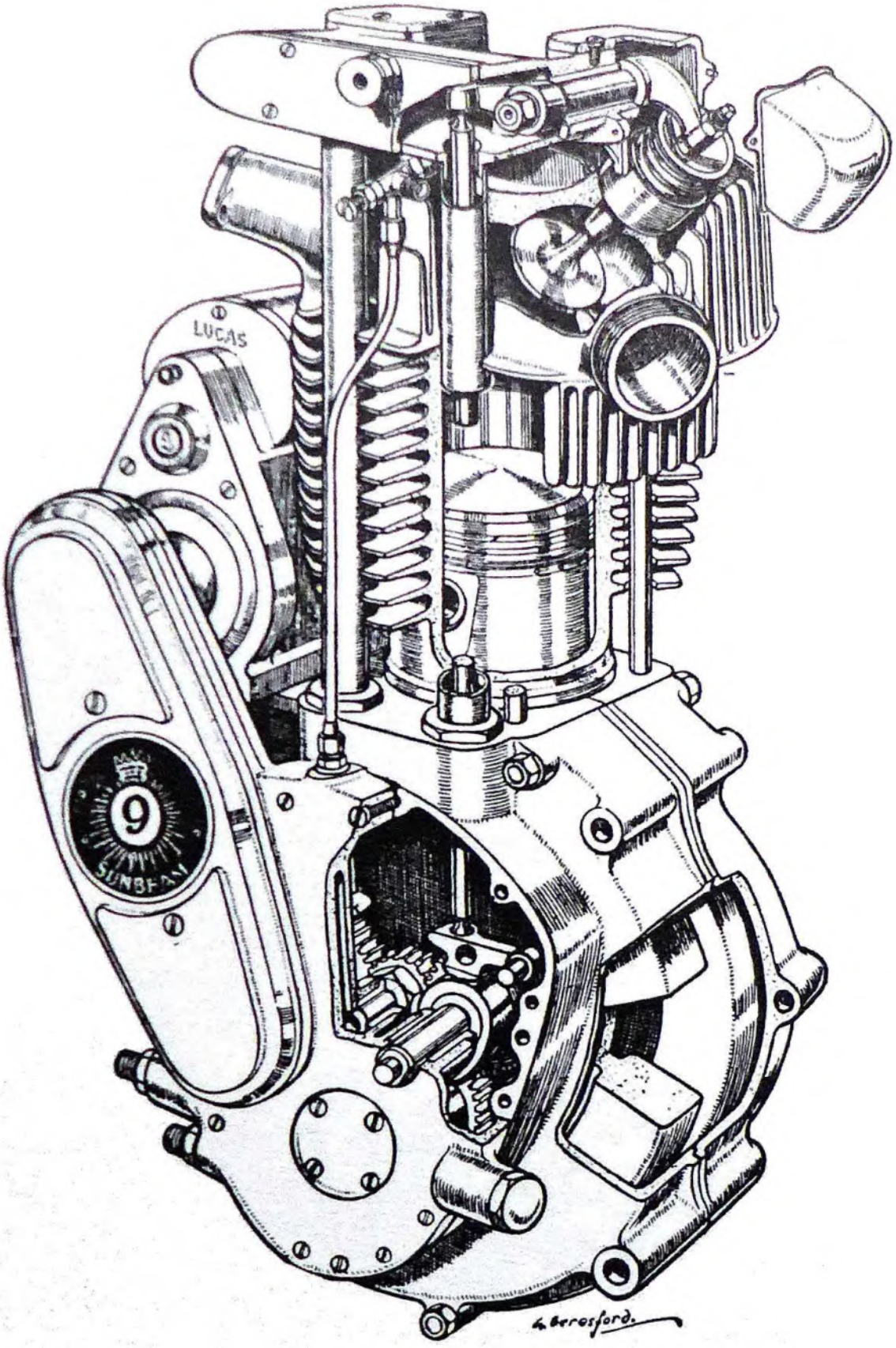
Thomas Eversberg

Joe Rayner

2021

The story starts after many miles of trouble-free riding when a mysterious vibration of the front girder fork assembly became a cause for concern. First checked were the girder bushes, wheel rims and tyres, primary drive, engine and gearbox mounts, all of which appeared to be in good order.

Content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Background

On a 1937 Sunbeam Model 9, the engine speed was suspected to induce resonant vibrations in the spring of the girder fork, which at some point suddenly appeared. Resonances occur when vibrating systems are set in motion by suitable excitation in such a way that these movements can reach very large deflections and thus destroy the vibrating system. In our case these oscillations occurred at certain revolutions, independent of the gear. It was therefore obvious to look for the cause in the engine revs and to examine the moving components involved, which are subject to changes over time (deposits on the piston, oversized pistons of greater mass, worn crank or big-end bearings out of true flywheels). All five possible causes cause an increasing amount of work in this order. However, their probabilities also increase. Replacing the big end/main bearings requires the most effort and one tends to avoid this work as long as possible. If one wants to completely disassemble the engine of a vintage motorcycle, one has a problem - there are usually no instructions[1].

One day a footrest suffered a fatigue break while driving. This was an alarm signal that could not be ignored. Should the fork spring or even the frame break during the ride, this could end fatally. Nowadays one plugs an analyser into the engine and know quite well about the engine. Because there is no other possibility than try and error in a vintage vehicle, the engine had to be dismantled to replace the main bearings. If one does that, one gets involved in a detective work, which is connected with some uncertainties. Although only parts are taken apart, it is not a nice feeling to have to open a cover and not know whether the parts behind it are falling apart and can no longer be matched. After all, the parts have to be reassembled later.

This text does not claim to deliver definite answers and guidelines for the described restorations and repair but should be considered as a subjective experience. Some steps can certainly be improved by others. The descriptions are intended to reduce uncertainties, but perhaps also to give suggestions for other motorcycle makes.

[1] The manual "Overhauling a 1927 Sunbeam Model 90" is available in the store of the Marston Sunbeam Club. It is only partly suited for later models.

Dos and Don‘ts

Before one even gets to work taking something apart on the motorcycle, we recommend at least generally thinking about the procedure. Of course, this does not go into the last detail, especially if individual steps and constructions are completely unknown, as is the case with other engines. However, it helps to avoid basic mistakes and possibly cause damage. So here are a few Dos and Don'ts, which can certainly be added to.

Dos:

Think before starting: As an enthusiast, you tend to take quick steps. But quick steps also potentially mean quick mistakes. After all, every step also has consequences that are sometimes quite undesirable and difficult to predict. So, it is recommended to think about what could be caused with the next step.

Take your time: The maintenance and repair of old vehicles takes time, especially if there are no instruction manuals and spare parts are not quickly available. Deliveries from other countries sometimes take months. And in a hurry, mistakes happen and cost money. So "time is money" has a reverse meaning here.

Take photos and make notes: Disassembling the engine is complicated and without good documentation one will have problems reassembling it. In our case, we took about 500 photos of the individual steps. They also serve for discussion in case of individual unclear steps. We also documented all the steps, measurements and remarks in a notebook.

Label parts: After the disassembly comes the assembly. To prevent this from becoming an unsolvable puzzle, all parts removed should be clearly marked or provided with notes. This can be done with labeled adhesive tape.

Save time by planning: Some work requires the delivery of new components. So, if one can plan such work in advance, one can place appropriate orders at an early stage. This includes work on the cylinder (e.g. new valves, valve guides, piston and piston rings), new seals (cylinder, timing case, primary chain case) and bearings (crankshaft), but also clutch parts and, of course, the corresponding tools.

Don’ts

Saving money at the wrong place: Vintage motorcycles are valuable and quite expensive. It is hence a good advice not to be only generous when buying it but also when maintaining and repairing the machine. That is valid for the parts but also for the tools. In this sense we believe in John Ruskin's common law of business balance": You get what you pay for."

Applying undefined brute force: Some steps require the application of greater force others do not. For example, high torque is needed for the cylinder head bolts, but not for the rocker box. Covers can be levered open with a screwdriver or carefully loosened with a blade in the joint. The decisive factor is the adapted and appropriate force applied for the task at hand.

Confuse metric and imperial units: All sizes on English motorcycles are given in imperial units. Today, however, metric units have become established (e.g. shims from England). Out of habit, e.g., for owners out of the UK it can happen that one confuses these units. This is particularly annoying when one orders bolts, washers or shims and these then arrive in the wrong size.

Requirements

Basically, one should already know the technology of the machine. Previous work is helpful but not necessary. For the tools a basic equipment of wrenches, hexagon nuts etc. is required. These can be easily supplemented for special work during the procedure (see below). A sufficient quantity of workshop cloths as well as various collection facilities and containers tame escaping oil. And for loosening screws and especially the roller bearings, a heat gun is a wonderful tool.

With regard to the space available, the machine should be placed high up to ensure easy access to all components. In our case, it was placed on two beverage crates (sadly empty), each under the front wheel and the rear stand, using an electric hoist. In contrast to commercial and expensive lifts, this way one can easily get to the bottom of the engine as well. In addition one should create space and storage possibilities to ensure a certain order for the dismantled parts. For the later assembly a maximum of documentation is essential. These are a logbook, in which every single step is recorded, a camera, with which as much as possible is documented (one is later grateful for every photo) as well as adhesive tape, which is attached to already dismantled parts with appropriate notes (position, orientation, possible special features etc.).

From Tank to Cylinder Base

Figure 1: The upper sprocket pulled off the magneto taper.

Figure 2: Opening the timing cover. To avoid damage, one should not apply force but the careful use of a cutter blade and a hammer.

While the oil is drained after the engine has warmed up, the exhaust pipe, the battery and horn are disconnected and removed. In addition, the fuel is drained from the tank, the saddle and all tank connections including the bridge tube between the tank halves are removed. The oil pressure gauge must also be disconnected. Only then can the tank be lifted off and the engine becomes accessible. All oil lines are now unscrewed. These are the two lines from and to the oil tank as well as the ascending line from the crankcase to the rocker arm housing and the line to the oil pressure gauge. Also the Bowden cables to the valve lifter and to the gearbox are disconnected. Now also the carburetor and the fuel line need to be removed. In principle it can remain connected to its Bowden cables and be placed on the frame in a cloth. After opening the housing for the timing chain on the right side, the two chain sprockets can be removed. The upper sprocket is screwed onto a taper on the axis of the magneto ignition (Fig. 1). After removing the nut, it must be pulled off using an appropriate tool. This can be done with a special puller which can be bought or by making one yourself. The lower sprocket is screwed to the camshaft of the inlet valve with a hexagon nut and can be removed without special tools. Both sprockets and the chain were in good condition and did not need a replacement. The decompressor mechanism lifting the exhaust valve on the cover of the timing box is also unscrewed.

The timing cover can now be removed. To overcome the adhesion of the gasket and to avoid damaging the cover, one cuts along the gasket surface with a cutter at various spots until the cover has come off the crankcase (Fig. 2). The ends of the two camshafts are now free in their bushes.

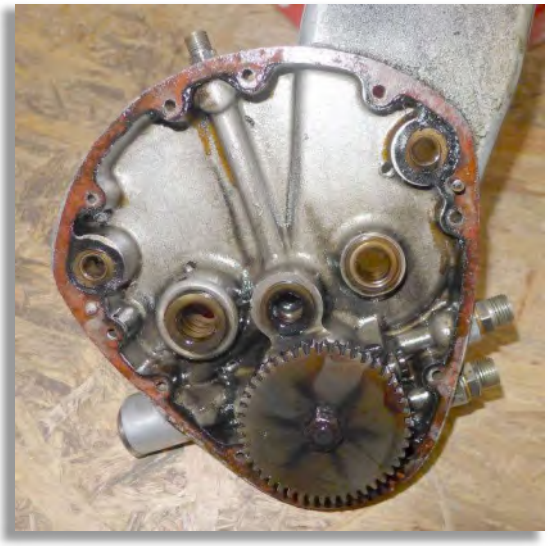


Figure 3: The inner side of the timing case. Note the large gear of the oil pump and the bushes for the camshafts and rocker arms. The central bush above the gear feeds the oil pipe towards the big end via the hollow crankshaft.

One can now use the thumbs to prevent the shafts from being pulled out with the cover and falling off.

At this point it is advisable to think about the oil pump, which is located on the inside of the cover (Fig. 3). It is driven by the crankshaft via a large gear ring and should transport the motor oil. We had no reason the dismantle the pump. The engine oil pressure gauge always indicated a certain pressure (the pressure varies from engine to engine) which reasonably decrease with engine temperature. The return of oil to the tank was always good and there was little wet-sumping. All that are indicators of a decent oil pump. Without any spares available there is little point in dismantling, other than inspection and cleaning.

Figure 4: Contents of the timing cover with the two camshafts and their respective rocker arms. Note the moveable inner part of the exhaust cam shaft for the valve lifter.

The lower rocker arms are now free in their bearing bushes of the crankcase (Fig. 4). The inlet and exhaust valves must open and close at the correct piston position. Therefore, the three positions of the two valves and the piston must be coordinated with each other via the three corresponding drive gears on the camshafts. The valve timing setting is unique and was marked when the engine was manufactured (Fig. 5).

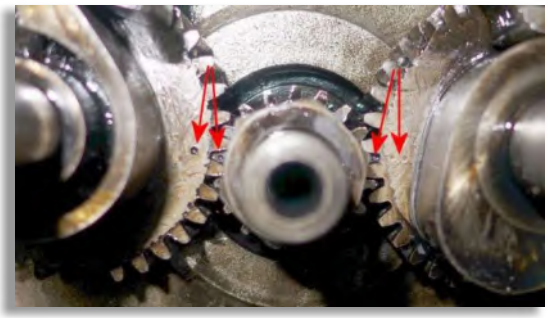
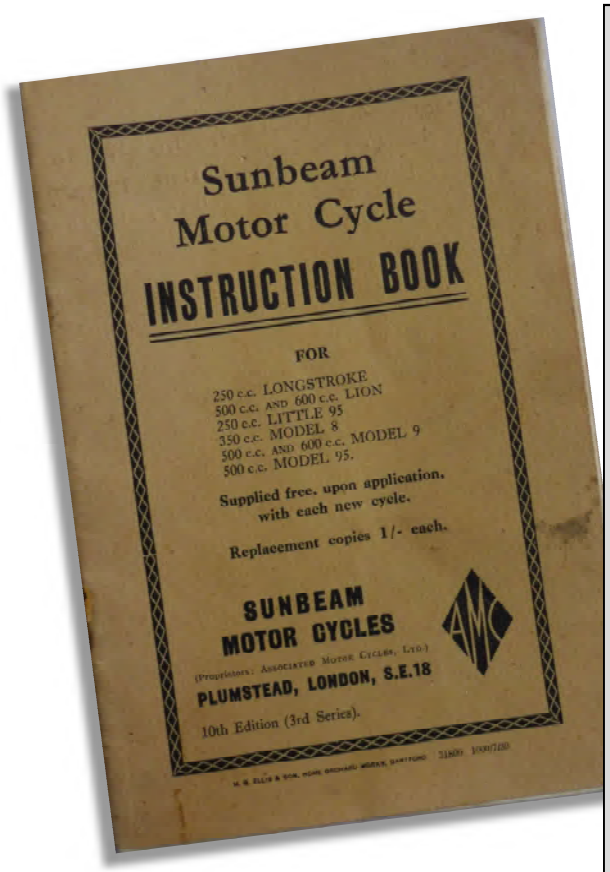


Figure 5: Markings on the gears of the two camshafts and the crankshaft avoid ambiguous positions of the valves. Single marks on the inlet side, double marks on the exhaust side.



SUNBEAM DRV SUMP LUBRICATION SYSTEM
(From *Sunbeam Motor Cycle Instruction Book*)

Engine
Sunbeam engines have the dry sump lubrication system (Pat. No. 290413)

The oil is gravity fed from the tank to the mechanical pump on the engine. On starting the engine, the pump forces out the telltale which opens an oilway and the oil is fed under pressure through the crankshaft to the big end bearing. By centrifugal action oil is thrown out from the big end in the form of an oil mist which adequately lubricates the piston, cylinder walls, small end bearing and main bearings. The sump at the bottom of the crankcase collects the oil as it drains down the sides of the crankcase and the return pump takes it back to the tank where it is cooled. This sequence of operations takes place the whole time the engine is running and the oil is in constant circulation.

Filters
The oil is filtered at two points, (a) in the tank where the supply pipe is connected and (b) in the engine sump where the return pipe is connected. These filters are easily accessible and should be taken out and washed when the system is periodically drained.

In the case of the side valve engines, crankcase pressure forces a certain amount of the oil mist into the valve chamber, thereby ensuring lubrication of the valve stems and tappets and this oil is drained into the timing gear and lubricates the cams, etc. In the Models 9 and 95 engines an oil lead is taken to the overhead rockers, the oil being controlled by a small jet which is situated in the end of the elbow union in the rocker box. The rockers are thereby amply lubricated and the surplus oil drains down through the push rod tubes to lubricate the timing gear, The lubrication of the rockers on the Models 8, 80 and 250 c.c. engines is by grease applied by means of the grease gun through the nipples in the rocker shafts and crankcase pressure forces the oil mist from the crankcase through the push rod tubes to provide lubrication for the ends of the push rods and valve stems.

Figure 6: The rocker box on top of the cylinder head. Note the cups for the pushrods at the rocker arm ends. The rocker box cannot be shifted aside until the pushrods are lowered.

To remove the deeper 1937 Model 9 rocker box, which is bolted to the cylinder head, both pushrods must be lowered. Otherwise the upper frame tube will be in the way (Fig. 6). To do this, one needs pull the two lower rocker arms out of their bushes. At this point, it makes sense to check the running surfaces, which may have to be polished. New spares are available from the Marston Sunbeam Club. The cams on their shafts should also be inspected and refurbished in case of need. We have found them in excellent condition.

Figure 7: Loosen the bolts of the rocker box.

Now the upper rocker arm housing can be unscrewed from the cylinder head (Fig. 7). The outer valve covers must first be removed. There may be washers on the cylinder head bolts into which the rocker arm housing bolts are screwed. These must be reinstalled later (Fig. 8). Remove the push rods. They are picked up by cups of the rocker arms and it is advisable not to change the fits of the round rod heads and cups. It is therefore important to ensure that the push rods are later installed on the original side and with the original orientation. They should be marked accordingly.

Figure 8: The cylinder head without the rocker box.

Figure 9: Diametric loosening the bolts of the cylinder head.

The cylinder head is now exposed and its bolts must be released progressively in a diagonal pattern to prevent warping (Fig. 9). Before removing the head, check whether hardened caps rest on the valve heads and secure them if necessary (Fig. 10). They are easily lost. The Sunbeam does not have a cylinder head gasket and special care must be taken not to damage the two connecting surfaces. If the head cannot be easily lifted off, light hammer blows near the heavy casting of the exhaust port, which are transmitted via a piece of wood, will help (Fig. 11). Avoid striking the fins!

Figure 10: Hardened cups protect the valve tips against wear.

Now the push rod tubes can also be unscrewed from the crankshaft housing (Fig. 12). As soon as the cylinder has been lifted, wrap a cloth around the connecting rod so that nothing falls into the crankcase. To release the piston, remove the two circlips and then remove the gudgeon pin. If the gudgeon pin cannot be pushed out, the piston must be heated up accordingly with the heat gun. **Caution**: If one wants to use the piston again, its orientation should be marked, ideally on its underside so that it can be used again later with regard to the direction of travel. A wrong orientation of the already run-in piston otherwise leads to increased wear.

Figure 11: The Sunbeam has no cylinder head gasket and the surfaces must not be damaged.

Figure 12: The push rod tubes are screwed into the crankcase but not into the rocker box.

The Crankcase

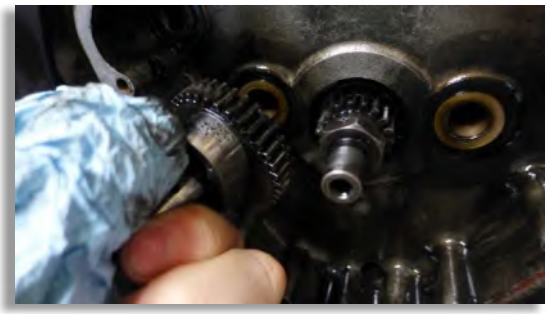


Figure 13: Since the camshaft positions are unambiguously referenced by marks the shafts can be pulled out of their bushes.

Now the two camshafts can be removed from their bushes (Fig. 13). Loosen the hexagon nut on the crankshaft (Fig. 14) and pull off the gear. **Caution**: The timing side shaft has a left hand thread. The primary chain and the clutch on the drive side should not yet be removed, since the crankshaft can be blocked with them and the rear wheel brake. **Caution**: On the crankshaft there is a perpendicular key that determines the position of the cam drive gear (the central gearwheel) for controlling the camshafts (Fig. 15). It falls out easily and must not be lost. The lower timing chest is now empty.

Figure 14: The timing case is cleared of its parts. The small hole at the lowest end acts as an oil pipe from the sump to the timing case and then to the oil pump. The central crankshaft is hollow. It acts as an oil pipe to the con rod big end. On the upper left side is the connection to the vent pipe.

Figure 15: A perpendicular key on the crankshaft defines the unambiguous position of the timing gear.

Figure 16: The cush drive inside the primary chain case. The central nut is locked by an already removed cotter pin.

Figure 17: When pulling off the drive sprocket the oil scroll dynamic seal with its worm grooves becomes visible. The seal rotates counterclockwise and the grooves transport leaking oil back into the crankcase.

Figure 18: The conrod in the flywheel inside the crankcase. (To unlock the nuts on the crankshafts a bolt should not be positioned into the small end unless great care is taken not to mark the bearing face.)

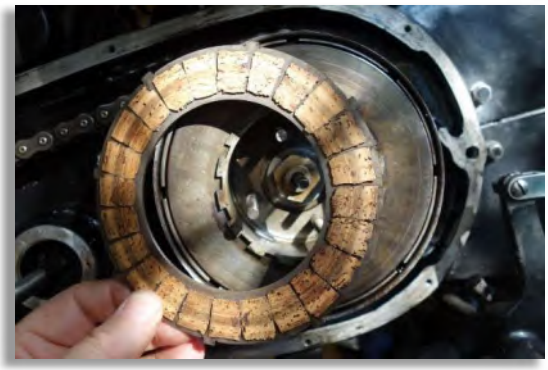


Figure 19: Dismantling the clutch.

On the drive side, the primary chain case must now be removed after the oil has been drained off there as well. Before removing the clutch, unscrew the hexagon nut (note the split pin) of the crankshaft on the drive side (Fig. 16). This needs to be undone whilst the primary chain and clutch are still in place, which act as a brake for the crankshaft. Analog to the timing side, the shaft is fixed via the primary chain, the clutch and the rear brake. Then the entire cush drive including spring, pinion and the dynamic seal underneath with its oil scroll can be removed (Fig. 17). If the hexagon nut on the cush drive is too tight, the small end of the con-rod can be fixed to behind the cylinder head bolts, but dismantling by using the primary drive is the far better option (Fig. 18).

Now the clutch can be removed. After the clutch and friction disks and the inner clutch cage have been removed (Fig. 19), one reaches the thrust washer that covers the clutch roller bearing on the outward side.

Figure 20: The clutch rollers inside their housing. The rollers are not positioned in a cage but are freely moving in a housing consisting of a front and back thrust washer and the inner and outer race (here well lubricated). When the outer cage is pulled out, all rollers will fall out.

Figure 21: The clutch rollers.

Figure 22: Side view after the primary chain case is dismantled. Note the gasket on the left crankcase which has to be renewed.

Caution: The rollers of the roller bearing are not located in a cage, but lie loosely on an inner ring. They fall out immediately when the outer clutch cage (which also acts as the outer ring of the bearing) is removed with the primary chain (Fig. 20). One can catch them with a cake tray or similar (Fig. 21). Then the inner ring of the clutch roller bearing and the inner washer covering the clutch roller bearing on the gearbox side can be pulled off.

To remove the inner side of the primary chain case, the drive chain link must be opened and the chain removed (pulled) from the drive sprocket. In addition, the drive chain box must be loosened. The retaining bolts of the box at the crankcase are unscrewed, the rear part of the primary chain case is removed and the drive side of the engine is fully exposed (Fig. 22).

Since the primary chain case is no longer in the way, the mounting nuts of the magneto dynamo unit (magdyno) on its platform behind the cylinder are now very easily accessible. The magneto does not necessarily have to be detached from its Bowden cable. It is a simpler job to remove the handlebar control than extract the cable from the magdyno and is an opportunity to lubricate the cable and adjust the points whilst on the bench. The whole unit can easily be positioned to the side so that it is not in the way. In addition, the two breather pipes for the timing case and the oil tank can now be unscrewed (Fig. 23 and 24).

Figure 23: Disconnected vent pipe at the timing cover.

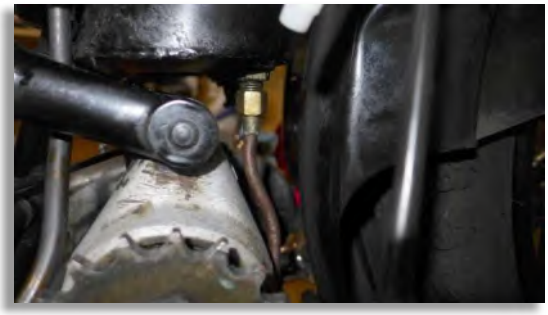


Figure 24: The vent pipe of the oil tank can now be unscrewed.

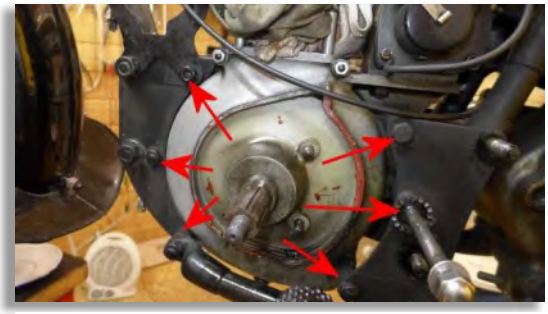


Figure 25: The crankcase is held by six bolts in the front and rear rear carrier plates. The rear center bolt also acts as the bracket for the footrests. The right top bolt in the rear plates holds the rear of the primary chain case.

The crankcase is now only held in the frame by its various bolts, which are removed one after the other (Fig. 25).

Figure 26: The two front carrier plates.

The two front carrier plates are also removed (Fig. 26). However, the lower carrier bolt (Fig. 27) cannot be pulled out yet because it is blocked by the frame. The crankcase together with the two rear carrier plates must be lifted first.

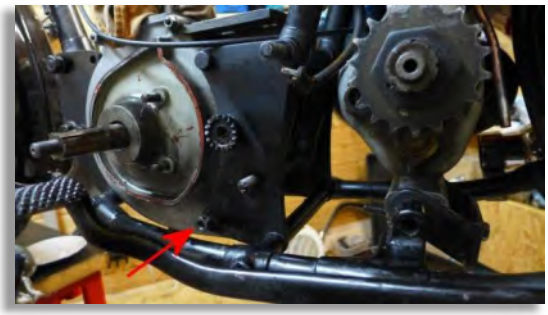


Figure 27: The lower carrier bolt is blocked by the frame. The two rear carrier plates cannot be dismantled.

Figure 28: The upper rear bolt of the two carrier plates cannot be pulled out in its regular position. The gearbox is in the way and must be pushed aside.

Figure 29: The crankcase in the hoist before dismantling the front carrier plates. The motorcycle was lifted down onto a trolley.

However, the upper rear bolt of the two carrier plates is again blocked now by the gearbox (Fig. 28). Therefore, the pin for adjusting the gearbox position must be pulled out completely in order to be able to tilt the gearbox accordingly. Only then all bolts can be removed and the motor block together with the rear carrier plates can be lifted (Fig. 29).

Figure 30: The crankcase is lifted out of the frame, the motorcycle on the trolley pushed beside and the case is then lifted onto a bench (working plate).

The remaining motor block weights about 21 kg. One should therefore use a hoist to first lift the whole motorcycle back to the ground and push it aside (trolley) after lifting the engine out of the frame. The engine can then be lowered onto a work platform (Fig. 30). The rear carrier plates are unscrewed (Fig. 31) and the two halves of the crankcase can be separated.

Figure 31: The crankcase on the bench (working plate). The rear carrier plates are still attached.

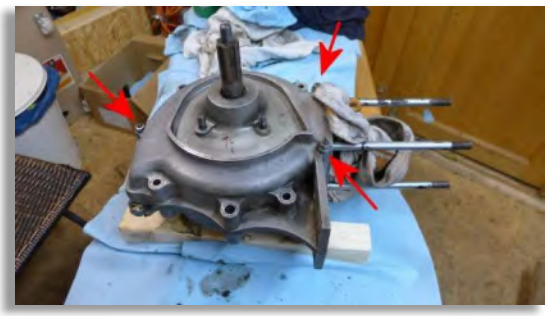


Figure 32: The crankcase on the bench without the rear carrier plates. The arrows indicate the three bolts which hold the two halves together.

Loosen the three smaller bolts (two at the cylinder base, one at the bottom) that still hold the two halves together (Fig. 32). To separate the two halves of the crankcase, use a cutter as for the cover of the timing case (Fig. 33).

Figure 33: Opening the crankcase. Like for the timing cover one should not apply force but the careful use of a cutter blade to avoid damage.

Figure 34: As soon as the two crankcase halves are loose one can carefully separate them from each other.

Then, the drive side can be lifted off the timing control side (Fig. 34).

Between the two halves of the crankcase we found a paper gasket of about 0.35 mm thickness (Fig. 35). As a replacement we made a new gasket of 0.5 mm thickness. However, we later found out that there was no gasket installed by the works. It must have been installed during an earlier overhaul. Hence, we waived a gasket completely (see below).

Figure 35: The old 0.35 mm gasket between the two halves of the crankcase.

Figure 36: The blade of the oil separator on the timing side next to the hole for the oil drain plug with its filter.

We thoroughly cleaned the case for inspection and found that the blade of the oil separator on the timing side was in good order (Fig. 36). However, the blade on the driving side was significantly disturbed (Fig. 37). The reason for the damage remains unsolved. We can only guess that parts of a damaged shim washer we later found on the crankshaft timing side (see below) somehow found their way to the blade on the driving side.

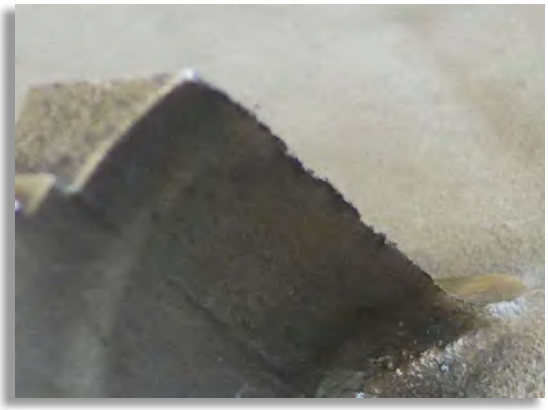


Figure 37: The blade of the oil separator on the driving side. Note the damage at the blade edge.

Bearings, Bushes, Races

Figure 38: The crankcase driving side. On the outer side is an imperial RLS8 ball bearing of 2 ¼ inch outer diameter, 1 inch shaft diameter and 5/8 inch width.

Figure 39: The imperial timing side LRJ1L (alternatively CRL8) roller bearing on the crankshaft driving side. Note that the LRJ series represents various bearings of different size and designs. The bearing for the Sunbeam must have a lip to avoid axial shaft movement. There are shims on both bearing sides. They are for adjusting the shaft end float.

Figure 40: The metric timing side RMC22L roller bearing on the crankshaft timing side (‚L' indicates a lip on the bearing race). It is a metric bearing of 50mm outer diameter, 22mm shaft diameter and 17mm width.

Figure 41: The two plain bearings of the lower rocker arms in the timing case.

The crankshaft is seated on three bearings. The type of bearing varies across the model years. On the drive side, an imperial RLS8 ball bearing is on the outside (Fig. 38). On this side, an imperial roller bearing (CRL8 or LRJ1) takes the main load (Fig. 39). The dimensions for both bearings: outside diameter 2.25" (57.15mm), inside diameter 1" (25.4mm), width 0.625" (15.875mm). The axis on the timing side is supported by a metric RMC22L bearing (Fig. 40). It has the dimensions 50 x 22 x 17mm. All bearings are a sliding fit on the crankpin, they are not press-fitted. At this point it is advisable to inspect the races and rollers for wear if one has not yet decided whether to renew the bearings.

The Model 9 has a range of bearing types – simple 'brass' bushings as found in the timing chest, roller bearings and ball races. Assessing for wear and serviceability is not always that easy and replacement can be seen as the obvious choice, considering the amount of work required to access the bearings. However not all of the bearings are available 'off the shelf' and roller bearings can be expensive when sourced from specialist suppliers.

Plain Bearings

Firstly the 'brasses' found in the timing chest (Fig. 41). Hardened shafts are running inside these and the bearing itself is somewhat sacrificial. Fortunately they have a good oil supply so have a decent life expectancy. However they have to cope with the uneven loading caused by the cam and valve gear. Look at the bearing surfaces for signs of scoring and, if one has the means, measure the bearings for ovality and wear – a couple of thou" would be good to find! As an alternative to measurement using 'feel' for any rocking

movement (should be close to nil) or lack of smooth running will be a good indicator. Their replacement will probably involve the making of new bushes from phosphor bronze by an engineer with a lathe, but it is not a difficult task to produce a good 'running' fit. The cases will need to be heated to remove and re-fit the bushes, and if one is replacing a pair it makes sense to do all of them. On cost grounds and availability, one might be tempted to look towards 'Oilite' bearings – these are fine for use where easy access and simple replacement is available, but they are not really man enough for the task here.

Figure 42: The small end phosphor bronze bush in good condition.

The Little-End Bush

Check this using the gudgeon pin – there should be no discernable play or scoring. This is an easy bush to replace (Fig. 42). Make up a simple puller with a long bolt and suitable sockets. Any replacement must be reamed to fit as the conrod eye squeezes the new bush when it is pressed into place. Low cost adjustable reamers are available on eBay.

Figure 43: The imperial timing side LRJ1L (alternatively CRL8) roller bearing on the crankshaft driving side. Note that the LRJ series represents various bearings of different size and designs. The bearing for the Sunbeam must have a lip to avoid axial shaft movement. There are shims on both bearing sides. They are for adjusting the shaft end float.

Roller Bearings

In many ways the 'king' of bearings, as they can take a high loading (Fig 43). But they do eventually wear out. In the Sunbeam the big end roller bearing receives oil from the oil pump – this floods the bearing at near zero pressure. The two crank roller bearings (and drive side ball race) rely on oil splash. It is not too easy to assess wear once the bearings have been removed, but in situ one may be able to feel play or roughness in the big end and main bearings by lifting and dropping the conrod/crank pin. When dismantling look for signs of 'cooked' brown oil – like a well-used frying pan - the worn bearing will run hot and overheat the oil locally. With the bearing out, look for pitting both on the roller surface and the race surface and any tracking or grooving in the parts. Early warning signs are to see a

frosted/grey surface on the rollers or races – they are beginning to eat one another and will continue to do so! If all looks good add a very thin coat of oil and feel for super-smooth running. Any checks in movement are the sign to replace. Some roller bearings have a 'lip', often denoted by an L at the end of their code. Make sure that the new bearing corresponds to the one coming out/original specification. Specialist suppliers have these bearings – whether they actually source them from countries like China where standards are much lower is difficult to tell – but in the absence of new 'old stock' there is little choice.

Figure 44: The RLS8 ball bearing on the driving side.

Ball Bearings

The 'cheapest' of the bearing types and most likely to suffer from wear (Fig. 44). Wash out the race and look for any debris. With the bearing 'dry' put a finger or two within the race and spin the outer. If it clatters round or shows any chattering or play then bin it. They will continue to run until they disintegrate completely. Replacement – well, one can buy replacements from China & India for pennies and they will last a matter of hours, despite arriving in (fake) SKF packaging. Only buy branded bearings from an established bearing company. When one has the new bearing to hand one will realise just how worn the old one was. The ball race takes quite a load on the drive-side and is last to receive oil, so replacement is likely to be a necessity and it should be treated as a service item. Do not be tempted to fit a sealed bearing where grease is already added. This bearing needs oil for lubrication and cooling – if one take the seals out of a new 'sealed' bearing one will be surprised as to how little grease is there.

At this point one should test the crankshaft-flywheel assembly for any misalignment and little

and big end play[2]. For practical reasons and because this procedure is best done by an expert we gave the unit to a specialized workshop[3]. In particular it was important that the flywheels and crankshaft were correctly aligned to ensure that they were not the potential cause of the engine vibration. Our assembly was in good order and no additional work was required. However, had there been any sign of mis-alignment this would have needed correction as it would have caused damage to the newly fitted bearings.

Note on the crankshaft end float.
When installed, the crankshaft is, so to speak, clamped between the two crankcases. When the engine warms up, the crankshaft expands and lengthens. There must be a certain amount of clearance for this axial expansion to prevent damage to the crank bearings. This is called crankshaft end float. This clearance is measured when the engine is cold, especially after an overhaul. Too much play and the crankshaft moves from side to side, too little and the bearings receive a lateral load that damages them. During production, the engine is generally manufactured with too much end float. During assembly, however, shims are placed on the shaft axes to set the correct clearance, allowing for thermal expansion of the crankshaft. The shims also centralise the con-rod relative to the crankcases. The thickness of the shims varies from engine to engine. On the crankshaft there was one shim on each side of the driving side roller bearing and one on the inner side of the timing roller bearing. Their thickness is 0.015" (0.38mm). According to the Marston Sunbeam Club the crankcase does not get hot and a correct clearance for a Sunbeam Model 9 is between 0.05mm and 0.10mm (2 - 4 thou"). However, in the Book of the Sunbeam gives up to 10 thou. We presume that a value around 5 thou should be fine.

[2] A task description can be found in „The Book of the Sunbeam“ by L.K. Heathcote.
[3] This task can be done in a lathe with two gauges.

Rebuilding the Crankcase – The End Float

Figure 45: The RMC22L race. Note the lip on the race which avoids axial shaft movement.

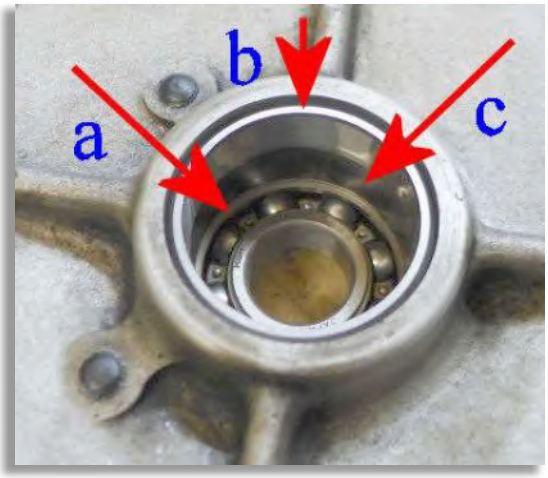


Figure 46: Details of the crankcase driving side. One can see a) the RLS8 ball bearing, b) the race of the LRJ1 roller bearing and c) a spacer sleeve, which separates both.

We already knew that the complete bearing set will be changed and we waived the bearing inspection. In any case, if the races have been turning on the crankpins they may have worn the surface and become loose. They can be re-fitted with Loctite Bearing Locker if the damage is not too extreme. To remove the ball bearing and the pressed-in running surfaces of the two roller bearings and the spacer ring from the bushings in the casing halves, the latter must be heated. This can be done in the oven (approx. 70°C are enough) or with a heat gun. The housing aluminium expands more than the bearing steel when heated. The parts slip out by themselves or are gently knocked out with a punch. The running faces of the two roller bearings have lips (Fig. 45). Ball and roller bearings are separated on the axle and on the outside by spacer sleeves (Fig. 46).