SIXTH EDITION 1952

RIDER'S HANDBOOK

for

The Vincent Motorcycles

SERIES "B" and "C"

BLACK LIGHTNING

BLACK SHADOW

STANDARD RAPIDE

COMET

METEOR

THE SERIES "C" BLACK SHADOW

SERIES "B" and "C"

Frame Nos. Commencing R2002, RC3296, RC/1/3568 and R/1/4542

1000 c.c. Engine Nos. commencing F10AB/1/3, F10AB/1A/- and F10AB/1B/696.

500 c.c. Engine Nos. commencing F5AB/2/1585 and F5AB/2A/1668.

Important Note.

All correspondence regarding the riding or upkeep of the motorcycle should be addressed to—

THE VINCENT H.R.D. CO., LTD.,
STEVENAGE, HERTS, ENGLAND.

(*Telephone and Telegrams, Stevenage* 375).

In such communications IT IS ESSENTIAL to quote the FRAME NUMBER and the ENGINE NUMBER of the motorcycle concerned, as this is the only way in which your queries can be correlated with our records.

The Frame Number is stamped on the left-hand side of the head lug, just above the front tank mounting, and also on the left-hand rear fork lug.

The Engine Number is stamped on the crankcase, adjacent to the symbol at the base of the front cylinder, above the primary chain-case.

ALL LETTERS AND FIGURES IN EACH NUMBER MUST BE GIVEN ; it is not sufficient to quote the figures only.

Fill in particulars of your machine in this space for easy reference—

Registration No.............................

Frame No..................................

Engine No..................................

TECHNICAL INFORMATION

	BLACK SHADOW "B" & "C"	RAPIDE "B" & "C"	COMET "C"	METEOR "B"
ENGINE TYPE SYMBOL...	F10AB/1B	F10AB/1	F5AB/2A	F5AB/2
CYLINDER BORE	84 mm.	84 mm.	84 mm.	84 mm.
STROKE	90 mm.	90 mm.	90 mm.	90 mm.
CAPACITY	998 c.c.	998 c.c.	499 c.c.	499 c.c.
COMPRESSION RATIO ...	E7/7 Piston 7·3 to 1	E7/6 Piston 6·8 to 1 with no Comp. Plate 6·45 to 1 with 1/16" Comp. Plate 6·2 to 1 with 1/8" Comp. Plate	E7/6 Piston 6·8 to 1	E7/6 Piston 6·45 to 1 with 1/16" Compression Plate
CYLINDER ANGLE	50° Rear Cylinder is No. 1	50° Rear Cylinder is No. 1	—	—
IGNITION TIMING	38/40° before T.D.C. AT FULL ADVANCE		37/38° before T.D.C. AT FULL ADVANCE	
VALVE TIMING (Theoretical) at ·005" lift	Inlet opens 40–42° Inlet closes 60–64° Exhaust opens 72–70° Exhaust closes 28–33°	As Black Shadow	As Black Shadow	As Black Shadow
CARBURETTOR SETTINGS (Standard Fuels)	1⅛" Bore, 180 Main Jet 29/4 Throttle Valve Needle in Middle Notch	1 1/16" Bore, 170 Main Jet 6/4 Throttle Valve Needle in Middle Notch	1⅛" Bore, 200 Main Jet 29/3 Throttle Valve Needle in Middle Notch	1 1/16" Bore, 170 Main Jet 6/4 Throttle Valve Needle in Middle Notch
SPARKING PLUGS ... ... Grade of Plug must be selected to suit conditions of riding.	14 mm. Long Reach Champion N8 or NA8 KLG FE50 or FE70 Lodge HLNP or HL14S	14 mm. Long Reach Champion N8 or NA8 KLG FE50 or FE70 Lodge HLNP or HL14S	14 mm. Long Reach Champion NA8 KLG FE70 Lodge HL14S	14 mm. Long Reach Champion NA8 KLG FE70 Lodge HL14S
GEAR RATIOS	3·5, 4·2, 5·6, 9·1 with 46-T (Solo) Sprocket 4·25, 5·1, 6·8, 11 with 56-T (S/Car) Sprocket	3·5, 4·2, 5·6, 9·1 with 46-T Sprocket 4·25, 5·1, 6·8, 11 with 56-T Sprocket	4·64, 5·94, 8·17, 12·4 with 48-T (Solo) Sprocket	4·64, 5·94, 8·17, 12·4 with 48-T (Solo) Sprocket
TYRE SIZES	Rear 3·50 × 19 Studded Front 3·00 × 20 Ribbed	Rear 3·50 × 19 or 4·00 × 18 Front 3·00 × 20 or 3·50 × 19	Rear 3·50 × 19 Studded Front 3·00 × 20 Ribbed	Rear 3·50 × 19 Studded Front 3·00 × 20 Ribbed
TYRE PRESSURES	See Chapter VIII, Page 61, for Instructions			
REAR CHAIN	⅝" × ⅜" × ·400 Rollers, 106 Pitches	⅝" × ⅜" × ·400 Rollers, 106 Pitches	⅝" × ⅜" × ·400 Rollers, 108 Pitches	⅝" × ⅜" × ·400 Rollers, 108 Pitches
PRIMARY CHAIN	Renolds Triplex × ⅜" Pitch Endless 94 pitches	Renolds Triplex × ⅜" Pitch Endless 94 pitches	½" × 5/16" × ·335 Rollers 64 pitches	½" × 5/16" × ·335 Rollers 64 pitches
FUEL TANK CAPACITY...	All Models : 3½ Imperial Gallons (16 Litres) approximately			
OIL TANK CAPACITY ...	All Models : ¾ Imperial Gallons (3½ Litres) approximately			

RECOMMENDED LUBRICANTS

Black Shadow and Rapide Engines

	TROPICAL	TEMPERATE SUMMER	TEMPERATE WINTER	ARCTIC CONDITIONS
WAKEFIELD	Castrol Grand Prix SAE 50	Castrol XXL SAE 40	Castrol XL SAE 30	Castrolite SAE 20
VACUUM	Mobiloil D SAE 50	Mobiloil BB SAE 40	Mobiloil A SAE 30	Mobiloil Arctic SAE 20
SHELL	Shell X-100 Motor Oil 50	Shell X-100 Motor Oil 40	Shell X-100 Motor Oil 30	Shell X-100 Motor Oil 20/20W
PRICE'S	Energol SAE 50	Energol SAE 40	Energol SAE 30	Energol SAE 20
ESSO	Essolube 50	Essolube 40	Essolube 30	Essolube 20

Comet, Meteor, Grey Flash and Black Lightning Engines

	TROPICAL	TEMPERATE SUMMER	TEMPERATE WINTER	ARCTIC CONDITIONS
WAKEFIELD	Castrol Grand Prix SAE 50	Castrol XXL SAE 40	Castrol XL SAE 30	Castrolite SAE 20
VACUUM	Mobiloil D SAE 50	Mobiloil D SAE 50	Mobiloil A SAE 30	Mobiloil Arctic SAE 20
SHELL	Shell X-100 Motor Oil 50	Shell X-100 Motor Oil 50	Shell X-100 Motor Oil 30	Shell X-100 Motor Oil 20/20W
PRICE'S	Energol SAE 50	Energol SAE 50	Energol SAE 30	Energol SAE 20
ESSO	Essolube 50	Essolube 50	Essolube 30	Essolube 20

Note: Engine oil is also used in dampers as listed below.

	PRIMARY CHAINS AND 1000 C.C.'S GEARBOXES	HYDRAULIC DAMPERS (SERIES "C")	HUB BEARINGS HIGH MELTING POINT GREASE ONLY TO BE USED	OTHER CYCLE PARTS
WAKEFIELD	Engine Oil	Castrolite SAE 20	Castrolease WB Grease	Castrolease Medium
VACUUM	Engine Oil	Mobiloil Arctic SAE 20	Mobil Hub Grease	Mobilgrease No. 2
SHELL	Engine Oil	Shell X-100 Motor Oil 20/20W	Shell Retinax A or H	Shell Retinax A or CD
PRICE'S	Engine Oil	Energol SAE 20	Energrease N2	Energrease C3
ESSO	Engine Oil	Essolube 20	Esso High Temp. Grease	Esso Grease

COMET AND METEOR GEARBOXES

WAKEFIELD—Castrolease Medium. VACUUM—Mobilgrease No. 2. SHELL—Retinax A or C
PRICE'S—Energrease AO ESSO—Esso Grease *See Page 10.*

B

CHAPTER I

INTRODUCTORY

The Series " B " and " C " ranges of Vincent models are logical developments of the world-famous Series " A " Rapide, Comet and Meteor models, re-designed in the light of post-war knowledge. The outstanding design features of the earlier models have, however, been retained. Particular features are the Girdraulic forks, Spring Frame and duo-brakes.

There are many features of these machines which are unique, and some of the adjustments are performed in an unusual manner. These are described in detail in order to assist riders to obtain maximum enjoyment from their machines.

The arrangement of controls is similar to the conventional British pattern, and riders accustomed to any British machine equipped with foot gear-change will have no difficulty in familiarising themselves with the models. The remarks contained in this handbook re operation of controls, therefore, are intended mainly for the benefit of riders who are not accustomed to the normal British layout.

Broadly speaking, the riding methods and running adjustments for the 500 c.c. is the same as for the 1000 c.c. models.

The main constructional differences are the employment, in the 500 c.c. models, of a separate Burman gearbox, and, of course, the omission of the rear cylinder and its attendant parts.

In this handbook, therefore, separate instructions are given only where differences exist, and a considerable amount of information is common to all models.

SIDECAR FITTING—ALTERATIONS TO MACHINE

Gear Ratios

1000 c.c. models normally require a 56 Tooth and 500 c.c. models a 58 Tooth Rear Wheel Sprocket. This can be fitted during manufacture if specifically ordered, either alternative or additional to the solo sprocket at an extra charge.

Owing to the wide variation in the loaded weights of various sidecars, these recommendations may need to be varied. Some riders find a 54 tooth sprocket is preferable on 1000 c.c. models, while on 500 c.c. models the 58 tooth sprocket may not give a sufficiently low gear ; in that case a 17 tooth gearbox sprocket may be fitted in place of the standard 18 tooth, or a 60 tooth sprocket can be fitted to the rear wheel.

Front Forks

The " Girdraulic " (Series " C ") pattern only requires adjustment as described in Chapter V to alter both trail and effective spring strength.

Series " B " Girder pattern fork trail must be changed by fitting shorter top links. The 180 lb. fork spring fitted as standard for solo use is also suitable with a sidecar of normal weight.

Rear Frame Springs

Replace solo type Part No. F84/1 by sidecar type Part No. F84/0.

Mounting Points

Three fixed points are provided on all machines. The fourth point is obtained by bolting a bracket part No. FT170 to the pillion footrest bracket.

On no account must the sidecar be attached to the large tapped holes in the rear frame lugs.

The sidecar may be fitted on either side of the machine, and a conversion set is available for 1000 c.c. models *only* to permit left-hand kick-starting where the sidecar is fitted on the right.

This comprises :—

L.H. Kickstarter Shaft	Part No. G83/1
L.H. Kickstarter Crank	Part No. G76/1
L.H. Kickstarter Footpiece	Part No. F72/7

The Sidecar Chassis

Most of the reputable makers will supply chassis adapted to fit our machines, but in cases of doubt our advice should be sought.

We can accept no responsibility for mechanical faults or poor handling due to incorrect fitting of a sidecar.

Hand Controls. All Models

Reading from right to left, as seen from the saddle, are the following controls :—

Twist Grip.—Opening inwards to open throttles. Below twist grip boss is a small screw and locknut ; tightening this screw increases friction on grip and *vice versa*.

Front Brake Lever.—Adjustable for position, but if so adjusted, see that lever does not foul twist grip boss before brake is fully applied.

Air Control Levers.—1000 c.c. Top lever controls front carburettor, bottom lever rear carburettor. 500 c.c. One lever only is fitted. These levers are normally only used to provide a rich mixture for starting, after which they are both moved inwards to full extent. They can, however, also be used individually on 1000 c.c. models to determine which cylinder is weak if misfiring occurs or when tuning carburettors.

Clutch Lever.—The uppermost of the pair on left bar. Raising lever lifts the clutch.

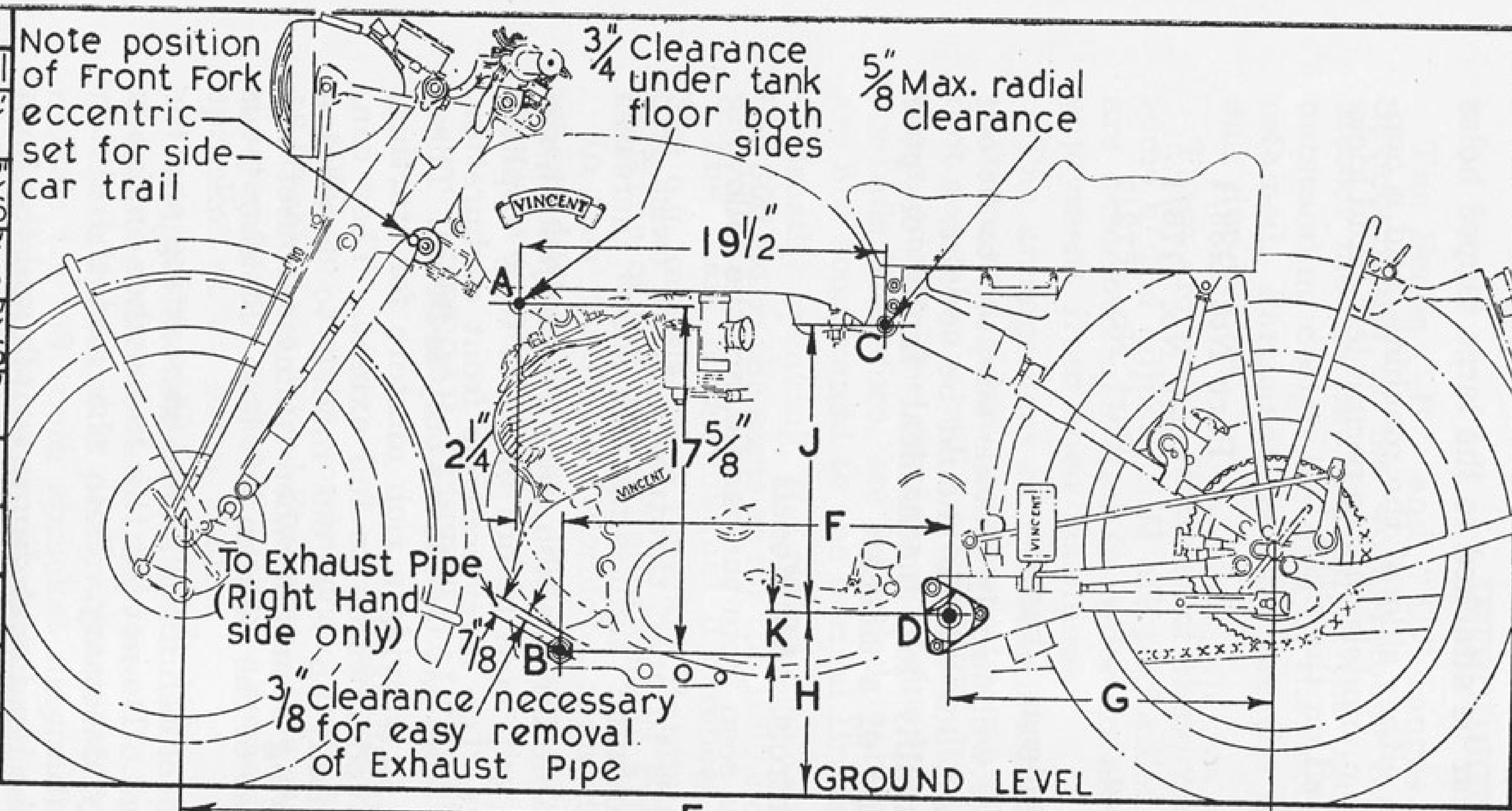
Exhaust Lifter Lever.—Below clutch lever. Used at starting and for stopping engine from slow speed. Do not lift this lever when engine is rotating fast unless absolutely necessary. Both this and the clutch lever are adjustable for position.

Also fitted on the bars are the headlamp dipper switch and the horn button.

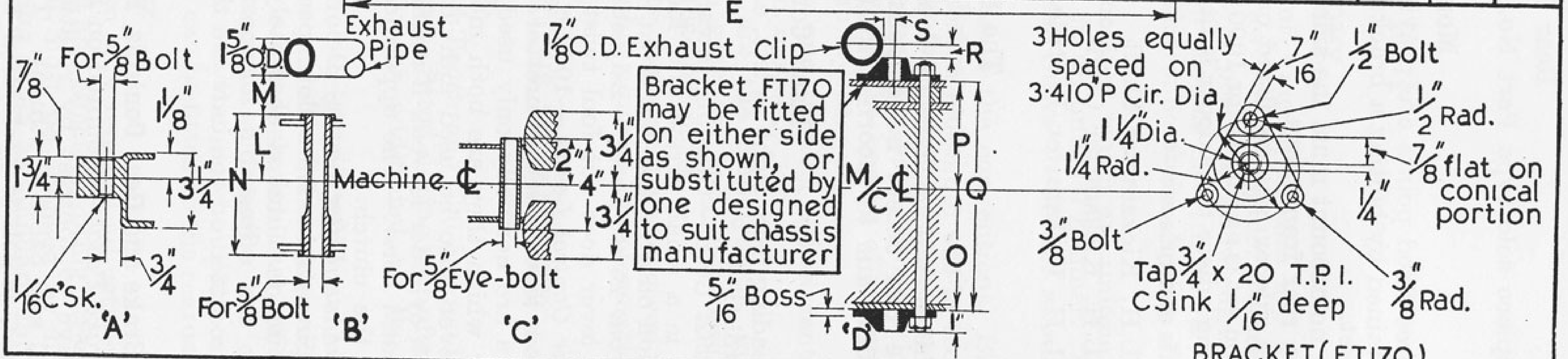
Brake and Gear Controls, Footrests, etc. (1000 c.c. Models Only)

Brake Pedal.—Mounted on L.H. footrest hanger. Height adjustable relative to footrest by rotating adjusting thimble on cable between pedal and cable abutment. This does not effect actual adjustment of brakes, which is performed by wing nuts on brake rods (see Brake

Location	Dimens'n Twin	Dimens'n S'ngl
E mean	$57\frac{3}{4}''$	$57\frac{1}{4}''$
F	$20\frac{11}{16}''$	$19\frac{13}{16}''$
G mean	$17\frac{1}{2}''$	$17\frac{7}{8}''$
H	$9''$	$10\frac{5}{16}''$
J	$14\frac{9}{16}''$	$13\frac{1}{4}''$
K	$2\frac{1}{4}''$	$3\frac{9}{16}''$
L	$3\frac{5}{16}''$	$2\frac{15}{16}''$
M	$1\frac{3}{4}''$	$2''$
N	$7\frac{1}{8}''$	$6''$
O	$5\frac{1}{4}''$	$5\frac{1}{4}''$



Location	Dimens'n Twin	Dimens'n S'ngl
P	$4\frac{7}{8}''$	$5\frac{3}{16}''$
Q	$10\frac{1}{8}''$	$10\frac{7}{16}''$
R	$\frac{5}{8}''$	$\frac{1}{2}''$
S	$\frac{5}{8}''$	$2''$



SIDECAR MOUNTING DETAILS

Adjustment). Length of pedal adjusted by removing two screws in footpiece and reversing same.

Gear-Change Pedal.—Mounted on R.H. side of machine. Length adjustable by fitting footpiece in any one of the holes in lever. Height adjustable in two ways: (*a*) by slackening nut retaining serrated gear shift lever at upper end; moving to desired position and re-tightening nut; (*b*) by removing lower ball-joint from pedal, loosening locknut on connecting link and lengthening or shortening links, afterwards refitting and tightening all nuts concerned. In extreme cases, it may be necessary to apply both methods (*a*) and (*b*). **The aim is to maintain the link as nearly as possible square to the gear shift lever and the pedal, when the latter is in its centralised position.** One-piece pedals are adjusted as under (*a*).

To change gear, the pedal is moved *upwards* to obtain a lower gear, *downwards* to obtain a higher gear.

Indicator Lever.—On kick-starter cover. This indicates whether gears are in neutral or any other ratio, and can be operated by hand to select neutral or, if necessary, as an emergency measure to change gear should the foot-change mechanism become inoperative.

Adjustable Footrests.—Both the brake and gear-change pedals are adjustable, so that the distance between rests and pedals can be altered when the footrests are adjusted to suit individual riders. To make this adjustment, slacken off the nuts at the upper ends of the footrest hangers one or two turns, give the hangers a sharp blow with a soft hammer to free them from the tapered ends of the footrest distance pieces, move to the desired position and re-tighten the nuts. It is likely that the pedals will then have to be adjusted for height, as described previously.

The footrests are arranged to fold forwards and inwards, and it is not advisable to move the hangers further back than 2in. past the vertical, otherwise the rests may have a tendency to fold inwards when weight is applied. If, however, an extremely rearward position is required, as in racing, the ordinary footrests can be removed by unscrewing the pivot bolts in the hangers and then using the pillion footrests as main footrests. To bring the brake and gear-change pedals within reach, these are reversed from their normal positions, and the brake cable changed over from the abutment forward of the hanger to that at the rear. Likewise, the serrated gear-shift lever on kick-starter cover is reversed, bringing the link connecting it to the pedal, if fitted, approximately vertical. The footrest forgings are cranked, and adjustment for height can be made by interchanging the right and left rests, which will bring the direction of cranking below instead of above the pivot-bolt centre.

Brake and Gear Controls, Footrests, etc. (500 c.c. Models)

***Brake** Pedal.*—Of exactly identical design to 1000 c.c. models, and adjustment identical.

Gear Change Pedal.—Mounted direct on gearbox end cover. Adjust for height by resetting in a different position on splines.

Footrests.—Adjust for fore and aft position similarly to 1000 c.c. models.

Pillion Footrests—All Models

These are of two patterns, one identical to the main footrests, the other of a greater length, mainly intended for use when pannier bags are fitted. Standard equipment is the short-cranked pattern, identical with the main rests, mounted in adjustable lugs. Fore-and-aft adjustment is carried out by removing the bolt, attaching these lugs and moving them to the next hole, making sure that the screw-head in the rear face of the lug also fits into a hole, to prevent accidental rotation of the lug ; the right and left pillion rests can be interchanged to obtain additional fore-and-aft adjustment. It is worth noting that the swivel joints for the main and pillion footrests and the folding kick-starter footpiece are of identical designs and any part which fits in one of the joints mentioned can be fitted, if required, in any other joint. By this unique feature a very wide range of footrest positions can be obtained.

Prop Stands Also Used as Front Stand (1000 c.c. and Comet)

Two prop-stands are fitted, one on each side of the machine. These are pivoted on the front engine plates, and are normally swung backwards to lie beneath the exhaust pipe and the chain-case. On a flat surface, either stand can be used by simply swinging it outwards and forwards and leaning the machine to that side. When on a slope, as when standing on the road camber near the kerb, use the stand which is towards the higher or uphill direction of the slope, to avoid undue stress on the stand and to lessen the angle at which the machine leans over. It is advisable to have bottom gear engaged to prevent the machine being accidentally pushed forward, so causing the stand to swing backwards and let the machine fall over. For the same reason, when on a hill do not use the prop-stand unless the front wheel is heading uphill. Always turn front wheel towards the stand used.

The prop-stands are so arranged that they can be used simultaneously to form a front-stand to hold the front wheel clear of the ground. First, raise the machine on to the rear stand, slacken off the ¼in. B.S.F. nuts at both lower front corners of magneto cowl, loosen ¼in. setscrew at upper rear corner, and pull lower edge of cowl forwards. Next remove the 5/16in. hexagon-headed setscrew in the left-hand front engine plate, adjacent to the large hexagon nut. Both stands will then be pulled downwards into contact with the ground by a spring ; next, lift the front wheel by grasping the front mudguard stays (*not* the guard itself) and the stands will swing into a vertical position under the action of the spring. To lift the wheel still higher, the rear stand can be swung back, so lowering the rear wheel and raising the front.

The easiest way to return the front stand to the running position is simply to push the machine forwards off the stand, raise the stand upwards against the resistance of the spring as far as it will go, then insert and fully tighten the retaining setscrew. Finally, replace cowl and tighten setscrew and nuts.

Front Stand (Meteor)

In lieu of the prop-stands described above, the Meteor is equipped with a normal stand pivoting from the lower fork ends. This also serves as a mudguard stay.

Starter Pedal (All Models)

Normally fitted on the right-hand side, the starter pedal has a folding footpiece, which should always be swung inwards when riding ; otherwise the rider's foot may depress the starter slightly, thereby bringing the internal ratchet mechanism into engagement and causing unnecessary wear thereon. The crank is fixed to its shaft by fine serrations, and if the footrests are used in the extreme rear position it may be necessary to remove the crank and reset it on the shaft in a lower position to avoid fouling the footrest hanger.

Steering Damper (All Models)

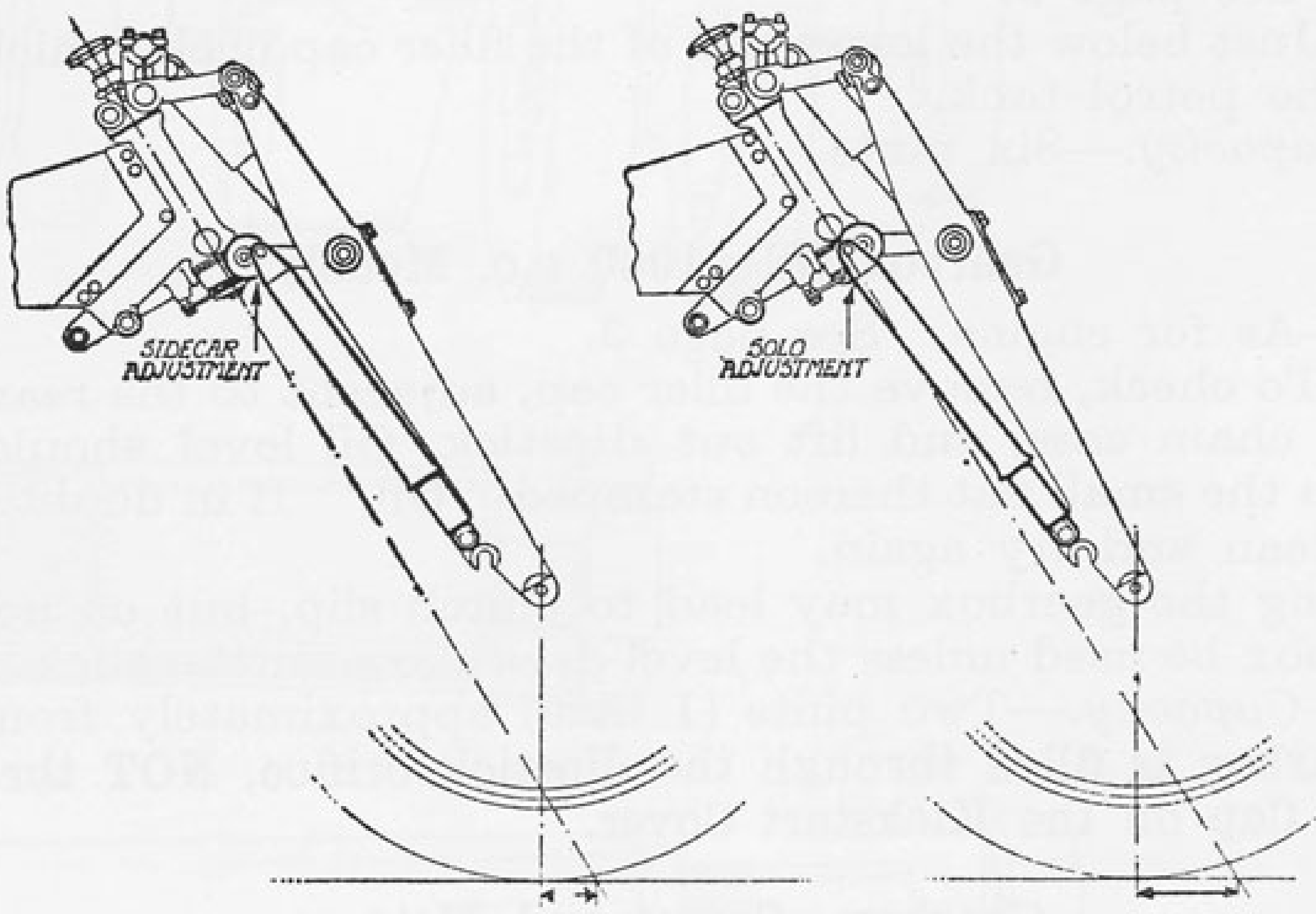
This is operated by the knob in centre of handlebars, and some riders find a gentle application of some assistance at high speeds or over rough surfaces. Too much damping has the effect of causing a slow rolling motion of the machine, particularly at low speeds. When a sidecar is fitted, a considerable amount of damping can be applied, according to the rider's taste.

Front Fork Friction Dampers (Series " B " Models)

These are applied by the knob on the right-hand lower fork links by screwing inwards. This action increases the friction applied to the forks and damps out fork oscillations after striking a bump. On smooth surfaces only very light damping is required, the heaviest damping being required at high speeds over rough surfaces. The correct adjustment again is largely a matter of individual taste.

Rear Fork Friction Dampers (All Models)

These are applied by the two aluminium knobs at the lower ends of each saddle stay, which should be screwed up to an equal tightness, just sufficient to damp out oscillations at the rear end. Too much damping is undesirable, as it simply stiffens up the action of the rear springing and so reduces the rider's comfort without giving any additional benefit. Insufficient damping will permit a " bucking " action of the frame, but the adjustment is not unduly critical. If after considerable mileage there is insufficient damping when the knobs are fully tightened, the friction material has worn away sufficiently to allow the slot in the damper clamp to close up. Fit new material. If the dampers tend to squeak some thin oil can be applied without detriment to the linings.



By courtesy of "Motor Cycling."

Illustrating method of converting " Girdraulic " forks from Solo to Sidecar use.

CHAPTER II

FUEL, OIL AND RIDING INSTRUCTIONS

Fuel

The petrol tank, holding a little over 3½ English gallons (16 litres), should be filled with petrol of not less than 72 octane number ; higher octane fuel can be used, but as the compression ratio is not unduly high, little is to be gained by using fuel of higher than 80–84 octane, and very heavily leaded fuels are not recommended primarily because of the bad effect on plugs.

In many countries, only low-grade fuel is obtainable, and Rapide machines are usually sent out with 1/32in. compression plates under the cylinders to allow for this. In extreme cases it may be advisable to increase the compression plate thickness to 1/16in.

Alcohol-blend fuels can be used, but may necessitate the fitting of larger main jets.

Oil—All Models

Important.—On taking delivery of a new machine ALWAYS check the oil level in the main tank, gear-box and chaincase. In addition, before starting up a new engine which has not been run for a long period, always pour a small quantity of oil down each push-rod tube after first removing the inspection caps.

If desired, running-in compounds of the GENUINE Colloidal graphite type may be used. Flake graphited oil must NEVER be used.

Engine Oil—All Models

Grade.—See page 3.

Level.—Just below the lower end of the filler cap neck, which extends through the petrol tank.

Tank Capacity.—Six pints.

Gearbox Oil—1000 c.c. Models

Grade.—As for engine. See page 3.

Level.—To check, remove the filler cap, adjacent to the rear cylinder above the chain case, and lift out dipstick. Oil level should be just showing on the small flat thereon stamped " Oil." If in doubt, wipe the dipstick clean and try again.

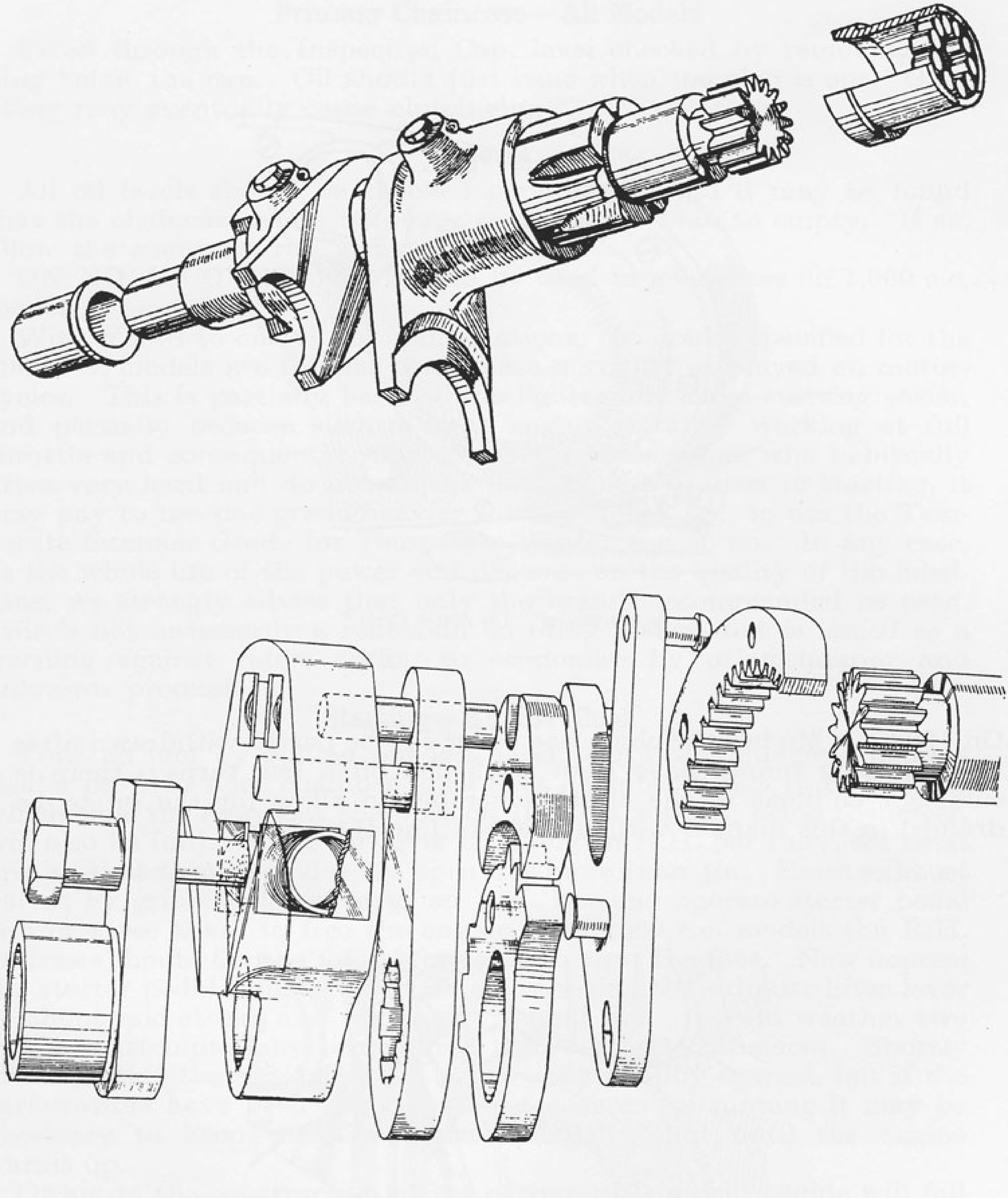
Overfilling the gearbox may lead to clutch slip, but on no account must the box be used unless the level does show on the stick.

Gearbox Capacity.—Two pints (1 litre) approximately from empty.

The Gearbox is filled through the dipstick orifice, NOT through the Inspection Cap on the Kickstart Cover.

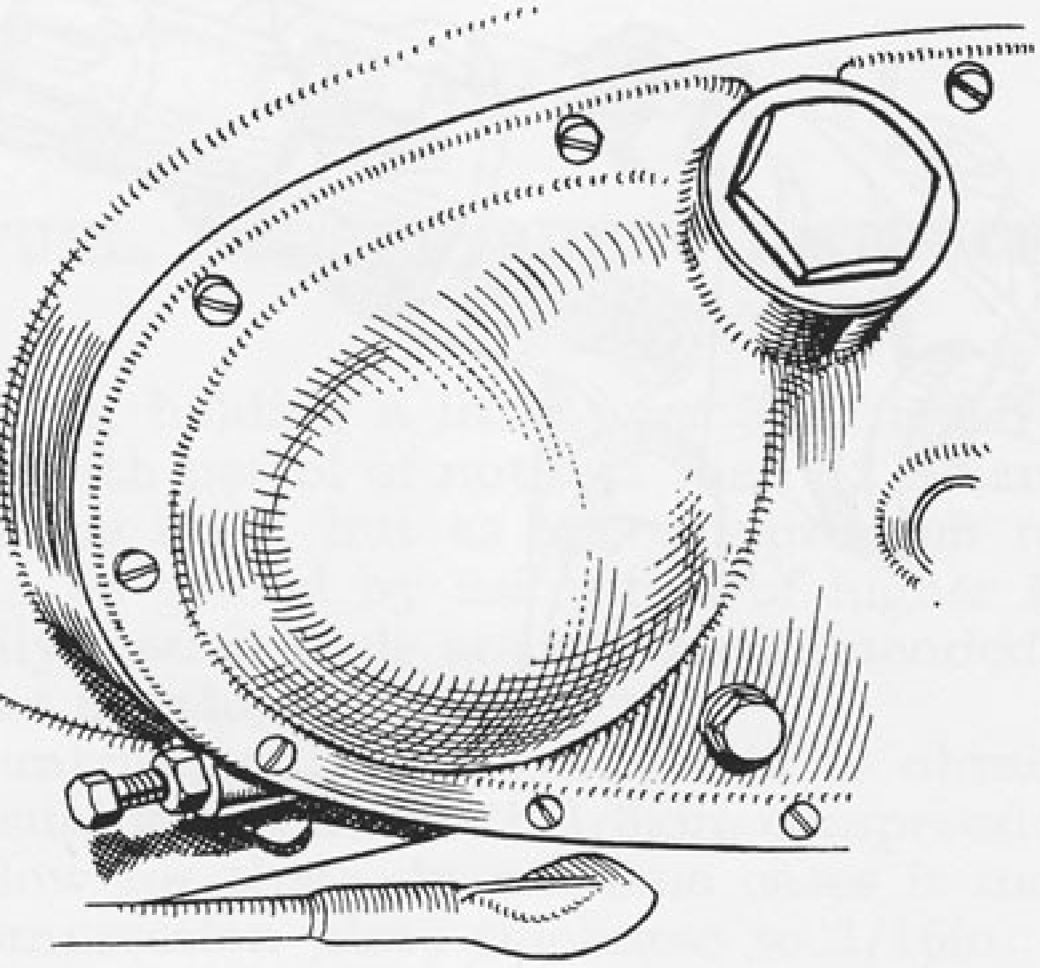
Gearbox—Comet and Meteor.

In addition to the greases specified on page 3 about ¼ pint grease or oil should be added every 2,000 miles. The gearbox is filled with about 1¾ lbs. of grease before leaving the factory.



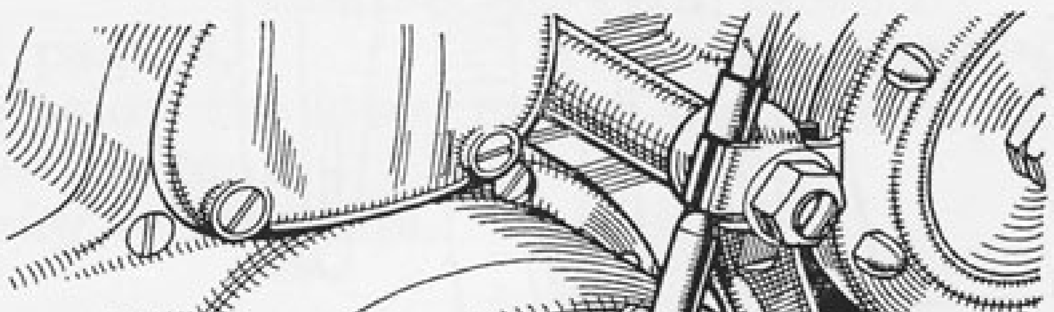
BURMAN SELECTOR MECHANISM DETAILS

500 c.c. Models



By courtesy of "The Motor Cycle"

On 1000 c.c. Models the chaincase cover can be partly withdrawn after the retaining screws have been slackened off a few turns; there is sufficient endfloat in the clutch assembly to allow for the oil to be drained in this manner without dismantling the cover.



By courtesy of "The Motor Cycle"

The brake pedal is adjustable for height and length, see page 5.

Primary Chaincase—All Models

Filled through the Inspection Cap, level checked by removing the plug below the cap. Oil should just issue when the plug is out. Over filling may eventually cause clutch slip.

General

All oil levels should be checked periodically, and it may be found that the chaincase has a tendency to fill rather than to empty. If so, allow the excess to run away.

ON NO ACCOUNT must grease be used in gearboxes on 1,000 c.c. models.

With regard to our oil recommendations, the grades specified for the 1000 c.c. models are thinner than those normally employed on motor-cycles. This is partially because the lighter oils make starting easier, and partially because such a large engine is rarely working at full throttle and consequently runs cool. For those riders who habitually drive very hard and do not object to a slight heaviness in starting, it may pay to use one grade heavier than specified, *i.e.*, to use the Temperate Summer Grade for Temperate Winter and so on. In any case, as the whole life of the power end depends on the quality of the lubricant, we strongly advise that only the brands recommended be used. This is not necessarily a reflection on other makes, but is issued as a warning against riders trying to economise by using inferior and unknown products.

Starting—Engine Cold

Turn on fuel by pulling out left-hand petrol tap plunger ; depress tickler on *front* float chamber until float chamber is felt to be full (by which time the rear float chamber on 1000 c.c. models, being the lower, will also be full). Close air lever or levers on R.H. bar fully, set twist grip so that throttle slides are open not more than ⅛in. Raise exhaust valves by gripping lower lever on L.H. bar and operate starter pedal two or three times to free the engine. On 1000 c.c. models the R.H. footrests should first be folded forwards to clear the foot. Now depress the starter pedal smartly downwards, releasing the exhaust lifter lever at about mid-stroke and the engine should fire. In cold weather two or three attempts may be required before firing commences. Shortly after starting the air levers can be partially or fully opened, but if the carburettors have been tuned for most economical running it may be necessary to keep the air controls partially shut until the engine warms up.

Owing to the construction of the carburettors a cold engine will fail to start if the throttle opening is too great, and care must be taken to see that the twist grip is not inadvertently moved beyond the correct point when starting. Another cause of poor starting is over-flooding of carburettors ; should this have been done, turn the engine over several times with the exhaust lifter raised and the throttle wide open, then partially close throttle and start in the normal manner.

Starting—Engine Hot

As for cold engine, except that air levers are left open and throttle is opened little, if any, beyond the tick-over position.

Riding—1000 c.c. Models

After a period of idleness it is advisable to check the oil circulation as soon as engine is running by removing the oil tank cap and observing that oil is flowing through the return pipe in the filler neck. The oil at first should be free from air bubbles, though it will only emerge in pulsations, due to the pump construction; after a few minutes air bubbles will be observed in the oil, but this is quite in order, as the scavenge pump delivery is greater than that of the pressure pump.

In very cold weather the engine should be allowed to run for several minutes before moving off in order that the oil may circulate, but if this course cannot be followed drive gently for the first two or three miles.

To move off, raise clutch lever on L.H. bar fully and engage bottom gear by raising gear change pedal to its full extent, or by moving the gear indicator lever backwards; occasionally resistance will be felt before the gear is fully home, which is caused by the dogs in the box being end-on, in which event move the machine forwards or backwards a little until the gear snicks into place.

Open the throttle slightly and gently release the clutch lever until the machine commences to move. Owing to the construction of the clutch, which, though very light to operate, possesses great gripping power, the drive does not commence to take up until the lever is nearly fully released, but with a little practice smooth quiet starts can be effected without revving the engine unnecessarily.

Under normal circumstances, bottom gear is only required up to about 20 m.p.h., at which speed second gear is engaged by lifting the clutch lever and closing the throttle, simultaneously, then depressing the gear pedal to its full extent downwards, by firm pressure of the foot, but *not* by stamping on it. Then release the clutch lever and open the throttle again.

Changes from second to third and third to top gear are made in precisely the same manner, and changing down is equally simple, except that the pedal is raised instead of being depressed, and the throttle is not fully closed, so that the engine speed, instead of dropping, is raised to suit the lower gear about to be engaged. It will be seen that to reach bottom gear from top it is necessary to go through both the intermediate gears, and thus after changing from top to third the pedal must be allowed to return to its central position before again moving it upwards to engage second, and so on to reach bottom.

A neutral notch is provided between bottom and second, and neutral can be found from second by gently raising the pedal to about half its full travel, until the neutral notch is felt to be in engagement, or similarly by depressing the pedal if bottom gear is the gear in engagement. An easier and more positive method is to move the gear indicator lever by hand from whatever position it is in to the position marked "N." This avoids the necessity of operating the gear pedal several times if the machine happens to have been stopped in top gear; it may, however, be necessary to move the machine forwards or partially engage the clutch if by chance the dogs of any gear are end-on and thus preventing free movement of the indicator lever.

The flexibility of the engine is such that under normal circumstances there is rarely any need to change out of top gear, except at speeds below 30 m.p.h., when it is better to employ third. The engine is, however, deliberately overgeared in order to provide effortless cruising at 75–85 m.p.h., and when maximum performance is desired, full use can be made of the gearbox and the high-revving capabilities of the engine. It should be remembered, however, that continuous use of maximum engine revolutions should not be indulged in if longevity is expected of the machine, whether a twin or single cylinder model.

Riding—500 c.c. Models

Riding methods are similar to the Rapide, except that when engaging bottom gear from neutral it is advisable to lift the clutch and " blip " the throttle two or three times to free the plates ; bottom gear will then engage quietly. The Burman clutch is of the conventional 4-plate type, and there is a neutral indicator near to the footchange pedal ; neutral can be found by easing the pedal upwards from 2nd gear position or downwards from 1st gear, but the indicator cannot be used to select neutral by hand. Always change into a lower gear when the engine is felt to be labouring.

Braking and Cornering

The front brakes are designed to be *used*, and exert a more powerful retarding effect than those on the rear—in fact, the rear brake leverage is purposely designed so that a fair amount of pedal pressure is required, to avoid danger of locking the wheel on greasy surfaces. When stopping from a high speed, the front brakes can be applied, if necessary, with full force when travelling straight ahead, but some discretion must be used in applying it on loosely-surfaced corners or at low speed. When driving hard, downward gear changes can be made when approaching a corner with both sets of brakes applied in order to gain the maximum acceleration out of the corner, and in any case it is always wise to change down before it becomes absolutely necessary, rather than attempt to pull away in high gear and then have to change. This is particularly true on strange roads.

To stop the engine, raise the exhaust lifter lever on left handlebar, but *only* when the engine is turning over slowly ; *never* lift this lever at high revolutions, except as an emergency measure if the engine refuses to throttle down.

Running-In a New Machine

For the first few hundred miles of its life a new machine should be treated with great care, and in particular high speeds should not be attempted until the main working parts have properly bedded-down. At the same time, there is no point in not allowing the speed to rise above 30 m.p.h. for 500 miles, and then straightway commencing to drive at or near maximum revolutions, for this course of action would be very likely to cause complete or partial piston seizure. The correct system is to allow the engine to turn over easily, neither revving hard or " slogging " in too high a gear, and gradually to work the speed up in bursts of increasingly higher speed and longer duration. On the twins a top gear running-in speed of around 50 m.p.h. would not be too fast owing to the very high top-gear ratio, and the intermediate gears should be used whenever a steep gradient is met or in traffic ; this assists the engine and simultaneously runs-in the gearbox bearings and pinions under light load. Similarly, the brakes can be applied frequently in order to get the drum and shoe surfaces in good condition for the high-speed work which will inevitably follow.

The initial running-in period also forms a good introduction to the capabilities of the machine for those who have not previously ridden a motor-cycle of such outstanding performance. *It cannot be too strongly emphasized* that such a rider is very prone to be deluded into badly under-estimating his speed, through the smoothness of the engine and frame suspension, coupled with the high top-gear ratio, and it is a very wise plan indeed to watch the speedometer closely to avoid approaching corners at speeds which are too great for safety.

Running-In—500 c.c. Models

Adopt the same procedure as for the Rapide, but limit the speed in top to 40 m.p.h. for the first two or three hundred miles, then commence to work it up gradually.

Reserve Fuel Supply

If only the L.H. tap is turned on a small quantity of fuel will remain in the R.H. side when the other side has emptied. This forms a useful reserve supply of fuel by which the next fuel pump can be reached. This would also apply if only the R.H. tap is used, but the quantity is smaller, although the amount of reserve can be verified through the filler cap. Under conditions when the engine is being driven hard, turn on *both taps* to avoid any chance of fuel starvation and possible damage to the engine. Fine gauze filters are fitted to both taps, and it is a wise precaution to remove the taps occasionally to verify that these filters are clean and undamaged, and also to make sure that the small air-vent hole in the filler cap is clean.

Preparation for Speed Events

Though our models are turned out primarily as fast touring machines the needs of those who wish to enter speed events occasionally have been given much attention. Thus considerable weight can be saved by removal of the lamps, dynamo and battery (see Chapter VI), and the rear mudguard flap complete with number plate can be taken off by removing the hinge bolt. If it is desired to remove and refit this flap frequently, the tail and stop light wires can be cut and rejoined with screwed connectors (as fitted elsewhere in the tail-light wire), which can be concealed within the mudguard hinge. The rear stand must then be removed, by loosening the stand bolt locknuts inside the rear fork ends and then removing the bolts.

Either or both the front prop-stands can be removed simply by taking out the pivot-bolt and levering the return spring clear of the pegs, but for maximum weight reduction the entire prop-stand and engine-plate assembly can be taken off as a unit by removing the magneto cowl, the crankcase drain plug and the three engine-plate bolts. Under the nuts of the forward bolt are two hollow dowels which must be levered out of their holes, after which the assembly can be pulled clear and the drain-plug, dowels and bolts replaced with sufficient washers or distance pieces under the nuts to make up for the thickness of the plates. Further weight can be saved by removal of the kick-starter crank, but if the whole K.S. mechanism is removed from 1000 c.c. models the bushes in which the shaft runs *must* both be plugged to prevent escape of oil and entry of dirt.

Regarding the engine, alternative pistons can be obtained giving much higher compression ratios, depending upon the grade of fuel to be used. We do not recommend the shortening of barrels to obtain higher compression ratios with the standard E7/6 pistons. The following table gives the range of alternative pistons which are available, the ratios (with *no* compression plates), and an indication of suitable fuels:—

Piston.	C.R.	Fuel.
E7/7	7·3	75 Octane Petrol
E7/8	8	50/50 Petrol/Benzol
E7/9	9	Alcohol-Petrol Blend or Petrol above 90 Octane
E7/10	11	Alcohol fuels only
E7/11	13	Alcohol fuels only

The magneto timing will, of course, have to be adjusted to suit the particular fuel and compression-ratio in use.

The above range of pistons is interchangeable between 500 c.c. and 1000 c.c. models, and gives the same compression ratios in each.

Comets are fitted as standard with $1\frac{1}{8}$in. carburettors, and E7/6 pistons with no compression plates.

In countries where fuel above 75 octane rating is obtainable, a better performance for ordinary use is available by fitting E7/7 pistons.

Exhaust System

The standard silencer can be removed, and a length of straight pipe reaching to the rear axle substituted. The use of a megaphone is not recommended with the standard engine.

Carburettors

When running with an open exhaust, the main jet size will have to be increased, otherwise trouble with burnt valves is to be expected. The correct jet size cannot be quoted, as it depends entirely upon atmospheric conditions and the fuel used, and so has to be determined by experiment, but as a rough guide use 180 jets in $1\frac{1}{16}$in. carburettors, 200 in $1\frac{1}{8}$in. carburettors.

On Meteor and Rapide models greater power will be given by the fitting of $1\frac{1}{8}$in. bore carburettors, mounted on $1\frac{1}{8}$in. bore carburettor adaptors, Parts No. ET32/2 and /3, which can be supplied to order. There will be little or no gain from the larger carburettors unless the large-bore adaptors are fitted ; also these are made of bronze to cope with the greater weight of the larger instruments.

It must be noted that the standard $1\frac{1}{16}$in. or $1\frac{1}{8}$in. " Amal " carburettors are *not* suitable for use with alcohol—special racing instruments are required for such fuels.

Sparking Plugs

The plugs recommended for touring will stand up to fairly hard work, but for serious racing " harder " grades, such as Champion NA10 or NA12, Lodge RL51 or K.L.G. 646LR or 689LR should be used.

Lubrication

Use the heavier of the alternative grades recommended for Tropical use and increase the cylinder feed jet size to 190 or 200. A standard " Amal " jet can be used (see " Lubrication " Section, Chapter III).

Gearing—1000 c.c. Models

The standard top-gear of 3·5 to 1 was chosen in the first place to give effortless cruising at around 80 m.p.h., and is rather too high for maximum lap speeds, except on courses where very great speeds can be attained. If the course is twisty and has only short straights, or if the surface is heavy, it will pay to use a lower gear-ratio, the precise figure depending on the general conditions, the state of tune of the engine and whether or not it is possible to make full use of the gear-box. The aim should be to keep the r.p.m. below 5,500 r.p.m., except possibly for short periods in the indirect gears, where r.p.m, up to 6,000 are permissible. Remember, however, that excessive r.p.m. always increases the risk of mechanical failure which is inseparable from racing.

The ratio is altered by varying the rear wheel sprocket, the standard size fitted for solo use being 46 teeth. The following table gives the range of sizes available and the corresponding ratio :—

Part No.	Sprocket size.	Ratio.
H5/45	45	3·42
H5/46	46	3·5
H5/47	47	3·58
H5/48	48	3·66
H5/49	49	3·73
H5/50	50	3·82
H5/52	52	3·96
H5/54	54	4·1
H5/56	56	4·26
H5/58	58	4·42
H5/60	60	4·57

As the engine does almost exactly 4,600 r.p.m. on 3·5 to 1 gear at 100 m.p.h., the revs. for other speeds and ratios can be calculated very easily. If 27in. diameter racing wheels are fitted engine revs. will be 4% lower than with 26in. diameter wheels.

Gearing—500 c.c. Models

The standard top gear of 4·64 gives a comfortable cruising speed range between 65 and 70, but can with advantage be altered for speed events, particularly on aerodromes or similar circuits. The standard sprocket fitted has 48 teeth, and the table gives the sizes obtainable, the corresponding ratio and the engine speed per 10 m.p.h.

Part No.	No. of Teeth.	Ratio.	Revs. per 10 m.p.h.
H5/45	45	4·35	573
H5/46	46	4·44	584
H5/47	47	4·54	598
H5/48	48	4·64	610
H5/49	49	4·74	624
H5/50	50	4·83	637
H5/52	52	5·02	660
H5/54	54	5·22	688
H5/56	56	5·42	714
H5/58	58	5·61	738
H5/60	60	5·80	763

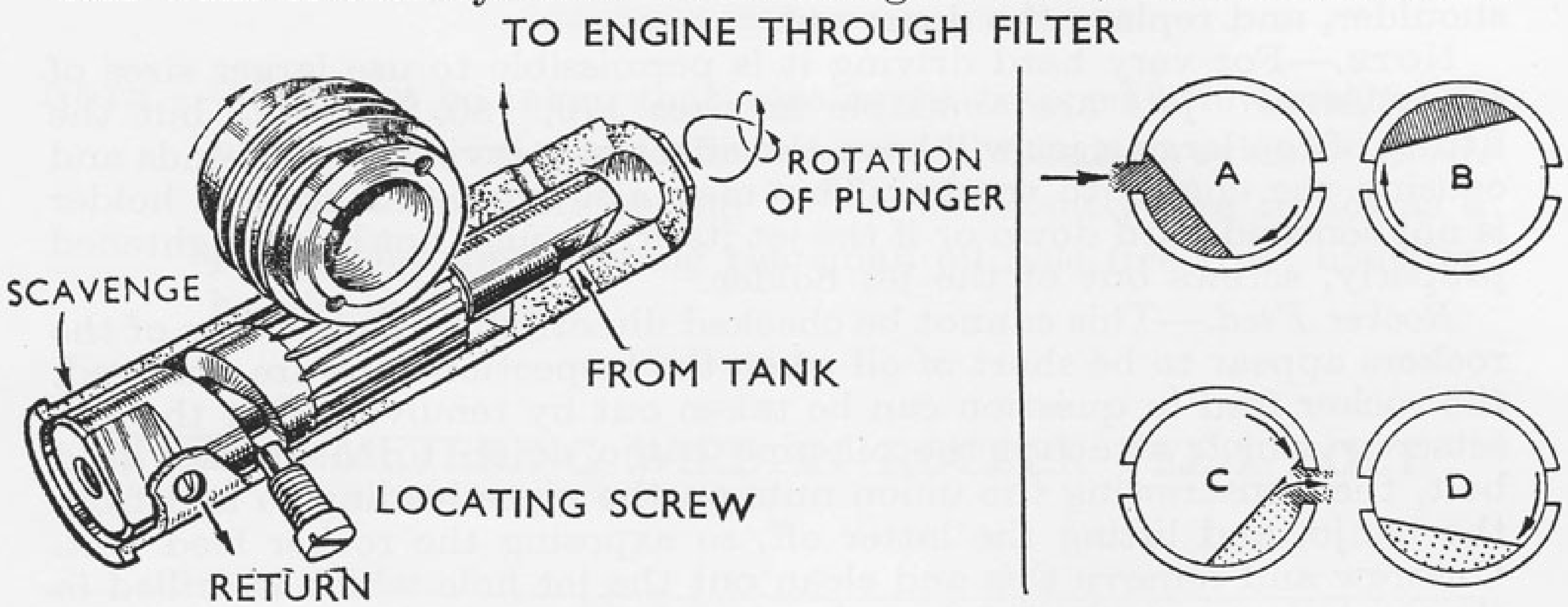
The standard gearbox sprocket size is 18 teeth, and to obtain ratios other than those above, sprockets from 17 to 21 teeth can be fitted to the box. The primary drive cannot be altered.

CHAPTER III

LUBRICATION SYSTEM

Engine Lubrication—All Models

The engines are lubricated on the " dry-sump " system by means of a duplex rotating plunger pump situated in the lower timing-case wall. Oil is supplied from the tank in the upper frame member via a coarse-mesh gauze filter and stop-valve through a large-bore pipe to the pressure side of the pump ; from there it goes to a large star-type fabric filter, situated just below the magneto, and is led through a banjo bolt into drilled passages in the timing cover to two jets, one feeding the big-ends, the other controlling the total flow to the camshafts and the rear walls of each cylinder. After doing its work, the oil falls to the



By courtesy of " Motor Cycling."

THE OIL PUMP.

Illustrating four stages of a single plunger revolution.

sump and is drawn from there by the suction side of the pump and fed through a 5/16in. pipe which passes over the cylinder heads and eventually it returns to the tank, where it can be observed issuing from the return pipe inside the filler neck (the other pipe inside the neck is the tank vent pipe, which emerges at the rear end of the upper frame member, from where an additional pipe conducts air and oil vapour to the rear chain). On its way over the cylinder heads the oil return pipe is connected by banjo unions and setscrews to rocker-feed bolts, each of which is drilled, so that a metered quantity of oil is fed to each overhead rocker. This oil lubricates each valve and its gear and returns by the push rod tubes to the timing chest. This system ensures that oil reaches the rockers immediately after the engine starts, even in very cold weather, which is not necessarily the case when the rockers are fed through long, small-bore pipes. For later models see opposite page 18.

Checking the Lubrication System

The return flow of oil can be observed at any time through the tank filler cap, but it is wise to check over the system at other points occasionally, even if the return flow seems to be correct.

Big End Feed.—Oil is fed to the big-end via a quill screwed into the timing case near the lower corner. This quill, Part No. OP 9/2, can be removed bodily, and the central jet hole and also the six radial feed holes can then be cleaned out. A rapid check that the oil is reaching the jet orifice can be made by removing the 3/16in. screw in the head of the quill, but this is no guarantee that the jet is clear, and it is not advisable to push a wire through the jet without removing the quill, as this would push any foreign matter which may have been present up into the internal oil passages. With quill removed, oil should issue freely if the engine is rotated.

Cylinder Feed Jet.—Remove the dome nut on upper side of timing cover and unscrew the cylinder feed jet holder, which is thereby exposed. Screwed into the jet holder is a standard "Amal" carburettor jet, which can be cleared with a fine wire, and the cross holes in the jet holder also cleared. With the big-end quill in place, oil should issue freely from the jet holder chamber if the engine is started ; if not, there is a remote possibility that the vertical passage is blocked, which can be cleared by a wire with the quill removed. If the passage is clear, replace the jet holder, screwing it down *firmly* against the internal shoulder, and replace the dome nut.

NOTE.—For very hard driving it is permissible to use larger sizes of jet. "Amal" jets are available in sizes 170, 180, 200, etc., but the fitting of too large a jet will have the effect of starving the big-ends and causing the engine to smoke. This may also happen if the jet holder is not screwed hard down or if the jet itself, through not being tightened properly, screws out of the jet holder.

Rocker Feed.—This cannot be checked directly, but should any of the rockers appear to be short of oil when the inspection caps are removed, the rocker feed in question can be taken out by removing first the ¼in. setscrew which attaches the oil pipe banjo union to the rocker feed bolt, then unscrewing the union nuts on the pipes leading to and from the banjo, and lifting the latter off, so exposing the rocker feed bolt. Unscrew and remove this and clean out the jet hole which is drilled in the angle between the hexagon head and the round shank just above, and also the cross holes at the lower end. Replace by reversing the above procedure, taking care to see that the rocker-feed bolt enters the hole in the rocker bearing properly, which will be the case if the engine is not turned round or the rocker disturbed whilst the feed bolt is out. Replace the thin copper and asbestos washer round the feed bolt hexagon before fitting the banjo, and when tightening the unions and setscrews work round each in turn, so that the joints tighten down evenly and the banjo can take up its correct position relative to the pipes. The correct size of jet hole is ·032in (·8 mm.) ; this should be verified if at any time a rocket jet becomes blocked.

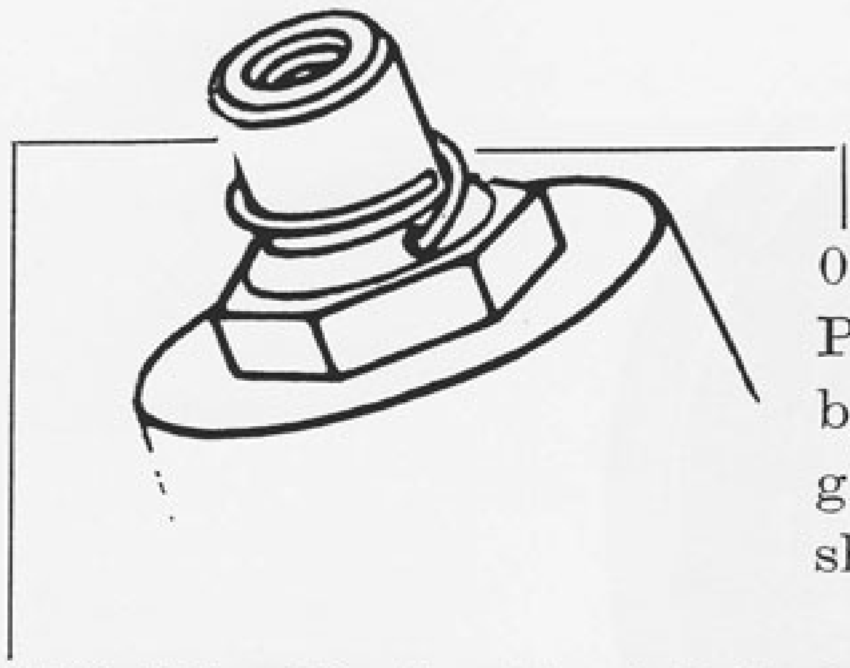
Metering Wires

All models are fitted with a metering device in the rocker feed bolts, consisting of a piece of wire ·020in. diameter coiled around the bolt, one end being inserted through the feed hole. This limits the amount of oil reaching the inlet valve guide and reduces the possibility of oiled plugs when the engine is being driven very slowly.

Draining the Oil Tank

The oil should be changed every 2,000 miles, choosing intervals when the tank level is low to avoid waste. To proceed, remove the banjo bolt connecting lower end of oil feed pipe to the pump, and allow all oil to drain away. A small quantity will, however, still remain in the tank, which can be removed by taking out the stop valve connecting the oil pipe to the tank : a piece of sheet metal in the form of a scoop should be held underneath to keep oil off the electrical gear.

This operation will drain the bulk of the oil, but to make a really

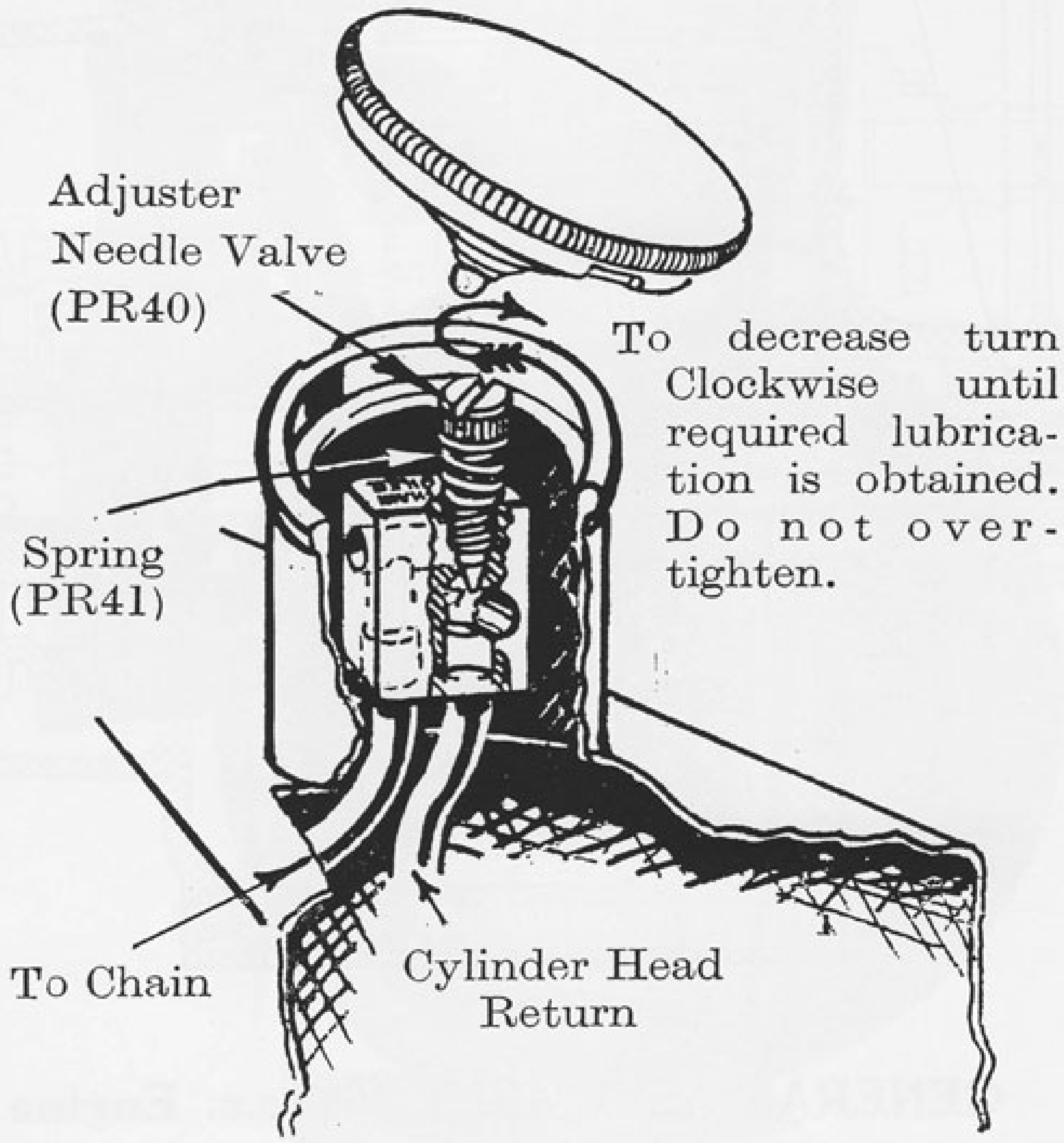


0·020in. dia. wire, about $1\frac{3}{4}$in. long. Pushed into $\frac{1}{32}$in. dia. hole in rocker feed bolt for about $\frac{5}{8}$in. Remainder of wire given one turn round shank of bolt as shown.

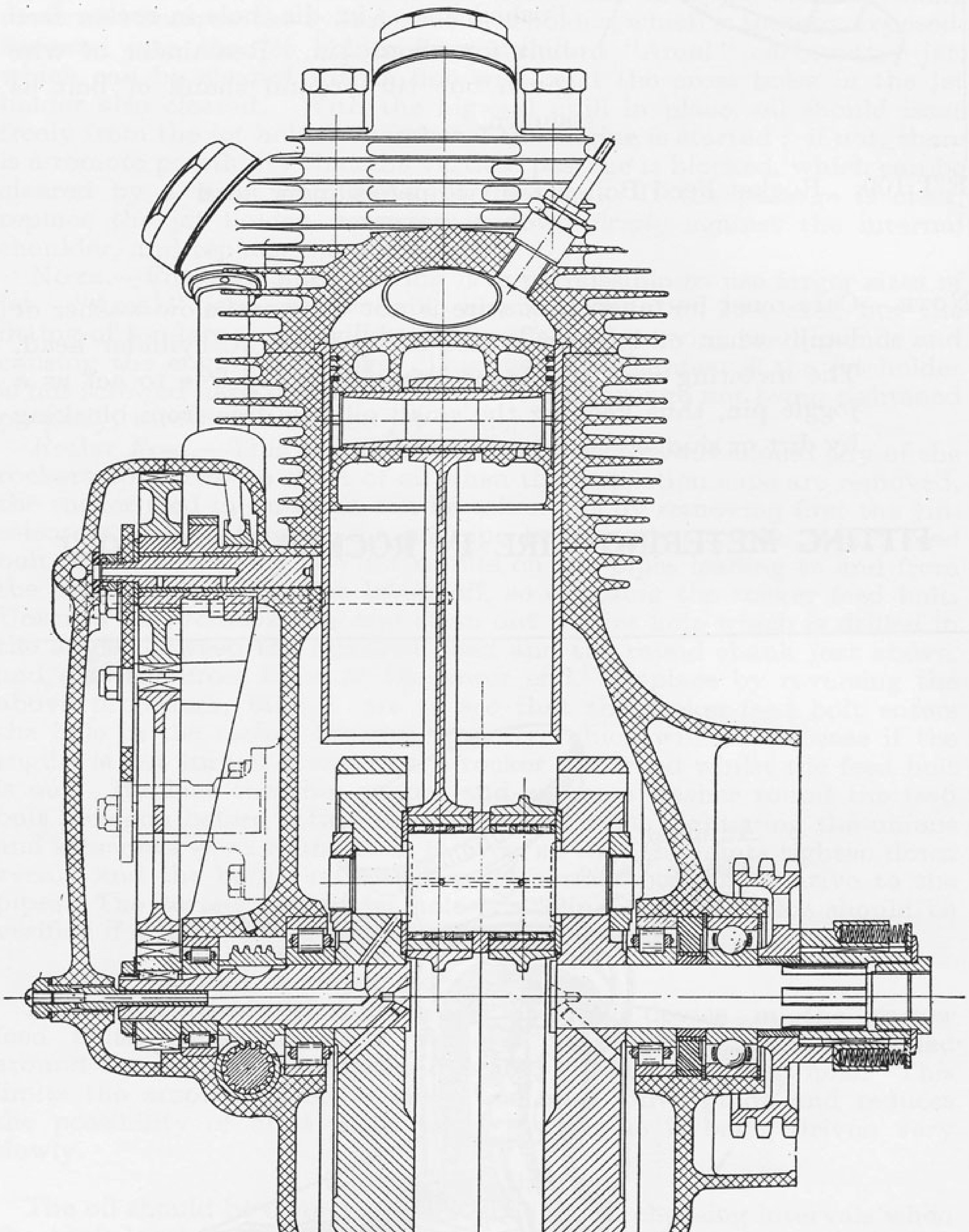
E.T.100. Rocket Feed Bolt fitted two per cylinder head

NOTE.—Care must be taken that wire is not trapped below washer or banjo when oil pipe is subsequently fitted to cylinder head. The metering wire should be left sufficiently free to act as a joggle pin, thus keeping the small oil hole free from blocking by dirt or sludge.

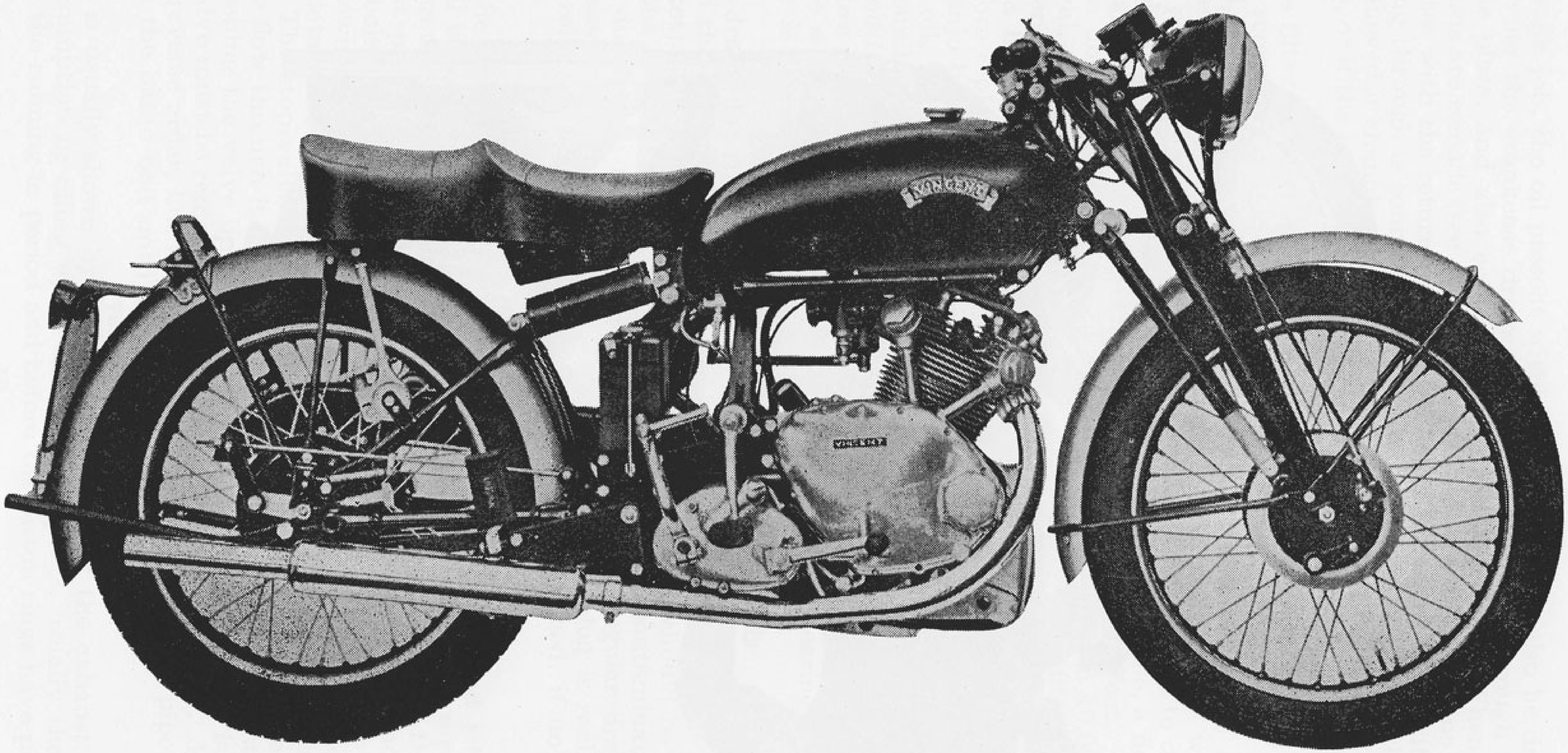
FITTING METERING WIRE IN ROCKER FEED BOLT



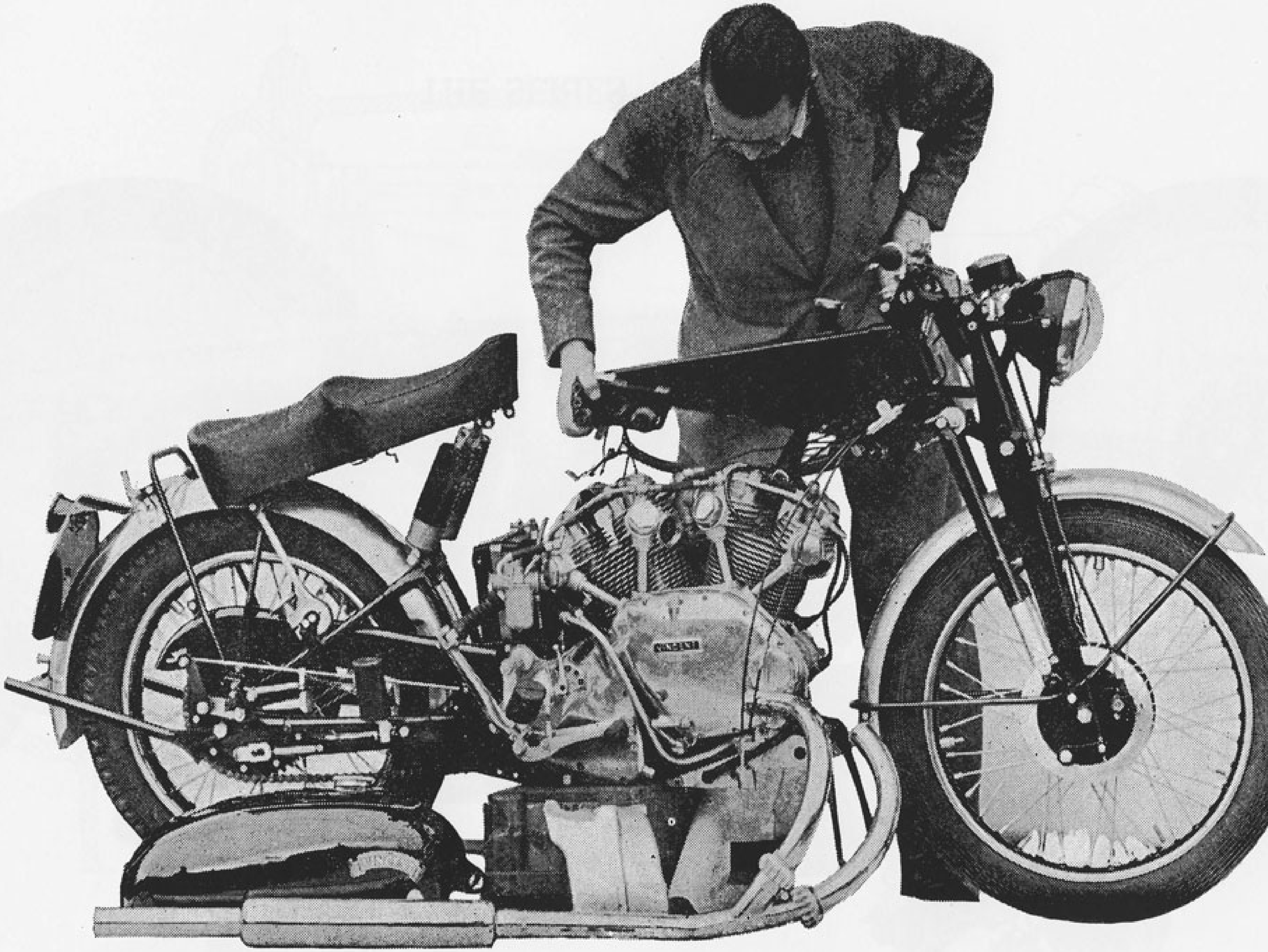
CHAIN OILER



GENERAL ASSEMBLY 1000 c.c. Engine



THE SERIES "C" COMET



REMOVAL OF FRONT END

thorough job, the oil present within the engine can also be drained by removing the crankcase drain plug, which extends through the L.H. engine plate, and also emptying the filter chamber. When all connections are remade (see also page 60), fill tank and run engine for a few minutes with the return pipe disconnected from the tank, until the oil coming through is comparatively clean. This procedure should always be followed if changing over from one oil to another of greatly different grade, or if the engine has been allowed to become very dirty internally.

Cleaning the Filter

The filter is situated below the magneto and the element is retained by a screwed hexagon-headed cap. To remove, detach the magneto shield, place a drip tray beneath to catch oil, unscrew the cap with spanner K1, and withdraw the element. This can then be washed in clean paraffin or petrol, but *not* scrubbed, as this will tend to drive dirt into the texture of the felt. If compressed air is available, a flow of air through the fabric *from the inside* will have a beneficial effect. Cleaning can be done as often as one likes, but at not more than 10,000 miles' interval, and after 20,000 miles a new element should be fitted. A little time and a few pence spent in seeing that the filter is really efficient pays a handsome dividend in reduced engine wear.

Before replacing the element wipe out the filter chamber and remove the banjo bolt passing through the timing cover. Soak the element in clean oil, lightly coat the bevelled seating of the cap with jointing compound and screw up tight. *Then pour oil through the banjo bolt hole until the filter chamber is at least half full, verify that banjo bolt holes are clear and replace it.* Unless the filter chamber is filled there will be a considerable delay before oil reaches the bearings when the engine is started.

Draining the Gearbox—1000 c.c. Models

The drain plug is screwed into the gearbox wall in a protected position behind the R.H. pivot bearing plate (*i.e.*, forward and below the gearbox sprocket). The box holds nearly 2 pints of oil and should be drained after the first 1,000 miles to get rid of oil possibly contaminated with metal during the running-in period. After that, regular draining is unnecessary. Do not omit to see that the drain plug is really tight when refitted. The 500 c.c. gearbox cannot be drained, if no plug is fitted.

Lubrication Troubles

In the unlikely event of oil failing to reach the big-end jet, check that oil is actually reaching the pump by removing the feed pipe banjo bolt screwed into the lower side of the timing chest behind the front exhaust pipe. Oil should then flow freely from the pipe, and if the banjo bolt holes are clear oil *must* be reaching the pump and the trouble lies elsewhere. If oil does not issue, and there is actually some in the tank, detach feed pipe from stop valve in tank and verify that pipe is clear. The stop-valve automatically closes when the pipe is removed, but the flow through it can be checked by inserting a piece of stiff wire and pushing the valve up as far as it will go ; if oil does not issue the stop valve must be removed to clean the internal gauze filter. Replace in the reverse order, but to prevent an air-lock in the feed pipe do not tighten the banjo bolt until oil is flowing freely through.

Overlubrication

This is usually shown by excessive smoking of the exhaust, heavy oil consumption or oiling up of one or both plugs, usually the front. During the running-in period and before the piston rings have properly bedded in, the front plug may cease to function due to excess oil, particularly if the engine is driven very slowly for long periods. This condition usually cures itself when harder driving is commenced.

If the engine smokes badly though the pistons and rings are in good condition and yet the return flow of oil to the tank is less than usual or contains a great deal of air, the scavenge side of the pump is at fault. Test that the oil pump plug lying between timing chest and kick starter cover and also the pump drive screw lying just forward of the return pipe banjo, are tight, as air leaks at these points lessen the pump delivery. Check that the blanking plug screwed up into the crankcase just behind the right-hand front engine plate is tight, but do not force this plug up so far that it lies more than ⅛in. below the surface of the boss, as this would have the effect of blocking the cross hole drilled into the sump. In extreme cases this cross hole may be blocked by foreign matter, such as a piece of rag carelessly dropped into the crankcase during overhaul, and this may be cured by removing the plug and inserting a hook-shaped piece of fine wire. As a general rule, however, it is not recommended that the blanking plug be disturbed.

Smoking and/or oiling of plugs may also be caused by an obstruction in the oil return line anywhere between the rear inlet rocker feed banjo and the oil outlet in the filler cap neck. If such an obstruction exists, an excessive oil pressure is built up in the return line, which forces an excess quantity of oil through the rocker jets. Some of this may work down through the inlet valve guides (particularly if the engine has seen much service) and the rest flows down in the normal manner through the push rod tubes, leading to an excess quantity of oil in the engine. The remedy is to detach the oil return pipes and make sure they are clear and particularly that there are no flaps of rubber projecting into the bores of the flexible hoses. The internal oil pipe in the oil tank should also be checked to see that it is not blocked.

Lubrication of Cycle Parts

(See list of Recommended Lubricants, page 3.)

Tecalemit grease nipples are fitted at a number of points, through which grease of the recommended grade should be injected at regular intervals. Over-generous lubrication of the brake cam spindles or speedo drive gearbox must be avoided, as this may lead to grease finding its way on to the brake linings. The same remark applies to the hub bearings, which are packed on assembly with grease, sufficient to last for several thousand miles ; a *small* quantity of *high melting point* grease can, however, be injected at intervals into hubs which are fitted with grease nipples. On later hubs these nipples are intentionally omitted, and it is necessary to dismantle the hubs every 8,000–10,000 miles and repack the bearings with fresh lubricant (see page 37 for instructions for dismantling).

Location and Number of Grease Nipples

Brake Cam Spindles (4).—At side of each brake plate.

Speedometer Drive.—In centre of drive gearbox, on brake plate.

Frame Pivot Bearing (2).—On rear forks, approximately in line with edges of mudguard.

Hydraulic Dampers (2).—Near filler plug

Front Brake Balance Beam.—In centre of beam above front guard.

Steering Head.—At right side on head lug.

The front forks, brake and clutch pedals, saddle pivot and stays are fitted with self-oiling bushes and therefore need no grease lubrication.

Control Cables and Levers

The inner Bowden cables should periodically be given a few drops of oil where they emerge from the outer cables, and the controls operated a few times to work the oil into the cables ; this particularly applies to the rear brake cable, which is more exposed to water than the others.

Oil should also be applied to the control lever joints (excepting the air levers) and to any ball joints of the link connecting the gear-change pedal to the gearbox. Regular attention to greasing and oiling the few points enumerated takes only a few minutes and will do much to keep all the various components concerned operating sweetly.

CHAPTER IV

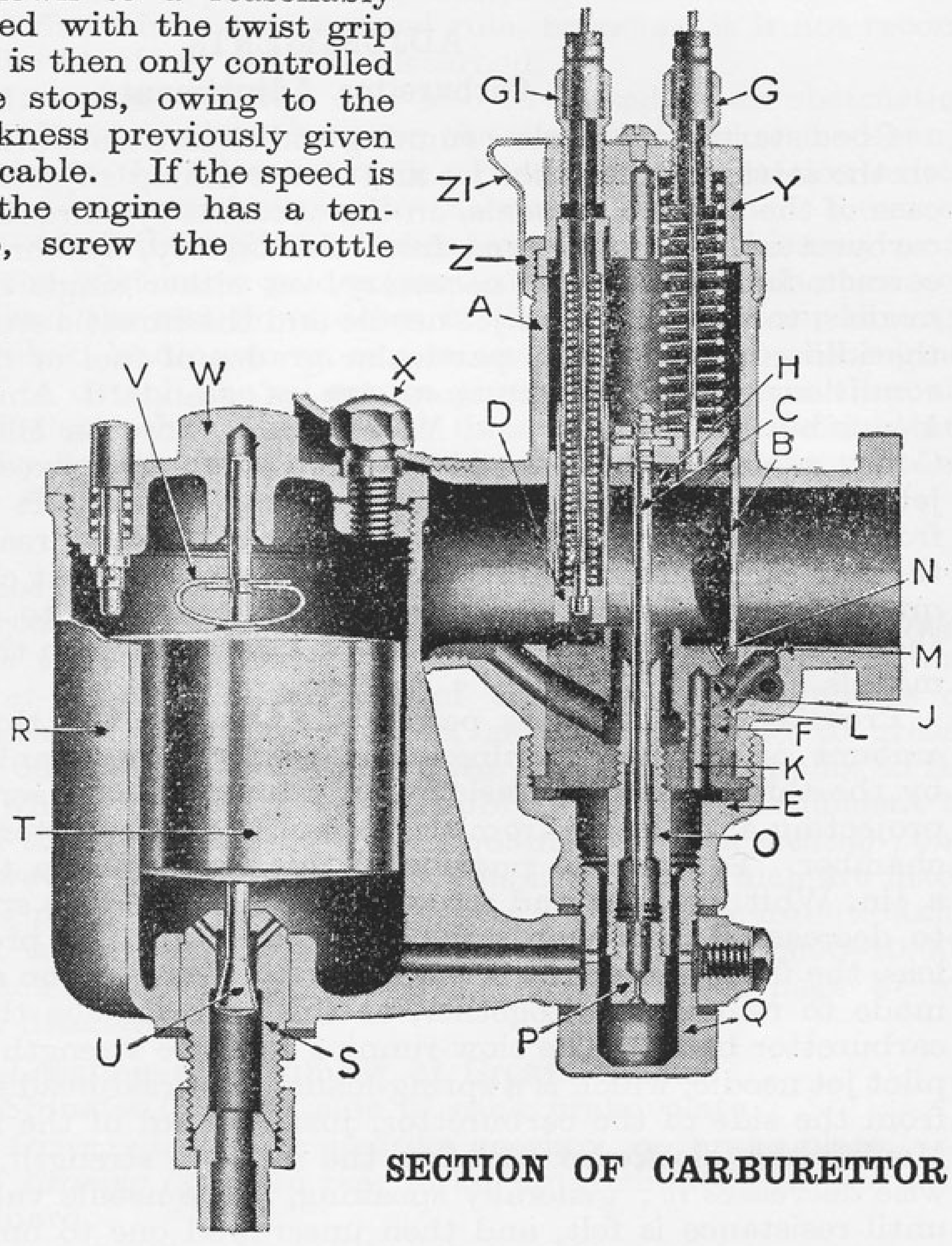
ADJUSTMENTS

Carburettor Adjustment

Good starting, even slow running and clean acceleration are dependent on the setting of the pilot jet and slow running adjustment, and, in the case of the 1000 c.c. models, on the accurate synchronization of the two carburettors. As delivered from the factory, synchronization will be correct, but it may be necessary, on either single or twin cylinder models, to reset the pilot jet needle and the throttle stops which control the idling speed to suit particular grades of fuel or different climatic conditions. The carburettors are of standard Amal construction, 1 $\frac{1}{16}$in. bore on Rapide and Meteor, 1$\frac{1}{8}$in. bore on Black Shadow and Comet models. They are identical on all models except for size, pilot jet and throttle stop adjustments being on the left on 500 c.c. and front carburettor on 1000 c.c., and on the right on rear cylinder, while the rear carburettor on 1000 c.c. has a top feed float chamber. Consequently, the following instructions apply equally to all models, with the exception that synchronization is unnecessary on the single cylinder models.

Provided that there is perceptible slack in the throttle cable, the amount of throttle opening provided for slow running is controlled by the throttle stops, consisting of a knurled-head screw and locknut, projecting at an angle from the side of the carburettor body or mixing chamber. To alter the position of this stop, slacken the locknut with a $\frac{1}{8}$in. Whit. spanner and screw upwards to increase speed, downwards to decrease it, afterwards relocking the nut. (To prevent accidental loss, the inner end of the screw is burred over, and no attempt must be made to remove it altogether, as this will damage the thread in the carburettor body.) The slow-running mixture strength is varied by the pilot jet needle, which is a spring-loaded, knurled-head screw, projecting from the side of the carburettor, just forward of the mixing chamber. Moving this clockwise increases the mixture strength, and anti-clockwise decreases it ; generally speaking, if the needle valve is screwed in until resistance is felt, and then unscrewed one to one and a quarter turns, the mixture strength should be approximately correct. On some twin cylinder machines the throttle stop and pilot jet needle are rather difficult of access, being on the right of the carburettor body. For the pilot jet, a long thin screwdriver can be used, while access to the throttle stop is made easier by unscrewing the air intake. On the rear carburettor the throttle stop is directly accessible, but the pilot needle valve is best moved with the aid of a pair of thin-nosed pliers. On later models carburettors are fitted with these controls on the left-hand side, accessibility being thereby considerably improved.

Supposing for any reason that the slow-running adjustment has been completely upset, the best method of procedure is to slacken off both throttles by screwing in the adjuster in the throttle cable, near the twist grip, until there is about $\frac{1}{8}$in. slack in the outer cable with the twist grip in the closed position. Then set both throttle stops so that the slides are open 1/16in., measured on the engine side of the carburettors ; by looking down the air intakes the amount of opening can just be seen, though the view is masked to some extent by the central needle. Screw in both pilot needle valves and screw back again one and a quarter turns, as mentioned previously. Start the engine, which, when warm, should settle down to a reasonably good idling speed with the twist grip shut ; its speed is then only controlled by the throttle stops, owing to the amount of slackness previously given to the throttle cable. If the speed is too slow, and the engine has a tendency to stop, screw the throttle stops upwards, one at a time, noting from the sound of the exhaust that the cylinders are firing equally. It is possible to screw one stop up so far that one cylinder is doing all the work, whilst the other is not firing at all, but this condition is easily detected by ear. When the stops are correctly set, movement of either one up or down will cause the engine speed to rise or fall.



SECTION OF CARBURETTOR

Incorrect pilot mixture strength is indicated by the sound of the engine ; if too rich, the cylinder in question will eight-stroke ; if too weak, it will spit back through the carburettor. The pilot jet setting also has a considerable effect on the slow-running speed, and to some extent the pilot jet and the throttle stop positions are dependent on each other. Thus, when the throttle stops are set to give equal running, each pilot jet setting should be varied a little in turn. If the engine speeds up when the pilot jet is screwed in, screw the throttle stop out to bring the speed back to what it was before, but if it slows down or eight-stroking commences, screw the pilot jet out again to where it was or a trifle further.

When the throttle stop and pilot settings are correct, stop the engine and proceed to synchronize the throttle controls to obtain equal amounts of throttle opening to each cylinder as the twist grip is moved ; the system of adjustment consists of the master adjuster in the throttle cable near the twist grip and a synchronizing adjuster in the cable to the rear carburettor and purposely placed in a rather inaccessible position, just behind the right-hand fuel tap, to avoid tampering. The method of use is to screw out the master adjuster so that the throttle slide of the *front* carburettor lifts off the throttle stop as soon as the twist grip is moved from the closed position, or, put another way, so that the slide contacts the stop just before the grip is fully closed. It is possible to hear a metallic click as the throttle touches the stop and also to watch the movement of the slide as the grip is moved. Having got this adjustment dead right, screw the adjuster in the rear cable in, if necessary until there is definite slack in the cable, then screw it out again until the rear slide is just about to leave its throttle stop. If the twist grip is now opened and closed the two slides should be heard to strike the stops simultaneously, or alternatively, a finger can be rested lightly on one slide, while the other one is watched to see that both commence to move absolutely in unison. If not, alter the synchronizing adjuster *only*, remembering that the lie of the cable under the tank affects the throttle position to a small extent ; bending the cable has the effect of opening the rear throttle a little.

When the adjustment is correct, start the engine, which should after a minute or two to warm up again run at the speed as previously set by the throttle stops. If it runs faster, the slides are probably held open a little by the cables, which can instantly be verified and cured by slackening the master adjuster a little. Now open the twist grip slowly, when the engine should speed up with both cylinders firing evenly, but occasionally it will be found that one cylinder will be firing more strongly than the other, due to variation in mixture strength or slight differences elsewhere. If so, leave the twist grip in the same position and first try the effect of varying the setting of the synchronizing adjuster, very gently screwing it in and out until both cylinders are firing evenly, even though in the process the engine speed rises, as this can subsequently be rectified if necessary by altering the setting of the master adjuster.

Unequal firing when opening out caused by unequal mixture strength can be detected by the air levers, of which the top one controls the front carburettor, the bottom one the rear. If closing either lever tends to make the firing more even, screw the pilot jet of that cylinder inwards a little and *vice versa*.

As described, the process of setting the carburettors sounds rather difficult and complicated, but only takes a few minutes to perform. Under normal circumstances all that is required from time to time is simply resetting the throttle stop to give the correct idling speed.

It must be understood, however, that good idling cannot be obtained unless the ignition system is in good order, and this should be verified if trouble is experienced in obtaining good results.

Tuning Carburettors for Power

The tuning of carburettors on standard machines is designed to suit the average commercial straight or leaded fuels, and localities not much above sea level. The settings are given in the data sheet at the beginning of this handbook. When running on alcohol blend fuels, or petrol-benzole mixtures, it may be necessary to increase the main jet size or, conversely, to decrease it at high altitudes. Larger main jets will also be required if the silencer is removed, but the correct size is then best determined by trial ; when racing, it is always best to use a rich mixture rather than a lean one, as the latter can easily lead to burnt exhaust valves or seized pistons.

The main jet only determines the mixture strength at or near full throttle ; from approximately three-quarters down to half throttle it is controlled by the needle position, and below half throttle by the amount of cut-away of the throttle slide. Hesitation or spitting-back when opening out from low speeds is an indication that the cut-away is too great ; to remedy this, fit a pair of throttle slides with smaller cutaway. If, on the other hand, the engine does not accelerate crisply, but is inclined to eight-stroke, the mixture is too rich, and slides with larger cutaway should be tried. The air levers can, of course, be used as a means of determining whether the mixture strength is too weak at any point in the range, but are most useful when determining the main jet size. If, when running at or near full throttle, the speed increases when the levers are slightly closed, the main jets are too small, but if the speed falls off the jets are too large. Remember, however, that in these carburettors the air levers commence to act as throttles when closed considerably, and the speed will fall off whatever the jet size may be if the levers are brought too far back.

RUNNING ADJUSTMENTS
Power Units—All Models

Valve Clearance Adjustment.—The valve clearances of a new engine should be checked at 500 and 1,000 miles, but after that much longer intervals can elapse between inspections ; though should any excessive valve gear noise develop suddenly, it is wise to verify the adjustment immediately.

Under normal circumstances check and adjust the clearances with the engine cold. Remove sparking plugs to allow the engine to rotate freely, and, using the kit spanner K1, unscrew the inspection caps on the cylinder heads just above the push rod tubes. (Note.—These caps must *never* be unscrewed when the engine is running, as this would cause damage to the valve gear. Also it may be found that one of the caps tightens up again after being unscrewed a few turns ; if so, it is being fouled by its rocker, and it will be necessary to rotate the engine about one revolution, so that the rocker in question drops and thereby permits the cap to be removed.)

Commencing with the inlet rocker (rear cylinder on twins), turn the engine until both valves are fully closed (*i.e.*, with the piston on Top Dead Centre of firing stroke), grasp the rocker end and move it up and down to detect any slackness there may be in the push rod adjustment. If slackness can be felt, hold the head of the rocker adjuster firmly with the O.B.A. spanner in kit, and loosen the locknut with the ¼in. Whit.

spanner, and then screw the adjuster down until all slack is taken up but the push rod is still free to turn. Finally, re-tighten the locknut, holding the adjuster hexagon with a spanner at the same time to prevent strain on the rocker, and check to see that the adjustment has not altered during the locking operation. If correct, repeat the process on the other rockers, turning the engine to a fresh position for each rocker being dealt with to ensure that the corresponding valve is fully closed.

Occasionally it may be found that there is no play at all in one of the rockers and that the push rod cannot be rotated freely. In this case the rocker adjuster must be slackened back.

The reason for checking the clearances with the engine cold is that they become greater as the engine warms up, and if the clearances are adjusted to zero with the engine hot there is a danger that the valves may be held off their seats through insufficient clearance when the engine cools down.

Should any of the rockers appear to be dry instead of copiously supplied with oil, the rocker oil feed jet is probably blocked ; *this must be rectified immediately*, as described on page 18.

Primary Chain Tension—1000 c.c. Models

This again should be checked fairly frequently when the power plant is new to ensure that all is well, but after the initial running-in period need only be inspected every two to three thousand miles. Unlike the rocker adjustment, the chain tension must only be adjusted when the unit is thoroughly warm, as the expansion of the crankcase tightens the chain perceptibly. To inspect, remove the inspection cap on chain case and feel the up-and-down play in the chain with the finger, rotating the engine several times to determine the tightest spot in the chain, taking care that the finger does not get drawn forward and become trapped by the engine sprocket. Should the play at this point be between ½in. and ¼in. the adjustment is correct ; if not, slacken the locknut on the chain tension adjuster on the lower side of the case towards the front and screw the adjuster inwards to tighten the chain, or outwards to slacken it, then re-tighten the adjuster nut and replace the inspection cap.

Primary Chain Tension—500 c.c. Models

The chain should be checked fairly frequently in the early life of the machine, but after running-in adjustment should only be necessary every 2,000–3,000 miles.

The temperature of the engine has little or no effect on this adjustment.

Access to the chain is gained by removal of the inspection cap on the chaincase. To adjust for ½in. to ¼in. up and down play slacken the ½in. B.S.F. bolt below gearbox and the ½in. bolt just below the footrest distance piece against the engine plate on R.H. side of machine. Right underneath the gearbox will be found two adjuster screws which bear on opposite sides of the lower bolt. To tighten the chain unscrew the front adjuster several turns, then screw the rear adjuster inwards until the chain reaches the correct tension. Tighten the ½in. bolts and check the tension. If still correct screw the front adjuster in until it is just bearing firmly against the bolt, but do not over tighten it. To slacken the chain, screw the rear adjuster out first, then operate the front adjuster, making sure first that the rear chain is sufficiently slack to permit the gearbox to move forwards. As adjusting the primary chain is bound to affect the rear chain adjustment (unlike the 1000 c.c.

models) it is always necessary on single cylinder models to adjust the rear chain afterwards. *Remember*, *never* screw one gearbox adjuster inwards unless the other has first been screwed outwards.

Clutch Adjustment—1000 c.c. Models

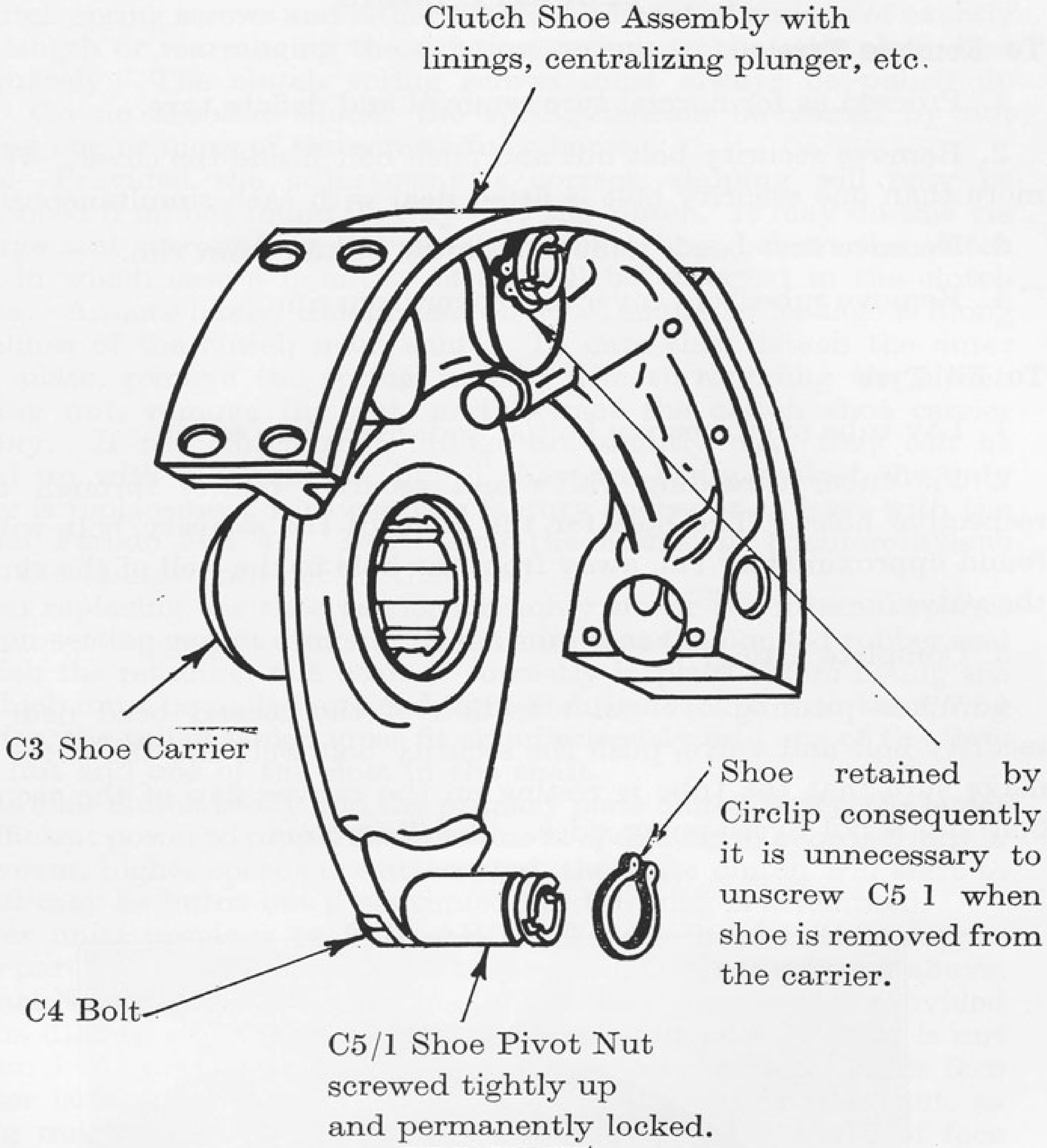
There are two points of adjustment in the clutch operating gear, one in the cable and one in the kick-starter cover. The first is supplied mainly for initial adjustment on assembly or if another cable is fitted; under normal circumstances very little wear takes place in the cable and therefore this adjustment is rarely used. To verify that it is set correctly remove the inspection cap on upper front corner of kick-starter cover, thereby exposing the end of the clutch lever, the inner cable and the cable abutment. Lift the handlebar lever until it touches the grip, and at that point the clutch lever should be just touching the clutch cable abutment. If not, loosen the adjuster locknut, screw out the adjuster by the required amount and relock. It may be that the clutch operating lever comes up against the abutment before the handlebar lever touches the grip; in that event the cable adjuster must be screwed in until simultaneous contact is made. *Always* check the cable adjustment before carrying out the push rod adjustment next described.

Adjustment for normal wear or bedding down of the clutch plates is performed by the adjuster and locknut in the face of the kick-starter cover, and somewhat hidden by the kick-starter crank; the same spanners can be used as for tappet adjustment. Slacken the locknut and screw the adjuster in or out until there is $\frac{1}{8}$in. to 3/16in. of free movement or slackness in the clutch cable. If less than this amount is present there is a chance that the clutch may slip when the power unit is very hot, due to expansion taking up all the clearance. Slip may also occur if the cable is stiff, either through damage to the outer casing or lack of lubrication, and the inner cable should always be checked to verify that it is working freely before adjusting the clutch.

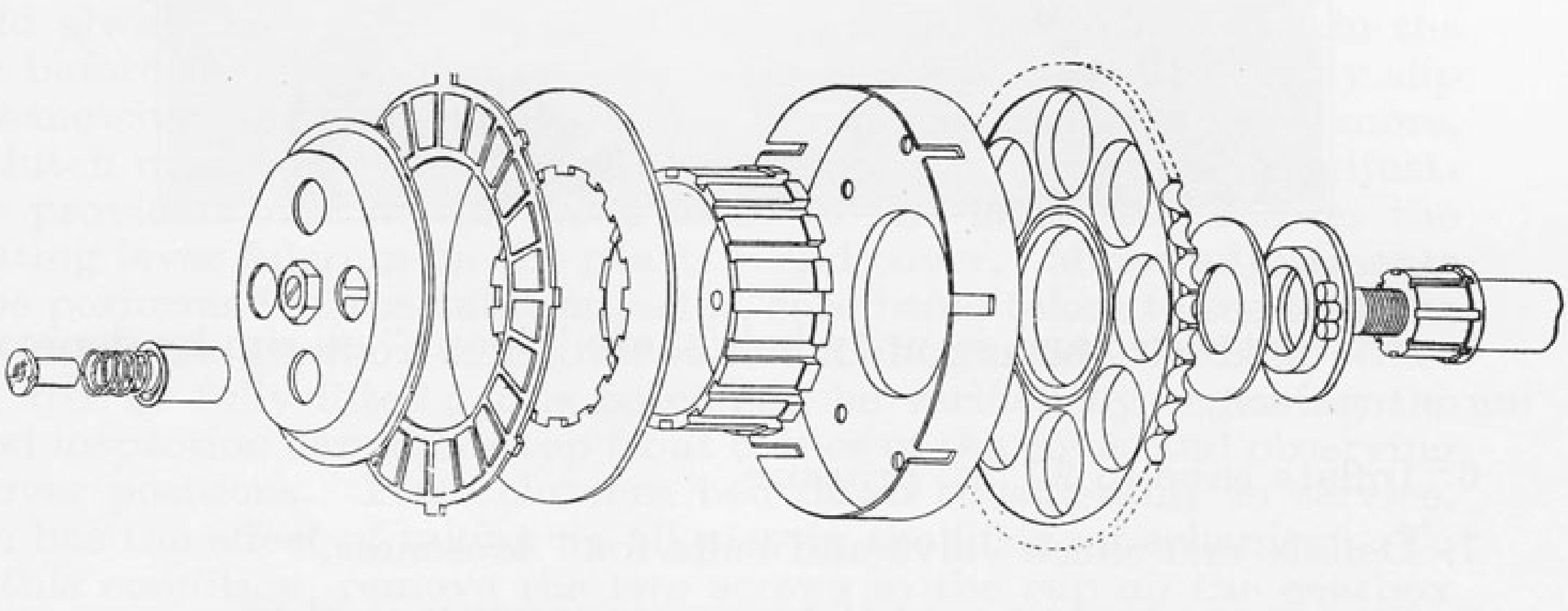
In course of time the lever adjuster may become screwed hard up against the case; in that event remove the clutch dome attached to the primary chain case, and in the centre of the large nut in the outer clutch plate will be seen another and similar adjuster and locknut. This can be screwed in several turns and relocked, after which the adjuster on the kick-starter cover can be operated in the normal manner. Alternatively, if much wear has taken place on the clutch plate the normal adjuster may have to be screwed so far back that it ceases to have any effect, due to the clutch withdrawal lever fouling its housing in the kick-starter cover; in this event the adjuster in the clutch plate can be screwed outwards a few turns and the normal adjuster can then be screwed inwards to give the requisite amount of cable slack. One point which must be watched is that there must always be a minimum of $\frac{1}{8}$in. gap between the clutch plate adjuster and the inner face of the clutch cover to permit the clutch to lift its full amount.

Incorrect Clutch Operation—1000 c.c. Models

Dragging.—This may be caused by incorrect adjustment so that the outer plate is not lifted its full amount; to rectify adjust as above. Another cause is failure of the outer plate to lift squarely. This can be observed by lifting the clutch with the clutch cover removed, and operating the starter crank. If the outer plate appears then to wobble considerably, it is not lifting squarely. The main cause of this is uneven spring pressure and the trouble can usually be rectified by removing



CLUTCH SHOE RETENTION, 1000 c.c. Models



THE BURMAN CLUTCH. 500 c.c. Models

USEFUL HINTS ON TYRE FITTING FOR WHEELS FITTED WITH SECURITY BOLTS

To Remove Tyre

1. Proceed as for normal tyre removal and deflate tyre.

2. Remove security bolt nut and push bolt inside the cover. Where more than one security bolt is fitted deal with each simultaneously.

3. Remove first bead, remove security bolt(s) from rim.

4. Remove tube from cover and cover from rim.

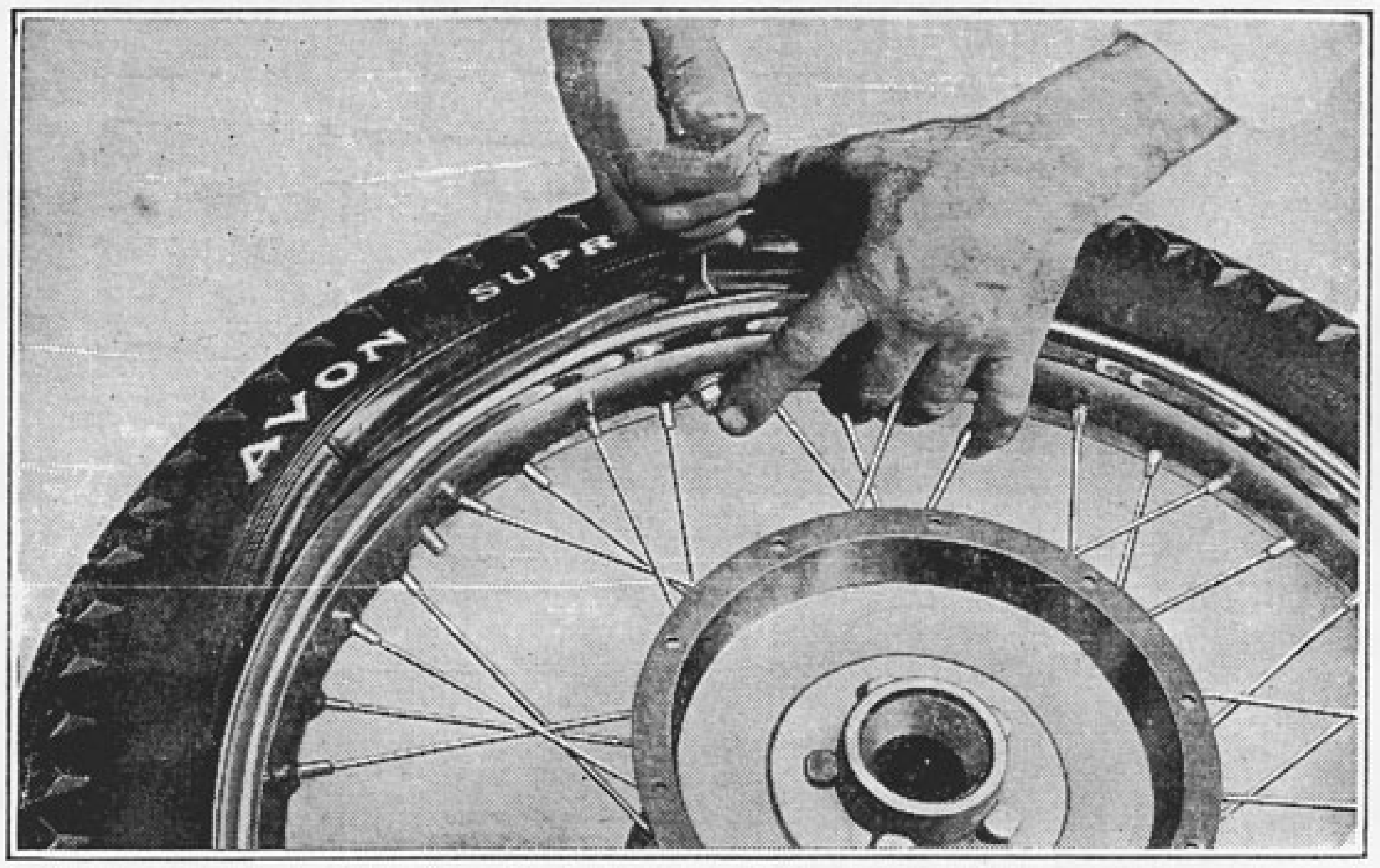
To Fit Tyre

1. Lay tube over security bolt(s) and insert into cover.

2. Fit tube, threading valve and security bolt(s) through their respective holes. The hole for the stem of the security bolt will be found approximately 9in. away from the hole in the well of the rim for the valve.

3. Complete fitting.

4. When pushing over that section of the second bead near the security bolt and valve, push the security bolt well into the cover and make sure that the tube is resting on the canvas flap of the security bolt and is not overlapping sides. *See illustration.*



5. See that valve and security bolt(s) are " loose " on rim by depressing into wheel.

6. Inflate tube to 20 lbs. pressure.

7. Deflate and check valve and bolts for " looseness."

8. Fit valve, rim nut, and tighten security bolt nut(s).

9. Inflate to recommended pressure, tighten nuts and fit dust cap.

FOR CARE AND MAINTENANCE SEE CHAPTER VII.

the clutch spring screws and either fitting a new set of springs of exactly equal length or rearranging the existing springs so that the plate does lift squarely. The clutch spring screws must always be pulled up tight. On no account should the spring tension be varied by not screwing one or more of the screws fully home.

Slip.—Provided the adjustment is correct, slipping will only be experienced if oil has found its way into the clutch. It may do this via the large seal surrounding the clutch sprocket boss behind the clutch drum, in which case a quantity of oil will be observed in the clutch housing. A more likely, though less obvious, source of leakage is along the splines of the clutch main shaft. To cure this, detach the outer clutch plate, remove the spring locking wire surrounding the clutch retaining nut, remove the nut, and extract the clutch shoe carrier assembly. If the clutch shoe linings are slightly oily, they can be cleaned up with a rough file, but if they are badly soaked the only remedy is replacement with genuine factory spares or at least with the material Ferodo MR 41. Degreasing the linings in trichlorethylene makes the linings unfit for further use.

When replacing the shoe carrier assembly smear the internal splines with non-setting gasket cement. Make sure that the bonded rubber seal on which the retaining nut bears is correctly in place before fitting the nut, which must be pulled up dead tight and then locked with the spring lock wire, the tail of which must fit simultaneously into one of the slots in the nut and one of the slots in the shaft.

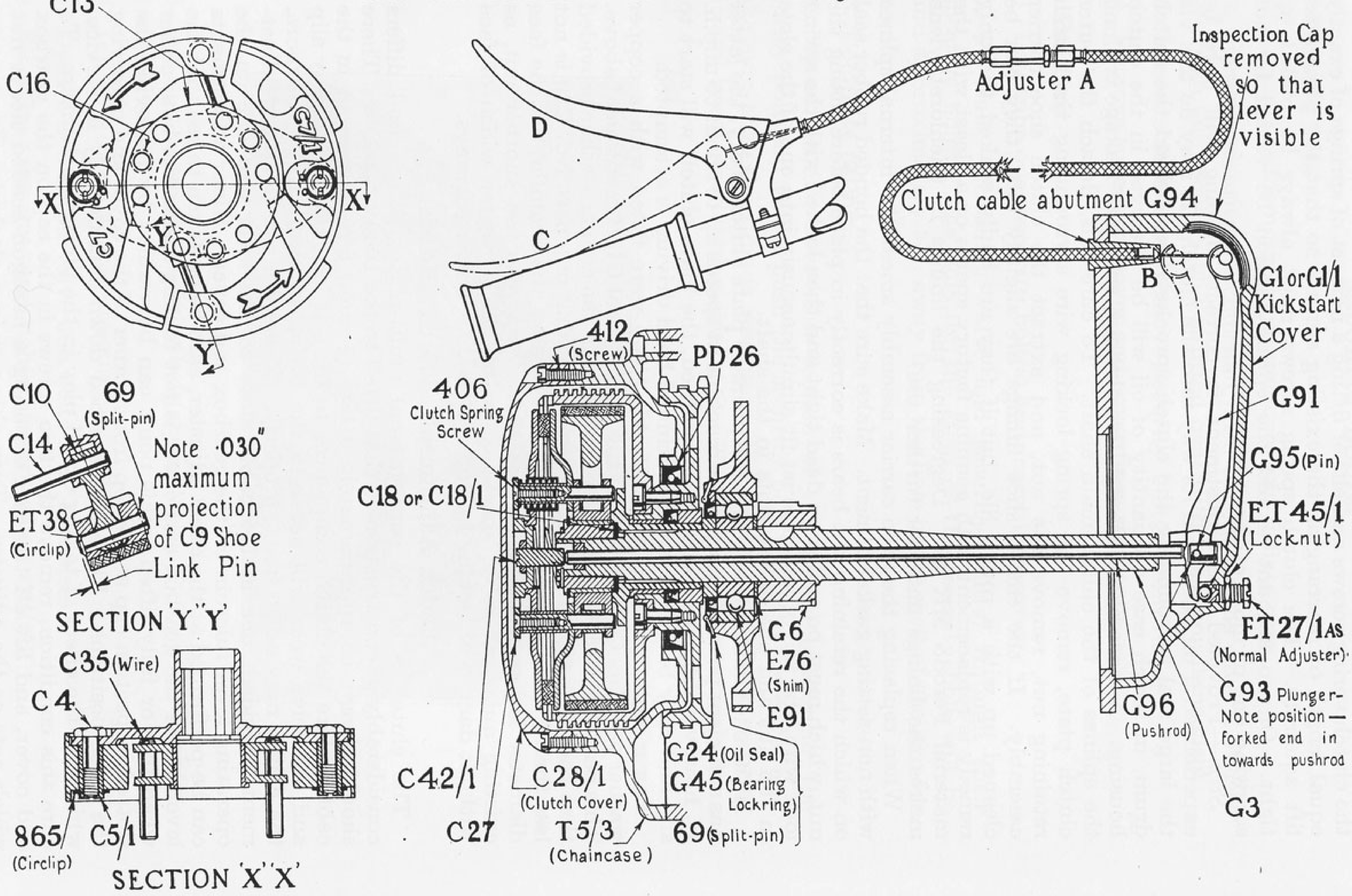
If the shoe clutch is oily and the primary plate clutch is dry, the latter has sufficient power to propel the machine at speeds up to about 60 m.p.h. If, however, higher speeds are attempted, the plate clutch will start to slip and may be burnt out if continued hard driving is attempted.

Power units previous to F/10 AB/1/656 were fitted with a copper washer part No. C 18 in place of the bonded seal C18/1 mentioned above. This part No. C18/1 can be fitted in place of the copper washer provided that the diameter of the face clutch retaining nut part No. C20 is not less than 1·218 measured at the inner edge of the chamfer. If the face diameter is less than this it will be necessary to use another nut, as existing nuts cannot be shortened to obtain a greater width of face without danger of locking up the clutch shoe carrier endways.

Clutch Adjustment—500 c.c. Models

The clutch is of the conventional multi-plate pattern and differs considerably in construction to that fitted to the 1000 c.c. models. There should always be approximately 3/16in (4 mm.) free movement in the cable before the clutch commences to lift ; if less, the clutch may slip and excessive wear will occur in the lifting mechanism, and if more, the clutch may not " free " properly. There are two points of adjustment provided, one in the cable close to the lever and one on the operating lever fulcrum on the gearbox end cover. Minor adjustments can be performed at the cable adjuster, care being taken to see that the lever inside the gearbox end cover is not fouling inside the box, either when free or fully lifted ; this point can be verified by removing the slotted inspection cap at the top front corner of the cover and observing the lever positions. Plate clutches bed down considerably in service, which has the effect of taking up all play in the lifting mechanism. To cure this condition, remove the two screws in the cap on the gearbox end cover, and lift off the cap, exposing a hexagon-headed sleeve nut which acts as the adjuster. Turn this nut in a clockwise direction to

1000 c.c. CLUTCH—CARE AND ADJUSTMENT



EXPLANATORY NOTES FOR DIAGRAM.

Note relative position of shoes C7 and C7/1, links C10, and plate carrier C13. Clutch will not function unless links are pivoted on correct pins. Spacers C16 are fitted between flanges of plate carrier C13 in three positions only, as shown by dotted circles.

Pins, C14, retained by wire ring, C35, threaded through holes in pins.

Shoe pivot bolt, C4, and nut C5/1, screwed up dead tight and locked by punching metal of bolt into slots in nut. A circlip, 865, is used to hold the Clutch Shoe assembly in position on the Shoe Carrier and the assembly can if necessary be removed simply by undoing the circlip. C5, the Shoe Pivot Nut on early models, had a hexagon head and washer in place of the circlip. If for any reason removal of this Nut, C5, is found necessary, it should be replaced by the later type C5/1 and circlip.

CORRECT SEQUENCE OF CLUTCH ADJUSTMENT

(i) Adjust length of cable by adjuster A, so that clutch lever is just touching abutment as at B when handlebar lever is pulled back against grip as at C. Once correctly set, the cable should rarely need further adjustment.

(ii) Screw normal adjuster ET27/1As in or out so that there is $\frac{3}{16}''$ of slack in the outer cable when the handlebar lever is in engaged position as at D.

C42/1 is an auxiliary adjuster for use when wear has taken place to such an extent that adjustment of the clutch can no longer be effected by means of the normal adjuster, ET27/1As. It should never be screwed out so far that it is proud of the spring ring C27.

give more play in the cable, or anticlockwise to take up play. One or two turns should be sufficient, but the cap and screws must be replaced before the adjustment can be checked.

Incorrect Clutch Operation—500 c.c. Models

Dragging.—May be caused by incorrect adjustment so that the outer plate is not fully lifted ; to rectify, adjust for correct amount of cable slack. If this does not affect a cure, the outer plate may not be lifting squarely, which can usually be cured by removing the cover plate on chaincase and screwing one or more of the spring adjuster nuts inwards by a small amount until the clutch frees properly, which can be checked by operating the kick-starter with the clutch lifted. Care must be taken not to overdo the screwing-in process, as otherwise one or more of the springs may close up solid before the clutch is fully lifted.

Slipping.—This may be caused by (*a*) an excessive amount of oil on the plates, (*b*) by insufficient spring pressure or (*c*) after a considerable amount of work, by the inserts being worn down level with the steel plates.

To cure (*a*), remove chaincase, remove all spring nuts, dismantle clutch and remove all traces of oil from the plates. To cure (*b*), screw all springs in by an equal amount until sufficient grip is obtained. The remedy for (*c*) is to fit new inserts.

Clutch and Exhaust Lifter Control Wires—1000 c.c. Models

These are identical so can be interchanged if desired, and both are quickly detachable for ease of replacement or when dismantling the engine. To detach exhaust lifter wire, pull outer cable free from recess in lever body to provide some excess slackness, then pull back the knurled cable abutment, which fits into the cable stop sleeve just behind the clutch lever inspection cap on kick-starter cover. This stop is slotted, and when drawn back clear of the sleeve can be slipped sideways off the cable. The sleeve can then be moved back to expose the inner cable and nipple. Push the nipple sideways out of the slot in which it fits and the cable will come clear. To reassemble, reverse the procedure

(NOTE.—Always adjust the cable with not less than $\frac{3}{16}$ in. slackness, otherwise the exhaust lifter mechanism will be held up and oil may leak from the cable sleeve.)

To remove clutch cable detach inspection cap, push inner clutch lever inwards with a screwdriver or other tool, and lift inner cable out of its seating in the lever end. The cable and its slotted cable stop can then be drawn backwards to clear. To reassemble, reverse the procedure. The whole operation can be made a little easier if the upper end of the cable is detached from the lever body as described for the exhaust lifter.

Clutch and Exhaust Lifter Cables—500 c.c. Models

These are not strictly interchangeable, as the clutch wire has a different form of nipple, but the lengths are the same and the exhaust lifter wire can in an emergency be used for the clutch. Detaching of both wires is performed in the same way as for the Rapide ; the exhaust lifter wire is partially hidden by the right-hand engine plate.

Adjustment of Cycle Parts—All Models
Brake Adjustment

All models, 500 and 1000 c.c., are fitted with wheels, brakes, hubs, steering column, forks, etc., of identical design (with the exception that Black Shadows are fitted with ribbed brake drums and 10 bolts in lieu of 5, each side of the rear hub. These details do not affect adjustments). The following instructions, therefore, apply equally to all models.

Front Brakes.—These are adjusted by loosening either or both of the knurled locknuts at each end of the brake balance beam (just below the lower fork links) and screwing the adjuster upwards until the brakes just commence to rub. This operation is best conducted with the front stand in action to raise the tyre off the ground. When correctly adjusted the balance beam should lie with its long cable end slightly higher than the short cable end, and it may be necessary to vary the positions of the two adjusters to obtain this result. Sometimes it will be found that the balance beam does not centralize correctly, so that one of the two brakes is binding even though the adjustment is slack. This is invariably due to friction somewhere in the system, either in the cam bearings, balance beam pivot or brake cable, and if the cause is removed the brakes will operate correctly.

After prolonged use all the movement provided by the adjusters will become used up ; when this occurs the cam arms can be reset to a lower position on the cam spindles by slackening off the nuts retaining the cam arms against the serrated washers, and rotating the arms one or two notches further round. The cam arms should be parallel to each other when this operation is finished, otherwise the brakes will not operate equally. The wheel can then be replaced and the cables readjusted, and the cam arm nuts finally checked over to verify that they are fully tightened. See also Chapter V.

Rear Brakes.—These are adjusted individually with the machine on the rear stand by screwing up one of the brake-rod wing nuts until the brake on that side just commences to bind. Then unscrew the wing nut six half-turns by which time the brake should be quite free, and repeat the process on the other brake. This procedure should always be adopted if there is any doubt as to the equalization of the brakes, but any small adjustments subsequently becoming necessary can be made by screwing up each wing nut by an equal number of half-turns. The cam arms can be reset into a different position on the spindles in the same way as described for the front brakes, should all the adjustment available on the rods become used up.

Rear Chain

This has the unique feature of being adjustable for tension without the use of any tools. Slacken off the rear axle by means of the tommy bar and rotate the knurled chain adjusters on each side by an equal number of half-turns, which are indicated by the " clicks " of the adjuster mechanism against the fork ends. Continue until the chain has ¾in. up-and-down play, measured at its tightest spot, which can be found by rotating the wheel several times ; then re-tighten the axle. To make sure of this being tight some riders prefer to give a final thrust on the tommy bar with the sole of their boot.

It is almost always necessary to readjust the rear brakes after adjusting the rear chain, and in extreme cases it may be necessary to slacken off the brake adjustment before the wheel can be moved back far enough to obtain the correct chain tension.

Steering Column and Head Adjustment

This should be checked periodically and adjusted, if necessary, as running with the races slack impairs the steering and will shortly destroy the race tracks. A rough test can be performed by holding the front brake on hard and pushing forward on the bars, when any slackness there may be will be distinctly felt or may be observed by watching for any fore-and-aft movement between the fork clip lug and the head lug. A better method is to place the machine on the front stand (in the case of a Meteor it is necessary to support the crankcase on a box so that the front wheel is clear of the ground), slacken off the steering damper, stand astride the front wheel and, grasping both fork blades fairly low down, try to move them backwards and forwards at the same time watching the bearing for play. Should any be detected, adjust by slackening the nut of clamping bolt in the head clip (just behind and below the damper knob) two or three turns, then screw the plated steering column nut clockwise by means of the kit spanner K3 until all play is taken up, but the forks are still quite free to turn. Some delicacy of touch is required to get the correct result, as the nut can be considerably over-tightened before stiffness becomes apparent, yet overloading the races in this manner will lead to damage.

On Series " B " machines it will occasionally be found that the full weight of the wheel hanging on the fork spring causes the latter to touch the steering head, and the slight friction so caused may be mistaken for bearing stiffness. The remedy is temporarily to place some object between the rear fork tubes and the fork crown lug, which will prevent the forks dropping to their full extent. When the bearings are correctly adjusted, re-tighten the clip lug clamp bolt.

After prolonged use, particularly if run slack, the head races may become pitted, which will spoil the steering at low speeds. If the forks turn in a series of jerks or have a pronounced tendency to remain in a central position after tightening the column nut, the race tracks are certainly pitted and should be replaced. Meanwhile the adjustment should be slackened sufficiently far back to permit the forks to turn freely, even if this introduces a small amount of play.

Fork Link Adjustment (Brampton Pattern Girder Forks only)
For Girdraulic Forks refer to Chapter V

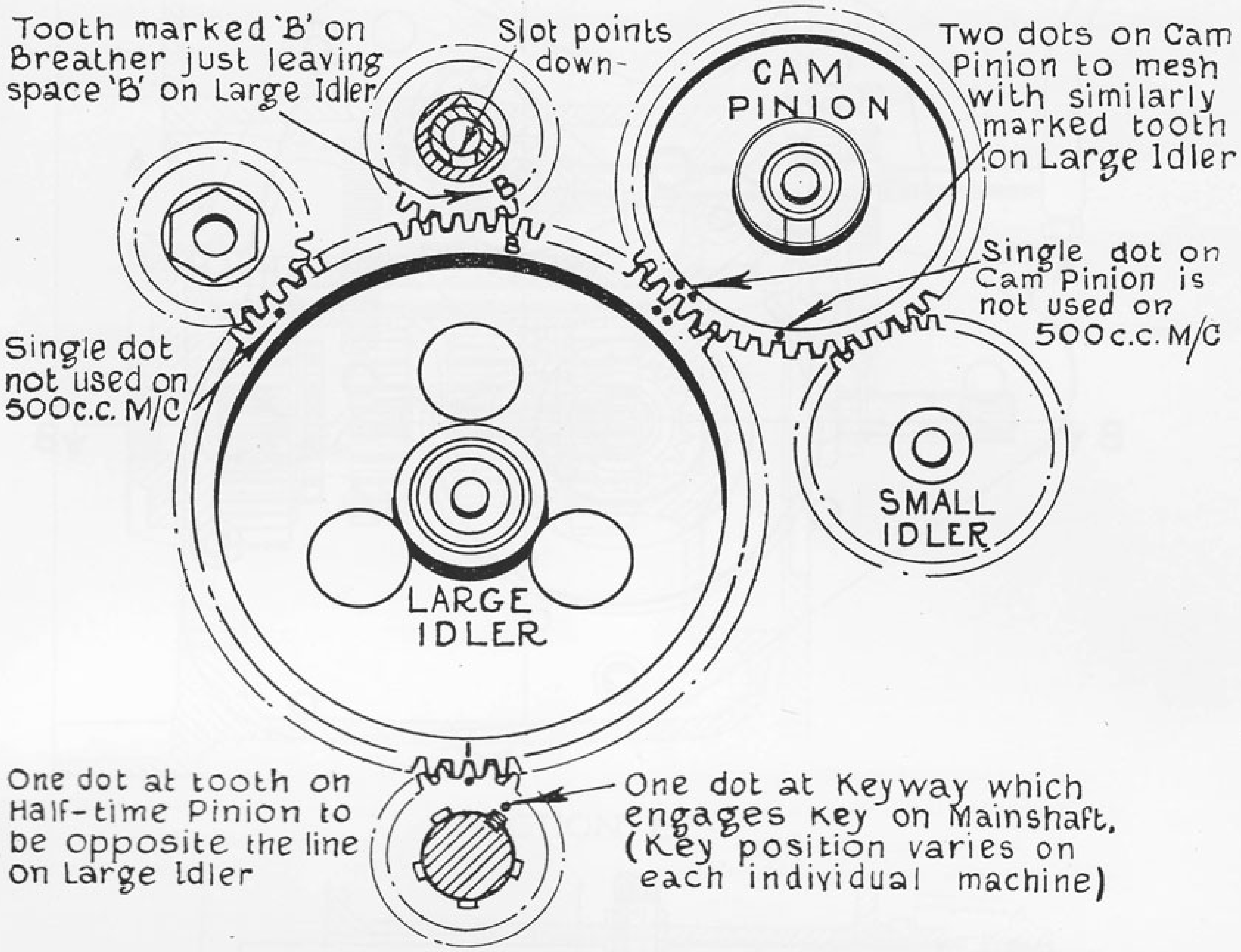
As self-lubricating bearings are fitted, no periodic lubrication is required, but the links should be periodically checked to see that no side-play has developed. This is instantly carried out on the top links by turning the four knurled bronze washers on the spindles with the fingers. They should have no side-play at all, but should be just free enough to be rotated. If play is detected, slacken off the four locknuts, all of which turn in the same direction, as those on the squared ends of the spindles have left-hand threads. Then screw each spindle up clockwise by the squared end until all play is taken up, slacken back one-quarter turn, re-tighten the spindle nuts and check. This method usually gives the correct adjustment, but one or two attempts may be required to get it just right. Occasionally one or two of the washers will seem to be stiffer to turn than the others, in which event disregard the tight ones and control the adjustment by the looser ones.

The adjustment of the bottom links is similar, but there is no visible means of checking and the action of the four-point damper masks the presence of side-play. Hence this must first be slackened right off and any play will be indicated either by relative movement between the links and girder, when the handlebars are alternately pulled and pushed sideways, or by a metallic knock being set up if the forks are turned from lock to lock. To adjust proceed as for the top links, successively tightening the adjustment until no play can be felt. Over-tightening can be detected by stiffness in the fork action if the handlebars are pushed and pulled up and down. Finally, re-tighten the damper to the amount normally used. As mentioned, tightening the damper appears to take up any play there may be, but it is not correct to depend upon this. Always carry out the adjustment as described.

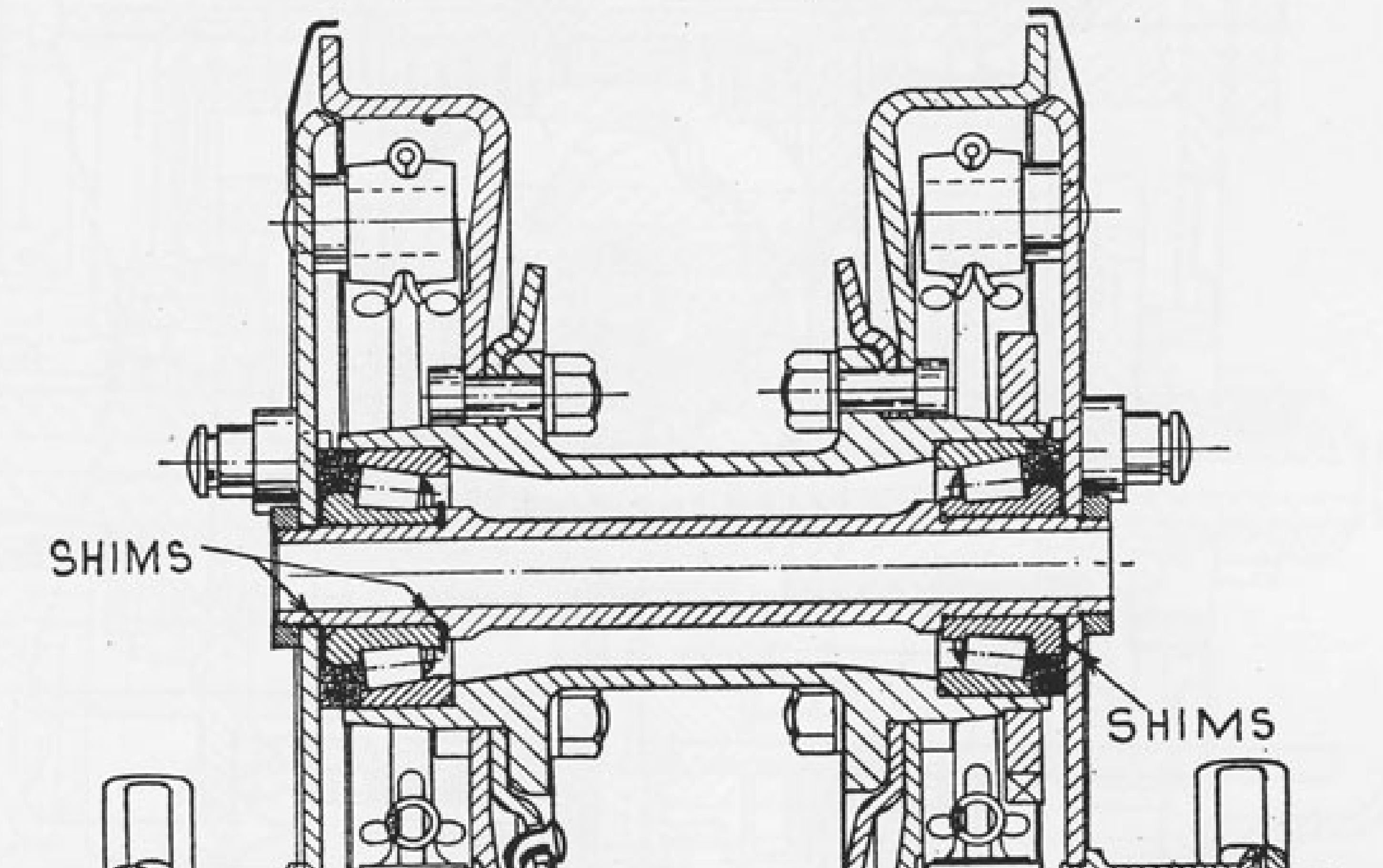
Removing Wheels

Front Wheel.—Place machine on both front and rear stands, unscrew lower end of speedometer cable, remove front axle and lower wheel to the ground. The brake cables can then be removed by pulling them downwards until the nipples are clear of the motion blocks in the cam arms, and the motion blocks which are slotted for the purpose can then be pushed out in a direction away from the brake plates. The wheel can then be slipped out ; turning the forks to full lock will give more clearance of the guard over the tyre.

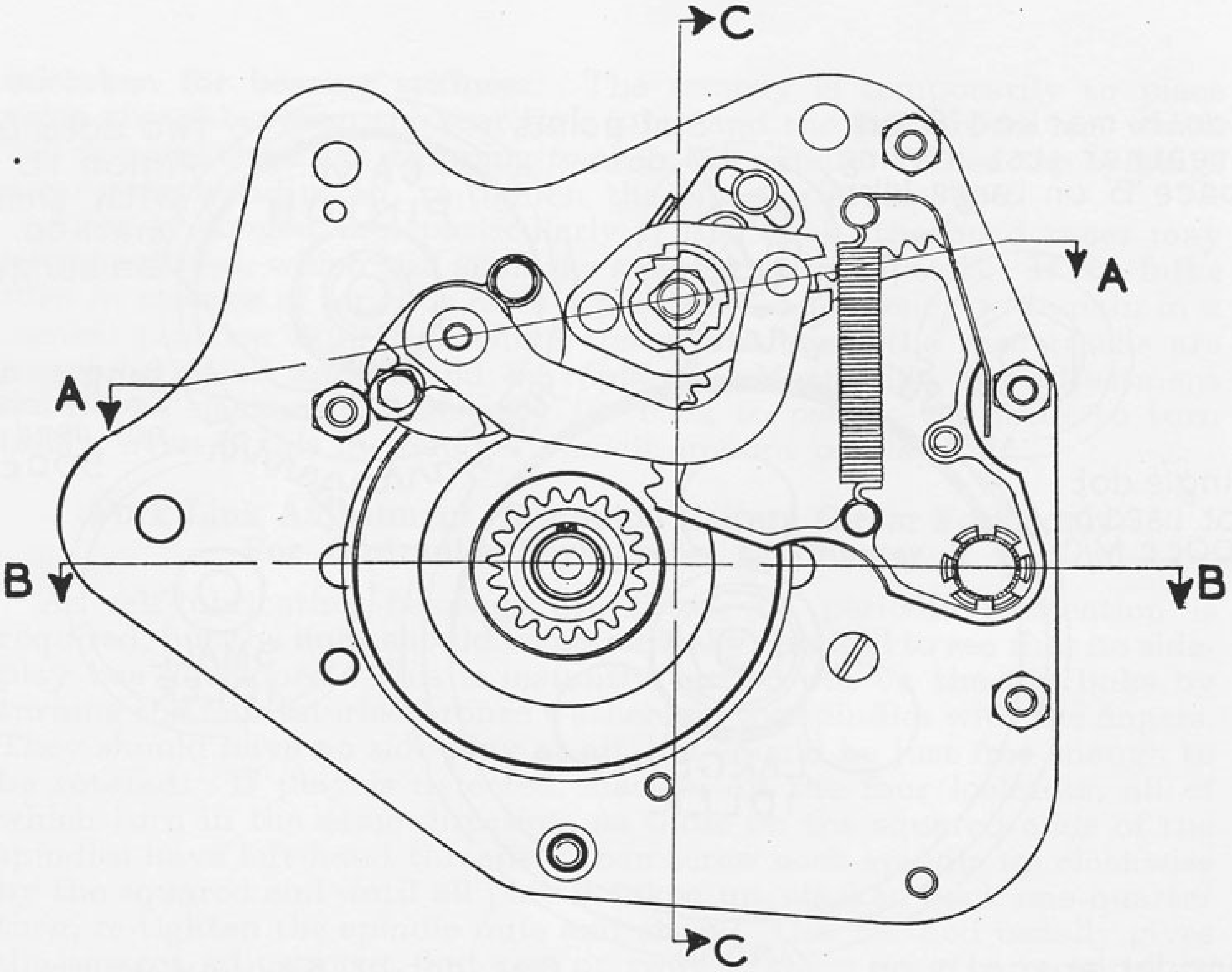
To replace the wheel, reverse the above procedure, making sure that the axle is fully tightened, and that the brake plate pins are lying correctly in the slots to the rear of the fork end lug.

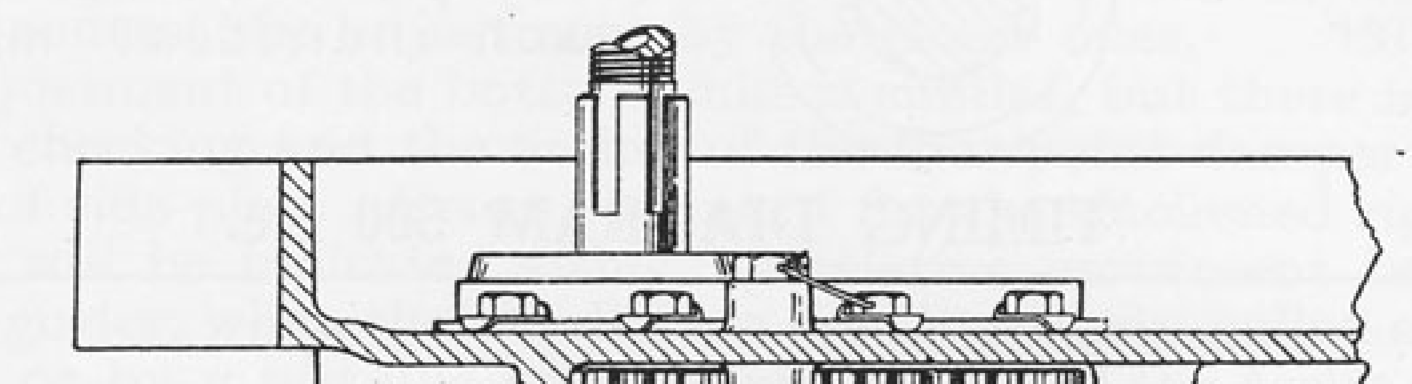


TIMING DIAGRAM 500 c.c.

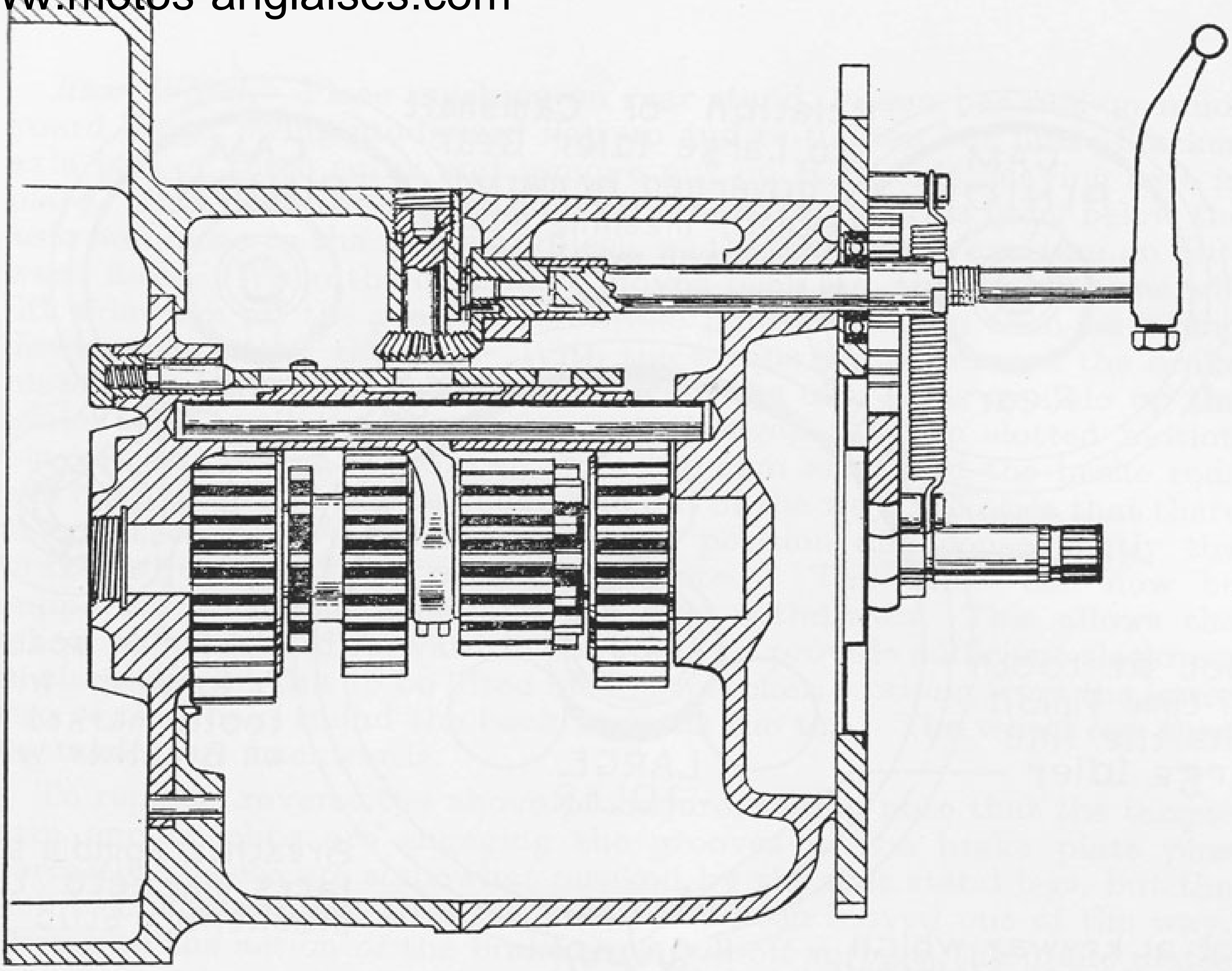


THE "VINCENT" FRONT HUB WITH TAPER ROLLER BEARINGS

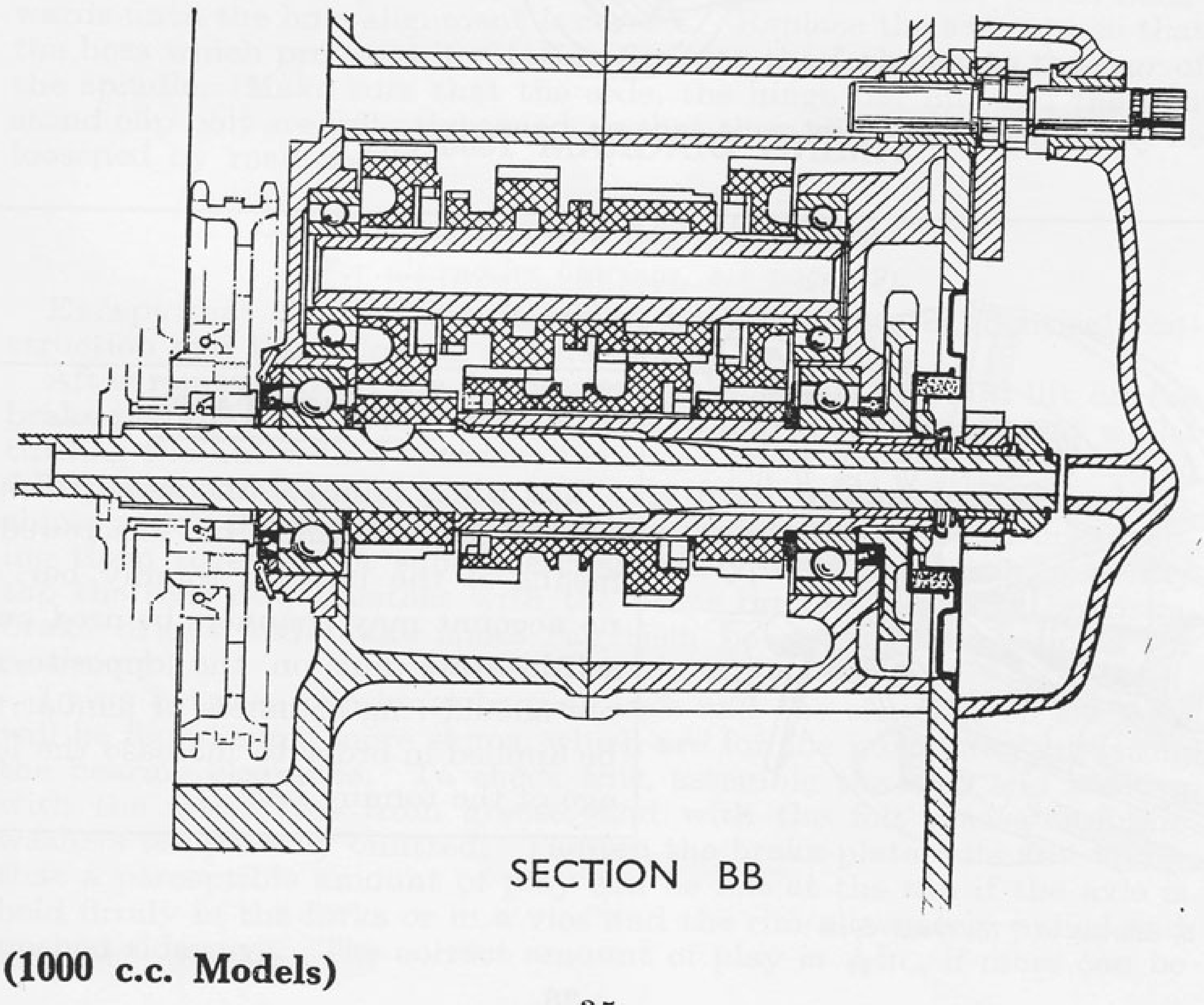




SECTION AA

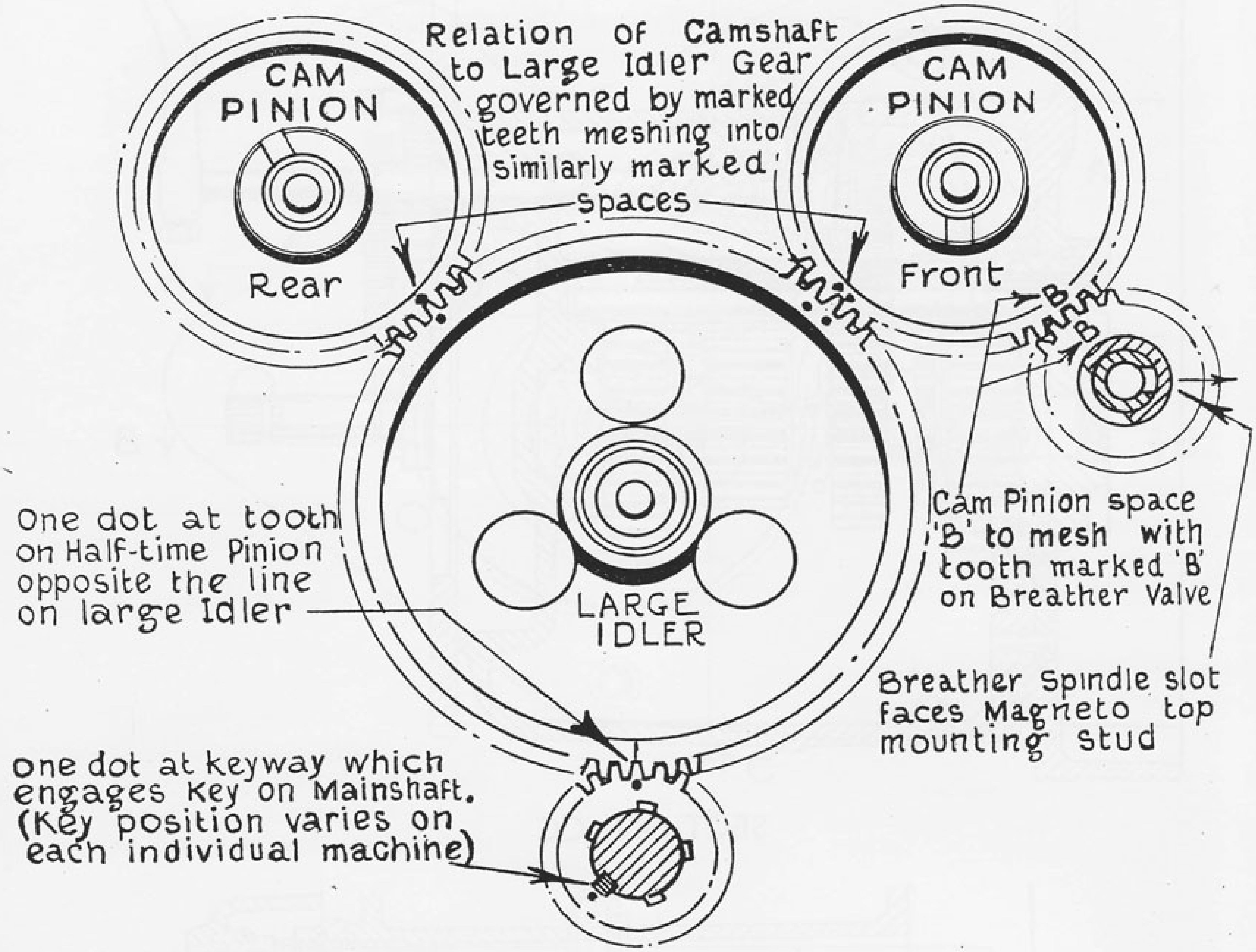


SECTION CC

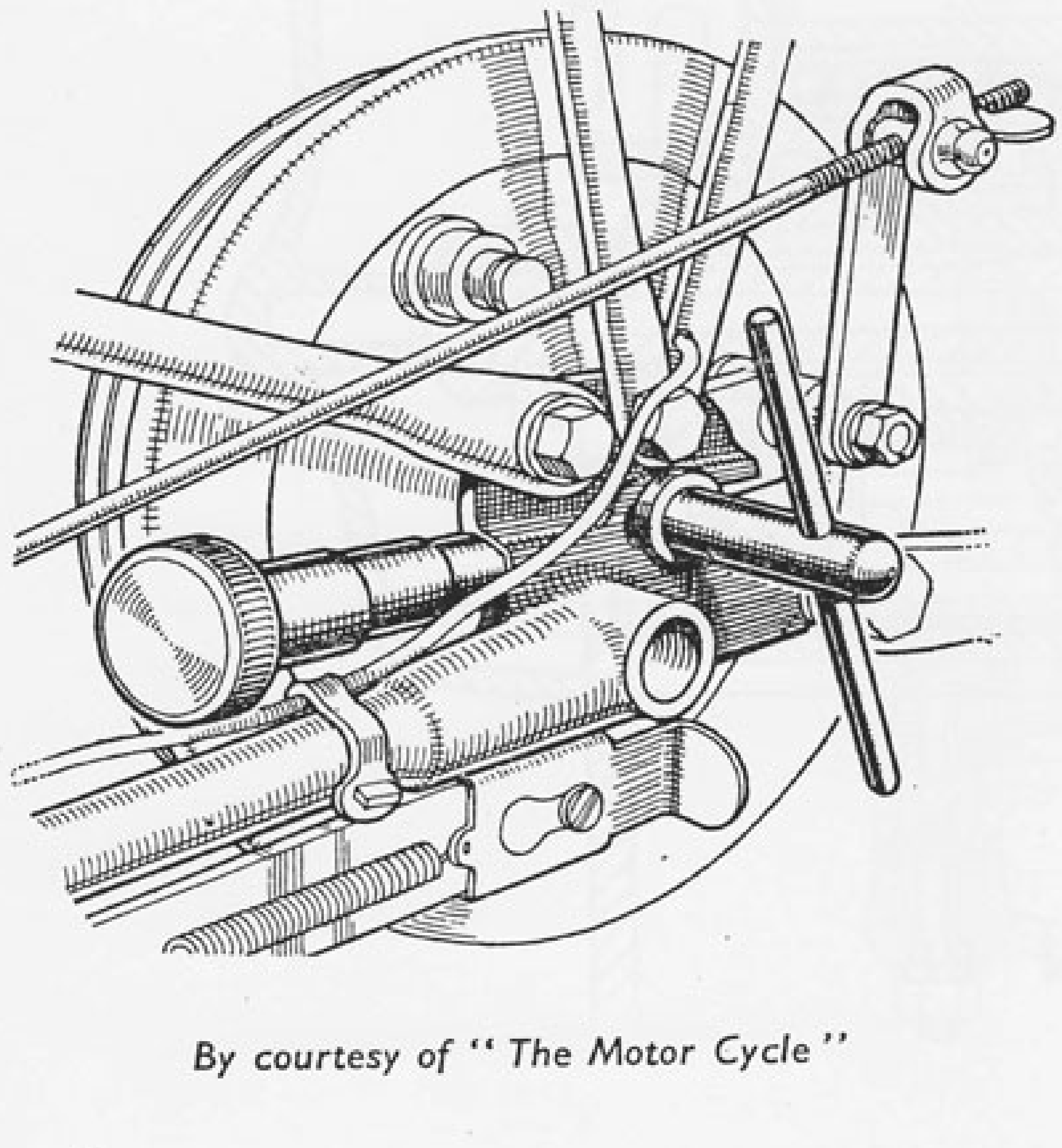


SECTION BB

BOX (1000 c.c. Models)



TIMING DIAGRAM 1000 c.c.



By courtesy of "The Motor Cycle"

IMPORTANT

For wheel removal, the axle, which has a R.H. thread, must be unscrewed by means of the integral tommy bar. On no account may spanners be used on the self-locating nut on the opposite side, nor should ring spanners or similar tools be applied in order to increase the leverage of the tommy bar.

Rear Wheel.—Place machine on rear stand, loosen bar nut on mudguard hinge, swing mudguard flap up and re-tighten bar nut. Slacken axle two or three turns and remove nut on R.H. side, leaving axle in place. Pull back the anchor clips on brake torque arms lying below the axle and close to the rear stand legs, at the same time exerting an outward force. When the clips have moved back ½in. the torque arms will lift sideways off the pins on the brake plates, and can then be swung downwards out of the way. With the torque arms removed the brake plates can be rotated forwards, allowing the cam arms to slide up the brake rods until the wing nuts are disengaged. The slotted motion blocks can now be withdrawn from the cam arms and the brake rods will drop clear and can be hooked up out of the way. (Notice that there is no necessity to alter the wing nut position and consequently the brake adjustment can remain unaffected.) The wheel can now be supported with one hand and the axle withdrawn. This allows the wheel to be pushed forward in the forks to provide sufficient slackness in the chain for this to be lifted off the sprocket, working from the lower run of the chain round the back towards the top. The wheel can then be taken out backwards.

To replace, reverse the above procedure, taking note that the torque arm anchor clips are engaging the grooves in the brake plate pins correctly. These are somewhat masked by the rear stand legs, but the point can be verified after the stand has been moved out of the way. Owing to the action of the brake shoe pull-off springs, the brake plates have a tendency to rotate forwards so that the pins do not line up with the torque arm holes ; this is overcome by pressing downwards on the cam arm bearing bosses, which will rotate the brake plates backwards until the hole alignment is correct. Replace the axle nut so that the boss which prevents it rotating fits into the fork slot to the *rear* of the spindle. Make sure that the axle, the hinge bar nut and the rear stand clip bolt are fully tightened, so that they will not subsequently be loosened by road shocks.

Dismantling and Adjusting Hubs

(*For alternative bearings, see page 39*).

Except that the rear one is wider, both hubs are of identical construction and the following remarks apply to both.

After removal from the frame, remove one axle nut and lift off the brake-plate. (Note.—By holding the cam-arm with one hand whilst turning the nut with a spanner, the brake shoes will be applied and so will prevent the brake plate and axle from turning.) Remove any shims which there may be between the brake-plate and bearing, keeping them together for subsequent assembly, and then push or gently tap the axle out, together with the other brake-plate. The bearings, brake drums and brake shoes can then be cleaned in readiness for re-assembly.

Lying between one inner bearing race and one shoulder on the axle will be found some more shims, which are for the purpose of adjusting the bearing clearance. To check this, assemble the axle and bearing with the latter free from grease, and with the felt grease-retaining washers temporarily omitted. Tighten the brake-plate nuts and verify that a perceptible amount of play can be felt at the rim if the axle is held firmly in the forks or in a vice and the rim alternately pulled and pushed sideways. The correct amount of play is $\frac{1}{32}$in., if more can be felt, shims must be removed from behind the inner bearings. The shims are of varying thickness to enable a fine adjustment to be made. If new parts are being fitted, there is a possibility that no play will be felt ; in that event, shims must be added, as the roller bearings will rapidly fail if run with insufficient clearance.

When the adjustment is correct, dismantle the hub and pack each bearing with high-melting point grease, and replace the felt washers if the old ones appear to have been allowing grease to leak past.

The purpose of the shims between the bearings and brake plates is to adjust the clearance between the edges of the plates and the chamfer in the drums, and their thickness should be such that the wheel rotates freely, but with the minimum possible clearance between plates and drum. Attention to this point by experimenting with shim thicknesses will ensure that water and dirt are excluded from the brake.

Under normal circumstances the rate of wear in the hub bearings is low, and provided the play at the rim does not exceed $\frac{1}{32}$ in., it is best to replace all shims in the same order as they were before. If for any reason new bearings have to be fitted, it is likely that the thickness of shims fitted will need to be altered considerably. It is essential that the axle-nuts stand slightly proud of the ends of the hollow axle, so that they are finally locked when the solid axle is tightened. If necessary, shims can be placed between nuts and plates to ensure this.

Reversing the Rear Wheel

If two sprockets are fitted to provide alternative top gear ratios the procedure for bringing the second sprocket into action is :—

If the second sprocket is more than two teeth larger than the first, locate the connecting link of the rear chain and turn wheel so that this link is somewhere on the rear half of the sprocket. In this position the spring clip can be prized off with a screwdriver or pair of pliers, the outer plate lifted off and the remainder of the link pushed out, thus disconnecting the chain. The wheel is now removed in the normal manner, reversed and put back into place and the brake torque arms refitted, leaving the brake rods disconnected because the cam arms will now be pointing downwards instead of upwards owing to the reversal of the wheel.

It may be necessary to insert a section of chain of the necessary short length, using another spring link for the purpose, and also to readjust the position of the axle. With a combination of 46- and 56-tooth sprockets a section of chain containing six rollers, plus the extra spring link, almost exactly makes up the difference when the chain is new and only minor adjustment is necessary, but for other sprocket combinations and partly-worn chains, the extra length required needs to be found individually. The simplest way is to screw the chain adjuster back until the axle reaches the end of the slots, fit the chain and note the smallest gap which can be obtained between the two ends with an *even* number of tooth spaces unoccupied. Select a piece of chain with an equivalent number of rollers and insert both connecting links, with the usual precaution that the closed ends of the spring clips point towards the direction of motion. The chain can then be adjusted for tension and the wheel correctly lined up.

To couple up the brakes, loosen both cam arm nuts and swing the arms upwards into positions such that when the brakes are on the wing nuts are about midway along the rod threads. Insert the rods and slotted motion blocks and adjust each brake individually as described in Rear Brake Adjustment.

Once the necessary extra chain length has been determined the whole operation can be conducted in under ten minutes, which enables changes of ratio to be made *en route* to suit road conditions, as in long-distance trials or when entering mountainous country.

Lining-Up the Wheels

Should the machine show a tendency to steer to one side or the other when ridden " hands off," the rear wheel is not in correct alignment, probably because the chain adjusters have not been moved equally or because the axle is not hard up against the adjuster screws. To verify the alignment, set the front wheel dead straight by glancing along each side of the tyre. As the front tyre is narrower than the rear, a little of the rear tyre should be visible on both sides of the front tyre when the latter is set centrally. Attach a piece of stout cord to one spoke on the rear wheel, pass it round the rear of the tyre and under the power unit out past the front wheel. Pull the string taut and move the free end so that it just touches the leading edge of the rear tyre. Alternatively, a 6ft. length of wood or steel with one straight edge can be used in place of the string. With the standard equipment of 3·5in. rear and 3·0in. front tyres there should be a gap of ¼in. present between the string or straight edge and both edges of the front tyre when the string or straight edge is just touching the rear tyre. If not, set the rear wheel over with the adjusters to the side required, and finally check on both sides of the wheels to ensure that no error has crept in through small irregularities in the tyre widths or the wheels not running dead true.

Adjustment of Gear-change Mechanism 1000 c.c. Models

Access to mechanism is gained as follows :
Remove exhaust pipes and silencer, slacken R.H. footrest hanger nut, disconnect gear-change linkage from pedal and swing footrest away.
Remove gear indicator lever, gear-change lever, kick-start crank, and main oil feed pipe.
Remove inspection cap and disconnect clutch cable from inner lever.
After removal of set screws and nuts the kick-start cover may now be removed exposing the mechanism illustrated.

Alternative Wheel Bearings—All Models.

Machines with frame number suffix "A," "B" or "C" (*e.g.* RC9230C) are fitted with Metric taper roller bearings in the front wheel only, the rear wheel only, or in both wheels respectively. The method of adjusting these bearings is identical to the procedure described on page 37.

Frame number suffix "D" and "E" denotes the use of a ball bearing in conjunction with a roller bearing, "D" indicating retention by circlip, and "E" retention by screwed and split-pinned lock ring. Hubs of this type are not adjustable and the procedure described for the taper roller variety does not apply, although the brake plates are shimmed in the same manner.

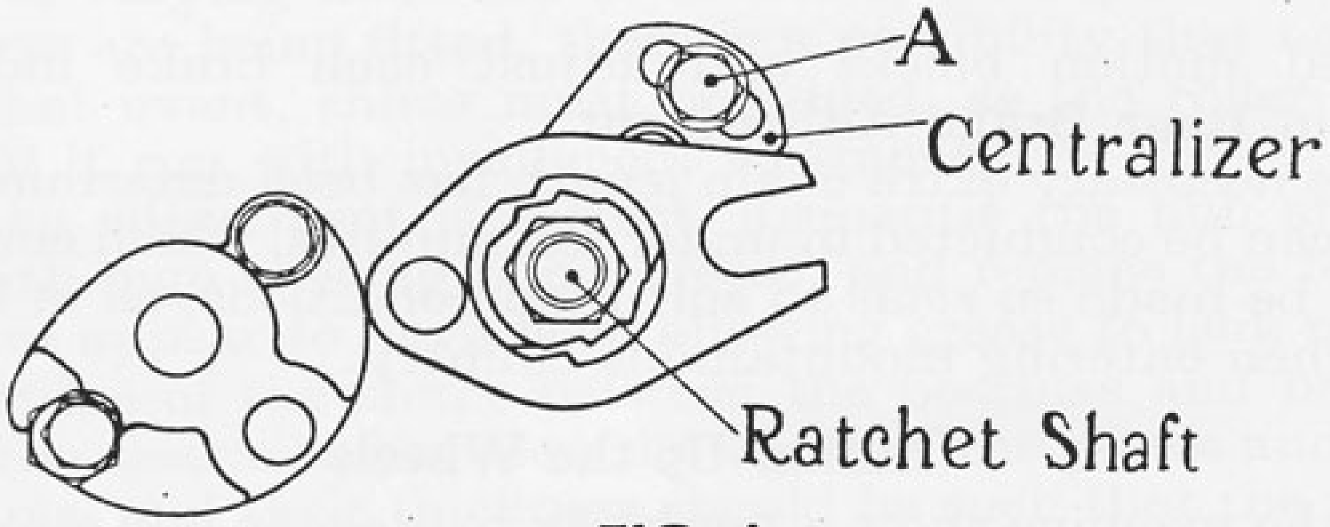


FIG. 1

Stage 1: Engage ratchet shaft in 2nd gear (Fig. 1).

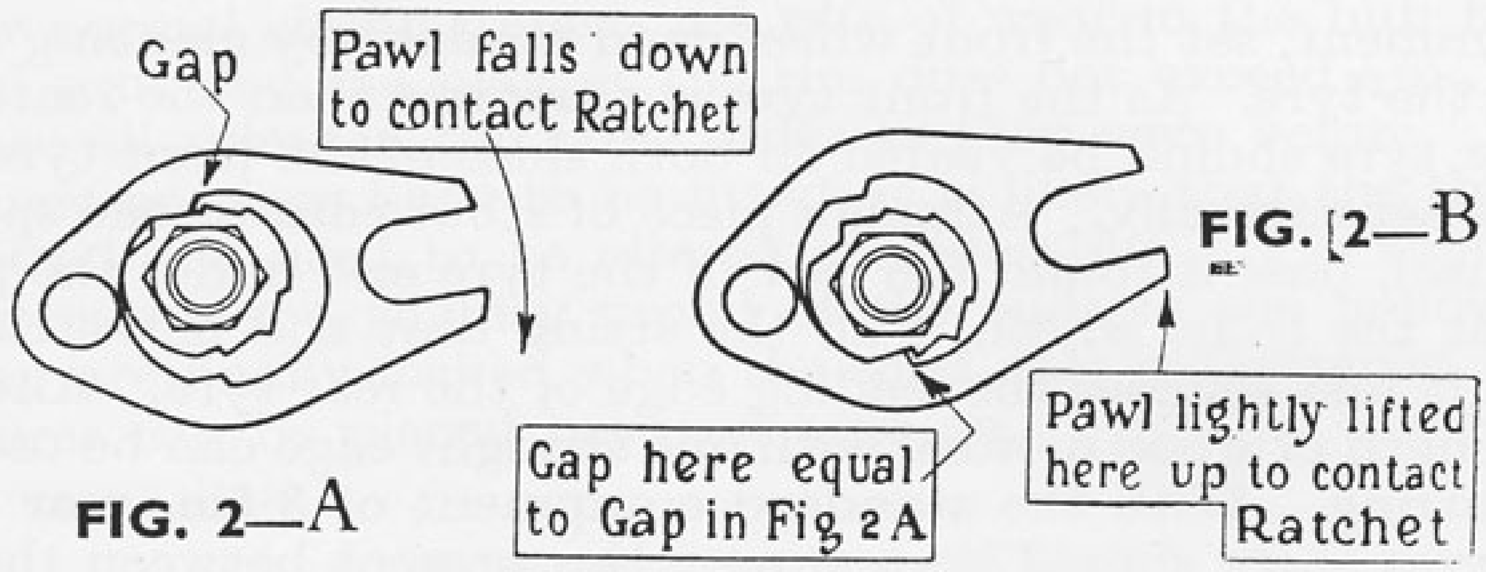


FIG. 2—A **FIG. 2—B**

Stage 2: Adjust centraliser so that pawl engages ratchet equally in up and down positions (Fig. 2) and tighten screw A when this condition is obtained.

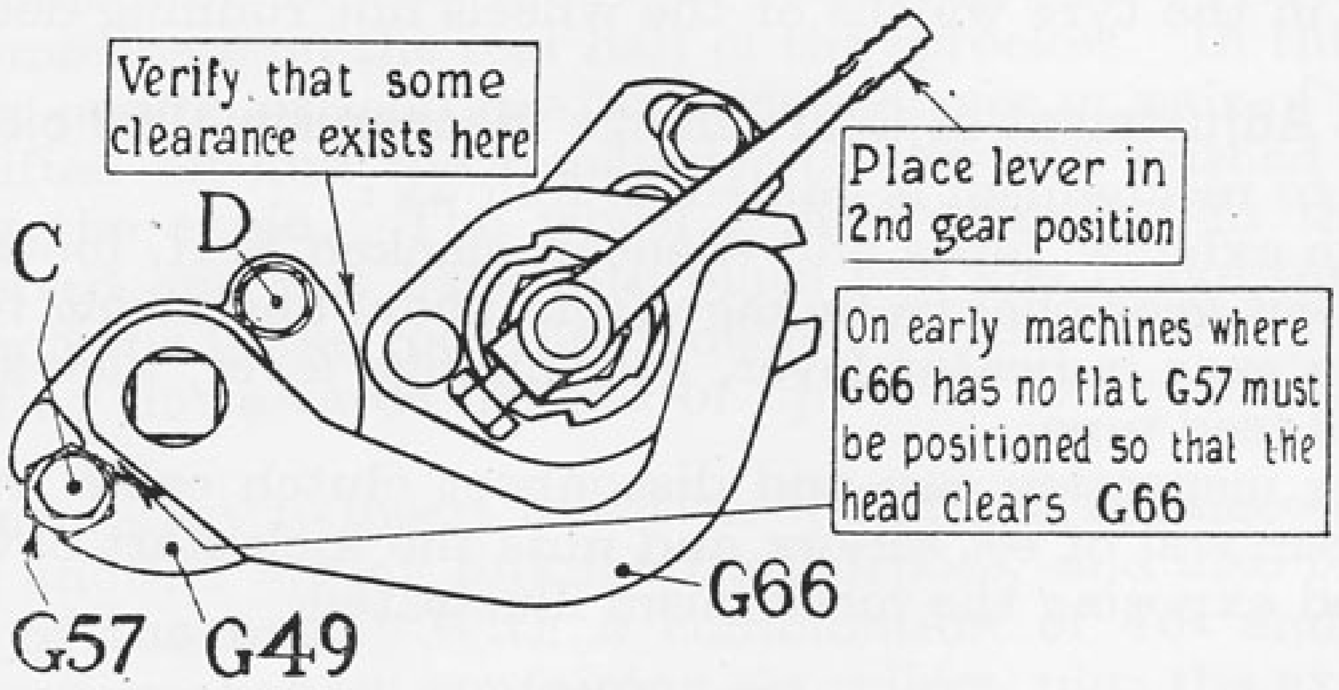
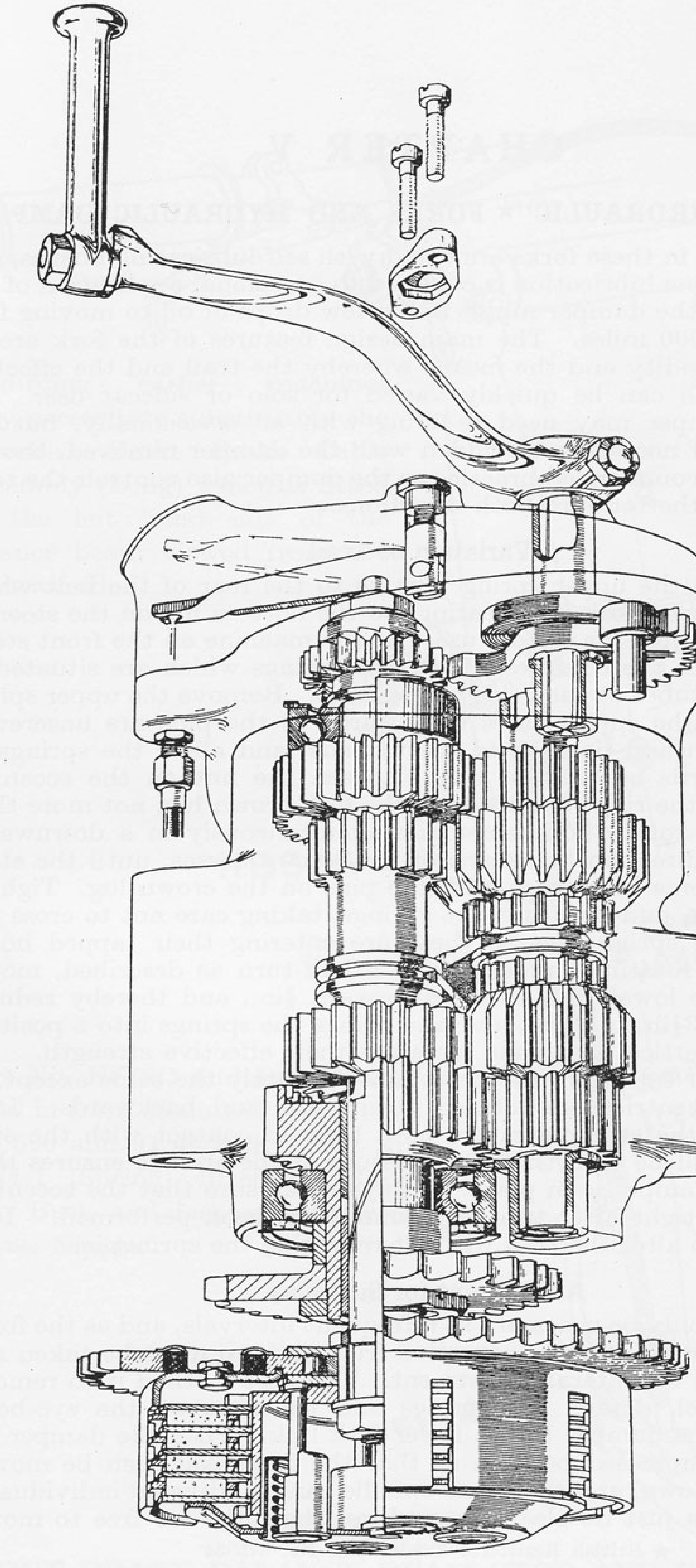


FIG. 3

Stage 3: Adjust position of lever stop G49 by loosening D and C and then turning eccentric adjuster G57 so that when actuating arm is moved by its squared boss upwards to full extent bottom gear is correctly engaged and when downwards, 3rd gear. Tighten screws C and D.

Stage 4: Check for gear-change. In all ratios ratchet shaft must be firmly notched in position after actuating arm has been slowly moved to its full extent. The indicator lever is used to check this condition. It may be necessary to re-position G49 slightly to obtain correct engagement in all gears.

CORRECT SEQUENCE FOR ADJUSTING GEAR-CHANGE MECHANISM. 1000 c.c. MODELS.



THE BURMAN GEAR BOX. 500 c.c. MODELS

CHAPTER V

VINCENT "GIRDRAULIC"★ FORKS AND HYDRAULIC DAMPERS

All bearings in these forks are fitted with self-lubricating bushes, and therefore routine lubrication is confined to occasional application of the grease-gun to the damper nipple and a few drops of oil to moving fork parts every 3000 miles. The main design features of the fork are its exceptional rigidity and the means whereby the trail and the effective spring strength can be quickly varied for solo or sidecar use. The hydraulic damper may need re-filling with oil occasionally, but the machine can if necessary be ridden with the damper removed, though this is not a recommended practice as the damper also controls the total movement of the forks in both directions.

Variation of Trail

For solo use the upper spring pins lie to the rear of the bolt which attaches the lower fork link bearings to the bottom lug on the steering column. To adjust for sidecar use, put the machine on the front stand to take some of the compression off the springs which are situated in the telescopic tubes at each side of the forks. Remove the upper spring pins, levering the spring cases downwards as the pins are unscrewed to avoid strain and damage to the threads, and allow the springs to swing backwards out of the way. Loosen the nut on the eccentric sleeve bolt on the right-hand side of the fork crown lug, not more than one turn, and rotate both eccentrics simultaneously in a downwards and forwards direction by means of the square bosses, until the stop-plates again come in contact with the pins on the crown lug. Tighten the spindle nut, and re-attach the springs, taking care not to cross the threads of the spring pins as these are entering their tapped holes. The action of rotating the eccentrics a half-turn as described, moves the axis of the lower link bearings forward $\frac{3}{8}$in., and thereby reduces the trail from $3\frac{1}{4}$in. to $2\frac{1}{2}$in., and also brings the springs into a position more nearly vertical and thus increases their effective strength.

To adjust for solo trail, the procedure is exactly the same except, of course, the eccentrics are rotated downwards and backwards. It is essential that the stop-plates are both hard in contact with the stop pins, and it will be seen that the pressure of the springs ensures this, provided the damper is in place. Always make sure that the eccentric spindle nut is tight after trail adjustment has been performed. It is also possible to alter the trail without removing the springpins.

Adjustment for Side-play

This should only be necessary at infrequent intervals, and as the fork-action is rather sensitive to excessive friction, care must be taken not to over-tighten the lateral adjustment. The best method is to remove the front wheel, detach the springs and the nuts on the eye-bolts which retain the damper to the lower fork link. Push the damper up to its fully compressed position so that the forks can then be moved freely up and down, and then each spindle can be adjusted individually so that there is just no clearance and yet the forks are free to move.

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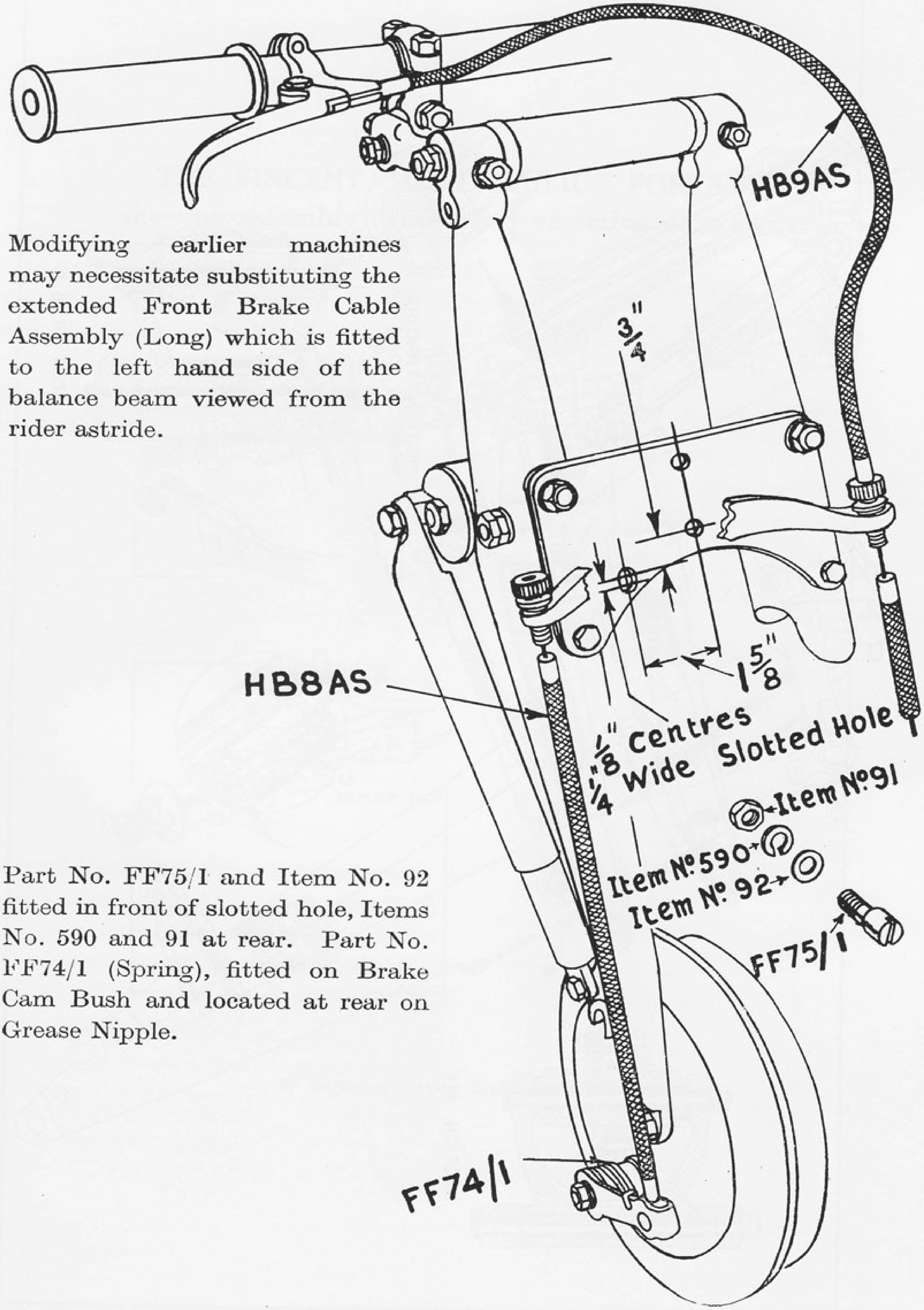
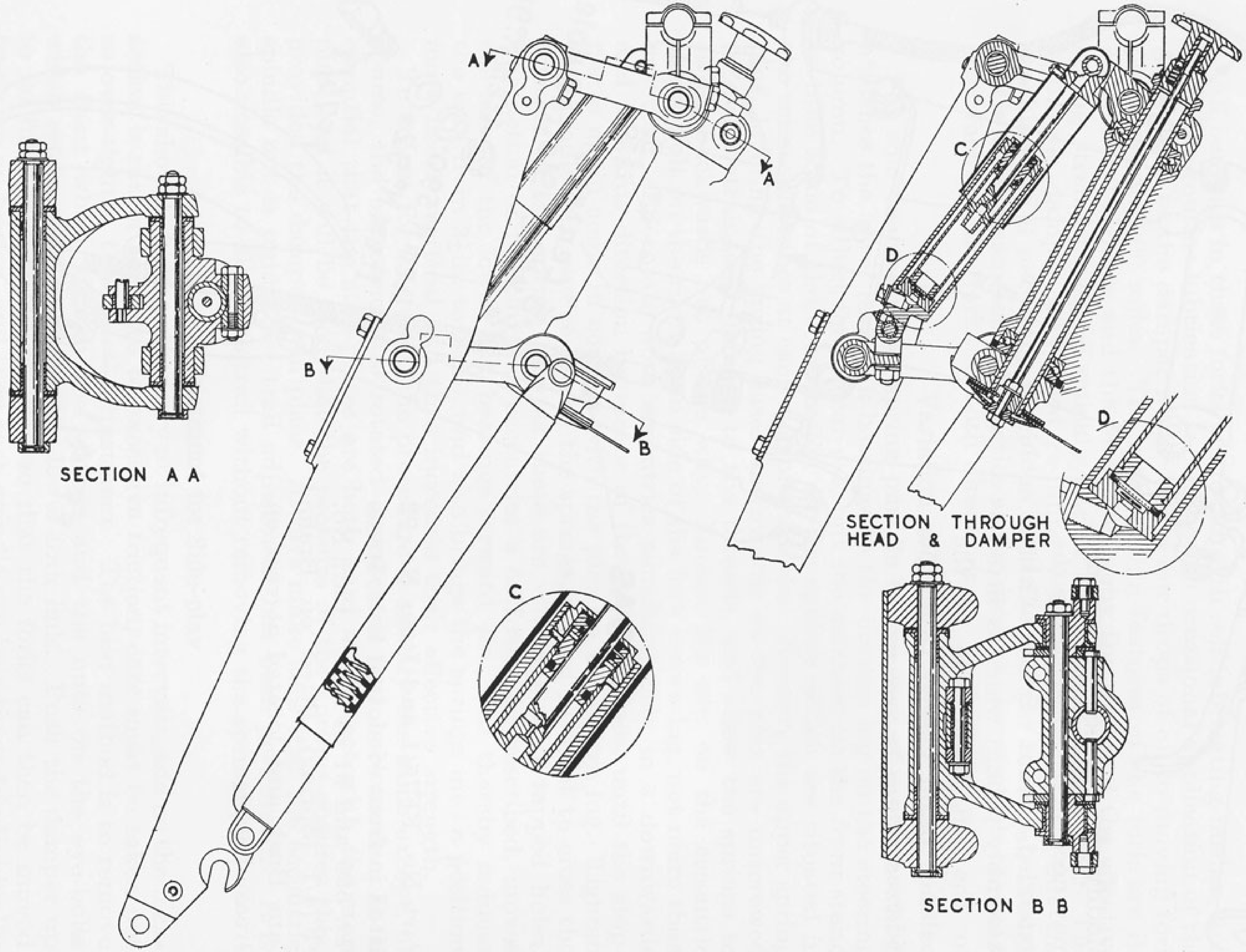


Modifying earlier machines may necessitate substituting the extended Front Brake Cable Assembly (Long) which is fitted to the left hand side of the balance beam viewed from the rider astride.

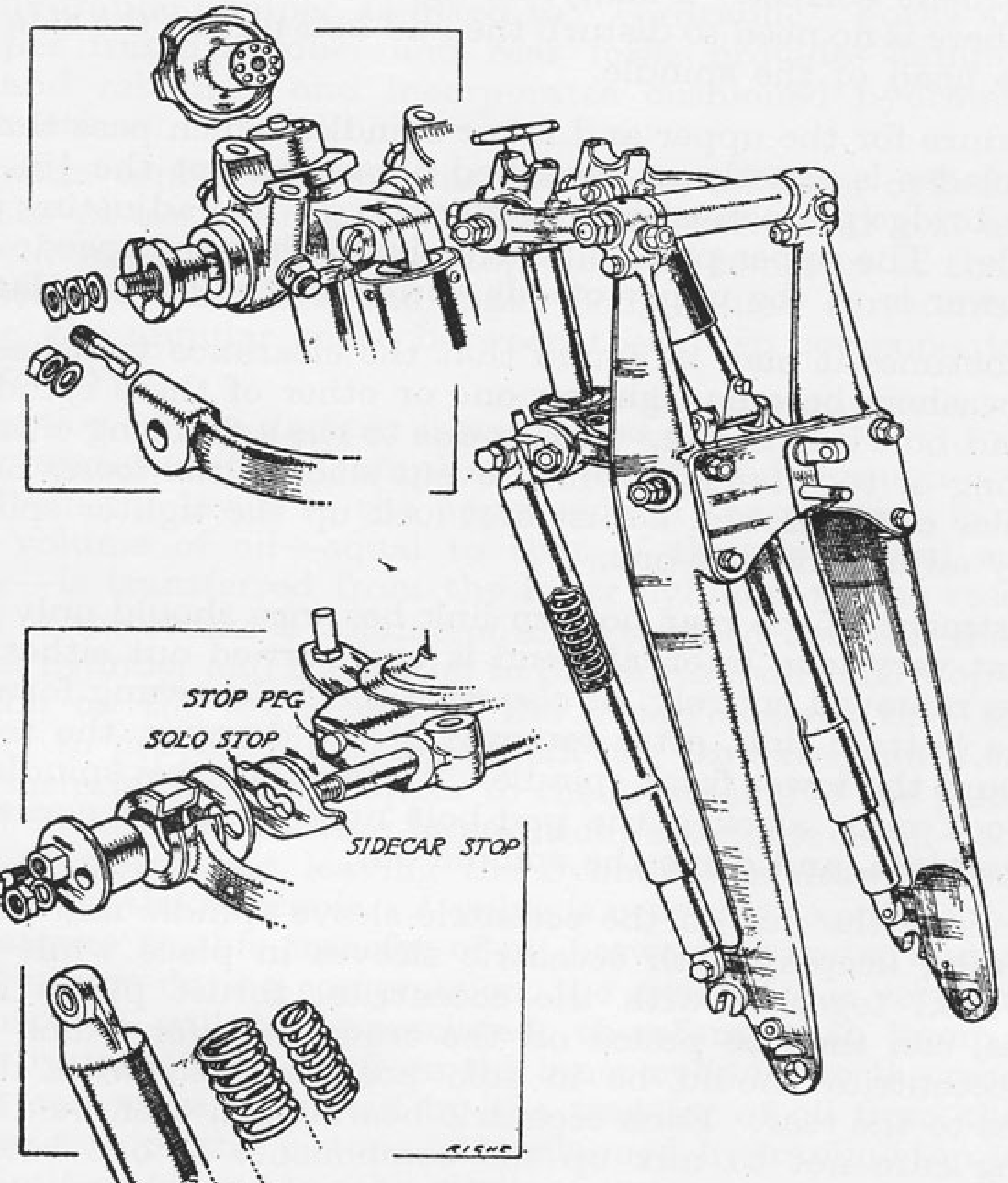
Part No. FF75/1 and Item No. 92 fitted in front of slotted hole, Items No. 590 and 91 at rear. Part No. FF74/1 (Spring), fitted on Brake Cam Bush and located at rear on Grease Nipple.

FRONT BRAKE BALANCE BEAM STOP AND RETURN SPRING



THE VINCENT "GIRDRAULIC" FORKS

THE VINCENT "GIRDRAULIC" FORKS
showing assembly details and variation of trail



By courtesy of "Motor Cycling"

In this condition, the cadmium-plated dust-washers lying between the links and the fork-blades and the top clip lug should be just free to turn with the fingers.

Adjustment, however, can be performed without removing any components as described, and in either case the operation is as follows :

(1) Slacken the $\frac{3}{8}$in. nut on pad-bolt at rear of top fork link on side adjacent to spindle lock nuts. Unlock nuts, and screw inwards until clearance is correct. Lock nuts together, and if clearance is still correct, re-tighten pad-bolt nut. The action of locking the nuts sometimes causes the clearance to close up and so cause friction, hence one or two attempts may be necessary to get the adjustment correct. Finally, re-tighten the pad-bolt nut. Note that there is no need to disturb the pad-bolt nut on the side adjacent to the head of the spindle.

(2) Procedure for the upper and lower spindles which pass through the fork blades is exactly as described above, except the $\frac{1}{4}$in. setscrew in the bridge plate must also be slackened when adjusting the lower spindle. The upper pad-bolt nut is just below the speedo. bracket, the lower is at the upper offside corner of the bridge-plate.

Sometimes it may be found that the clearance vanishes and the dust-washers become tight on one or other of these spindles when the pad-bolt is loosened. This is due to the axle being either a little too long or too short, in which event slacken the *looser* of the two spindles considerably, adjust and lock up the tighter spindle, and finally adjust the first one.

(3) Adjustment of the rear bottom link bearings should only be necessary at very long intervals, and is best carried out either with the blades removed entirely, or else with the forks swung forward clear of the bottom link, after removal of the damper, the top spring-pins and the lower front spindle. To take out this spindle, remove the lock nuts, slacken the pad-bolt nuts at upper corners of the bridge plate, and drive the spindle out.

Remove the nut on the eccentric sleeve spindle and push it out carefully, keeping both eccentric sleeves in place while so doing. The link, together with the eccentrics, thrust plates and stop-plates, can then be pulled off the crown lug, for which operation the eccentrics should be in solo position, *i.e.*, with the square bosses to the rear. Each eccentric bearing can then be dismantled, taking care not to mix up the components of one bearing with those from the other. Shims will be found lying between the inner face of the eccentrics and thrust plates, and also between the thrust plates and the stop-plates, although in some cases no shims will be fitted in the latter position. Adjust each bearing individually by reducing the thickness of shims between eccentric and thrust plate until the side clearance, when these components are held tightly together, is between ·002in. and ·004in. at the tightest point.

Then fit both stop-plates, slip the link assembly on to the column lug and measure with feelers the clearance between the stop-plates and the lug faces. Fit shims equal to half this clearance on each side of the lug in order to keep the link central, then push the spindle through and tighten the nut. The link should then be free enough to fall by its own weight, without any perceptible amount of side-play, but if the link is stiff, or alternatively still has side-play, the job must be done again.

Some difficulty may be met when pushing the spindle through, as the shims tend to fall out of position and foul either the thread or the shoulder of the spindle. The operation is made easier by using a "nose"-tapped $\frac{7}{16}$in. B.S.F. to fit the spindle, and with a bullet-shaped form over which the shims can slide easily.

Hydraulic Dampers

The hydraulic damper as fitted to "Girdraulic" Forks and between the upper frame number and rear forks provides damping both on bump and rebound, and incorporates cushioned hydraulic stops in both directions.

The main components of this device are an inner cylinder in which works the piston, the valve housing with valve and grid at the lower end of the inner cylinder, the stop and seal housings at the top end of the inner cylinder, and the main body which surrounds the inner cylinder, the annular space between these two components providing an oil reservoir.

The action of the damper is as follows :—

On compression (*i.e.*, bump) oil is transferred through a port in the piston from the lower to the upper side of the piston ; in addition to this, a volume of oil—equal to that of the piston rod entering the cylinder—is transferred from the inner cylinder to the reservoir. At the end of the stroke a volume of oil is trapped between the bottom of the inner cylinder and the piston to provide a hydraulic stop—a tapered projection on the lower side of the piston ensures that this is done gradually to provide a cushioning effect. On extension (*i.e.*, rebound) oil is transferred from the upper to the lower side of the piston through the port mentioned above ; in addition, a volume of oil—equal to the volume of piston rod leaving the cylinder—is drawn into the inner cylinder from the reservoir. A valve is provided to ensure that whereas the resistance to this transfer of oil between cylinder and reservoir is relatively large during compression, the resistance is very small during extension. It will be appreciated, therefore, that bump control is effected by transfer of oil from the inner cylinder to the reservoir, and rebound control is regulated by the transfer of oil from the upper to the lower side of the piston. A cushioned hydraulic stop is provided at the limit of extension in a similar manner to the compression stop.

Sealing of the piston rod is effected by two round section rubber seals ("O" rings) with a "bleed off" return to the reservoir between them. In service the only attention the damper should require is a very occasional refilling. The rate of fluid loss from the damper is very slow ; the amount lost being the small quantity which is allowed to remain on the rod by the seals in the form of a fine film for lubrication purposes. Topping up every 2000 miles is however recommended.

Owing to the relatively large reservoir capacity the damper will continue to function efficiently even after the escape of a considerable amount of fluid. If the leakage takes place at an excessive rate it is advisable to dismantle the damper for examination.

Filling of Hydraulic Dampers

The method adopted at the works is as follows :—

(I) The shroud is removed by undoing three 4BA fixing screws, and the filler plug with special Dowty sealing washer is taken out.

(II) The damper is inverted (*i.e.*, with filler hole uppermost) and submerged in oil (see page 3).

(III) The damper is compressed and extended *slowly* to its full extent (while still submerged) about a couple of dozen times. It is important that this is done slowly to avoid aeration of the oil.

(IV) Still in the inverted position, and *fully extended,* the damper is withdrawn from the oil and suspended for about two hours to allow any entrapped air to escape.

(V) The damper is slowly compressed to nearly its full extent, and the filler plug with seal is screwed in *loosely*.

(VI) The damper is then fully compressed until the eye end contacts the surface of the end plug, and while in this position the filler plug is fully tightened.

(VII) The damper is then wiped off with a clean cloth and placed in a testing rig which oscillates rapidly and the damper is then checked for any fluid leak.

(VIII) The shroud is replaced.

It is appreciated that (II), (III) and (VII) may be impracticable for the private owner, and the filling may be done (rather more slowly) as below :—

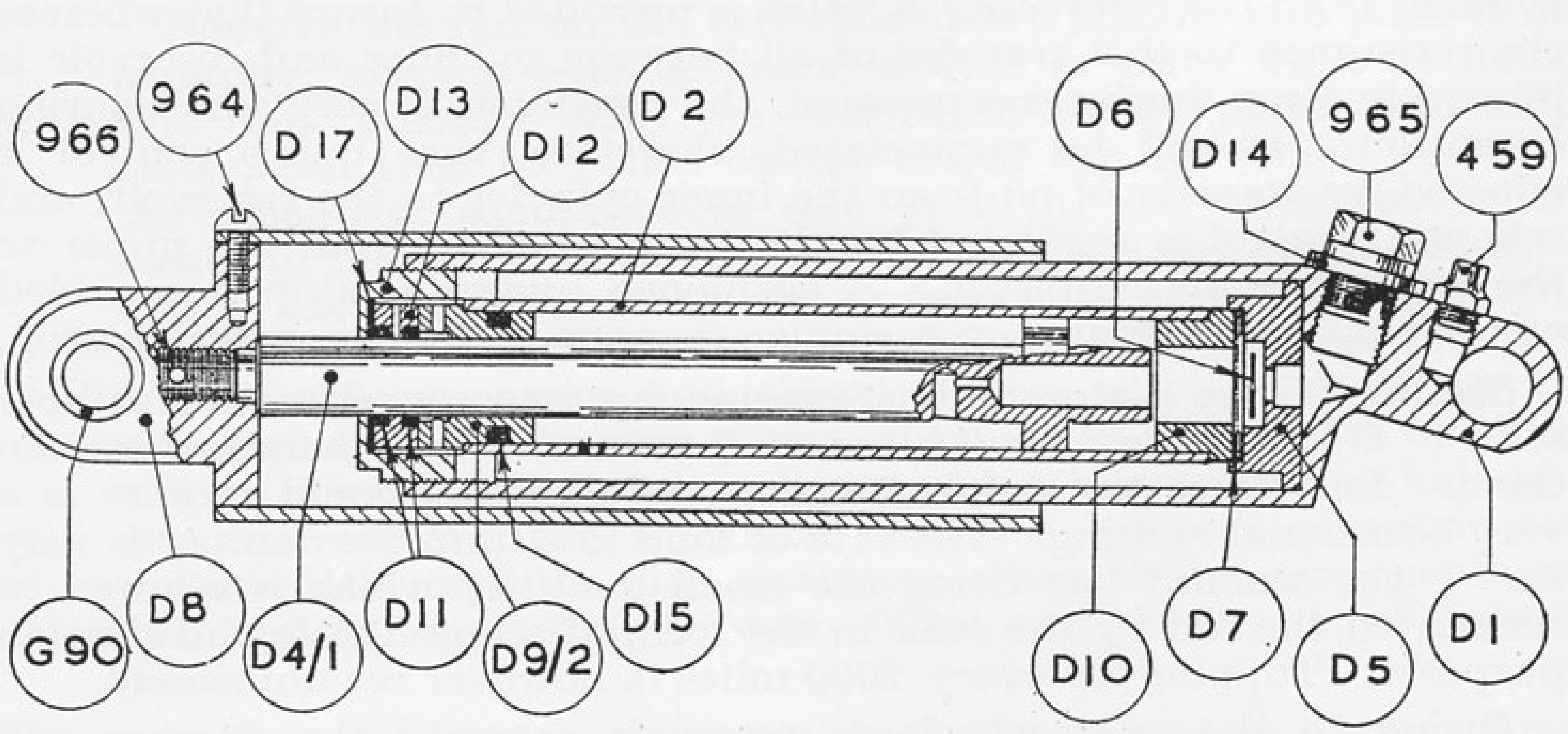
(*a*) Remove shroud and filler plug.

(*b*) Stand damper at about 15 degrees to the vertical, *fully extended,* with the filling hole uppermost.

(*c*) Slowly fill with oil, drop by drop, until obviously full.

(*d*) Suspend for about two hours to allow any air to escape.

(*e*) Perform operations (V), (VI), (VII) and (VIII) of works procedure —operation (VII) may be substituted by working up and down as rapidly as possible by hand.



THE HYDRAULIC DAMPER

CHAPTER VI

ELECTRICAL EQUIPMENT—IGNITION SYSTEM

Sparking Plugs

All models are fitted with sparking plugs as indicated by type numbers in the data sheet, page 2. Alternative grades of Champion, K.L.G. and Lodge manufacture are also shown. These are all 14mm. long-reach patterns, and on no account should short-reach plugs be used, except as a temporary measure. If used for any length of time, the inner threads which are then exposed become carboned-up and the next time a long-reach plug is fitted there is a danger that the threads may seize.

The Champion plug is non-detachable, and if after much running the insulator becomes fouled, it can only be cleaned properly by shot-blasting, which can be done at any reputable service station. The points should be set to 0·018in. to 0·020in. gap by bending the *earth* electrode, *i.e.*, the one attached to the plug body.

K.L.G. and Lodge detachable plugs can be taken apart for cleaning and the gaps must be reset to 0·018in. after the plug has been re-assembled. Both these makes are now fitted with ceramic insulators, and on no account must the central electrode be bent in when setting the gap, as this would almost certainly crack the insulation.

The plugs mentioned are satisfactory for running-in and touring at moderate speed, but for conditions where cruising speeds of over 80 m.p.h. are indulged in the " harder " grades specified on page 2 are advisable.

Ignition

This is by means of a " Lucas " magneto, fitted with an automatic timing device which adjusts the amount of ignition advance according to the speed of the engine, thus relieving the rider of the necessity for operating an ignition lever. Except that 500 c.c. models are fitted with a single-cylinder magneto, all the following instructions apply equally to all models. The magneto is able to run for long periods without attention, but it is wise to check the condition of the breaker points and high-tension pick-up brushes occasionally. To do so, the magneto cowl must first be taken off by removing the ¼in. set-screw in upper near corner and slackening the nuts in both lower front corners; the cowl can then be slipped off.

Contact Breaker

Push spring clip over the bakelite contact breaker cover to one side, lift off cover and the breaker is exposed. Turn engine until the heel of the breaker arm is resting on one of the two lobes of the cam ring, and check the opening of the points with the 0·012in. feeler gauge attached to the magneto spanner. (NOTE.—Wipe this gauge before using to ensure that the points are not contaminated with oil.) The gauge blade should just enter freely; if the gap is incorrect, slacken locknut of the adjustable point and screw adjustment in or out by the appropriate amount until the gap is correct. Now turn the engine until the breaker arm heel rests on the other cam lobe, and again check the gap. This should be the same as before, but if a slight difference is found readjust the points to give an average gap equal to the gauge, *i.e.*, the gap corresponding to one cylinder will be slightly more than 0·012in., the other will be slightly less. Finally, tighten locknut and re-check to see that the gap has not altered.

Cleaning Breaker Points

If engine misfires or runs erratically, and no other cause can be found, the points may be dirty. To clean, unscrew the bolt in centre of contact breaker until it is clear of the internal thread, then grasp the head of the bolt and rotate it with a conical motion so that it bears against the side of the hole. This will have the effect of loosening the breaker on its taper, and the latter can then be lifted out. Swing back the spring leaf which retains the contact breaker arm and wriggle the latter off its pin, taking care not to overstress the control spring, and the points are then exposed. Their surfaces should present a smooth matt-grey appearance with the actual contact between them occurring at their centres, which is ensured when new by making the surfaces slightly domed. If the surfaces are rough or blackened, dress them with a carborundum slip in such a way that when reassembled they contact each other squarely and not towards one side. Clean the points thoroughly with petrol and then, before reassembling, add a few drops of thin machine oil to the wick contained in the small hole in the contact breaker cam and also lightly smear the contact breaker arm pivot with clean engine oil. Finally, reassemble in reverse order to the above, taking great care to see that the small projection or key on the breaker boss registers correctly with the keyway in the shaft, and readjust the gap as described.

The earth brush is fitted in a holder screwed into the magneto body near the drive end and *not* in the usual position in the back of the contact breaker, although a hole is drilled there seemingly for this purpose.

Cleaning H.T. Pick-Up Brushes and Slip Ring

The brush holders are held in by spring clips, above and below the magneto. Push clips to one side and carefully lift out brush holders to avoid damage to the delicate carbon brushes or to the water-excluding washers. There should be no traces of oil present, but there may be a film of carbon dust on the brush holders ; before replacing the holders must be wiped clean with a *dry cloth*. The brushes should be free to move easily in the holders and, if not, removed and cleaned or eased down until free movement is obtained.

New brushes should be fitted when the old ones are worn down below ¼in. in length.

To clean the slip ring, moisten a piece of clean cloth with petrol, push the end through one brush holder hole and hold it lightly against the slip ring with some non-conducting object, such as a thin piece of wood. Rotate the engine several times and continue the process until the cloth comes out clean.

Replace brushes in reverse order to above, making sure that the water-excluding washers are undamaged in the process ; if broken, they should be replaced at the earliest opportunity. The brush holders are prevented from turning by a flat on one side, and care must be taken to see that the holders are properly seated and are not held up by the corners of the flat fouling the magneto body. Before replacing the brush holders the cables should be removed by unscrewing the knurled terminal nuts thereon. For wet conditions plasticine or similar material can be applied to the nuts and cables when they are replaced to exclude water. Be careful not to reverse the leads in the brush holders ; the upper brush holder should be connected to the rear cylinder H.T. wire.

Removing the Magneto

This operation is only necessary in the unlikely event of complete failure to spark. To proceed, remove magneto pinion cover on timing case and loosen the central nut which retains the pinion and automatic timing device. When the nut has been unscrewed two or three turns remove the C washer beneath its head and continue unscrewing until the nut comes tight again. It is then up against an internal shoulder, and further unscrewing has the effect of pulling the complete pinion off its taper. Now remove the long magneto nut adjacent to the contact breaker housing and between it and the crankcase and loosen the remaining two flange nuts several turns. Pull the magneto outwards and these two nuts and washers can be removed and the magneto will then come clear.

NOTE.—On rare occasions the A.T.D. may not come off the shaft taper easily when the extractor nut is operated. If excessive force is applied to the nut in an effort to remove the A.T.D., the threads may be stripped and it will then be almost impossible to complete the removal. In such circumstances slacken the magneto studs back at least three turns and push the magneto back so that the fibre gear wheel of the A.T.D. is in contact with the timing case wall. Then give the extractor nut a hard straight blow with a 1-lb. hammer, which will jar the A.T.D. off the shaft taper. The extractor nut can then be used to withdraw the A.T.D. entirely if required.

To replace, proceed in the reverse order, making sure that the flange washer is intact. When replacing the magneto pinion do not hold it hard up against the taper and then tighten the nut. The correct procedure is to hold the pinion assembly outwards against the underside of the central nut, and move the pinion into place by screwing the nut inwards. Unless this is done, interference between the shaft thread and the extractor thread may occur, and the mechanism will lock up in an incorrect position. Replace the C washer, but do not fully tighten the nut until the magneto is timed.

Timing the Magneto

The following procedure applies equally to single and twin cylinder models ; owners of single cylinder models will automatically ignore the phrases which obviously do not apply to their machines.

This operation is best conducted with the aid of a degree plate attached to the main shaft, but, failing that, can be carried out by measuring the position of the pistons through the plug holes. Remove sparking plugs and turn engine until the rear cylinder (No. 1) is at top dead centre on the compression stroke (*i.e.*, with both valves shut). The position of the piston can be determined by inserting a thin rod through the plug hole and rocking the engine backwards and forwards to determine by " feel " the exact top dead centre position. Now turn the engine backwards through 4 deg. until the piston descends 0·008in., which corresponds to the position at which the spark should occur with the magneto fully retarded. Next insert a piece of clean *thin* paper (cigarette paper or similar) between the contact breaker points so that it is gripped by them, and turn the magneto so that when the heel of the cam is contacting the *lower* of the two lobes of the cam ring the paper is *just* free to slide. Make sure that the A.T.D. is in the fully-retarded position, *i.e.*, with the two bob-weights in their innermost position, and tighten the central nut. When tightening, the A.T.D. will move round into the fully-advanced position, but this will not matter, provided it is moved back again to the fully-retarded position before re-checking. Check the timing by turning the engine backwards, then turn it forwards until the piston is 4 deg. before T.D.C., at which point the paper between the points should just come free. If correct, check the timing on the front cylinder, which should be exactly the same.

When timed at full retard in this manner, ignition should occur 39 deg. before T.D.C., when the magneto is fully advanced. This can be verified by setting the rear piston 39 deg. before T.D.C. (0·5in. measured on stroke) and then turning the central portion of the A.T.D. *clockwise* by hand to its full extent. The breaker points should begin to separate just as the A.T.D. reaches the limit of its travel.

Should any difference be discovered between the timing of the two cylinders, set the magneto to split the difference, with the front cylinder having the lesser amount of advance.

Altering Ignition Timing from Standard Setting

The timing described above is correct for a compression ratio of 6·8 and fuels of 74 octane number, but may with advantage be modified within limits to suit other conditions. Remember that the fully-advanced timing affects the power output, and the full retard affects the slow running and starting. For low-grade fuels use less advance, unless the compression ratio has been lowered.

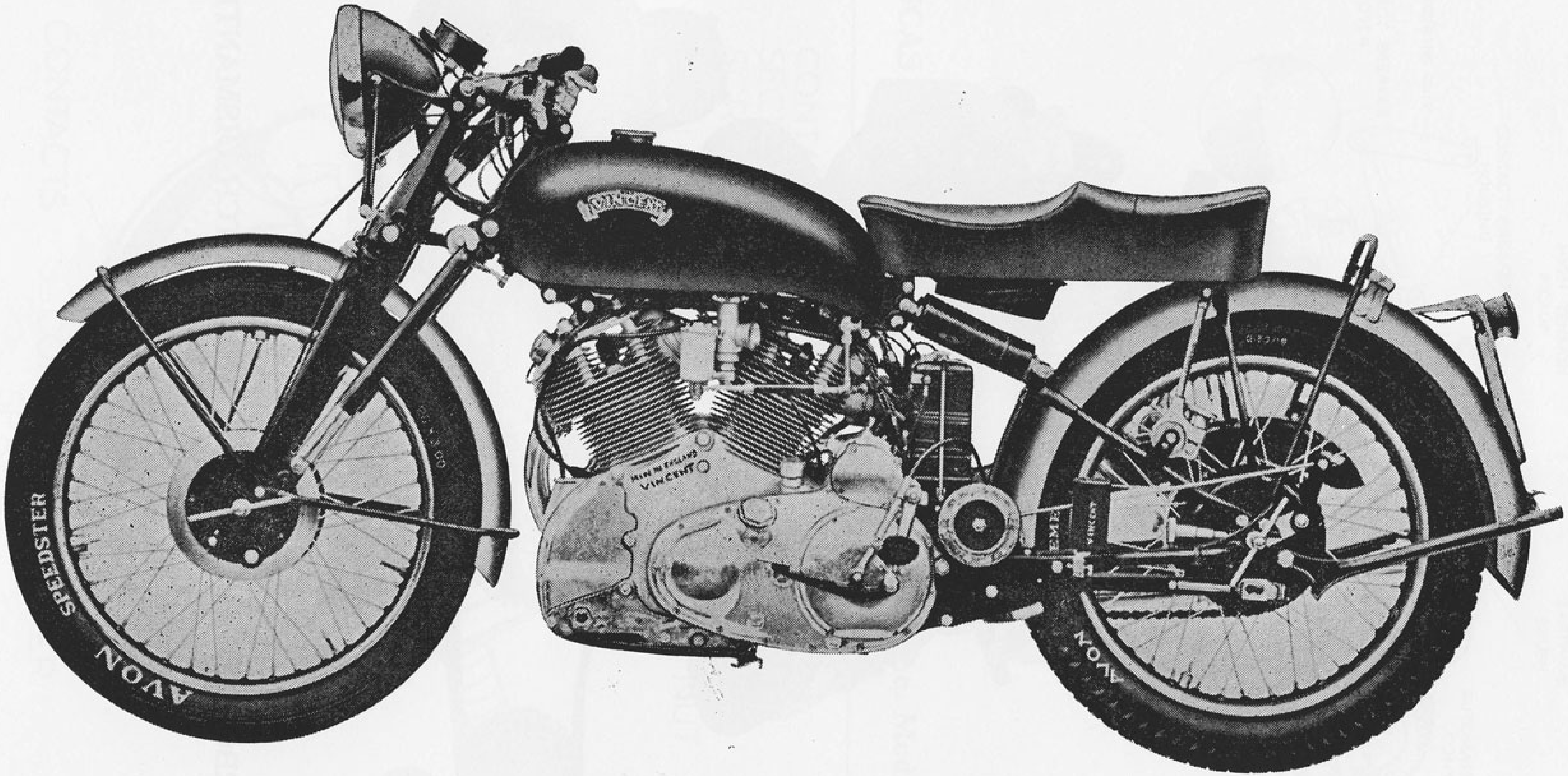
It is, however, a mistake to think that merely advancing the ignition will give more speed, and there is nothing to be gained by using more than 42 deg. advance. If high compression pistons are fitted the advance will need to be reduced according to the ratio and fuel used : for instance, only 34 deg. is required for 13–1 CR on methanol.

ELECTRICAL EQUIPMENT—LIGHTING SYSTEM

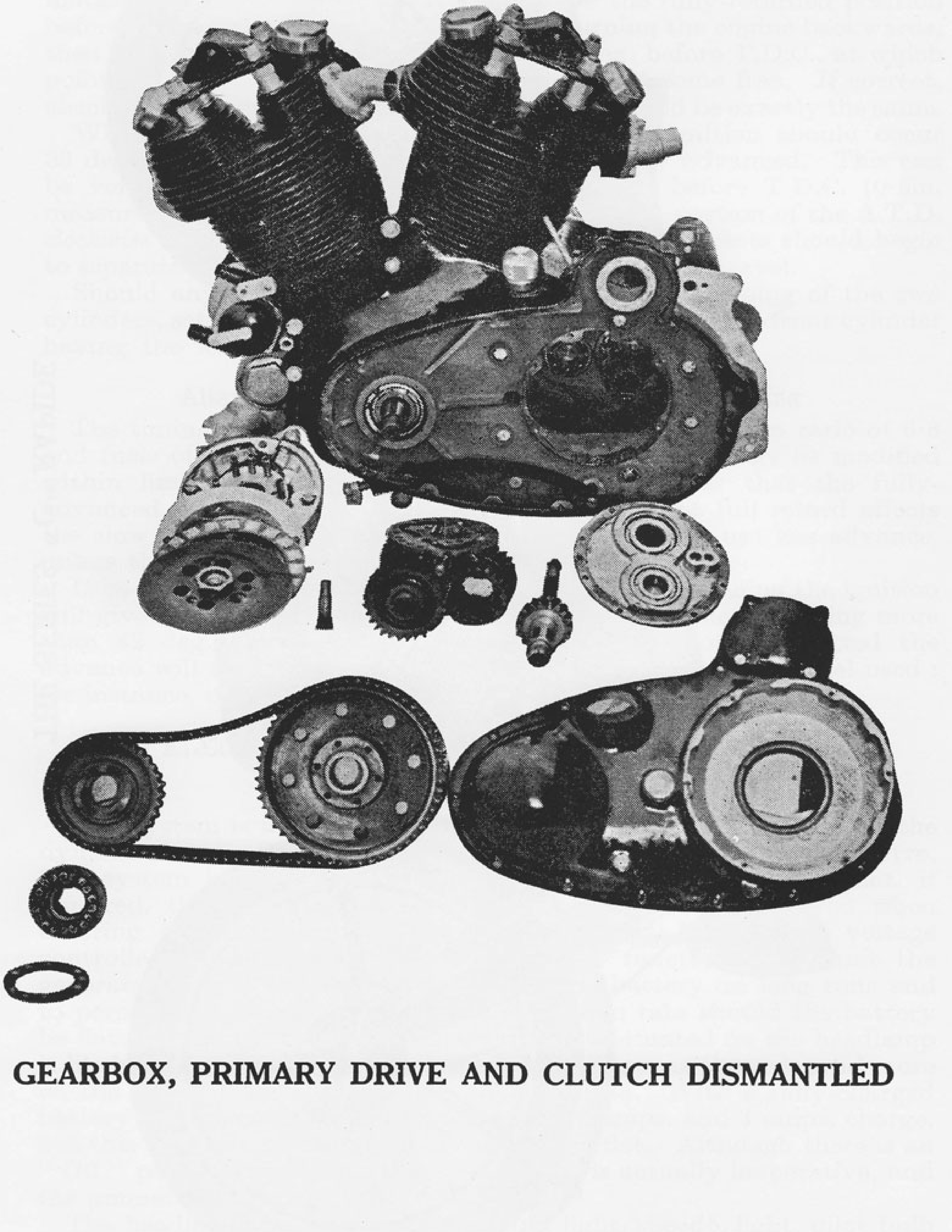
Lighting System

This system is identical on all models with the sole exception of the dynamo drive. Separate instructions follow for each type of drive. The system is quite independent of the ignition circuit, so that, if required, the dynamo can be either disconnected or removed when entering sporting events. The 6-volt, 50-watt dynamo is voltage controlled by an external regulator, whose function is to limit the generator output to avoid overcharging the battery on long runs and to permit the dynamo to charge at maximum rate should the battery be flat. Consequently, the ammeter which is situated on the headlamp is likely to show somewhat inconsistent readings, as these depend more on the state of the battery than anything else. With a fully-charged battery the ammeter should read between 2 amps. and 4 amps. charge, but this may rise to 8 amps. if the battery is flat. Although there is an " Off " position shown on the switch, this is actually inoperative, and the ammeter will still show " Charge."

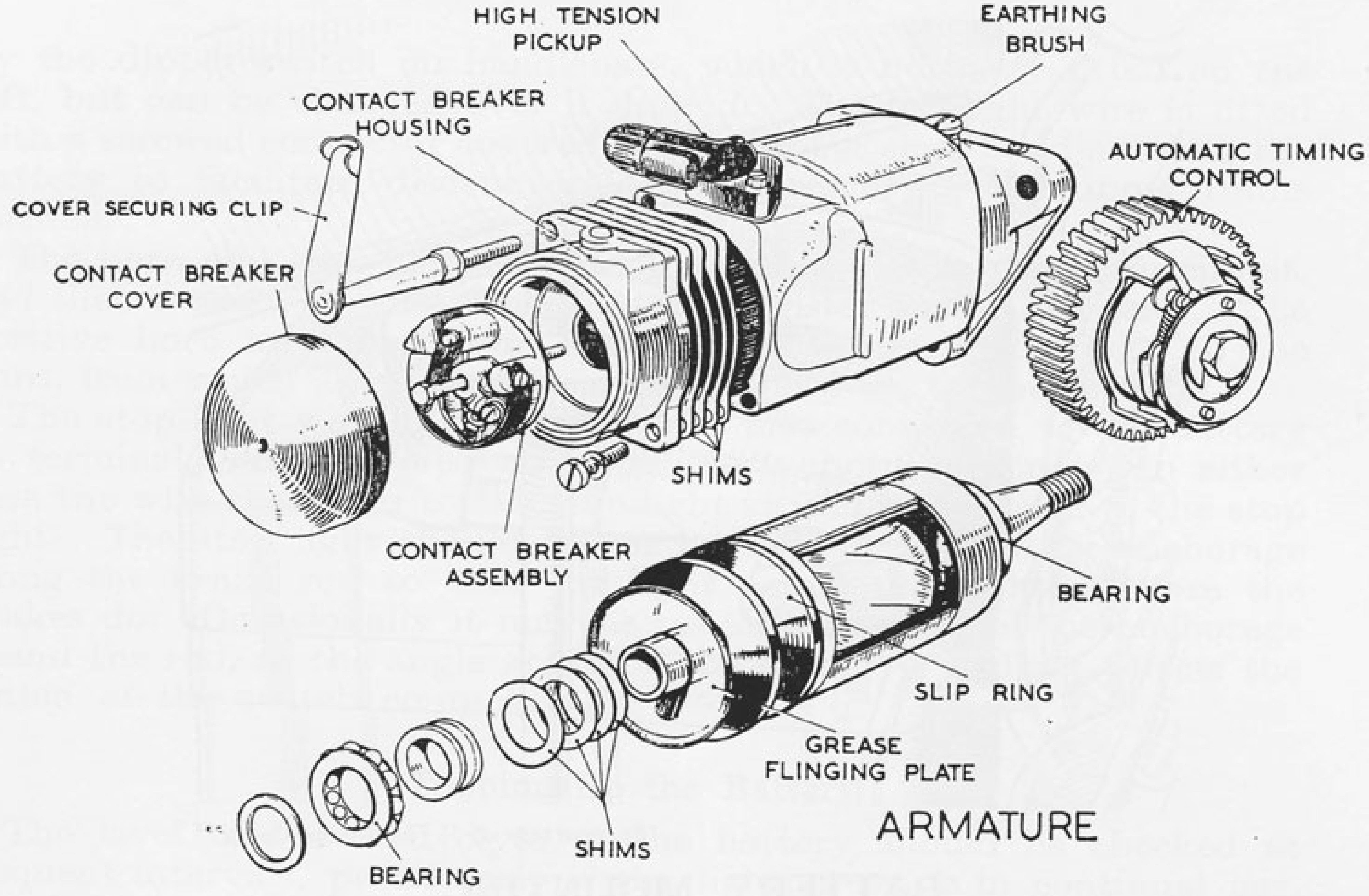
The headlamp switch controls the tail light, speedo. light, pilot bulb and the twin-filament main bulb. The main beam is dipped or raised



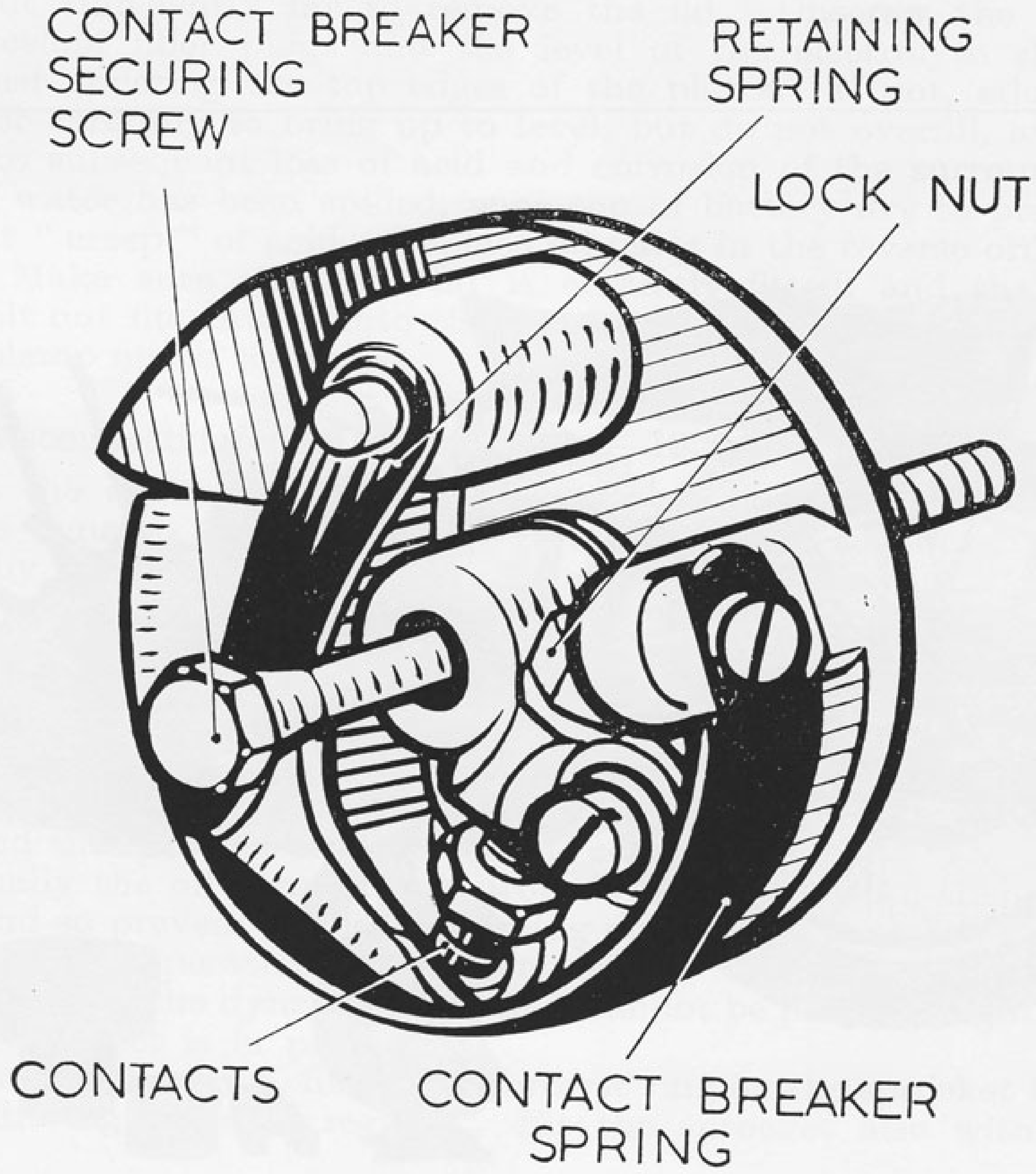
THE SERIES "C" RAPIDE



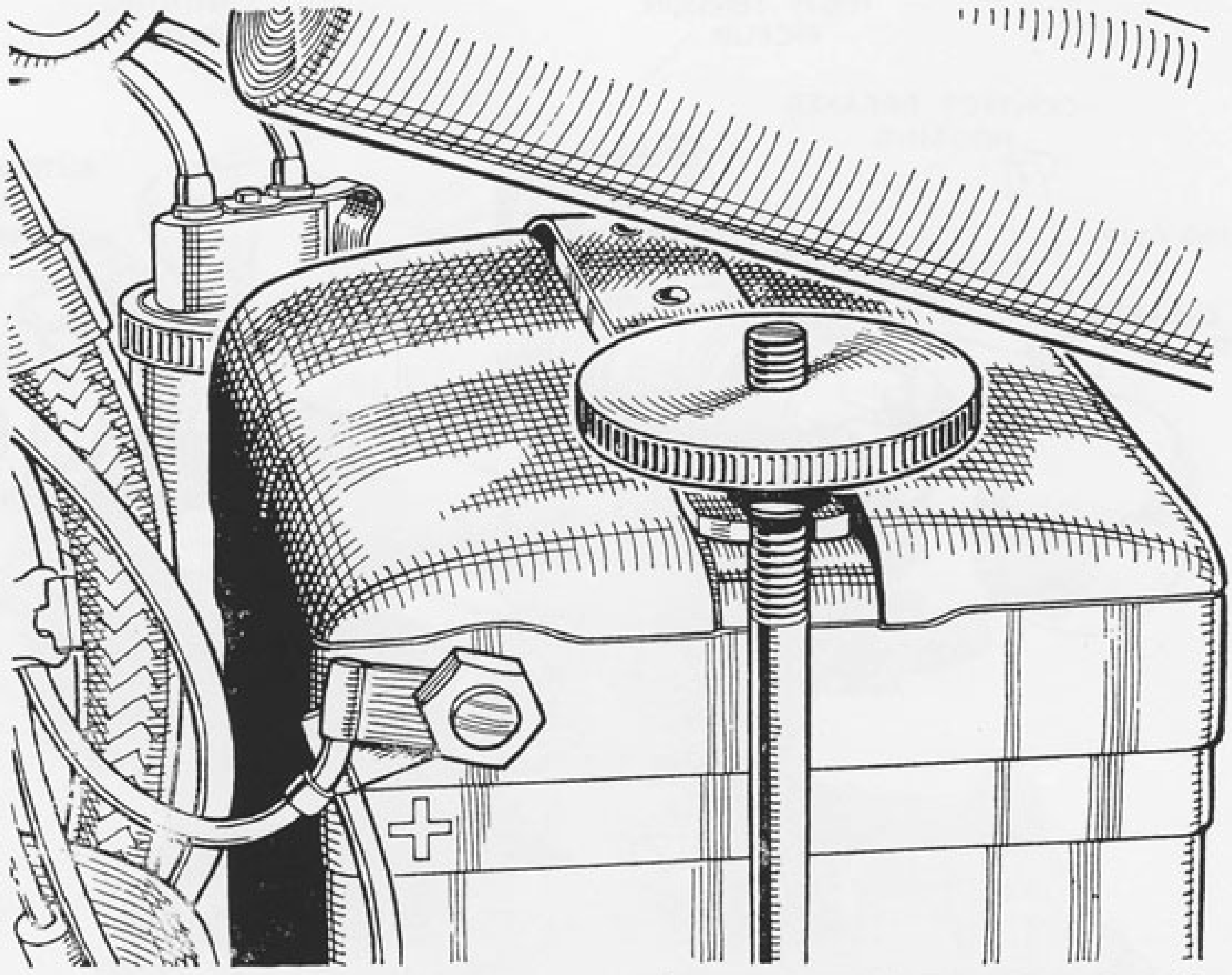
GEARBOX, PRIMARY DRIVE AND CLUTCH DISMANTLED



LUCAS KIF MAGNETO DISMANTLED, 500 c.c. Models



THE LUCAS CONTACT BREAKER ASSEMBLY

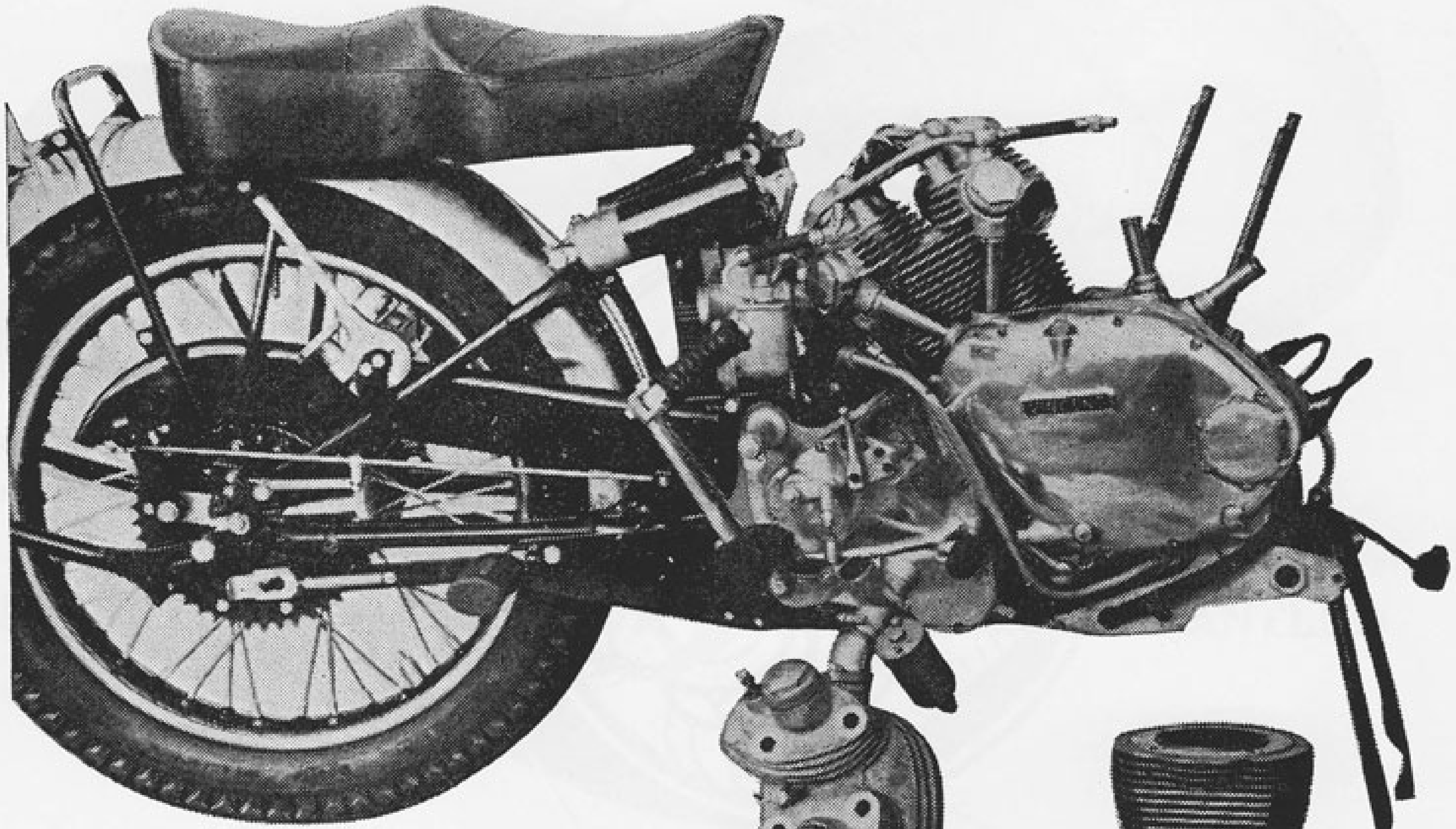


By courtesy of "The Motor Cycle"

BATTERY MOUNTING

Note the two leads on the positive terminal

Tightening the terminal nuts with a spanner is not recommended.



"RAPIDE" FRONT CYLINDER DISMANTLED

by the dipper switch on handlebars, which is normally fitted on the left, but can be changed over if desired. The tail light wire is fitted with a screwed connector covered with a rubber sheath, adjacent to the battery to facilitate disconnection when removing the upper frame member.

The horn and stop-light circuits are separate from the main circuit, and their current consumption does not register on the ammeter. The positive horn lead goes from the battery + terminal direct to the horn, from which an earth wire runs to the push button on bars.

The stop-light wire in early models is also connected to the battery + terminal, but later was taken off the + horn terminal. In either case the wire then goes to the stop-light switch and thence to the stop light. The stop light should be set by moving the spring anchorage along the brake rod so that the light comes on slightly before the brakes do. Occasionally it may be necessary to swivel the anchorage round the rod, as the angle at which the spring is pulling affects the action of the switch contacts.

Topping-Up the Battery

The level of the electrolyte in the battery should be checked at frequent intervals, particularly if the lighting set is in continual use. To check the level, remove all wires from the positive terminal on L.H. side of machine, unscrew battery clamp nut several turns until the bolt is loose enough to be slipped out of the slots in the battery strap and lower anchorage. Lift the battery strap upwards and slide battery out sufficiently far to remove the lid. Unscrew the three white porcelain filler plugs and the level of the electrolyte should be seen just covering the top edges of the plates. If not, add distilled water carefully to bring up to level, but do not overfill, as this will lead to subsequent loss of acid and corrosion of the surrounding metal. If water has been spilled, wipe top of battery dry to prevent subsequent " creep " of acid. Replace all parts in the reverse order of removal. Make sure that the lid is correctly fitted, and that the battery bolt nut fits snugly into the lower anchorage so that it cannot rotate as clamp nut is tightened.

Disconnecting the Dynamo Drive—1000 c.c. Models

Remove the dynamo drive cover on the primary drive case, disclosing the dynamo sprocket and shaft nut, which is prevented from loosening by a bent-up tab washer. Bend down the tab with a screwdriver and remove the nut, the tab washer and the dynamo drive plate beneath, being careful not to drop any parts down into the chain case. Insert one of the long screws holding the cover plate into the tapped hole in the sprocket, and with this as a handle pull the sprocket outwards and upwards, tilting it so that it clears the dynamo shaft and then lifts out of the chain case. Then remove the oil-thrower ring lying behind the sprocket and replace the cover plate.

Occasionally the oil thrower will drop down between the chain and sprocket and so prevent the latter coming out easily, but with a little manipulation the operation can be completed. It is not advisable to replace the nut on the dynamo shaft, as it cannot be properly tightened unless the sprocket is in position.

To re-connect the drive, fit the oil-thrower ring on the sprocket boss with the driving holes in register. Fit the sprocket also with the driving holes in register or nearly so, then line up the holes with a thin rod and fit the driving plate with the two pins passing through the holes in all components. Fit the tab washer with the turned-down tab on its edge registering with the appropriate hole in the sprocket, fully tighten the nut and bend up part of the washer against a flat of the nut, using a different portion to that previously used. After being used three times a new tab washer should be fitted ; proceed exactly as described, but, in addition, depress the edge of the washer into the sprocket hole with a punch to prevent it rotating.

Disconnecting the Dynamo and Drive—500 c.c. Models

To disconnect the drive, remove timing cover, remove spigot-nut from dynamo drive pinion, and extract pinion, with the aid of a simple extractor. To remove the dynamo completely, remove the two nuts which retain the dynamo clamp, take off the clamp together with the voltage regulator, and the dynamo will then slide out towards the drive side of the engine. The engine can be run without the dynamo provided the hole left when the dynamo is removed is blocked up. Care must be taken to see that the rubber oil-seal is not damaged or the thin lip turned over when detaching or refitting the dynamo, and should the seal have to be renewed, it must be fitted with the edge of the seal towards the timing case.

When replacing the dynamo, make sure that the shaft boss is central in the seal before and after tightening the clamp bolts.

Removing the Dynamo Completely—1000 c.c. Models

Dismantle sprocket as described, detach all wires from battery, remove battery (see Topping-Up instructions). Detach petrol pipe from R.H. tap and float chamber of rear carburettor and lift clear of float chamber. Loosen carburettor clip and slip carburettor off stub, taking care not to damage control wires. Unscrew tank vent pipe and oil feed pipe union nuts from their attachments underneath rear end of tank and remove tank vent pipe. Pull dynamo lead plug out of dynamo end cover. Remove nut and washer on clamp bolt (just behind rear cylinder to the L.H. side) and swing bolt forward to clear slot in clamp. The dynamo can now be slid along in its cradle towards the R.H. side, and after moving about an inch can be lifted up and turned forwards, thereby providing sufficient clearance for the clamp to be worked clear of the hook bolt, the head of which can just be seen lying below and slightly in front of the battery bracket. The clamp is slotted to clear this bolt and, when free, the clamp, voltage control box and dynamo, which are mutually attached by two insulated wires, can be taken out towards the R.H. side.

If it is desired to run the engine without the dynamo for any length of time, the hole in the chain case will need to be blocked up ; the necessary parts are obtainable as spares or can easily be made up. Blocking-up is necessary to prevent oil escape and also the entry of air into the chain case. Use Part No. ET216—Dynamo Blanking Plate.

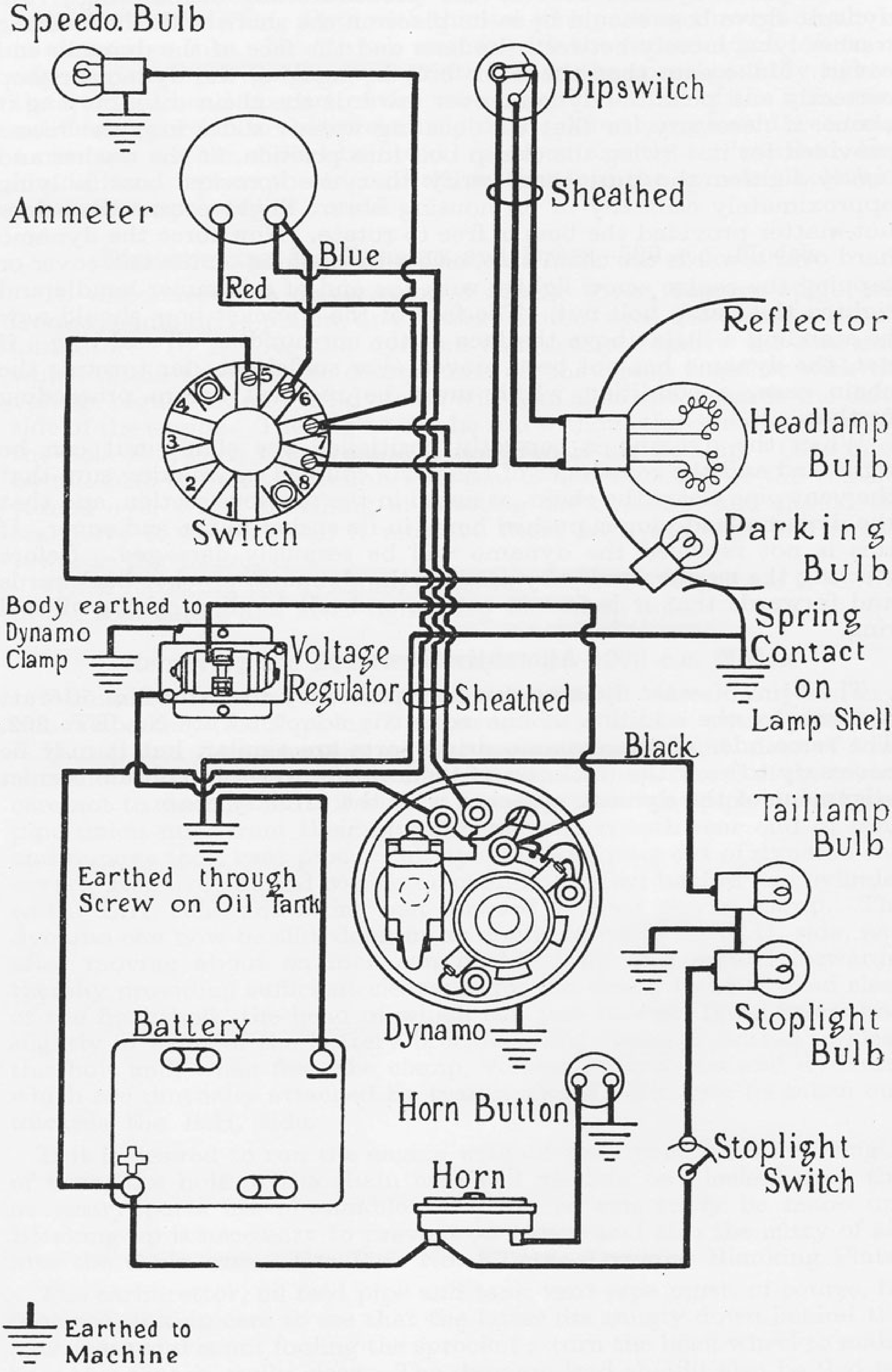
The carburettor, oil feed pipe and tank vent pipe must, of course, be replaced, taking care to see that the latter fits snugly down behind the rear chain and is not fouling the sprocket ; turn the back wheel to make sure this pipe is really clear. The dynamo lead should also be tied up out of the way to prevent it falling into the chain, and insulated to prevent accidental short-circuiting.

To replace dynamo reverse the procedure for dismantling; the dynamo drive boss should be in its place on the shaft, with the locating washer lying loosely between the boss and the face of the dynamo end cover. Make sure that the hook bolt is engaging the dynamo clamp correctly and push the dynamo over towards the chain case, moving it about, if necessary, so that the locating washer slides into the recess provided for it. Swing the clamp bolt into position, fit the washer and *lightly* tighten the nut, then verify that the sprocket boss is lying approximately centrally in its housing bore. Slight eccentricity does not matter provided the boss is free to rotate. Now force the dynamo hard over towards the chain case, either by pushing on the end cover or tapping the centre screw lightly with the end of a hammer handle and tighten the clamp bolt nut. The face of the sprocket boss should now be standing a little above the face of the surrounding oil seal ring; if not, the dynamo has not been moved over sufficiently far towards the chain case, a condition which must be rectified before proceeding further.

When the dynamo is correctly positioned the clamp nut can be tightened and the remainder of the parts coupled up, making sure that the vent pipe clears the chain, as noted in the previous section, and that the dynamo lead plug is pushed home in its socket in the end cover. If this is not replaced the dynamo will be seriously damaged. Before starting the engine, verify by moving the dynamo sprocket backwards and forwards that it is free to rotate, and not binding on the oil-seal ring.

Alternative Dynamos

The $3\frac{1}{2}$in. 50-watt dynamo can be replaced by the later 3in. 50-watt dynamo by the addition of the eccentric adaptor Part No. ET. 202. The remainder of the dynamo drive parts are similar, but it may be necessary to vary the thickness of the locating washer to obtain correct alignment of the dynamo sprocket with the primary chain.



WIRING DIAGRAM

CHAPTER VII

DECARBONIZING

Top Overhaul of the Engine

No hard-and-fast rule can be laid down as to the periods at which decarbonizing should be performed. As a general rule, provided the performance is up to standard and there is no evidence of trouble in the form of poor compression or excessive smoke, it is best to leave the engine undisturbed, and phenomenal mileages have been covered by machines which have been well cared for. Eight to ten thousand miles should be a reasonable average estimate.

Owing to the frame construction, the decarbonizing procedure is a little unconventional, but quite straightforward, if the following procedure is adopted.

The process is exactly similar on single and twin cylinder models, except that in the single a frame tie takes the place of the rear cylinder, and is joined to the upper frame member by a plain bolt which should be fully tightened, as there is no need to allow for expansion as in the case of the twin cylinder engine.

Preliminary Operations

Put the machine on front and rear stands (except in the case of the Meteor, where the machine must be supported on the rear stand only, with a suitable box under the crankcase) and put blocks under gearbox of sufficient height to take the weight off the rear springs. Take one nut off saddle nose bolt, push out bolt and move saddle backwards out of the way. Unscrew petrol pipe unions, remove front and rear tank-fixing bolts, remove oil filler cap and lift tank upwards and backwards a couple of inches. The front tank rubbers can then be pushed clear and the tank can be lifted off. Detach electrical connections by unplugging dynamo lead from end cover, positive and negative leads from battery terminals, unscrewing connector in tail-light wire and pulling connector in horn wire apart (see Lighting System). Remove battery. Remove nut from front fixing bolt of rear frame springs and push bolt out. Remove tank vent pipe and oil feed pipe from rear of oil tank and remove banjo bolt connecting oil return pipe to centre of tank. (In some models it may be necessary to remove the flexible section of the return pipe between the two cylinder heads to get this banjo bolt out.) Unscrew milled lock rings on carburettors and lift out throttle and air slides. Disconnect clutch and exhaust lifter wires at the lower ends. Remove locknut and inner nut of rear cylinder anchorage, tap out anchorage bolt, and working back through the hole, tap out the anchor piece which has remained in place. Remove one locknut from front anchor bolt and the spigot nut beneath it and tap bolt out. The upper frame member, complete with forks and wheel, can now be lifted clear and wheeled away, leaving the engine completely exposed. Though somewhat complicated to describe, the whole operation can be done in under fifteen minutes.

Remove petrol pipes from float chambers, loosen carburettor clip screws and pull carburettors off inlet pipes. Remove exhaust system by taking out the two bolts which attach the silencer and exhaust pipe to the R.H. pillion footrest support. Loosen the clamp bolt at junction of the two pipes, unscrew finned nuts with spanner K3 and the whole system will come away.

Removing the Rear Forks

Although this operation is not necessary, the Rear Forks can, if desired, be quickly removed by taking off the pivot bolt nut at the *right-hand* side, just aft of the kick-starter cover, and driving out the bolt towards the clutch side. With the rear chain disconnected, the forks can then be pulled backwards to clear the pivot-bearing plates.

DISMANTLING ENGINE

To remove cylinder heads, unscrew push rod tube nuts with spanner K1 and slide tubes down clear of rocker boxes. Remove sparking plugs and rocker inspection caps. It may be found that one of the caps tightens up again after being unscrewed a few turns ; if so, it is being fouled by its rocker and it will be necessary to rotate the engine about one revolution, so that the rocker in question drops and thereby permits the cap to be removed. Remove rocker oil pipes, and all nuts holding cylinder head bracket and cylinder heads, rotate the engine until both valves are shut, and lift off the head. (In the case of the twin cylinder engine work on No. 1 rear-cyclinder head first, then rotate the engine until No. 2 valves are shut, and remove No. 2 head.) It will be found that the push rods tend to foul the rocker-box holes when the heads are being raised ; hence the necessity to have the valves closed. Another method is to remove all rocker adjusters and extract the push rods upwards through the rockers with the aid of a pair of thin pliers. The barrels can now be lifted off, taking care to see that the pistons are not damaged as they come clear of the liners. It is a wise precaution to stuff a cloth into the crankcase openings just before the pistons clear the barrels to avoid any pieces of piston ring falling into the case ; broken rings are unlikely, but fragments which may fall into the crankcase are very likely to cause severe damage later. Mark barrels so that they go back as before.

To remove pistons, prise out one gudgeon pin circlip with a sharp-pointed instrument operated in the slot provided, and push out gudgeon pins. With comparatively new pistons the pins will come out more easily if the pistons are heated ; if, however, they have been undisturbed for a long period, a small burr or ridge is sometimes thrown up by the circlip, which impedes the pin unless carefully removed with a small sharp scraper. Mark each piston so that it can be replaced in the same position as it was before, and in its correct barrel.

Removing the Valves

Take out the rocker feed jets screwed into top of rocker boxes and pull rockers out complete with their bearings, which should be a light push fit in the rocker-box bores. Next, remove valve spring inspection caps and depress valve spring cap with a " Terry " spring compressor or similar tool. Hook out the split tapered collets, being careful to maintain them in pairs, remove spring compressor, spring cap and springs. Remove circlip from groove in end of valve stem and tap the end of the valve stem with a soft hammer or punch until it is driven out of the valve stem collar on which the forked rocker bears. The valve can now be extracted unless, as sometimes occurs after a considerable mileage, a burr has been thrown up round the circlip groove. If so, this must be removed by careful filing, otherwise the bore of the upper valve guide will be damaged if the valve is forced through it. Next, the upper valve guide can be lifted out or, if tight, it can be forced out of its recess with a lever from inside the rocker box. The overhead valve gear is then completely dismantled ; the procedure is identical for all valves, though the inlets and exhausts are not interchangeable.

NOTE.—The use of a guide both above and below the rocker is a unique feature of Vincent engines, and ensures a very long guide life and accurate seating of the valves even if a perceptible amount of wear has taken place. The lower guide is shorter than the conventional form, and consequently the valve may appear to be very loose in that guide if tested without the upper guide in position. This fact may mislead riders into thinking that new guides are required long before they really are.

Clean out carbon from inside of head and ports, polishing all surfaces with fine emery cloth and finally with metal polish. Clean and polish the valve heads and stems, being careful not to reduce the stem diameters in the process, and if the valve seats are badly pitted have the seats turned or ground before grinding in the valves.

NOTE.—The angle of both valve seats is 30 deg., *not* 45 deg., as is more usual.

Grinding-In the Valves and Head Joint

Smear grinding paste on seats and rotate valves to and fro with light pressure, using a suction cup tool on head of valve or T-wrench clamped on stem. During this operation the upper valve guides *must be in place.*

If badly pitted, the aluminium-bronze exhaust valve seats can be recut with a 30 deg. cutter having a double-diameter stem to fit both upper and lower guides. The inlet valve seats, being of austenitic iron, are too tough to be recut, but may be reground with equipment such as the Black and Decker reseating equipment. Owing to the restricted space in the rocker boxes, any recutting of the seats must be the minimum necessary to clean up the seats.

The head joint is formed by metal-to-metal contact between the head and the top flange of the liner, with a very small gap between the broad joint faces to obviate distortion when the head is tightened. If black areas are visible on the flange face, indicating leakage, apply a little *fine* grinding paste on the flange and *coarse* paste on the broad face. Rotate head back and forth on the barrel until continuous contact is obtained between head recess and flange. Full contact should by then also be obtained between the broad faces, but 75 per cent. contact is sufficient for the purpose. When grinding, do not apply a side load to the head, as this will enlarge the spigot diameter.

Finally, remove all traces of grinding paste from the valve, seats and joint faces, including the bolt holes, and the heads are ready to reassemble.

Replacing the Valve Gear

Smear oil on stem of each valve, insert it in the guide and push its valve stem collar down on to the upper part of the stem. Rest the hollow in the head of the valve on some solid object and by means of a hollow punch or piece of tube, which will slip easily over the 5/16in. stem, drive the collar on to its seat. It is important to see that the collar is not tilted during this operation, as that might lead to the stem being scored and so destroy the accurate fit of the collar. Then replace the upper guide and fit the circlip. Place springs and spring cap in position, compress the springs and fit the split collets. (NOTE.—Spare collets are supplied only partially split ; they *must* be separated and the ragged edge trimmed with a file before fitting.) Gradually loosen the spring compressor, guiding the collets as required to ensure that they contact the circlip evenly and that the circlip is eventually located in the small recess in the upper face of the collets ; this point *must* be closely watched.

Next, insert each rocker assembly, lining up the hole in the upper side of bearing with the rocker-jet hole in head ; clean out the jet and cross holes in rocker-feed bolt with a fine wire, insert bolt and when sure that it has entered the rocker-bearing hole, tighten fully. Check that rocker has about 1/16in. of free movement ; if the collar has not been driven home on the stem, or if the seats have been cut excessively deep, there may not be as much free movement as this, but as long as there is a perceptible amount the engine will function correctly.

Cleaning Pistons and Rings

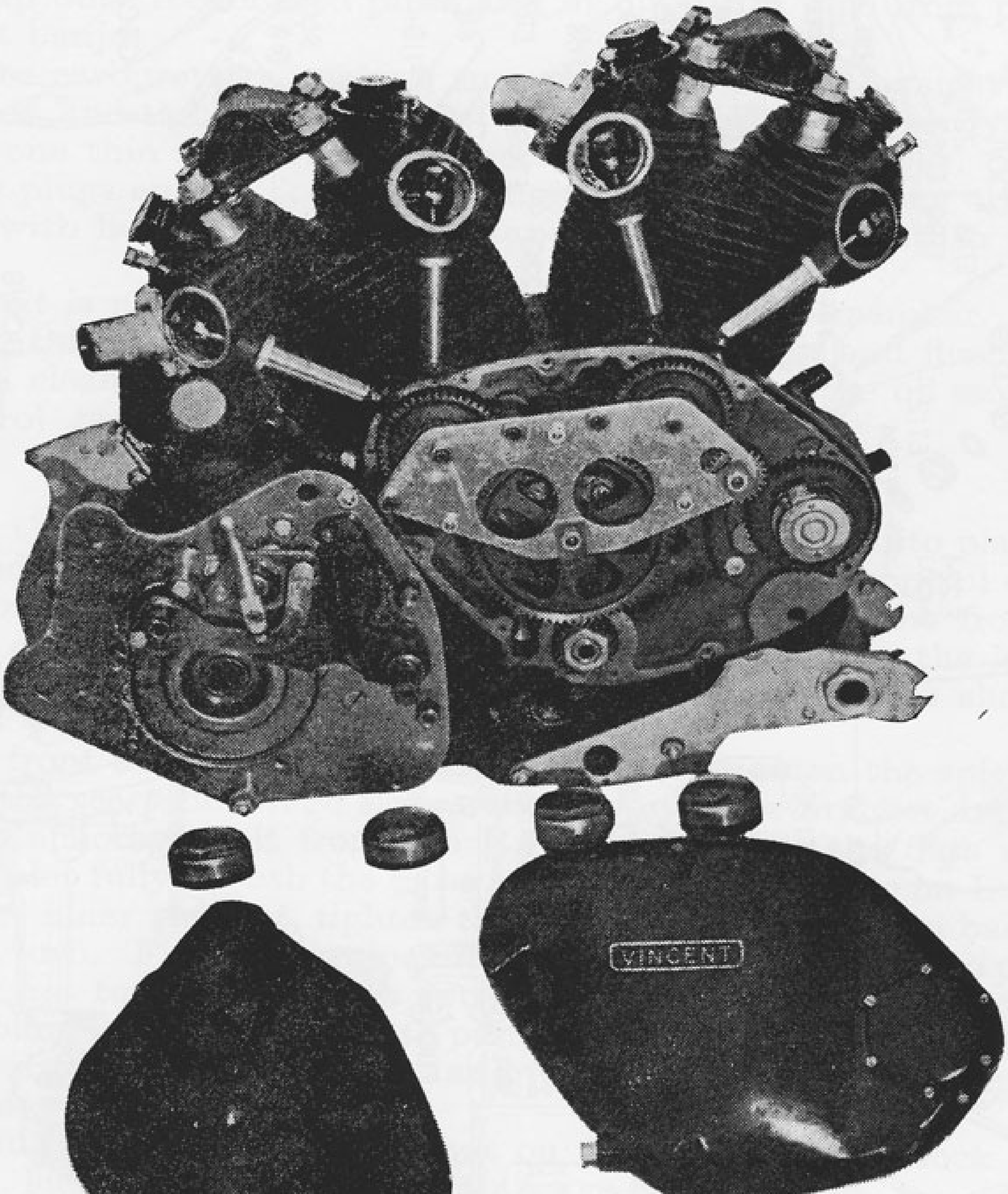
Carefully lift piston rings out of their grooves and scrape the deposit off the piston crown and out of the ring grooves ; probably the easiest way to perform the latter job is with an old ring, broken off to form sharp scraping edges. Finally, polish or buff the crown to a high finish. Regarding the thrust faces, these should possess a matt-grey appearance, free from scores or " high spots." High spots are areas where the surface shows a definite polish, and these can be *carefully* eased off with a fine file. Piston rings should have not less than $\frac{1}{4}$in. gap when free and between 0·012in. and 0·024in. when fitted in the bore. Side float in the grooves should be not more than 0·002in. for the two top rings and 0·004in. to 0·006in. for the slotted oil-control ring.

Reassembly

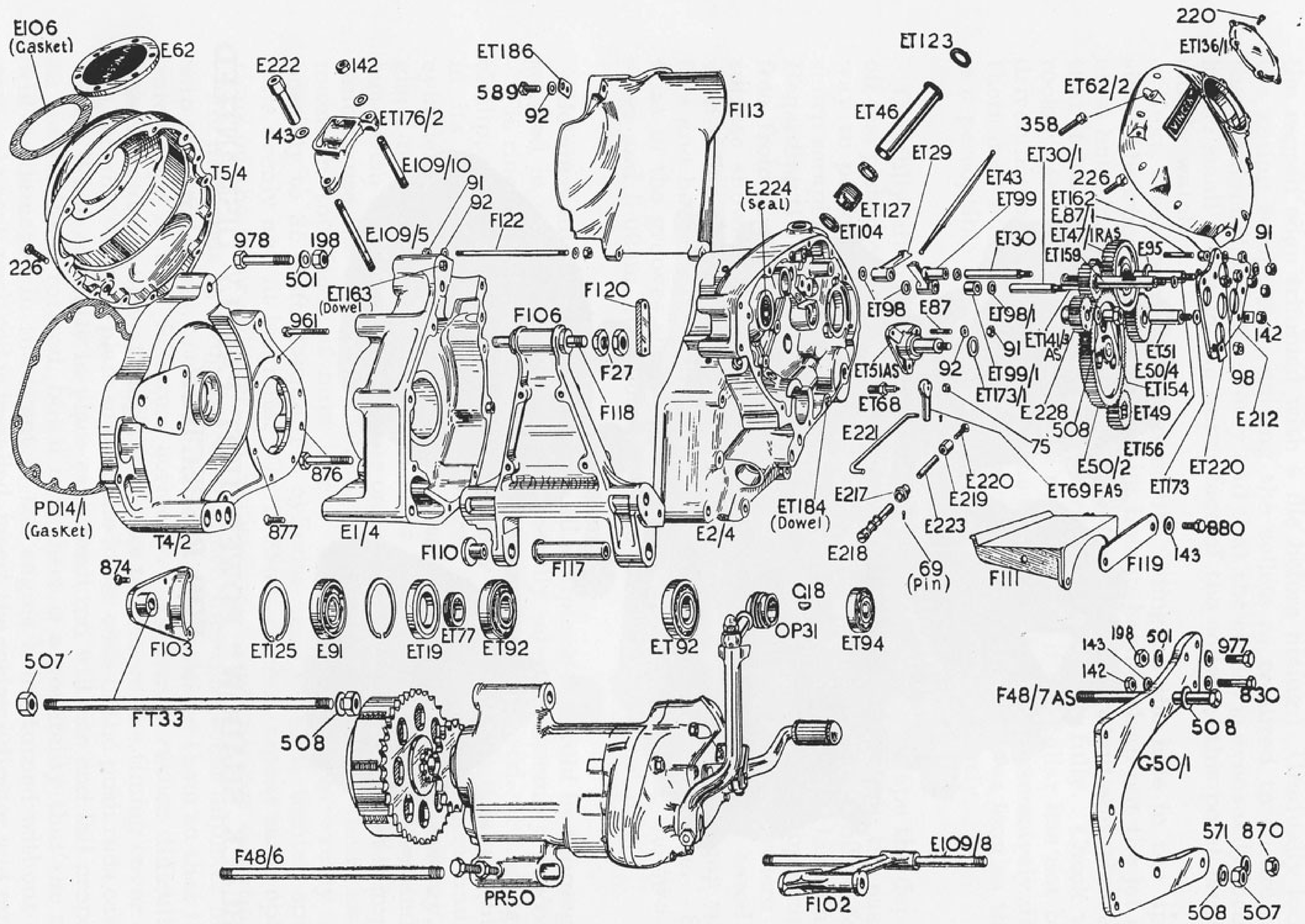
Before commencing reassembly, all components should be thoroughly washed in petrol or paraffin and liberally oiled as assembly proceeds.

Fit rings to pistons and piston to rear connecting-rod. Fit gudgeon circlip, stretching it a little if necessary to ensure that it is a tight fit in its groove. Renew any damaged cylinder-base washers and fit cylinder. Renew push-rod tube sealing rings, where necessary, in gland-nut recesses. Wipe joint faces of head and barrel clean and fit head with four washers and nuts on holding bolts. (NOTE.—It is important to use the standard washers, which are all of equal thickness, to maintain top faces of nuts level.) Tighten nuts down evenly and possibly to 35 lb–ft. torque. Fit cylinder head bracket, tighten spigot nuts evenly and fit locknuts. On 1000 c.c. models, repeat same operations on the other cylinder. A Registering Spanner is not essential.

Fit push rods by dropping them down through rocker adjuster holes into push rod tubes, one at a time, and manipulating them so that they enter cups in cam followers correctly. As this is rather difficult to ascertain at the first attempt, it is wise to remove the timing cover and the camshaft steady plate so that the lower ends of the push rods can be seen. When correctly in place each push rod will rise and fall properly as the engine is rotated, but if not, there is a possibility that the rods will be damaged in the event of the engine being turned without due care. As each push rod is installed, insert the rocker adjuster and repeat the process on the next rod.



"BLACK SHADOW" POWER UNIT PARTLY DISMANTLED FOR INSPECTION



THE 500 c.c. POWER UNIT

Finally, adjust each rocker to zero clearance (see Push Rod Adjustment), slide up push rod tubes and tighten gland nuts lightly ; excessive tightening may cause sealing rings to collapse into the tube bores. Inject some oil into each rocker box and fit inspection caps.

Fit front and rear rocker feed pipes, verifying that there is one thin C. and A. washer under each banjo and one plain copper washer under each of the ¼in. securing bolts. It is essential that the banjo unions rest squarely on the lower washers before the bolts are fitted and do not have to be strained into place ; otherwise an oil leak may develop. Couple up both rocker-feed pipes and fit oil-return pipe from pump to rearmost banjo.

Replace carburettors, making sure they are hard up against ends of inlet pipes, and tighten clip screws. Replace petrol pipes, verifying that there is one thin fibre washer on each side of banjo unions. Replace sparking plugs and H.T. leads, arranging these so that they are not in contact with head fins and finally tape them to the oil return pipe, as before.

The unit is now ready to receive the upper frame member. Before replacing this, opportunity should be taken to drain and flush the oil tank and clean the gauze filter at the inner end of the oil stop valve and petrol taps.

Replacing Upper Frame Member

Wheel the assembly over the engine unit and lower it into place over the cylinder head brackets, taking care to see that no control or electrical wires are trapped in the process. The wires to the front carburettor cross over under the oil tank from the right to the left just in front of the front inlet valve inspection cap, and these should be carefully watched.

Insert front anchorage bolt, refit and lightly tighten the spigot nut. Line up the rear anchorage slots with rear cylinder bracket and insert the rear anchorage bolt from the R.H. side so that the flats upon it enter the slot fully. Push the loose anchor piece into place on L.H. side and fit the inner ⅜in. nut, tighten this nut fully, then slacken back one-sixth of a turn. Fit the outer locknut and, using two spanners to prevent the inner nut turning, lock the two nuts firmly together. The purpose of assembling in this manner is to permit the joint to " creep " when the engine warms up and expands, and yet be tight enough to prevent rattle and wear.

Next, fully tighten the spigot nut on front bolt, fit and lock up the outer ⅜in. locknut. This bolt must always be kept tight.

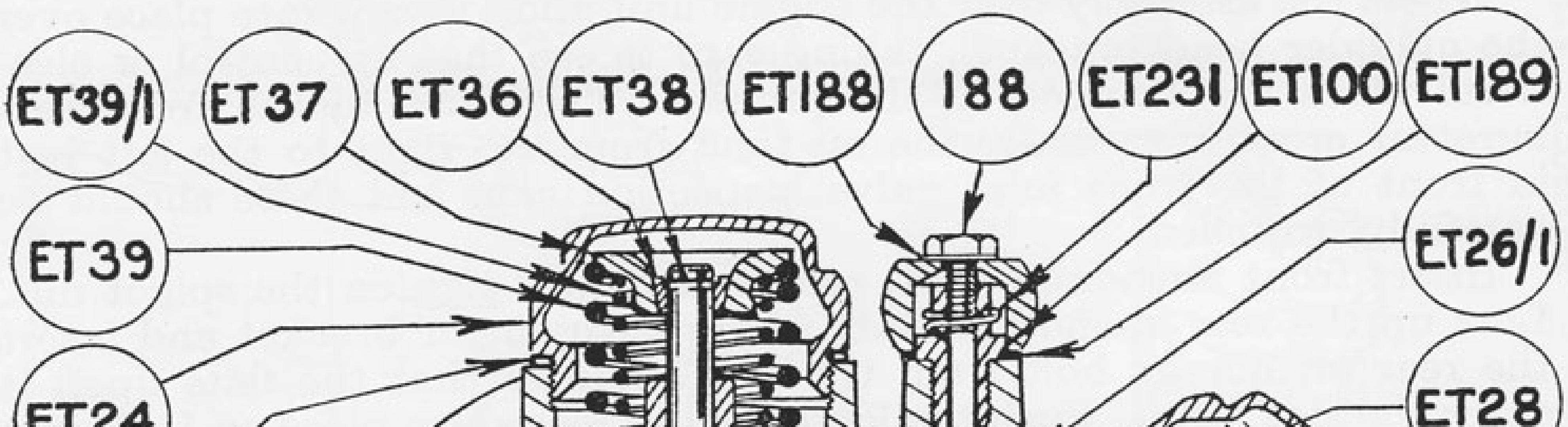
The carburettor slides can be replaced, the clutch and exhaust lifter control wires refitted and the oil return pipe, pump feed oil pipe and tank vent pipe coupled up. Make sure that the hose of the pump feed pipe is lying correctly in place and is not kinked by the rear cylinder inlet stub and that the hose extension of the tank vent pipe is lying snugly into its recess in the gearbox shell, so that the hose lies *under* the chain, but does not foul it. Fit battery and couple up and test all electrical connections.

Fit front bolt of rear frame springs, replace spring washer and nut and tighten fully. Slip petrol tank over upper frame member, making sure that no wires are fouled ; the front carburettor wires should lie *between* the tank tunnel and the upper frame member in a smooth curve. Just before the tank is right into position, insert the two front mounting rubbers with their large ends inwards into the holes in mounting lugs ;

then work the tank into position, insert and fully tighten the front mounting bolts and washers. Insert the rear mounting rubber block, two setscrews and washers, and tighten down moderately. Occasionally it may be necessary to tighten one more than the other, in order to obtain clearance between the tunnel in the tank and the upper frame member. When correctly tightened, it should be possible to give the tank a blow with the palm of the hand on each side without hearing a metallic knock ; if noise can be heard, tighten the appropriate setscrew. Fit the distance-piece and bolt which passes through the two lugs at rear end of tank, making sure that the distance-piece is not in contact with any adjacent parts. When all is correct, lock setscrews with fine wire through the holes provided in the heads. Couple up the petrol pipes, replace and fully tighten the saddle nose bolt.

Before fitting the exhaust system fill the oil tank and loosen feed pipe banjo bolt beneath timing case. Wait until all air is expelled and oil is flowing freely from bubbles and re-tighten banjo bolt. Fit the exhaust system and the engine is ready to be started up.

When started, run the engine slowly for a few minutes in order to test the lubrication system (see Lubrication page). If all is correct, the machine is ready for a road test ; after a few miles it is advisable to re-check the valve clearances and it may also be necessary to readjust the throttle stops and pilot jets to obtain the best possible tick-over.



THE CYLINDER HEAD

CHAPTER VIII

TYRES—CARE AND MAINTENANCE—PRESSURES

The pressure to which the front tyre is inflated has a bearing both on good handling and on the life of the tread. Ribbed tyres, which undoubtedly are the best for fast cornering, tend to wear the side ribs faster than the centre ribs and this tendency is accentuated by under-inflation, which also causes uneven circumferential wear. On the other hand, excessive pressures lessen both the accuracy of steering and comfort. Longer tread mileage can be obtained by increasing the pressures up to 26 lbs. in 3·00 × 20 tyres, though it must be pointed out that once uneven tread wear has commenced, later running at higher pressures will not be a complete cure. Due to the different spring characteristics, tyres can with safety be run at 4/5 lbs. greater pressure in "Girdraulic" forks than in the early Brampton pattern.

The following table gives the pressures which are found to be most suitable for best handling and maximum life. When racing, machines are usually stripped to reduce weight and, further, a perceptible rise in pressure occurs owing to the work done by the tyre. Consequently, lower pressures are recommended, but as in racing tread life is of less consequence than good steering, the eventual pressures to be used can only be determined accurately by the rider himself to suit the course and weather conditions.

Tyre Size	Shadow and Rapide				Comet C		Meteor B		
	Series B		Series C						
3·00 × 20 front ...	20	22	25	26	23	24	20	22	POUNDS
3·50 × 19 front ...	16	18	16	18	16	17	16	17	PER
3·50 × 19 rear ...	20	21	20	21	18	20	18	20	SQUARE
4·00 × 18 rear ...	16	17	16	17	16	17	16	17	INCH

It cannot be too strongly emphasised that on machines of the speed capabilities of our 1000 c.c. models, a little time spent at frequent and regular intervals in examining the covers for cuts, flints, nails, etc., and in checking pressures, will pay handsome dividends both in safety, and in longevity of the tyre.

It is undoubtedly an excellent plan to allot a weekly period of, say, 15 minutes, when both tyres should be carefully examined, any stones, flints, etc., found embedded in the tread should be removed with a suitable tool. During this period the pressures should be checked *with a reliable gauge* and adjusted as required. For security bolts see opposite page 27.

CHAPTER IX

THE BLACK SHADOW

The Black Shadow was introduced to satisfy the demands of the ultra discriminating rider who desires performance and appearance surpassing even that of the Rapide, and finished internally to the standards which are normally found only in special racing machines. Accordingly, the crankcase and cylinders are stove enamelled partly for improved heat dissipation, partly as a protection against sea water corrosion—an important point in some countries.

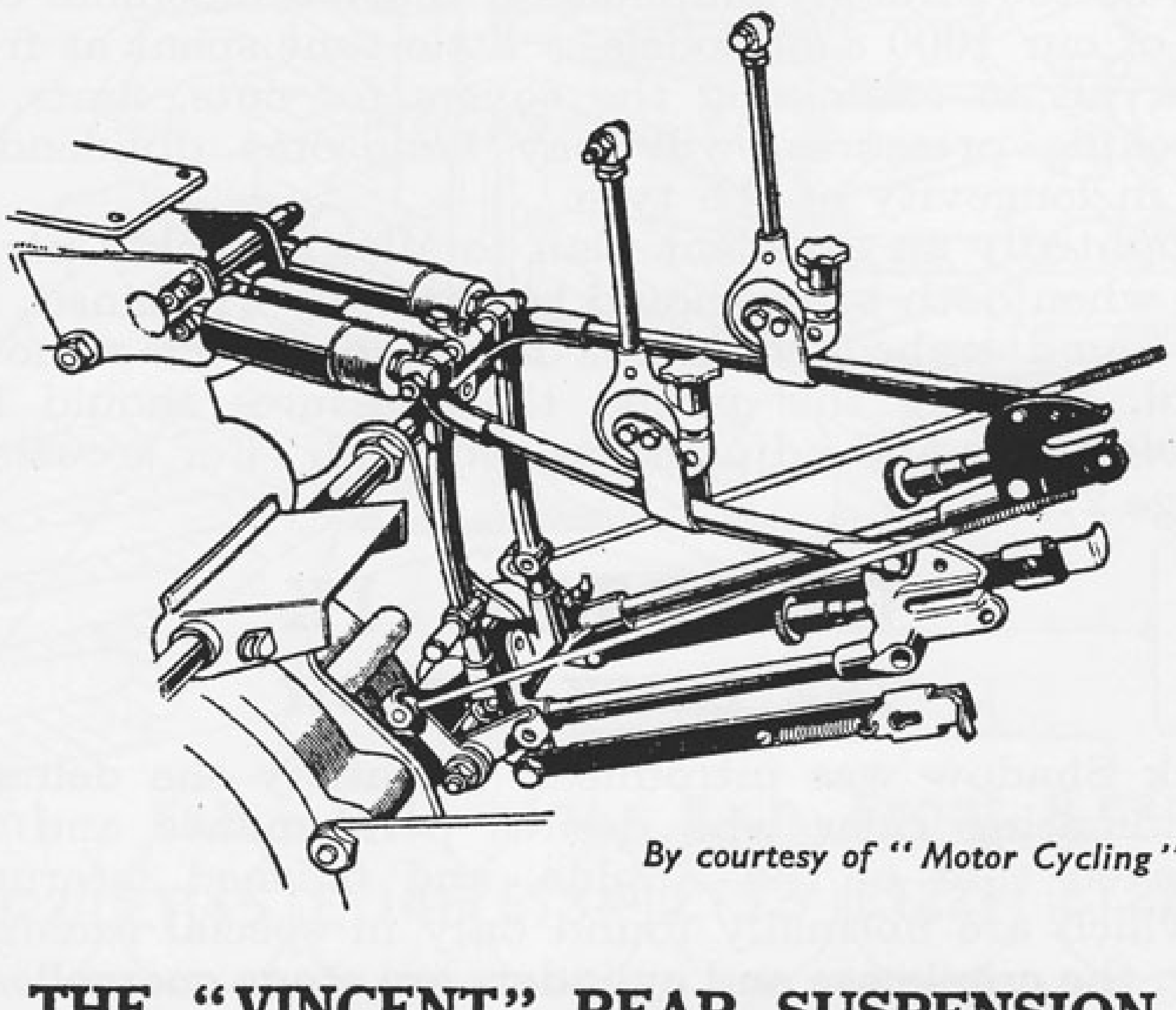
Highly-stressed internal components are highly polished in conformity with aircraft practice, to guard against fatigue failure. All components are specially selected for accuracy of fit and alignment, and exhaust and inlet ports are internally streamlined and highly polished to improve volumetric efficiency. These factors, in conjunction with the use of larger carburettors and pistons giving a higher compression ratio, provide a considerable increase in power output and several m.p.h. more in maximum speed.

Ribbed brake drums and a higher bottom gear make the machine suitable for road-racing, while the fitting of lightened clutch and gear-change components aid in obtaining rapid changes.

Apart from these extensive modifications, all the notes made in this book about riding methods, controls and adjustments apply equally well to the Shadow, except that the latter cannot be expected to give its best performance on low-grade fuels. Conversely, where high octane fuel is available, many riders prefer to fit E7/8 pistons giving approximately 8 to 1 compression ratio. The addition of a proportion of benzole to petrol of 70–72 octane (Pool) will be found to improve the running at moderate speeds.

Occasionally Shadows are ordered with 3·50 × 19in. front and 4·00 × 18in. rear tyres. These are suitable for rough conditions, but lower the maximum speed a little, partly because the 4·00 × 18 tyre has a slightly larger circumference than the standard size, giving the equivalent of a slightly higher gear ratio, and the larger sections detract a little from the superlative handling of the machine. For serious racing we recommend the use of a 3·00 × 21in. front tyre and a 3·50 × 20in. rear tyre, preferably fitted to the light alloy wheels as supplied with Black Lightnings. The increased diameter permits greater cornering angles, but, of course, some variation in sprocket size may be necessary, according to the type of circuit, as indicated in Chapter II.

After engine No. 1B/7076 the 7·2 Bottom Gear is fitted to special order only.



By courtesy of "Motor Cycling"

THE "VINCENT" REAR SUSPENSION
British Patent No. 424644

CHAPTER X

The Black Lightning

Being, like the Black Shadow, developed from the Rapide, practically all the running adjustments and maintenance hints given in this book apply equally to both. The Lightning is, however, intended purely as a racing and record-breaking mount, and is therefore equipped with open twin exhaust pipes, large-bore racing carburettors, cams giving greater overlap and higher lift, triple valve springs, highly polished 85-ton Vibrac Steel con-rods, a modified gearbox, rearwardly-placed footrests and control pedals, rev-counter, racing saddle and 27in. diameter racing tyres fitted to wheels with light alloy rims and with ribbed brake drums and ventilated magnesium-alloy brake plates. Being only built to order, variations may occur in the specification, particularly as regards compression ratio, gear ratio, wheel size and footrest layout. Normally, no lighting set is fitted, but it is possible to do so for events entailing night riding. The following notes explain the special features and adjustments, but we assume that anyone purchasing a Black Lightning already has a considerable knowledge of the meticulous care and attention which every racing machine deserves —and must get if it is to perform well.

Controls

Lever on L.H. bar controls advance of the " Lucas " racing magneto, type KVFTT. Moving lever forward, *i.e.*, slackening cable, advances the ignition ; ignition range is 24 deg. crankshaft. Double levers on R.H. bar operate the mixture controls on the T.T. type Amal carburettors.

Gear change pedal mounted on offside footrest support plate and connected to gearbox by a link. The position of the pedal, also the direction of change (*i.e.*, up for " up " or up for " down ") can be varied over a very wide range by placing the pedal pivot in any of the numerous holes provided, varying the length of the link by screwing the ends in or out, or by altering the position of the arm on the lever by first loosening the 9/16in. nut on the pedal sleeve and retightening the nut after obtaining the correct position. The aim should be to have the pedal-arm and the arm on the gearbox approximately parallel to each other and square to the link when the mechanism is in the centralized position.

The brake-pedal can be similarly adjusted over a very wide range ; it may be necessary to fit the cable-stop in an appropriate hole to make the run of the cable as smooth as possible.

The footrests can also be adjusted over a wide range, and it is very advisable to spend some time experimenting to find the combination of footrest and pedal positions which is most suitable for the kind of racing in view.

Lubrication

The most suitable grade of oil also depends upon the kind of racing. For sprints and short-circuit racing where the engine has to be push-started, the grade of oil recommended for temperate summer conditions can be used, but for long distance racing or record-breaking, the grades of oil recommended for tropical conditions should be employed. Engines are run in at the works with mineral oil, and should the rider prefer to use a castor-base oil, the following procedure must be adopted. Drain engine, filter chamber, gearbox, chain case and oil tank thoroughly, preferably with the machine hot and the oil consequently thin. Refill filter chamber with the castor oil, pour a little down each rocker inspection cap, pour 2 pints into oil tank and reconnect oil feed pipe when oil is seen issuing from the lower banjo. Pour $\frac{1}{2}$-pint into chain-case, and 2 pints into gearbox. Start up engine, and run under power gently for about ten miles to circulate the oil thoroughly. Again drain the engine, tank and chain case, but there is no real need to drain the gearbox again. Refill the engine, chaincase and oil tank properly, and the change-over is completed. Similar precautions are necessary if at any time the engine is changed back from castor to mineral oil.

Compression Ratios

Lightnings are generally supplied with E7/11 pistons, giving approximately 13 to 1 compression ratio ; the actual ratio may vary slightly, being more often below this figure than above it. Fuel composed of 80% dry blending methyl alcohol (Methanol), 10% benzole, 10% petrol with $\frac{1}{2}$% Castor Racing Oil or equivalent added as a lubricant, works very well with this ratio, giving a good combination of high power, good flexibility and easy starting. Any of the pistons listed in Chapter II can be used if it is not possible to employ alcohol fuel, but naturally the carburettor tuning and the ignition advance will need to be altered to suit.

Carburation.—Machines built prior to 1950 were fitted with either $1\frac{5}{32}$in. or $1\frac{3}{16}$in. type 10 T.T. Amal carburettors ; the size is stamped on the side at the base of the air-slide housing. The size of the bore in the region of the jet is $1\frac{3}{16}$in. in both cases, and it is easy to modify the smaller size by carefully reaming or boring out the body on the engine side of the mixing chamber to $1\frac{3}{16}$in. ; naturally, the adaptors will need to be opened out to match, though they are already $1\frac{3}{16}$in. at their junction with the inlet port. Later, 32 mm. (1·260) carburettors were only available ; these fit on special adaptors, Part No. ET32/4 front, ET 32/5 rear, with the inlet ports opened out to suit.

For 80/10/10 alcohol blend, the average setting for $1\frac{5}{32}$ or $1\frac{3}{16}$ carburettors is :—

Main jet 1600–1800.

Needle jet ·120in. diameter.

Throttle valve No. 8.

It is not possible to quote any hard-and-fast main jet size, but it should be remembered that with alcohol over-richness on full throttle does not diminish speed much, but lean mixtures will rapidly burn holes in piston crowns without any preliminary warning. Therefore, it is wise to start off with very large jets and reduce them if found to be too large. Great care must also be taken to see that the flow of fuel to the float chambers is not obstructed at any point.

Some riders prefer to use a blend containing less alcohol. E7/10 pistons giving approx. 10½ to 1 C.R. can be used with fuel containing 1/3 methanol, 1/3 benzole, 1/3 petrol. For such fuel, use ·113in. diam. needle jets and main jets approximately 1,000, depending, of course, on the precise blend of fuel and atmospheric conditions.

For petrol-benzole or petrol the needle jet should be decreased to ·113in., main jets to 380 approximately. The needle jet is screwed into the upper end of the main jet holder, and the size of jet is stamped on one flat of the hexagon. The importance of increasing the needle jet size when large mains are fitted is sometimes not fully appreciated.

No throttle stops are fitted on 10 TT carbs., and hence the slow running and synchronizing must all be done by adjusting the cable lengths in the manner described for standard Rapides. As a commencement, carefully set the cables so that both slides are just commencing to open absolutely simultaneously.

The pilot jet mixture strength is adjusted by turning the knurled screws anti-clockwise to richen, clockwise to weaken—that is, the reverse way to standard carburettors. As a commencement, about two turns open is about right, but this varies widely from engine to engine.

Tuning.—As despatched from the works, the carburation should be approximately correct for the fuel specified when ordering. The first thing to do is start up the machine, run for a few minutes to get it thoroughly warm, and then adjust the pilot jets and cables to obtain a reasonably good tick-over. It is, however, difficult—neither is it necessary—to attain slow running as steady and slow as on a touring machine, particularly with alcohol fuel. Next, check by slowly opening the throttle that the engine accelerates clearly and equally on both cylinders ; if there is misfiring accompanied by black exhaust smoke, the throttle cut-away is insufficient, but if spitting-back occurs, the cutaway is too great. At this juncture the mixture control levers can be employed to enrich the mixture ; if this cures the spitting, a lower cut-away is definitely required.

Having obtained a good tick-over and low-speed acceleration, the main jet size can next be determined by running at full throttle over a route long enough for maximum power to be maintained for at least twenty seconds, or by lapping as fast as possible on the race circuit.

A rough indication can be obtained by closing the air levers ; if the revs. increase, the jets are too small, but if the jets are too big the revs. will drop and the engine will sound "woolly" and probably misfire as soon as the levers are closed slightly. Roughly speaking, the difference in mixture strength between levers fully open and fully closed is equivalent to about four jet sizes.

The only reliable indication of mixture strength is, however, that obtained by observing the condition of the sparking plugs following a burst at maximum speed. The method is to hold maximum for as long as possible, then snap the throttle shut, lift the clutch, making sure the engine has stopped completely, snick into neutral and stop. It is essential that the engine does not continue to fire or to be motored over by the transmission after it has been shut off. Remove the plugs and, if the mixture is correct, the combustion faces should have a jet-black polished appearance, if sooty the mixture is too rich and if greyish or white or if whiskers can be seen on the points, the mixture is too lean. " Reading " plugs is more a matter of experience and cannot really be described in words. In a long-distance event it is wise to use jets one size larger than those indicated by the plugs, if the original " reading " has been obtained after only a short burst of speed. Occasionally it is found that different jet sizes are required for each cylinder.

If increasing the jet size does not appear to be having any effect, examine the fuel system, float chambers and air-vent to the tank, and if everything is clear increase the needle jet size.

Ignition Timing.—For alcohol fuel at 13 to 1 C.R. advance is 34°, for 70–75 octane petrol at 7·3 to 1 C.R., 39°. The correct advance for other C.R.s and fuels varies between these limits, and must be set to suit local fuel and atmospheric conditions ; for instance, at high altitudes where air pressure is low, a greater advance is necessary. The correct amount can be gauged by the ignition lever ; with the engine at maximum speeds, and full throttle, retard slightly and observe the rev. counter. If the revs. increase, the advance is too great ; if they decrease, the advance is insufficient. Having determined the best setting by the lever, finally re-time the magneto to give the correct advance with the lever at full advance. Do not run with the magneto partially retarded, as it may work into full advance later, and over-advance is very likely to cause damage to the engine.

Plugs.—Use Champion **N**A14 or equivalent in other makes for alcohol at 13 to 1. NA12 can be used for short circuit work on petrol, but in general use the hardest plugs which will function without danger of oiling-up. Always warm up on soft plugs and fit new or reconditioned plugs just prior to going to the starting line.

Maximum Revs.—6,500 r.p.m. can be used for short periods, but it is wise to keep below 6,200 for long periods. Generally speaking, the higher the revs. the greater the risk of some mechanical defect arising.

Gearing.—Standard solo gear is 3·27 obtained by a 45-tooth rear sprocket and 22-tooth gearbox sprocket (*i.e.*, one tooth larger than the Rapide). On this ratio the engine does 2,490 revs. per mile with 27in. diameter tyres, equivalent theoretically to 150 m.p.h. at 6,200 r.p.m. Surface conditions may not result in this speed being obtained, and it may be necessary to gear higher in some circumstances to allow for tyre slip. 44-, 42- and 40-tooth sprockets are available, but to fit them the right-hand brake gear must be removed and the sprocket with adaptor H57 bolted to the hub in place of the brake drum, by 10 bolts 5/16in. × 2½in. long.

For circuit racing or sidecar work lower ratios will be necessary, and are obtained in the usual way by fitting a larger rear sprocket. The lowest gear obtainable by this means is 4·36 with a 60-tooth sprocket, and if this is too high, it will be necessary to change the gearbox sprocket, which is obtainable with 21, 19 or 18 teeth, although the smallest should only be employed as a last resort, and then only in conjunction with a 56-tooth rear sprocket, as otherwise the chain will foul the lug on the gearbox. The following table gives the ratios obtainable with the various sprocket sizes :

Rear Sprockets	Gearbox Sprockets				
	18-T	19-T	20-T	21-T	22-T
40				3·04	2·9
42				3·19	3·05
44				3·34	3·19
45				3·43	3·27
46				3·5	3·34
47				3·58	3·42
48				3·63	3·47
49				3·73	3·56
50				3·82	3·64
52				3·96	3·78
54				4·1	3·92
56	4·95	4·7	4·46	4·26	4·06

Where no ratio is shown in the table this combination of sprockets must **NOT** be used except in special installations where the rear sprocket is mounted close up to the gearbox.

The following table gives an indication of the ratios to use for various events, but the ideal ratio must depend upon the condition of the course, the calibre of the rider and the fuel employed.

Event.	Ratio.
Short sprints, standing start	3·5–4·0
Long distance races over 90 m.p.h. average	3·4–
Short circuit races, 70 m.p.h. average	3·8–4·0
Short circuit races, 60 m.p.h. average	4·1–4·3

Gearbox Ratios.—The ratios in the box are 1, 1·19, 1·61, 2·07, the same as on the early Black Shadow, but top and third gears have modified engaging dogs, giving much greater backlash and a more certain change. The gears employed are G6/2 constant mesh pinion, G11/3 double gears, G12/1 third gear pinion, and although they are identical with the corresponding gears in the Shadow box, except for the dogs, any of the gears just mentioned must never be run in conjunction with any of the Shadow gears; in other words, if, say, the double gear has to be replaced, the Shadow double gear G11/2 must *not* be used unless the G6 and G12 pinions are also changed. The gears on the layshaft are, however, identical in both boxes.

CHAPTER XI

SPARES, ACCESSORIES AND SERVICE

The manufacturer of motorcycles is forced, by economic considerations, to produce his machines to a standard design, and it is very frequently found that a particular feature which is highly praised by some riders is condemned by others.

Owners of our machines, therefore, being among the most discerning of motorcyclists, frequently like to amend the specification of their models to suit their own requirements, and a number of items listed below are designed to assist such modifications.

Racing Equipment

(1) *Brake Shoe Plates.*—Of cast elektron, result in improved stiffness and braking, considerable weight saving. Front plates fitted with air scoops.

(2) *Alloy Rims.*—Used for road racing or high-speed touring, achieve appreciable saving of weight. Available only in 3·00in. × 21in. (Front) and 3·50in. × 20in. (Rear) sizes.

(3) *Revolution Counter.*—Can be supplied, with drive gear, but this is *only* available for use with manually controlled racing magneto.

(4) *Racing Carburettors.*—Fitting of these instruments necessitates special adaptors, and the Inlet Ports must be increased in diameter, and polished if full increase in power is to be obtained.

It must be noted that the standard battery and its carrier have to be moved (on 1000 c.c. models) in order to fit these instruments.

(5) *Footrest Plates.*—Racing Plates, of polished light alloy, achieve weight saving and greater variety of rear footrest positions than available with the standard pattern.

(6) *Gearchange Equipment.*—Black Lightning pattern is available for racing twin model owners using the rearward footrest position.

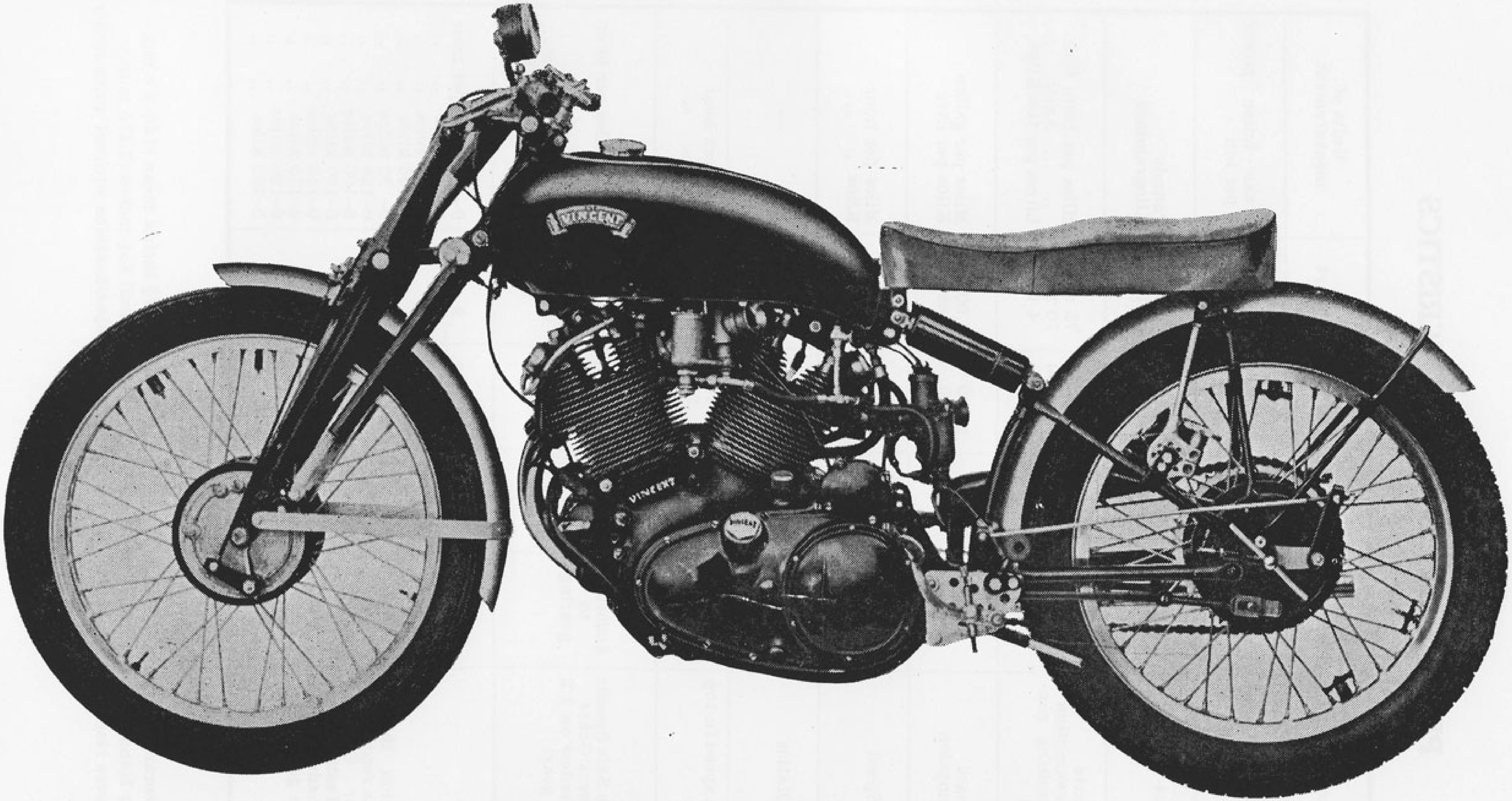
Touring Equipment

(1) *Crash Bars.*—Specially designed to suit our unique type of frameless construction, this equipment was originally provided for Police use and the availability to the ordinary rider will be announced from time to time.

(2) "*Cow-horn*" *Handlebars.*—A special handlebar bend is available to suit the requirements of the rider who prefers a more erect riding position than usual, and who does not frequently use the extremely high speeds of which our machines are capable.

Literature

(1) *Spares List.*—Owners who are interested in the technical details of their machines are advised to obtain this book which is lavishly illustrated with "exploded" views of the engine and various sub-assemblies.



THE SERIES "C" BLACK LIGHTNING

PERFORMANCE CHARACTERISTICS

Characteristic	Black Lightning	Black Shadow	Standard Rapide	Comet	Units of measurement
Power to Weight Ratio	480	280	222	150	Brake - horse power per ton
Dry weight	380 172	458 207	455 206	390 176	Pounds Kilogrammes
Approximate Petrol Consumption (normal touring conditions)	— — —	55 to 65 50 to 60 5 to 6	55 to 65 50 to 60 5 to 6	75 to 80 70 to 75 4 to 5	Miles per Imp. Gall. ,, ,, Amer. ,, Litres per 100 Kilos
Approximate Oil Consumption	— —	1,500 500	1,500 500	2,000 650	Miles per gallon Kilos per litre
Cruising Speed	— —	100 160	85 136	65 104	Miles per hour Kilos ,, ,,
Gearbox Ratios	1, 1·19 1·61, 2·07	1, 1·19 1·61, 2·07	1, 1·19 1·61, 2·60	1, 1·26 1·69, 2·67	—
Minimum speed in top gear	— —	18 29	18 29	19 31	Miles per hour Kilos ,, ,,
Maximum Safe Speeds in Indirect Gears (Black Shadow on 7·2 bottom gear)	According to gearing	110 85 65 175 136 104	96 80 50 154 127 80	77 55 38 123 88 60	3rd, 2nd, 1st } miles per hour 3rd, 2nd, 1st } kilos per hour
Acceleration through gears as recorded in "Motor Cycling" Road Tests (Black Shadow on 7·2 bottom gear)	Not yet tested	3½ secs. 6½ ,, 10 ,, 21 ,, 31 ,, 44 ,,	1½ secs. 6 ,, 12 ,, 24 ,, 35 ,, —	3 secs. 9½ ,, 21 ,, — — —	0– 30 miles per hour 0– 48 kilos ,, ,, 0– 60 miles ,, ,, 0– 96 kilos ,, ,, 0– 80 miles ,, ,, 0–128 kilos ,, ,, 0–100 miles ,, ,, 0–160 kilos ,, ,, 0–110 miles ,, ,, 0–175 kilos ,, ,, 0–120 miles ,, ,, 0–192 kilos ,, ,,

DIMENSIONS

Ground Clearance 6 inches (150 m.m.). Wheelbase 57¾ inches mean (146.5 c.m.).
Width over Handlebars 25½ inches (650 m.m.). Length Overall 85½ inches (2,175 m.m.).

Manufacturers reserve the right to effect alterations to the specifications without prior notice.