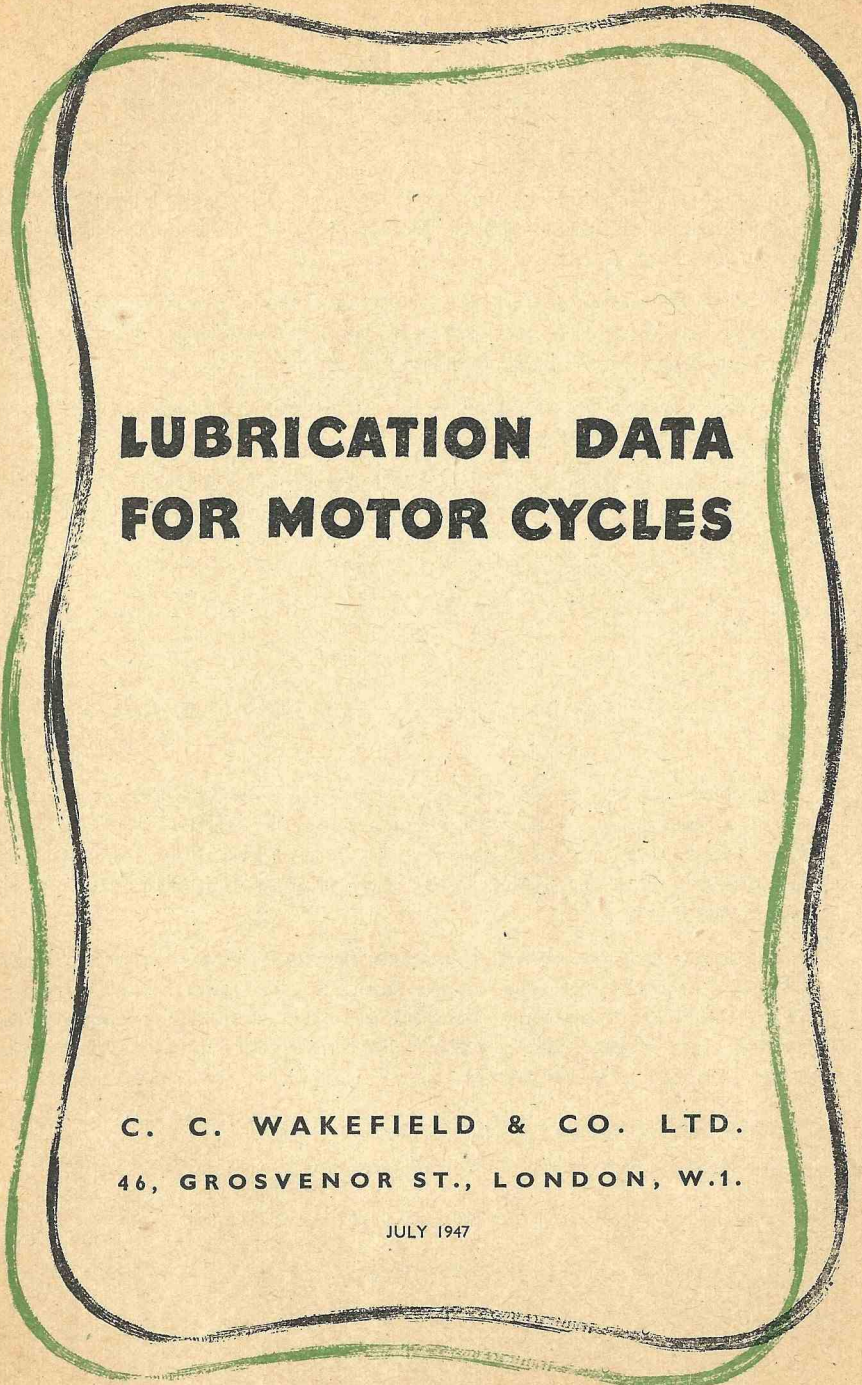


# **LUBRICATION DATA FOR MOTOR CYCLES**

**1939 — 1947**





# **LUBRICATION DATA FOR MOTOR CYCLES**

**C. C. WAKEFIELD & CO. LTD.  
46, GROSVENOR ST., LONDON, W.1.**

JULY 1947

# INTRODUCTION

The most necessary part of motor cycle maintenance is regular lubrication. This book gives the essential lubrication data for individual makes of motor cycles produced from 1939 to 1947.

It is NOT a substitute for the motor cycle maker's instruction book, which naturally covers one make or one model in full detail. To the rider and the mechanic this handy guide presents useful facts about all British makes.

To avoid unnecessary repetition under each make, the lubrication of exposed chains is covered by a single note below.

A separate book entitled "Motor Cycle Lubrication" is available on application and describes general lubrication principles, as distinct from the mechanical details set out herein.

## EXPOSED CHAIN LUBRICATION

On almost all machines the rear chain is either completely naked or else given the very meagre protection of a light skeleton guard. It runs under very bad conditions, receiving grit and water from the road in wet weather, plus drippings from the mudguards when the machine is stationary, dust and grit from the air in dry weather, and so forth.

On a touring machine the rear chain should be removed every 1,000 miles (though the maker's handbook may name a longer distance). On a sports or racing machine every 500 miles is not too often. Its *tension* and *alignment* require regular attention, as, owing to its length, neglect of either spells rapid wear plus a risk of straining bearings and even of bending shafts.

The proper treatment of a removed chain is as follows :—

1. Soak the chain in a bath of paraffin or petrol.
2. Remove all external dirt by hard scrubbing with a stiff brush.
3. Rinse in a second bath of clean paraffin.

4. Dry off the remaining paraffin in gentle heat. (Paraffin is *not* a lubricant for chain purposes, it is merely a cleanser. If paraffin remains in the joints at lubrication, it dilutes the real lubricant, and assists it to run out of the joints after reassembly.)

The cleansed chain is now ready for re-lubrication, thus :—

1. Select a suitable clean tin to act as a bath.
2. Take the necessary amount of Castrolase Graphited grease, which is specially made as a chain lubricant. It is obvious that too thin a grease would drain out too quickly, whereas too thick a grease would fail to enter the fine clearances of the chain. An inferior grease might set up chemical reactions. There is nothing to beat the right grade of grease, cleanly taken from an airtight tin.
3. Melt the grease until it runs freely, but do *not* melt it casually by placing the grease can on a hot stove. Both grease and oil heat up much more quickly than water and may lose some of their virtue if *overheated*. There is only one correct method of liquefying this grease, and this is to place the tin in a can of boiling water, removing it *as soon as it liquefies*.
4. Submerge the chain in the melted grease. Move it about freely to encourage the entry of the grease into the numerous fine clearances of the chain. External grease accomplishes nothing except to retard rust. It is grease inside the chain which lubricates.
5. Leave the chain in the grease until the latter has solidified again.
6. Remove the chain and wipe off the external grease. There is no need to polish the chain, but a thick outside layer of grease merely encourages grit to adhere.
7. Replace the chain on the machine.
8. Test chain alignment.
9. Test chain tension.
10. Remember that the use of the spanner may disturb either alignment or tension, though both were correct before the nuts were finally tightened right home.

When testing tension it should be borne in mind that the middle link of the bottom run of a rear chain should have a play of approximately  $\frac{3}{4}$  in.

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The Castrol grades recommended in these notes apply only to temperate climates. Owners operating their machines in arctic or tropical conditions should seek the advice of their local Castrol agent as to the correct grade to use.

## ABERDALE

### LUBRICATION SYSTEM      PETROIL

RECOMMENDED  
GRADES

{ ENGINE  
CLUTCHCASE

Castrol    X L  
Castrol    D

This autocycle is fitted with the 98 c.c. Villiers engine. Full details of the lubrication of this engine will be found in the section of this book devoted to Villiers (Page 37).



### LUBRICATION SYSTEM      DRY SUMP

RECOMMENDED  
GRADES

{ ENGINE  
ENGINE      Summer  
GEARBOX      Winter

Castrol    GRAND PRIX  
Castrol    X X L  
Castrolase    MEDIUM

Double-acting pump, which both rotates and reciprocates, is employed instead of the more usual pair of pumps.

*N.B.*—Should the crankcase be dismantled for any reason, *the pump plunger must be withdrawn* before separating the two halves of the crankcase.

There is no adjustment except for the feed to the inlet valve by a needle-pointed screw at the right side of the cylinder head. Its normal position is one-half turn from the fully closed position. The inlet valve is liable to squeak if the feed is too small, and a smoky exhaust is the usual symptom if the feed is too large.

Both filters are inside the oil tank.

### LUBRICATION ROUTINE

*Engine.*—The tank should not be overfilled. Leave an air space 1 in. deep below filler cap. Never allow the oil level to sink below half full. Preferably keep level close to maximum, except (for economy's sake) just before a complete change of oil is due.

Check circulation before every run by removing the filler cap of oil tank and looking inside the tank to see that the oil flows from the end of the scavange pump with the engine running.

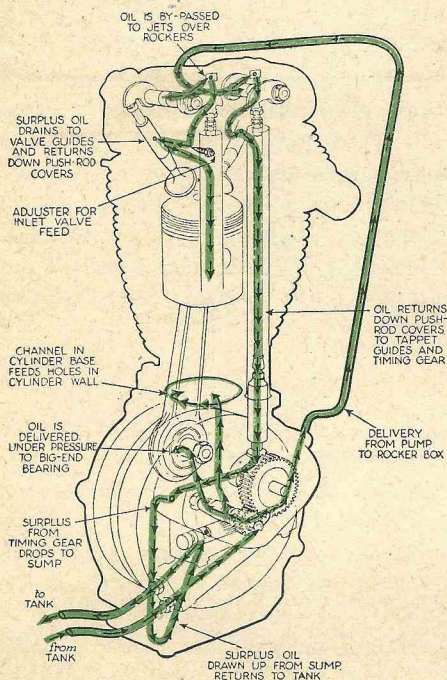
Change oil completely after the first 250 miles, and again after the next 750 miles, and afterwards at regular intervals of 5,000 miles. Tank and engine may be swilled out with flushing oil at all oil changes. Remove both filters, cleanse in petrol, dry

and replace. The large felt filter at the top of the tank cannot be removed without first raising the rear of the saddle, after having removed the two bolts fixing the spring brackets to the frame. This filter may be easily damaged by careless handling and a new filter **MUST** be fitted if the felt is perforated or the ends are damaged.

**Gearbox.**—The capacity of the gearbox is 1 lb. 14 oz. of Castrolase Medium. The correct level is  $2\frac{1}{2}$  in. by dipstick from the bottom of the kickstarter case. Topping up will call for about 2 oz. every 2,000 miles. A drainplug allows for complete change of grease at major overhauls. The grease must be warm before draining can be effected.

**Chains.**—A primary oil bath lubricates front and dynamo chains, and also the shock absorber. Top up every 500 miles to the level of the inspection cap; in replacing the cap be careful to centralise the cork washer and to tighten the knurled screw. The rear chain should receive the routine treatment for exposed chains (see Page 4) every 2,000 miles in summer and every 1,000 miles in winter. The magneto chain needs a little grease (from the gun) every 1,000 miles.

**Teledraulic Forks.**—Top up with Castrolite, if necessary, every 3,000 miles. The Copyright "The Motor Cycle"



## A.J.S. OIL CIRCULATION

method to be employed is as follows: Support machine vertically by blocks under the footrests, but so that the weight remains on both wheels. Then unscrew the plugs at the top of the fork legs, and pull the plugs up until the damper rods can be seen. Work the plugs up and down sharply in order to eject any fluid trapped above the damper valves. Allow the ejected fluid to work down to the main supply and then remove the oil level screws. These are on the sliders under the mudguard bridge. The level is correct when oil just oozes from both holes. If none does, pour two tablespoonsful of Castrolite down each fork inner tube and repeat pumping action. Wait two minutes to allow any excess of oil to drain out and then reassemble.

## Ambassador.

### LUBRICATION SYSTEM PETROIL

RECOMMENDED  
GRADES

{ ENGINE  
GEARBOX

Castrol X L  
Castrol D

This machine, made by U.S. Concessionaires, Ltd., is fitted with the Mark 5E Villiers engine of 197 c.c. The petroil ratio is 16 : 1. For full details of its lubrication see the section on Villiers Engines.

## ARIEL

### LUBRICATION SYSTEM DRY SUMP *Twin plunger pumps*

RECOMMENDED  
GRADES

{	4 cyl ENGINE	Summer	Castrol	XXL
	4 cyl ENGINE	Winter	Castrol	XL
	1 cyl ENGINE	Summer	Castrol	GRAND PRIX
	1 cyl ENGINE	Winter	Castrol	XXL
	GEARBOX		Castrolase plus Castrol	MEDIUM XXL

Four-cylinder models: The oil tank holds  $\frac{3}{4}$  gallon, and is placed under the saddle, high enough to prime the feed pump. Machine should be driven gently until the pressure gauge drops to 40-45 lb. when the engine has warmed up.

Single-cylinder models: The oil gauge reading is adjusted by a pressure regulator to show 10-15 lb.

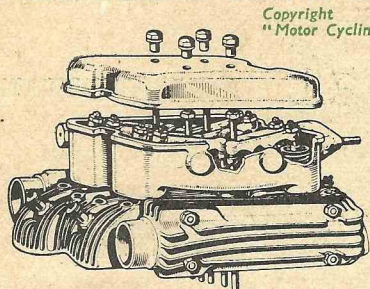
### LUBRICATION ROUTINE

*Engine. Four-cylinder models.*—Do not allow the oil level in the tank to fall below the indicator mark, and keep the level high, *i.e.*, with about one inch of air space above the oil. Drain and flush tank every 2,000 miles. Since a pressure-oiled four-cylinder engine of this type includes many oil ducts, observe maximum cleanliness in all lubrication matters.

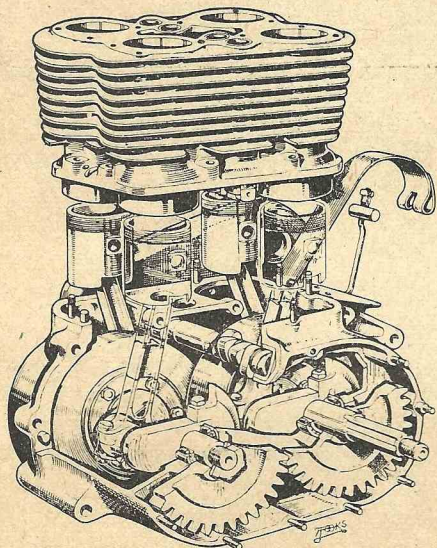
Should the oil ever fail to feed properly, or the crankcase become over full, the pump ball valves are probably deranged by dirt. Remove plugs below pump body, wash balls, springs and plugs with petrol, and squirt petrol on ball seatings.

Two filters must be kept clean, one at the inner end of the feed pipe inside the oil tank, the other in the sump. Both should be cleansed with petrol whenever the oil is changed.

*Single-cylinder models.*—The oil tank must never be either *under* or *over*-filled. Leave an air space 1 inch deep above the surface of the oil in the tank, and do not fail to keep the tank two-thirds full. The flywheel contains an ingenious oil purifier, which separates dirt from the oil by centrifugal force. The separated dirt collects in a cupped plug, which should be emptied every 5,000-8,000 miles, or oftener if the machine is used in exceptionally dusty conditions. Slight differences of lubrication exist between the Standard and Hunter models. For an exhaustive description the maker's handbook should be consulted.



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"Motor Cycling"



THE ARIEL SQUARE FOUR

Drain and flush the tank every 2,000 miles. Pay special attention to the usual pair of filters in the sump and oil tank respectively.

This system is naturally simpler than that of the four-cylinder model, and trouble with it is practically impossible, provided that the owner observes strict cleanliness, adheres to the recommended oil levels, and renews the oil every 2,000 miles. The first decarbonisation of these engines should be done after about 3,000 miles, and repeated subsequently at about double that distance.

*Gearbox.*—All Ariel gearboxes are lubricated with grease and oil. Use only Castrolase Medium and Castrol XXL. The wastage is at the rate of slightly more than a couple of ounces in every 2,000 miles. The most convenient method of replenishment is to force in 2 to 3 oz. with the grease gun via the nipple provided on the gearbox and add  $\frac{1}{2}$  pint of oil via the filler plug. Extreme cleanliness is essential.

**Chains.**—Engine oil is used. The primary chains are lubricated by dipping into a pool of oil in the base of their chaincase. This pool is *NOT* maintained automatically from the engine, but supplies are inserted by hand. Do not fill above the oil level plug. The rear chain is supplied with oil via a needle valve in the primary chaincase just behind the clutch dome. This valve controls the supply to the rear chain, which operates only when the engine is running. The valve is adjustable, and is turned clockwise to decrease the supply.

**Hubs.**—The hubs are lubricated by Castrolase Heavy. Be careful to stop the supply as soon as grease begins to seep past the dirt-excluding washer. Excessive greasing will produce brake weakness.

**Rear springing.**—Apply grease gun to the nipples on the clamp bolt and the pivot pin boss every 250 miles.

**Note.**—There are 31 points requiring periodic lubrication of some sort on the early Ariel single-cylinder models. The majority of these are covered by the use of the grease gun in less time than it takes to write this paragraph. Use Castrolase CL in the gun.



#### LUBRICATION SYSTEM DRY SUMP

RECOMMENDED GRADES	{	ENGINE & GEARBOX	
		Summer	Castrol GRAND PRIX
		Winter	Castrol X X L
		A7 VERTICAL TWIN ONLY	
		ENGINE & GEARBOX	
		Summer	Castrol X X L
		Winter	Castrol X L

At the moment, two main types of engine are manufactured, with overhead valves operated by pushrods and with side valves.

The lubrication system of all models is similar, except that on the 350 c.c. overhead valve engine a special oilfeed is required for the rockerbox on the top of the engine. This entails two extra external oil pipes, a small bypass feed pipe taken off the main return pipe at a point just short of the tank junction, and a small return pipe from the rockerbox to the crankcase. Maintenance is in no way complicated by these two additional pipes, except that they must be flushed and cleansed with the rest of the system after every 2,000 miles.

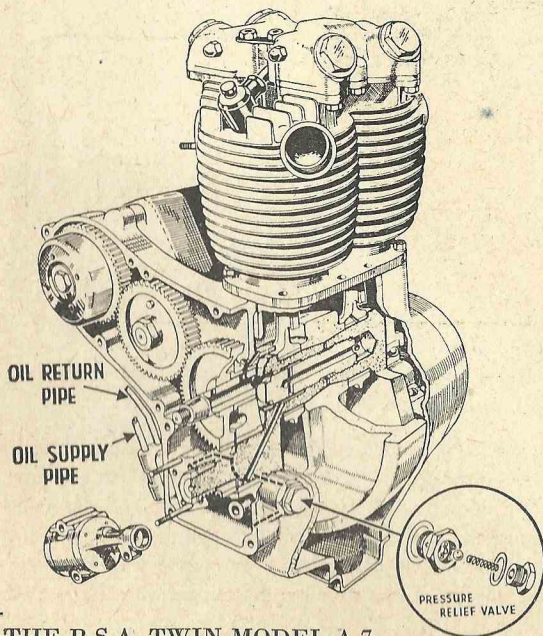
The feed and scavenge pumps are combined in a single unit at the base of the engine. Both pumps are of the geared type. As the oil tank is placed high, the feed pump is automatically primed by gravity. Each pump is coupled by an external pipe to the oil tank. There are two filters, one inside the tank guarding the supply to the pumps, the other above the pump cover plate.

From the feed pump the oil travels past a pressure valve to the oilways feeding the cam spindles and through the hollow crankshaft and the big-end bearing. The oil escaping from the bearings lubricates the interior of the engine in the form of oil mist and drains down to the bottom of the crankcase, whence it is returned by the scavenge pump through a second pressure valve to the oil tank.

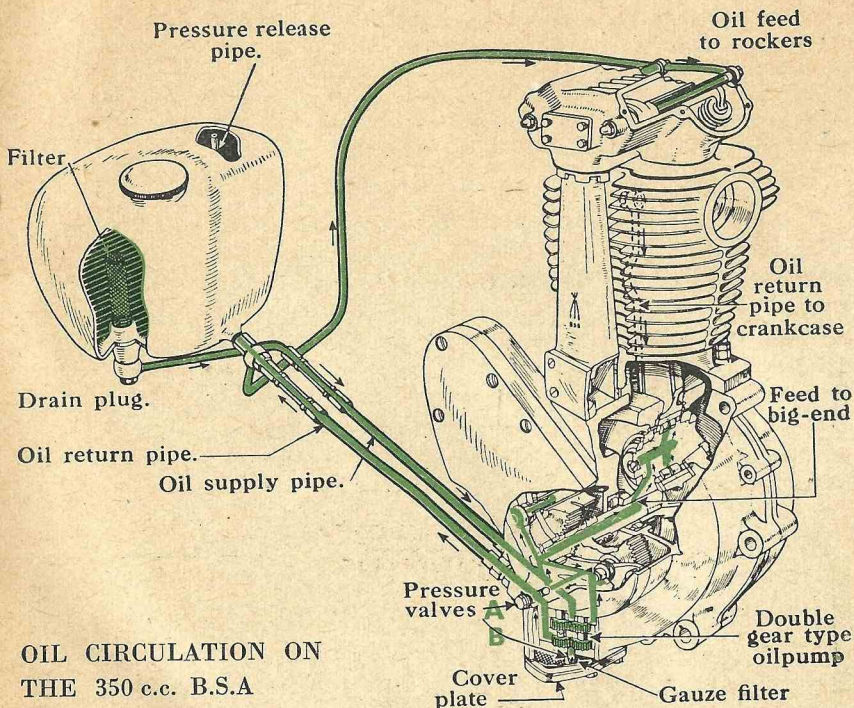
*On no account should the owner attempt to remove the oil pump.* Consisting merely of two pairs of cogwheels, it is simple and sturdy, and will never give any trouble. There is no sightfeed or gauge glass.

Trouble can only arise from two causes. These are (a) dirt, which can choke a pipe, a filter, or an oilway, and will never occur if the rider observes extreme cleanliness and attends to the servicing details set out below; and (b) improper seating of one

or both pressure valves, which is a rare event possibly occurring because of small metal particles originating in the engine itself. Both valves are of the ball type. If valve A (see diagram) fails to seat properly, oil may drain from tank to engine while the machine is standing in its garage and flood the crankcase. To remedy this unscrew the plug over the valve, remove the ball and spring, clean and replace. Similarly, if valve B gets stuck, the scavenge pump cannot return used oil to the tank. To remedy, remove cover plate below pump, and use a wire to free the ball from its seat.



THE B.S.A. TWIN MODEL A.7



## OIL CIRCULATION ON THE 350 c.c. B.S.A

It is easy to verify whether ball valve B is operating properly ; simply remove the oil tank filler cap, when oil will be seen issuing from the return pipe. If it is not, then ball valve B has stuck and must be freed.

Very occasionally the pressure release pipe in the oil tank may get fouled by dirt, supposing the owners' methods are slovenly. This will raise the pressure inside the tank, and oil may then leak from the oil filler cap. The pipe can be cleared by pushing a length of flexible wire (*e.g.*, an old Bowden cable with its tip soldered solid) up the lower end of the pipe, just in front of the rear mudguard.

## LUBRICATION ROUTINE

*Engine.*—At least once in every 250 miles remove the oil filler cap from the oil tank and inspect the level. This must not drop *below* the line on the outside of the tank. Neither must the surface of the oil come within an inch of the tank top. Scavenged oil returns swollen by air bubbles, for which space must be left.

With a brand new engine it pays to change the oil after 500 miles, and again after 1,500 miles. Later the oil is changed every 2,000 miles. But, if conscience

accuses the rider of any slovenliness in respect of cleanliness, all the oil should be changed at once and the system flushed out. Both filters *must* be cleansed. The tank filter is fixed to the banjo plug and will come out with it. The sump filter can be withdrawn after removing the pump cover plate. It is safe to wash both filters with petrol or paraffin, as they can be thoroughly dried before replacement, and no risk of diluting the fresh oil is therefore involved.

**Gearbox.**—Drain every 2,000 miles and refill to level of filler plug.

**Chains.**—The front chaincase should be drained and refilled to plug level every 1,000 miles. The rider should remember that the chaincase on these machines is *not* automatically replenished from the engine.

**Front Forks.**—These are designed to take a maximum of a quarter pint of Castrolite per leg. They should be topped up whenever the fork action becomes excessive. The forks on some of the earlier 250 c.c. models are not hydraulic, and merely demand the use of a grease gun on the link nipples.

**Other items.**—All other items are supplied by grease gun, except the brake cam spindles, which need a few spots of engine oil every 1,000 miles. Use Castrolase Heavy in the grease gun.

## Brough Superior

LUBRICATION SYSTEM	DRY SUMP	Double gear pump
RECOMMENDED GRADES	<div style="display: inline-block; vertical-align: middle; font-size: 3em; line-height: 1;">{</div> <div style="display: inline-block; vertical-align: middle;"> ENGINE      Summer      Castrol GRAND PRIX  ENGINE      Winter      Castrol    X X L  GEARBOX      Castrol GRAND PRIX </div>	

1. Separate oil tank.
2. No sight gauge.
3. The feed to the overhead valve gear is tapped by a passage from the oil pump. There are two spring-loaded ball valves, one controlling the oil supply to each cylinder wall, but they require neither attention nor adjustment.

### LUBRICATION ROUTINE

**Engine.**—The oil tank should be filled to the line of the spout and topped up as required to maintain the level. There is no minimum mark on the tank. The return flow from the scavenge pump is visible when the filler cap is off. Change the oil every 1,000 miles, and at the same time cleanse the filter. Every 5,000 miles fit a new filter element.

**Gearbox.**—Top up to the level plug as required.

**Chains.**—The primary chaincase should be kept filled with engine oil up to the level plug. The rear chain receives oil from the crankcase release.

## CYC-AUTO

LUBRICATION SYSTEM      PETROIL  
RECOMMENDED GRADE

Castrol X L

The engine of this auticycle is remarkable in that it uses 27 parts of petrol to one part of oil, a wider ratio than any other maker of two-strokes has yet adopted. Castrol XL is suitable for lubricating the special bottom bracket, wherein a helical drive couples the engine shaft to the chainwheel. A dipstick is fitted to verify the oil level. The same grade should be used for wheel hubs, chains and cycle parts.

## Douglas

LUBRICATION SYSTEM      DRY SUMP

RECOMMENDED  
GRADES

{	ENGINE	Summer
	ENGINE	Winter
	GEARBOX	

Castrol X X L  
Castrol X L  
Castrol X X L

Circulation of the oil is effected by submerged vane pump. The pressure is fixed and unalterable ; no indicator is fitted.

### LUBRICATION ROUTINE

*Engine.*—The sump should be kept topped up to the maximum permitted level, and a complete change of oil made every 2,000 miles, when the sump should be swilled out with flushing oil and the filter cleansed.

*Gearbox.*—The consumption is very slight. The level should be checked occasionally.

*Chains.*—There is no primary chain on the post-war model. No provision is made for automatic lubrication of the rear chain, which should receive routine maintenance as described on Page 4.

*Forks.*—Precise observance of the makers' maintenance instructions is essential. Use Castrolite for 1946 Radiadraulic forks.

*Hubs.*—Lubricate with Castrolase Heavy.

*Gun Nipples.*—Periodic attention with Castrolase CL.

## Excelsior

### LUBRICATION SYSTEM PETROIL

RECOMMENDED  
GRADES

{ ENGINE  
GEARBOX

Castrol XL  
Castrol XXL

At present three models are marketed—the 125 c.c. Universal, the 98 c.c. Autobyk and the 98c.c. Super Autobyk. The first two of these have Villiers engines, the third is fitted with an engine entirely produced by the Excelsior Motor Company and incorporating a two-speed gearbox integral with the engine.

Some earlier models, distinguished by separate cylindrical oil tanks, used the Villiers automatic lubrication system. See Page 38 for an account of this system.

### LUBRICATION ROUTINE

*Gearbox.*—The gearbox filler plug is unscrewed with a coin and requires a quarter of a pint of oil to be added every 1,200 miles.

*Chains.*—Castrol XXL is used in the chaincase. The chaincase filler plug also acts as a level control.

*Clutch.*—The clutch of the Autobyk requires engine oil to be inserted periodically to plug level after tilting the machine for easy access.

*Wheel Hubs and Cycle Parts.*—Use Castrolase Heavy.

## Francis Barnett

### LUBRICATION SYSTEM PETROIL

RECOMMENDED  
GRADES

{ ENGINE  
CLUTCH

Castrol XL  
Castrol D

The petrol mixture is one part of oil to sixteen parts of petrol. If these cannot be well mixed beforehand, close petrol tap, pour in one gallon of petrol and four measures of oil (a measure is usually provided). Shake well before opening tap to prevent the carburettor becoming clogged with oil.

On 98 c.c. and 125 c.c. models the clutchcase should be replenished to the level of the filler plug every 2,000 miles. For chain lubrication use Castrolase Heavy.

For fuller details of the engine lubrication system fitted to the 1939 250 c.c. model see the Section on Villiers engines.

# JAMES

LUBRICATION SYSTEM  
RECOMMENDED GRADE

PETROIL  
ENGINE

Castrol XL

## LUBRICATION ROUTINE

### (a) Autocycle.

*Engine.*—A measure is incorporated in the filler cap. Four measures of oil (the equivalent of half a pint) to one gallon of petrol.

*Clutch case.*—Every 2,000-2,500 miles remove the filler plug just underneath the sprocket on the magneto side and replenish with Castrol D Gear Oil. The filler plug also acts as a level plug.

### (b) 125 c.c. Model.

*Engine.*—A measure is incorporated in the filler cap. Three measures of oil (the equivalent of half a pint) to one gallon of petrol. The tank holds  $2\frac{1}{4}$  gallons.

*Gearbox and Chaincase.*—Use Castrol D Gear Oil. The front chaincase should be topped up every 500 miles.

*Wheel Hubs.*—Use Castrolase Heavy.

*Grease Gun.*—All frame parts should be lubricated with Castrolase CL.



RECOMMENDED  
GRADES

{ ENGINE  
ENGINE

Summer  
Winter

Castrol XXL  
Castrol XL

These engines have been supplied in a very wide range of sizes and types to assembling firms during the last 50 years. Over forty models are probably still in use, and space does not permit more than a superficial treatment here. A booklet is available from the makers, J. A. Prestwich & Co., Ltd., Northumberland Park, Tottenham, London, N.17, covering the variations since 1913 in detail. Standard, sports and racing models have been built in sizes ranging from 175 c.c. to 1,100 c.c.

The dry sump system has been adopted on all recent models and this system is selected for fuller description here.

The pump, fed by gravity from a separate oil tank, is of the double-acting plunger type. It is gear-driven, and the scavenging end of the plunger is larger than the delivery end. Distribution of the oil from the pump varies. On the more highly stressed engines oil travels through a series of ducts into a hollow crankpin. On other models the crankpin is solid, and oil is sprayed from an orifice on the inside boss of the timing side flywheel.

*Valve Gear.*—On models built from 1935 onwards an oil pipe has led from the oilbox to the rocker box. Since the oilbox is at atmospheric pressure, and a partial

vacuum exists in the rockerbox, oil is drawn up the pipe. The 1,100 c.c. engine since 1935 has a positive pressure feed from a bypass in the double plunger pump.

Dry sump and the double plunger pump are standard on the following models of recent date :—

Side valve : 350 c.c. sports, 500 c.c. sports, 600 c.c. sports.

O.H.V. : 175 c.c. standard, 250 c.c. standard, 350 c.c. standard, 500 c.c. standard, 500 c.c. sports, 600 c.c. standard.

*Maintenance.*—An air space  $1\frac{1}{2}$  in. deep should be left above the surface of the oil in the tank, as the oil returned from the engine is inflated by bubbles. The oil tank should be topped up to the above level every 100 miles. The oil should be completely changed every 1,000 miles. Be careful that any fine passages in the silencer are not choked with carbon.

Excessive oil consumption will betray itself by oiling up the plugs. It will usually be due to air leaks at unions, nipples and the joint between the return side of the pump and the oil tank. If these joints are dismantled they should be reassembled with complete cleanliness, and properly tightened. (On wet sump engines similar symptoms may be due to the rotary valve being improperly timed in re-erection. Its slots should commence to open 65 degrees before bottom dead centre.)



#### LUBRICATION SYSTEM TOTAL LOSS

RECOMMENDED GRADES	ENGINE GEARBOX	Castrol GRAND PRIX Castrolase MEDIUM
--------------------	-------------------	---

Pre-war engines still on the road consist of O.H.V. models in four sizes : 250 c.c., 350 c.c., 500 c.c. and 600 c.c. There are also two-stroke models, which will be dealt with separately.

The oil descends by gravity from the tank to a Pilgrim pump driven off the engine. Owing to individual variations in the driver, the engine and the pump, the rider must set the normal oil supply to suit his own engine. The factory setting may have been disturbed after a machine quits the works. The oil-regulating screw should be set to deliver 12 to 24 drops of oil per minute. Count only full blobs delivered from the beak, ignoring any petty flow between the full pulsations. To test the suitability of this feed take the machine on the road, close the throttle on top gear, change down to the next lowest gear, and accelerate sharply. If this reopening of the throttle is accompanied by a puff of blue smoke, the drip setting is correct. Otherwise, the setting should be increased or decreased, according to excessive smoke, or an absence of the blue puff. The pump is also fitted with a small toggle lever, which overrides the regulating screw. This should be opened out for very fast road work, and closed on entering a town. Many riders move it by foot. The movement of the lever is limited by its fouling either the oil pipe of the magneto chain cover, so that gross excess cannot be delivered in touring. For strenuous speed or competition work it is easy to re-set the lever for a greater supply. Undo the central screw, re-set regulating screw, and refit lever.

The valve guides are lubricated by oil which passes up the pushrod tube. Two small pipes run from the rocker box to the valve guides. These should be cleaned out at de-cokes to insure against choking.

Some early models have duplex Pilgrim pumps, the extra feed being connected by pipe to the rear of the cylinder. This second feed should be closed off for road work, but a supply of 10-12 drops per minute is used for racing.

Oil leakage from the rocker box usually implies either (a) too generous a setting of the regulating screw, or (b) damaged felt washers over the rockers.

If the sight bowl overfills with oil, stop at once or the engine may seize. The trouble may occur with an old engine if either the end cam or plunger of the pump become so seriously worn as to upset the timing of the pump.

The pump will be seriously damaged if the driving worm is rotated when either the end plate or end cam are removed.

## LUBRICATION ROUTINE

**Chaincase.**—The aluminium cases have three plugs, namely, filler, level and drain plugs. The pressed steel cases have an inspection plate near the top, intended for oil-filling, and for testing chain tension. The level plugs of both types of case should be removed every 500 miles for the removal of any surplus. The correct lubricant is a 50/50 mixture of paraffin and Castrol Grand Prix.

**Gearbox.**—This is a Burman. It will require topping up with Castrolase Medium, 3 to 4 oz. every 1,000-1,500 miles. Do NOT use oil.

## TWO-STROKE MODELS:

These were manufactured in variety up to the outbreak of war. A single Popular model utilised petrol lubrication on normal lines, with the usual 16 : 1 ratio and using Castrol XL. The more refined models employed a total loss system, broadly similar to that described above for the four-stroke engines. The Pilgrim pump has a branch pipe to each main bearing, and a special feed travels via the drilled crank-shaft to the big end.



### LUBRICATION SYSTEM DRY SUMP

RECOMMENDED GRADES	ENGINE	Summer	Castrol GRAND PRIX
	ENGINE	Winter	Castrol X X L
	GEARBOX		Castrolase MEDIUM

Double-acting pump, which both rotates and reciprocates, is employed instead of the more usual pair of pumps.

**N.B.**—Should the crankcase be dismantled for any reason, *the pump plunger must be withdrawn* before separating the two halves of the crankcase.

There is no adjustment except for the feed to the inlet valve by a needle-pointed screw at the right side of the cylinder head. Its normal position is one-half turn from the fully closed position. The inlet valve is liable to squeak if the feed is too small, and a smoky exhaust is the usual symptom if the feed is too large.

Both filters are inside the oil tank.

## LUBRICATION ROUTINE

*Engine.*—The tank should not be overfilled. Leave an air space 1 in. deep below filler cap. Never allow the oil level to sink below half full. Preferably keep level close to maximum, except (for economy's sake) just before a complete change of oil is due.

Check circulation before every run by removing the filler cap of oil tank and looking inside the tank to see that the oil flows from the end of the scavage pump with the engine running.

Change oil completely after the first 250 miles, and again after the next 750 miles and afterwards at regular intervals of 5,000 miles. Tank and engine may be swilled out with flushing oil at all oil changes. Remove both filters, cleanse in petrol, dry and replace. The large felt filter at the top of the tank cannot be removed without first raising the rear of the saddle, after having removed the two bolts fixing the spring brackets to the frame. This filter may be easily damaged by careless handling and a new filter **MUST** be fitted if the felt is perforated or the ends are damaged.

*Gearbox.*—The capacity of the gearbox is 1 lb. 14 oz. of Castrolase Medium, The correct level is  $2\frac{1}{2}$  in. by dipstick from the bottom of the kickstarter case. Topping up will call for about 2 oz. every 2,000 miles. A drainplug allows for complete change of grease at major overhauls.

*Chains.*—A primary oil bath lubricates front and dynamo chains, and also the shock absorber. Top up every 250 miles to the level of the inspection cap; in replacing the cap be careful to centralise the cork washer and to tighten the knurled screw. The rear chain should receive the routine treatment for exposed chains (see Page 4) every 2,000 miles in summer and every 1,000 miles in winter. The magneto chain needs a little grease (from the gun) every 1,000 miles.

*Teledraulic Forks.*—Top up with Castrolite, if necessary, every 3,000 miles. The method to be employed is as follows: Support machine vertically by blocks under the footrests, but so that the weight remains on both wheels. Then unscrew the plugs at the top of the fork legs, and pull the plugs up until the damper rods can be seen. Work the plugs up and down sharply in order to eject any fluid trapped above the damper valves. Allow the ejected fluid to work down to the main supply and then remove the oil level screws. These are on the sliders under the mudguard bridge. The level is correct when oil just oozes from both holes. If none does, pour two tablespoonsful of Castrolite down each fork inner tube and repeat pumping action. Wait two minutes to allow any excess of oil to drain out and then reassemble.

## NEW HUDSON

TWO-STROKE AUTOCYCLE		
LUBRICATION SYSTEM	PETROIL	
RECOMMENDED GRADE	ENGINE	Castrol X L

For the first 1,000 miles use three-quarters of a pint of oil to each gallon of petrol. After the first 1,000 miles reduce oil to half a pint per gallon. Use Castrolase Heavy for chains and hubs, and Castrol XL in the oil-can.



LUBRICATION SYSTEM	PETROIL	
RECOMMENDED GRADE		Castrol X L

### LUBRICATION ROUTINE

*Engine.*—Ratio : One part of oil to sixteen parts of petrol once the engine is run in.

*Primary Chain.*—Top up monthly with Castrol D Gear Oil to the level of the filler plug, with the machine standing level.

*Forks.*—Apply Castrolase CL weekly by grease gun.

*Hubs.*—Apply Castrolase CL monthly by grease gun.

*Bottom Bracket and Steering Head.*—Re-pack once a year with Castrolase CL.

*Gearbox (125 c.c. model only).*—Top up monthly with Castrol D Gear Oil to the level of the plug situated by the side of the kickstarter crank.

## Norton

LUBRICATION SYSTEM		DRY SUMP	Gear Pump
RECOMMENDED GRADES	ENGINE C.S.1 30 & 40		Castrol R
	OTHER MODELS	Summer	Castrol X X L
		Winter	Castrol X L
	GEARBOX		Castrol X X L

The system is broadly similar for side-valve, pushrod and camshaft engines, except that the latter require an additional pipe for supplying oil to the rockerbox. The rockerbox supply is metered by an oilhole registering with a keyway once in each revolution. Overflow holes conduct any surplus down the vertical shaft casing to the sump.

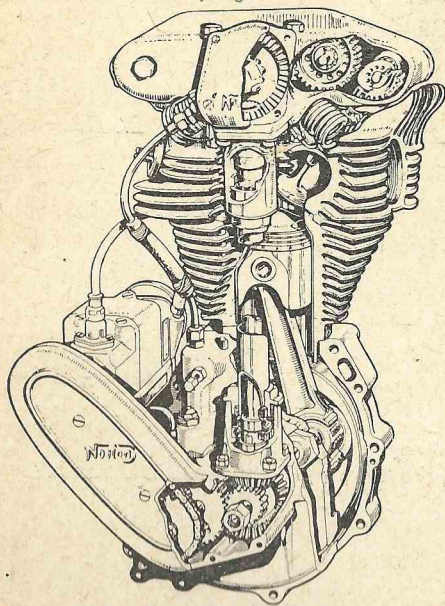
There is only one filter, a gauze type inside the oil tank above the feed pipe union. A sludge trap in the base of the crankcase affords additional protection against dirt.

On leaving the feed pump the oil actuates a tell-tale plunger. Until this rises no oil is circulating. The U head of the oil return pipe projects above the oil in the tank. With the engine running, a glance inside the tank shows oil dripping from this pipe to prove that the scavenge pump is working. An overflow relief pipe in the oil tank discharges surplus oil on to the road if the tank is overfilled. Preferably, the engine should be run for a minute before the oil level is checked, in case oil has syphoned into the engine.

## LUBRICATION ROUTINE

*Engine.*—After the first 500 miles, and subsequently after every 2,000 miles, drain the tank and sump, flush out with Wakefield flushing oil, wash the tank filter in petrol and dry, and empty the sludge trap. The oil tank holds four pints when filled to the correct level (three-quarters full). In running it should be kept up to this mark as far as possible. All engines run better with the maximum permissible quantity of oil in circulation.

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The pressure control valve is the sole adjustment in the circuit. The works setting is to screw the adjuster right home and then to screw it back two and a half turns. It is better not to tamper with this, but it may be washed in petrol and dried. The addition of Castrollo Upper Cylinder Lubricant to the engine oil is advised during the running-in period.

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## TWIN CAMSHAFT NORTON (T.T. Engine)

*Gearbox.*—Top up with Castrol XXL every 1,000 miles.

*Chaincase.*—Replenish with Castrol XXL about every 1,000 miles to height of level plug. Smear the inside face of the rear chain with grease every 1,000-2,000 miles.

*Spring Frame.*—Apply gun every 1,000 miles to the nipples, using Castrollease Medium.

**Roadholder Forks.**—It is necessary to drain and refill these forks at intervals of about 5,000 miles, in this way :—

1. Remove hexagon headed filler plug at the top of each fork leg.
2. Remove drain plug from each fork end ; allow oil to drain out and operate the forks a time or two to eject the last drops.
3. Replace drain plugs.
4. Re-fill each leg with a measured  $\frac{1}{2}$  pint of Castrolite.
5. Work the forks a few times to remove any air locks.
6. Replace filler plugs.



## PANTHER

LUBRICATION SYSTEM POSITIVE FEED (Centrifugal return)

RECOMMENDED  
GRADES

{	ENGINE	Summer
	ENGINE	Winter
	GEARBOX	

Castrol	XXL
Castrol	XL
Castrolase	CL

The oil supply is carried in a sump below the crankcase. A small rotor pump contains a reciprocating plunger which picks up oil and forces it through a pressure control valve to both the lower part of the engine and to the rocker gear. An external cap permits adjustment of the pressure (except on models 80 and 90, where the pressure is not adjustable). On removing this cap an adjusting screw becomes visible. This screw is carefully set at the works and should not be touched unless absolutely necessary. If the pressure control valve is properly set, overoiling will not be the fault of the pump, which should automatically by-pass any excess. Should over-oiling occur, however, examine the crankcase relief valve, which is integral with the nut securing the engine sprocket inside the crankcase. Its disc may fail to seat through dirt, or after long use may be worn, or may have been damaged by rough handling.

## LUBRICATION ROUTINE

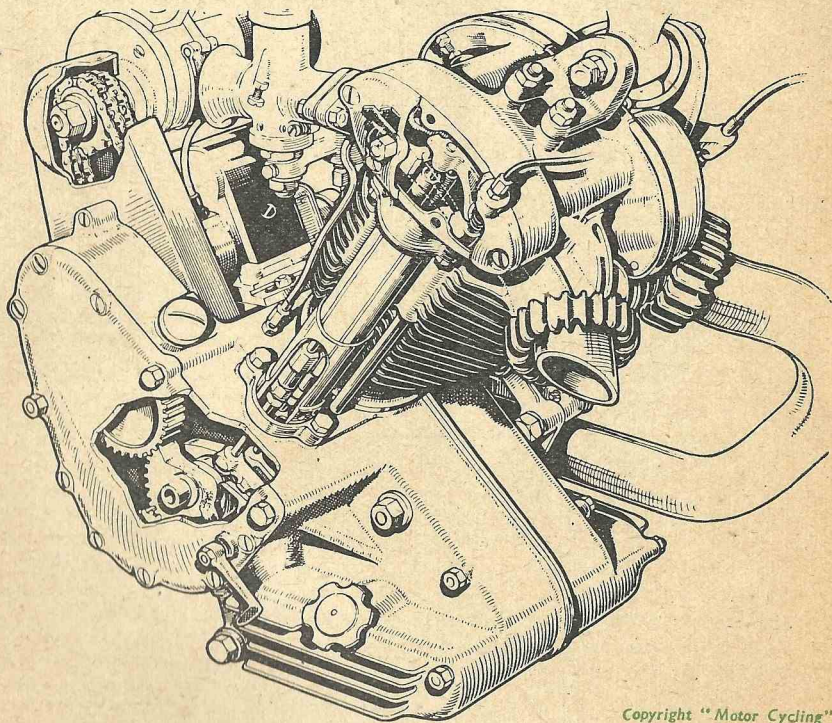
**Engine.**—The sump cannot be overfilled and should be inspected every 250 miles and topped up as required. After the first 500 miles remove the filter screwed in the right-hand side of the base of the sump, drain out all oil, choosing a moment when the oil is warm after a run. Refill with fresh oil. It is not necessary to swill out the sump, but Wakefield flushing oil should be used for that purpose should the sump become foul after long use. The filter should be cleansed with petrol and dried before replacement.

**Gearbox.**—Top up as required every 1,000 miles.

Engine oil is advised for the hubs, and Castrolase CL for all nipples.

**Oleomatic Forks.**—The 1947 Panther is fitted with telescopic front forks of the Dowty type in which air forms the shock-absorbing medium and oil provides the damping action. Topping up is only necessary if bottoming occurs in spite of correct inflation. Unless dirt has been allowed to enter with the oil during filling or topping up, the oil need never be changed during the life of the machine. However, the sequence of operations for charging is as follows :—

1. Remove filler plugs at top of each tube.
2. Extend legs  $1\frac{1}{2}$  in. below normal static position.
3. Pour  $\frac{1}{4}$  pint Castrolite into each leg.
4. Replace filler plugs.
5. Depress the core of the inflation valve until the weight of the machine has fully compressed the fork legs. This ejects surplus oil through the valve.
6. Over-inflate the forks with a tyre pump. A single valve at the top on the near side inflates both units.
7. Finally, with the rider's weight in the saddle, release the air pressure until the lower rim of the mud shroud on the static tube coincides with an indicator dot on the sliding tube. In this way the load deflection characteristics are adjusted to suit the weight of the individual rider. Where a sidecar is subsequently fitted it is only necessary slightly to increase the air pressure.



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THE PANTHER 600 c.c. "REDWING 100"

## RAYNAL AUTO

### LUBRICATION SYSTEM PETROIL

RECOMMENDED  
GRADES

{ ENGINE  
CLUTCH

Castrol XL  
Castrol D

*Ratio.*—One part of oil to eleven parts of petrol during the first thousand miles (i.e., three-quarters of a pint per gallon). After 1,000 miles reduce to half a pint of oil per gallon.

Use Castrol XL for chain lubrication and Castrolase CL for forks, wheel hubs and frame parts.

## Royal Enfield

MODELS 490 c.c. & 846 c.c.

### LUBRICATION SYSTEM DRY SUMP

RECOMMENDED  
GRADES

{ ENGINE & GEARBOX

Summer  
Winter

Castrol GRAND PRIX  
Castrol \* XXL

The engine lubrication system is distinguished from the usual pattern by the use of an oil reservoir formed in the crankcase, instead of as a separate tank under the saddle, with external feed and return pipes. Both the feed and the scavenge pumps are of the oscillating cylinder type, and are double-acting. A space in the pump housing is utilised as an auxiliary cylinder when the main cylinder is on its suction stroke, and vice versa. Thus, the primary side of the feed pump delivers oil via a felt filter and a feed-plug down the time-side shaft to the big-end, from which it is splashed to the cylinder, piston and the main bearings. The secondary side of the feed pump delivers a further supply to the rear wall of the cylinder. Surplus oil collects by drainage in two wells at the bottom of the crankcase, from which it is drawn by the double-acting scavenge pump through a filter and returned to the reservoir formed in the crankcase. A supply to the overhead rockerbox is provided by a ball valve at the outlet end of the delivery passage from the scavenge pump. The resistance of this ball valve generates sufficient pressure to force part of the returned oil up an external pipe to the rockerbox. From the rockerbox this oil drains back down the pushrod enclosure tubes and through grooves in the tappet guides into the timing case. Here it is picked up by two gearwheels of the magneto drive, and returned through a separate passage to the reservoir. The double-acting pumps are ill-suited for a verbal description, but are entirely reliable. The system embodies one control valve of the pressure release type, located at the inner end of the timing shaft, and operating at 30 to 40 lb. per square inch. There are three filters: (a) a felt filter located at an exit from the feed pump, (b) a gauze filter at the entry to the

feed pump, and (c) a gauze filter at the entry to the scavenge pump. All three should be cleansed at the periodic oil changes. There is no sight glass.

## LUBRICATION ROUTINE

*Engine.*—The oil reservoir should be kept just full enough to allow 2 in. of air space above the oil. As all scavenged oil is swollen with bubbles, excess will create pressure and cause oil leaks. It is equally important not to let the level fall too low—that is to say, below that indicated by the dipstick fixed to the underside of the filler cap.

Topping up should be carried out according to consumption, which, in turn, depends partly upon the condition and age of each individual engine. If the engine is in good condition, and there are no external oil leaks, consumption should not exceed one gallon in 2,000 miles.

After the first 500 miles, and thereafter at each 2,000 miles, the reservoir, timing valve and felt filter should be drained. Two hexagon plugs underneath the engine, and below the two gauze filters, drain the tank and sump respectively. (The rear plug drains the tank.)

Brush both the wire gauze filters with paraffin and dry them. Swill both tank and sump with flushing oil, NOT petrol or paraffin. Drainage is easier if tackled when the machine is just in from a run and the oil is hot.

The timing case is drained by removing the feed plug and leaning the machine well over on its right side. Note that the oil in the catch-pit will not return to the tank after replenishment until its proper level has been re-established. When this level is restored, the tank level will, of course, be about half a pint lower but obviously no actual loss of oil is involved.

The oil filter can be withdrawn after unscrewing the small finger nut on the end of its cover. The felt element should be washed in petrol every 2,000 miles and dried before replacement. It should be renewed every 5,000 miles. Note that seven small parts will come away with it when the nut is taken off. All of these must be replaced in their correct order. Let the engine tick over gently for five minutes to refill the filter housing.

Excessive consumption (above 800 to 1,000 miles per gallon on a well-worn engine, or 1,500 to 2,000 miles with piston rings and all joints in good condition) may be due to any of the following causes:—

- (i) *External leaks past faulty joints.*
- (ii) *Leakage at filler cap due to overfilling.*
- (iii) *Partial obstruction in leads to or from the scavenge pump. Such obstructions allow oil to accumulate in the crankcase and escape past the drive-side main bearing, or in excessive quantities through the crankcase breather.*
- (iv) *Air leaks on suction side of the scavenge pump, e.g. at the washer below the front gauze filter, or at the timing joint-cover face.*

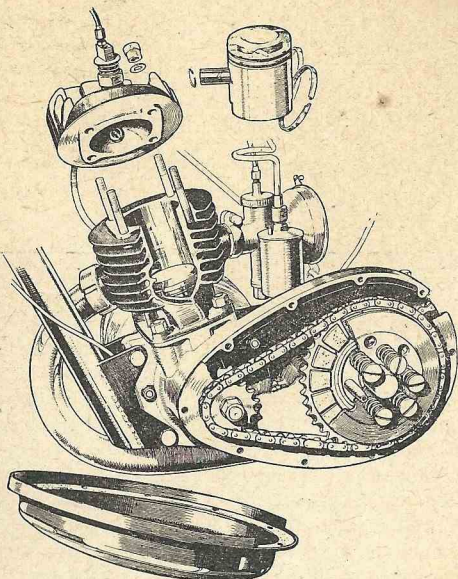
*Gearbox.*—The gearbox is packed with a light grease at the works, but engine oil is used for topping up. Under no circumstances must any heavy grease be used.

Check oil level every 500 to 1,000 miles, and top up with engine oil to the level of the filter plug.

**Chains.**—The front chaincase should be kept filled with engine oil to the level of the overflow plug. The rear chain should receive the treatment specified elsewhere in this book for all naked chains. It should never be run more than 2,000 miles without removal for thorough cleaning and re-lubrication.

**Front Forks.**—The oil in these forks determines the hydraulic action. To top up, remove hexagon cap nut from the top of each leg. Pour Castrolite through the gauze filter thus exposed. Next remove the small drain plugs from the bottom of the legs. When the oil stops flowing, the correct amount is retained in each leg.

**Grease Gun.**—Castrolase Heavy is recommended for all nipples, though Castrolase CL will, in fact, suit all points except the hubs and the older types of speedo drive on the brake cover plate. The hubs must not be given too much grease, lest brake action be impaired.



## THE 125 c.c. TWO-STROKE ROYAL ENFIELD

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### MODEL 125 c.c. Two-stroke

LUBRICATION SYSTEM		PETROL
RECOMMENDED GRADES	{ ENGINE { GEARBOX	Castrol GRAND PRIX Castrolase MEDIUM

### LUBRICATION ROUTINE

**Engine.**—For normal use, add one part of oil to twenty-four parts of petrol. A measure is fixed to the underside of the filler cap, two of these measures are added to each gallon of petrol. Mix well before pouring into the tank. Should no mixing vessel be available, close petrol tap, put oil in the tank first, and then the petrol. Either stir with a clean implement or raise the machine and joggle the tank violently. Then re-open the petrol tap.

**Gearbox.**—Top up every 500 miles with Castrolase Medium to which Castrol Grand Prix may be added. NEVER use heavy grease.

**Chains.**—The primary chaincase is delivered packed with soft grease, but engine oil may be used for topping up.

The remaining items are treated as described for the four-stroke models.



## LUBRICATION SYSTEM      DRY SUMP

RECOMMENDED GRADES	ENGINE	Summer	Castrol X X L
	ENGINE	Winter	Castrol X L
	GEARBOX		Castrol X X L

The Scott lubrication system is different from all others. This powerful twin-cylinder two-stroke requires a more elaborate oiling system than the small single-cylinder two-strokes which can operate on the petroil system. Oil descends by gravity from a compartment in the main tank to a duplex oil pump with twin sight feeds. These are separately adjustable by means of knurled screws, controlling the rate of supply. The twin pumps force oil at the determined rate to the two separate crankcases. The oil feed commences when the engine starts, and ceases when the engine stops. Except for the control of its rate it is entirely automatic. The oil feed reaches the crankcases through timed ports in the crankshaft packing glands. A well in each crankcase holds enough oil to last five minutes at moderate speed should the main oil tank run dry. Every internal part of the engine is thoroughly lubricated by oil flung from the cranks and by the oil mist dispersed by the crankcase suction and compression. (On the Power-Plus type of engine a special internal feed supplies additional oil by centrifugal force to the big-end rollers.)

### LUBRICATION ROUTINE

*Engine.*—The Scott system is automatic, with the sole exception of the over-riding control furnished by the adjustable screws on the duplex oil pumps. The owner's pleasure and the reliability of the machine depend in an unusual degree on the correct handling of this control, for the following reasons :—

A new two-stroke is delivered with its engine rather tight, as the crankcase shares in its pumping action. It takes longer to run-in than a four-stroke engine, and should be treated as new for 1,500 miles. During this period it pays to :—

- (a) *Set the oil drips at about 20 drops per minute, making sure by inspection of the crankcase levels that both cylinders receive an even supply.*
- (b) *Add Castrollo to the fuel at the rate of half an ounce per two gallons of petrol. Petroil may be used as additional lubrication during the first 1,500 miles, a quarter of an ounce of engine oil being well mixed with each gallon of petrol, if Castrollo is not available.*
- (c) *Keep the engine smoking rather freely at higher speeds, and slightly at lower speeds. 35 miles per hour is definitely a "higher" speed during the first 1,500 miles, and at this speed the engine should be kept smoking freely and visibly.*

The drip setting is reduced after 1,500 miles to the normal rate of 10 to 15 drops per minute. Slight divergencies between the two pumps of the two crankcases may cause the actual supply to vary as between the two halves of the engine. This can

be corrected by inspecting the actual working oil levels in the two crankcases. It is a simple matter, viz. :—

- (i) *Slacken off nuts holding each crankcase door strap (with the engine stopped).*
- (ii) *Swing each strap clear of its door.*
- (iii) *Rotate the engine by several smart depressions of the foot starter, when crankcase compression will dislodge the doors, exposing the two oilwells. If the doors stick, a blunt screwdriver may be gently used to prise them loose.*

Obviously, if the wells contain too much oil, the feed must be reduced, and perhaps an excess must be drained off. The drain plugs are on the sides of the crankcase below the doors. On later models they are on the underside of the crankcase.

These attentions may sound tiresome, but every motor-cyclist knows that the Scott has established a passionate cult among its devotees. It repays an owner generously for mastering its peculiarities, and comprehension of its lubrication is the main secret of success. It will run like a sewing machine for incredible distances, up to 40,000 miles or more, on two conditions. First, that it is carefully and intelligently run-in, and secondly, that when run-in it is accurately lubricated.

Under-oiling is notoriously destructive of any engine. Over-oiling is peculiarly tiresome with two-strokes. It enriches the mixture, which leads to "four-stroking." It generates sparking plug trouble. It fouls the silencers. All three nuisances are avoided by accurate oiling. When a Scott is accurately oiled, a very faint blue haze is perceptible astern at all times, changing momentarily to thicker blue puffs at each gear change. A second check on accurate oiling is obtained by running each cylinder separately with the gears disengaged. Hold each cable terminal in turn by the insulated vulcanite grip, and pull it off the plug terminal. If both cylinders eject exhausts of similar smokiness the oil feeds are evidently equal. If the engine smokes when first started up, but the smoke clears in a few moments, stop the engine at once; the oil level in the crankcase is too low. If at any time the exhaust is far too smoky, the pump screws should be adjusted to cut the feed. This can be done with the machine in motion along an empty road, but the machine should be stopped for the purpose if there is traffic about, making it dangerous to take the eyes off the road. Adjustments of the screws should be gentle and progressive; cut the drip one mark at a time.

It is extremely rare for trouble to occur with the pumps. If there is oil in the tank, but no drips are visible at the sightfeeds, the regulators should be opened up fully for a moment till the supply recommences. If the supply does not return, stop the engine, remove the sight glasses, and prime both sides of the pump by hand. If dirty oil has been poured into the tank, and filth has choked either or both feeds, the foreign matter can generally be got rid of by removing one or both regulators completely and running the engine. Care must be taken not to lose the small spring-loaded plungers.

*Warning.*—The pump driving worm must *NEVER* be revolved when either the end plate or the end cam have been removed from the pump body. The pump plunger must never be removed from the pump body unless both driving worm and bush have first been removed. Serious damage may result from failure to observe these precautions.

A crankcase-mounted pump is a unit with the crankcase door, and comes away with it when the clamping strap is removed. In such assemblies the pump spindle is made in one piece with the driving disc. When replacing the door-pump unit, the slot in the disc must engage with the boss on the crankpin screw.

The pumps will not give any trouble if real cleanliness is strictly observed in handling the oil and refilling the tank.

Take care not to be trapped on the road with a dry oil tank. The oil consumption is quite heavy during the running-in process. If the tank is found to be empty when on the road, a garage within five miles can be reached at moderate speed, provided the deficiency is spotted whilst both crankcase oilwells are still full.

These instructions are lengthy, and may sound complicated, but the rider will find that, in practice, mastery of the system is swift and simple.

**Gearbox.**—This is similar to the standard boxes on four-stroke machines. Top up with engine oil by hand every 1,000 miles. The level plug is on the front end of the lid at the box centre. The outside bearing, which supports the driving sprocket, should be repacked with grease every 5,000 miles. To do this, remove the bearing and plate which screws out of the bearing bracket. Oil the clutch withdrawal plate occasionally.

**Chains.**—Carry out periodic routine lubrication, as advised elsewhere in this book. The engine chain is less accessible than on many designs, and is best oiled by a brush or squirt when the engine is running slowly in neutral.

**Wheel Hubs.**—Use Castrolase Heavy grease.

**Forks.**—Brampton forks have grease nipples on all bearings.

Webb forks (on Flying Squirrels) should be lubricated by grease gun every 2,000 miles. Use Castrolase CL in the gun.



#### LUBRICATION SYSTEM PETROL

RECOMMENDED  
GRADES

{ ENGINE  
{ CLUTCH

Castrol XL  
Castrol D

The 98 c.c. Villiers engine is fitted to this make. The makers lay great stress on strict adherence to the recommended proportion of one part of oil to sixteen parts of petrol.

### LUBRICATION ROUTINE

**Clutch.**—This is normally lubricated with Castrol D Gear Oil, and the level is important. Place the machine vertical. Remove the filler plug just below the sprocket on the magneto side. Insert the oil until it overflows, the plug hole being so located as to act as a level indicator. If the clutch “drags” (*i.e.* if the machine is inclined to move slowly forward when the clutch control lever is fully withdrawn), the first action is to adjust the screw in the operating lever on the clutch casing. If the clutch refuses to free itself when the full range of adjustment has been used, a thinner oil such as Castrol XL should free the clutch until the component can receive skilled attention.

**Wheel Hubs, Forks and Frame parts.**—Use Castrolase CL in grease gun.

## SUNBEAM

### LUBRICATION SYSTEM

### CAR TYPE

#### RECOMMENDED GRADES

#### ENGINE & GEARBOX

Summer

Winter

Castrol X X L

Castrol X L

Three pints of oil are carried in a finned sump below the crankcase. The dipstick is marked with maximum and minimum levels. A single metal gauze filter runs the full length of the sump, with another filter inside filling the orifice. There are no external oil pipes, all leads being internal ducts. A spring-loaded ball release valve prevents overloading of the gear pump should a duct become choked, or cold oil flow sluggishly on first starting up in winter. It further keeps the mean pressure at about 30-35 lbs. per square inch. The supply to the hollow camshaft and the cam faces is automatically metered by suitable holes. The camshaft supply is reduced to about 10 lb. per square inch and a green light indicates any drop below that figure. The entire system is simple and automatic. Provided the sump is topped up as suggested by the dipstick, no trouble need be anticipated.

### LUBRICATION ROUTINE

*Engine.*—The sump should be drained, swilled with flushing oil, and replenished with fresh oil after the first 500 miles, and thereafter every 2,000 miles.

*Gearbox.*—A level plug is fitted. Drain and refill with engine oil every 2,000 miles.

*Rear Worm Drive.*—A level plug is provided. Drain and refill with engine oil periodically.

*Front Forks.*—The tubular blades are packed with cotton wick to within one inch of the top. Pour in oil until the wick is saturated and the space at the top is full. Inspect and replenish periodically.

*Rear suspension.*—Lubricate through grease nipples.

*Spring Saddle Support.*—This is wick lubricated. The member is immersed in oil for a short period, after which it requires no further attention for one year.

*Steering Head.*—A greaser is provided to receive grease as required.

*Sliding coupling of propeller shaft.*—Use the grease gun on the nipple about once a week. *This is important.*

*Other items.*—Use Castrol Heavy in the grease gun on the nipples occasionally. The front brake cam is packed with grease at the factory, and its supply lasts almost indefinitely.

# TRIUMPH

## LUBRICATION SYSTEM

## DRY SUMP

*Twin plunger pumps*

RECOMMENDED  
GRADES

ENGINE	Summer
ENGINE	Winter
GEARBOX	

Castrol X X L  
Castrol X L  
Castrol X X L

The oil pressure on single models should never fall below 5 lb. On twin-cylinder models it should not fall below 35 lb. These pressures should be obtainable with the engine hot. The twin cylinder models should be stopped for investigation if the pressure falls below 35 lb. In cold weather the pressure will be higher on first starting up, but will steady as the oil warms.

*The air vent in the oil tank filler cap must be kept clear.* If this vent becomes choked, pressure will build up in the tank and prevent the used oil being returned from the engine by the scavenge pump. The crankcase will then fill up with oil. Kinking or blocking of the tube which conducts pressure away from the vent will have the same effect.

## LUBRICATION ROUTINE

*Engine.*—In replenishing the oil tank, leave an air space of 1½ in. above the surface of the oil. Change the oil after the first 250 miles, again after the next 500 miles, and then regularly after every 1,500 miles. Between changes top up to the correct level every 250 miles.

On first starting up, run the engine slowly until the pressure settles at the correct figures, viz. :—

Single cylinder	...	...	...	...	...	...	5 lb.
Twin cylinder	...	...	...	...	...	...	35 lb.

Mechanical trouble is very rare. In extremely prolonged use the pump driving block will wear, but is cheap to replace.

The ball valves over the inverted plugs under the pump cylinders can be withdrawn and cleaned with ease, after the timing cover has been removed. Should the oil gauge register too low a pressure or none, when the tank is filled to the correct level, the oil pressure release valve is probably at fault. This is of the ball type on models up to 1939, and of the piston type on the 1946/47 models. Both protect the engine against excessive pressure, when the oil is cold, by releasing oil through a bleed hole. The valve is easily withdrawn for cleaning. Never suspect the gauge until this valve has been inspected and cleaned.

If under-lubrication of the rockerbox is suspected, the feed can be tested by removing the acorn nuts on the banjo connections to the rocker spindles and easing the pipe assembly clear of the box with a screwdriver. If the engine is now started, oil should run out. If the oil is either absent or scanty, clean out the feed pipe to the rockerbox, and inspect the rubber hose joining the feed pipe to the scavenge pipe.

Observe scrupulous cleanliness at all oil changes. The three filters should be removed, washed in petrol and dried. They are located (i) inside the oil tank above

the feed pipe union, (ii) under the crankcase, where the scavenge filter is fixed by four hexagon screws, and (iii) inside the pressure release valve.

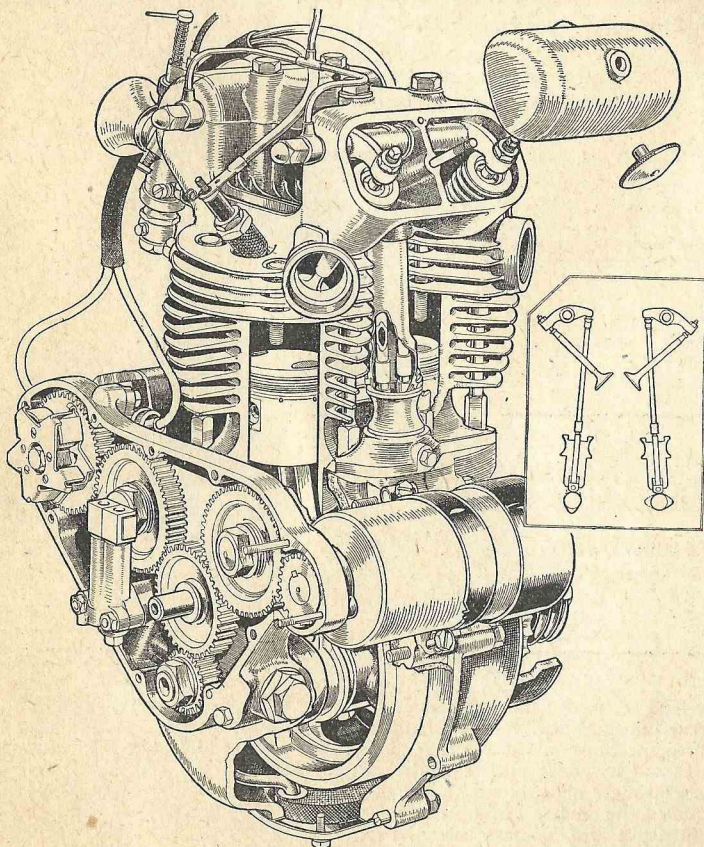
The oil tank and sump should be swilled out with Wakefield flushing oil.

The mechanical engine breather requires no attention, except at major overhauls. It is in the inlet camshaft on 1946/47 models, and on the crankcase (behind the primary chaincase) on pre-war models.

**Gearbox.**—Top up or replenish only with the recommended grades specified above. Never insert any grease or gear oil. A level plug indicates the correct amount.

**Chaincase.**—Heavy engine oils are quite unsuitable for this case. It contains the clutch and shock absorber, neither of which will function properly on a thick oil. Use Castrolite ONLY.

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THE TRIUMPH 350 c.c. VERTICAL TWIN

Never use a jointing medium in refitting this case. The makers' paper washer insures a sound joint, and should be renewed if it is accidentally damaged.

An adjustable lubricator at the tail of the chaincase supplies oil to the rear chain, but obviously has no cleaning effect upon it. The rear chain should therefore be removed for the "standard exposed chain" routine treatment at intervals of 1,000-2,000 miles, according to the weather and the state of the roads.

**Front Forks.**—The girder pattern fitted before the war merely requires the usual grease gun attentions. The hydraulic forks normally require neither lubrication nor topping up. Nevertheless, certain nuts should be checked for tightness occasionally, especially the drainplug and the pressure valve retaining screw. Both are located in the lower end of the bottom member. They are backed by fibre and copper washers. If any great amount of oil is lost in changing these washers, the forks should be completely drained. After draining, insert one-sixth of a pint (100 c.c.) of Castrolite into each leg. This is done as follows:—

- (i) *Disconnect front brake cable.*
- (ii) *Raise the front wheel 3 in. off the ground, e.g. by placing a box under the crankcase.*
- (iii) *Unscrew both large nuts at the top of the fork, but without detaching them from their rods.*
- (iv) *Remove box and lower wheel to ground, when both rods will rise, exposing the orifices through which the fresh oil is inserted.*
- (v) *Reassemble fork by reversing the above series of operations.*

**Grease Gun.**—Charge with Castrolase CL.



MODELS KSS and KTS		Overhead	Camshaft type
LUBRICATION SYSTEM	DRY SUMP	Double gear pumps	
RECOMMENDED GRADES	ENGINE & GEARBOX		
	Summer		Castrol X X L
	Winter		Castrol X L

The feed section of the pump maintains oil under pressure in the top and bottom bevel gear housings and vertical shaft cover. The oil is fed from the bottom bevel housing to the big-end via a spring loaded ball valve and oilway in the timing side mainshaft and flywheel, and from the top bevel housing it is metered into the cam chamber through oil grooves in the bearing and camshaft—which overlap every revolution of the shaft. An adjustable spring-loaded ball valve is arranged to release excess pressure and by-pass the oil to the feed side of the pump. Some earlier pre-war models incorporate an oil pipe to carry oil from the top bevel housing to a jet above the cams.

## LUBRICATION ROUTINE

**Engine.**—The oil should be changed completely after the first 500 miles and thereafter every 2,000 miles. Drain while warm. Remove, wash with petrol, and dry all oil filters. The number and location of these vary with different models at various periods; the maker's handbook should be consulted in this connection. Flush the oil tank with Wakefield flushing oil. If the engine has an oil pipe from the top bevel housing to the rockerbox, remove, and clean the hollow bolt and camshaft jet.

The makers do not advise swilling out the engine with flushing oil, but prefer a different method, as follows:—After refilling the tank, disconnect the return oil pipe hose from the tank and set the open end over a tin. Start the engine. The first gulps of oil will be the old and dirty oil, which is thus visibly scoured out. As soon as the oil begins to run clear stop the engine and re-connect the hose.

Owners are warned not to meddle with the adjustment of the pressure release valve except in real emergencies, as its readjustment is really a precision job requiring the use of a special oil gauge obtainable from the factory. Trouble with the valve is unlikely, and it can be cleaned without disturbing the original setting, as should it be necessary to remove the adjusting screw the lock-nut (if not slackened back further than needed to release the screw) will serve as a guide to the setting of the screw.

If adjustment becomes necessary, the screw is turned clockwise to increase pressure, and vice versa. Adjustment is only to be attempted while the oil is hot, and after each half turn of the screw, or even less, the results should be verified. Tiny adjustments may have a marked effect.

**Gearbox.**—Keep topped up to the level plug. See that machine is standing upright when refilling, and allow the surplus oil to drain away before refitting the level plug. Change the oil after the first 1,000 miles and again every 5,000 miles. Never insert grease or gear oil.

**Chaincase.**—Use engine oil, adding a quarter of a pint periodically. This oil will enter the clutch, but not cause slip, assuming that the clutch is properly adjusted and has not been run dry for a considerable mileage.

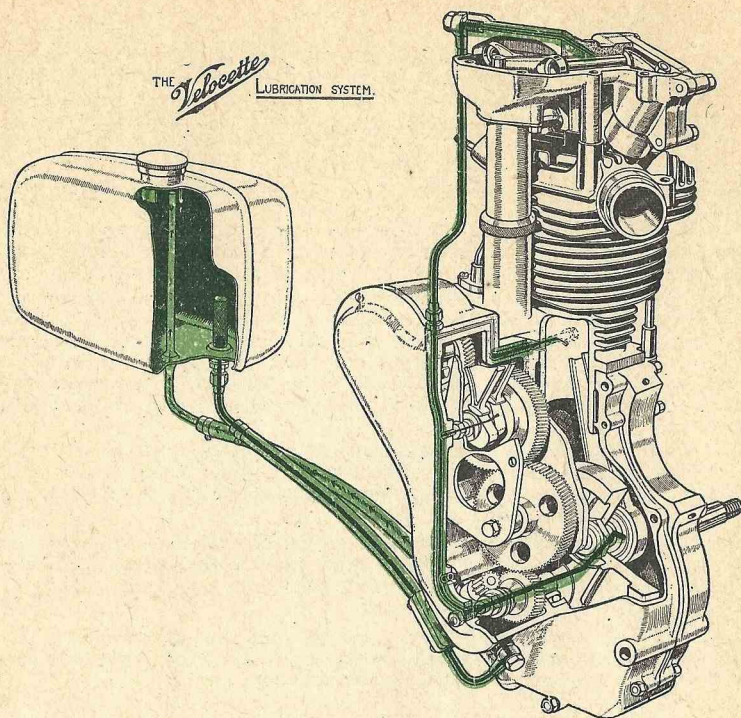
MODELS MOV, MAC, and MSS		Overhead Valve types
LUBRICATION SYSTEM		DRY SUMP
		Double gear pumps
RECOMMENDED GRADES	{	ENGINE & GEARBOX
		Summer
		Winter
		Castrol XXL
		Castrol XL

The feed section of the pump delivers oil through a spring-loaded check valve to the timing cover, from which by suitable passages the oil is directed to the big-end via the hollow mainshaft, the cams via a passage in the camwheel spindle and the rear wall of the cylinder via a removable hollow bolt. From the top of the timing cover a pipe leads oil to the bearings for the overhead rockers.

Some earlier pre-war models are not provided with the supplementary feed to the cylinder wall, or with the filter plug between the return section of the oil pump and the crankcase. No adjustment is provided for the system.

The oil should be changed as and when recommended for the O.H.C. types. Remove the hollow bolt (marked JET) through which oil is led to the cylinder and clear radial oil-hole.

The Gearbox and Chaincase lubrication is as described for O.H.C. types.



### MODEL G.T.P. Two-stroke

#### LUBRICATION SYSTEM TOTAL LOSS

RECOMMENDED GRADES	{ ENGINE	Summer	Castrol XXL
		Winter	Castrol XL

The lubrication system of this model differs from all other two-strokes in that the supply is directly controlled by the throttle lever, which is connected to an engine-driven oil pump. The pump is set at the works, and should not require any adjustment whatsoever, except when the engine is dismantled or the carburettor is stripped and the connection uncoupled. In that event, the control sleeve of the oil pump should be at its *lowest* position when the throttle is *shut*. The small nuts on the top of the coupling rod must be set to give this combination. If the oil supply at low speeds is found excessive, pull out the split-pin from the pump adjusting screw. To decrease the feed, give the screw a quarter turn clockwise and test the result after refitting the pin. The pump plunger should have not less than  $\frac{1}{16}$  in. stroke at the minimum setting, i.e. with the control sleeve at the bottom. An increased supply can always be secured by adjusting the coupling rod so that the adjusting sleeve is just short of its bottom position when the throttle is shut. The supply is controlled on earlier models by a knurled screw, two turns out from the shut position being correct. For full throttle running give four turns out. Other details of the lubrication of this model are as already described for the other models.



LUBRICATION SYSTEM  
RECOMMENDED GRADE

PETROIL  
ENGINE

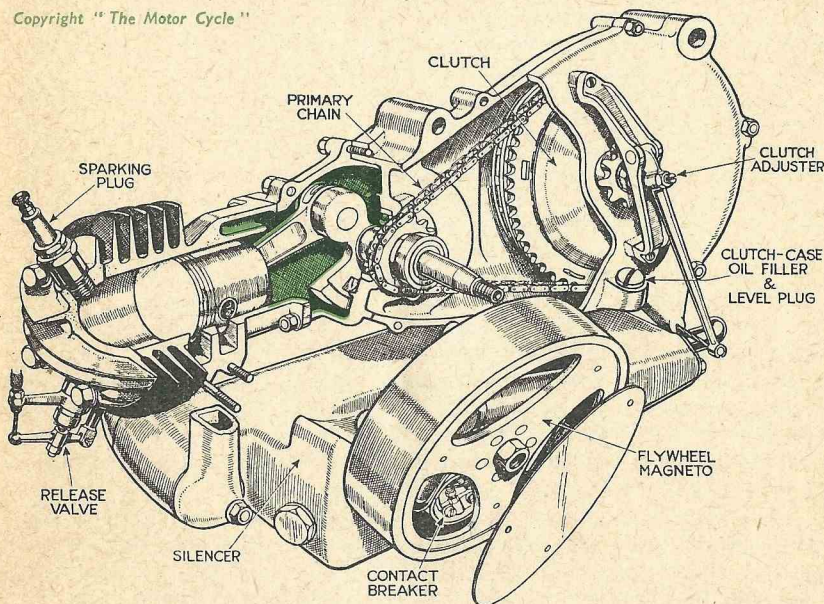
Castrol XL

Villiers two-stroke engines are fitted to many proprietary makes of motor-assisted bicycles and lightweight motor cycles, both in Britain and abroad.

The vast majority of these are lubricated by the petrol system. Early models of some of the larger sizes were lubricated by a simple pressure system, described in the concluding section of these instructions. The 250 c.c. Mark 14A fitted to the Francis-Barnett of 1939 manufacture utilises this automatic pressure system.

The Villiers Company do not themselves advise a higher oil : petrol ratio than 1 : 16 even during the running in period, though certain firms who fit Villiers engines make such a suggestion. Provided the engine is driven very carefully during its first 500 miles, the standard 1 : 16 ratio will be adequate, and runs no risk of fouling the engine, as an increased supply of oil may do.

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### THE VILLIERS 98 c.c. JUNIOR DE LUXE

Castrol XL is recommended for all Villiers engines. Other details for the smaller power units are as follows:—

Model.	Clutch Case.	Gearbox.
98 c.c. Junior and Junior de Luxe.	Castrol D to level of filler plug.	None.
125 c.c. Mark 9D ...	" " "	Castrol D to level of plug in end cover.
197 c.c. Mark 5E ...	" " "	Castrol D. Level by dipstick.

### Larger Engines.

Some of the larger Villiers engines are fitted with the simplest pressure lubrication system ever devised. Crankcase pressure is ingeniously utilised to supply oil direct to each bearing. The crankcase pressure varies with the throttle opening, so that the engine receives oil in proportion to its varying load.

Compressed air from the crankcase passes along the hollow centre of both shaft axles to radial holes in the shafts. When the piston descends, these holes register with grooves in the shaft bushes. Thence the oil passes through ducts in the casing to the pressure pipe leading to the oil tank. The pressure enters the tank above the oil surface, forcing oil up a central tube after the fashion of a soda-water syphon. The oil passes through a small control chamber fitted with knurled screw adjustment, and then via a pipe to the engine, where ducts lead it to all vital points.

The control chamber incorporates an *important* air vent which prevents oil from syphoning into the engine when stopped. This vent must be clear, for which purpose a short piece of wire is threaded through it (on sets Mark II and Mark III) to prevent oil films from stopping the airflow. On no account must the size of this vent be altered. The Mark I and II sets embody a sight-feed glass in the control chamber. It will be noted that this air vent in no way affects the pressure above the oil in the tank; it is simply an anti-syphon device.

Since the system operates by pressure, there must be no air leaks between the engine and the space above the oil in the tank. The maximum available pressure is only about 6 lb. per square inch, and the average about 4 lb. Quite small leaks will lower this seriously, when the engine will be over-oiled at low speeds and starved at speeds above 25 m.p.h. Leaks may occur at the filler cap and at either pressure pipe union. The threads of the filler cap and of its stub-collar must be kept scrupulously clean. The filler cap must be screwed hard down on a washer in good condition, intact, uncreased, and laid quite flat. The pipe unions are of an unusual type, unsoldered, and using a nipple with double taper. When the nuts are screwed up they compress the nipples and make a perfect joint. If the joint is disconnected, new nipples may be requisite to regain an airtight joint.

If oil continues to flow after the engine is stopped, the air vent is fouled, and should be cleared with a single strand of Bowden wire. No thicker wire should be used, for fear of enlarging the vent.

If the sight glass fills with oil, there is a leak under the glass, which should be refitted with a new washer or a jointing medium.

The adjusting screw of the control chamber is given a liberal setting at the factory, and this should be reduced slightly when the engine begins to run freely after 500 miles. All two-stroke engines should show a faint blue haze at the outlet of the exhaust pipe when running at 30 m.p.h. on a flat road, with momentary puffs of a thicker blue when the gear is changed. The additional lubrication desirable during the running-in process may occasionally oil up a sparking plug, or cause the engine to "four-stroke" at low speed. Both symptoms will disappear when the engine is run in and the oil supply re-set at normal.

*Note.*—Since 1939 only the Mark 14A 250 c.c. engine (as fitted to the Francis-Barnett) has been equipped with the latest version of this automatic system. The Marks I and II versions survive on certain earlier productions which are still running.



MODELS		... Pre-war	
LUBRICATION SYSTEM	DRY SUMP	Double gear pump	
RECOMMENDED GRADES	ENGINE	Summer	Castrol GRAND PRIX
	ENGINE	Winter	Castrol XL
	GEARBOX		Castrolase MEDIUM

Pressure-release and non-return ball valves are fitted to all pumps. These *must* be replaced, together with their correct springs, if the pump is dismantled.

### LUBRICATION ROUTINE

*Engine.*—The tank should be kept filled, subject to the usual air space of about two inches above the oil surface. Testing of the two main circuits is advised about every 1,500 miles, when the oil in the tank is changed. With the engine running easily (i.e., about 1,000 r.p.m.) detach the upper ends of the rocker feed pipes; oil should issue at the rate of 15-20 drops per minute. Remove the banjo bolt securing the rear cylinder feed to the drive side of the crankcase; oil should issue at 15-20 drops per minute. If not, the rate of feed should be adjusted by moving the needle-valve fitted to the banjo-bolt which secures the feed-pipe to the pump cover. Thirdly, with the engine stopped remove and clean the oil delivery quill which feeds the big-end. This can be removed without disturbing the pump body.

*Forks.*—Lubricate frequently with Castrolase CL.

*Grease Gun.*—Use Castrolase CL.

MODELS		Post-war	
LUBRICATION SYSTEM	DRY SUMP	Duplex Rotary Plunger pump	
RECOMMENDED GRADES	ENGINE	Summer	Castrol XXL
	ENGINE	Winter	Castrol XL
	GEARBOX		Castrol GRAND PRIX

All oil from the feed pump passes through a large fabric filter housed beneath the magneto, and is fed thence to the big-ends, camshafts and cylinder walls through fixed jets with no adjustments. The valve-gear is lubricated by oil returning from sump to tank, via jets in the bolts which attach the return pipe to the cylinder heads. The union which attaches the pump feed pipe to the tank contains a stop valve which prevents oil from flowing out when this pipe is detached at its upper end.

### LUBRICATION ROUTINE

*Engine.*—The tank should be kept filled to above 1" in. below the bottom of the filler-cap neck. Oil circulation can be checked by observing the pulsating flow of oil from the return pipe inside the neck. Oil should be changed at 2,000-2,500 miles by removing the feed-pipe banjo bolt below the timing chest (see note above concerning the stop valve). If the oil flow is sluggish, remove the feed pipe adaptor in the tank and clean the filter on its upper end. The fabric filter should be removed and cleaned at 5,000-10,000 miles, and renewed every 20,000 miles. The big-end delivery quill in the timing cover should be removed and cleaned when the oil is changed. If any rockers appear to be short of oil, remove the rocker feed bolt and clean the jet-hole. The jet controlling the supply to the camshafts and cylinders can be cleaned by removing the dome nut and jet holder from the timing case.

*Chaincase :* Engine oil should be used and must not be allowed to fall below the height of the level-plug. Check every 2,000 miles.

*Forks.*—Being fitted with self-lubricating bushes, these require no routine lubrication.



THE MASTERPIECE IN OILS