Workshop manual 250/500 cm³ models 1971

Publication
Ref. No. 00-41

Workshop manual

250 cm³ & 500 cm³ models

B25SS	**Gold Star**
B25T	**Victor**
B50SS	**Gold Star**
B50T	**Victor**
B50MX	**Victor**

B.S.A. Motor Cycles Limited
Registered Office and Works:
Armoury Road, Birmingham B11 2PX.
Telephone: 021 772 2381. *Telex:* 33315
Telegrams and Cables:
"Selmoto" Birmingham

Printed in England at
B.S.A. Press

May, 1971

Please Note!

Replacement parts or accessories must be of B.S.A. origin or as approved by B.S.A. Motor Cycles Ltd.

In this respect your attention is drawn to the Terms and Conditions of B.S.A. Guarantee.

BSA GOLD STAR 250 SS

BSA GOLD STAR 250 SS (U.S.A.)

BSA VICTOR 250

BSA GOLD STAR 500 SS

BSA VICTOR 500

BSA VICTOR MX 500

Introduction

This manual has been compiled to provide comprehensive service information for the B.S.A. owner and for the workshop fitter wishing to carry out either basic maintenance or major repair work. It is written in great detail, but because of the specialised skills and equipment required to carry out some of the work described, the inexperienced owner is strongly advised to consult his dealer whenever he is in doubt as to his own ability to carry out a satisfactory job.

The manual is divided into sections dealing with the major assemblies and these are sub-divided into the individual operations required for maintenance and repair. It is hoped that by using this arrangement, the manual will be found most useful as a quick work of reference even to the skilled mechanic.

All information and data given in this manual is correct at the time of publication but because of our policy of constant development, changes in specification are inevitable. Anyone finding this manual to be at variance with the machine in his possession is advised to contact the Service Department, where up-to-date information will be quickly provided.

ENGINE AND FRAME NUMBERS

Both engine and frame numbers, together with prefix and suffix letters, must be quoted in full on any correspondence relating to the machine or on any enquiry regarding this manual, to either the dealer or the Service Department.

The engine number ("A") is stamped on the left-hand side of the crankcase immediately below the cylinder base. The frame number ("B") is stamped on the prop-stand lug, or, on later models, on the left side of the steering head.

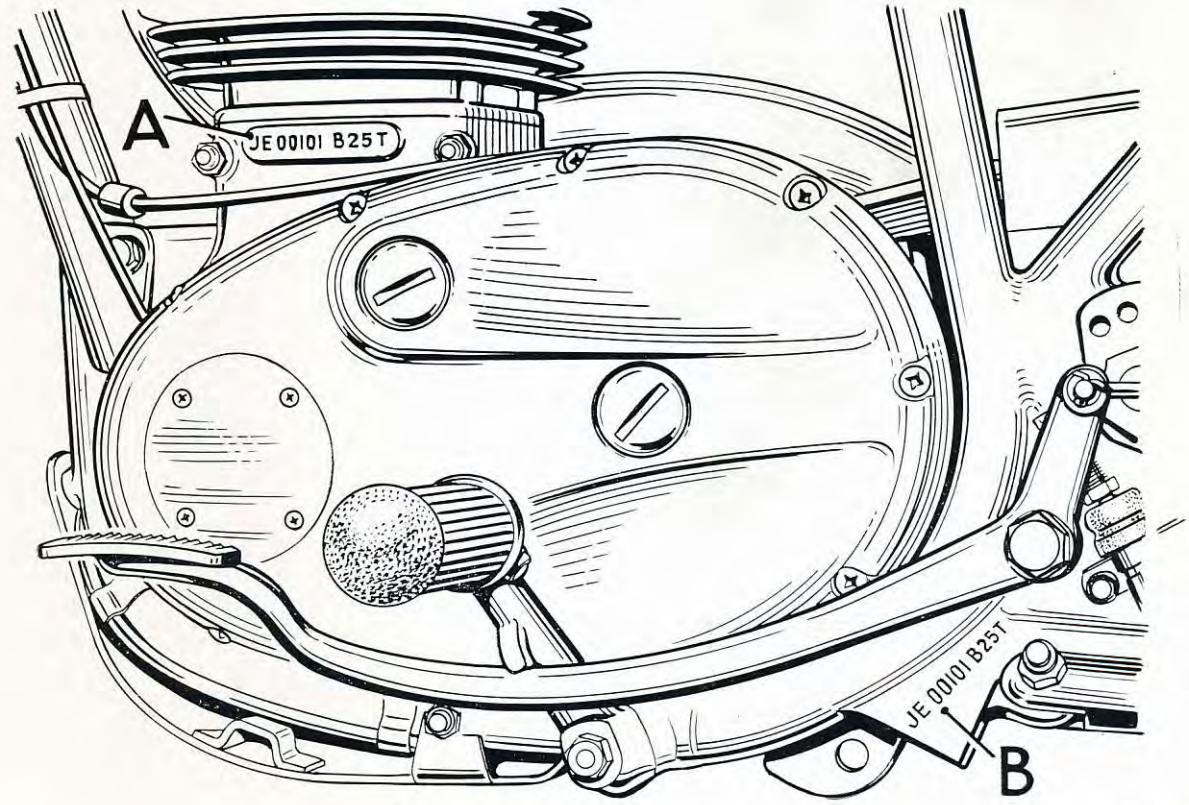


FIG. 1. *Engine and frame numbers.*

Factory Service Arrangements

(UNITED KINGDOM)

REPLACEMENT PARTS

Replacement parts are distributed through a national network of B.S.A. dealers, each of whom holds a stock of fast moving parts. These dealers have been selected for appointment as specialist replacement part stockists and each holds a comprehensive stock of replacement parts.

A complete list of appointed stockists is printed at the end of this manual, and also in every parts list.

GUARANTEE CLAIMS

In the interests of all concerned it is best that any owner of a new motor-cycle wishing to claim assistance under guarantee should do so through the dealer from whom his machine was purchased. All B.S.A. dealers are familiar with the procedure designed to give quick service to any owner of a B.S.A. motor-cycle who may find himself in difficulty.

REPAIRS

Most appointed B.S.A. dealers are able to carry out major repair work, and owners are asked to make all repair arrangements through their chosen dealer.

In the great majority of cases local repair will be possible and this will avoid the expense, inconvenience, and possibility of the machine being damaged in transit to or from the works.

Should your dealer decide that Service Department attention is required he will know how to make suitable arrangements with the factory. It is important to remember that a machine cannot be accepted at the works without prior appointment. Appointments may be made either by letter or telephone.

TECHNICAL ADVICE

B.S.A. Service Department staff are experienced in dealing with technical problems of all kinds and will be pleased to help in the event of difficulty. The correct address of the Service Department is as follows:—

B.S.A. MOTOR CYCLES LIMITED,
SERVICE DEPARTMENT,
ARMOURY ROAD,
BIRMINGHAM, B11 2PX.
Telephone: 021-772 2381.

WORLD SERVICE ARRANGEMENTS

In most markets of the world, B.S.A. have an appointed distributor to whom all service enquiries should be addressed.

These distributors are listed at the back of this manual, and also in all parts lists.

PROPRIETARY PARTS

Equipment not of our manufacture which is fitted to our motor-cycles is of the highest quality, but guaranteed separately by the manufacturer concerned. Any complaint or repair should be addressed to the manufacturer or his accredited agent who will give every possible assistance.

CARBURETTERS	Amal Limited, Holdford Road, Witton, BIRMINGHAM 6.
CHAINS	Renolds Chains Limited, Renold House, Wythenshawe, MANCHESTER.
ELECTRICAL EQUIPMENT	Joseph Lucas Limited, Gt. Hampton Street, BIRMINGHAM 18.
REAR DAMPERS	Girling Limited, Birmingham Road, WEST BROMWICH, Staffordshire.
SPARKING PLUGS	Champion Sparking Plug Co. Ltd., FELTHAM, Middlesex.
SPEEDOMETERS	Smith's Motor Accessories Limited, Cricklewood Works, LONDON N.W.2.
TYRES	Dunlop Company Limited, Fort Dunlop, BIRMINGHAM 24.

U.S.A. SERVICE ARRANGEMENTS

REPLACEMENT PARTS

Replacement parts are available through a network of B.S.A. dealers covering the entire United States. These dealers are listed under "Motorcycles" in the yellow pages of your telephone directory. All requests for parts must be made through franchised B.S.A. dealers; they are not sold direct to owners by the two factory branches.

GUARANTEE CLAIMS

In the interests of all concerned the owner of a new motor-cycle wishing to claim assistance under guarantee must do so through the dealer from whom his machine was purchased.

REPAIRS

B.S.A. dealers are capable of servicing and repairing B.S.A. motor-cycles; ask your dealer to help when repairs are needed.

Labour time will be greatly reduced if proprietary articles, such as legshields, crash bars, carriers or fibre-glass fairings are removed before handing the machine over for repair. Accessories such as mirrors or badges should always be removed before entrusting a machine to an independent carrier.

TECHNICAL ADVICE

The B.S.A. Service Department staff at the two U.S.A. factory branches are experienced in dealing with technical questions of all kinds and will be pleased to help in the event of difficulty.

The factory branch addresses are shown below:—

EASTERN: The Birmingham Small Arms Company Incorporated,
B.S.A. Sales Division,
P.O. Box 6790,
Towson,
Baltimore,
Maryland 21204.

WESTERN: The Birmingham Small Arms Company Incorporated,
B.S.A. Sales Division,
P.O. Box 337,
Duarte,
California 91010.

In all communications the engine and frame numbers with prefix and suffix letters and figures must be quoted as well as the year and model of the motor-cycle in question.

B.S.A. DEALER PRE-DELIVERY SERVICE

The following tasks must be completed before making delivery of a new B.S.A. motor cycle:—

(1) CHECK CLEANLINESS AND CORRECT SPARK PLUG GAP.

(2) CHECK AND ADJUST TYRE PRESSURES.

(3) CHECK ALL EXTERNAL NUTS AND BOLTS FOR SECURITY.

(4) FILL AND CHARGE BATTERY IN ACCORDANCE WITH FOLLOWING INSTRUCTIONS.

(5) CHECK ALL LIGHTS AND HORN.

(6) CHECK AND CORRECT IF NECESSARY ALL OIL LEVELS.

(7) CHECK, ADJUST AND LUBRICATE CONTROLS AND CABLES.

(8) APPLY GREASE AT ALL GREASE POINTS.

(9) TEST MACHINE ON ROAD TO ENSURE FULL ROAD WORTHINESS.

(10) REPORT ANY PROBLEMS TO B.S.A. SERVICE DEPARTMENT *BEFORE DELIVERY.*

(11) SIGN AND RETURN PRE-DELIVERY CHECK CARD.

Failure to carry out these checks or to sign and return the pre-delivery check card will nullify arrangements for the payment of guarantee labour costs.

BATTERY

The battery is supplied in a dry-charged condition and must not be filled unless it is known that the machine is to be sold within a few days.

To fill and charge the battery

All plates in the battery have been charged fully and dried completely by special process. The tape across the vent holes prevents the ingress of moisture or air and insures perfect condition of the plates during transportation and storage. This tape must only be removed immediately before the battery is brought into service.

Dilute sulphuric solution S.G. 1.260 is be prepared by slowly pouring one part of concentrated sulphuric acid into three parts of distilled water (by volume) or of S.G. 1.210 by adding one part of concentrated sulphuric acid to four parts of distilled water (by volume). **It is most important to add acid to water,** not water to acid due to the violence of the chemical reaction involved.

A glass, earthenware or lead vessel should be used and the mixture well stirred. Allow to cool to the temperature of the surrounding atmosphere before use.

Important:—With dry-charged batteries the filling of each cell with acid must be completed in one operation and levels restored after standing by syphoning off excess acid.

Fill each cell with dilute sulphuric acid to the "maximum" line at one operation. The temperature of the acid and battery must be between 60°F. (15·5°C.) and 80°F. (27°C.) (see chart).

	TEMPERATE Climates ordinarily below 90°F. (32°C.) shade temperature	TROPICAL Climates frequently above 90°F' (32°C.) shade temperature
Specific gravity for filling new cells	1·260 (at 60°F., 15·5°C.)	1·210 (at 60°F., 15·5°C.)
Specific gravity at completion of charge to be adjusted if necessary, to be between ..	1·220 and 1·300 (at 60°F., 15·5°C.)	1·210 and 1·230 (at 60°F., 15·5°C.)

(1) Batteries which have been stored at a lower temperature than 60°F. (15·5°C.) should have their temperature raised before filling by allowing the battery to stand in a warm room until it attains room temperature.

(2) Batteries used under these conditions are up to 90 per cent charged, but if time permits a freshening charge of four hours at 1·0 ampere is beneficial. If the acid level rises after the freshening charge restore the correct level by syphoning off excess acid.
of four hours at the normal recharge rate would be beneficial. If the acid level rises after this freshening charge restore levels by syphoning off excess acid.

Important:—On no account should the battery be topped-up to the separator guard, but only to the "maximum" line.

CONTENTS

Because the engine and transmission of the B25 and the B50 models are of different specification, it is necessary to divide data into two sections, one for each model. All other data is applicable to both models

INDEX

B25 ENGINE

CARBURETTER

Type	Amal Concentric 928/20	
Main jet	200	
Needle jet	·106	
Needle position	1	
Throttle valve	3½	
Choke diameter	28 mm.	
Throttle slide return spring free length	2·5″	(6·4 cm.)

VALVES

Seat angle	45°	
Head diameter (inlet)	1·450″ —1·455″	
Head diameter (exhaust)	1·312″ —1·317″	
Stem diameter (inlet)	·3095″— ·3100″	
Stem diameter (exhaust)	·3090″— ·3095″	

VALVE GUIDES

Material	Hidurel 5	
Bore diameter	·3120″— ·3130″	
Outside diameter	·5005″— ·5010″	
Length	1·844″	
Interference fit in head	·0015″— ·0025″	
Counterbore in exhaust guide	·323″ — ·326″ × ·12″ deep	

VALVE SPRINGS

Free length (inner)	1·40″	(35·5 mm.)
Free length (outer)	1·75″	(44·5 mm.)
Fitted length (inner)	1·26″	(32·0 mm.)
Fitted length (outer)	1·37″	(34·8 mm.)

VALVE TIMING

Tappets set to ·015″ (·381 mm.)
for checking purposes only:—

Inlet opens	B.T.D.C.	51°
Inlet closes	A.B.D.C.	68°
Exhaust opens	B.B.D.C.	78°
Exhaust closes	A.T.D.C.	37°

CAMSHAFT

Journal diameter, left and right	·7480″— ·7485″
Cam lift (inlet)	·345″
Cam lift (exhaust)	·336″
Base circle radius	·906″
Bush bore diameter, fitted	·7492″— ·7497″
Bush outside diameter, left and right hand	·908″ — ·909″

TAPPETS

Stem diameter	·3735″— ·3740″
Clearance in crankcase	·001″

SPARK PLUG

Type	Champion N3
Gap setting	·020″ — ·025″ (·50—·65 mm.)
Thread	14 mm.

IGNITION TIMING

Piston position fully advanced B.T.D.C.	·342″ (8·68 mm.)
Crankshaft position fully advanced B.T.D.C.	37°
Contact breaker gap setting	·015″ (·38 mm.)

CYLINDER HEAD

Inlet port size	1·125″
Exhaust port size	1·25″
Material	Aluminium alloy LM4 with integral cast iron valve seats

CYLINDER BARREL

Bore diameter (standard)	67 mm.
Oversizes	·020″ and ·040″ (·5 and 1·0 mm.)
Material	Aluminium alloy LM4 with austenitic iron liner

PISTON

Compression ratio	10· : 1 (alternative 8·5 : 1, Fleetstar only)
Clearance (top of skirt)	·0042″— ·0053″
Clearance (bottom of skirt)	·0025″— ·0028″
Gudgeon pin hole diameter	·6884″— ·6886″
Material	Aluminium alloy H.G.413

PISTON RINGS

Width (top and centre)	·101″ — ·107″
Width (scrapers)	·101″ — ·107″
Depth (top and centre)	·0615″— ·0625″
Depth (scraper)	·124″ — ·125″
Clearance in groove (all rings)	·001″ — ·003″
Fitted gap (all rings)	·009″ — ·013″
Material (all rings)	Cast iron H.G. 22

OIL PUMP

Type	Double gear	
Drive ratio	1 : 4	
Non-return valve spring free length	·5″	(12·7 mm.)
Non-return valve spring ball diameter	·25″	
Pressure release valve blow-off pressure	80–100 lbs. p.s.i.	(5·6–7·0 kg./sq. cm.)
Pressure release valve spring free length	1·37″	(34·8 mm.)
Pump body material	Cast iron	

CONNECTING ROD AND CRANKSHAFT ASSEMBLY

Connecting rod small end eye diameter	·6890″— ·6894″
Connecting rod big end eye diameter	1·5630″—1·5635″
Connecting rod length between centres	5·312″
Crankshaft big end journal diameter	1·4375″—1·4380″
Regrind undersizes	·010″, ·020″, ·030″ (·25, ·50, ·76 mm.)
Crankshaft diameter (left and right)	·9841″— ·9844″
Big end journal running clearance	·0005″— ·0015″
Crankcase main bearing (roller, left)	·875″×2·0″×·5625″ (Hoffmann R325L)
Crankcase main bearing (ball, right)	·875″×2·0″×·5625″ (Hoffmann 325)

CLUTCH

Type	Multiplate with integral cush drive	
Number of friction plates	5	
Number of plain plates	5	
Overall thickness of friction plate	·167″	(4·2 mm.)
Free length of springs	1·66″	(42·0 mm.)
Clutch pushrod length	9·0″	(22·9 cm.)
Clutch pushrod diameter	·1875″	
Clutch rollers	25 off, ·1875″×·1875″	

GEARBOX

Type	4 speed, constant mesh
Layshaft bearings (needle roller)	·5″×·625″×·8125″ (Torrington B108)
Mainshaft bearing (left)	30×60×16 mm. (Hoffmann 130)
Mainshaft bearing (right)	·625″×1·5625″×·4735″ (Hoffmann LS7)
Layshaft diameter (left and right)	·6245″— ·6250″
Mainshaft diameter (left)	·7485″— ·7490″
Mainshaft diameter (right)	·6245″— ·6250″
Sleeve pinion inside diameter	·752″ — ·753″
Sleeve pinion outside diameter	1·179″ —1·180″

GEAR RATIOS

	B25SS, B25T
Gearbox:	
Top..	1·00
Third	1·24
Second	1·64
First	2·65

Overall:	B25SS	B25T
Top..	6·92	7·35
Third	8·60	9·14
Second	11·35	12·06
First	18·33	19·48

SPROCKET SIZES (TEETH)

	B25SS	B25T
Engine	23	23
Clutch	52	52
Gearbox..	17	16
Rear Wheel	52	52

CHAINS

Primary Chain (all models)		
Pitch	·375″	(9·53 mm.)
Roller diameter	·250″	(6·35 mm.)
Distance between plates	·225″	(5·72 mm.)
Length	70 links	
Breaking load	3,900 lbs.	(1770 Kg.)
Type	Renolds 114 038 Duplex endless	
Rear chain:		
Pitch	·625″	(15·88 mm.)
Roller diameter	·400″	(10·16 mm.)
Distance between plates	·255″	(6·48 mm.)
Length	106 links (B25SS)	107 links (B25T)
Breaking load	5,000 lbs.	(2268 Kg)
Type	Renolds 110 054	

B50 ENGINE

CARBURETTER (EXCEPT MOTOCROSS)

Type	Amal Concentric 930/62	
Main jet	200	
Needle jet	·106	
Needle position	1	
Throttle valve	3½	
Choke diameter	30 mm.	
Throttle slide return spring free length	2·5″	(6·4 cm.)

CARBURETTER (MOTOCROSS ONLY)

Type	Amal Concentric R932/18	
Main jet	250	
Needle jet	·106	
Needle position	2	
Throttle valve	3	
Choke diameter	32 mm.	
Throttle slide return spring free length	2·5″	(6·4 mm.)

VALVES

Seat angle	45°	
Head diameter (inlet)	1·750″ —1·755″	
Head diameter (exhaust)	1·526″ —1·531″	
Stem diameter (inlet)	·3100″— ·3105″	
Stem diameter (exhaust)	·3095″— ·3100″	

VALVE GUIDES

Material	Phosphor-bronze	
Bore diameter	·3120″— ·3130″	
Outside diameter	·5005″— ·5010″	
Length	1·859″	
Interference fit in head	·0015″— ·0025″	
Counterbore in exhaust guide	·323″ — ·326″ × ·12″ deep	

VALVE SPRINGS

Free length (inner)	1·50″	(38·1 mm.)
Free length (outer)	1·67″	(42·4 mm.)
Fitted length (inner)	1·22″	(31·0 mm.)
Fitted length (outer)	1·31″	(33·3 mm.)

VALVE TIMING

Tappets set to ·015″ (·38 mm.) for checking purposes only:—

	B50SS, B50T	B50MX
Inlet opens B.T.D.C.	51°	63°
Inlet closes A.B.D.C.	68°	72°
Exhaust opens B.B.D.C.	78°	80°
Exhaust closes A.T.D.C.	37°	55°

CAMSHAFT

Journal diameter, left to right	·7480″—·7485″	
Cam lift (inlet)	·345″ (·355″ B50MX)	
Cam lift (exhaust)	·336″ (·355″ B50MX)	
Base circle radius	·906″	
Bush bore diameter, fitted	·7492″—·7497″	
Bush outside diameter, left and right	·908″ —·909″	
Tappet clearance (inlet)	·008″	(·20 mm.)
Tappet clearance (exhaust)	·010″	(·25 mm.)

SPARK PLUG

Type	Champion N4	(N3, B50MX only)
Gap setting	·020″ —·025″	(·50—·65 mm.)
Thread	14 mm.	

IGNITION TIMING

Piston position fully advanced B.T.D.C.	·385″	(9·78 mm.)
Crankshaft position fully advanced B.T.D.C.	34°	
Contact breaker gap setting	·015″	(·38 mm.)

CYLINDER HEAD

Inlet port size	1.20″
Exhaust port size	1.625″
Material	Aluminium alloy LM4 with cast iron valve seats

CYLINDER BARREL

Bore diameter (standard)	84 mm.	
Oversizes	·020″ and ·040″	(·5 mm. and 1·0 mm.)
Material	Aluminium alloy LM4M with austenitic iron liner	

PISTON

Compression ratio	10 : 1
Clearance (top of skirt)	·005″ —·007″
Clearance (bottom of skirt)	·0035″—·0045″
Gudgeon pin hole diameter	·7499″—·7501″
Material	Aluminium alloy H.G. 413

PISTON RINGS

Width (top and centre)	·127″ —·134″	
Width (scrapers)	·138″ —·145″	
Depth (top and centre)	·0615″—·0625″	
Depth (total, scrapers)	·1550″—·1560″	
Clearance in groove (all rings)	·001″ —·003″	
Fitted gap (all rings)	·016″ —·024″	(·40—·60 mm.)
Material (all rings)	Cast iron H.G. 22	

OIL PUMP

Type	Double gear	
Drive ratio	1 : 4	
Non-return valve spring free length	·5″	(12·7 mm.)
Non-return valve spring ball diameter	·25″	
Pressure release valve blow-off pressure	80-100 lbs. p.s.i.	(5·6-7·0 kg./sq. cm.)
Pump body material	Cast iron	

CONNECTING ROD AND FLYWHEEL ASSEMBLY

Connecting rod small end eye diameter	·8115″—·8125″
Small end bush bore diameter	·7503″—·7506″
Connecting rod big end eye diameter	2·0190″—2·0195″
Big end bush bore diameter	1·8110″—1·8116″
Connecting rod length between centres	6·00″ (15·24 cm.)
Crankpin bearing diameter	1·4957″—1·4961″
Big end bearing (needle roller)	38×46×20 mm. (R & M K38-46-20F)
Flywheel shaft diameter (left and right)	·9841″—·9844″
Crankcase main bearings (roller, left and right)	·875″×2·0″×·5625″ (Hoffmann R325L)
Crankcase main bearing (ball, left)	·875″×2·0″×·5625″ (Hoffmann LS9)

CLUTCH

Type	Multiplate with integral cush drive
Number of friction plates	5
Number of plain plates	5
Overall thickness of friction plate	·167″ (4·2 mm.)
Free length of springs	1·66″ (42·0 mm.)
Clutch pushrod length	9·0″ (22·9 cm.)
Clutch pushrod diameter	·1875″
Clutch rollers	·1875″×·1875″, 25 off

GEARBOX

Type	4 speed, constant mesh
Layshaft bearings (needle roller)	·5″×·625″×·8125″ (Torrington B108)
Mainshaft bearing (left)	30×60×16 mm. (Hoffmann 130)
Mainshaft bearing (right)	·625″×1·5625″×·4735″ (Hoffmann LS7)
Layshaft diameter (left and right)	·6245″—·6250″
Mainshaft diameter (left)	·7485″—·7490″
Mainshaft diameter (right)	·6245″—·6250″
Sleeve pinion inside diameter	·752″—·753″
Sleeve pinion outside diameter	1·179″×1·180″

GEAR RATIOS

Gearbox:—	B50SS, B50T	B50MX
Top	1·00	1·00
Third	1·24	1·24
Second	1·64	1·64
First	2·65	2·18

Overall:—	B50SS	B50T	B50MX
Top	5·14	6·45	6·92
Third	6·38	8·03	8·60
Second	8·42	10·58	11·35
First	13·60	17·10	15·04

SPROCKET SIZES (TEETH)

	B50SS	B50T	B50MX
Engine	28	28	28
Clutch	52	52	52
Gearbox	17	15	14
Rear Wheel	52	52	52

CHAINS

Primary chain (all models)		
Pitch	·375″	(9·53 mm.)
Roller diameter	·250″	(6·35 mm.)
Distance between plates	·225″	(5·72 mm.)
Length	72 links	
Breaking load	3,900 lbs.	(1770 Kg.)
Type	Renolds 114 038 Duplex endless	
Rear chain:—		
Pitch	·625″	(15·88 mm.)
Roller diameter	·400″	(10·16 mm.)
Distance between plates	·255″	(6·48 mm.)
Length	106 links (B50MX) 107 (B50T) 108 (B50SS)	
Breaking load	5,000 lbs.	(2268 Kg.)
Type	Renolds 110 054	

FRAME AND FITTINGS

FRONT FORKS

Type	Coil spring, hydraulically damped	
Steering head bearings	Taper roller (Timken LM 11949L)	
Springs:	Main Spring	Recoil Spring
free length	19·5″ (48·2 cm.)	·94″ (23·8 mm.)
spring rate	21 lbs./in.	242 lbs./in.
number of coils	63	$4\frac{1}{2}$
Shaft diameter	1·3610″—1·3605″	
Sliding tube diameter	1·363″ —1·364″	

SWINGING ARM

Bearings	Needle roller (Torrington B1616)
Housing diameter	1·2505″—1·2495″
Spindle diameter	·800″ — ·801″

REAR SUSPENSION UNITS

Type	Girling coil spring, hydraulicaaly damped		
	B25, B50SS, T	B25 Fleetstar	B50MX
Extended length (between centres)	12·9″	12·9″	12·9″
Compressed length (between centres)	10·3″	10·3″	9·9″
Springs:			
Fitted length	8·4″	8·4″	8·4″
Spring rate	100 lbs./in.	100 lbs./in.	70/100 lbs./in.
Colour identification	Green/green/ green	Green/green/ green	Green/pink/ green
Spring part number	64543708	64543708	64543626
Part number (complete unit)	64052483	64052453	64052487

WHEELS, BRAKES AND TYRES

WHEELS

	B25T, B50T & B50MX	B25 & B50SS, B25 Fleetstar	B25SS (U.S.A. only)
Rim size and type:			
(Front)	WM1×20	WM2×18	WM2×18
(Rear)	WM3×18	WM2×18	WM2×18
Spoke sizes:			

The length of a spoke (L) is ascertained by measuring from the threaded end to the intersection of the two centre-lines (as in Fig. 2). This method applies whatever angle (A) may be.

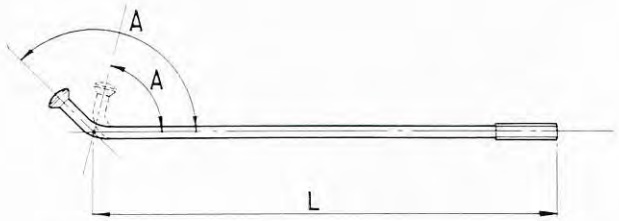


FIG. 2. *Measurement of spoke length.*

Front (right, outer) 10	10SWG×7·37″	10SWG×4·67″	10SWG×6·42″
Front (right, inner) 10	10SWG×7·25″	10SWG×4·54″	10SWG×6·31″
Front (left) 20	10SWG×8·77″	10SWG×6·92″	10SWG×7·73″
Rear (left, inner) 10 } all models		10SWG×5·72″ }	
Rear (left, outer) 10 } all models		10SWG×5·91″ }	
Rear (right) 20 } all models		10SWG×6·92″ }	
Bearings, front and rear, all models	20×47×14 mm. ball journal (Hoffmann 120)		

BRAKES

	B25SS, T, B50T B50MX	B25, B50SS, B25 Fleetstar
Front:		
Diameter and type	6″ single leading shoe	8″ twin leading shoe
Width	·875″	1·5″
Rear:		
Diameter and type	7″ single leading shoe	7″ single leading shoe
Width	1·125″	1·125″
Lining area, sq. in. (sq. cm.)		
Front	9·8 (63·3)	22·5 (145·4)
Rear	17·4 (112·4)	17·4 (112·4)

TYRES

	B25 & B50SS	B25T & B50T	B50MX
Type (Dunlop)	K70	Trials Universal	Sports
Size:			
Front	3·25×18	3·00×20	3·00×20
Rear	3·50×18	4·00×18	4·00×18
Pressures (p.s.i.)			
Front on road	22	22	—
Rear on road	24	24	—
Front off road	—	10	8
Rear off road	—	14	12

ELECTRICAL EQUIPMENT

	B25 & B50 SS, T	B50MX
Battery	PUZ5A	—
Capacitor	2MC	—
Coil	17 M 12	Wipac 967
Ignition capacitor	54441582	54441582
Contact breaker	6CA	6CA
Flasher unit	8FL	
Generator:		
Stator	RM21	RM22
Rotor	54213901	54213901
Handlebar switch unit, right	169 SA (39596)	—
Handlebar switch unit, left	169 SA (39595)	—
Headlamp	MCH 66	—
Horn	6H, High note	—
Ignition switch	149 SA	—
Rear stop switch	118 SA	—
Rectifier	2DS 506	—
Tail lamp	L689	—
Zener diode	ZD715	—

Bulbs:	Rating	Type
Headlamp	50/40 watt	370 (371 France only)
Stop-tail	21/5 watt	380
Flasher	21 watt	382
Speedometer	6 watt	281 or 643
Tachometer	6 watt	281 or 643
Warning lights	24 volt, 2 watt	281
Pilot	6 watt	989

CAPACITIES

	B25 & B50SS	B25 & B50SS (U.S.A. only)	B25 & B50T	B50MX
FUEL TANK				
British gallons	3	2	2	1
U.S. gallons	3½	2½	2½	1½
Litres	13·5	9	9	4·5
OIL RESERVOIR				
British pints			4	
Litres			2·25	
GEARBOX				
British pints			½	
cm³			280	
PRIMARY CHAINCASE				
British pints			¼	
cm³			140	
FRONT FORK (EACH LEG)				
British pints			⅓	
cm³			190	

DIMENSIONS

	B25 & B50 SS	B25 & B50 T	B50 MX
Overall length ins. (cm.)	85 (216)	85 (216)	82½ (209)
Wheelbase ins. (cm.)	54 (137)	54 (137)	54 (137)
Ground Clearance ins. (cm.)	7 (17·8)	7½ (19)	7½ (19)
Overall width ins. (cm.)	29 (73·7)	29 (73·7)	33½ (85)
Seat height ins. (cm.)	32 (81)	32 (81)	32 (81)
Overall height ins. (cm.)	43·5 (110·5)	43·5 (110·5)	43·5 (110·5)

WEIGHTS

	B25SS	B25T	B50SS	B50T	B50MX
Machine unladen (lbs.)	290	287	310	298	240
(Kg.)	131·5	130·2	140·6	135·2	108·8
Engine/gearbox unit (lbs.)	83	83	86	86	86
(Kg.)	37·6	37·6	39	39	39

GEAR RATIO CALCULATION

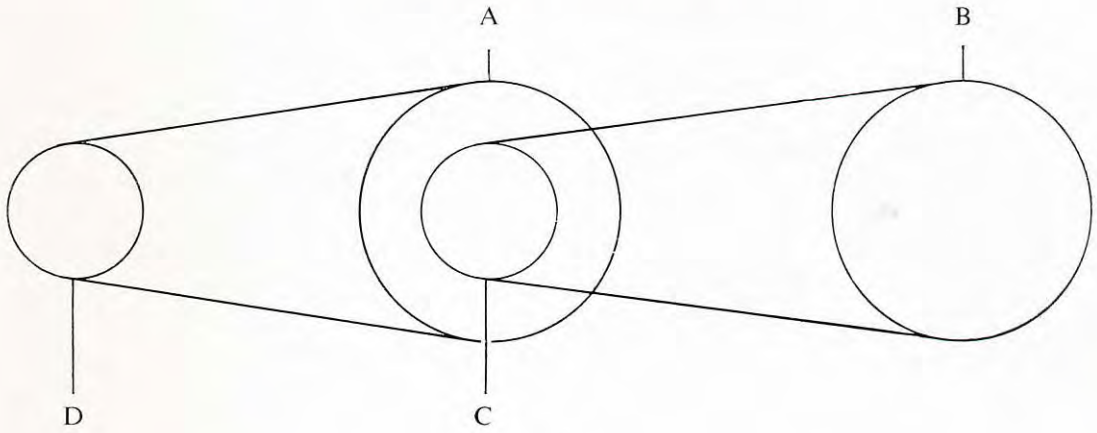


FIG. 3.

To find the gear ratios of a machine, first calculate top gear as follows:—

Divide the number of teeth on the clutch sprocket (A) by the number of teeth on the engine sprocket (D) and multiply the result by the number of teeth on the rear wheel sprocket (B) divided by the number of teeth on the gearbox sprocket (C) for example:—

$$\frac{\textit{clutch sprocket}\ (52)}{\textit{engine sprocket}\ (23)} \times \frac{\textit{rear wheel sprocket}\ (52)}{\textit{gearbox sprocket}\ (17)} = \frac{2704}{391} = 6{\cdot}89$$

To find the intermediate ratio, multiply top gear by the internal ratio concerned, for example:—

top gear 6·89 × *bottom gear internal ratio* 2·65 = 14·03 *bottom gear ratio*

$$\text{Gearbox internal ratio} = \frac{\textit{layshaft gear}}{\textit{mainshaft gear}} \times \frac{\textit{mainshaft top gear}}{\textit{layshaft top gear}}$$

for example:—

$$\frac{(\textit{layshaft}\ 3rd)\ 22T}{(\textit{mainshaft}\ 3rd)\ 26T} \times \frac{(\textit{mainshaft top})\ 23T}{(\textit{layshaft top})\ 17T} = 1{\cdot}144$$

INDEX

ROUTINE LUBRICATION

Ref. No. (Fig. A1)		
	EVERY 250 MILES (400 Km.)	
1	Check oil level.	
	EVERY 1,000 MILES (1,500 Km.)	
2	Check oil level in primary chaincase (B25 only)	Page A9
	EVERY 2,000 MILES (3,000 Km.)	
3	Check oil level in transmission case (gearbox)	Page A9
15	Lubricate side stand pivot (oil).	
4	Lubricate rear chain	Page A11
5	Lubricate contact breaker cam	Page A8
5	Lubricate auto-advance mechanism	Page A8
16	Lubricate brake pedal pivot	
6	Oil exposed cables and control rod joints	Page A10
7	Grease clutch cable	
18	Grease swinging arm bearings	Page A10
8	Grease speedometer drive	Page A10
	EVERY 4,000 MILES (6,500 Km.)	
3	Drain and refill transmission case (gearbox)	Page A9
2	Drain and refill primary chaincase	Page A9
9, 1	Drain and refill the oil reservoir	Page A6
10	Clean oil filters	Page A6
11	Clean external oil filter (B25 only)	Page A7
12	Examine pump ball valve	Page A7
17	Grease rear brake cam spindle	
	EVERY 10,000 MILES (15,000 Km.)	
13	Drain and refill front forks	Page A10
14	Clean and repack wheel bearings with grease	Page A10

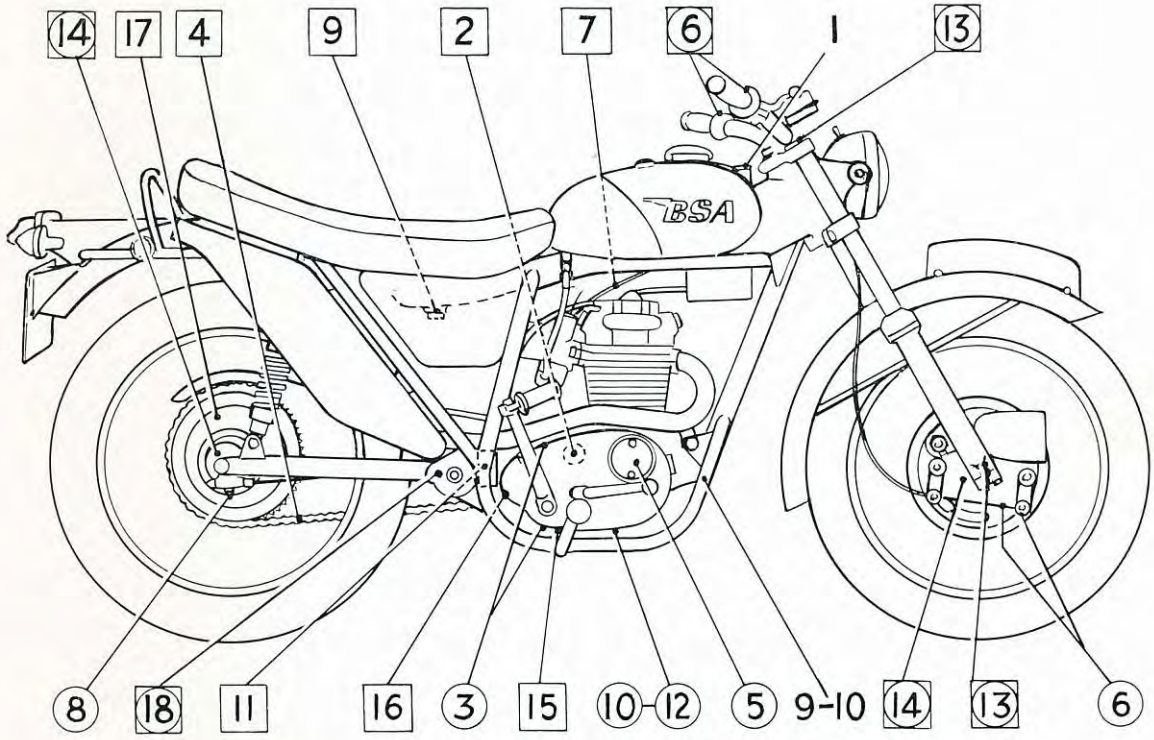


FIG. A1. *General lubrication diagram for all models.*
(The numbers in circles refer to the right side of the machine and numbers in squares refer to the left side.)

The choice of lubricant grade is, to a certain extent, dependent on the application of the machine and the climate in which it is to be used. The chart below gives recommended lubricants for use in temperate climates. In countries where climatic conditions are extreme, obviously some variation in grade will be necessary to provide adequate lubrication. Remember that the higher the temperature, the higher the S.A.E. number required.

Note:—During factory testing the engine is run on a mineral-base oil and a similar type of oil **must** be used thereafter. If it is desired to change to a vegetable-base oil, the engine and oil reservoir must be thoroughly cleansed of the previous lubricant. If the two types of oil are mixed, an emulsion will be formed which will damage the engine.

RECOMMENDED LUBRICANTS

Brand	Engine (Chaincase, B50 only)	Gearbox	Chaincase (B25 only)	Front Forks	Grease
Castrol	GTX or XL	Hypoy	Castrolite	TQF	Castrolease LM
Mobil	Super 20W50	Mobilube GX90	Super	ATF 210	Mobilgrease MP or Super
Shell	Super 20W50	Spirax 90EP	Super Motor Oil	Donax T7	Retinax A
B.P.	Super Visco-Static	Gear Oil 90EP	Super Visco-Static	Autran B	Energrease L2
Texaco	Havoline 20W50	Multigear 90EP	Havoline 10W30	Texomatic F	Marfak All-Purpose
Esso	Uniflo	Gear Oil GX90/140	Uniflo	Esso Glide	Multipurpose H

APPROVED LUBRICANTS

The following lubricants are also approved for use in B.S.A. motor-cycles: Duckham's—motor and chaincase oil, Q20–50; transmission (gearbox), Hypoid 90; forks, Q-Matic; chaincase (250 cm^3 only), Q5500; grease, LB10. Filtrate—motor and chaincase oil, Super 20W/50; transmission (gearbox), EP90; forks, AT Fluid F; chaincase (250 cm^3 only), Super 10W/30; grease, Super Lithium.

Approval is also given to lubricants marketed by companies other than those listed above, provided that they have similar multi-grade characteristics and meet the A.P.I Service M.S. performance level.

It is always advisable to make sure that the oil in the lubricating system is warm before driving at high speeds. When taking part in competitive events, advantage should be taken of any warming-up period to run the engine in order to warm and circulate the oil.

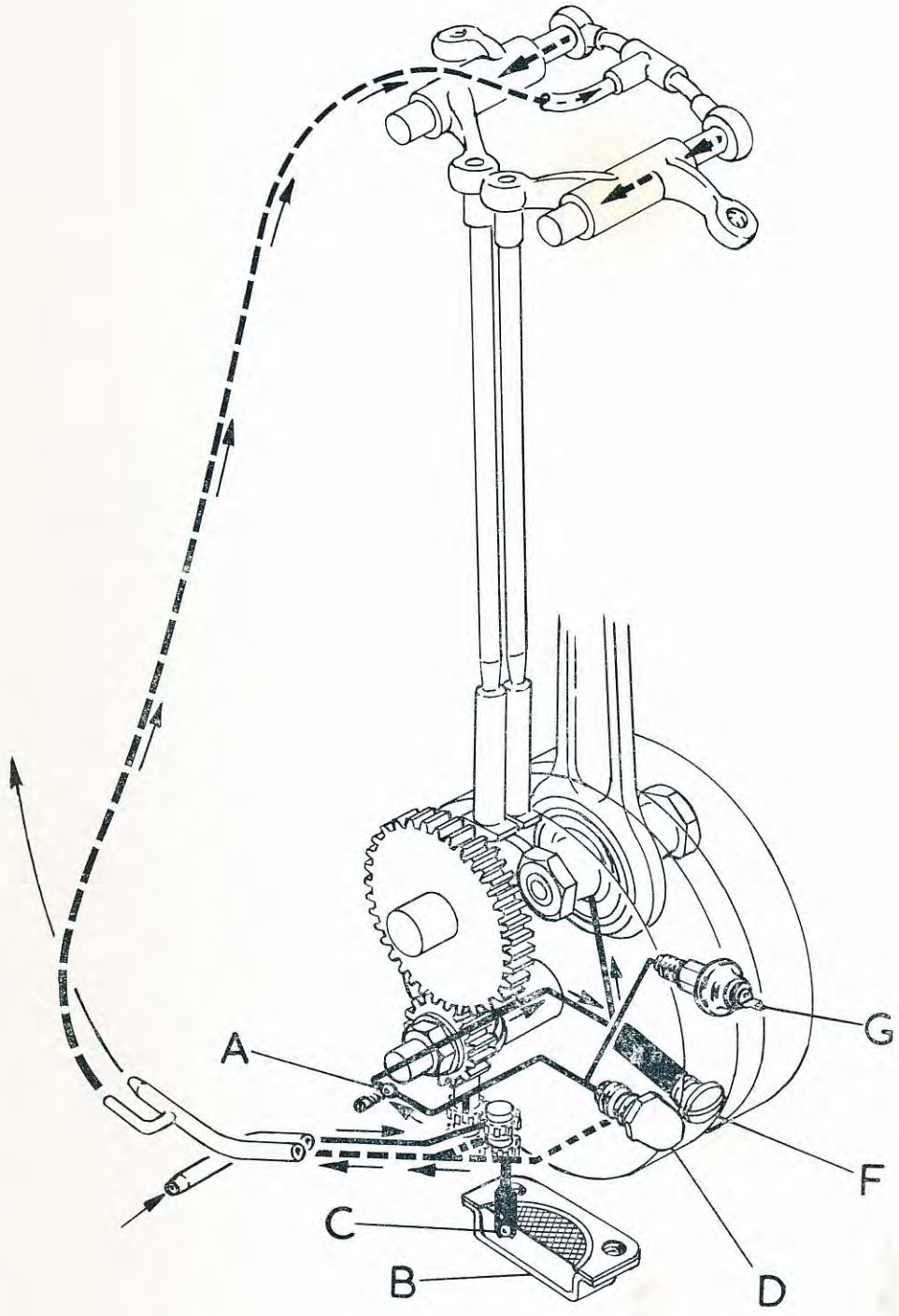


FIG. A2. *General engine lubrication diagram.*

A — Non-return valve (feed side)
B — Sump plate and filter
C — Non-return valve (return side)
D — Pressure release valve
F — Crankshaft sludge trap
G — Oil pressure switch (B25 only)

ENGINE LUBRICATION

The lubrication system is of the dry sump type, i.e., oil is contained in an external reservoir. This reservoir is incorporated in the main frame tubes (see Fig. A3).

Oil is drawn from the reservoir through a gauze filter at the base of the front tube by a double gear pump situated in the right side of the crankcase and driven by a worm drive on the engine shaft. The shallow gears in the top of the pump feed oil under pressure past a non-return valve to the big-end bearing via a drilling in the timing side engine shaft and centrifugal sludge trap. The sludge trap will arrest any foreign matter which would otherwise circulate with the oil.

Because of oil pressure at the big end, oil is forced between the bearing surfaces and is discharged by centrifugal force on to the cylinder walls and moving parts within the crankcase.

After lubricating various components the oil then drains to the sump, where, having passed through a gauze screen, it is returned to the reservoir by the lower, and deeper, gears in the oil pump. These gears draw oil from the sump via the scavenge pipe located in the lowest point of the crankcase. This pipe incorporates a non-return valve. Owing to the capacity of the scavenge side of the pump being greater than that of the feed gears, a mixture of oil and air will be seen to enter the reservoir from the return pipe.

If oil pressure exceeds the intended maximum, a release valve opens in the crankcase, passing surplus oil directly to the scavenge side of the pump en-route to the reservoir.

At the crankcase oil pipe connection the return pipe is tapped to provide oil at low pressure for the valve rocker gear. This pipe is connected to a union at the rockerbox and from this source oil is fed to the hollow rocker spindles. The rockers are drilled to provide a positive feed to the push rod ball pins and cups.

Incorporated in the return pipe is a cartridge-type filter on B25 models only.

CHANGING THE OIL AND CLEANING THE FILTERS

New or reconditioned engines must have the oil changed at 250, 500 and 1,000 mile (400, 800, 1,500 km.) intervals during the running in period and thereafter at every 4,000 miles (6,500 km.). The oil should be drained when warm as it will flow faster and carry impurities from the reservoir.

Oil may be drained from the frame reservoir after removing filter "C" and plug "B" (Fig. A3), but in order to gain access to plug "B" it is necessary to remove the right side panel (B50MX excepted). Make up a suitable chute from stiff cardboard to catch the oil and guide it into a receptacle capable of holding at least 6 pints (3·5 litres). Clean filter "C" in petrol before replacing.

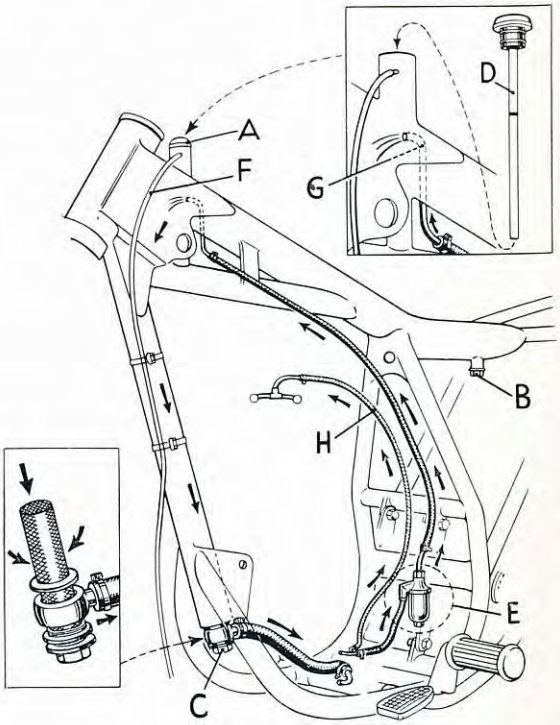


FIG. A3.

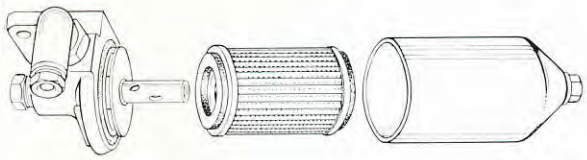


FIG. A4. *External oil filter.*

To clean the external filter in the return oil line of B25 models, unscrew the centre bolt to withdraw the bowl. Extract the filter cartridge, making sure that the sealing washers are retained, and wash it in petrol. However, if the cartridge is badly contaminated it must be renewed. Clean the bowl and filter body and re-assemble the unit, using new sealing rings if the old rings show signs of deterioration.

After ensuring that all unions, etc., are fully tightened the system may be refilled with fresh oil (see recommendations on Page A4) through filler orifice "A" (Fig. A3). Do not exceed the level shown on the dip-stick as an air space above the oil is essential for correct breathing. If this level is exceeded oil will be blown out of breather tube "F". Before starting the engine, pour ½ pint of oil into the sump. This can be done by removing the push rod inspection cover on the right side of the rockerbox.

OIL PRESSURE AND NON-RETURN VALVES

Pressure release valve

A constant oil pressure is maintained by the release valve situated on the front right side of the crankcase.

To prevent oil pressure becoming excessive, the valve opens and releases excess oil direct to the crankcase from where it is returned to the reservoir.

The valve is pre-set at the Works to open at a pressure of 80—100 lbs. p.s.i. (B25), or 45—50 lbs. p.s.i. (B50). This setting must not be altered. However, after prolonged service the spring does tend to weaken and the whole assembly must then be renewed since its component parts are not available separately. All pressure release valves are selectively assembled and tested before being released from the factory.

Unscrew the valve using a 1" A.F. spanner applied to the larger of the two hexagons. Ensure that the sealing ring is fit for further use.

The valve must be refitted to the crankcase with a torque of 25 lbs. ft.

Non-return valves

The feed side non-return valve consists of a ball and spring and is located in the inner timing cover (see Fig. A5). After unscrewing the retaining plug, the valve spring and ball may be removed for examination.

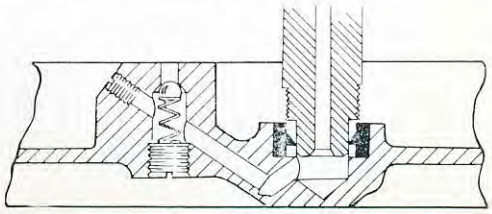


FIG. A5. *Non-return valve.*

Whilst changing the oil it is wise to check the scavenge pipe non-return valve for correct operation. Using a piece of wire, push the ball up off its seating and allow it to drop of its own weight. If the ball will not drop it indicates a build-up of sludge which can usually be cleared by immersing the pipe in petrol for a short period.

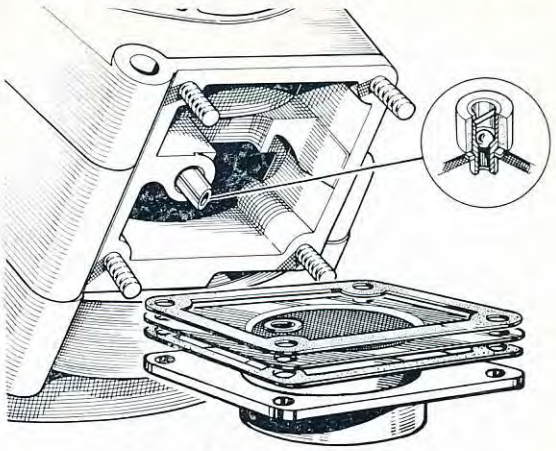


FIG. A6. *Sump filter.*

Low oil pressure

Low oil pressure is dangerous since insufficient oil will be delivered to the engine components The possible causes of low pressure are:—

(1) Insufficient oil in the reservoir. Check the level and the return after replenishing. If the return is correct it will show as a mixture of oil and air issuing from the return pipe.

(2) Reservoir and sump filters partly blocked, preventing the free passage of oil.

(3) Badly worn oil pump or big-end bearing in need of attention.

(4) Worn pressure release valve.

Crankcase oil pipes

The oil pipes are threaded into the crankcase beneath the engine and are secured by locknuts. Periodically, these nuts must be checked for tightness.

Crankcase breather

The engine breather is automatic, being incorporated in the camshaft. The camshaft is drilled along its length and a drilling in the inner cover camshaft bush corresponds with a similar drilling in the camshaft itself. At every revolution of the engine, pressure from within the unit is permitted to escape to atmosphere through the short breather pipe fitted adjacent to the clutch cable abutment.

The purpose of the breather is to release pressure that would otherwise build up within the engine causing lubrication problems and oil leaks. Therefore, it is most important that a regular examination of the breather pipe be made to ensure that it is clear and functioning correctly.

CONTACT BREAKER

The contact breaker is situated within the outer timing cover and it is essential that no engine oil enters the housing. To prevent this, an oil seal is pressed into the inner timing cover behind the auto-advance unit.

Lubrication of the contact breaker cam and the auto-advance unit pivot points, however, is necessary.

To gain access to the auto-advance unit the contact breaker plate must be removed. Scribe a mark across the plate and housing so that the plate may be replaced in exactly the same position. Take out the fixing screws and withdraw the contact breaker plate.

The bob-weight pivot points of the auto-advance unit must be lightly oiled at intervals of 2,000 miles (3,000 km.).

After lubricating, replace the plate to the mark, but if the ignition timing has been upset, follow the instructions for retiming on page B20.

The contact breaker heel is lubricated by a felt wick which must be very lightly greased every 2,000 miles (3,000 km.).

Every 2,000 miles (3,000 km.), the auto advance unit cam bearing must be lubricated with thin oil applied at the slot in the cam. Turn the engine until the slot is at the top, and allow time for the oil to penetrate.

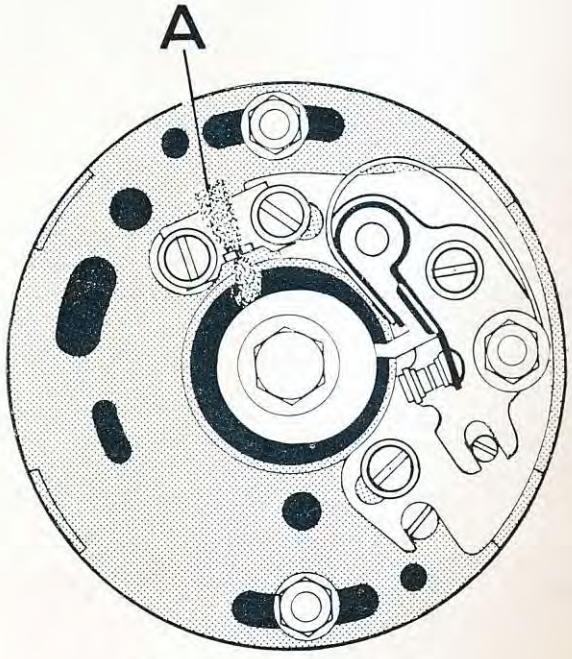


FIG. A7. *Contact breaker.*

GEARBOX LUBRICATION

The gearbox, having its own oil bath, is independent of the engine for lubrication but the oil level must be checked and any loss due to leakage made good.

The layshaft gears run in the oil bath and oil carried by or thrown off these gears lubricates the mainshaft gears, bearings and bushes.

To drain the gearbox, take out the filler plug/dipstick on top of the gearbox ("D", Fig. A8), then remove the drain plug underneath ("E") draining the oil into a suitable receptacle.

After draining, replace the drain plug, having made sure that the rubber "O" ring is in good condition.

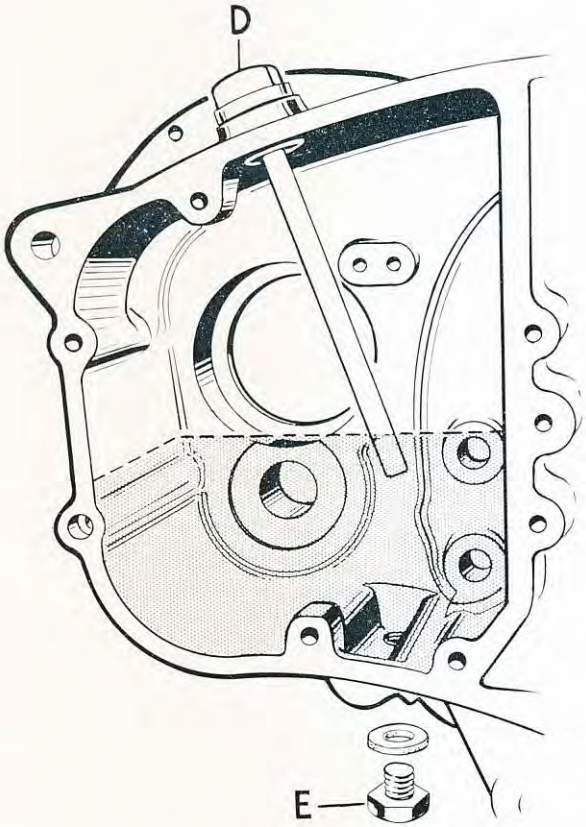


FIG. A8. *Gearbox oil level.*

Fill the gearbox with oil and check the level with the dipstick, which should be screwed home.

Recommended oils are given on page A4, capacity on page GD12 and checking frequency on page A2.

PRIMARY DRIVE (B25 Models)

Like the gearbox, the primary chaincase is independent of the engine lubrication system but the level of oil must be checked every 1,000 miles (1,500 km.) and the oil bath drained and refilled every 4,000 miles (6,500 km.). Draining procedure is the same as for B50 models, described below.

PRIMARY DRIVE (B50 models)

On B50 models the primary chaincase oil level is maintained by oil mist entering the compartment past the drive side main bearings. The oil finds its level and returns to the sump through filters fixed in the crankcase wall.

Therefore, periodic checking of the oil level is not called for, but it must be remembered that oil drained from the chaincase at oil change intervals must be replaced before further running to avoid damage to the primary transmission assembly. Use a suitable engine oil—see page A4.

To drain the oil, take out the chain inspection cap ("J", Fig. A9) at the top of the case and the drain screw "N".

Cap "H" is only removed to enable clutch adjustments to be carried out.

After draining, replace the drain screw, take out level screw "M" and pour oil through the inspection cap hole until it commences to run out of the level screw hole. Replace the level screw and inspection cap. The machine must be upright and on level ground when this operation is carried out to ensure correct level of oil.

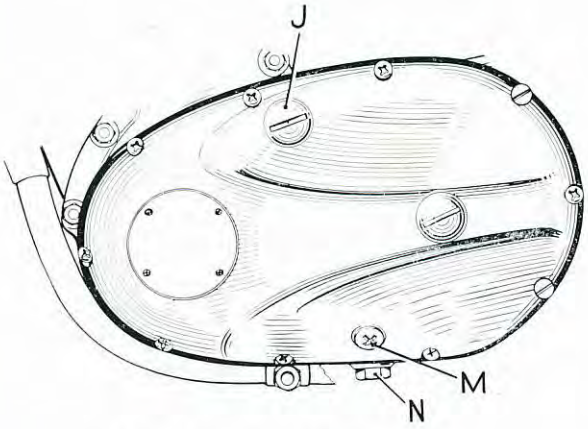


FIG. A9. *Primary drive lubrication.*

Oil containing molydbenum disulphide or graphite must not be used in the primary chaincase. Vegetable-based oil must not be used either. (see page A4).

FRONT FORK

The oil contained in the fork legs not only lubricates but acts as the damping medium. Because of the latter function, it is essential that the amount of oil in each fork leg is exactly the same.

The oil should be changed every 10,000 miles (15,000 km.), but some owners may not cover this mileage in a year, in which case it is suggested that the oil be changed every twelve months.

To drain the oil, unscrew the top cap nuts and drain screws at the lower end of the sliding members. Allow the oil to drain out, but take care to prevent oil dripping onto the tyre. Then, whilst standing astride the machine, apply the front brake and depress the forks a few times to expel any drops of oil remaining in the system.

Replace the drain screws, and pour oil into each fork leg. (See page A4 for recommended oils and page GD12 for capacity.)

SWINGING ARM

Early models are not fitted with grease nipples for greasing the swinging arm bearings, but sufficient grease is packed around the bearings on assembly to last a very considerable mileage, at least until a complete overhaul is required.

Machines fitted with grease nipples should have the bearings greased at intervals of 2,000 miles.

WHEEL BEARINGS

The wheel bearings are packed with grease on assembly but require re-greasing at intervals of 10,000 miles (16,000 km.).

The bearings must be removed as described on pages F4 and F5. After removal, the bearings must be washed thoroughly in paraffin and, if possible, an air line should be used to blow out any remaining grit or paraffin.

Repack the bearings with fresh grease (see recommendations on page A4) and reassemble them into the hubs. Do not over-lubricate, and avoid handling the brake shoes with greasy hands.

CONTROL CABLES

Exposed sections of inner cables should be lubricated periodically (see page A2). This may be done either by greasing or with an oil can.

The most satisfactory way, however, is to induce a flow of oil between the inner cable and casing by using a proprietary cable lubricator in conjunction with an air line or tyre inflator.

SPEEDOMETER AND TACHOMETER CABLES

The speedometer and tachometer cables must be lubricated to prevent premature failure of the inner wire. However, care must be taken to avoid

over-greasing, which will result in lubricant entering the instrument head. Unscrew the cable ferrule at the instrument end to withdraw the inner wire, and apply grease sparingly to all but the top six inches (15 cm.).

REAR CHAIN

The best method of lubricating the rear chain is to remove the chain every 2,000 miles (3,000 km.), wash it thoroughly in paraffin and allow to drain. Immerse it in a bath containing one of the many special preparations available for the purpose, and wipe off surplus lubricant before replacing the chain on the machine.

When replacing, make sure that the spring clip of the connecting link has its closed end facing the direction of travel of the chain (i.e. forwards on the top run).

INDEX

INDEX (*continued*)

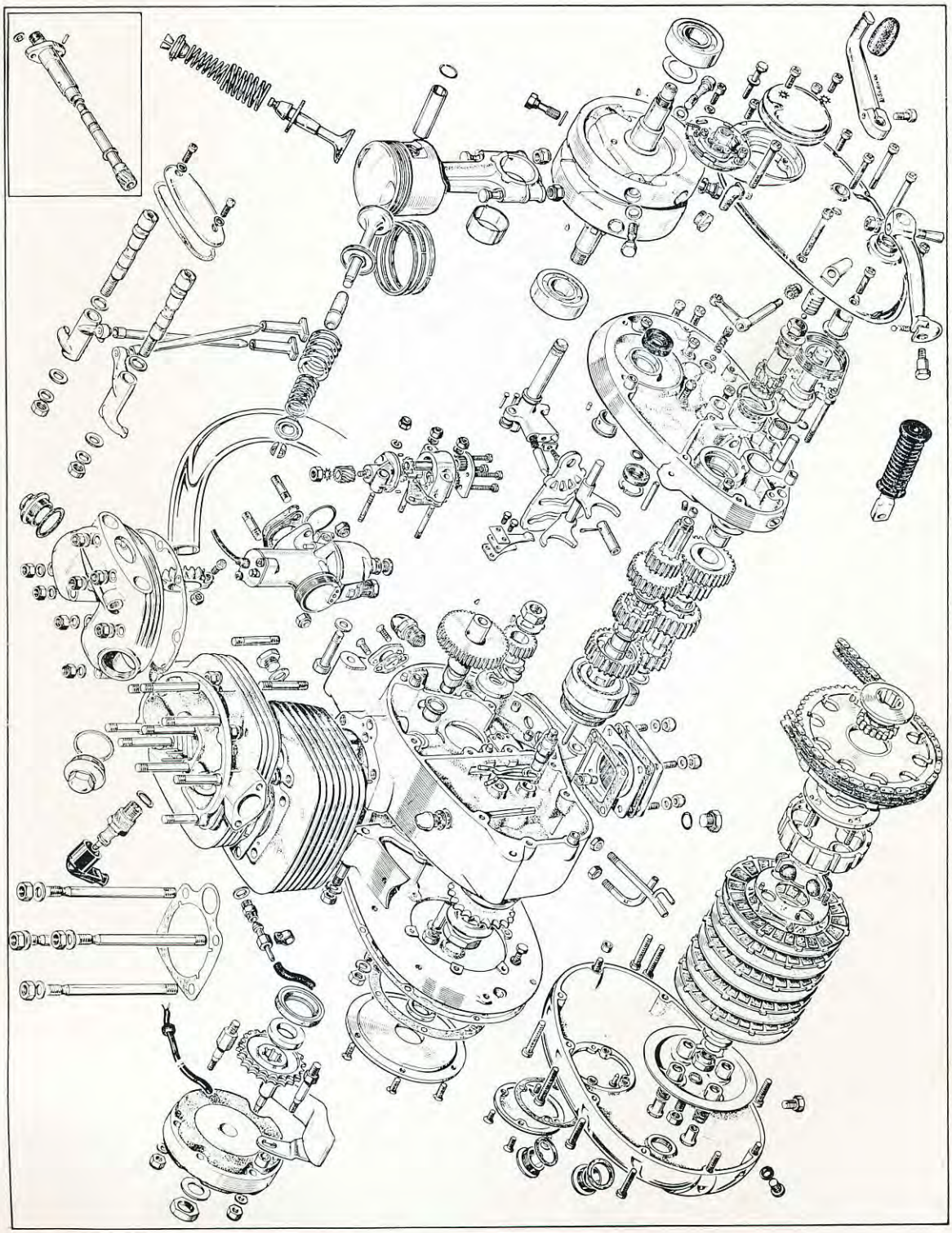


FIG. B1A. B25 *engine exploded.*

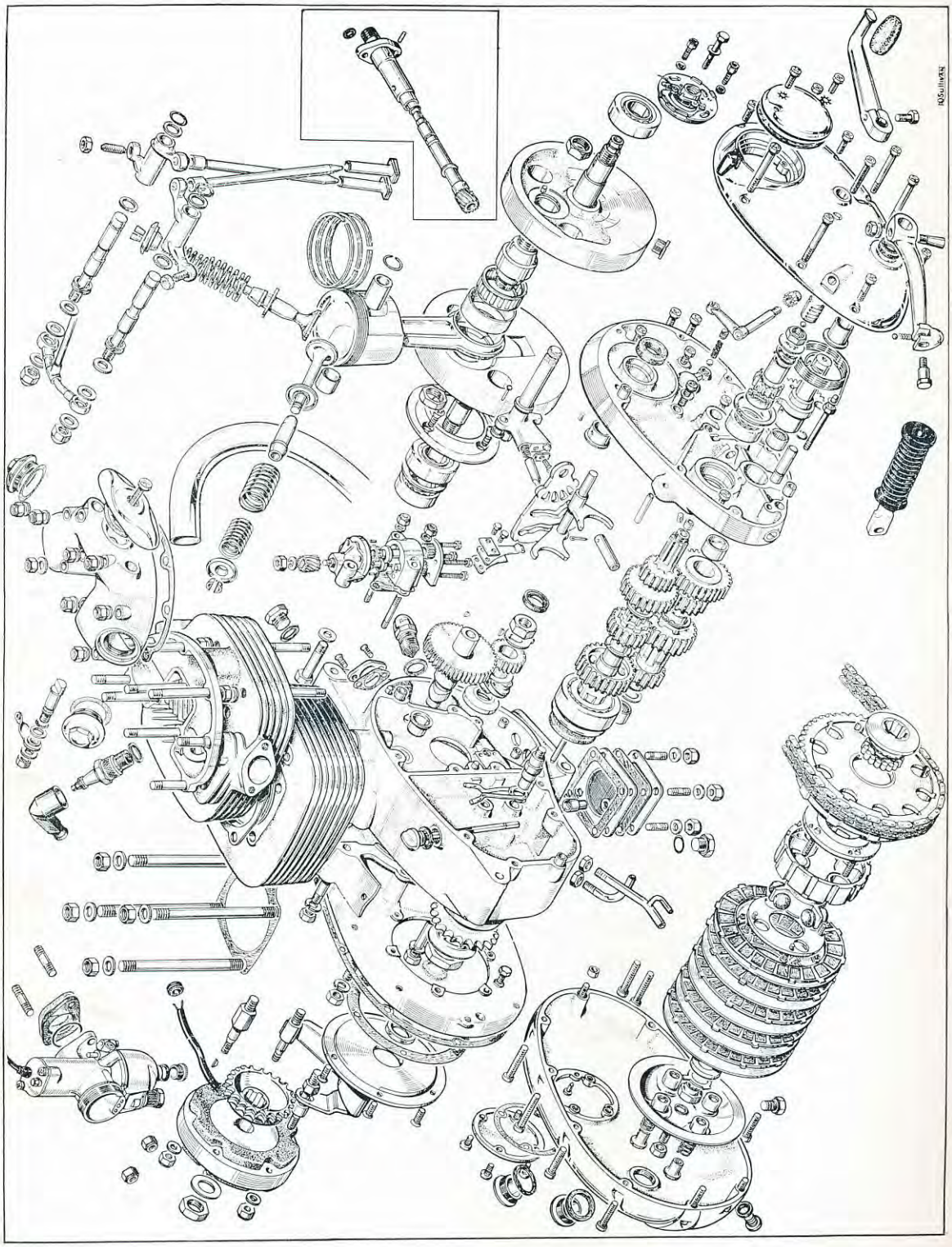


FIG. B1B. *B50 engine exploded.*

DESCRIPTION

B50 models

The B50 o.h.v. four-stroke engine is of the unit construction type, having a single cylinder barrel incorporating an austenitic iron liner.

The aluminium alloy slipper piston has two tapered compression rings and a two-piece scraper ring and is fitted to the H-section steel connecting rod which employs a needle roller bearing big-end assembly.

Two balanced flywheels (with crankshafts) and the crankpin are held together by two large nuts, the unit revolving in three crankcase bearings. The right flywheel is fitted with a centrifugal oil sludge trap.

The aluminium alloy cylinder head has cast-in, heavy duty cast-iron valve seats and removable valve guides. Housed within the rocker box are two valve rocker spindles, carrying the inlet rocker at the rear and the exhaust rocker at the front.

The camshaft revolves in two bushes, one of phosphor bronze and the other of sintered bronze.

Contained within the primary drive case on the left side of the crankcase are the clutch assembly, primary chain and alternator. The alternator unit consists of an encapsulated stator, mounted on three studs, and a rotor secured to the drive-side engine shaft. The chaincase contains an oil bath fed by the engine lubrication system.

A vertically mounted oil pump of the double gear type is driven from a worm gear on the timing side crankshaft and supplies oil to the big-end assembly, piston, cylinder walls and the timing gears.

The four-speed, constant mesh gearbox, at the rear of the right half of the crankcase, is independent of the engine lubrication system and contains its own oil-bath.

Power from the engine is transmitted through the engine sprocket and duplex primary chain to the clutch assembly which has a built-in cush drive. Here the drive is taken up by the bonded friction plates and is transmitted through the gearbox to the final drive sprocket.

B25 Models

Although being of smaller capacity, the B25 engine is similar in construction to the B50. The most noticeable differences are in the valve rocker gear and crankshaft assembly. The valve rocker spindles are eccentric, and valve clearances are adjusted by rotating the spindles which are secured by locknuts at their left ends.

The crankshaft is a one-piece forging with bolt-on flywheels, and incorporates a centrifugal sludge trap at the right side. The aluminium alloy connecting rod has a shell-type big-end bearing. Two main crankcase bearings are used, and the primary drive oil bath is completely independent of the engine lubrication system.

DECARBONISING

Decarbonising or "top overhaul" as it is sometimes called, means the removal of carbon deposits from the combustion chamber, piston crown, valve heads and inlet and exhaust ports, and to restore a smooth finish to these surfaces. Obviously, whilst the upper portion of the engine is dismantled for this purpose, opportunity should be taken to examine the valves, valve seats, springs, guides, etc., for general wear and tear, hence the term "top overhaul."

Carbon formed by combustion of the fuel mixture within the engine is not harmful provided that an excessive deposit is not allowed to build up. Any excess deposit will reduce engine efficiency.

The usual symptoms indicating the need for decarbonisation are an increased tendency for the engine to "pink" (a metallic knocking sound when under load), a general decrease in power and a tendency for the engine to run hotter than

usual. An increase in fuel consumption may also be apparent.

PREPARING TO DECARBONISE

Perfect cleanliness is essential to ensure success in any service task, so before starting a job such as this, make sure that you have a clean bench or working area on which to operate and room to place parts as they are removed.

Before commencing work the following equipment must be available:—

Suitable spanners.

Scrapers.

Feeler gauges (·008″ & ·010″).

A supply of fine grade emery cloth.

Jointing compound or cement.

Valve grinding tool No. 61-5035.

Coarse and fine grade grinding paste.

Valve spring compressor No. 61-3341.

Clean engine oil.

Two short lengths of square section hardwood to support the piston.

Top overhaul gasket set:—
No. 00-3174 (B50)
No. 00-3168 (B25).

Gudgeon pin circlips (2):—
No. 66-0954 (B50).
No. 70-6869 (B25).

Valve springs (set):—
Nos. 65-2494 (outer) and
65-2495 (inner) (B50).
Nos. 71-2223 (outer) and
40-1007 (inner) (B25).

A supply of paraffin and clean rag.

The fuel tank must be removed in order to gain access to the cylinder head (see page D.10).

Release the engine steady stay bolt at the cylinder head bracket and push the stay upwards clear of the working area. Remove the carburetter from the cylinder head, leaving it suspended from the throttle cable, and detach the complete exhaust system. Disconnect the rocker oil feed and take out the spark plug.

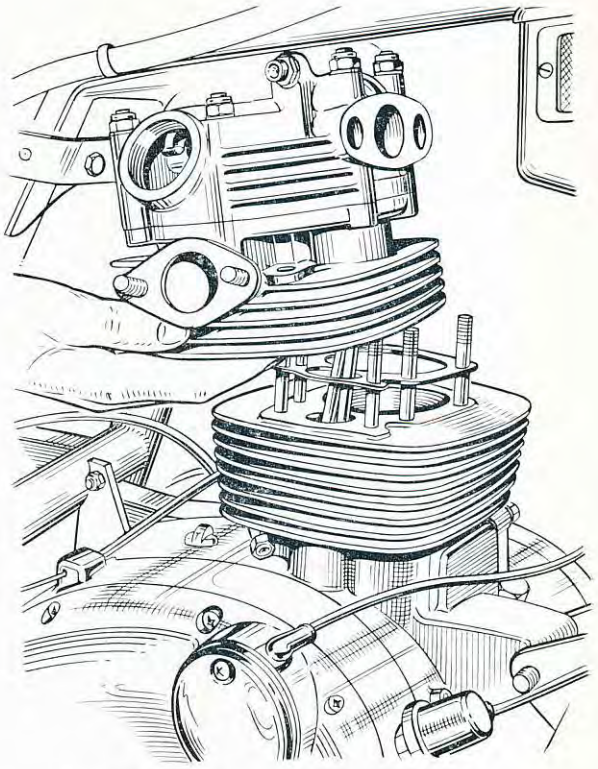


FIG. B2. *Removing the cylinder head and rocker box* (B25).

Removing the Cylinder Head and Rocker Box (B25 Models)

The rocker box assembly should remain in position until the cylinder head has been removed from the engine. Set the piston at top dead centre on the compression stroke (both valves closed) and release the six nuts retaining the cylinder head. Rotate the head about the push rods so that it will clear the frame, and lift it off the engine.

The rocker box may be removed from the cylinder head once the assembly is on the work bench.

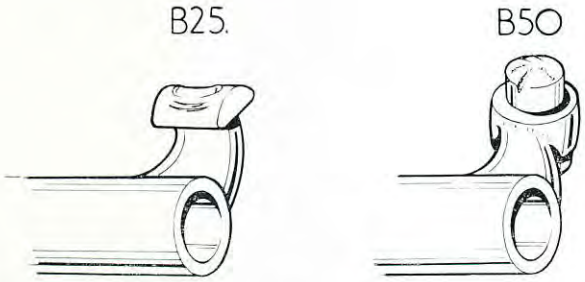


FIG. B3. *Worn valve rockers.*

Removing the Cylinder Head and Rocker Box (B50 Models).

Clearance between the rocker box and frame top tube is not sufficient to allow the rocker box or cylinder head to be removed unless the engine is first taken out of the frame. Removal and replacement of the engine unit is described on page B13.

Once the engine is out of the frame, the cylinder head and rocker box may be removed in the same manner as for the B25, described above.

Valve rockers

Figure B4 shows rocker arms which have been subjected to a great deal of wear, making correct valve clearance difficult to determine. During their manufacture the pads (B25) and pins (B50) are case-hardened and no attempt should be made to grind them smooth. If wear of this nature is apparent new parts must be fitted.

If the rockers and spindles are dismantled take care to renew any damaged washers. B50 rocker spindles are fitted with rubber sealing rings which must be in good condition. The rings must be renewed if damaged.

Refer to Figs B4 when reassembling.

Pushrods

Examine the push rod end cups to see if they are chipped, worn or loose, and check that the rods are not bent by rolling them on a flat surface such as a piece of plate-glass. If any of these faults are evident the rod(s) must be renewed.

Removing the valve springs

Using service tool No. 61–3341 (valve spring compressor), compress each spring until the split collets may be removed. The valve springs and top collars may now be lifted from the valve stems.

The springs may have settled through long use and they should therefore be checked in accordance with the dimensions given on page GD2 (B25) or GD6 (B50).

If the springs have settled appreciably, or there are signs of cracking, replacements must be fitted.

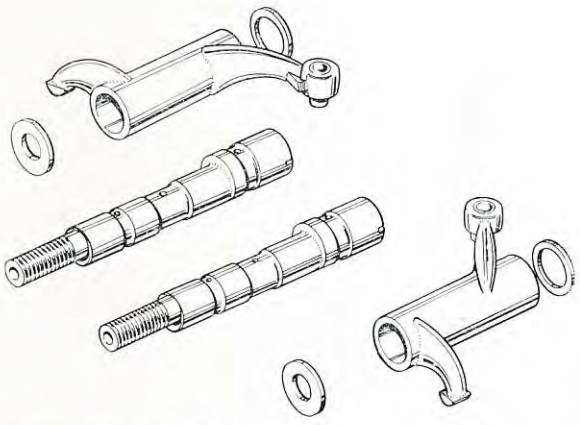


FIG. B4A. *Valve rocker assembly* (B25).

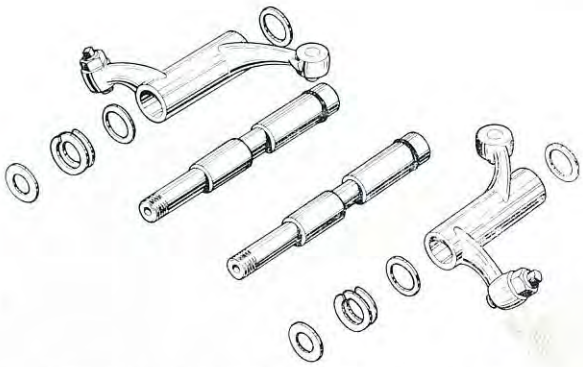


FIG. B4B. *Valve rocker assembly* (B50).

Valve guides

An old valve guide may be driven out with service tool No. 61-3382 but the cylinder head must first be heated in a hot oven or by submersion in hot water. The new guide may be driven in with the same punch whilst the head is still warm. Note that the exhaust guide is counterbored at its lower end.

Whenever new guides have been fitted, each valve seat must be refaced with a piloted valve seat cutter, to ensure that the seat is concentric with the guide bore.

Valves

Check the valves in their guides; there should be no excessive side-play or evidence of carbon build-up on that portion of the stem which operates in the guide. Carbon deposits may be removed by careful scraping and very light use of fine-grade emery cloth, but if there are signs of scoring on the valve stems, indicating seizure, both valve and guide must be renewed.

Valve heads may be refaced on a valve refacer (possessed by most dealers) but if pitting is deep or the valve head burnt, a new valve must be fitted and ground-in.

The valve seats in the cylinder head are unlikely to require attention, but if they are marked, they must be refaced with valve seat cutter No. 60–1832 (small), 60–1833 (medium) or 60–3769 (large) used with cutter holder and pilot set No. 60–1863. The seat angle is 45°.

Sometimes, when an engine has been decarbonised many times, valves become "pocketed". When the valve head and seat are below the surface of the combustion chamber, so impairing efficiency of the valve and affecting gas flow, the "pocket" (area "A", Fig. B5) must be removed with a special blending cutter (No. 60-1835, small or 60-1836, large) before recutting the seat or grinding-in the valve.

Removing carbon deposits

Removal of carbon may be carried out with scrapers or rotary files, but whichever method is used great care must be taken to avoid scoring the soft metal of the cylinder head and piston crown. A stick of tinsmiths solder, flattened at one end, provides an ideal scraper.

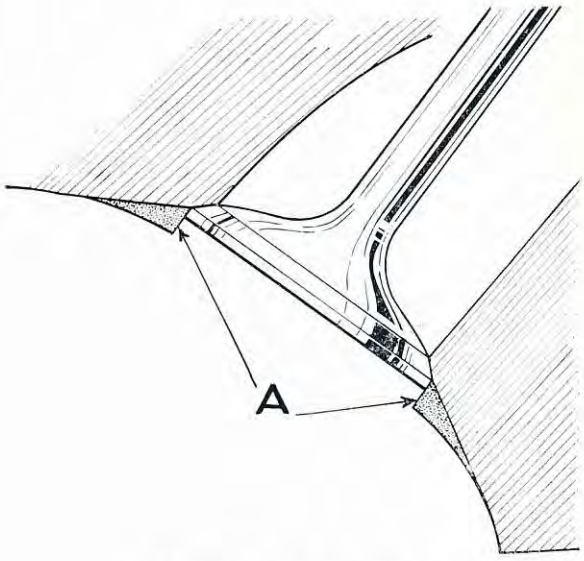


FIG. B.5. *Pocketed valve.*

If the cylinder barrel is not to be removed, bring the piston to the top of the bore, and, after plugging the push rod opening with clean rag, proceed to remove carbon from the piston crown.

Always leave a ring of carbon around the edge of the piston crown and around the top of the cylinder bore. This will help to provide an additional seal.

After cleaning the piston crown, rotate the engine to lower the piston and wipe away loose carbon from the cylinder wall.

The cylinder barrel and head joint faces must be cleaned, care being taken not to cause damage with the scraper. Score marks will result in gas leakage, loss of compression and burning of the cylinder head face.

Do not attempt to clean aluminium alloy parts in caustic soda solution.

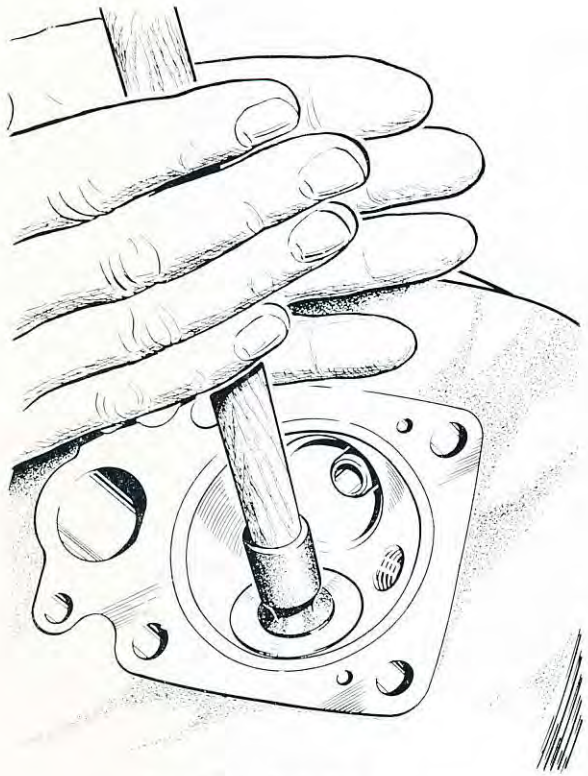


FIG. B.6. *Grinding-in valve.*

Valve grinding

If the valves have been renewed or refaced they must be lightly ground-in to their seats to ensure a gas-tight seal.

This operation is carried out only after all carbon deposits have been removed from the combustion chamber, inlet and exhaust ports.

Having decarbonised, smear a small quantity of fine grinding paste around the seating face of the valve and return the valve to its seat.

Now, using service tool No. 61-5035, rotate the valve backwards and forwards, maintaining steady pressure. Every few strokes, raise the valve and turn it to a new position. A light spring inserted under the valve head greatly assists in raising the valve, enabling it to be repositioned.

Grinding must be continued until the mating surfaces of both the valve and seat show a uniform matt finish all round.

Note:—Prolonged grinding-in of the valve does **not** produce the same results as recutting the seat and must be avoided at all costs.

Reassembling the cylinder head

Before reassembling the valves and springs all traces of grinding paste must be removed from both valves and valve seats.

Smear each valve stem with clean engine oil and replace the valves in the head.

Fit the spring cup, valve springs (with close coils at the bottom), and top collar over each valve stem, then compress the springs with service tool No. 61-3341 to allow the split collets to be inserted in the top collar. A little grease on the valve stem will assist in keeping the collets in position as the compressor is released. Make sure that the collets are correctly seated in the valve stem recesses by tapping the valve stem lightly with a copper hammer.

Cylinder barrel

Unless the condition of the engine indicates that the piston, piston rings or cylinder bore require attention, the cylinder barrel should not be disturbed.

If the bore is worn it may sometimes be detected by placing the fingers on top of the piston and attempting to push the piston backwards and forwards in the plane of flywheel rotation. Symptoms indicating worn piston rings include heavy oil consumption and poor compression, but only if the valves are known to be in good order.

Excessive piston slap when warm may indicate a worn bore or severe damage as a result of seizure.

The cylinder bore may be measured for wear with a suitable dial gauge, after moving the piston to the bottom of the bore.

Removing cylinder barrel

To remove the cylinder barrel, rotate the engine until the piston is at the bottom of its travel, then lift the barrel upwards until the piston emerges from the base of the bore. Steady the piston as it comes free from the cylinder so that it is not damaged by contact with the crank case mouth. As soon as the cylinder has been withdrawn, cover the crankcase mouth with a clean rag to prevent the entry of foreign matter.

Examine the cylinder carefully for wear. If a deep ridge has formed at the top of the bore or the bore shows score marks, the barrel requires reboring.

The cylinder barrel on both the B25 and B50 is fitted with an austenitic iron liner, enabling reboring for use with oversize pistons. Recommended oversizes for the both models are ·020″ and ·040″.

It is not necessary to remove the piston unless it requires replacement or further dismantling of the engine is to be carried out.

Removing the piston

Prise out one of the gudgeon pin circlips using a suitable pointed instrument, but before attempting to push out the gudgeon pin, the piston must be warmed in order to expand the material of which it is made. In this way, the gudgeon pin may be removed without risk of damaging the piston or connecting rod. Either wrap the piston in a rag that has been soaked in hot water, or apply an electric iron to the piston crown.

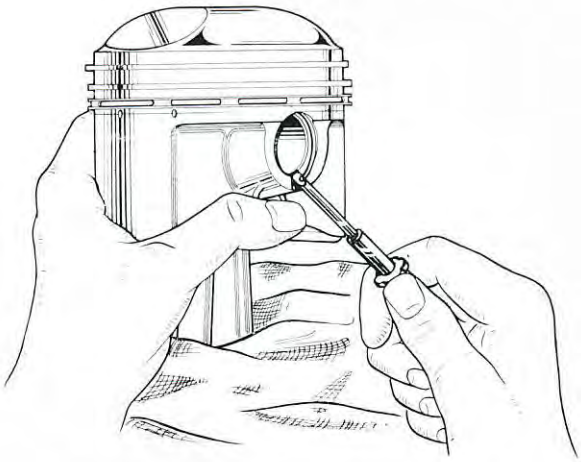


FIG. B7. *Removing a gudgeon pin circlip.*

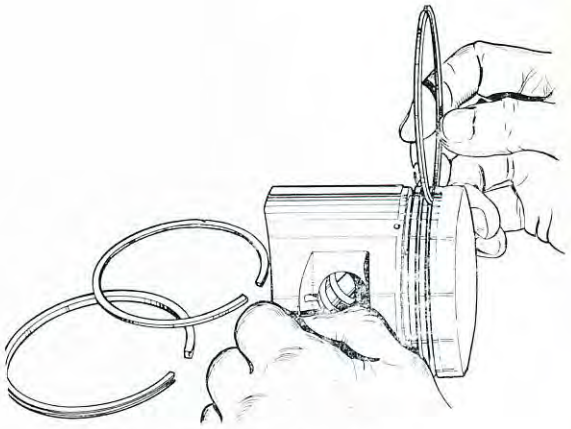


FIG. B8. *Checking piston ring grooves.*

Piston rings

The outside face of each ring should possess a smooth metallic surface. Any sign of discolouration means that the ring is in need of replacement.

The rings should also retain a certain amount of "springiness" so that when released from the barrel the ends of each ring lie at least $\frac{1}{4}$″ apart.

Each ring should be free in its groove but with minimum side clearance. If the rings tend to stick in the grooves, remove them and clean out all carbon from the groove and the inside face of the ring. Care is necessary to permit only a minimum amount of movement when removing the rings as they are very brittle and easily broken.

A piece of a broken piston ring, ground as a chisel, is a useful tool for removing carbon deposits from the ring grooves.

To check the piston ring gaps, place each ring in the least worn part of the cylinder bore (at the bottom) and locate it with the top of the piston to ensure it is square in the bore.

Measure the gap between the ends of the ring with a feeler gauge. The correct gaps when new are ·009″—·013″ (B25) and ·017″—·025″ (B50). Although an increase of a few thousandths of an inch is permissible, any large increase to say ·040″ indicates the need for a replacement ring.

It is advisable to check the gaps of new rings before fitting. If a gap is less than the specified minimum the ends of the ring must be carefully filed to the correct limit.

Both compression rings on B50 models are tapered on the outside face and their upper surface is marked TOP to ensure correct fitting. B25 models have a top compression ring of plain section and the second compression ring only is tapered. This is also marked TOP. If tapered rings are fitted upside down, oil consumption will become excessive.

Small-end bush

Small-end bush wear is normally very slight, but a worn bush will cause an unpleasant high-pitched tapping sound.

The gudgeon pin should be a good sliding fit in the bush, but if there is considerable up and down movement, the bush must be replaced. The B25 does not have a replaceable bush—the complete connecting rod must be replaced.

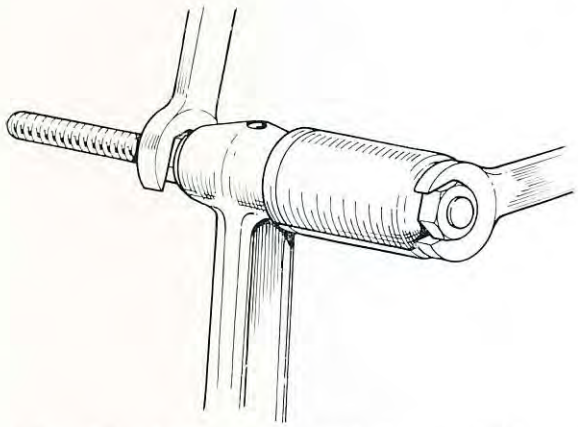


FIG. B.9. *Using Service-tool No. 61–3653 to remove small end bush (B50 only).*

Using service tool No. 61–3653, the bush may be changed in one operation by pushing the old bush out and, at the same time, pressing the new one in. The new bush must be correctly aligned with the oil hole in the connecting rod, and reamed to ·7503″—·7506″ after fitting.

Reassembly after decarbonising

Scrupulous cleanliness must be observed when reassembling, and each component should be smeared with fresh engine oil before replacing.

Warm the piston before inserting the gudgeon pin and ensure that the piston is the correct way round before fitting. Always use new gudgeon pin circlips and make absolutely certain that they are securely fitted. A loose circlip will result in severe damage.

Fit a new cylinder base gasket and support the piston with two pieces of hardwood (½″ square by 6″ long) placed across the crankcase, under the piston skirt (see Fig. B10).

The piston ring gaps must always be equally spaced round the piston, that is, at 120 degrees apart, to restrict gas leakage through the gaps to a minimum.

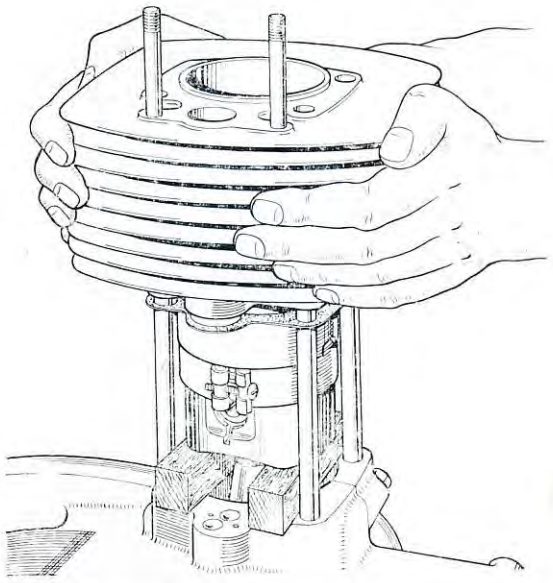


FIG. B.10. *Replacing cylinder barrel.*

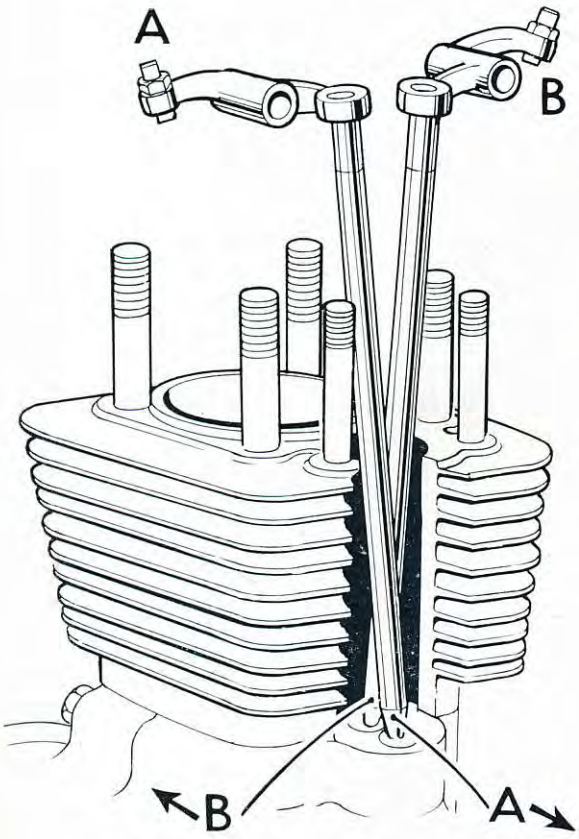


FIG. B11. *Location of pushrods.*

Using piston ring slipper No. 61–3682 (B25) or 61–6112 (B50) compress the rings so that the slipper is just free to rotate and refit the barrel. The slipper will be displaced as the piston enters the bore.

Take off the slipper and remove the hardwood supports, allowing the barrel to drop on to the crankcase.

Insert the two push rods down the barrel aperture, on to their respective tappets, the outer one operating the inlet valve (see Fig. B11).

Note that on B25 models only the top of the exhaust push rod is painted red for identification purposes and is very slightly shorter than the inlet rod. The push rods of B50 engines are identical.

Refit the rocker box assembly using a new gasket, and tighten the fixing nuts to 7 lbs. ft. using a torque wrench.

In order to avoid any strain on the cylinder head fixing nuts from valve spring pressure, the piston must be set at top dead centre on the compression stroke before attempting to refit the cylinder head assembly.

Check that the push rods are correctly located, place a new cylinder head gasket in position, and refit the head, complete with rocker box.

Now, using a torque wrench, tighten the six cylinder head fixing nuts to the figures given on page J1. It is necessary to use an extension of the type shown on page J2 to reach the nuts on the right side.

On B50 models only, the pushrod inspection cover may be refitted at this stage.

If, as in the case of the B50 model, the engine was removed for decarbonising, it may now be refitted. Follow instructions given on page B13.

Check the valve clearances as described below, and refit the sparking plug. Refit the carburetter, and tighten the fixing nuts to a torque 10 lbs. ft.

Reconnect the rocker oil feed using new sealing washers where necessary.

Replace the exhaust pipe and secure in position. Do not omit to tighten the silencer clip. Refit the engine steady stay and fuel tank.

CHECKING VALVE CLEARANCES

Valve clearances must be adjusted with the piston at top dead centre on the compression stroke (both valves closed). At this point valve clearances must be adjusted to · 008″ (· 20 mm.) inlet and · 010″ (· 25 mm.) exhaust.

The engine must be cold at the time of adjustment.

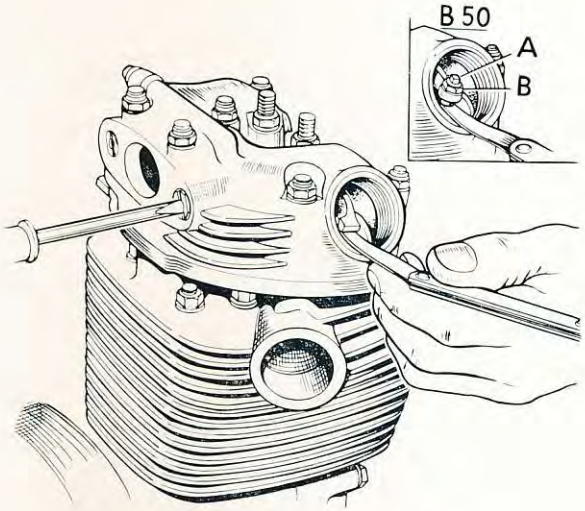


FIG. B.12. *Checking valve clearances.*

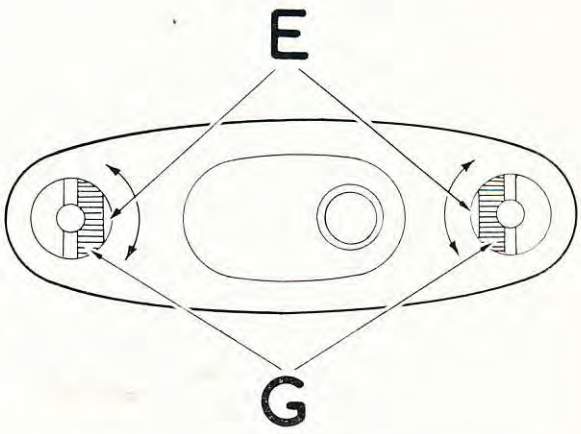


FIG. B13. *Valve rocker adjustment* (B25).

B50 models

If the clearances require adjusting slacken the locknut (*A*) and adjust the pin (*B*) until the correct gauge will just slide between the valve stem and pin (see inset, Fig. B12).

Holding the pin in its new position, retighten the locknut.

Check the clearance again to make sure that the setting has not altered whilst tightening the locknut, and refit the inspection caps.

B25 models

These engines have eccentric rocker spindles, valve clearances being adjusted in the following manner.

Having removed the pushrod inspection cover, slacken the spindle locknuts at the left side. Ideally, there should be at least one thread of the spindle visible past the locknut. If this is not the case, the spindle is not correctly positioned in the rocker box and must be turned clockwise using a screwdriver at the right side. Unless this operation is performed with the rockerbox removed, there will be resistance to turning from valve spring pressure.

Before adjustment, the flats milled on the right end of the rocker spindles ("E" Fig. B13) must face each other as illustrated. This is most important, as otherwise the pad of the rocker arm will not contact the valve stem centrally. Adjust valve clearances by turning the spindles, but ensure that correct clearances are achieved with the flats remaining in the shaded area ("G", Fig. B13).

When adjustments have been completed, secure the spindles with their locknuts and recheck the clearances.

Finally, replace the cover plate and gasket and the two inspection caps.

REMOVAL AND REPLACEMENT OF THE ENGINE UNIT

During removal of the engine unit, watch for any nuts or bolts which are found to be loose or have worn considerably. Such parts are no longer serviceable and must be replaced.

Examine the wiring for places where the insulation may have rubbed through and protect with a few turns of insulating tape. A bare wire could cause an electrical short-circuit which may set the machine on fire.

Procedure for removal of the engine unit is as follows.

(1) Remove the fuel tank—see page D.10.

(2) Remove the exhaust system. The silencer is secured to the frame at two points and may be detached once the two fixing bolts, and the exhaust pipe clamp, are released. Release the front engine bolt nut, so that the exhaust pipe may be withdrawn from the cylinder head in which it is a push fit.

(3) Take off the crankcase shield and right side panel, and drain the oil reservoir as detailed on page A6. Uncouple the rocker oil feed pipe and disconnect the flexible scavenge pipe from the crankcase pipe.

(4) Disconnect the generator, oil pressure switch (if fitted) and contact breaker leads from their snap connectors at the electric box and disconnect the high-tension lead from the sparking plug.

(5) On removal of the flange fixing nuts, the carburetter may be detached and tied out of the way. Leave the rubber connecting hose attached to the air cleaner box.

(6) Detach the engine steady stay from the bracket on the rocker box, and disconnect the exhaust valve lifter cable (if fitted).

(7) Remove the chainguard front extension (see page D.8.) and uncouple the rear chain. Detach the chain from the machine. Disconnect the clutch cable, using a suitable open-ended spanner as a lever on the operating arm.

(8) Slacken the footrest fixing bolt so that the right footrest may be swung down out of the way.

The engine bolts may now be released, and it will be noted that distance pieces are fitted between the engine and frame at the right side of the front and bottom bolts.

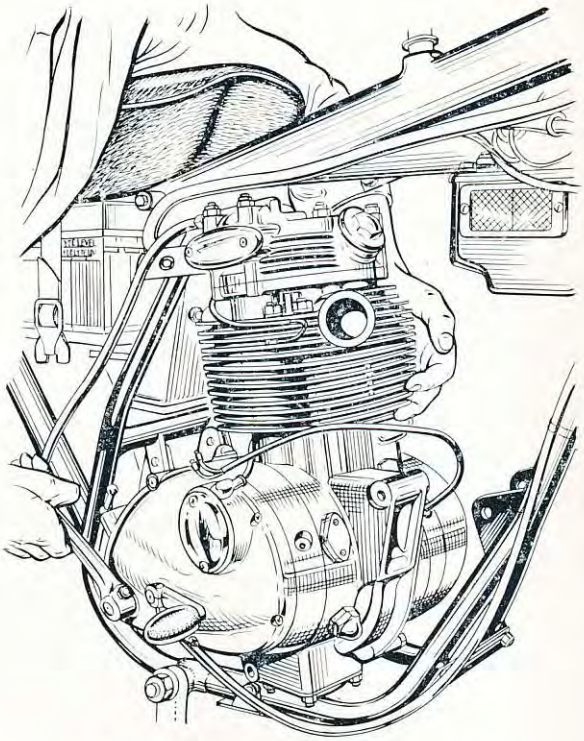


FIG. B.14. *Removing engine unit.*

Remove the rear right engine plate by releasing the top and bottom fixing bolts, and lift the engine unit out from the right side. See Fig. B.14.

Replace the engine in the reverse manner making sure that all nuts, bolts, and electrical connections are secure. Take care to replace the two distance pieces correctly (to the right of the engine), make a final check of all nuts and bolts, etc., before using the machine on the road.

TRANSMISSION

Description

Power from the engine is transmitted through the engine sprocket and primary drive chain to the clutch chainwheel, then via the clutch driving and driven plates to the cush drive or shock absorber unit and gearbox mainshaft.

The drive is then transmitted through the four-speed gearbox to the final drive sprocket and finally, to the rear wheel.

The clutch cush drive, as its name implies, smooths out the drive as the power impulses fluctuate.

The clutch, when operated correctly, enables the rider to stop and start his machine smoothly without stalling the engine, and assists in providing a silent and effortless gearchange.

Thus it will be evident that the satisfactory operation of one part of the transmission system is dependent on another. In other words, if one part is worn or faulty, it can very often prevent other parts from working properly.

DISMANTLING AND REBUILDING THE PRIMARY DRIVE

The following notes assume that the engine unit is isolated on a workbench, although attention to the primary drive and gearbox assemblies may be carried out with the engine installed in the frame. However, if this is to be the case, both footrests and the rear brake pedal (see page D10) must be taken off.

Removing primary drive cover

Drain the oil as described on page A6 and take out the fixing screws. The screws are of three different lengths and careful note should be taken of their respective positions to facilitate refitting. Break the joint by tapping the cover gently with a hide mallet, but have a suitable receptacle ready to catch any remaining oil.

Clutch dismantling

Remove the locking wire (B50 only) and the four spring retaining nuts and withdraw the pressure plate complete with springs and cups. The remaining clutch plates may now be taken out. If these are the only items requiring attention, the clutch need not be dismantled further.

So that the clutch centre nut may be unscrewed, the clutch centre and chainwheel must be locked together with service tool No. 61–3774, and a bar inserted through the connecting rod small-end. If the service tool is not available, or if the cylinder and piston are still in position, engage top gear and lock the gearbox sprocket with a length of chain in a vice. If the engine is still in the frame, apply the rear brake. Flatten the lockwasher beneath the clutch centre nut and unscrew the nut, which has a normal right-hand thread.

Take off the nut, lockwasher and distance piece, and withdraw the clutch push rod. Do not attempt to remove the chainwheel at this stage.

Generator removal

As the primary drive chain is endless, it is not possible to dismantle the clutch completely unless the generator and engine sprocket are removed. The generator comprises the rotor, fitted to the engine shaft, and the stator which is mounted on three studs around the rotor, both parts being detailed in section "G".

To remove the stator, release the three nuts and pull the generator lead through the rubber grommet in the front of the crankcase. Take care not to damage the stator casing when pulling the stator off its studs and note that the stator unit is fitted with the lead on the inside.

The primary chain tensioner may now be taken off. Note that a distance piece is fitted on the rear stud.

Bend back the tab of the lockwasher under the engine shaft nut and unscrew the nut. Pull off the rotor, wipe it clean of swarf, and store it in a clean place. Take out the Woodruff key from the crankshaft, and stick it to the rotor for safe keeping.

With extractor No. 61–3583, the clutch sleeve may be freed from the tapered mainshaft, enabling the clutch chainwheel, chain and engine sprocket to be withdrawn together (Fig. B15).

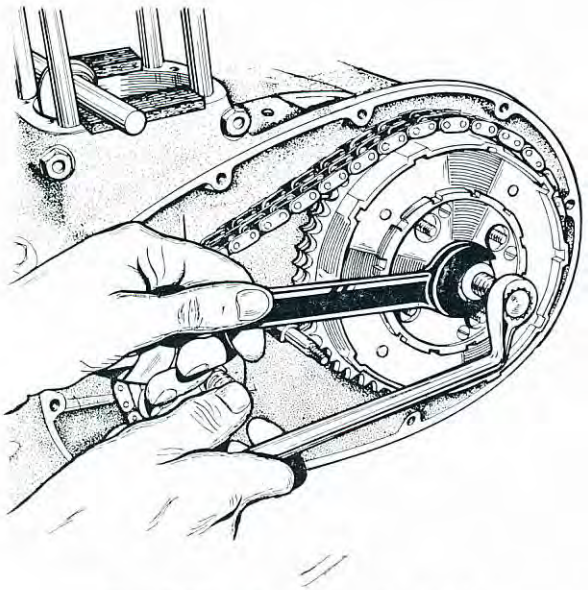


FIG. B.15. *Removing the clutch.*

Inspecting the clutch

The driving plates have segments of special friction material which are securely bonded to the metal. These segments must be complete, unbroken and not displaced. Even if there is no apparent wear or damage to the plates or segments, the overall thickness of each segment should be measured, and if the extent of wear is more than ·030″ (·75 mm.), the plates must be replaced. Standard thickness is ·167″ (4·24 mm.).

The tags on the outer edge of the plates should be a good fit in the chainwheel slots and must not be "hammered". If there are burrs on the tags the plates must be renewed.

The plain driven plates must be free from score marks and perfectly flat. To check flatness, lay the plate on a piece of plate glass; if it can be rocked from side to side, it is buckled and must be replaced.

Clutch centre and cush drive

To inspect the cush drive rubbers which are contained in the clutch centre, take out the four countersunk-head screws adjacent to the clutch spring housings and prise off the retaining plate

The rubbers must be firm and sound, and should not be disturbed unless wear or damage is evident.

When refitting the rubbers it will be found necessary to use a lubricant, in which case a liquid soap is recommended. **Do not use oil or grease.**

The clutch centre housing slots must be smooth and unmarked—damaged grooves will cause a jerky clutch action.

Clutch chainwheel

Examine the slots for wear; if they are corrugated or the teeth are hooked and thin, the chainwheel must be replaced.

Check the chainwheel roller bearing for up and down movement. Slight play is permissible, but if excessive, the rollers must be renewed.

Gearbox sprocket

Access to the gearbox sprocket is possible once the clutch assembly has been removed.

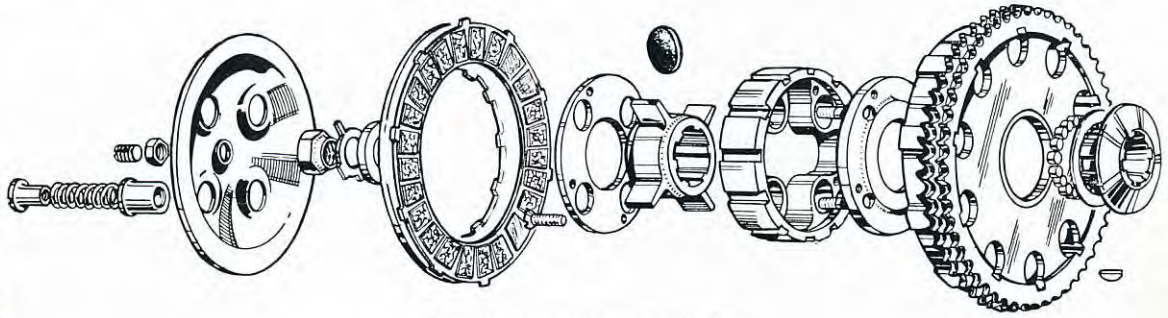


FIG. B16. *Clutch exploded.*

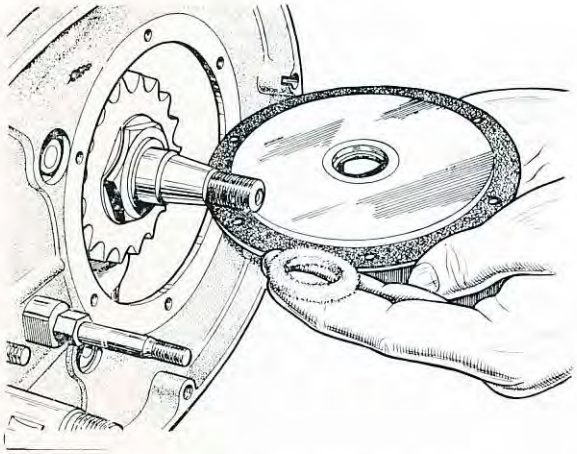


FIG. B.17. *Primary case back plate.*

Take out the six screws securing the circular plate at the rear of the primary case, break the joint and remove the plate with its oil seal. It will be noted that there is a small boss cast onto the rear of the plate—on reassembly this boss must be at the four o'clock position as it will otherwise foul the rear chain.

Look for signs of oil leakage down the back of the cover. If leakage is evident, change the oil seal, ensuring that it is fitted correctly with the lip of the seal to the inside of the primary case.

A felt washer is fitted between the circular plate and the sprocket fixing nut, preventing the entry of grit which may damage the oil seal. This washer must be renewed on reassembly.

If it is necessary to renew the gearbox sprocket, place a length of chain round the sprocket and lock in a vice or with a suitable bolt or, in the case of an engine still fitted in the frame, engage top gear and apply the rear brake. Flatten the tab washer and unscrew the retaining nut which has a normal right-hand thread. The sprocket may now be pulled off the gearbox sleeve pinion splines.

The gearbox oil seal is retained by a circlip, and may be renewed at this stage if it shows signs of leakage, but the sprocket boss must be examined for signs of wear. A worn sprocket must be replaced, though it may be possible to overcome slight wear by using fine emery cloth to rub the boss smooth. A sprocket that is "hooked" (see Fig. H3) must be renewed. Lightly oil the sprocket boss when replacing to avoid damage to the oil seal.

Refit the nut with a new lockwasher, and bend up the washer to lock the nut.

PRIMARY CHAIN ALIGNMENT

If any engine component such as the crankshaft, crankcase, gearbox mainshaft, engine sprocket, clutch hub, clutch chainwheel or inner timing cover has been renewed, true alignment of the primary chain must be re-established in order to avoid excessive wear of the chain and sprockets.

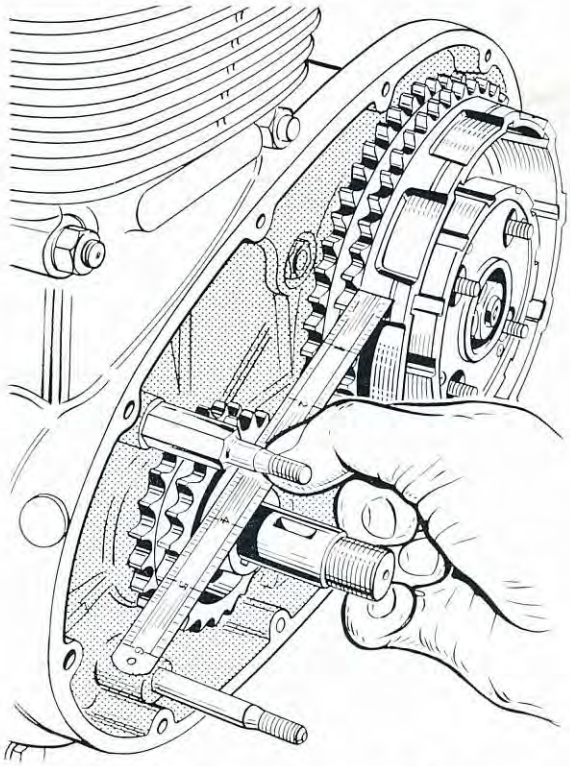


FIG. B.18. *Checking alignment of the primary drive.*

Rebuild the clutch assembly (see below) without the primary chain and fit the engine sprocket. Do not omit the engine sprocket distance piece, fitted to B25 engines only, which must be fitted with the chamfered side outwards.

Apply a steel rule or other suitable straight-edge across the face of the clutch chainwheel and engine sprocket teeth, as shown in Fig. B18. The straight-edge will make contact at three points if the sprockets are truly aligned.

If the sprockets are not in alignment, indicated by a gap between the straight-edge and engine sprocket if the straight-edge is applied to the clutch chainwheel only, shims to the value of this gap must be fitted behind the engine sprocket to bring the sprockets into line.

Part numbers and thicknesses of the various shims available are:—

B25: ·010″ (71–1819)
·015″ (71–1820)

B50: ·015″ (71–1630)
·030″ (71–1629)

Reassembling the primary drive

Remove the clutch assembly complete, with service tool No. 61–3583, if primary chain alignment has been checked, and pull off the engine sprocket.

If the clutch sleeve has been removed from the chainwheel, smear the sleeve with grease and place the twenty-five rollers in position. Slide the chainwheel over the rollers and fit the clutch centre over the splines of the sleeve.

Fit the primary chain around both clutch and engine sprocket, and screw service tool No. 61–3583 into position in order to provide means of holding the assembly.

Pick up the assembly in both hands and locate the sprockets over their respective shafts. (Fig. B19). Ensure that the gearbox mainshaft key is correctly located. Add the clutch centre nut distance piece and fit a new lockwasher. Ensure that the threads of the clutch retaining nut and gearbox mainshaft are free from grease, and apply a drop of "Loctite" to the threads of the mainshaft before fitting and tightening the nut to a torque of 60—65 lbs. ft.

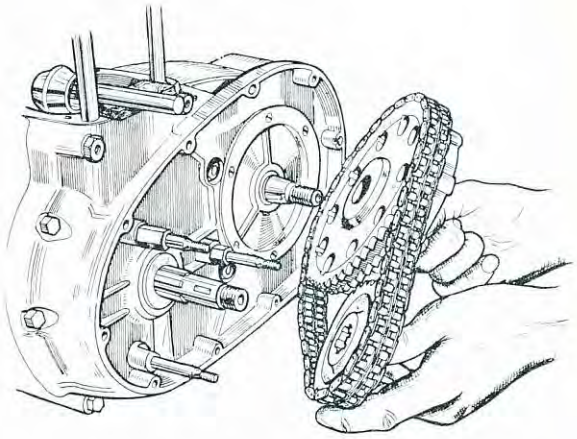


FIG. B.19. *Fitting primary drive.*

Pass the stator lead through the grommet at the front of the crankcase. Fit the rotor Woodruff key to the engine shaft, and push the rotor home with its marked face outwards. Locate the tag of the lockwasher and fit the nut, having first applied a drop of "Loctite" to the threads. Tighten the nut to 60 lbs. ft. and bend up the lockwasher.

Replace the primary chain tensioner, fitting the distance piece on the rear stud, behind the tensioner adjustment strap.

Fit the stator on to its studs with the lead on the inside at the front, and secure with the self-locking nuts. It is important that the air gap between the rotor and the stator pole pieces is equal all round. The gap may be checked with a ·008″ feeler gauge. Any variation may be corrected by slackening the stator fixing nuts sufficiently to allow the stator to be tapped into the required position with a hide mallet.

Having refitted the stator, checked the air gap and tightened the three fixing nuts, slacken the

rearmost nut in order to adjust the primary chain. Adjust the chain tensioner to permit $\frac{1}{4}$" (6 mm.) free play on the top run of the chain midway between the sprockets, and tighten the stator nut firmly.

Replace the clutch plates, beginning with a friction plate, then a plain plate, and so on alternately, there being five plates of each type. Insert the clutch pushrod into the mainshaft.

Place the pressure plate in position and fit the four spring cups with springs, which should be of equal length (1·65" or 42·0 mm.). If the springs are found to have settled in service they must be renewed. Ensure that the location pips of the spring cups are properly located in the slots in the pressure plate.

Screw on the four spring nuts with the special screwdriver No. 61–3700 until the first coil of each spring is just proud of its cup.

If the springs are compressed excessively, the handlebar lever will be stiff to operate. Conversely, if spring pressure is insufficient the clutch will slip. Check the accuracy of the spring setting by declutching and depressing the kickstart lever, when it will be seen whether or not the pressure plate is running "true". If necessary, adjust each nut to correct any "run-out". On B50 models only, lock the spring retaining nuts in position with a length of copper wire.

When the spring setting has been determined the clutch movement can be adjusted by means of the central screw and locknut on the pressure plate. The pushrod must also be adjusted in this way so that the clutch operating lever on the timing cover lies at an angle of approximately 30° to the cover joint face.

Having completed assembly of the clutch, the primary cover may be refitted. Apply grease to each joint face, and, using a new gasket, fit the cover. Tighten the fixing screws evenly to a torque of 3·5—4·5 lbs. ft.

CONTACT BREAKER

The contact breaker assembly and auto-advance mechanism are contained within a circular compartment in the inner timing cover. The contact breaker points are mounted on a circular base plate, which is slotted at its circumference and therefore may be moved within fixed limits to provide a means of adjusting ignition timing. It is also possible to carry out fine timing adjustments by means of an eccentric screw, and the points gap is adjusted in a similar manner.

Mounted in a taper at the right end of the camshaft is the automatic advance/retard unit which consists of a pair of spring loaded bobweights actuating the contact breaker cam. The unit provides automatic control of ignition timing, according to the needs of the engine. When the engine is stationary, the bobweights hold the cam in the fully retarded position, necessary for easy starting. As engine revolutions rise, so the bobweights are flung outwards, progressively advancing the timing until the fully advanced position is reached at a crankshaft speed of approximately 4,250 r.p.m. in the case of the B25 and 3,000 r.p.m. for the B50.

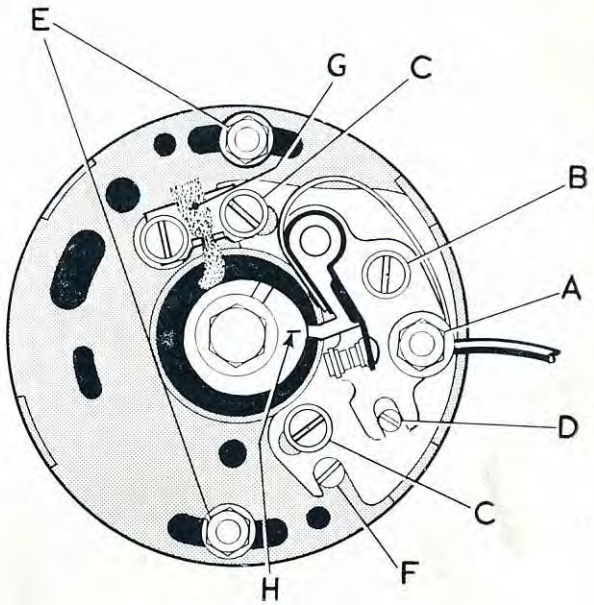


FIG. B20. *Contact breaker.*

An oil seal pressed into the inner timing cover prevents oil reaching the contact breaker housing, and the cam is lubricated by a felt wick which must be greased periodically (see page A8).

Contact breaker points

To change or inspect the contact points, which may be done without removing the backplate from the engine, unscrew and remove the screw "B", Fig. B20. Both moving and fixed contacts together with the points mounting plate may be taken off as a sub-assembly by pulling the moving contact from its pivot.

The contacts must be free from grease and oil. If they are blackened or burnt, clean with a fine carborundum stone or very fine emery cloth. Wipe away any traces of dirt or metal dust with a clean rag moistened with petrol.

Having refitted the points, it will be necessary to reset the points gap to ·015″ (·38 mm.). Revolve the engine until the nylon heel is on the peak of the cam, indicated by a stroke ("H' Fig. B20), loosen screw "B" and move the fixed contact by turning the eccentric screw "D" to give the correct gap. Tighten screw "B" and recheck the setting.

It is advisable to check the ignition timing after carrying out any adjustment to the contact breaker points as any variation in the points gap will alter the timing. Increasing the points gap advances the timing; closing the gap retards the timing. Although this variation is very slight, it must be remembered that accurate timing is essential if optimum performance is to be achieved.

Details for checking the timing are given below.

Removing the contact breaker and auto-advance unit

Before removing the back plate scribe a mark across the plate and housing so that it may be replaced in exactly the same position, otherwise the ignition timing will have to be reset.

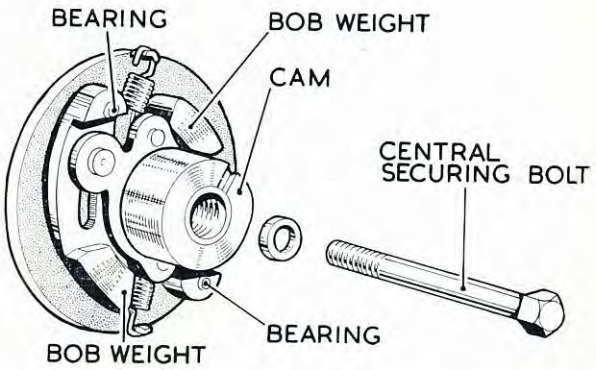


FIG. B21. *Automatic-advance unit.*

Disconnect the condenser lead at the electric box snap connector, unscrew the two pillar bolts ("E", Fig. B20) and take off the plate complete with contacts and lead.

To remove the auto-advance unit take out the fixing bolt, then free the unit from its taper.

IGNITION TIMING

Before carrying out any check on ignition timing, the contact points gap must first be verified and if necessary readjusted as described above.

Remove the sparking plug to enable the engine to be easily rotated. If the engine is in the frame, it will also help if top gear is engaged so that the engine may be turned by rotation of the rear wheel.

Piston position

Early engines are fitted with alternator rotors having one timing mark, later rotors have two marks. In the case of a later model, the mark opposite the keyway and identified by the figure "2" applies to B25 and B50 models.

Set the piston at top dead centre on the com-

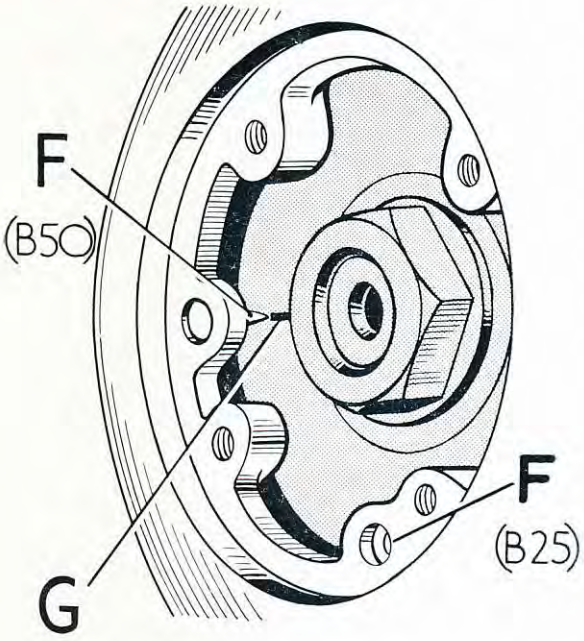


FIG. B22. *Ignition pointer positions.*

pression stroke (both valves closed), then turn the engine backwards until the pointer in the primary cover coincides with the line scribed on the rotor. It must be noted that there are two possible positions for the ignition pointer (see Fig. B22). One is used for B25 engines, the other for B50 engines, and under no circumstances must the positions be confused.

In order to take up backlash in the contact breaker drive the engine must be turned past the mark then rotated forwards to meet it. The piston is now in the correct position for setting the ignition timing.

There is provision in the crankcase for the use of the ignition timing peg (service tool No. 61–1859) comprising a body and plunger. Having lined-up the alternator timing mark, the tool may be used as a means of locking the crankshaft in the correct timing position. Remove the plug at the front of the left crankcase and insert the tool body. Gently push the tool plunger into engagement with the hole that is drilled in the flywheel.

At this stage the auto-advance unit must be freed from its taper, if it is apparent that correct timing will not be achieved by movement of the contact breaker backplate.

Setting the ignition timing statically

It is best to check ignition timing by means of a stroboscope (service tool 00–5177), but in order to do this the engine must be running. Therefore, it is necessary to set the timing statically so that the engine may be started. The simplest method involves the use of a battery and bulb in series with the contact points, as illustrated in Fig. B23.

Connect the contact breaker lead to one terminal of the battery, and make a good earth with the other terminal on the machine via a bulb. It is suggested that the speedometer bulb and lead be used for this purpose.

Slacken the two screws "C", Fig. B20, and centralise the eccentric adjuster "F" so that

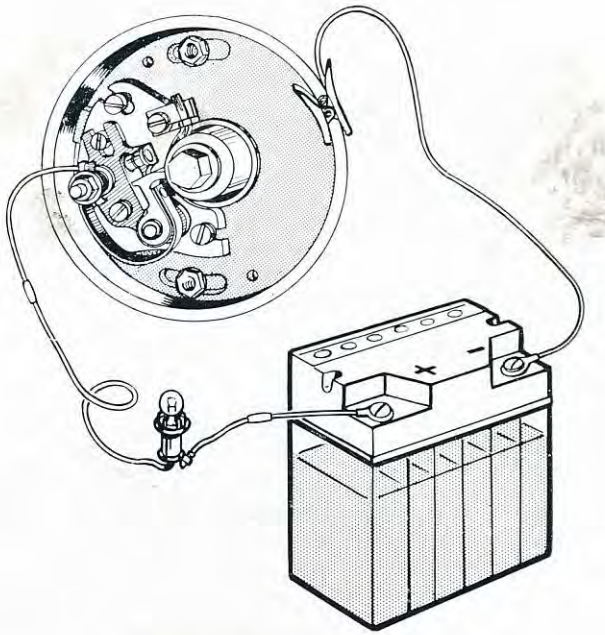


FIG. B23. *Ignition timing light.*

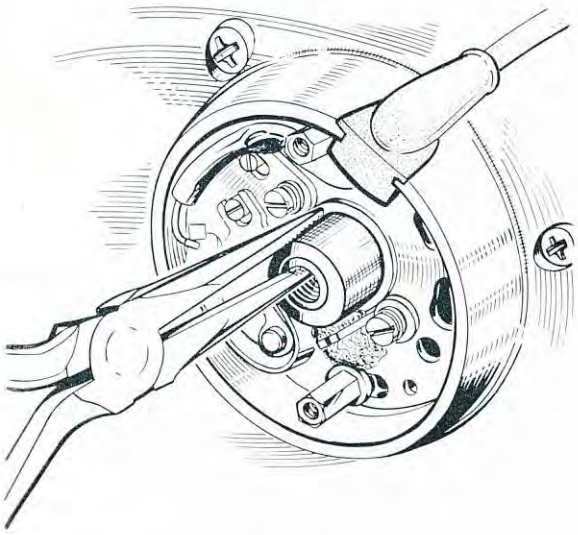


FIG. B24. *Using pliers to set the cam.*

equal adjustment in each direction of rotation of the eccentric is available. Turn the contact breaker base plate as far as possible in a clockwise direction, and fix it lightly with the pillar bolts "E".

Next, using a pair of slim-nosed pliers as shown in Fig. B24, hold the auto-advance unit into its taper, at the same time rotating the unit anti-clockwise until the points are just opening and the light is out. Be very careful not to mark the very accurate finish of the cam with the pliers.

Fix the auto-advance unit with the centre bolt, tightening the bolt to 6 lbs. ft. The timing is now set in the fully retarded position, and it will be necessary to set the timing fully advanced.

Slacken the pillar bolts "E", and turn the contact breaker base plate anti-clockwise to its limit so that the timing light is again lit. Now, push the auto-advance unit cam to the fully advanced position using a screwdriver or similar tool applied in the slot of the cam, and rotate the contact breaker base plate clockwise until the points have just opened and the light is extinguished. The contact breaker base plate is now in its correct position and the pillar bolts "E" may be firmly tightened.

Check the setting by pushing the cam from the retarded to the advanced position—the timing light should be extinguished at the very end of travel of the cam. If necessary, fine adjustment may be made by means of the eccentric "F". Tighten the screws "C".

The engine may now be started and the timing checked by stroboscope.

The importance of accurate ignition timing cannot be over-emphasized. Care and patience must be taken to ensure that the final setting is absolutely correct.

Checking ignition timing with a stroboscope

Most dealers possess electronic equipment specially designed for setting ignition timing very accurately, and it is recommended that owners take advantage of this facility at intervals, or whenever the timing has been disturbed.

If the contact breaker setting has been completely lost or if the engine has been dismantled, a basic static check and preliminary setting as described above must be made in order to facilitate engine starting for the strobe check.

Remove the small inspection cover at the forward end of the primary drive case to expose the generator rotor and ignition pointer.

Connect the strobelight to a suitable battery and attach the high-tension lead to the spark plug. Start the engine and direct the light on to the generator rotor. If the ignition timing is correct, the pointer and the mark on the rotor will line up exactly when the engine exceeds 4,250 r.p.m. (B25) or 3,000 r.p.m. (B50).

Correct any variation by adjusting the contact breaker plate as detailed previously. A minute degree of adjustment may also be obtained by altering the contact points gap. By increasing the gap by ·001″ the timing will be advanced by one degree. By closing the gap by ·001″ the timing will be retarded by one degree.

REMOVING THE TIMING COVERS

To gain access to the camshaft, oil pump and gearbox components it is necessary to remove the covers on what is known as the timing or gear-side of the engine. The primary drive must have been dismantled as described on page B15, though it is possible to carry out attention to the oil pump, tappets and gear selector mechanism without need of this. However, the complete gear cluster cannot be removed unless the primary drive is first dismantled.

Before attempting to dismantle the inner and outer covers, turn the engine to top dead centre on the compression stroke if the rocker box is fitted—this will avoid straining the inner camshaft bush (due to valve spring pressure) as the inner cover is removed.

To remove the outer cover, take off the gear-change and kickstart pedals, then take out the cover retaining screws, noting their respective locations. The cover, complete with contact breaker plate and clutch operating mechanism, may now be withdrawn, exposing the auto-advance unit and kickstart mechanism.

Take care to avoid losing the clutch operating rack and ball which are loosely located inside the outer cover.

Disengage the kickstart spring from its anchor and kickstart quadrant and unscrew the spring anchor. Leave the kickstart quadrant in place.

Remove the contact breaker auto-advance unit. Take out the remaining fixing screws, noting their locations, and break the crankcase to cover joint by tapping the cover gently with a hide mallet. The cover, with gear cluster assembled, may now be removed, but when withdrawing the cover, hold a finger against the camshaft to avoid disturbing the valve timing unnecessarily.

Note that the camshaft bush in the cover is located by a small peg to ensure correct alignment of the oil holes during reassembly. Check that the oil seals in the covers are not damaged and are fit for further service.

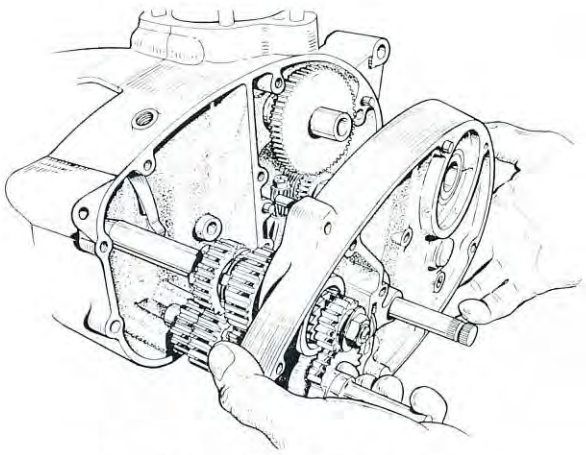


FIG. B25. *Removing inner cover.*

OIL PUMP, TIMING GEARS AND TAPPETS

Oil pump removal

During engine dismantling the oil pump need not be removed unless it is known to require attention.

Use a suitable bar through the connecting rod to prevent rotation of the engine, but use pieces of wood beneath the bar to prevent damage to the crankcase face. Flatten the tab washer under the crankshaft nut and unscrew the nut.

Pull off the crankshaft pinion, using extractor No. 61–3773 with legs 61–3588. The oil pump wormdrive need not be disturbed unless further engine dismantling is to be carried out, in which case the extractor should be used with legs 61–3769.

Unscrew the nuts securing the pump to the crankcase and pull the pump from its mounting studs.

Do not dismantle the pump unless internal damage is suspected.

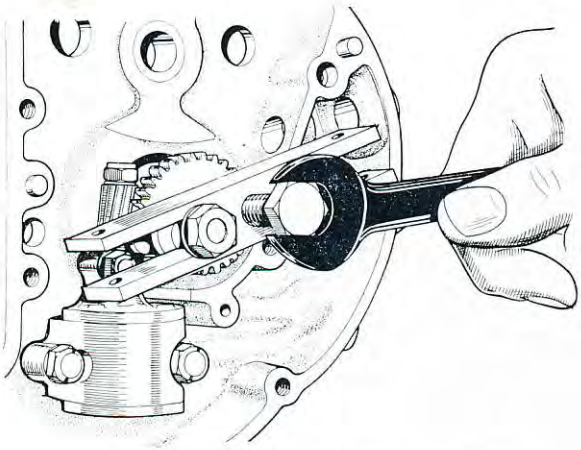


FIG. B26. *Using tool No.* 61–3773.

Dismantling the oil pump

Having removed the oil pump from the engine, take out the four screws from the base of the pump, releasing the base plate and top cover from the pump body.

The driving spindle and driving worm gear are secured to the top cover with a nut and shake-proof washer. Note the position of thrust washers below the feed gears (B50 models only), and that the spindle housing and body are located by means of small dowel pins.

Wash all the parts thoroughly in petrol and allow to dry before examining. Look for foreign matter jammed in the gear teeth and deep score marks in the pump body. These will be evident if regular oil changes have been neglected. Slight marks may be ignored, but any metal embedded in the gear teeth must be removed.

Wear may be found on the gear teeth; if the teeth are worn to the extent that the sharp edges are rounded they must be renewed.

Rebuilding the oil pump

Absolute cleanliness is essential when rebuilding the oil pump.

Insert the driving spindle with fixed gear into its housing, fit the worm drive and secure in position with the nut and spring washer.

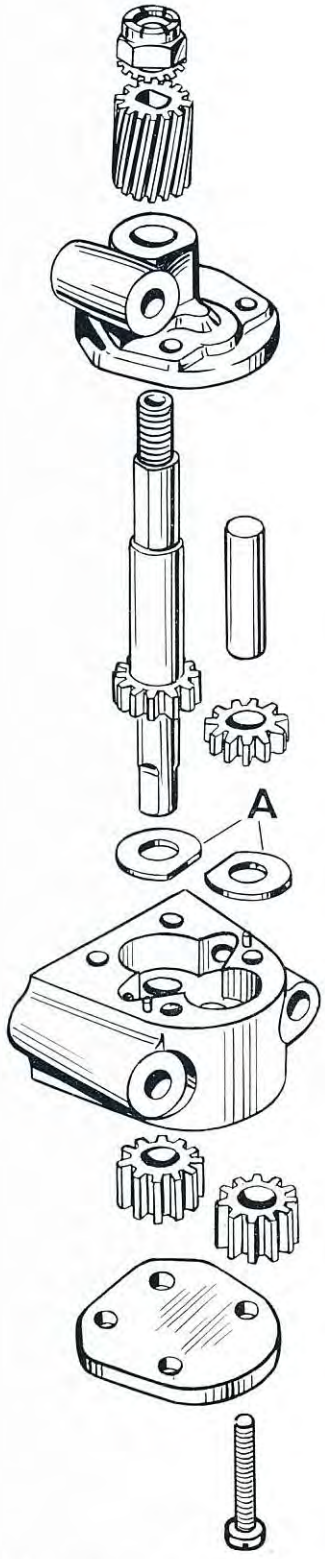


FIG B27. *Oil pump exploded.*

Fit the thrust washers (B50 only) into the pump body, followed by the driven feed gear with its spindle. Lightly coat one of the joint faces with "Loctite Plastic Gasket" and offer the spindle housing and body up to each other, taking care to locate the dowels and gear teeth correctly. Check that the assembly rotates freely.

Proceed to fit the scavenge gears and bottom plate, again using "Loctite Plastic Gasket" to seal the joint. Tighten the four screws evenly, and again check that the pump is free in operation.

Introduce a few drops of clean oil into the passages in the pump body and rotate the driving spindle to draw oil into the pump, thus lubricating the internal parts.

Finally check that the joint faces are parallel. If the housing face is not level it will be distorted when tightened to the crankcase and may prevent the pump from working freely.

Refitting the oil pump

Ensure that the joint faces are perfectly clean, apply a smear of grease to a new gasket and place the gasket in position on the crankcase face. Locate the pump over the studs, replace the fixing nuts and tighten evenly to a torque of 5—7 lbs. ft. The nuts are self-locking using nylon inserts and it is most important that any replacements are of this type. Any alternative nut **must** be sealed with a drop of "Loctite" to prevent it coming loose in service.

Timing gears

Careful examination of the timing gears will show that there are marks on the faces of the gears, adjacent to the gear teeth.

These marks are to assist in correct reassembly, so ensuring precise valve timing. On early engines, it will be noted that there are two marks on the camshaft gear—a dash and a vee—because the same gear is common to other models. In the case of the B25 and B50, however, **the dash must be ignored** and the marks aligned as in Fig. B28. If the gears are aligned dash to dash

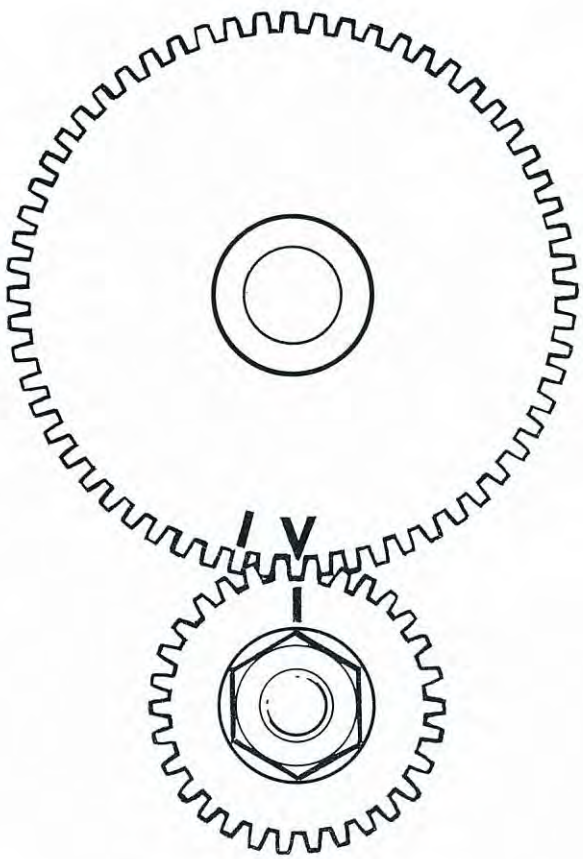


FIG. B28. *Timing marks.*

the valve timing will be advanced by two teeth, causing the inlet valve to foul the piston.

Later engines have only one mark on the camshaft gear—a dash. Align the gears dash to dash.

Pull the camshaft, with pinion, from its location in the crankcase and allow the tappets to fall clear. The pinion is a press-fit on to the keyed end of the camshaft, but must not be disturbed.

Note that on later B25 engines a thrust washer is fitted on the camshaft between the gear and inner cover. Such a washer is not fitted to B50 units.

Removal of the crankshaft pinion and oil pump wormdrive is described in the section dealing with oil pump removal (page B.23).

Tappets

Examine both ends of each tappet for signs of excessive wear or chipping and make sure that they are quite free to move in their locations in the crankcase. If there are signs of "scuffing" on the feet, they should be replaced. The camshaft must also be examined as this may be damaged too.

Note that one end of each tappet foot is slightly **thinner** than the other. When refitting, it is most important that this end faces **forward** as indicated in Fig. B29.

On reassembly of the gears, take care to match the timing marks (see Fig. B28, and text).

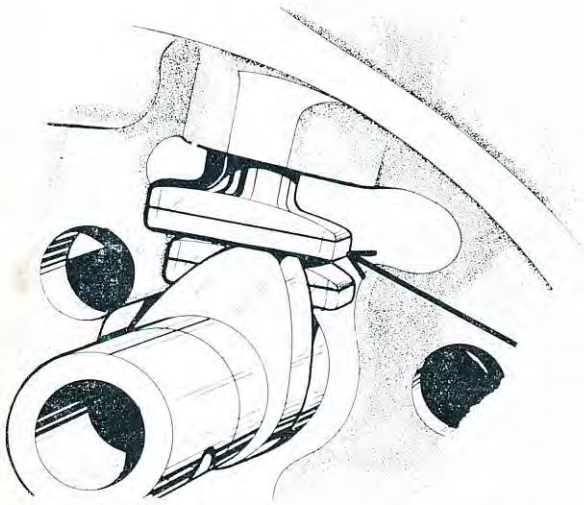


FIG. B29. *Correct fitting of tappets.*

TACHOMETER DRIVE

The tachometer drive is situated in the timing-side crankcase half, just above the pressure release valve. It consists of a spindle with drive gear which is housed in an aluminium body and retained with a small dowel pin. After passing through the body, this pin locates in a groove around the spindle. As a tachometer is not a standard fitting, the crankcase aperture of standard engines is covered by a small plate fixed with two screws.

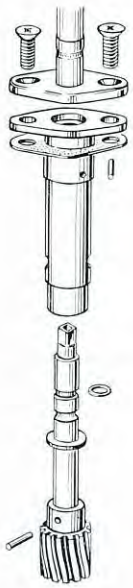


FIG. B30. *Tachomer drive (exploded).*

Dismantling and reassembly

Due to the position of the tachometer drive aperture in the crankcase, it is necessary to raise the engine unit at the front in order order to remove or refit the drive assembly. Refer to pages B13 and B14.

There should be no need to dismantle the unit except to replace the "O" ring or thrust washer. If it is thought necessary to renew any part, tap the dowel out of the body with a suitable punch. then withdraw the spindle.

Check that the thrust washer has not broken up or that the rubber "O" ring has not perished or split. If even slight evidence of this is noticeable these parts must be replaced. Check also that the drive gear is not worn.

To rebuild the unit slide the thrust washer over the spindle followed by the "O" ring, now smear clean engine oil on to the spindle and slide it into the housing and replace the location dowel.

When refitting the unit into the crankcase do not force the gear into engagement with the oil pump gear drive. If any difficulty is experienced

use a sharp instrument to turn the spindle until it engages, then push the unit home, refit the cable, and replace the screws.

GEARBOX DISMANTLING

Having removed the timing covers with gear cluster assembled as described previously, the gearchange mechanism and gear cluster may be dismantled.

Insert a suitable flat blade between the camplate and gearchange quadrant, thus depressing the plungers, and withdraw the gearchange quadrant complete with spring.

The spring-loaded plungers are retained by a small plate, secured with one screw.

The gearchange return spring pivot bolt need not be disturbed.

Take out the camplate pivot retaining split-pin from the outside of the cover, and, using one of the small inner timing cover screws as an extractor, pull out the pivot with a pair of pliers.

The camplate may now be taken out, together with the selector forks and their spindle, permitting removal of the layshaft complete with gears and the mainshaft sliding gear. Note that although the selector forks are of similar dimensions, the mainshaft fork has a turned witness for identification (see Fig. B31). It is most important that the forks are correctly replaced.

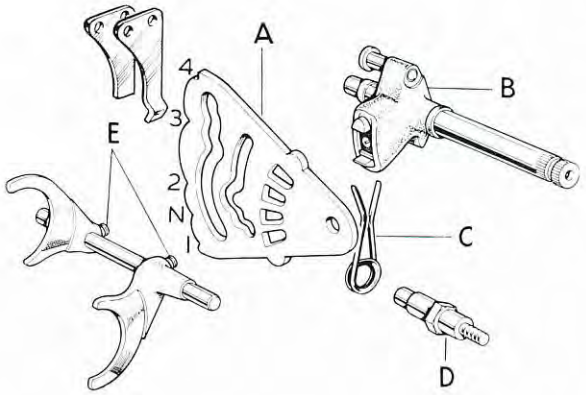


FIG. B32. *Gearchange mechanism.*

A—Camplate
B—Plunger quadrant
C—Return spring
D—Pivot bolt
E—Selector forks

The mainshaft fixed gears and the kickstart ratchet assembly remain fixed to the inner cover bearing.

Grip the mainshaft in a soft-jawed vice, and release the ratchet fixing nut. The kickstart mechanism and mainshaft are now separated (Fig. B33),

Kickstart ratchet assembly B50 only

On all B50 models the kickstart ratchet assembly is assembled in reverse of the order

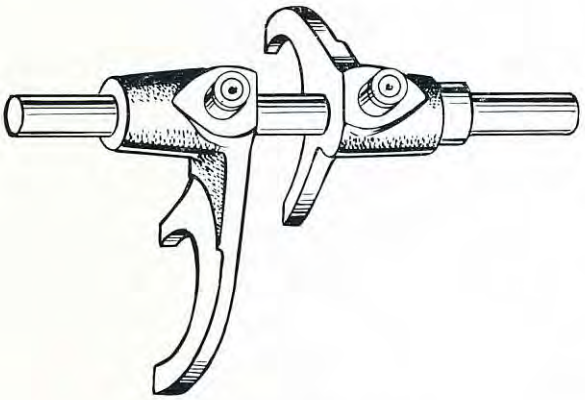


FIG. B31. *Selector forks.*

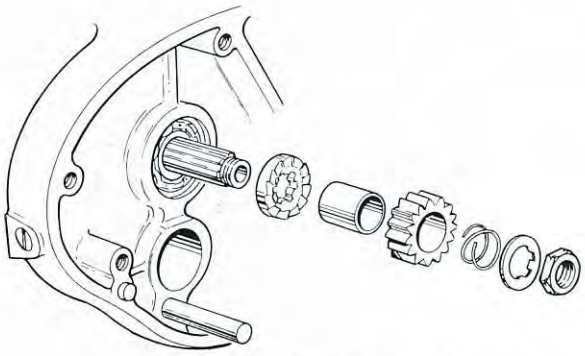


FIG. B33. *Kickstart ratchet.*

shown for B25 in Fig. B33 and there is an additional washer which is fitted against the bearing, followed by the ratchet pinion bush and spring.

To take off the two gears remaining on the shaft it is necessary to support the shaft and gears between the jaws of a vice in order that the shaft, which is an interference fit within the fixed gear, may be driven out using a copper hammer. Make note of the fact that a thrust washer is fitted between the free gear and mainshaft splines.

The layshaft second gear is held by a circlip.

To remove the left gearbox bearing, take off the gearbox sprocket as described on page B17. Using a drift that will pass over the protruding sleeve pinion bush, drive the pinion out of the bearing. Take out the oil seal, and drive the bearing from its housing, having heated the crankcase with the aid of a blow-torch.

Having dismantled the gearbox, make a careful inspection of every component to ensure that it is fit for further service. Look for worn camplate tracks, weak springs, worn bearings and bushes. Examine the gear teeth for pitting on their thrust faces, and replace any part appearing worn or damaged.

GEARBOX REASSEMBLY

With the aid of a blow-torch, heat the crankcase very gently in the area of the bearing housing, being careful to play the flame around so as not to cause distortion, and fit the main gearbox bearing. Refit the oil seal and gearbox sprocket, remembering to bend up the lockwasher. The correct torque for the nut is 100 lbs. ft.

If necessary, fit a new inner cover bearing (having heated the cover in an oven), and assemble the camplate. The camplate must be replaced with the bottom gear notch at the bottom because gearchange positions will otherwise be reversed. Fit the camplate pivot pin, with the threaded end visible to assist future dismantling, and push the split pin through to locate the pin in the inner cover.

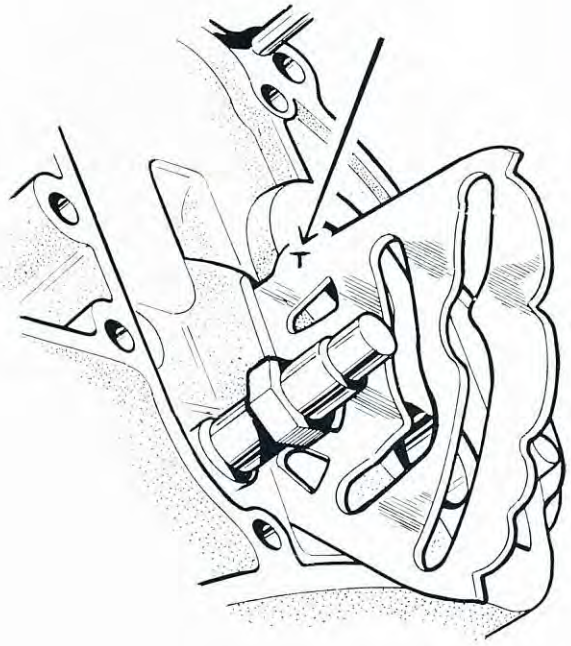


FIG. B34. *Correct fitting of camplate.*

The top side of the camplate is marked "T" for ease of identification—see Fig. B34.

Re-assemble the mainshaft gears, fit the shaft into the inner cover bearing and fit the kickstart ratchet, referring to Fig. B33. Tighten the kickstart ratchet nut to 50–55 lbs. ft. and bend up the lockwasher.

Fit the kickstart quadrant in position, and place the partly assembled inner cover on the edge of the workbench, outside face down, so that the kickstart quadrant is retained but the quadrant shaft and stop are clear of the surface.

Using a little grease to hold it in position, place the layshaft gear shim ("H", Fig. B35) over the bearing in the kickstart quadrant. Engage the layshaft bottom gear ("J") teeth with the corresponding mainshaft gear ("G") making sure that the gear is properly aligned with the layshaft bearing. Take the layshaft sliding gear "K", fit its selector fork (flat face uppermost), and engage the roller of the fork in the lower camplate track.

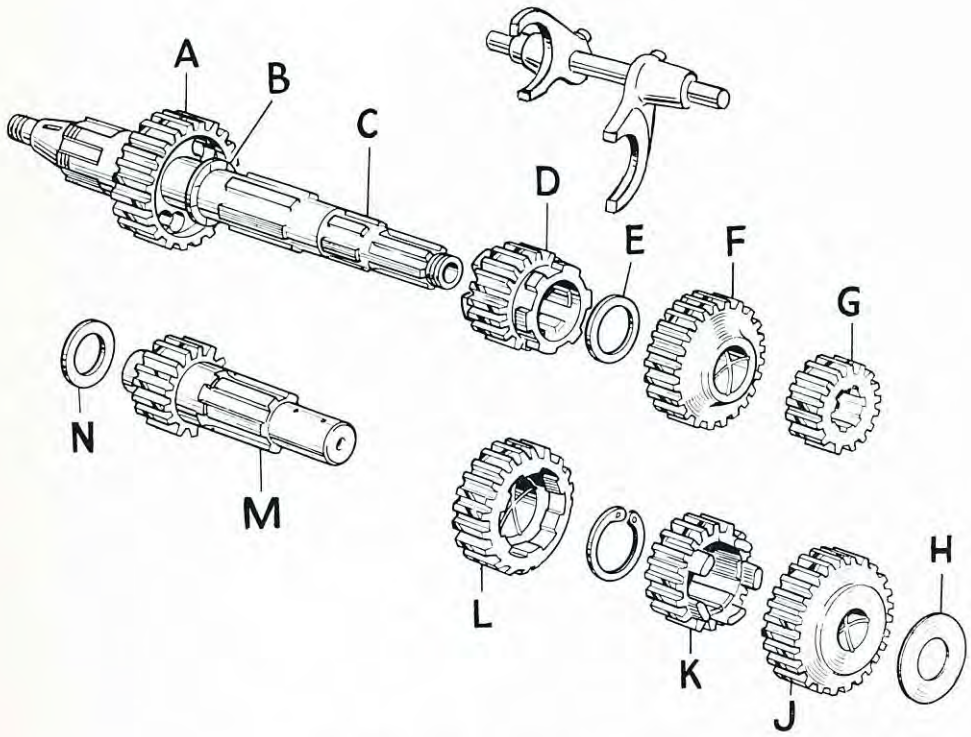


FIG. B35. *Gear cluster exploded.*

A—Mainshaft sleeve pinion (top gear)
B—Mainshaft sleeve pinion thrust washer
C—Mainshaft
D—Mainshaft sliding gear (second gear)
E—Mainshaft third gear thrust washer
F—Mainshaft third gear
G—Mainshaft bottom gear
H—Layshaft bottom gear shim
J—Layshaft bottom gear
K—Layshaft sliding gear (third gear)
L—Layshaft second gear
M—Layshaft
N—Layshaft thrust washer

Assemble the mainshaft sliding gear ("D") with its selector fork (flat face down), and engage the roller of the fork in the upper track of the camplate. Push the selector fork spindle through the forks and into the inner cover, and complete assembly of the gear cluster by fitting the layshaft and layshaft second gear assembly.

Place the mainshaft top gear thrust washer over the mainshaft and retain it with a dab of grease. Fit the layshaft thrust washer, ensuring that the side having a chamfered internal bore faces the gear. If the washer is reversed, the sharp corner may foul the radius of the layshaft, causing the layshaft to lock up through lack of end-float when the gearbox is assembled. Retain the washer with a dab of grease.

Lightly oil all components and rotate the shafts to ensure freedom of movement.

If it has been removed the gearchange return spring must be refitted to the plunger quadrant. The spring is set on manufacture to give accurate positioning of the quadrant plungers in the camplate windows, and usually, it is only possible to achieve the correct relationship of

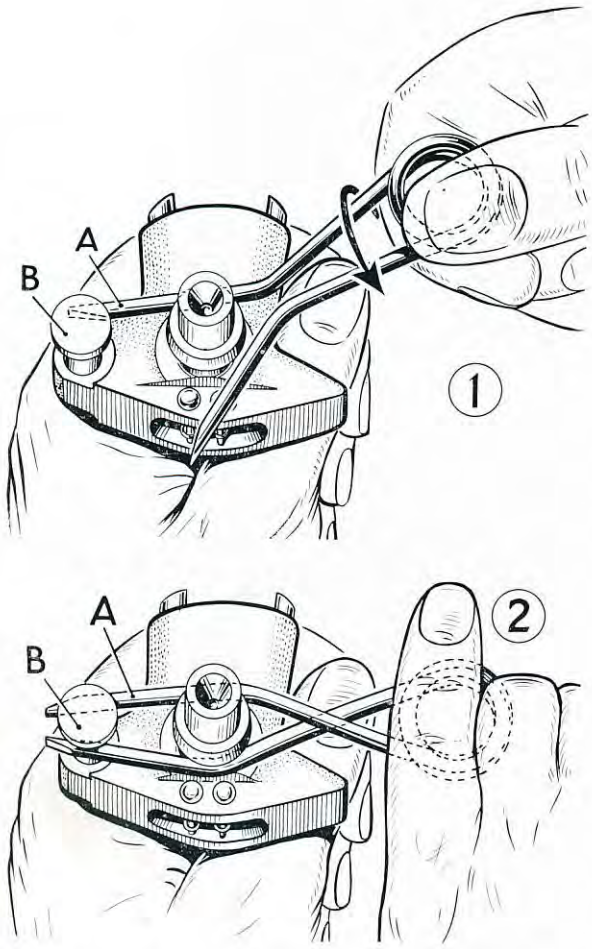


FIG. B36. *Fitting the gearchange return spring.*

parts with the spring fitted one way round. For this reason, the spring is marked with a dab of paint on one side of the coiled end after manufacture, and this side should always face the outside of the gearbox, i.e. towards the body of the plunger quadrant.

If for any reason the spring is not marked, the correct position must be established by trial and error. The spring is correctly fitted when the centres of the two pins on the quadrant and the centre of the coil of the spring are in perfect alignment.

To fit the spring to the quadrant the spring must be twisted into position as illustrated in Fig. B36. Hold the quadrant in the left hand and the coil of the spring, marked side uppermost, between the thumb and forefinger of the right hand. Turn the coil over, at the same time keeping the far point of the spring ("A", Fig. B36) beneath the cap of the quadrant pin ("B").

Fit the quadrant plunger and spring assembly to the inner cover, using a flat blade to depress the plungers whilst the plunger is pushed home.

However, later engines are fitted with an eccentric adjuster, and the position of the plunger quadrant relative to the camplate windows may be adjusted once the gearbox is reassembled into the engine.

The eccentric diameter of the adjuster stop must face the plunger quadrant and any adjustment needed obtained within 90° each way.

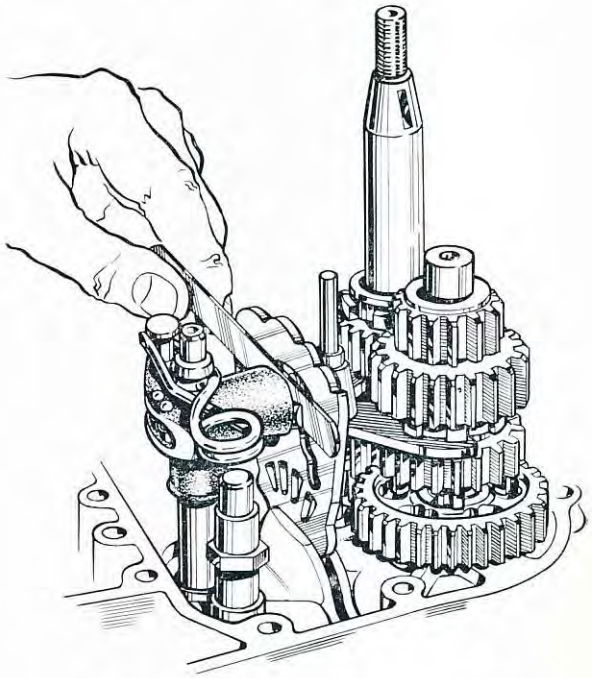


FIG. B37. *Fitting the plunger quadrant.*

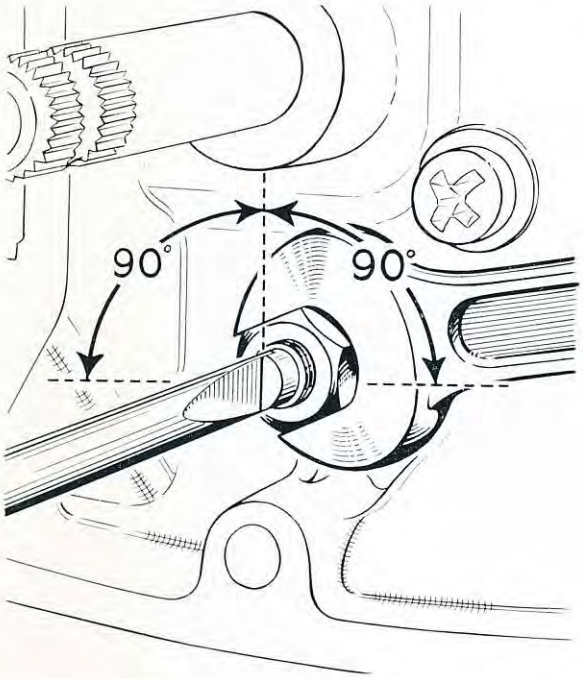


FIG. B38. *Gearchange spring adjustment.*

To adjust the spring, select each gear in turn. If it is not possible to pick up each gear positively, turn the adjuster a little at a time until a suitable condition is arrived at. Lock the adjuster with the nut (see Fig. B38).

If the gearbox has been re-assembled with its original components there will be no need to check the mainshaft and layshaft for end float. However, if new parts such as a crankcase, inner cover or shafts have been fitted, clearances may have altered and alternative thrust washers may be required to take account of this.

Check available and float before the inner cover is tightened to the crankcase permanently by removing the kickstart ratchet mechanism. Layshaft end-float may be established by means of a pair of pliers after removal of the kickstart quadrant. When doing this, be very careful not to damage the bearing surface of the shaft.

See Fig. B35 for the position of each washer, the thicknesses and part numbers of which are as follows:—

(B) ·093″—·094″ (40–3020);
·098″—·099″ (40–3126);
·103″—·104″ (40–3127)'

(E) ·070″—·071″ (40–3119);
·075″—·076″ (40–3019);
·080″—·081″ (40–3120).

(H) Standard shim (40–3258).

(N) ·078″—·080″ (41–3072);
·083″—·085″ (41–3074).

When all components have been assembled on the inner cover, clean both joint faces with petrol and apply an unbroken film of "Loctite Plastic Gasket" to one face only.

Lubricate the crankshaft oil seal and camshaft spindle, and slide the cover with gears assembled into the crankcase.

Proceed by fitting all screws to the cover, and tighten them evenly to the correct torque (3·5—4·5 lbs. ft.). Before fitting the outer cover check for correct operation of gears.

Refit the outer cover, again after applying "Loctite Plastic Gasket" to one joint face. Set the ignition timing as described on page B20.

SEQUENCE OF GEARCHANGING

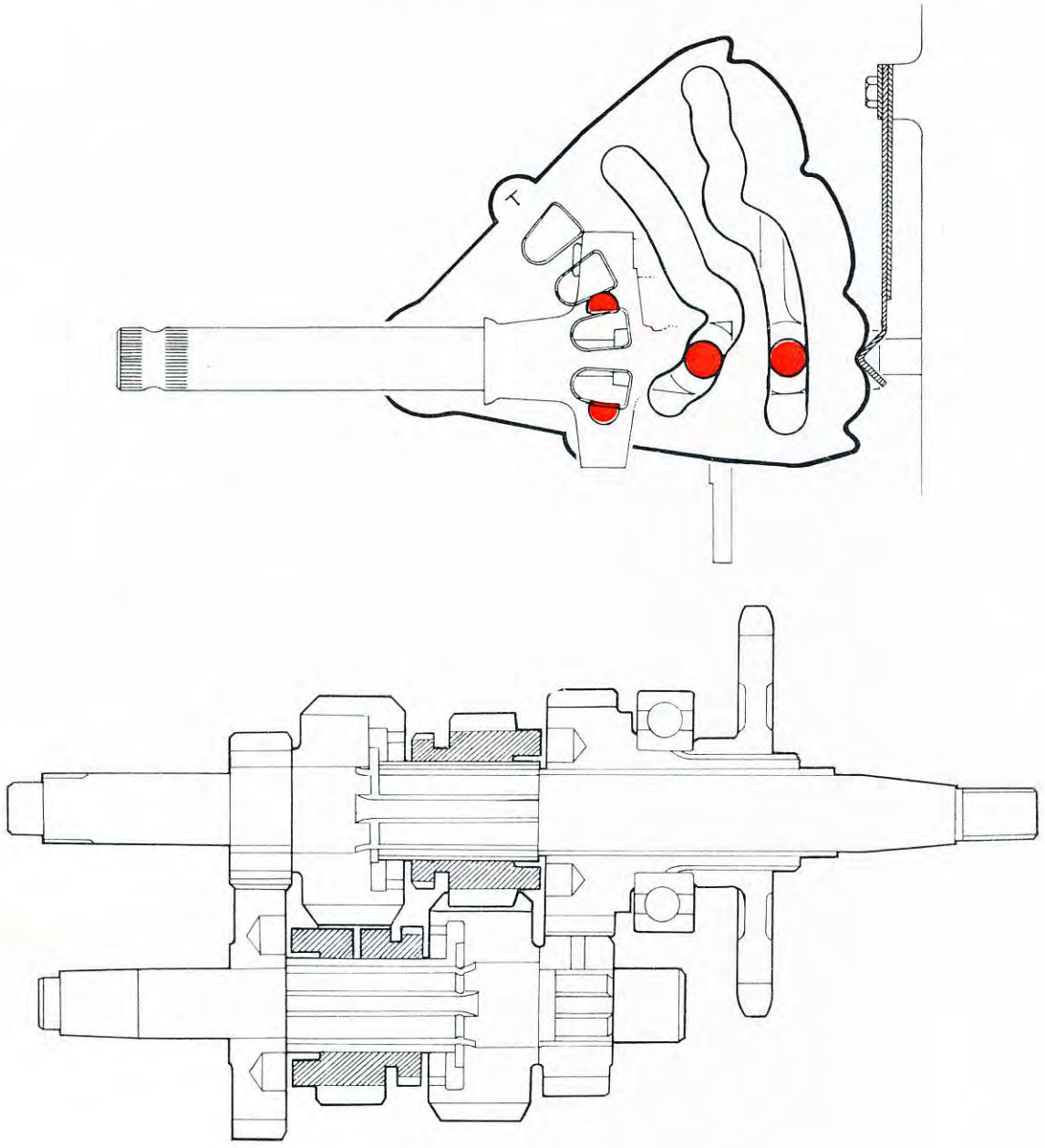


FIG. B39. *Neutral gear position.*

The gears must always be in the neutral position for kickstarting the engine. This is the position shown in Fig. B39.

The spring plate is holding the cam plate by the second notch. At the other end of the camplate the selector quadrant plungers are compressed ready to operate either way the pedal is moved.

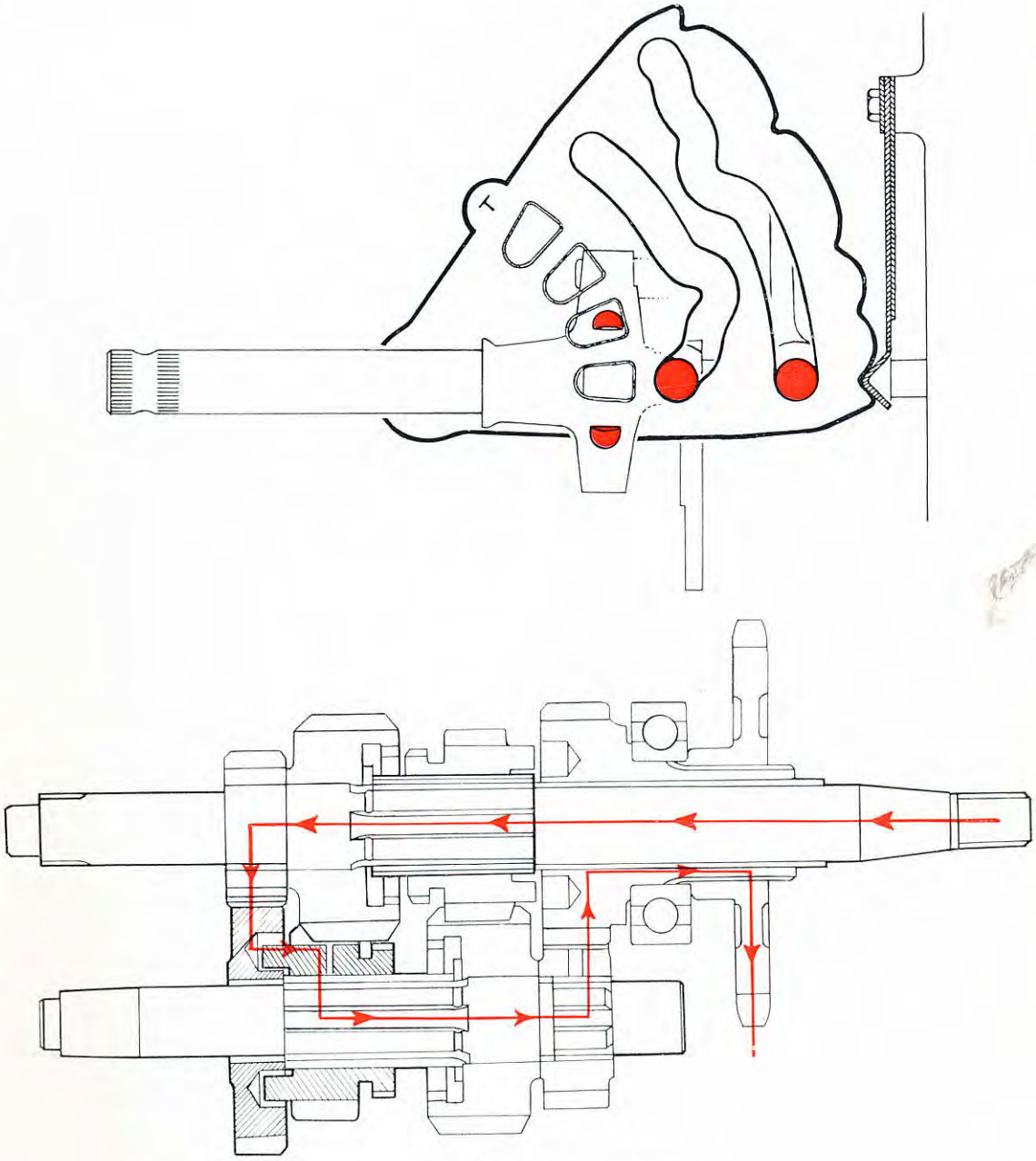


FIG. B40. *First gear position.*

When the pedal is moved downwards to engage first gear, the plungers enter the camplate windows to move the camplate to the first gear position. The layshaft sliding gear is engaged with the layshaft first gear, by movement of the layshaft selector fork.

The plungers are poised to move the camplate and gears to the neutral position in half a stroke, or to the second gear position in a full stroke (see Fig. B41).

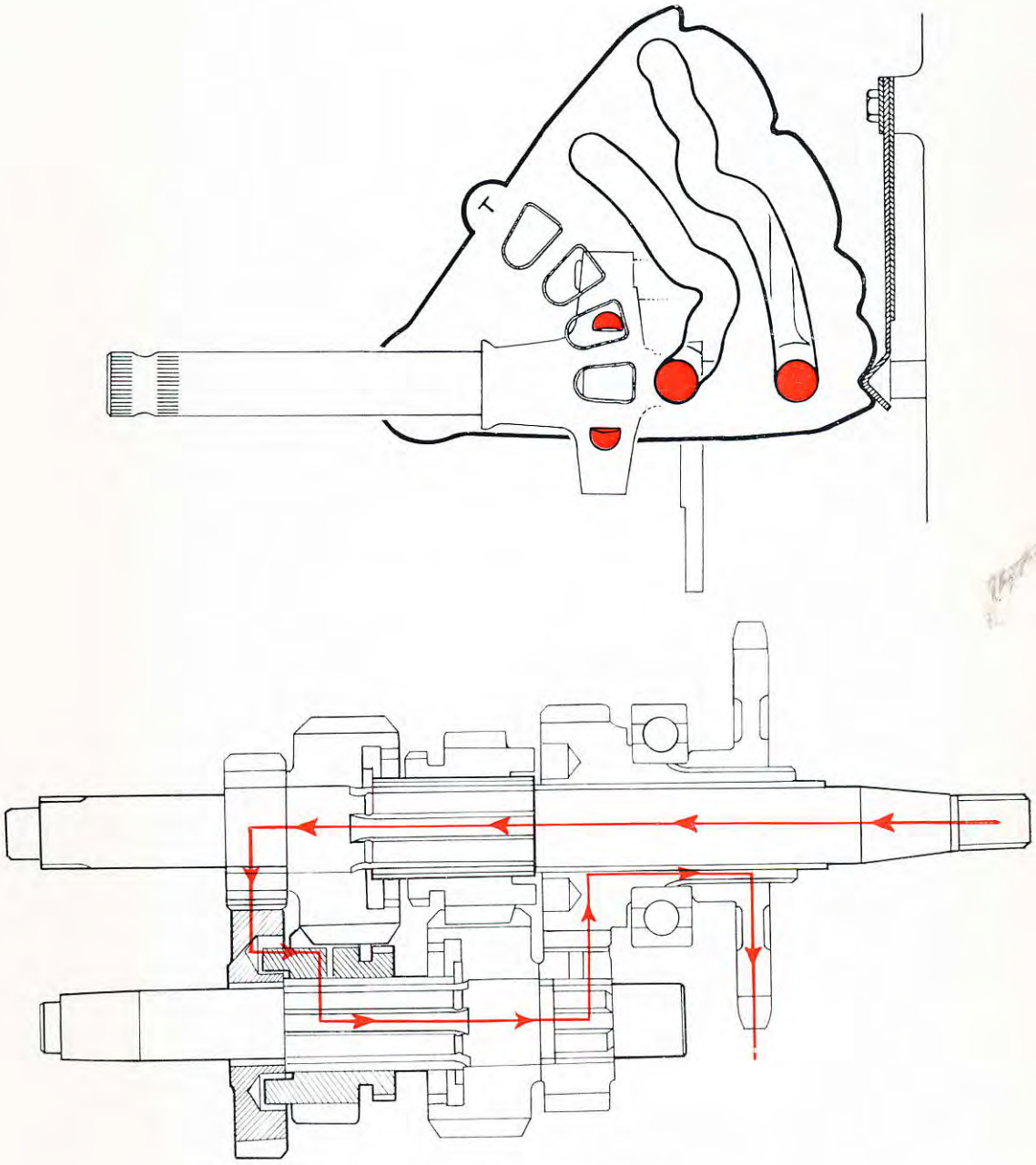


FIG. B40. *First gear position.*

When the pedal is moved downwards to engage first gear, the plungers enter the camplate windows to move the camplate to the first gear position. The layshaft sliding gear is engaged with the layshaft first gear, by movement of the layshaft selector fork.

The plungers are poised to move the camplate and gears to the neutral position in half a stroke, or to the second gear position in a full stroke (see Fig. B41).

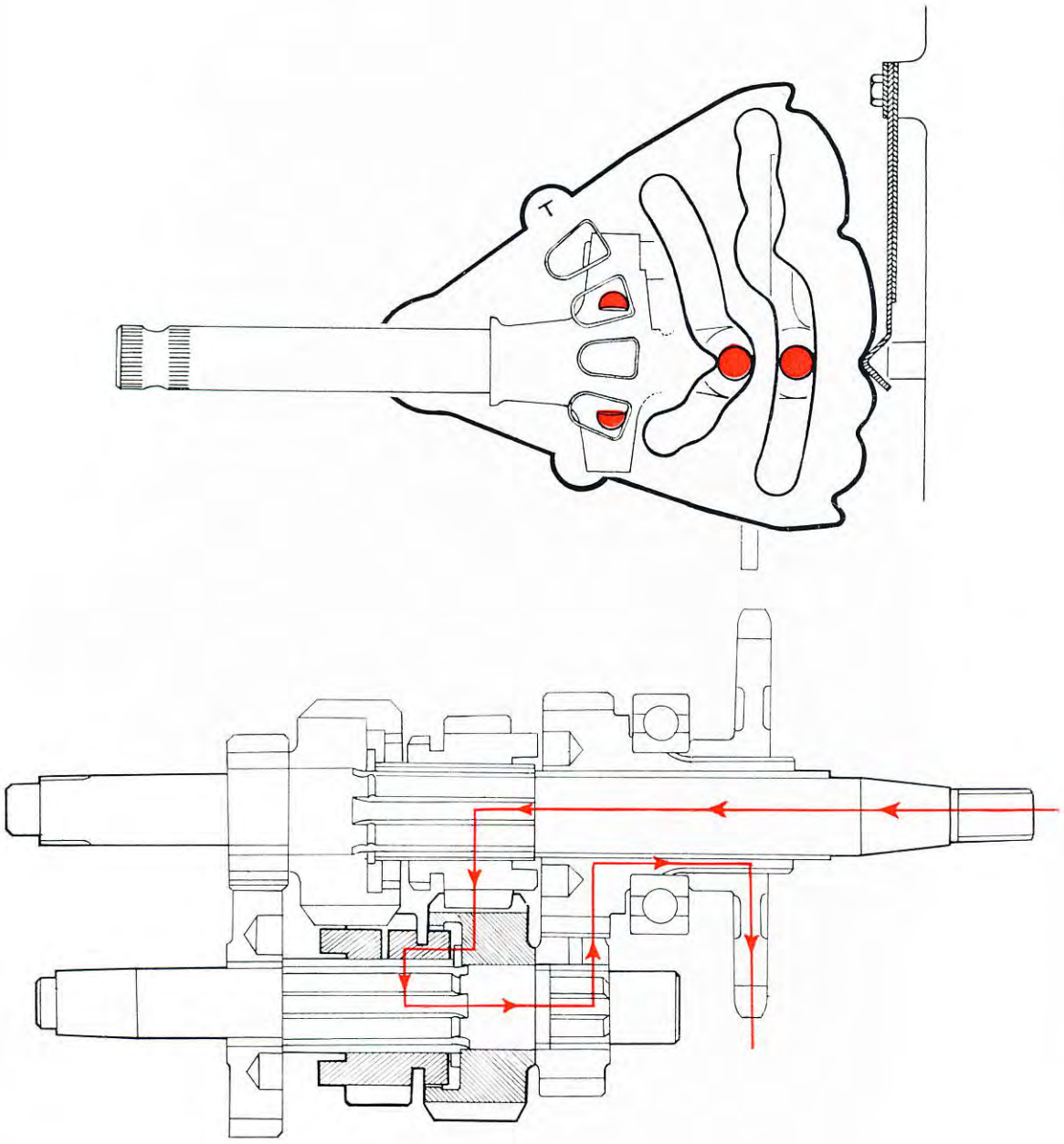


FIG. B41. *Second gear position.*

In the second gear position the layshaft sliding gear is engaged with the layshaft second gear, having been moved by the layshaft selector fork.

Fig. B41 shows the quadrant plungers in the camplate windows ready to move the gears from second to either neutral, first or third, according to movement of the gearchange pedal.

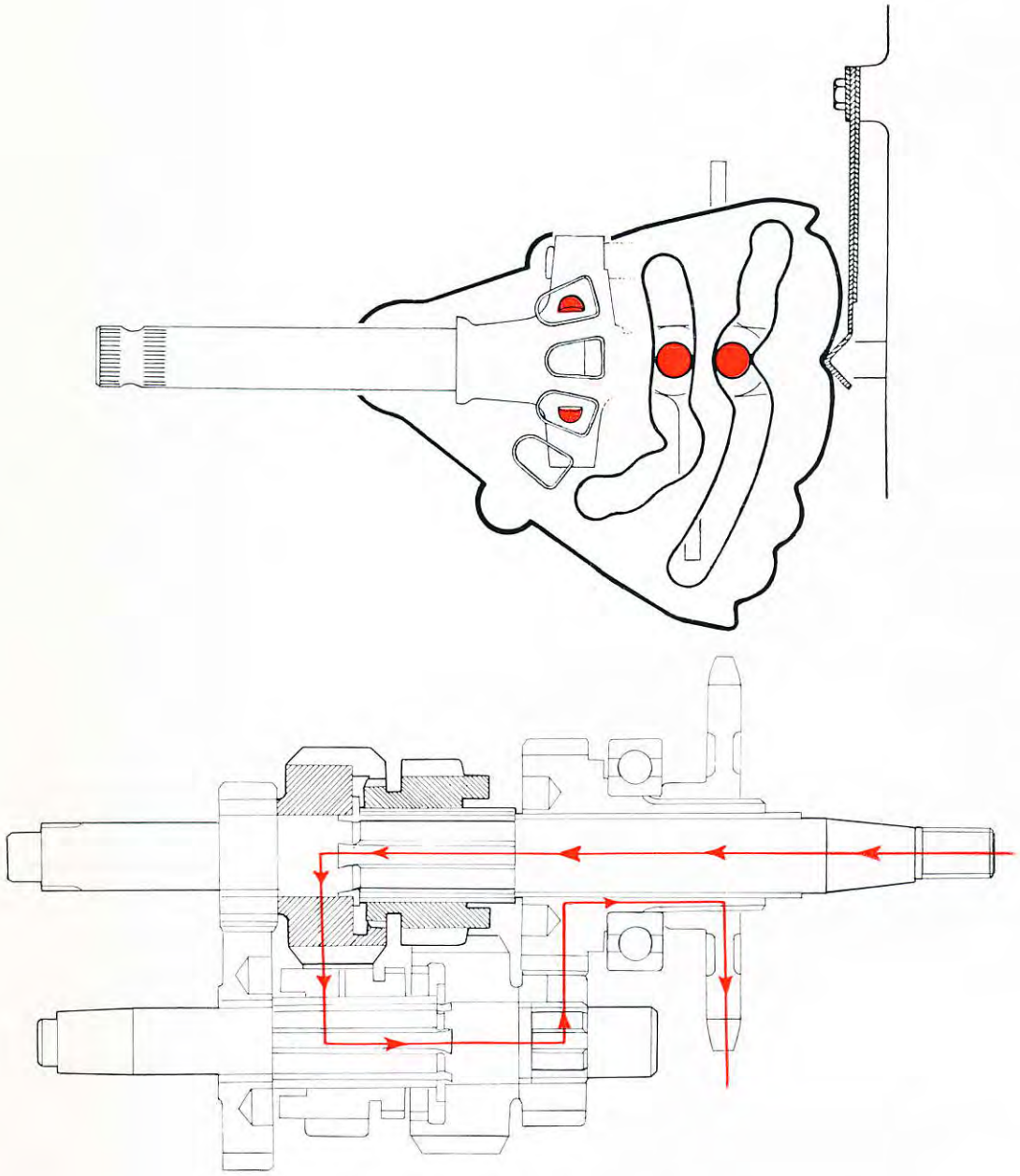


FIG. B42. *Third gear position.*

When third gear is selected, movement of the camplate actuates both selector forks. The layshaft sliding gear moves to a neutral position, and the mainshaft fork engages the mainshaft sliding gear with the mainshaft third gear.

In the camplate windows, the quadrant plungers are ready to move the camplate to either second or top gear (see Fig. B42).

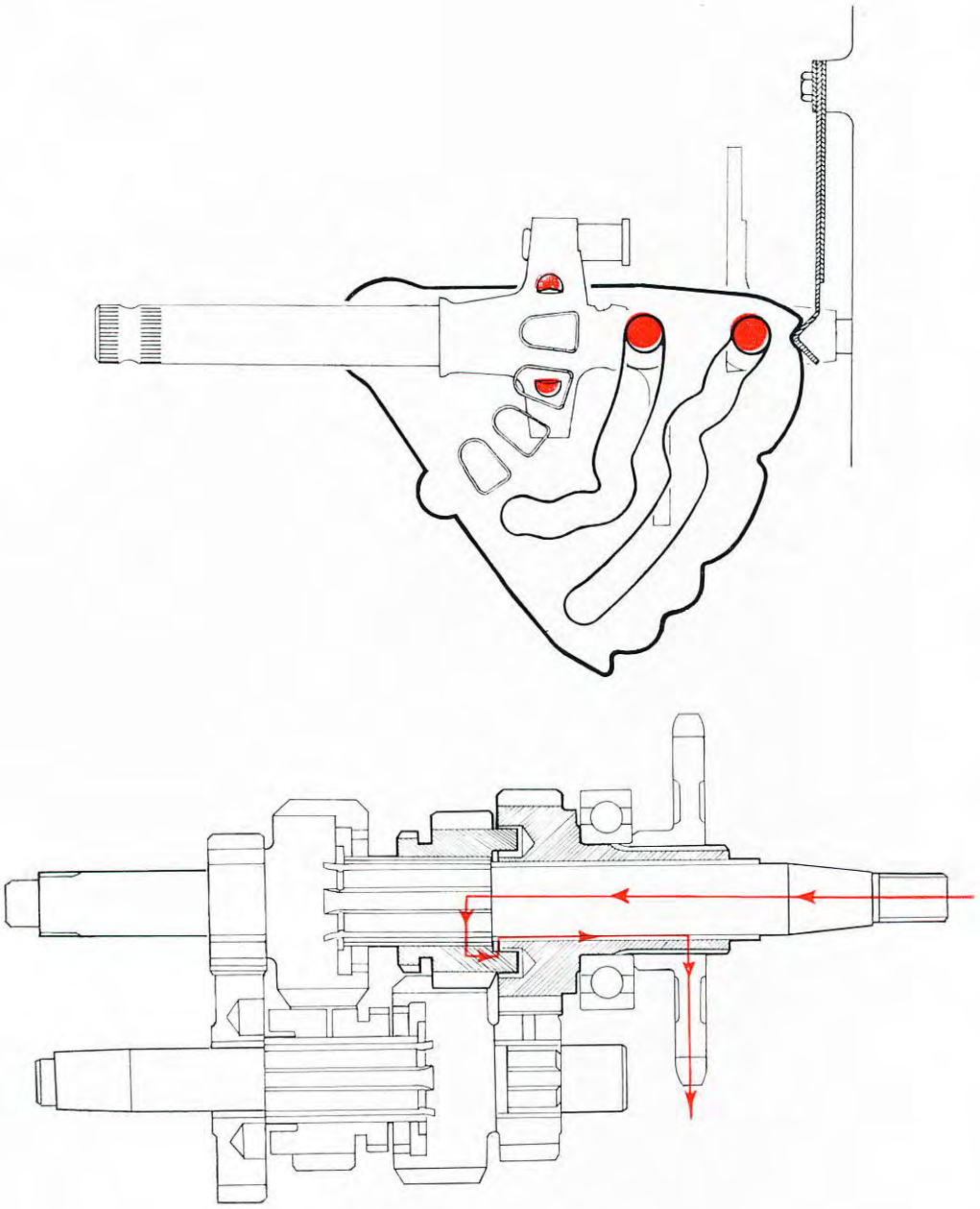


FIG. B43. *Fourth gear position.*

The change into top gear moves the mainshaft sliding gear into engagement with the mainshaft sleeve pinion.

The top quadrant plunger is now concealed behind the camplate, and only the lower plunger is able to engage in a window and so move the camplate to the third gear position.

SPLITTING THE CRANKCASE HALVES

Before attempting to part the crankcase halves, remove the primary drive assembly, timing covers and timing gear as described on previous pages.

Working on the left side of the crankcase, remove the three bolts at the lower front of the case then take off the four stud nuts; two from the centre of the case and two from the cylinder base.

Remove any Woodruff keys which may still be in the shafts, noting their particular locations, and break the crankcase joint by tapping gently with a hide-mallet.

Do not attempt to prise the crankcase halves apart by using a tool between the joint. This will only damage the joint faces, resulting in oil leak.

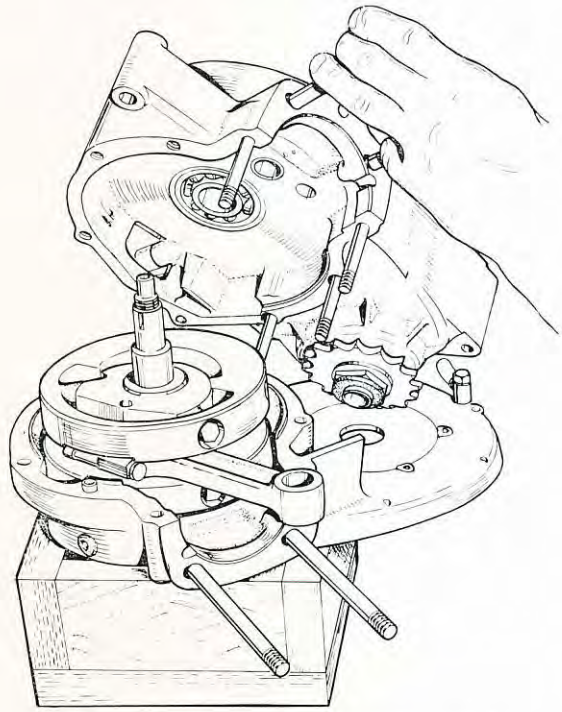


FIG. B44. *Parting the crankcase halves.*

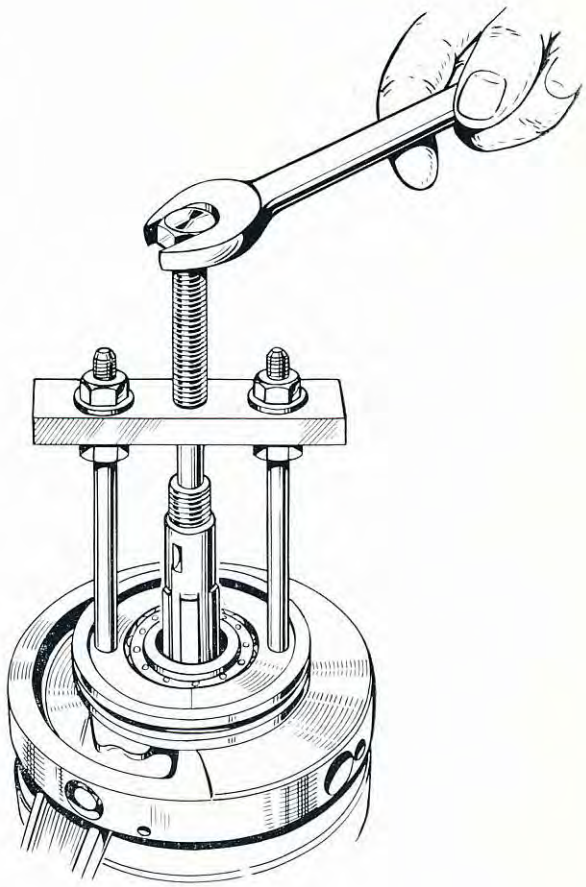


FIG. B45. *Using tool No. 61–3778 to remove the roller bearing inner race.*

Support the crankcase assembly timing side uppermost (see Fig. B50 for a suitable support) and, using a hide-mallet, strike the front engine mounting lug from below in order to remove the timing side crankcase half (see Fig. B44). Having done this, the crankshaft may be lifted out of the drive-side crankcase half, but in the case of the B50, gentle pressure may be required due to the main bearing arrangement.

Crankshaft end-float must be restricted in the case of the B25, and to control this there may be shims fitted between the crankshaft web and timing side bearing.

Main bearings (B25)

The drive-side bearing is a roller, and the

inner and outer races being separated when the crankcase is parted. By heating the case in an oven, the outer race will be free to be tapped out. The inner race, in position on the crankshaft, may be pulled off using extractor No. 61–3778 as illustrated in Fig. B45.

The timing side ball bearing may be tapped out of the crankcase after the case has been warmed in an oven.

Main bearings (B50)

B50 engines have, unlike the B25, two drive-side bearings, the outer being a ball, the inner a roller. The bearings are an interference fit in the crankcase, but additional security is provided by a ring fixed to the crankcase by four countersunk screws. Take out the four screws to remove the ring, and heat the crankcase to facilitate removal of the bearings, spacer and abutment ring.

BIG END AND FLYWHEEL ASSEMBLY

B25 models

Removal of the connecting rod from the crankshaft is straightforward. Unscrew the cap retaining nuts a turn at a time to avoid distortion, then withdraw the cap and connecting rod. When extracting the bearing shells, note that they are each located by means of a small tag. To assist in correct reassembly, the rod and its cap are marked at the front or rear face with a centre-punch. These marks **must** be adjacent on reassembly.

Examine all parts carefully. If the bearing shells or journal is scored or appears worn the crankshaft must be reground. This work must be entrusted to a specialist as an accurate machining operation is involved. Refer to the chart below for correct dimensions.

It is most important that the radii at the inner faces of the journal remain at ·070″—·080″.

Replacement bearing shells are pre-finished to give the correct diametrical clearance on a correctly ground journal. On no account should the shells be scraped or the connecting rod end cap joint faces filed.

In order to regrind the crankshaft, the flywheels must be detached. Four bolts, of two different lengths, secure each flywheel to the crankshaft webs. Loosen and remove the four short bolts (those nearest the big-end journal) first to avoid distortion.

	Bearing Shell Marking and Part No.	Crankshaft Journal Size	
	Standard 40–907	1·4375″ 1·4380″	36·513 mm. 36·525 mm.
First regrind ..	—·010″ 40–917	1·4275″ 1·4280″	36·259 mm. 36·271 mm.
Second regrind ..	—·020″ 40–918	1·4175″ 1·4180″	36·005 mm. 36·017 mm.
Third regrind ..	—·030″ 40–919	1·4075″ 1·4080″	35·751 mm. 35·7632 mm.

Opportunity should be taken, whilst the flywheel assembly is out of the crankcase, to clean the oil sludge trap, located in the right flywheel. Remove the screwed plug and thoroughly clean out the drilling with paraffin. If possible, use a high-pressure air line to blow through the oil-ways.

When rebuilding the crankshaft assembly be sure to replace the flywheels correctly. The flywheel incorporating the sludge trap **must** be fitted on the right side.

Add a drop of "Loctite" to the threads of each bolt, and tighten evenly to 50 lbs. ft.

Flywheel balancing

Flywheel balancing is a skilled operation and should not be undertaken by anyone other than an expert mechanic having access to the necessary equipment. The equipment required is a drilling machine with depth stop and knife-edge rollers similar to those shown in Fig. B47. The rollers must be perfectly horizontal. To ensure accurate balancing, a weight equivalent to 54 per cent of the reciprocating weight (Service tool No. 61–6124, weight 18 ozs. 3 drms.) must be attached to the crankshaft journal.

Place the crankshaft centrally on to the rollers and revolve a few times. Allow the assembly to come to rest then mark the lowest point on the flywheel with chalk. This will indicate the heaviest part of the assembly.

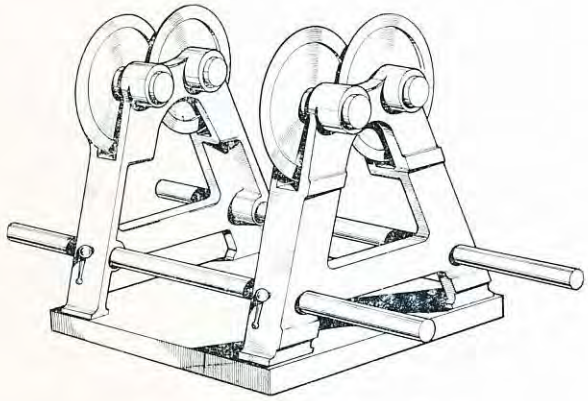


FIG. B47. *Knife-edge rollers.*

The wheels must now be drilled at the heaviest point to remove sufficient metal to bring the assembly into balance, indicated when the assembly may be brought to rest in any position without further movement.

Drilling must be confined to the thicker portion of each flywheel, opposite the balance weight, and must be carried out equally on the periphery of **both wheels**. The holes must not be deeper than $\frac{3}{8}$" or be more than $\frac{3}{8}$" in diameter. Obviously, it is wise to start with a small diameter hole which can be opened out if necessary, rather than beginning with a large hole only to find that too much metal has been removed.

Finally, thoroughly wash the assembly in clean paraffin.

Refitting the connecting rod

The need for cleanliness cannot be over-emphasized, and, as the various parts are assembled, all bearing surfaces should be coated with clean engine oil.

Place new bearing shells in the connecting rod and cap, making sure that they are seated correctly, and refit the connecting rod, ensuring that the oil hole drilled in the big end faces the drive-side flywheel. Next fit the cap, using the centre punch markings as a guide to ensuring that it is fitted in its original position.

It is recommended that new connecting rod nuts and bolts are used, because these bolts tend to stretch in service. Clean the threads and apply a drop of "Loctite" screw lock to each part before tightening to 22 lbs. ft.

Using a pressure oil-can, force clean oil through the duct at the right end of the crankshaft until it is seen to issue from around the big-end bearing, thus indicating that the oil-ways are not blocked and are full of oil.

B50 models

Should the big-end bearing require replacement, unscrew the crankpin nuts at each side using socket No. 61–3770 and release the crank-

pin from each flywheel in turn using a hand press and stripping bars.

When parting the flywheels, take care not to lose the small locating peg in the timing side flywheel.

Clean the oil sludge trap, located in the right flywheel, whilst the flywheel assembly is removed from the engine. Remove the screwed plug and thoroughly clean out the drilling with paraffin. If possible, use a high-pressure air line to blow through the oilways.

When reassembling, place the locating peg in the right side flywheel and locate the crankpin over the flywheel hole so that the peg will coincide with the groove in the tapered face of the crankpin. This ensures that the oil hole in the crankpin will line-up with the oil-way in the flywheel. It is most important that these holes are not obstructed. Press the crankpin firmly in position, then fit the drive-side flywheel. Replace the crankpin nuts and tighten to 200 lbs. ft.

The flywheel assembly will now have to be "trued".

Flywheel truing

Place the crankshaft bearings on to the shafts and mount the assembly in vee-blocks. True-up the flywheels as indicated in Fig. B48 using dial indicators for checking.

Flywheel truing may only be carried out successfully using the equipment illustrated. Therefore, it is recommended that the work be entrusted to a specialist or dealer.

The flywheels must be true on their side faces to ·005″. The drive-side shaft must be true to ·002″ and the timing-side shaft to ·0005″.

Using a pressure oil-can, force clean oil through the duct in the right engine shaft until it is seen to issue from around the big-end bearing, thus indicating that the oil-ways are not blocked and are full of oil.

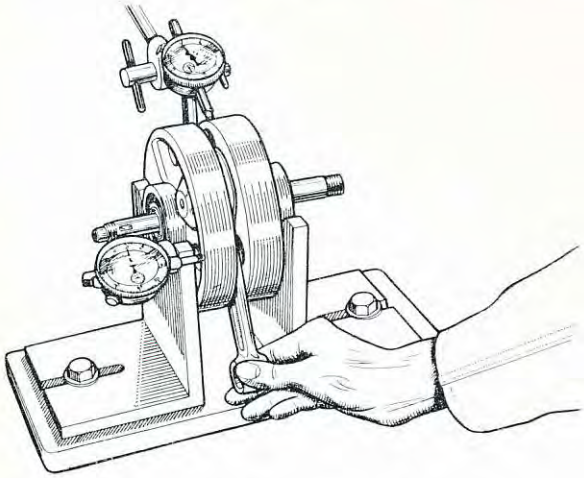


FIG. B48. *Checking the flywheels.*

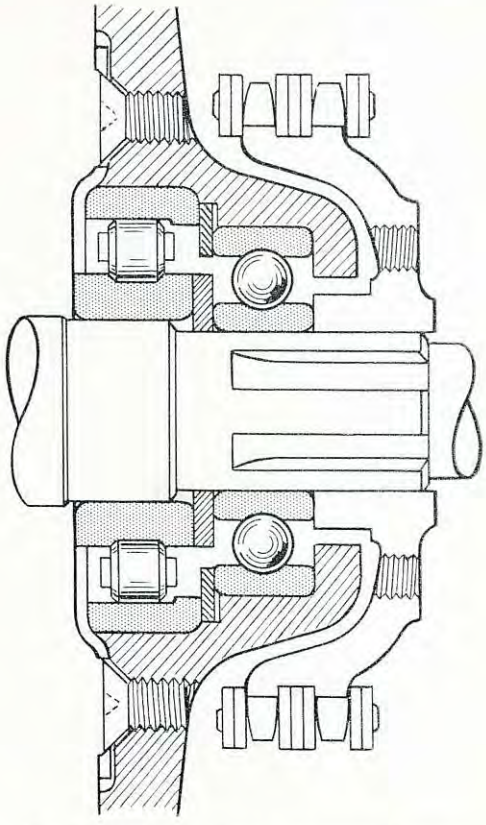


FIG. B49. *B50 drive side main bearing assembly.*

REASSEMBLING THE CRANKCASE

Heat the crankcase in order to fit new bearings and bushes as required. In the case of B50 engines ensure that the bearing abutment ring on the drive side is correctly located, and apply a drop of "Loctite" to the threads of each of the four screws securing the bearing retaining plate.

On B25 engines, crankshaft end-float must be restricted to ·002″—·005″. This is controlled by shims fitted between the crank web and the inner face of the right bearing. Shims are available in thicknesses of ·003″ (40–0064), ·005″ (40–0065), ·010″ (40–0066), and ·015″ (40–0069).

Place the crankshaft assembly into the drive-side crankcase. This operation will be simplified if the case is supported on a wooden box of the dimensions shown in Fig. B50.

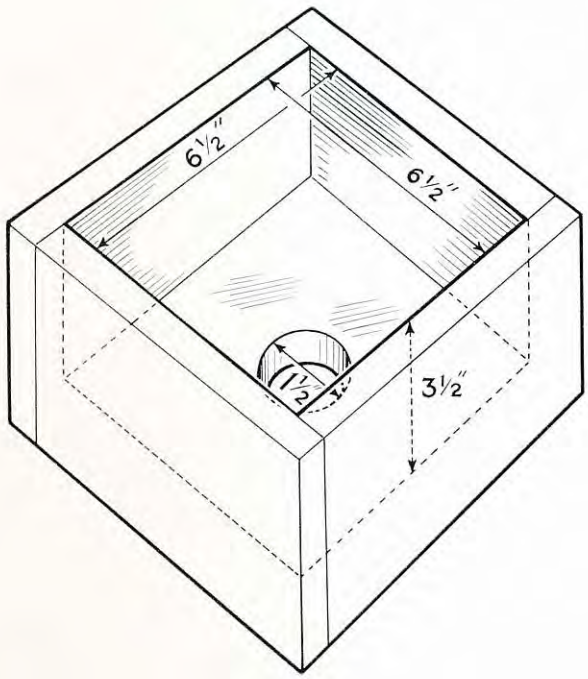


FIG. B50. *Box for supporting crankcase.*

Apply a thin coating of "Loctite Plastic Gasket" to one joint face of the crankcase halves and fit the timing-side half.

Replace the three bolts at the front of the case and the four nuts (two at the base of the cylinder and two in the primary case).

Tighten nuts and bolts evenly, to a torque of 16–18 lbs. ft.

Check that the crankshaft assembly rotates freely. If it does not, alignment may be incorrect or too many shims are fitted behind the timing side ball bearing. The cause of the trouble must be located and rectified.

Fit the engine sprocket distance piece (B25 each with the chamfered face outwards.

Reassembly from this point is described in previous pages.

INDEX

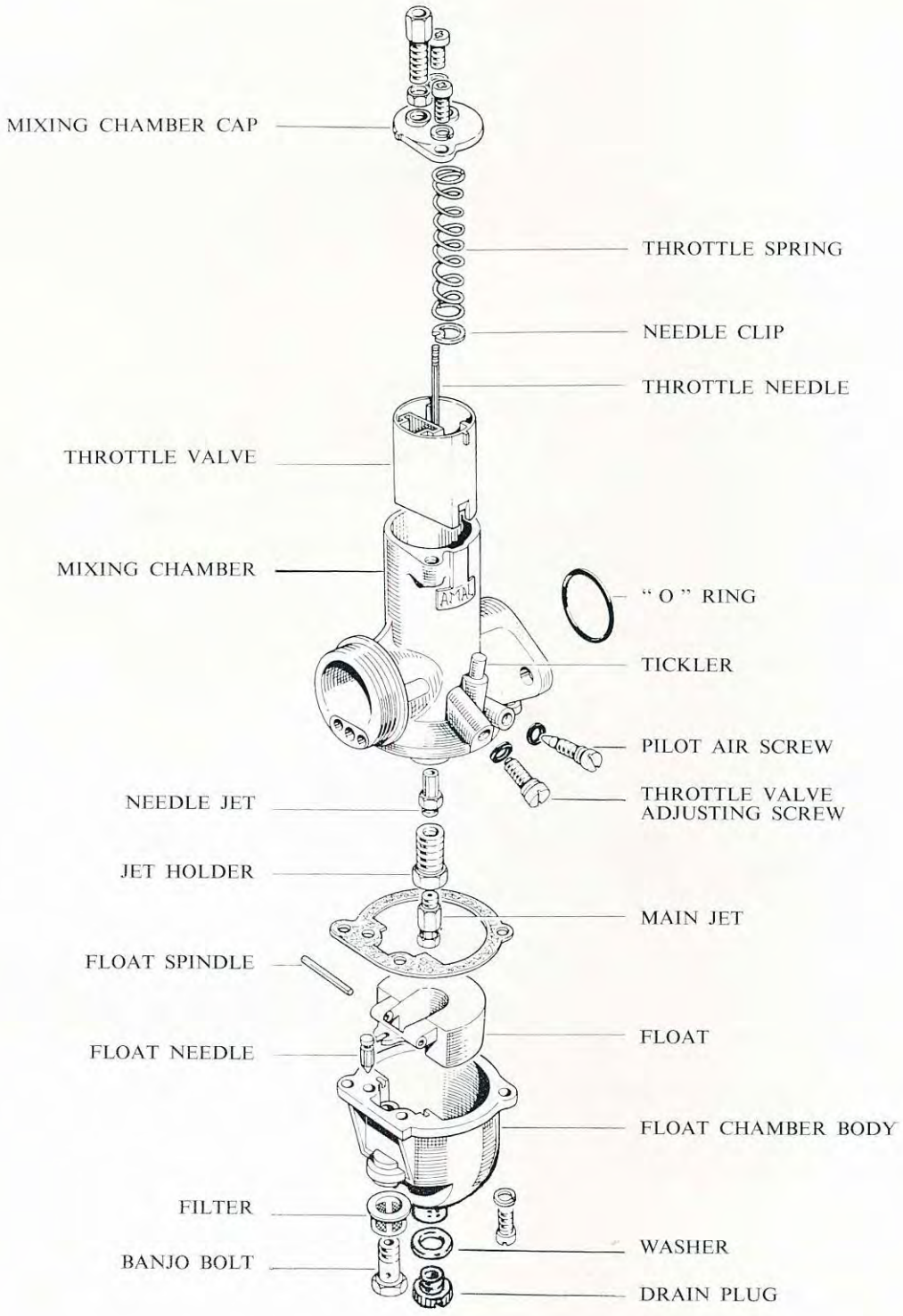


Fig. C1. *The Amal concentric carburetter exploded.*

DESCRIPTION

Both B25 and B50 models are fitted with an Amal carburetter, incorporating a concentric float chamber.

The carburetter proportions and atomises just the right amounts of petrol and air to provide a highly inflammable mixture. The mixture is drawn into the engine and ultimately burnt within the cylinder head, hence the term "combustion chamber".

The float chamber maintains a constant level of fuel at the main jet and incorporates a valve which cuts off the supply when the engine stops.

The throttle valve, operated from the handle-bar twist grip, controls the volume of mixture supplied to the engine and therefore the power developed.

At small throttle openings (see Fig. C2) when the engine is ticking-over, the mixture is supplied via the pilot jet. As the throttle is opened, the pilot mixture is augmented by the supply from the main jet. In its early stages, this supply is controlled by the taper needle in the needle jet, and by the cutaway of the throttle valve.

The pilot jet consists of a drilled bush pressed into the mixing chamber, and is therefore not replaceable. Other parts may be identified on the illustration opposite.

The main jet does not spray directly into the mixing chamber, but discharges through the needle jet into the primary air chamber, and goes from there as a rich petrol/air mixture through the primary air choke into the main air choke.

The primary air choke has a compensating action in conjunction with bleed holes in the needle jet, which serves the double purpose of compensating the mixture from the needle jet and allowing the fuel to provide a well outside and around the needle jet available for snap acceleration.

DISMANTLING AND REBUILDING THE CARBURETTER

Unscrew the clip securing the air filter hose to the carburetter, release the two fixing nuts and withdraw the carburetter from its mounting studs; it is not necessary to detach the cable from the twist grip.

Take out the two Phillips-head fixing screws and remove the mixing chamber cap complete with throttle valve assembly. Compress the throttle spring and remove the needle clip to release the needle. Whilst still compressing the spring, push the cable downwards to release the nipple from its location in the valve.

Unscrew the bolt securing the fuel pipe banjo connector to the float needle seating block and withdraw the nylon filter.

The float chamber is secured to the base of the mixing chamber by two screws with spring washers. On removal, it will be noted that the float spindle lies in recesses in the chamber body and that the needle is retained by a fork on the float.

The needle jet and main jet (with holder) may now be unscrewed from the mixing chamber base.

Take out the throttle valve adjusting and pilot air adjusting screws and ensure that the small rubber "O" ring around each screw is in good condition before replacing.

The float chamber tickler (or primer) consists of a spring and plunger, splayed at one end to retain it in the mixing chamber. This item should not be subjected to a great deal of wear and is therefore unlikely to require replacement.

Having dismantled the carburetter, carefully clean all parts in petrol (gasolene). Hard deposits on the carburetter body are best removed with a light-grade wire brush. After washing the parts, allow them to dry and ensure that all holes and small drillings are free from dirt. A hand pump is ideal for "blowing through" any blockage in

the drillings. Inspect component parts for wear and check that the jets are in accordance with the recommended sizes given in the General Data section.

INSPECTING CARBURETTER COMPONENTS

The parts most liable to show wear after considerable mileage are the throttle valve and mixing chamber.

(1) Inspect the throttle valve for excessive scoring of the front area and check the extent of wear on the rear slide face. If wear is apparent, the valve should be renewed; be sure to fit a valve with the correct cut-away.

(2) Check the throttle return spring for efficiency. Check also that it has not lost its compressive strength by measuring the free length, which should be 2·5 ins. (6·4 cm.).

(3) Examine the needle jet for wear or possible scoring and check the tapered end of the needle for similar signs.

(4) Check the float needle for efficiency by inserting it into the seating block, pouring a small amount of fuel into the aperture surrounding the needle and checking for leakage.

(5) Ensure that the float is not punctured by shaking it to see if it contains fuel. Do not attempt to repair a damaged float—if there is any doubt about its condition, replace it with a new one.

(6) Check the fuel filter that fits over the needle seating block for possible damage to the mesh. If the filter has parted from its supporting structure it will allow fuel to pass through unfiltered.

Referring to Fig. C1 for guidance, reassemble the instrument using a new float chamber gasket. Replace any other parts that have worn.

HINTS AND TIPS

Throttle cable

There should be a minimum of backlash when the twist grip is turned back, and the throttle cable must be routed so that movement of the handlebar does not cause the throttle to open. There must be no sharp bends or kinks in the cable which will impair free action of the control.

Use the adjuster on the cable to obtain the correct setting, but ensure that the throttle valve closes freely on to the adjusting screw.

Fuel feed

Unscrew the float chamber bolt, remove the banjo, and take off the filter gauze from the needle seating.

Ensure that the filter gauze is undamaged and free from all foreign matter. Check fuel flow before replacing the banjo by turning the fuel tap on momentarily to see that fuel gushes out.

Flooding

This may be due to a worn needle or punctured float, but is more likely to be the result of impurities (grit, fluff, etc.) in the fuel tank. The trouble may sometimes be cleared by periodically cleaning out the float chamber. However, the tank must be drained and swilled out to effect a permanent cure.

Carburetter air leaks

Erratic slow-running is often caused by an air leak between the carburetter flange and cylinder head, and may be detected by applying oil around the joint. Small leaks may be eliminated by fitting new gaskets and tightening the flange nuts to the correct torque (10 lbs. ft.). Make sure that the rubber sealing ring is undamaged and correctly located.

However, if the carburetter flange is warped (check with a straight-edge) flatness must be restored by lapping the face on emery cloth placed over a perfectly flat surface, e.g., plate glass.

On much used or old machines look for air leaks caused by a worn throttle valve or a worn inlet valve guide.

Banging in exhaust

This may be caused by too weak a pilot mixture, and is evident when the throttle is closed or nearly closed. It may also be caused by too rich a pilot mixture or an air leak in the exhaust system. The reason in either case is that unburnt mixture has ignited in the hot exhaust system.

However, if banging occurs at wider throttle openings the trouble will be the result of ignition faults.

Excessive fuel consumption

If not due to flooding (see above) and cannot be corrected by carrying out normal adjustments, it is probable that the needle and needle jet are worn and require replacement.

However, the entire fuel system must be checked over to ensure that the fuel tank, taps and pipes are sound and not leaking.

Finally, it should not be assumed that excessive fuel consumption is the result of carburetter faults. Unskilled driving techniques, such as allowing the machine to labour in high gear, may often be blamed.

Air cleaner

As the carburetter is set for use with an air cleaner, carburation will be upset if the cleaner is subsequently disconnected. The engine must not be used without the connection unless the carburetter has been suitably re-jetted. Serious damage could result through overheating caused by a weak mixture.

Generally, an increase of approximately 20 in main jet size will correct this weakness, though the final setting must be determined by trial and error. It may be necessary to raise the needle.

Effect of altitude on carburation

Increased altitude tends to cause a rich mixture; the greater the altitude, the smaller the main jet required. The carburetter is suitably set for use in altitudes of up to approximately 3,000 feet. Carburetters used constantly in altitudes of between 3,000 and 6,000 feet should have a reduction in main jet size of 5 per cent from standard, and a further reduction of 4 per cent should be made for every 3,000 feet in excess of 6,000 feet altitude.

No adjustment can be made to compensate for lost power due to rarified air.

TRACING FAULTS

Faults likely to occur in carburation can be placed in one of two categories; either richness or weakness of petrol/air mixture.

Indications of richness

Black smoke in exhaust.
Fuel spraying out of carburetter.
Eight-stroking.
Heavy, lumpy running.
Sparking plug sooty.

Indications of weakness

Spitting back in carburetter.
Erratic slow-running.
Overheating.
Engine runs better if throttle is almost closed.

Having established whether the mixture is too rich or too weak, check if caused by:—

(1) Fuel feed—check that jets and passages are clear, that the filter gauze in the "banjo" connection is not choked with foreign matter, and that there is an ample flow of fuel. Ensure there is no flooding.

(2) Air leaks—usually at the flange joint, but possibly due to a worn inlet valve stem and/or guide.

(3) Worn or loose parts—such as a loose-fitting throttle valve, worn needle jet or loose main jet.

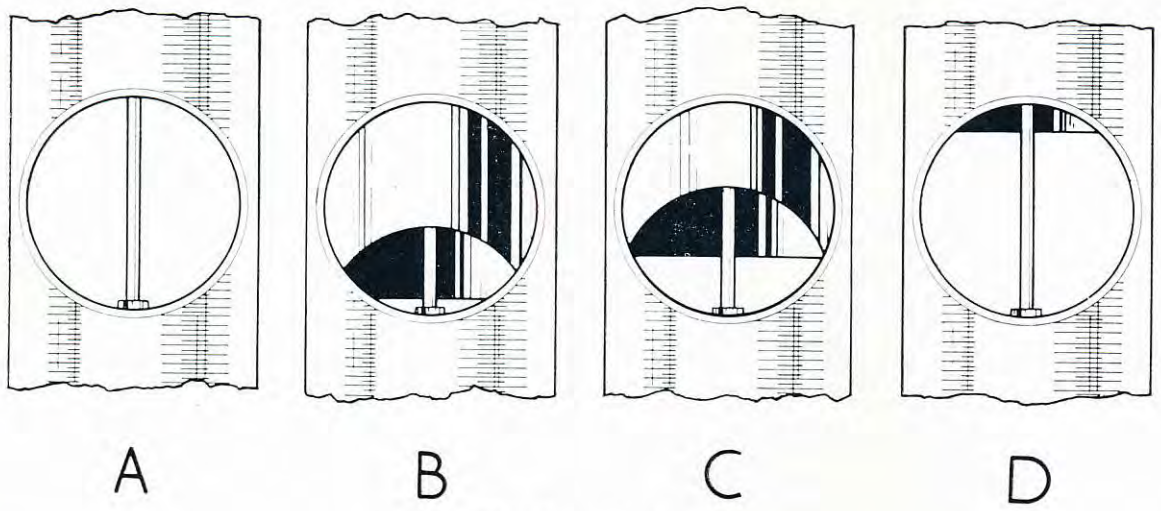


FIG. C2. *Sequence of tuning.*

A—First Stage: Main jet size (¾ to fully open)

B—Second and Fifth Stages: Pilot jet (up to ⅛ open)

C—Third Stage: Throttle cut-away (⅛ to ¼ open)

D—Fourth Stage: Needle position (from ¼ to ¾ open)

(4) The air cleaner being blocked.

(5) The air cleaner having been removed.

(6) Removal of the silencer—this requires a richer setting.

Having ensured that the fuel feed is correct and that there are no air leaks etc., check the ignition timing, valve operation and timing. Now test to see if the mixture is rich or weak.

If required, proceed as follows:—

(Positions 1, 2, 3 and 4 refer to positions of throttle openings as shown in Fig. C2).

To cure richness

Position A. Fit smaller main jet.

Position B. Screw out pilot air adjusting screw.

Position C. Fit a throttle valve with a larger cut away (see paragraph "3", page C8).

Position D. Lower needle one or two grooves (see paragraph "4", page C8).

To cure weakness

Position A. Fit larger main jet.

Position B. Screw pilot air adjusting screw in.

Position C. Fit a throttle valve with a smaller cut away (see paragraph "**3**", page C8).

Position D. Raise needle one or two grooves (see paragraph "4", page C8).

It is incorrect to attempt to cure a rich mixture at half-throttle by fitting a smaller jet because the main jet may be correct for power at full throttle. The correct method is to lower the throttle needle.

VARIABLE SETTINGS AND PARTS

Throttle valve adjusting screw

Set this screw to hold the throttle open sufficiently to keep the engine running when the twist grip is closed.

Pilot air screw

This screw regulates the strength of the pilot mixture for idling and for initial opening of the throttle. The screw controls depression on the pilot drilling by metering the amount of air that mixes with the petrol. Screw in to weaken the mixture, out to richen.

Main jet

The main jet controls the fuel supply when the throttle is more than three-quarters open, but at smaller throttle openings, although the supply of fuel goes through the main jet, the amount is diminished by the metering effect of the needle in the needle jet.

Each jet is calibrated and numbered so that its exact discharge is known, and two jets of the same number are alike. Never ream out a jet—fit another of the right size. The larger the number the larger the jet.

Needle and needle jet

The needle is attached to the throttle valve assembly and, being tapered, either allows more or less petrol to pass through the needle jet as the throttle is opened or closed throughout the range, except when idling or nearly at full throttle. The needle position in relation to throttle opening can be set according to requirement by fixing the retaining clip in an alternative groove, thus either raising or lowering the needle. Raising the needle richens the mixture and lowering it weakens the mixture at throttle openings from a quarter to three-quarters open.

Throttle valve cut-away

The atmospheric side of the throttle is cut away to influence depression on the main fuel supply and thus gives a means of tuning between the pilot and needle jet range of throttle opening. The amount of cut-away is recorded by a number marked on the top face of the valve, viz., 3½. Larger cut-aways give weaker mixtures, smaller cut-aways a richer mixture.

Tickler or primer

This is a small spring-loaded plunger in the carburetter body. When pressed down on the float, the needle valve is opened and so "flooding" is achieved. Flooding temporarily enriches the mixture until the level of fuel subsides to normal.

TUNING THE CARBURETTOR

Having read the previous pages, have the machine running on a quiet road with a slight up-gradient so that on test the engine is pulling under load. Tune the carburetter in the following sequence.

1st—Main jet with throttle in position A (Fig. C2). If at full throttle the engine runs "heavily", the main jet is too large. If at full throttle, the engine seems to have better power when the throttle is eased off the main jet is too small.

With the correct sized main jet, the engine should run evenly and regularly at full throttle with maximum power.

If testing for speed, ensure that the main jet is sufficiently large for the mixture to be rich enough to maintain the engine at normal working temperature. To verify this, examine the sparking plug after taking a run at full throttle, declutching and stopping the engine quickly. If the sparking plug electrodes are light brown in colour, the mixture is correct; if sooty, the mixture is rich; if, however, there are signs of intense heat, the plug being white in appearance, the mixture is too weak and a larger main jet is required.

2nd—Pilot jet with throttle in position B. With the engine idling fast and the twist grip closed (use the throttle adjusting screw): (1) Screw out the pilot air screw until the engine runs slower and begins to falter. Then turn the screw in or out to make engine run regularly and faster. (2) Now lower the throttle adjusting screw until the engine runs slower and just begins to falter. Adjust the pilot air adjusting screw to get best slow-running. If this second adjustment leaves the engine running too fast, go over the job a third time.

3rd—Throttle cut-away with throttle in position C. If, as the throttle is opened from the idling position, there is spitting from the carburetter, slightly richen the pilot mixture by screwing in the air screw. If this is not effective, return to the original adjustment of the screw and fit a throttle valve with a smaller cut-away. If the engine jerks under load at this throttle position and there is no spitting, either the jet needle is much too high or a larger throttle valve cut away is required to cure richness.

4th—Needle with throttle in position D. The needle controls a wide range of throttle openings and also acceleration. Try the needle in the lowest position with the clip in the top groove: if acceleration is poor raise the needle a groove at a time until the best results are obtained. If the mixture is too rich even with the clip in the top groove, the needle and needle jet probably need replacement because of wear.

5th—Finally, go over idling again for final touches.

CARBURETTER AIR CLEANER

The air cleaner should be examined at intervals of 1,000 miles but more often in dusty climates. In the case of a competition model, the air cleaner should receive attention before every event.

A choked air cleaner will restrict performance and increase fuel consumption.

The element is of dry paper, and is retained by a central nut (see Fig. C3), visible after removal of the left side panel.

A stiff brush or air line should be used to remove dirt deposits from both inside and outside the element. To maintain efficient performance, the element must be renewed every 5,000 miles.

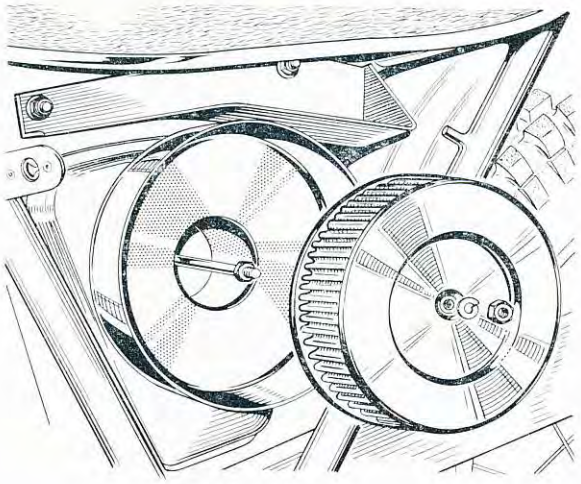


FIG. C3.

INDEX

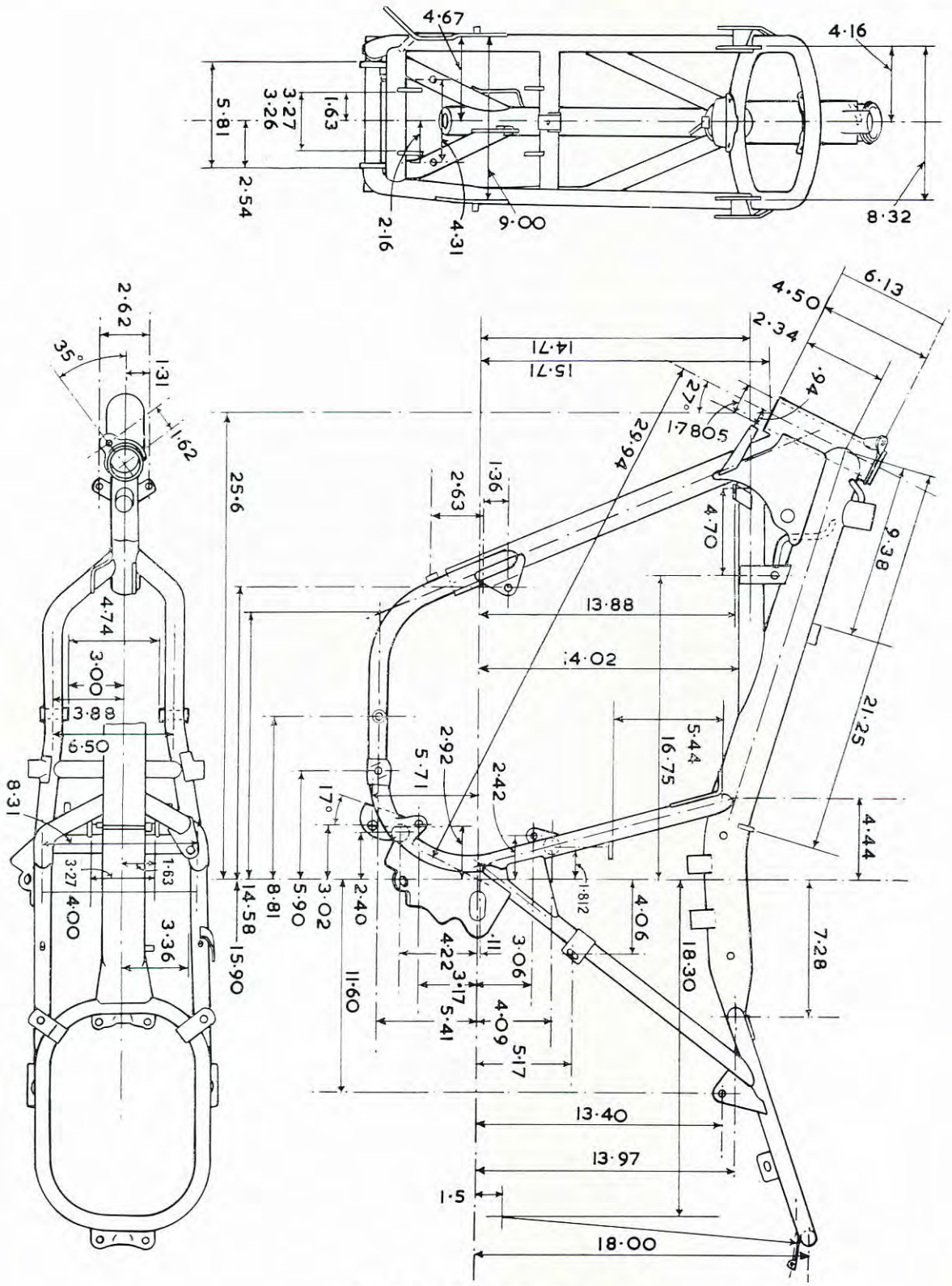


FIG. D1. *Frame dimensions.*

FRAME ALIGNMENT

The only satisfactory way of checking the frame for correct alignment is on an engineer's surface table. In addition to the table, which must measure at least five feet by three feet, the following equipment will also be necessary.

One mandrel as in Fig. D2.

One mandrel or bar for swinging arm pivot $\frac{51}{64}$" diameter by 12" long.

One large set-square.

One 18" Vernier height gauge or large scribing block.

One pair of large "V" blocks and several adjustable height jacks.

If a scribing block is used, an 18" steel rule will also be required. The mandrels must be straight and round, otherwise measurements will be affected. Figure D3 shows the basic set-up for checking the frame, though variations can of course be used according to facilities available.

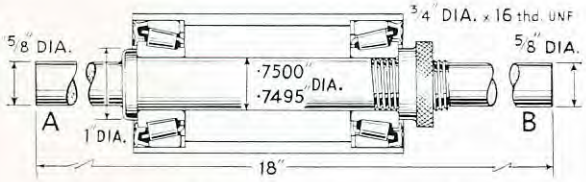


FIG. D2. *Steering head mandrel.*

Place the blocks into the steering head, insert the mandrel and support with the "V" blocks at one end of the table. Check the mandrel at each end to ensure that it is parallel with the surface of the table. Insert the $\frac{51}{64}$" diameter mandrel through the swinging arm pivot hole.

Now, using jacks or packing pieces, set the frame horizontal to the table so that checks taken at points (*A*) are the same.

If the frame has suffered damage in an accident, it may not be possible to set points (*A*) parallel in which case points (*B*) can be used.

If the machine has been subjected to frontal impact, the main tube may remain parallel at points (*A*) but will be bent behind the steering head. A straight-edge must be used for this check.

When the frame is set parallel to the surface table, the mandrel through the swinging arm pivot holes should be vertical. This may be checked using the set-square and internal calipers or a slip gauge between the mandrel and the square.

The set-square should touch both the upper and lower tubes together at points (*C*) and (*D*) if the frame is true and correctly set-up on the table. To find the frame centre line, take the height of the main tube and subtract half the diameter of the tube.

Checks may now be taken at the engine mounting lugs and other points of the frame. Errors at any point should not exceed $\frac{1}{32}$" (·8 mm.).

TESTING FOR OIL LEAKAGE

Following the resetting of a frame, it is essential to examine the main tube for possible fractures, especially at the welded joints, which must be rewelded as required. This is necessary to ensure that all joints are oil-tight. A major fracture, of course, means that the frame must be replaced.

Seal the three pipe apertures (breather, oil return and oil supply) by means of short lengths of flexible tubing, retained by worm clips. Screw down the filler cap firmly, using a rubber sealing ring.

Replace the oil filter, at the base of the front tube, and take out the drain plug. It will then be necessary to adapt a tyre valve to a screwed union

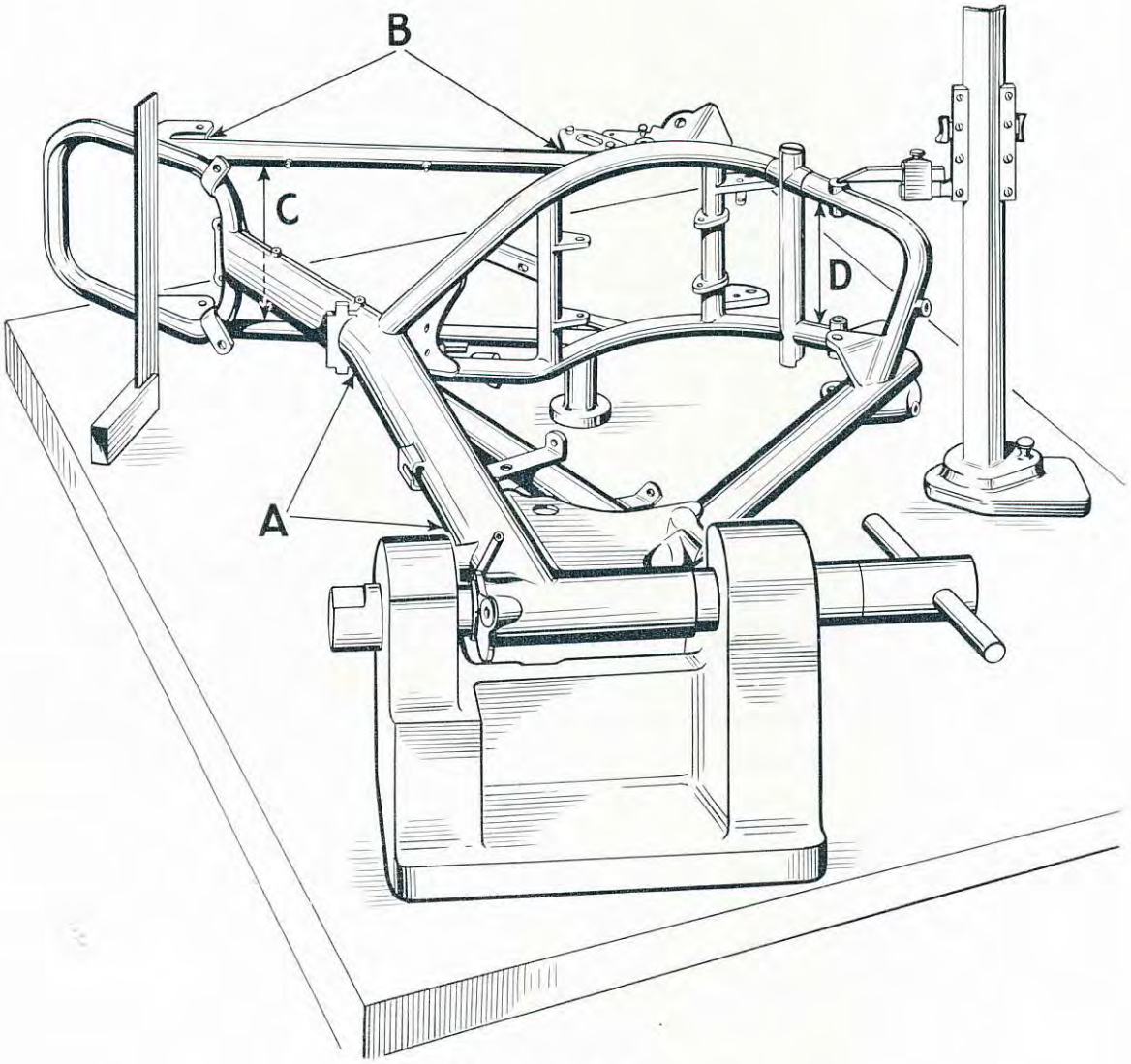


FIG. D3. *Setting up the frame.*

to replace the drain plug for test purposes. The plug is threaded $\frac{3}{8}$" UN.F. × 24 t.p.i.

Inject compressed air at a pressure of 20 p.s.i. (maximum) into the frame tube and immerse the frame in a bath of water, when any air leaks will be apparent. Mark all sources of leakage and re-weld.

The air-line from a tyre service pump will be suitable if the gauge is first set to the above figure. As an alternative, a foot pump may be used, but in this case it will be necessary to add a pressure gauge to, say, the filler cap.

If a large enough bath of water is not available, a suitably diluted solution of "Bowe's Leak-finder" brushed over the joints will show as bubbles in the event of leakage.

SWINGING ARM

Removal

Take out the rear wheel and brake assembly, then remove the chainguard (see pages F5 and D8 respectively). It is not necessary to remove the rear suspension units entirely, but the bottom fixing bolts must be taken out and the units held clear of the swinging arm. Take off the pillion footrests (if fitted).

Push the rear brake pedal down so that the swinging arm pivot bolt will clear it on withdrawal, and release the pivot bolt nut at the right side. Drive out the bolt using a hide-mallet and suitable drift.

Support the swinging arm as the bolt is driven out. Spacers are fitted at either side of the assembly—these protect the oil seals and may be removed with the fingers.

Removing the bearings

The needle roller bearings run on bushes separated by a distance spindle, and are protected by oil seals and spacers at either side. The spacers may be removed with the fingers and the bushes withdrawn using a pair of pliers. Take care not to damage the bearing surface of the bushes if they are to be refitted.

The bearings themselves may now be driven out from the opposite side. This operation will necessarily involve removal of the oil seals, which must be renewed.

Refitting the bearings

When replacing a bearing, ensure that it is square above its housing before commencing to drive it into position. It is most important to use a drift of the correct size for this operation because of the risk of damaging the bearing and housing and thereby impairing bearing action.

Alignment

Before checking the swinging arm, it must be established that the bearings are in good condition.

Using the same mandrel that was used for the swinging arm pivot on the frame (see page D3), set the swinging arm in "V" blocks as shown in Fig. D5. Another mandrel 12″ long by $\frac{5}{8}$″ diameter should be inserted through the wheel spindle lugs. Both mandrels should be parallel to the surface table.

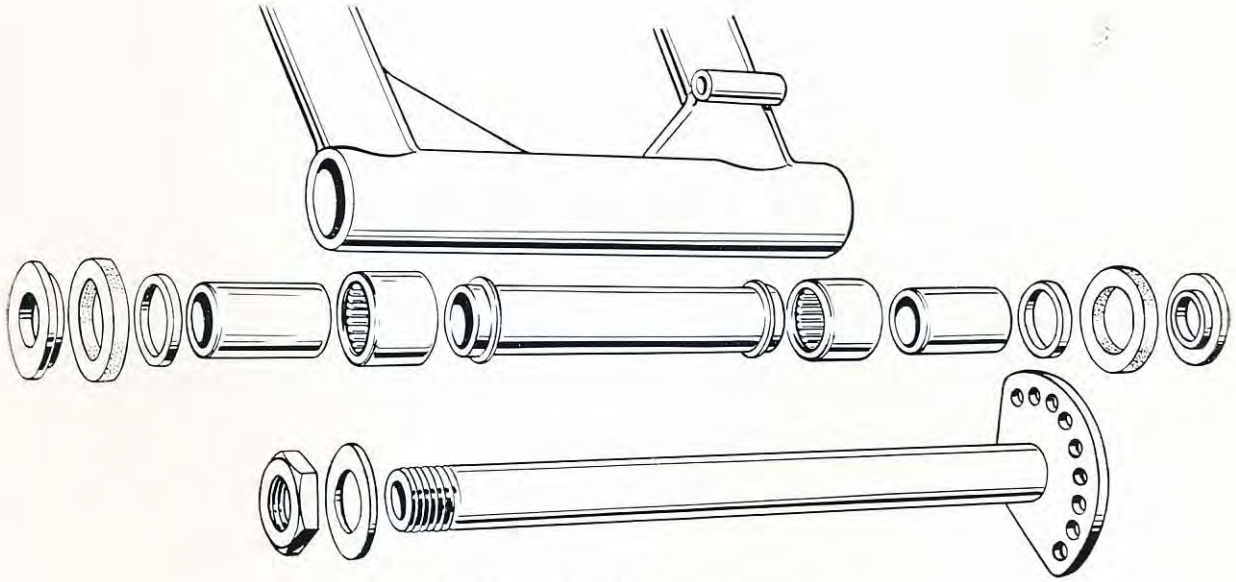


FIG. D4. *Swinging arm bearings.*

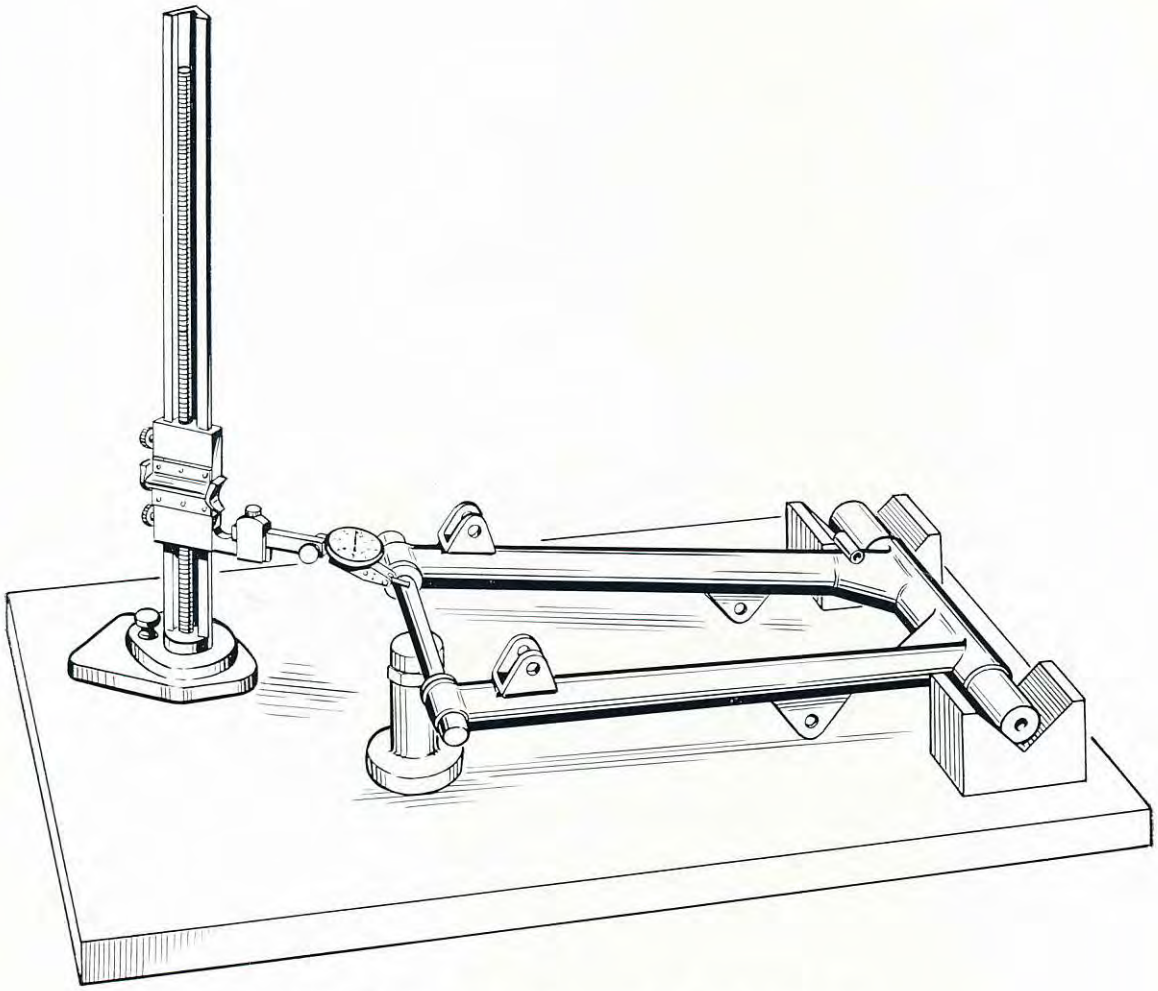


FIG. D5. *Checking alignment of the swinging arm.*

Should there be less than $\frac{1}{4}$" malalignment of the swinging arm fork it is permissible to correct it by means of a suitable lever, but care must be taken to avoid causing further damage. In the event of damage in excess of $\frac{1}{4}$" out-of-true the swinging arm must be renewed.

To check that the wheel spindle lugs are square to the pivot, the assembly must be set-up at 90 degrees to the position illustrated, so that the pivot is vertical. Next, find the centre of the pivot and check that all dimensions are in accordance with those given in Fig. D6.

Note:—There may also be a variation in the rear dampers and a careful examination should be made of the overall length between the mounting eyes. It is possible that one damper may be weaker than the other, caused by "settling" of the spring. If this should be the case, it is advisable to renew the springs in both dampers. Refer to information given in "General Data."

FRONT MUDGUARD

Trail and MX Models

The front mudguard is secured to its bracket by two bolts, after removal of which the mud-

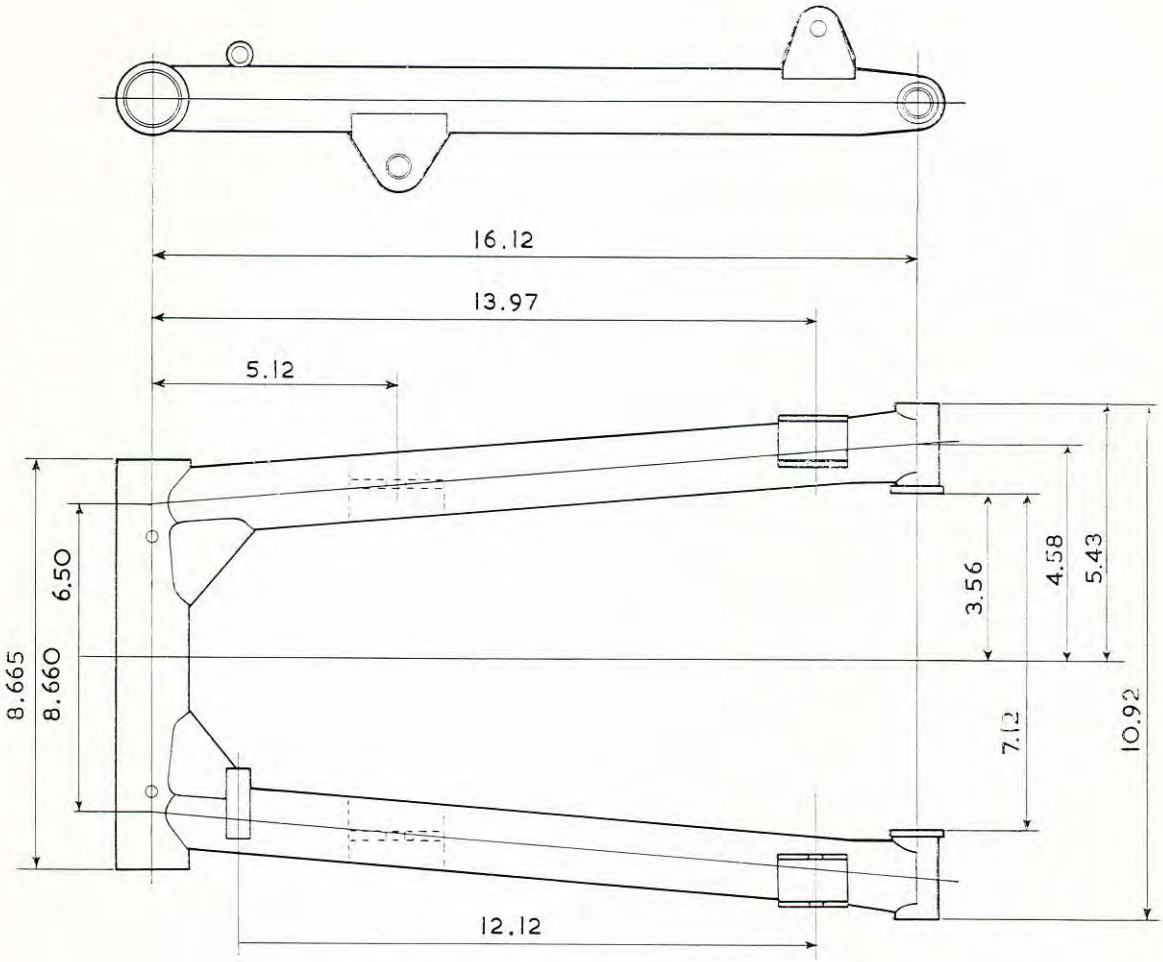


FIG. D6. *Swinging arm dimensions.*

guard may be taken out. The bracket is attached to the fork bottom yoke by a further two bolts, and the large locknut at the base of the steering column.

Street Scrambler Models

The front mudguard is mounted on the fork sliding tubes by four bolts passing through split clamps holding rubber grommets, and may be taken out after these bolts are removed.

On re-assembly new mounting grommets should be fitted if the old parts show signs of chafing.

REAR MUDGUARD (All models)

Before removing the rear mudguard, the seat, battery and battery carrier must be taken off, (see page D8). Though not essential, it is helpful if the rear wheel and brake assembly is also removed (see page F5).

The rear light and flasher leads should be disconnected at the five-way block connector, the stop-tail leads being brown and brown/green and the flasher leads green/red and green/white.

Take off the tail light mounting assembly, which is retained by three bolts beneath the

mudguard. Note that the forwardmost bolt has a UN.C thread, whereas the rear two are UN.F.

It is not necessary to disturb the rear light and number plate assembly unless further examination of these parts is required.

Release the two bolts securing the handrail to the mudguard, then the five bolts fixing the mudguard to the frame. The mudguard is now free to be withdrawn from the rear.

SEAT

The seat is mounted at the rear on two brackets attached to the frame immediately forward of the rear damper top fittings, and fixed by bolts attaching to captive nuts on the seat pan. At the front the seat is located by a bracket above the air cleaner chamber. The seat complete may be lifted off the machine when the rear fixing bolts are removed. When replacing, ensure that the front mounting is properly located before the rear of the seat is lowered into position.

BATTERY CARRIER AND TOOL TRAY

The battery carrier is concealed behind the right side panel, and is rubber-mounted to the frame at three points.

Disconnect the battery terminals, unclip the fixing strap and lift the battery out of the carrier. Note that a vent pipe is fitted to carry corrosive fumes clear of the machine.

The lower mounting consists of a peg within a rubber sleeve, and the carrier may be removed after the fixing nuts of the top mounting points are released.

The tool tray, fixed opposite the battery carrier behind the left side panel, is held by the two bolts which support the battery carrier at the right end, consequently it is necessary to remove the battery carrier in order to take out the tool tray. Note that washers are fitted underneath the bolt heads and between the tray and frame.

CHAINGUARD

The chainguard is secured at the front by a bolt passing through a bracket on the swinging arm, and at the rear by the bottom damper fixing nut. After removal of the bolt at the front and nut at the rear, the chainguard may be withdrawn from behind the machine.

The chainguard extension at the front is fixed to the crankcase by a bolt with one plain and one spring washer beneath the head, and the rear

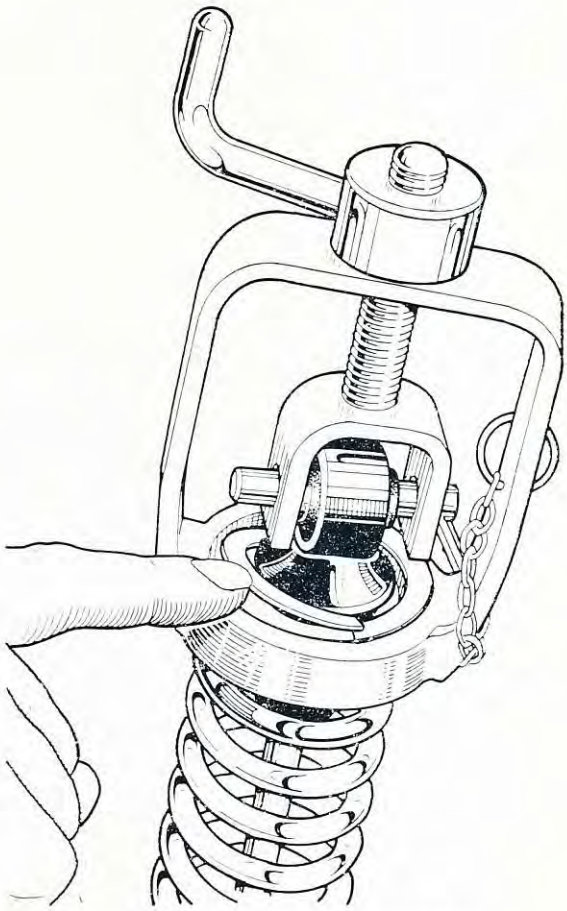


FIG. D7. *Using tool No.* 61–3503.

mounting bracket is slotted between the top left engine plate and frame bracket. The extension may be removed after removal of the bolt at the front and slackening off the bolt at the rear.

REAR SHOCK ABSORBERS

The rear shock absorbers, or dampers, are of the coil spring type, hydraulically damped, and mounted at each end on bonded rubber bushes. The actual damping unit is a sealed assembly and must be returned to the manufacturer for attention in the event of trouble.

The only dismantling possible is for removal and replacement of springs, and for this operation Service Tool No. 61–3503 is required. Use of this tool is illustrated below.

The tool is used to compress the springs, permitting removal of the retaining collets. When the tool is removed the spring may be lifted clear.

If for any reason it is necessary to remove the rubber bushes, replacement will be found much easier if a little soapy water is applied as a lubricant.

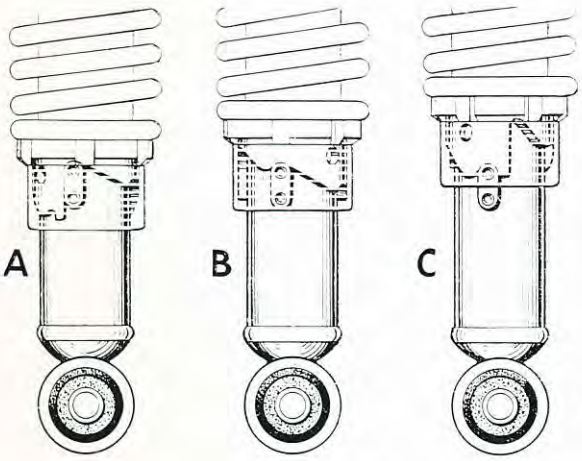


FIG. D8. *Cam ring positions.*

A—Light setting
B—Medium setting
C—Heavy setting

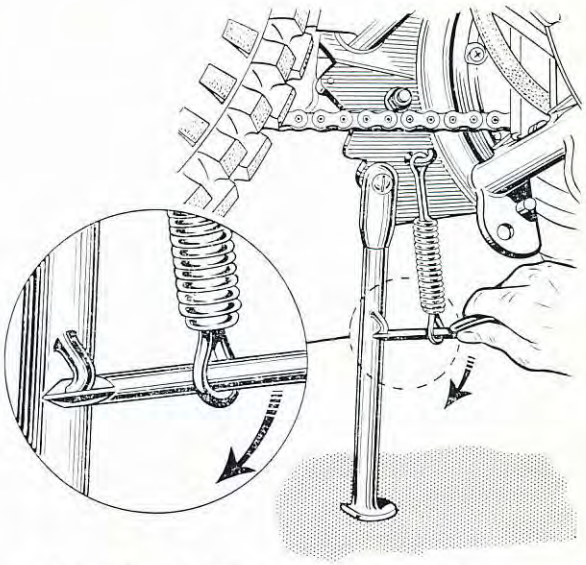


FIG. D9. *Replacing the prop stand spring.*

The dampers have three load positions, as illustrated below, and a "C" spanner for adjustment is provided in the tool kit.

It is important to remember that adjustment of the cam ring does not have the same effect as the fitting of heavier springs. The standard springs are selected as being most suitable under average conditions but where a rider is considerably above or below average weight or when heavy loads are frequently carried, it may be advisable to fit alternative springs. Many alternatives are available, and it is suggested that reference is made to the manufacturers for guidance.

PROP STAND

The prop stand is attached to the frame below the rear brake pedal with a bolt and locknut. A return spring ensures that the stand is held clear of the road when not in use.

To re-fit the return spring a Phillips screwdriver may be used as in Fig. D9.

CENTRE STAND

Though not normally fitted, the frame has provision for a centre stand which is available as an optional extra. The stand is attached to the frame with two special bolts and locknuts, and a return spring is fitted.

CRANKCASE SHIELD

Fitted to the frame tubes by two bolts at the front, the crankcase shield is hooked over the bottom engine bolt at the rear. It is necessary to slacken this bolt and remove the two front bolts before the shield can be removed.

REAR BRAKE PEDAL

The pedal is mounted on a pivot carried on the frame bracket and may be removed after releasing the fixing nut behind the bracket and disconnecting the brake rod. A bolt and locknut provide means of adjusting the stop light switch.

To adjust the switch, depress the switch plunger fully by hand and position the adjusting bolt so that there is a gap of $\frac{1}{32}$" between the bolt and plunger when the pedal is against the stop on the footrest. Tighten the locknut.

FUEL TANK

A centre bolt assembly is used to secure the fuel tank, and the tank is mounted on two rubber pads over the frame tube. Two rubber plugs steady the tank at the front.

It is not necessary to remove the centre bolt nut entirely in order to take off the tank. The nut need only be slackened enough for the washer beneath to be free to move.

Turn off both taps, and disconnect the fuel pipes at either side. Take out the oil filler cap/dipstick assembly. The tank may now be pulled clear of the machine, but care must be taken to avoid damage to the enamel finish which may occur as the tank clears the top fork yoke.

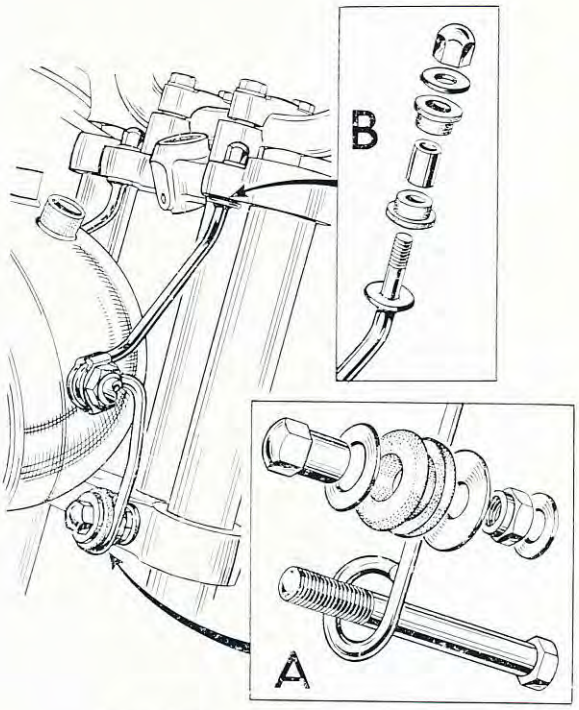


FIG. D10. *Headlamp mounting.*

Take note of the order of assembly of the centre bolt rubber and washers.

When replacing the tank, it will be helpful if a little soapy water is used to lubricate the steady rubbers at either side of the steering head.

REMOVING THE HEADLAMP

The headlamp is rubber-mounted to the fork yokes, and on dismantling a note should be made of the order of assembly of the various parts comprising the mountings.

Referring to Fig. D10, remove the sleeve nuts and acorn nuts at A and B respectively and disconnect the headlamp harness from the electrical box. The headlamp complete with flashers and mounting struts may now be with-

drawn, though it may be necessary to remove the fuel tank in order to free the harness.

CONTROL CABLES

Throttle cable

Turn the twist grip to open the throttle, then, whilst maintaining tension on the cable outer, release the grip to allow the slotted cable stop to be removed.

Remove the two screws from the twist grip control and take off the top half to expose the cable nipple. Ease the nipple out of the grip and remove the cable.

Fit the replacement cable to the grip by inserting it up through the lower half and locating the nipple in its slot. Replace the top half of the grip, but, before tightening the screws, check that the grip turns freely. Do not replace the cable stop at this stage.

Take off the fuel tank (page D10) and detach the cable from the frame clips.

Take out the two fixing screws and withdraw the carburettor top cover complete with throttle valve assembly. Compress the throttle spring, remove the needle and clip. Whilst still compressing the spring, push the cable downwards to release the nipple from its location in the valve.

Whilst compressing the spring, insert the nipple of the replacement cable through the valve needle hole and locate it in its housing.

Fit the throttle needle, assemble the throttle valve to the carburetter body, making sure that the needle enters the needle jet squarely. Locate the peg on the throttle valve with the slot in the mixing chamber, fit the top cap and cable stop. Replace the fuel tank and adjust the cable if required. (See page C4.)

Front brake cable (6″ brake)

Slacken the cable adjuster completely, allowing the cable to be disengaged from the handlebar lever. Disconnect the stop switch leads, and extract the split pin from the brake plate lever. The cable may now be pulled clear of the machine.

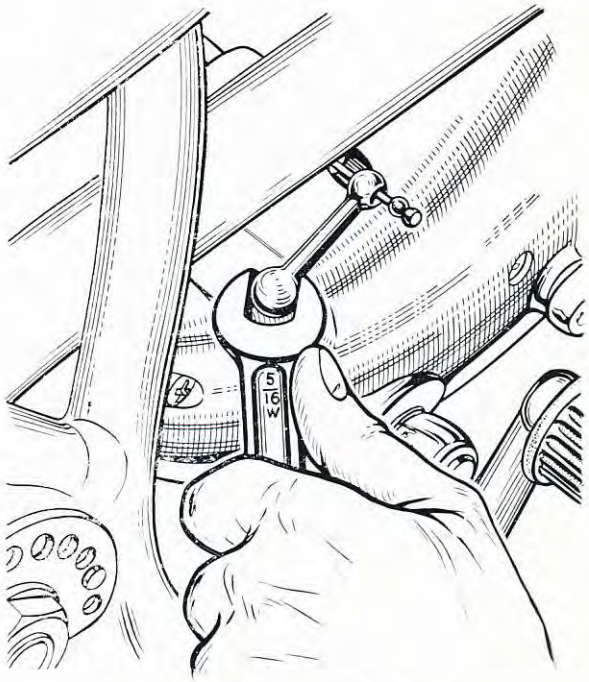


FIG. D11. *Fitting a clutch cable.*

Fit a replacement cable in the reverse manner but renew the split pin at the lever fulcrum. Adjust the cable before using the machine on the road.

Front brake cable (8″ brake)

Slacken the cable adjuster completely, and disengage it from the handlebar lever. Disconnect the stop switch leads, and extract the cable outer from the rearmost lever on the brake plate. Disengage the nipple of the inner wire from the forward lever and pull the cable clear.

Fit a replacement cable in the reverse manner, but ensure that the cable return spring is fitted between the two brake levers.

Clutch cable

Completely slacken the handlebar adjuster, and, if necessary, use an open-ended spanner of suitable size to disengage the nipple of the inner wire from the lever on the timing cover (see Fig. D11). Remove the cable from the handlebar lever, and from the machine.

Fit the new cable first to the handlebar lever, then to the timing cover lever, again using a spanner to operate the arm. Make sure that the cable is properly secured with cable clips, and that it is routed clear of the bottom fork yoke steering stops.

Adjust the cable and if necessary, position the timing cover lever so that it lies at an angle of approximately 30° to the timing cover joint face in the free position. This is done by means of the adjuster in the clutch pressure plate, see page B19.

Exhaust valve lifter cable (B50 only)

Undo the handlebar control lever pivot bolt and nut. Pull the lever away from the bracket and disconnect the cable nipple.

Now, working from the right side of the machine, pull the cable outer cover out of its location in the valve lifter lever and raise the cable to release (see Fig. D12). Screw out the cable adjuster from the bracket and withdraw the cable complete with adjuster and spring.

After replacing the cable, use the cable adjuster and locknut on the bracket to obtain the correct setting. Ensure that there is ample slack in the cable to allow the exhaust valve to close properly whilst the lever is not operated. Incorrect setting of this control will cause difficult starting, a burnt valve and a considerable depreciation in performance.

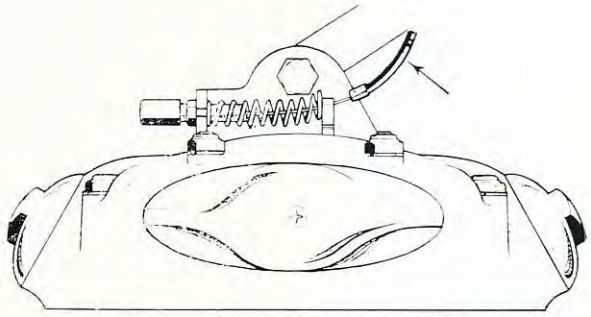


FIG. D12. *Exhaust valve lifter cable.*

INDEX

The telescopic front fork is hydraulically damped and internally sprung, and requires very little routine maintenance. The damping fluid must be changed every 10,000 miles (15,000 km) or twelve months, whichever is the sooner (see pages A2 and A10), and the assembly should be checked over periodically to ensure tightness of all external nuts and bolts.

It is important that the quantity of damping fluid in each leg is identical and that the correct type of fluid is used (see page A4).

ADJUSTING STEERING HEAD BEARINGS

It is most important that the steering head bearings are correctly adjusted.

There should be no more than a trace of play evident between the races, but great care must be taken not to overtighten, as this will result in damage to the bearings, causing difficult steering.

Place a strong support beneath the engine so that the front wheel is lifted clear of the ground.

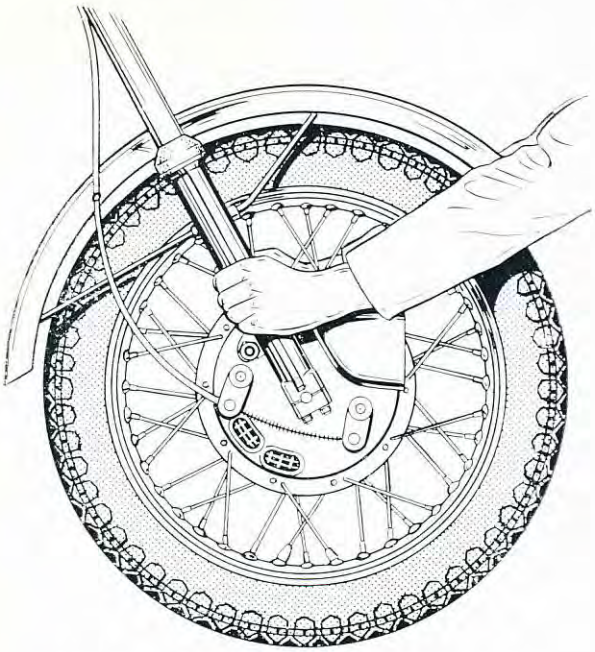


FIG. E1. *Testing the steering head for play.*

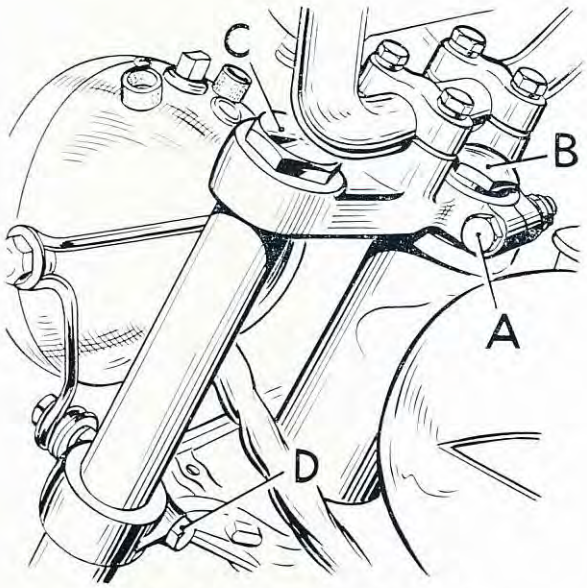


FIG. E2. *Steering head adjustment.*

Then, standing in front of the machine, feel for play on the head bearings by alternately pushing and pulling the fork legs (see Fig. E1).

To adjust the steering head bearings, slacken off the pinch bolt (A). Using a ring spanner, turn the nut (B) in a clockwise direction to reduce play or anti-clockwise to increase play (see Fig. E2).

When adjustment is satisfactory, tighten the pinch bolt A.

Care is needed when testing for play to distinguish between play in the head and play between the fork stanchions and sliding tubes. It is possible that there may be both.

If possible, have an assistant place the fingers of one hand lightly round the bottom head bearing while testing. If play is present, it will be easily detected.

It should also be possible to move the forks from lock to lock without jerky movement. If movement is irregular the bearings are damaged and must be renewed.

RENEWING STEERING HEAD BEARINGS

Dismantling the steering head

In order to change the roller bearings, the steering head may be dismantled without stripping the forks, but the instruments and headlamp (if fitted) must first be removed.

Disconnect the driving cables at the unions below the instruments and release the headlamp mounting struts at the upper and lower steering yokes, noting the order of assembly of the rubber mountings (see Fig. D10). Disconnect the headlamp harness at the electrical box socket so that the headlamp complete with struts may be removed. Take out the instrument lights and suspend them clear of the working area.

Completely slacken the front brake cable at the handlebar adjuster and uncouple the cable from the lever. Extract the inner and outer cables from the lever(s) on the brake cover plate. Disconnect the leads to the brake switch incorporated in the cable (if fitted) and remove the wheel as described on page F2, followed by the mudguard assembly.

Take off the handlebars and lay them on the petrol tank, which should be protected with a piece of cloth. Slacken the pinch bolt (A) and remove the adjuster nut (B) Fig. E2. Using service tool No. 60–0779, remove the top nuts (C). This operation will also release the instruments, which must be supported to avoid damage. Using a hide-mallet, strike the sides of the top yoke alternately from below, to release it from the tapered stanchions.

Draw the steering column, lower yoke and fork legs downwards and out of the frame, as a complete assembly. It may be necessary to apply light blows with a mallet to the top of the column if the latter should be tight in the top inner race. The lower inner race can be withdrawn from the column by means of two suitable levers applied evenly between the race and the yoke.

REASSEMBLING THE STEERING HEAD

When replacing the outer steering head races, it is most important that they enter the housing squarely.

To be sure of this, it is advisable to use service tool No. 61–6121, Fig. E3, which must be located against the face of the outer race and carefully aligned so that it lies parallel with the centre-line of the frame head lug. A few sharp blows with a hammer on the head of the tool should ensure that the bearing race is driven home and is seating correctly.

Do not drive the cup in with the drift in contact with the bearing surface as this will cause irreparable damage.

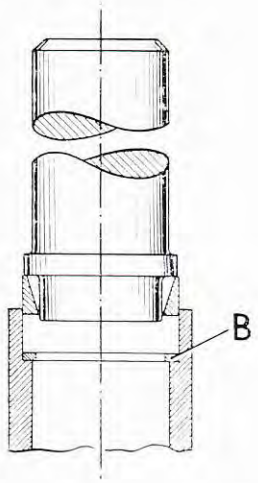


FIG. E3. *Fitting new steering head races.*

Fit a new inner race to the bottom of the steering column. Grease the bearing rollers and reassemble the column into the steering head. Grease the rollers of the upper inner race and slide it into position from the top of the column. Add the dust cover, replace the top yoke and tighten the adjuster nut B, Fig. E2, making final adjustment as described on page E2.

Completion of assembly will not present difficulty, but it is important to refer to page F2 or F3 for details of refitting the front wheel.

DISMANTLING THE FORK LEGS

Changing the fork springs

Once the handlebars are removed, the fork top nuts may be unscrewed using service tool No. 60–0779. These nuts also retain the speedometer and tachometer (if fitted) which must be supported to avoid damage as the nuts are unscrewed. The fork springs are located over the spigot underneath the top nut, and similarly over the damper valve retaining nut at the lower end. The springs may be withdrawn by hand and exchanged.

Dismantling the damping assembly

Before commencing work on the forks it is advisable to have the following tools and replacement parts available.

2 off 97–4001	Oil seal.
2 off 97–4003	"O" ring.
2 off 97–4004	Dowty washer
2 off 97–4002	Scraper sleeve.
60–0779	Spanner for top nuts.
61–6113	Damper valve removal and assembly tool.

Take off the handlebars and lay them on the petrol tank, which should be protected by a piece of cloth. Unscrew the top nuts using spanner No. 60–0779, and take out the main springs.

It is not necessary to remove the fork stanchions from the yokes in order to dismantle the damping assembly, though the front wheel and mudguard must be taken out (pages F2, D6).

Prior to removal of the fork end cap on one side, remove the drain screw on the opposite side, allowing the damping fluid to drain into a suitable receptacle. Be careful not to allow oil to drip on to the tyre.

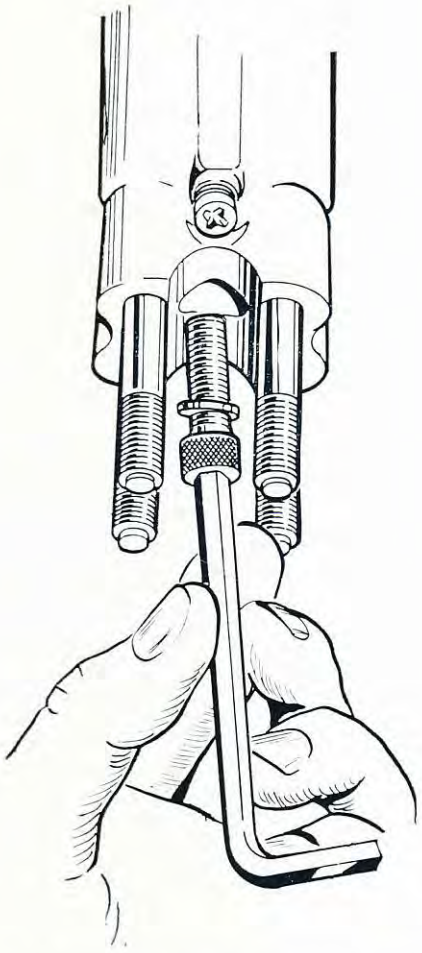


FIG. E4. *Damper valve retaining screw.*

Unscrew the fork top nuts, being careful to support the instruments, if fitted. Disconnect the driving cables and light leads from the instruments.

Extract the fork springs, and engage service tool No. 61–6113 in the slots in the top of the damper tube. Hold the tool in position (Fig. E7) whilst unscrewing the socket screw at the base of the outer member (Fig. E4).

Having removed the screws, it is now possible to withdraw the outer members from the end of the stanchions leaving the damping assembly retained in the stanchion by the end plug. The end plug, screwed in position, is made of alu-

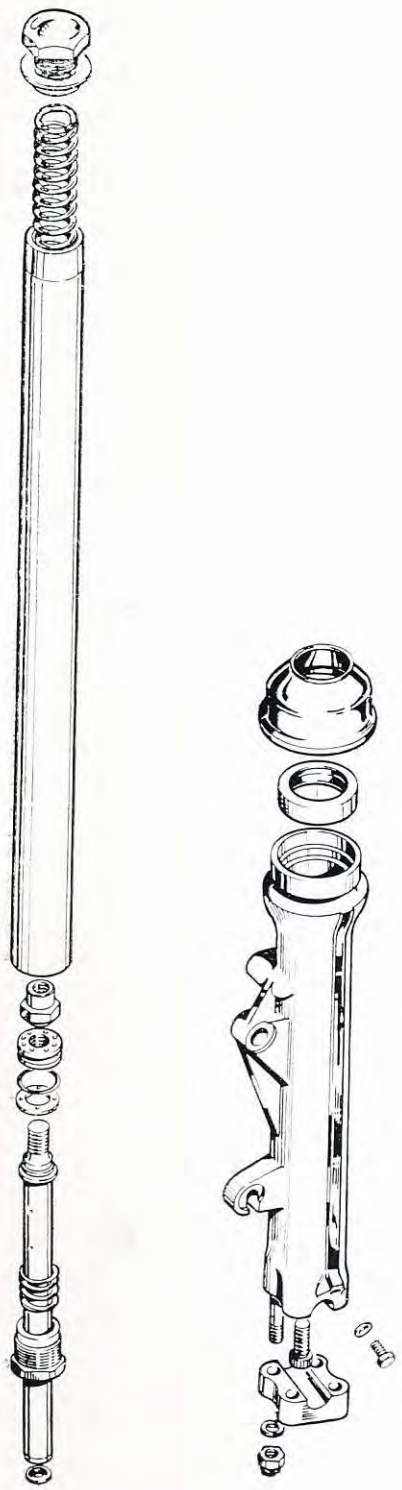


FIG. E5. *Fork leg exploded.*

minium alloy and care is therefore necessary to avoid damage with the spanner. With the end plug removed, the damping assembly may be taken out, together with the recoil spring.

The various components of this assembly are shown in exploded form in Fig. E5. Unscrew the valve retaining nut, followed by the valve and shuttle washer. Carefully inspect each part for signs of wear or damage before reassembly.

If necessary the fork stanchions may now be removed from the yokes. Remove the headlamp (see page D10), slacken the top yoke pinch bolt ("A", Fig. E2) and remove the adjuster nut "B". Using a hide mallet strike the top yoke from below at each side alternately to release it from the tapered stanchions. When the top yoke is free, the forks and steering head may be completely dismantled.

The oil seals

Two oil seals are used in each leg. One takes the form of an "O" ring around the damper valve, and the other, of the garter type, is pressed into the top of the outer member. A flexible scraper sleeve, stretched over the top of the outer member to exclude dirt, may be removed with the fingers.

To remove the garter seal, hold the outer member by the wheel spindle lug in a soft jawed vice and, using a small cold chisel or screwdriver blade, collapse the metal body of the seal inwards as shown in Fig. E6. Great care must be exercised to ensure that the chisel is applied solely to the rim of the seal and that it is held clear of the housing otherwise, if the latter is damaged, there will be oil leakage at the rim of the new seal.

With the seal partly collapsed it is then easily removed with the aid of a lever such as a Britool "Prytool" No. 219.

FIG. E6. *Removing oil seal.*

REBUILDING THE FORK LEGS

Begin by replacing the stanchions in the yokes, and if necessary adjust the steering head (page E2) at this stage. Having fully tightened the top nuts, to 50–55 lbs. ft. (to draw the mating tapers of the top yoke and stanchions together), remove the nuts until a later stage.

New oil seals should be fitted as a matter of course. The seal in the outer member must be fitted with the metal lip uppermost, i.e. with the open side downwards. When pressing it into position, make sure that the seal enters the housing squarely. It is preferable to insert it with the aid of a drift made from a short length of tubing or bar, of a diameter slightly smaller than the seal.

Referring to Fig. E5, assemble the damping unit and note specially that, after fitting the shuttle washer, the **damper valve** must be screwed home with its plain face against the retaining nut. Securely tighten the nut, and fit a new "O" ring seal around the damper valve.

Add the recoil spring and end plug, and introduce the assembly into the end of the stanchion. Tighten the end plug to 23–25 lbs. ft. Slide the scraper sleeve up over the stanchion, in preparation for the next stage of assembly.

A new oil sealing washer must be inserted in the recess at the bottom of the outer member. Using a correct grade of damping fluid (see page A4), lightly lubricate the lower end of the stanchion and main oil seal, and fit the outer member over the stanchion. **Take extreme care to avoid damage to the delicate edges of the seal.** Clean the socket screw threads in petrol prior to the application of a drop of "Loctite" sealant.

Using service tool No. 61–6113 to hold the damping assembly firm, tighten the socket screw.

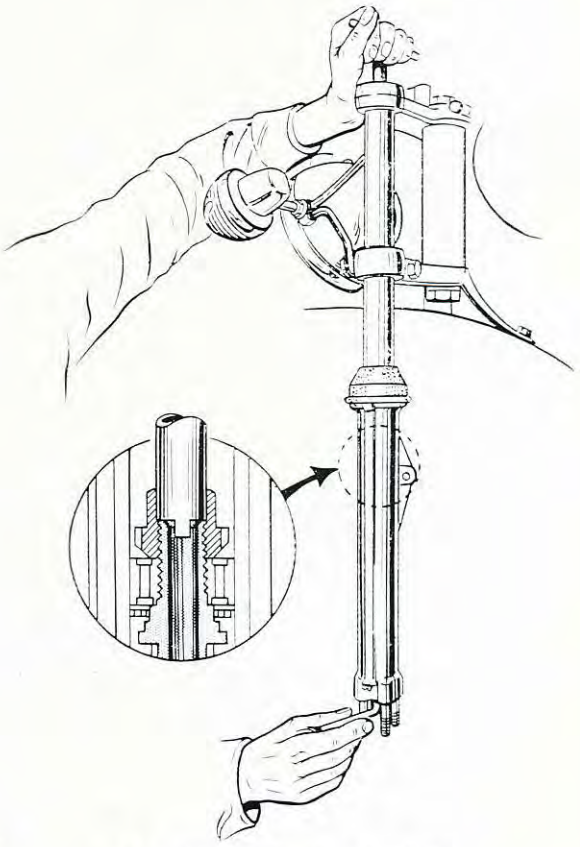


FIG. E7. *Using tool* 61–6113.

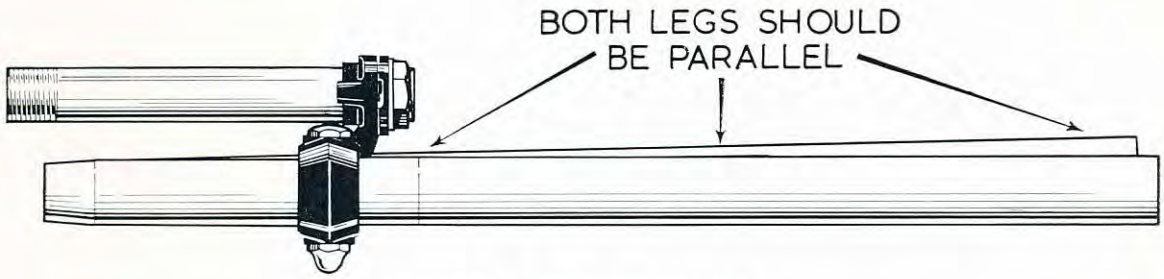


FIG. E8. *Bottom yoke twisted.*

To complete assembly, fit the scraper sleeve over each outer member, fit the main springs, instruments, top nuts and headlamp. Make a final check to ensure tightness of all nuts and bolts.

The forks are now ready to receive the front wheel (see pages F2 and F3) and mudguard, page D6.

FORK ALIGNMENT

Accurate checking of the fork stanchions requires special equipment such as knife-edge rollers and dial gauges, while special gauges are required to check the yokes.

However, it is possible to obtain a reasonably accurate check of the tubes by rolling them on a good flat surface such as a piece of plate-glass, but it is not a simple operation to straighten a bent stanchion. It is better to obtain a new stanchion if the old part is more than $\frac{3}{16}$" offset.

When it is known that the stanchions are straight, the top and bottom yokes may be checked for truth.

Assemble the two stanchions into the bottom yoke and tighten the pinch bolts. When inspected from the side the stanchions should be parallel and this condition may be checked on a surface table.

If the tubes are not parallel, as shown in Fig. E8, the yoke must be replaced.

When it is certain that the stanchions are parallel in both planes, check that they are in alignment with the steering column by adding the top yoke which should be lightly secured with the cap nuts to ensure full engagement of the tapers. If the stanchions and columns are not parallel with each other, the column will be offset in the yoke as shown in the illustration E9. Replacement parts must be fitted where necessary.

Alternative method

An alternative method of checking the yokes may be employed in cases where very slight damage is suspected.

For this operation service tool No. 61-6025 is necessary.

The forks may remain fitted to the motorcycle, but the front wheel and mudguard assemblies must be removed. See pages F2, D6.

The front wheel spindle must be clamped in position, or alternatively, a steel bar of suitable dimensions may be used.

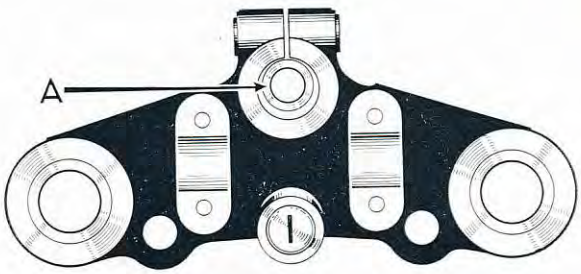


FIG. E9. *Offset steering column.*

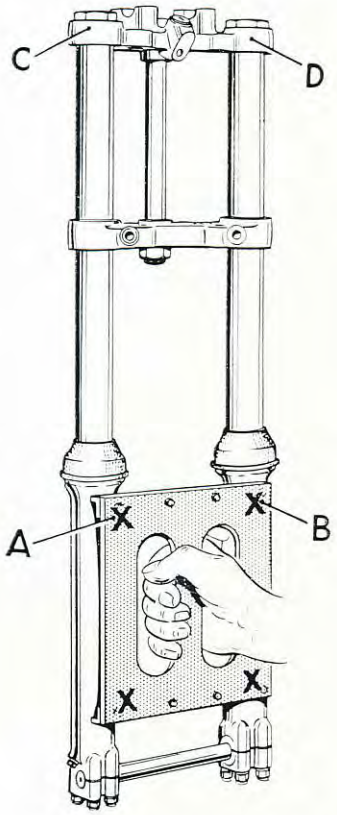


FIG. E10. *Using service tool No.* 61–6025.

Hold the alignment gauge firmly against the fork legs as shown in Fig. E10 and check that the gauge contacts at all four corners. If the gauge does not make contact at point (A) then this indicates that point (B) is too far forward.

To remedy this condition slacken off the two bottom yoke pinch bolts ("D", Fig. E2) and the stem sleeve nut pinch bolt ("A", Fig. E2) and give point C, Fig. E10, a sharp blow using a lead hammer or a hammer used in conjunction with a soft metal drift.

Check the alignment again with the gauge and if necessary give correction blows in the above manner until the amount of "rock" at any one corner of the gauge does not exceed $\frac{1}{64}$". When this is achieved, tighten all three pinch bolts and recheck.

It will be appreciated that in certain circumstances there is no alternative but to replace damaged items with new parts. Much time can be wasted by attempting repairs that will ultimately be unsatisfactory.

INDEX

FRONT WHEEL WITH 6″ BRAKE

Wheel removal

Support the machine beneath the engine, so that the front wheel is held approximately two or three inches clear of the ground.

Unscrew and remove the bolt securing the brake anchor strap to the right fork leg and disconnect the brake cable at the lower end, which is achieved by withdrawing the fulcrum pin, having taken out the split-pin with which it is secured.

Unscrew the fork end cap nuts, remove the caps and withdraw the wheel.

Brake shoes

The brake plate assembly is retained by a nut, and is a push fit on the wheel spindle. The brake plate and shoe assembly may be removed when the nut is released.

The brake is of the conventional single leading shoe type. Remove the shoes by turning the operating cam through 90°, so that the shoe ends are disengaged from their location slots. Having done this, lever them upwards and outwards clear of the cam and fulcrum pin.

The shoes are interchangeable, but it is preferable to replace them in their original positions if they are not renewed.

On re-assembly, grease the cam spindle and shoe pads lightly, but be careful not to overlubricate as grease may contact the linings and impair braking efficiency.

Adjustment is by means of the cable adjuster incorporated in the handlebar control lever. The shoes themselves are non-adjustable.

Wheel replacement

Reverse removal procedure, but when replacing the fork end caps ensure that the nuts are tightened to the correct torque of 15 lbs. ft. Do not omit the washers.

Before using the machine, check that the front brake cable is securely located in the cable stops and, if necessary, adjust the cable itself.

FRONT WHEEL WITH 8″ BRAKE

Wheel removal

Support the machine beneath the engine, so that the front wheel is held approximately two or three inches clear of the ground.

Completely slacken the brake cable at the handlebar adjuster and uncouple the cable from the lever. Disconnect the cable at its lower end from the levers A, Fig. F.1.

Slacken the anchor stud nut B, unscrew the fork end cap nuts, remove the caps and withdraw the wheel.

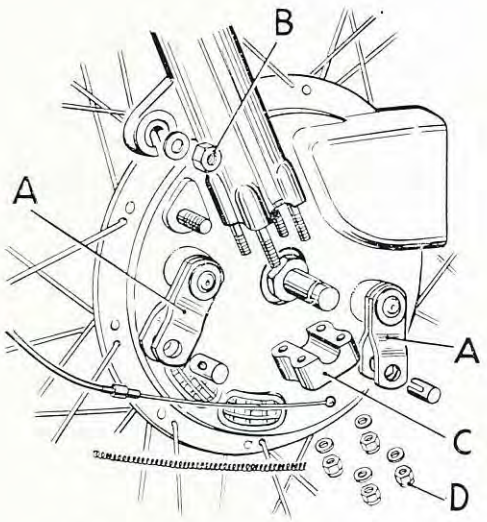


FIG. F1. *Front wheel (8″ brake).*

Brake shoes

The brake plate assembly is a push-fit on the wheel spindle, and is retained by a locknut. Unscrew the nut in order to gain access to the brake shoes.

To remove the brake shoes from the anchor plate, prise them upwards and outwards at their pivot points (adjacent to the long portion of the return springs).

The shoes are interchangeable, and are fitted with loose abutment pads to prevent wear on the pivot block. When re-assembling, the pads must not be omitted and it should be noted that the assymetrical return springs must be fitted with the short portion adjacent to the adjuster screws.

The adjustment cam, cage, operating tappet, and "O" ring may now be dismantled, following which the cam spindle may be withdrawn. Clean all parts in paraffin and check that the cam spindle and operating tappet slide freely in the pivot block. It is advisable to renew the "O" rings. A **small amount** of grease may be applied to the operating cam (not the adjuster), but only if the "O" ring is in good order.

Keep all grease, paraffin, etc., away from the linings and handle all parts with grease-free fingers.

On re-assembly, set the shoes in their contracted position (i.e. with the adjustment cam turned to its limit in an anti-clockwise direction), since the new linings will be thicker than the worn ones which have been removed, and make final adjustments to the brake shoes after the wheel has been refitted to the forks.

Front wheel replacement

Lift the wheel into position between the fork legs locating the brake anchor plate stud in the slotted ear on the fork outer member. Fit the wheel spindle ends on the upper half of their mountings and pull the forks downwards to retain the wheel in position while the end caps are replaced. Their nuts must be tightened very lightly at this stage.

Firmly tighten the brake anchor plate nut B, and note that the spindle grooves are elongated to allow the wheel assembly to align itself in the forks, during this operation. Finally, tighten the end cap nuts to 15 lbs. ft.

Replace the brake cable and adjust at the handlebar lever until all slackness is eliminated, but without applying the brake.

Brake shoe adjustment

The brake is of the two leading shoe type, expansion of the shoes being automatically equalised by the caliper action of the levers A, Fig. F1.

All brake adjustments should be carried out with the wheel on the forks, the normal adjustment being made at the cable abutment on the handlebar lever.

The correct brake setting should be such that the shoes are just clear of the drum when the brake lever is released, but close enough for immediate contact when the brake is applied.

Individual adjustment is provided for the shoes, comprising a serrated cam and screw at each fulcrum, inside the anchor plate.

Completely disengage the cable from the handlebar lever, and remove the grommet (G) Fig. F2, from the hub shell. Rotate the wheel until the aperture is opposite to the adjuster screw which can be turned with the aid of a screwdriver.

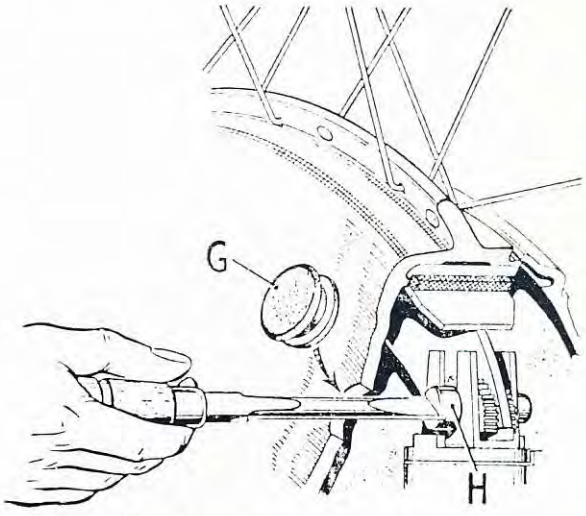


FIG. F2. *Front brake shoe adjustment.*

Rotate the screw in a clockwise direction, one click at a time, until the shoe is fully expanded against the drum. Now unscrew the adjuster until the shoe is just clear of the drum and the wheel rotates freely.

Turn the wheel through half a revolution and repeat the adjustment on the second shoe. Refit the cable to the handlebar lever, and adjust it if necessary.

The internal adjusting screws are situated, one below the front operating cam and the second one above the rear cam.

FRONT HUB DISMANTLING (All Models)

Removing the bearings

Having removed the wheel from the forks (page F2), unscrew the brake plate retaining nut and take out the brake plate assembly complete.

The right bearing is retained by a lock-ring which has a left hand thread, and may be unscrewed using service tool 61–3694. The bearing may now be driven out by striking the left end of the wheel spindle with a mallet. If a mallet is not available, protect the spindle end with a piece of hardwood.

When the right bearing, right inner grease retainer and spindle are removed, take out the circlip locating the left bearing together with the outer grease retainer and drive out the bearing from the inside using a suitable drift. (The wheel spindle may be used for this purpose, but ensure that the shoulder at the right end contacts the bearing, and that the spindle end is protected from damage by hammer blows).

The wheel bearings are interchangeable. If they are not to be replaced wash out all traces of old grease before repacking them with fresh grease of a suitable type (see page A4).

Whilst the bearings are free of grease ensure that they are fit for further service by spinning them next to the ear. If in good condition, the bearings will sound smooth and revolve freely, but if worn will be noisy and rough. Examine the tracks and balls for signs of pitting. Pitted bearings should be discarded.

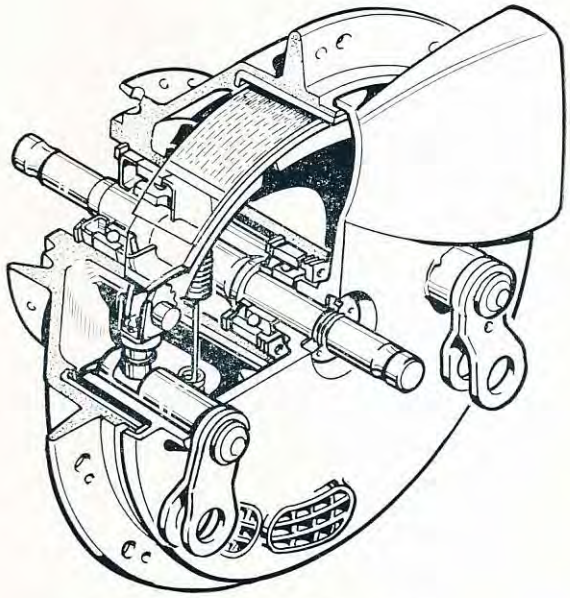


FIG. F3. *Front hub (8" brake).*

Refitting the bearings

Grease the bearings with a suitable grease and fit the right bearing abutment ring and bearing.

It is essential that the bearings are driven in absolutely square to the housing, and that pressure is only applied to the outer bearing race.

For this reason, it is advisable to use a short length of bar or tube, having a similar diameter to the outer race, as a drift.

Fit the lock-ring and spindle, and the left inner grease retainer. Drive in the left bearing and complete assembly with the outer grease retainer and circlip.

Refit the brake anchor plate assembly and replace the complete wheel in the forks.

REAR WHEEL (All Models)

Wheel removal

The wheel and brake assembly is retained in the swinging arm fork by a spindle and locknut (P and N) Fig. F4.

In order to remove the wheel, the rear brake operating rod and speedometer cable must be disconnected and the brake anchor strap released from the brake plate. To release the strap, loosen the pillion footrest bolt and undo the nut "M". Uncouple the rear chain at its spring link, and pull out the spindle and withdraw the wheel. The speedometer drive may be pulled off its flange, releasing the distance piece.

Brake shoes

The rear brake plate assembly may be withdrawn from the hub once the wheel is removed from the machine.

Turn the actuating cam through 90° and remove the shoes by levering them upwards and outwards clear of the brake plate.

The shoes are interchangeable, but it is preferable to replace them in their original positions if they are not renewed.

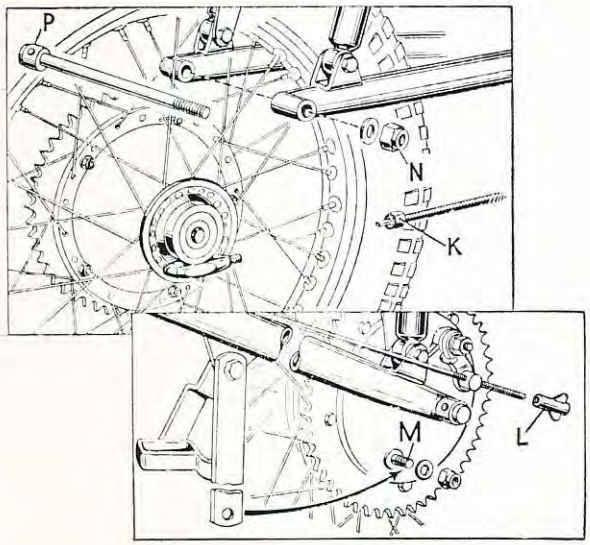


FIG. F4. *Removal of rear wheel.*

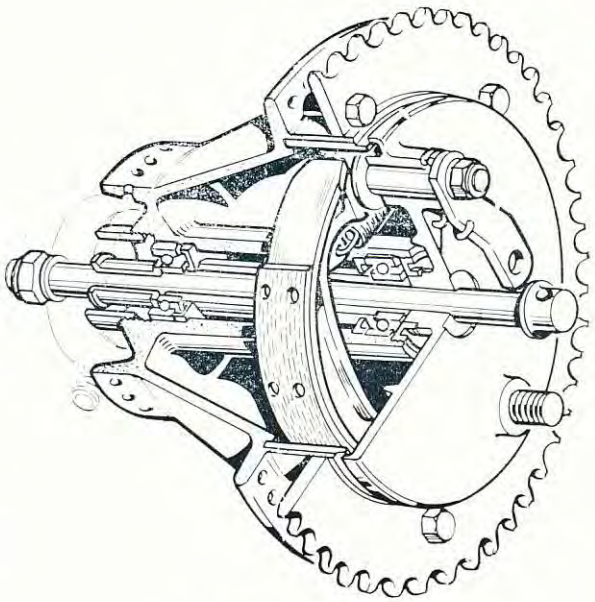


FIG. F5. *Rear hub.*

On reassembly, grease the cam spindle and shoe pads lightly, but be careful not to overlubricate as grease may contact the linings and impair braking efficiency.

Removing the bearings

Once the rear wheel is removed from the machine and the brake assembly taken out, access to the bearings is possible.

Unscrew the speedometer driving flange, which has a left-hand thread. Turning to the left side of the wheel, unscrew the locking ring securing the left bearing. This has a normal right hand thread.

The bearings are separated by a spacer tube, which has a spigot at either end over which the bearing inner races are located, one bearing with the tube in position may be driven out of the hub using a soft drift having a diameter of ·780" (19·8 mm.).

Take out the inner abutment ring or grease retainer from the side from which the bearing has been removed, and use the spacer tube in conjunction with a hide mallet as a drift to

remove the opposite bearing. Take out the remaining grease retainer, wash the bearings free of grease and test them for wear as described on page F4. The bearings are interchangeable.

Refitting the bearings

Begin by fitting the left bearing abutment ring. Having greased the bearings with a suitable grease (see page A4) drive the left bearing into position.

Fit and tighten the lock-ring on the left side and insert the spacer tube from the right. Locate the right grease retainer, and drive in the bearing. Complete assembly by fitting the speedometer and driving flange.

It is essential that the bearings are driven in absolutely square to the housing, and that pressure is only applied to the outer bearing race. For this reason, it is advisable to use a short length of bar or tube having a similar diameter to the outer race as a drift.

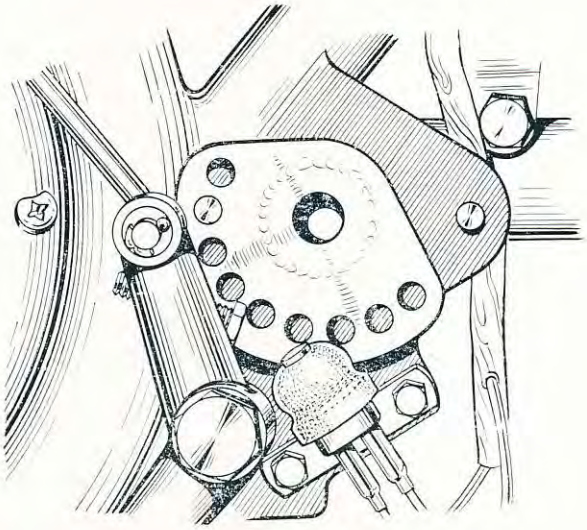
Rear wheel sprocket

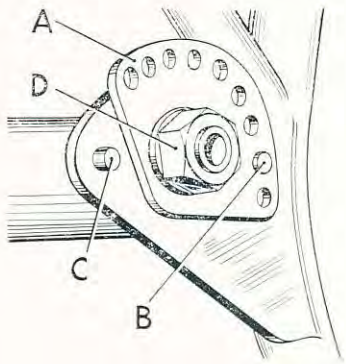
The sprocket is bolted to the hub with five nuts and bolts, and may be removed once the wheel is taken out of the swinging arm. However, it is not possible to apply a spanner to the heads of the bolts due to the proximity of the brake drum flange. A socket or tubular spanner is needed to reach the nuts from the right side between the spokes.

Wheel replacement

Fit the assembled brake anchor plate into position in the drum, and fit the distance piece and speedometer drive. Offer the wheel assembly to the swinging arm, and push the wheel spindle **through from the left side.**

Make sure that the speedometer drive is located at a suitable angle, and connect the brake anchor strap. Tighten the wheel spindle nut and fit the rear chain. Ensure that the chain spring clip is correctly fitted with the closed end facing the direction of travel, i.e., forwards on the top run of the chain. See Fig. H4, page H4.





FIGS. 6a & 6b. *Rear chain adjustment.*

REAR CHAIN ADJUSTMENT

It is most important that in the static position with the rear suspension units fully extended there be **at least** $1\frac{3}{4}$" (4·5 cm) slack in the centre of the lower run of the rear chain.

Adjustment of the chain is achieved by means of a quadrant and peg arrangement at either end of the swinging arm pivot bolt (see Fig. F6).

Release the rear brake adjuster and disengage the rod from the brake lever to permit free movement of the swinging arm and rear wheel assembly. Release the nut "D" and tap the pivot bolt through to the left side far enough to allow

the quadrant on the left to clear the peg. Draw the swinging arm rearwards, and refit the quadrant using an alternative hole.

Engage the peg with the corresponding hole in the right quadrant in order to maintain correct wheel alignment, and tighten the nut "D".

Tighten the nut "D" and adjust the rear brake.

When all adjuster holes have been used in conjunction with page "B", a further range of adjustment is available if the quadrants are located over the rearmost pegs "C".

RENEWING BRAKE LININGS

When new linings are necessary it is always preferable to use shoes which have been re-lined by a skilled mechanic. The 8″ twin leading shoe front brake utilises lined shoes supplied by the Lockheed Hydraulic Brake Co. Ltd., and replacements, which are a standard automobile component, are available from their Service Depots.

Alternatively, front or rear brake shoes can be relined at the nearest Ferodo Service Depot. Owners who wish to re-line the shoes themselves, should adopt the following procedure.

Hold the shoe firmly in a vice and, using a good sharp chisel, cut off the head of the rivet.

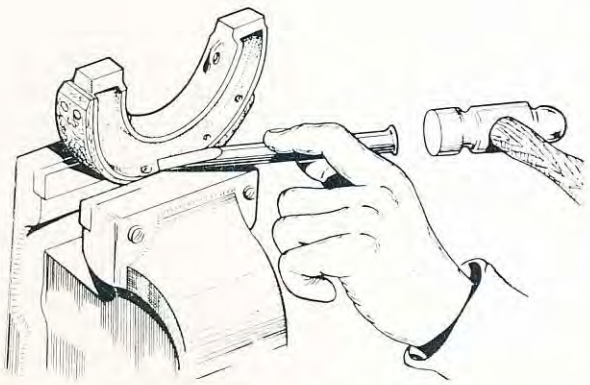


FIG. F7. *Chopping out the rivets.*

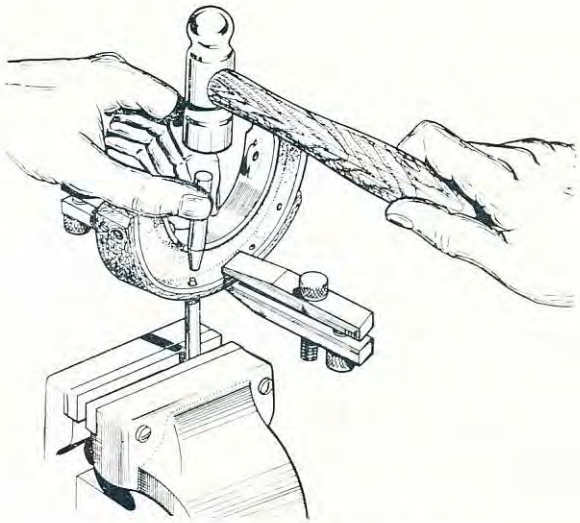


FIG. F8. *Peening-over rivets.*

Drive out the old rivets with a suitable punch. Reverse the shoe in the vice and drawfile the face of the shoe to remove any burrs.

Clamp the new lining in position and drill straight through with 5/32″ diameter drill using the holes in the shoes as a guide.

Remove the clamps and holding the lining carefully in the vice counterbore or countersink, according to the type of rivet used, to no more than two-thirds the thickness of the lining; i.e., if the lining is $\frac{1}{16}$″ thick, the counterbore must not be deeper than $\frac{1}{8}$″.

Having prepared the linings for riveting, start at the centre and position the lining with one or more rivets.

Using either small "G" or toolmakers clamps close to the rivets and with a suitable mandrel in the vice, peen-over the rivets to form a head, working alternate rivets outwards from the centre, see Fig. F8.

The mandrel in the vice must be flat on the end and the diameter no more than that of the rivet head. It will also help to press the rivet into the lining if a hollow punch is used before peening.

The linings must be fitted closely against the brake shoe, and it is therefore essential to use the clamps correctly when riveting, viz., the clamp must be as close as possible to the rivet.

Failure to adopt this procedure will lead to the formation of a gap between lining and shoe resulting in a "spongy" brake.

When riveting is complete, file a chamfer on the leading edge of each lining to approximately half its thickness and lightly draw-file the rest of the lining to remove fraze from the drillings.

WHEEL BUILDING

This is a job which is best left to the specialst as it is essential that the wheel is laced correctly and that when truing, the spokes are correctly tensioned.

However, it is possible for the less experienced owner to avoid trouble by periodically examining the wheels. As spokes and nipples bed down, tension will be reduced and unless this condition is corrected, the spokes will chafe and ultimately break.

Periodically test the tension either by "ringing" that is striking with a metal tool, or by placing the fingers and thumb of one hand over two spokes at a time and pressing them together.

If tension has been lost there will be no ringing tone and the spokes will move freely across each other.

When a spoke needs tensioning, the nipple must be screwed further on to the spoke, but at the same time, the truth of the wheel must be checked and it may be necessary to ease tension at another part of the wheel in order to maintain truth.

It will therefore be obvious that spoke replacement, spoke tensioning and wheel truing are operations which should not be treated lightly.

Careful examination of the wheel will show that every spoke is opposed by another on the opposite side of the hub, and that alternate spokes round the rim are attached to the same side of the hub.

Increasing tension tends to distort the rim, and therefore, to counteract this, it is sometimes necessary to increase tension on the spoke or spokes on both sides to maintain truth of the wheel.

With care and patience it is possible for the unskilled owner to re-tension the spokes, when each nipple must be turned only a little at a time. Once the spoke is under tension, only a fraction of a turn is sometimes sufficient to put the rim out of truth.

Following any adjustment to spoke tension, file off any surplus lengths of spoke which may protrude through the nipple. These could be a cause of punctures.

WHEEL BALANCING

When a wheel is unbalanced, it is often due to variations in weight distribution in the tyre, which is usually marked on the wall with a white spot (or spots) to indicate the lightest part. At moderate speeds, an unbalanced wheel may not be noticed, but at high speeds, however, unbalanced forces will seriously impair handling of the machine, more especially if the front wheel is affected.

Weights are available to attaching to the spokes as an aid to correct balancing, but before beginning this task, make sure that the wheel revolves freely.

In the case of the rear wheel, this will involve removal of the chain.

With the wheel clear of the ground turn it gently and allow it to stop. Mark the top of the wheel or tyre which will be the lightest point, and repeat two or three times to check.

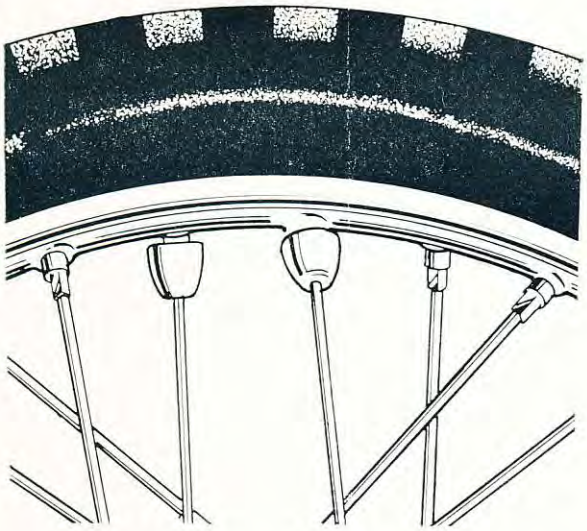


FIG. F9. *Balance weights.*

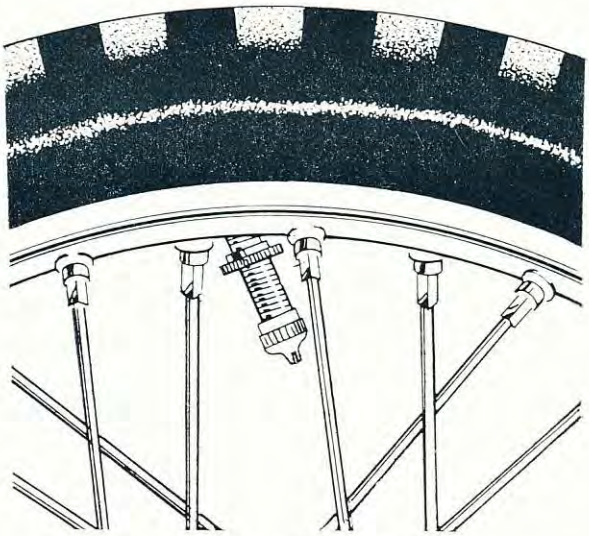


FIG. F10. *Tyre creeping.*

If the wheel stops in the same position each time, extra weight must be added at the marked spot.

The next step is to ascertain how much weight is to be added. This can be done by adding small pieces of plasticine to the nipples and rechecking as above until the wheel shows no tendency to stop in any particular position.

Having ascertained how much weight is required, a balance weight of exactly the same amount must be attached to the spokes at the spot originally marked.

If security bolts are to be used they must be fitted before balancing.

SECURITY BOLTS

If a tyre is used in an under-inflated condition it will creep round the rim taking the tube with it and will ultimately cause the valve to be pulled from the tube (see Fig. F10).

Therefore, on high performance or cross-country models, it is usual to fit two security bolts to the rear wheel, spaced at 120° each side of the valve.

To fit the bolts, remove the tyre and tube, mark their positions and drill the rim between two nipples to the required size of the bolt.

After removing fraze from the holes, fit the bolts quite loosely and replace the tyre so that

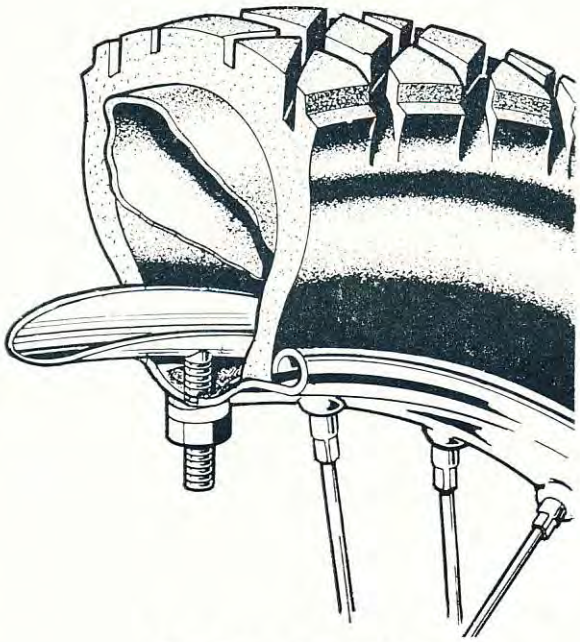


FIG. F11. *Security bolt.*

the covered portion of the security bolt is inside the tyre (see Fig. F11).

Check that the tyre is correctly positioned, inflate to the required pressure and tighten the nuts on to the rim.

WHEEL ALIGNMENT

Steering will be affected if the wheels are out of alignment (out of track) even by only a very small amount.

Since the front wheel cannot be adjusted in this respect, it is the rear wheel which must be aligned to the front wheel. It is necessary to adjust the rear brake whenever re-alignment has been carried out.

To check alignment of the wheels, a straight-edge of timber or steel approximately 7 feet (2·2 m) long is required, and stepped at "D" to suit the difference in size between the front and rear tyres.

The straight edge should be laid on blocks four to six inches high (10—15 cm.) and applied to each side of the machine alternately.

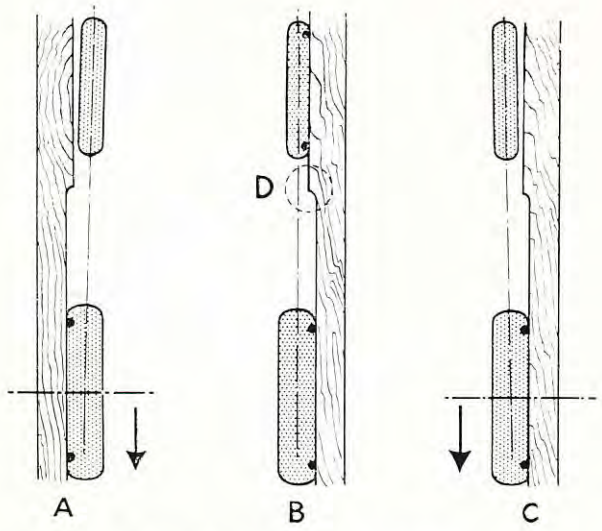


FIG. F12. *Checking alignment.*

If the tyres are the same size and the wheels in alignment, the straight-edge will be touching the tyres at four points on each side as in (B) Fig. F12.

If the alignment is as either (*A*) or (*C*), then the rear chain adjusters must be repositioned to move the wheel as indicated by the arrows to correct alignment.

Assuming that chain adjustment is correct, movement of the rear wheel will be made on the right side chain adjuster.

A machine suffering accidental damage may have wheels so much out of alignment that alignment cannot be corrected in this way. The basic geometry of the frame, forks or wheels may be upset, but in such cases a specialist repairer will probably be able to reset any faulty assembly, using information in Sections D and E.

REMOVING AND REFITTING TYRES

Tyre removal

There are a few points about tyres which should be thoroughly understood:—

(1) The beads have wire cores which cannot be stretched over the rim flanges without damage.

(2) Removal and replacement will be simplified if the beads are pressed right down into the well of the rim, except at the point being "worked". The well is the centre section.

(3) The tyre beads will slip over the rim easily and damage will be avoided if the beads and the levers are lubricated with soapy water.

Unscrew and remove the valve core to deflate the tyre.

Some valve caps incorporate a slotted extension for this purpose, but, if the cap is plain and a core removal tool is not available, depress the centre of the valve and keep "treading" the tyre to expel the air.

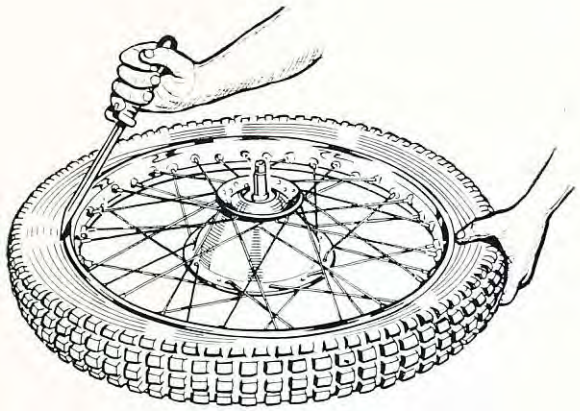


FIG. F13. *Removing the first bead (operation 1).*

Press each bead off its seat into the well of the rim.

Insert the lever at the valve position, and while levering, press the bead into the well diametrically opposite the valve.

Fig. F13 shows the initial steps in removing the first bead. It is impossible to prise the tyre bead over the rim flange until the opposite bead is pushed off its seat down into the well. Then the bead slips easily over the rim flange.

Insert a second lever close to the first and prise the bead over the flange, holding the free part with the other lever.

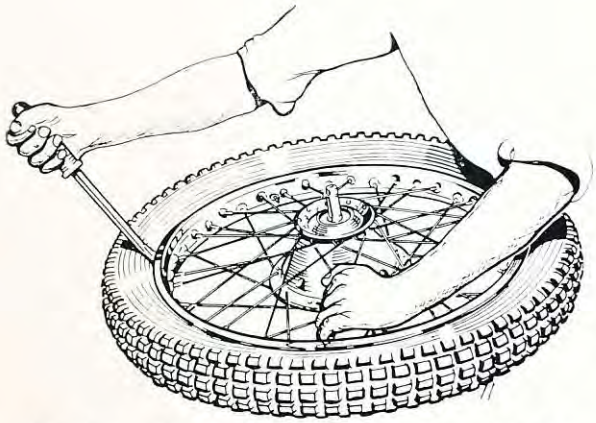


FIG. F14. *Removing the first bead (operation 2).*

Remove one lever and insert further along the bead, continuing every two or three inches until the bead is completely removed (see Fig. F14).

Take care when inserting levers not to pinch the inner tube as this will result in a puncture. Lift the valve out of the rim and remove the tube.

Stand the wheel upright, insert a lever between the remaining bead and the rim and prise the tyre back over the flange as in Fig. F15. Do not forget to press the bead at a point diametrically opposite the lever into the centre of the rim and to apply a soapy solution to the rim flange.

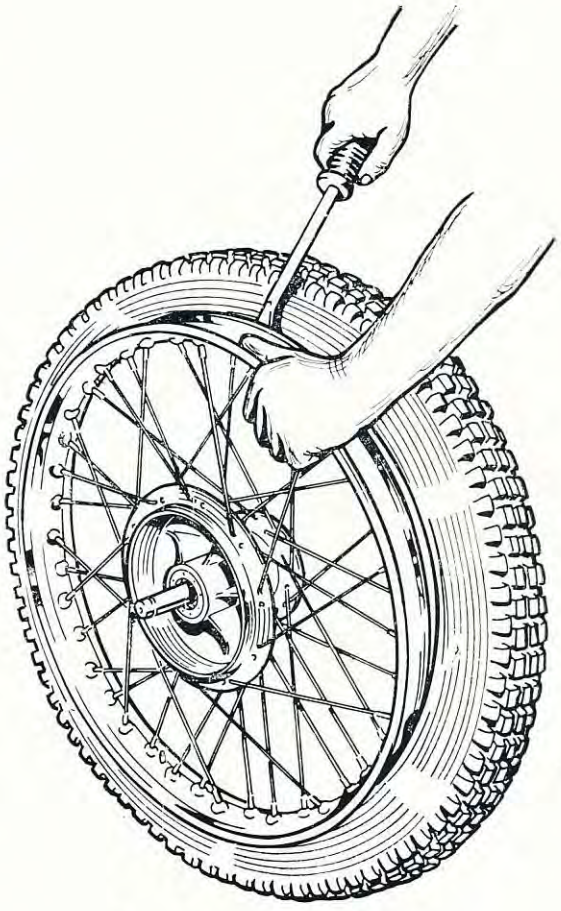


FIG. F15. *Removing the tyre.*

Tyre replacement

Before a tyre (new or used) is replaced, it should be carefully checked inside and outside for loose objects or nails, flints, glass and cuts.

Do not forget that although there may be nothing visible outside there could be a nail projecting inside. When repairing a tyre or tube be patient and make sure that the area of the repair is absolutely clean before applying solution. A rag dampened with petrol will help to clean the area, but it must be completely dry before solution is applied.

Remember that when replacing the tyre, it is very easy to cause another puncture by nipping the inner tube with the levers.

Some new tyres have balance adjustment rubbers inside the casing. They are not patches and should not be disturbed.

When there is a white spot near the tyre bead, it should be placed at the valve position or, if two security bolts are fitted, midway between the bolts. This will ensure a high degree of tyre balance.

If the spokes have been tensioned, or renewed, they must not project through the nipples. File flush any that are showing through.

Replace the rim tape with the rough side next to the rim. Place the tube in the tyre and inflate it just sufficiently to round it out without stretch.

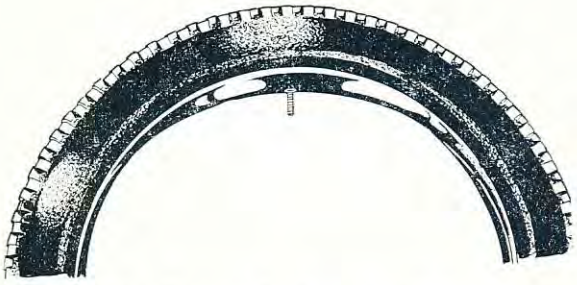


FIG. F16. *Tyre and tube assembled ready for fitting.*

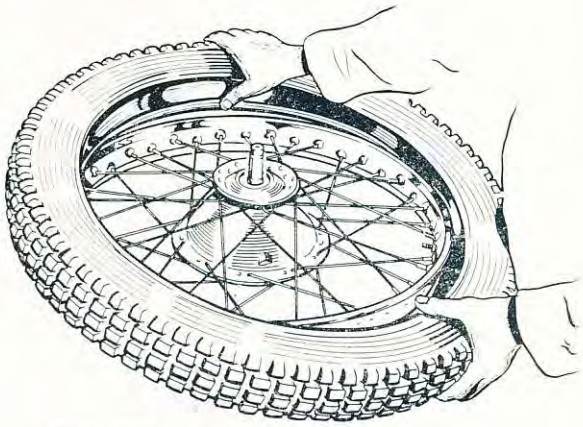


FIG. F17. *Commencing to fit the tyre.*

Too much air makes fitting difficult, but too little will make the tube more liable to be nipped by the levers. Dust the tube and inside the cover with talcum powder.

Lubricate the tyre beads and the rim flanges with a soap and water solution or liquid soap.

Pull the tube slightly out of the cover so that it protrudes about 1″ beyond the beads for about 4″ to 5″ each side of the valve as in Fig. F16.

Squeeze the beads together at the valve to prevent the tube slipping back and push the tyre to the rim as shown in Fig. F17, at the same time passing the valve through the holes in the tape and rim.

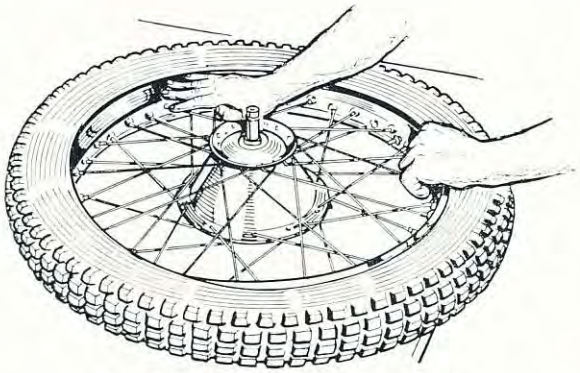


FIG. F18. *Fitting the first bead.*

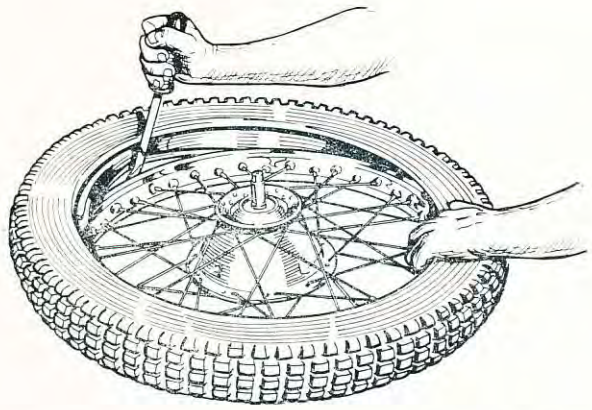


FIG. F19. *Completing fitting of the first bead.*

Allow the lower bead to go into the well of the rim and the upper bead to be above the rim flange.

Working from the valve outwards, press the lower bead over the rim flange by hand, moving along in short stretches, and ensuring that the bead lies right down in the well of the rim—this is most important (see Fig. F19). If necessary use a tyre lever for the last few inches as in Fig. F19.

Turn the wheel over and check that the bead is concentric with the rim before proceeding further.

Reverse the wheel again and press the upper bead into the well of the rim diametrically opposite the valve.

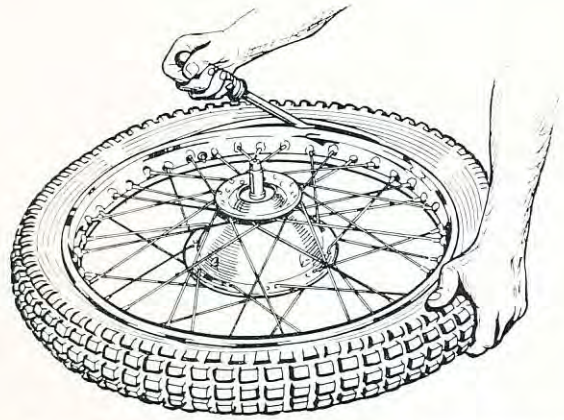


FIG. F20. *Completing fitting of the second bead.*

Insert a lever as closely as possible to the point where the bead passes over the flange, and lever the bead over at the same time pressing a fitted portion into the well of the rim.

Repeat progressively round the tyre until the bead is completely over the flange, finishing at the valve (see Fig. F20).

Push the valve inwards to ensure that the tube adjacent to the valve is not trapped under the bead, then pull the valve back firmly into position. Also ensure that the tube is resting on the flap of the security bolt and is over-lapping the sides.

Check that the fitting line on the tyre wall just above the bead on each side is concentric with the rim, and see that the valve protrudes squarely through the valve hole before screwing down the knurled nut. Replace the dust cap.

Partially inflate the tyre and if necessary bounce the wheel to help seat the tyre, but ensure that there is adequate pressure to prevent damaging the tyre or tube and use only moderate force. If the tyre will not seat, it is better to release the pressure, apply soap solution to lubricate, and reinflate.

Inflate to the required pressure and check fitting lines again. Inflation should not be too rapid, particularly at the commencement, to allow the beads to seat correctly on the rim.

Tighten down the security bolts (if fitted).

TYRE MAINTENANCE

Always maintain correct inflation pressures (see page GD11). Use a tyre pressure gauge and check weekly when tyres are cold. The pressures quoted in the General Data pages are for a rider of 154 lbs. (70 kg) weight. If the rider's weight exceeds 154 lbs. (70 kg) pressure should be increased as follows:—

Tyre size and type	INFLATION PRESSURE (lbs. per sq. in.)				
	16	20	24	28	32
	Maximum load per tyre (lbs.)				
3·25×18 K70	225	275	330	385	440
3·50×18 K70	255	315	370	430	485
3·00×20 T.U. and Sports	195	240	290	340	385
4·00×18 T.U. and Sports	345	410	470	530	595

Front tyre

Add 1 lb. per square inch for every 28 lbs. above 154 lbs. (70 kg).

Rear tyre

Add 1 lb. per square inch for every 14 lbs. above 154 lbs. (70 kg).

For sustained high speeds, normal pressures should be increased by 5 lbs. per square inch. If a pillion passenger or luggage is carried, the actual load on each tyre should be taken and the pressures increased in accordance with the table below. The load on each tyre can be found by placing each wheel in turn on a weighbridge with the rider or riders astride the machine.

Pressure should then be adjusted to the chart above.

INDEX

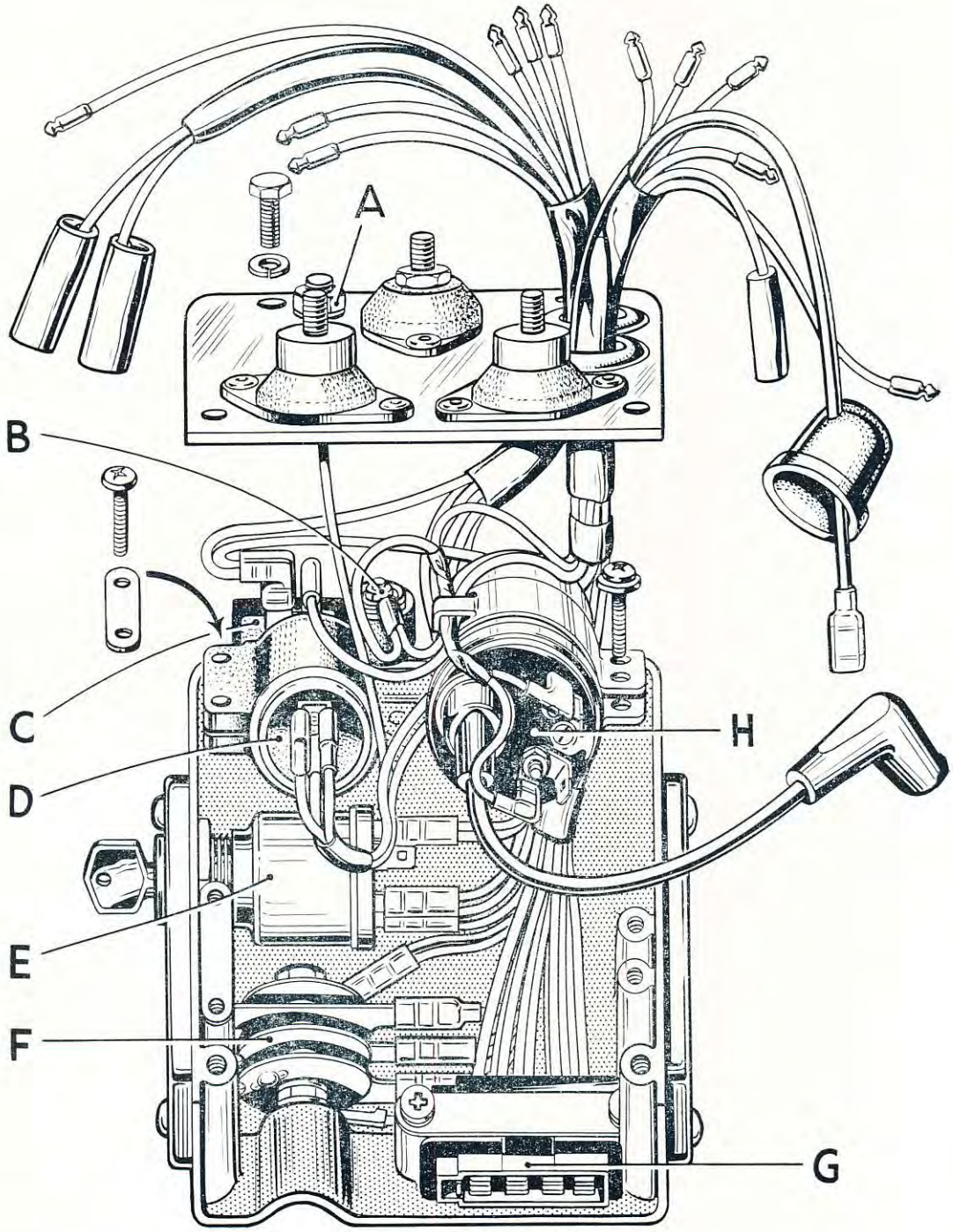


FIG. G1. *Electrical box.*

A—Zener diode
B—Condenser
C—Flasher unit
D—Capacitor
E—Ignition master switch
F—Rectifier
G—Headlamp harness socket
H—Ignition coil

INTRODUCTION

The electrical system is supplied from an A.C. generator, contained in the primary chaincase and driven by the engine shaft.

A Zener diode is connected in circuit to control the battery charging current and thereby prevents over-charging.

The current supplied to the ignition system is interrupted by a contact breaker, driven by the camshaft.

Routine maintenance needed by the various components is detailed in the following sections. Whilst checking the electrical system, opportunity should be taken to ensure that all wiring connections and frame earthing points are clean and secure.

All electrical components except the battery, lamps, horn and handlebar switches are housed in a rubber-mounted box beneath the fuel tank. The various items within the box are shown in Fig. G1, and it should be noted that the lid of the box serves as the Zener Diode heat sink. A short earth lead is fitted between the box and the frame of the machine.

Having removed the fuel tank, the box may be removed in order to test suspect components.

ALTERNATOR

The alternator consists of a spigot-mounted six-coil laminated encapsulated stator with a rotor carried on and driven by an extension of the crankshaft. The rotor has an hexagonal steel core, each face of which carries a high-energy permanent magnet keyed to a laminated pole tip. The pole tips are riveted circumferentially to side plates, the assembly being cast in aluminium alloy and machined to give a smooth external finish.

There are no rotating components apart from the rotor, and consequently the alternator requires no maintenance apart from occasionally checking that the snap connectors in the output cables are clean and tight, and that the rotor fixing nut is secure.

If rotor removal is necessary, there is no need to fit magnetic keepers to the rotor poles. Wipe off any swarf which may have been attracted to the pole tips and put the rotor in a clean place until required for refitting.

BATTERY INSPECTION AND MAINTENANCE

The container for the PUZ5A battery is moulded in transparent material through which the acid can be seen. The tops of the containers are so designed that when the covers are in position, the special anti-spill filler plugs are sealed in a common venting chamber. Gas from the filler plugs leaves this chamber through a vent pipe. Polythene tubing is attached to the vent pipe to lead corrosive fumes away from the machine.

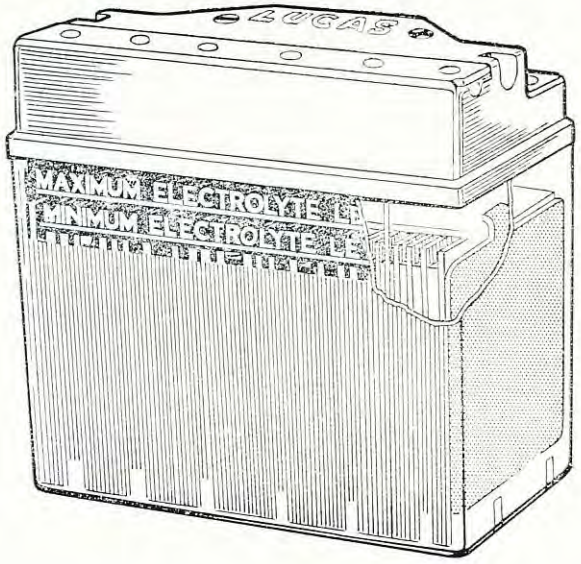


FIG. G2. *The PUZ5A battery.*

PART "A"

Charging the battery

Whilst the battery leaves the factory in the fully "dry-charged" condition, it will require a pre-service charge after being taken from storage. Therefore the filling instructions on page 12 must be carefully observed.

PART "B"

Routine maintenance

Every 1,000 miles (1,500 km) or monthly, or more regularly in hot climates the battery should be cleaned as follows.

Remove the battery cover and clean the battery top. Examine the terminals: if they are corroded "dry-charged" condition, a wire brush will be required to scrape them clean. Having cleaned the terminals, smear them with a film of petroleum jelly, or silicone grease.

The level of electrolyte in each cell should be checked weekly or every 250 miles. Add distilled water to maintain the level at "maximum".

Note:—On **no account** should the battery be topped-up above the "maximum" line.

With this type of battery, the acid can only be reached by a miniature hydrometer, which would indicate the state of charge.

Great care should be taken when carrying out these operations not to spill any acid or allow a naked flame near the electrolyte. The mixture of oxygen and hydrogen given off by a battery on charge, and to a lesser extent when standing idle, is explosive.

The readings obtained from the battery electrolyte should be compared with those given in the table on page 13. If a battery is suspected to be faulty it is advisable to have it checked by a Lucas depot or agent.

A lead/acid battery slowly loses its charge whilst standing—the rate of loss being greater in hot climates. If a battery is not being used, it is important to give it refreshing charges at the appropriate re-charge rate. These should be given fortnightly in temperate climates and weekly in the tropics.

THE IGNITION SYSTEM

The coil ignition system comprises an ignition coil, mounted within the electric box, and a contact breaker unit fitted in the timing cover. Apart from cleaning between terminals, and checking connections for soundness, the coil will not require attention. Testing the ignition coil is covered in Part "B", page G5, while the contact breaker is dealt with in Part "C".

The method of approach to a faulty ignition system is to first check the low-tension circuit for continuity as in Part "A", then follow the procedure laid out in Part "B" to locate the fault(s).

Failure to locate a fault in the low-tension circuit indicates that the high-tension circuit or sparking plug is faulty, and the procedure detailed in Part "D" must be adopted. Before commencing any of the following tests, however, the contact breaker and sparking plug gaps must be cleaned and adjusted.

PART A

Checking the low tension circuit for continuity

To check whether there is a fault in the low-tension circuit and to locate its position, the following tests should be carried out.

First inspect the in-line fuse situated in the battery Brown/Blue lead and replace if suspect: check also the cut-out switch; this can be done by disconnecting the White and White and Yellow leads from the right handlebar switch and connect together, this will complete the ignition circuit, by passing the cut-out switch.

Connect a 0-15 volt D.C. voltmeter, with the black lead to the "CB" or "+" terminal of the coil and the red lead to earth. Turn the engine until the contacts open. With the ignition switched on, the voltmeter should read battery

voltage. No reading indicates an open circuit ignition switch, coil primary winding or a short circuit across the contacts which can be confirmed by disconnecting the coil/contact breaker lead at the coil. If battery voltage is then indicated by the voltmeter the fault lies in the contacts or the circuitry from the coil to them. This fault is very often caused by incorrect assembly of the contact insulating washers.

Turn the engine until the contacts close and the voltmeter should then read zero. Any reading indicates the contacts are either burnt or dirty and should be cleaned or stoned flat.

Connect the voltmeter with the red lead to earth and the black lead to the "SW" or "—" terminal of the coil. Ensure the contacts are closed and switch on the ignition switch. Take careful note of the voltmeter reading then quickly transfer the black lead to the battery '—' terminal and again take careful note of the reading. The difference between the two readings should not exceed 0·5 volts. Readings in excess of this indicate a high resistance in the ignition feed circuit, faulty ignition switch switch or cut out button.

PART "B"

Ignition coil

The ignition coil consists of a primary and secondary winding, wound concentrically about a laminated soft iron core, the secondary winding being next to the core.

The primary and secondary windings of the coil have 280—372 turns and 21,000 turns respectively of shellac-insulated wire, the secondary being much finer. Each layer is paper insulated from the next on both primary and secondary windings.

To test the ignition coil on the machine, first ensure that the low-tension circuit is in order as described in Part "A", then disconnect the high-tension lead from the sparking plug. Turn the ignition switch to the IGN position and crank the engine until the contacts are closed.

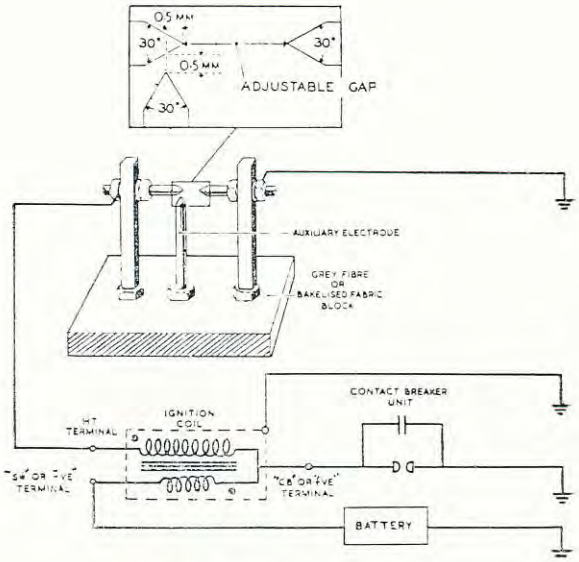


FIG. G3. *Ignition coil test rig.*

Flick the contact breaker points open a number of times whilst the high-tension lead from the ignition coil is held about $\frac{3}{8}$" away from the cylinder head. If the ignition coil is in good condition a strong spark should be obtained; if no spark occurs this indicates the ignition coil to be faulty.

Before a fault can be attributed to the ignition coil it must be ascertained that the high-tension cable is not cracked or showing signs of deterioration, as this may often be the cause of misfiring, etc. It should also be checked that the ignition points are actually making good electrical contact when closed and that the moving contact is insulated from earth when open. It is advisable to remove the ignition coil and test it by the method described below.

Bench testing ignition coil

Connect the ignition coil into the circuit shown in Fig. G3, and set the adjustable gap to 9 mm. Using a single-lobe contact breaker (160 degree closed period) running at 600 revs. per minute, not more than 5 per cent. missing should occur at the spark gap over a period of fifteen seconds. The primary winding can be checked for short

circuit coils by connecting an ohmeter across the low-tension terminals. The reading obtained for the 17M12 coil should be within the figures below (at 20°C.).

Primary resistance	
minimum	maximum
3·3 ohms	3·8 ohms

PART "C"

Contact breaker

Faults occurring at the contact breaker are in the main due to incorrect adjustments of the contacts or the efficiency being impaired by piling, pitting, or oxidation of the contacts due to oil, etc. Therefore, always ensure that the points are clean and that the gap is adjusted to the correct working clearance of ·015" (·38 mm.).

To test for a faulty condenser, first switch on the ignition, then take voltage reading across the contacts when open. No reading indicates that the capacitor internal insulation has broken down, indicated by excessive arcing when in use, and over-heating of the contact faces, a check should be made by substitution.

Particular attention is called to the periodic lubrication procedure for the contact breaker which is given on page A8. When lubricating the parts ensure that no oil or grease reaches the contacts. The centre spindle must also be lubricated.

If it is felt that the contacts require surface grinding then the complete contact breaker unit should be removed as described on page B20, and the moving contact disconnected by unscrewing the securing nut from the terminal. Grinding is best achieved by using a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a clean petrol (gasolene) moistened cloth.

The contact faces should be slightly domed to ensure point contact. There is no need to remove pitting from the fixed contact. When refitting the moving contact do not forget to refit the insulating shield to the terminal and apply a smear of grease to the contact breaker cam and moving contact pivot post.

PART "D"

Checking the high-tension circuit

If ignition failure or misfiring occurs, and the fault is not in the low-tension circuit, then check the ignition coil as described in Part "B". If the coil proves satisfactory, ensure that the high-tension cable is not the cause of the fault.

If a good spark is available at the high-tension cable, then the sparking plug suppressor cap or the sparking plug itself may be the cause of the fault. Clean the sparking plug and adjust the electrodes to the required setting as described on page G8 and then reset the engine for running performance. If the fault re-occurs then it is likely that the suppressor cap is faulty and should be renewed.

2 MC ELECTROLYTIC CAPACITOR

The capacitor is an electrolytic polarised unit, which will be irreparably damaged if incorrectly connected.

Terminal identification

Looking at the terminal end of the unit, two Lucar terminals of different sizes will be observed, the small terminal being the positive earth terminal: for identification the rivet has a red spot.

The double Lucar terminal is the negative connection.

The basic object of using the electrolytic capacitor in the system is to enable the motor cycle to be run without a battery giving the rider

the advantage of using the machine for competition work, and re-fitting the battery for normal road use.

If the battery should be disconnected and the machine run on capacitor ensure that the negative (brown/blue) lead is well insulated.

Periodic check

Disconnect the battery, start and run the engine. Full lighting should be available.

Conclusion—If engine will not fire and run, proceed to next check.

Efficiency check

(1) Disconnect the capacitor.

(2) Connect the capacitor direct to a 12 volt battery for 5 seconds (see polarity note).

(3) Disconnect the battery and let the charged capacitor stand for 5 minutes.

(4) Connect a D.C. voltmeter across the terminals (see polarity note) and note the steady reading after the initial swing, which should not be less than 9 volts for a serviceable unit.

Service notes

Before running the machine with the battery disconnected **it is essential that the battery negative lead be insulated** to prevent it from reconnecting and shorting to earth. This can be done by removing the fuse from its holder, replacing it with a length of $\frac{1}{4}$" diameter wooden dowel or other insulating medium.

A faulty capacitor may not be apparent when used with a battery system. To prevent any inconvenience arising, periodically check that the capacitor is serviceable by disconnecting the battery to see if the machine will start easily.

Should the engine fail to start without the battery, substitute a new capacitor. If the engine still will not start, check the wiring between the capacitor and rectifier for possible open or short-circuit conditions. Also check the earth connections.

Do not run the machine with the Zener diode disconnected, as the capacitor will be damaged due to excessive voltage.

If difficulty is encountered in starting with a battery fitted, disconnect the capacitor to eliminate the possibility of a short-circuit.

SPARKING PLUG

It is recommended that the sparking plug be inspected, cleaned and tested every 2,000 miles (3,000 km.) and a new one fitted every 10,000 miles (15,000 km.).

To remove the sparking plug a box spanner (13/16", 19·5 mm. across flats) should be used and if any difficulty is encountered a small amount of penetrating oil should be placed at the base of the sparking plug and time allowed for penetration.

Examine the plug for signs of fuel fouling. This is indicated by a dry, sooty, black deposit, which is usually caused by over-rich carburation, although ignition system defects such as a faulty contact breaker, coil or condenser defects, or a broken cable may be additional causes.

Examine the plug for signs of oil fouling. This will be indicated by a wet, shiny, black deposit on the central insulator. This is caused by excessive oil in the combustion chamber during combustion and indicates that the piston rings or cylinder bore is worn.

To rectify this type of fault the above mentioned items should be checked with special attention given to the carburation system.

Over-heating of the sparking plug electrode is indicated by severely eroded electrode and a white, burned or blistered insulator. This type of fault can be caused by weak carburation or over-advanced ignition timing although plugs which have been operating whilst not being screwed down sufficiently can easily become overheated due to heat that is normally dissipated

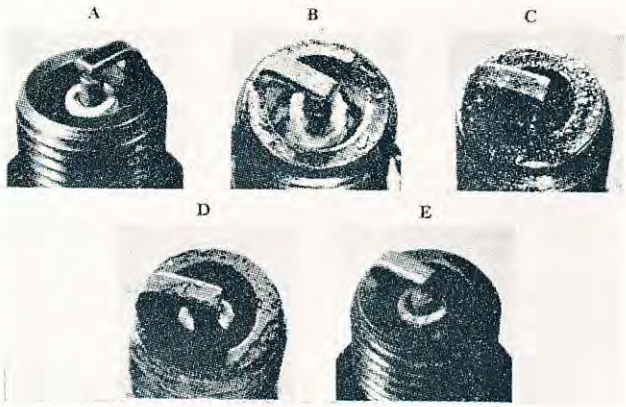


FIG. G4. *Sparking plug diagnosis.*

through to the cylinder head not having an adequate conducting path.

Over-heating is normally symptomised by pre-ignition, short plug life, and "pinking" which can ultimately result in piston failure. Unnecessary damage can result from over-tightening the plugs. To achieve a good seal between the plug and cylinder head, screw the plug in by hand on to its gasket, then lightly tighten with a box-spanner.

A plug of the correct grade will bear a light flaky deposit on the outer rim and earth electrode, and these and the base of the insulator will be light chocolate brown in colour. A correct choice of plug is marked (*A*). (*B*) shows a plug which appears bleached, with a deposit like cigarette ash; this is too "hot-running" for the performance of the engine and a cooler-running type should be substituted.

A plug which has been running too "cold" and has not reached its self-cleaning temperature is shown at (*C*). This has oil on the base of the insulator and electrodes, and should be replaced by a plug that will burn off deposits and remove the possibility of a short-circuit. The plug marked (*D*) is heavily sooted, indicating that the mixture has been too rich, and a further carburation check should be made. At illustration (*E*) is seen a plug which is completely worn out and in need of replacement.

To clean the plug it is preferable to make use of a properly designed proprietary plug cleaner. When the plug has been carefully cleaned, examine the central insulator for cracking and the centre electrode for excessive wear. In such cases the plug will have completed its useful life and a new one should be fitted.

Finally, the sparking plug electrode should be adjusted to the correct gap setting of ·025" (·65 mm.). Before refitting sparking plug the threads should be cleaned by means of a wire brush and a minute amount of graphite grease smeared on to the threads. This will prevent any possibility of thread seizure occurring.

If ignition timing and carburation settings are correct and the plug has been correctly fitted, but over-heating still occurs, then it is possible that carburation is being adversely affected by an air leak between the carburetter and the cylinder head. This possibility must be checked thoroughly before taking any further action (see page C4). When it is certain that none of the above mentioned faults are the cause of over-heating, an alternative plug type and grade should be considered.

Normally the type of plug mentioned in General Data is satisfactory for general use of the machine, but in special isolated cases, conditions may demand a plug of a different heat range. Advice

from the plug manufacturer is readily available to solve these problems.

CHARGING SYSTEM

The alternator gives maximum output with the lighting switch in all switch positions, the coils being permanently connected across the rectifier. Excessive charge is absorbed by the Zener diode, which is connected in parallel with the battery, and dissipated in the form of heat to the lid of the electric box which acts as a heat sink.

Always ensure that the ignition is switched "off" whilst the machine is not in use.

Proceed to test the alternator as described in Part "A". If the alternator is satisfactory, the fault must lie in the charging circuit, hence the rectifier must be checked as in Part "B" and then the wiring and connections as in Part "C".

PART "A"

Checking alternator output

Disconnect the two alternator output cables and run the engine at 3,000 revs per minute.

An A.C. voltmeter (0—15 volts) with a 1 ohm load resistor in parallel is required for this test.

A suitable 1 ohm load resistor can be made from a piece of Nichrome wire as shown in Part "D", page G12.

The test is conducted by connecting a voltmeter and the 1 ohm load resistor between the following cables and note the readings.

The test procedure is as follows:—

Disconnect the two alternator leads, then connect the voltmeter with 1 ohm load resistor between the white/green and green/yellow cables. With the engine running at 3,000 revs. per minute the voltmeter should read 9·0 volts minimum.

From the results obtained, thefollowing deductions can be made.

(1) If the reading is equal to or higher than those quoted then the alternator is satisfactory.

(2) A low reading indicates either that the leads concerned are chafed or damaged due to running on the chains or that some turns of the coils are short-circuited.

(3) A low reading would also occur if the rotor had become partially demagnetised. As this is an extremely rare occurrence it is advisable to check by substitution before returning the rotor to the manufacturer for remagnetisation. If it is found that the rotor has become demagnetised, check that it has not been caused by a faulty rectifier and that the battery is of correct polarity.

(4) A zero reading indicates that a coil has become disconnected, is open-circuit, or is earthed.

(5) A reading obtained between green/yellow lead and earth indicates that coil windings or connections have become earthed.

If any of the above mentioned faults occur, always check the stator leads for possible chain damage before renewing the stator.

PART "B"

Rectifier maintenance and testing

The rectifier is a silicon semi-conductor device which allows current to flow in one direction only. It is connected to provide full-wave rectification of alternator output current.

The rectifier requires no maintenance beyond checking that the connections are clean and tight. The nuts clamping the rectifier plates together must not under any circumstances be slackened. A separate nut is used to secure the rectifier and it is important to check periodically that the rectifier is firmly attached and therefore well earthed.

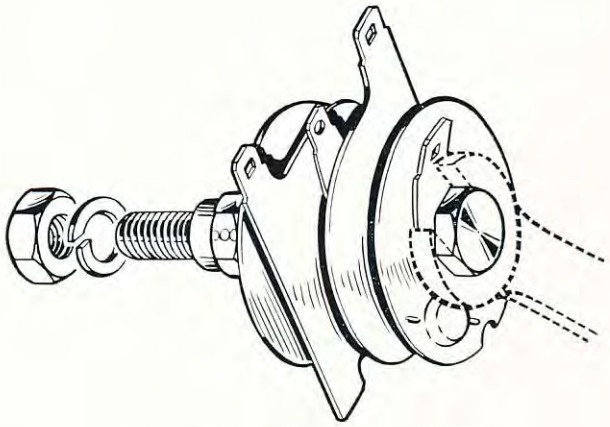


FIG. G5. *Refitting the rectifier.*

When tightening the rectifier securing nut, hold the rectifier with a second spanner as shown in Fig. G5, for if the plates are twisted, the internal connections will be broken.

Testing the rectifier on the machine

(1) Disconnect the Zener Diode by removing the **straight** Lucar connector with the Brown/Blue cable from the 2 MC capacitor.

(2) Locate the snap connector junction for the Brown/Blue cable to the box and disconnect.

(3) Connect a D.C. voltmeter (with the 1 ohm load in parallel) with the red lead to earth and the Black lead to the Brown/Blue cable from the box.

(4) Locate the White/Yellow cable in the other snap connector junction from the box, and using a jumper lead connect the cable from the box to the negative (—) terminal of the battery.

(5) Start the machine and run at approximately 3,000 rev./min., and take a reading from the voltmeter. This should not read less than 7·75 volts, which indicates the rectifier is operating satisfactorily. A lower reading indicates a fault in the rectifier which can be confirmed by a bench test.

(6) Stop engine before disconnecting the voltmeter.

Bench testing the rectifier

This necessitates removing the electrical box from the machine in order that the rectifier may be taken out.

Connect the rectifier to a fully charged 12 volt battery of approximately 40 ampere/hours capacity at the 10 hour rate, and 1 ohm load resistor, and then connect the D.C. voltmeter in the V2 position, as shown in Fig. G6.

Note the battery voltage (should be 12 volt) and then connect the voltmeter in V1 position whilst the following tests are conducted.

A voltmeter in position V1 will measure the volt drop across the rectifier plate. In position V2 it will measure the supply voltage to check that it is the recommended 12 volts on load.

In Fig. G8, the rectifier terminal markings 1, 2 and 3 are shown physically in Figs. G5 and G6, while terminal 4 represents the rectifier centre bolt. One and 3 are the A.C. input terminals while 2 and 4 are the D.C. output terminals (—ve and +ve respectively).

FIG. G6. *The rectifier showing terminal connections.*

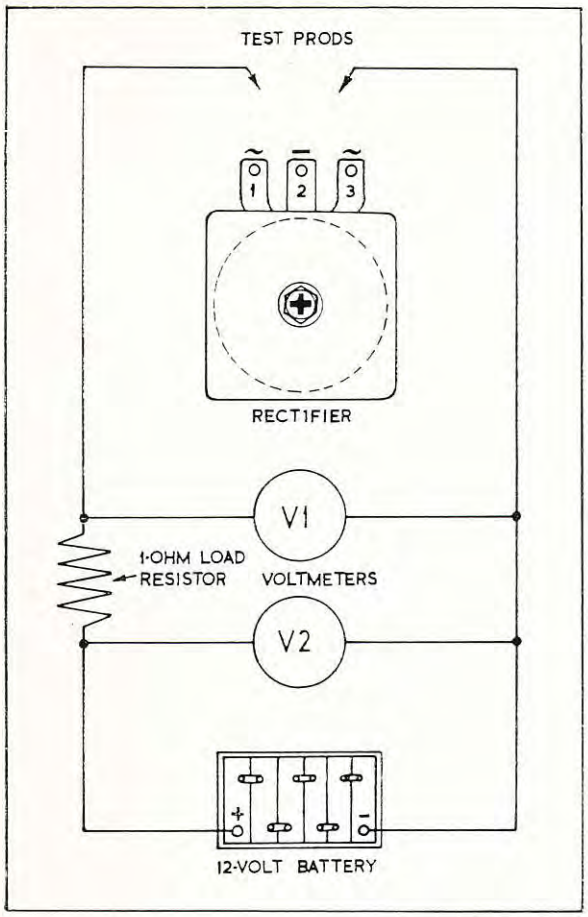


FIG. G7. *Bench testing the rectifier.*

Test 1
With the test leads, make the following connections but keep the testing time as short as possible to avoid over-heating the rectifier cell: (*a*) 1 and 2, (*b*) 1 and 4, (*c*) 3 and 4, (*d*) 3 and 2. Each reading should not be greater than 2·5 volts with the battery polarity as shown.

Test 2
Reverse the leads or battery polarity and repeat test 1. The reading obtained should not be more than 1·5 volts below battery voltage (V2) *i.e.*, 10·5 volts minimum.

If the readings obtained are not within the figures given, then the rectifier internal connections are shorting and the rectifier should be renewed.

PART "C"

Checking the charging circuit for continuity
This test utilises the machine's own battery to test for continuity or breakdown in the D.C. section of the charging system.

The battery must be in a good state of charge and the alternator leads must be disconnected at the snap connectors so that there is no possibility of demagnetising the rotor.

First, check that there is voltage at the rectifier centre terminal by connecting a D.C. voltmeter, between the rectifier centre terminal and earth,

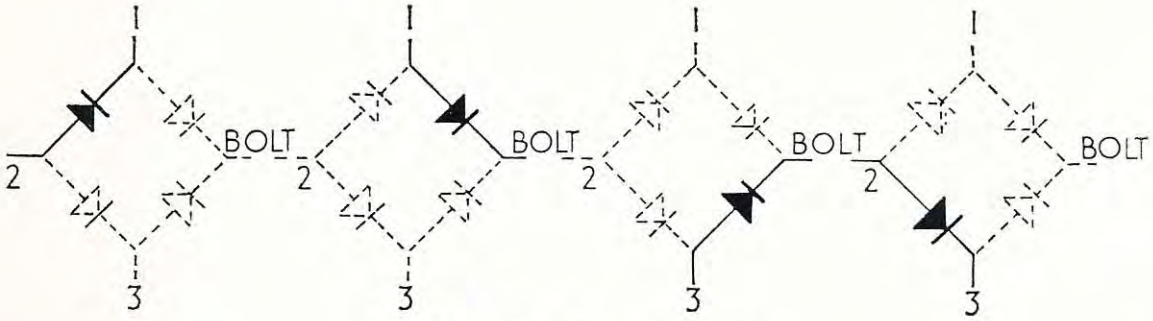


FIG. G8. *Rectifier test sequence.*

remember (+ve) positive earth (ground). The voltmeter should read battery volts. If it does not, there is a faulty connection in the wiring and test 1, 3 and 4 in Part "B", page G10, should be carried out to locate the fault.

PART "D"

Constructing a 1 ohm load resistor

The resistor used in the following tests must be accurate and constructed so that it will not overheat otherwise the correct values of current or voltage will not be obtained.

A suitable resistor can be made from 4 yards ($3\frac{3}{4}$ metres) of 18 S.W.G. (·048", *i.e.*, 1·22 mm diameter) Nichrome wire by bending it into two equal parts and calibrating it as follows:—

(1) Fix a heavy gauge flexible lead to the folded end of the wire and connect this lead to the positive terminal of a 6 volt battery.

(2) Connect a D.C. voltmeter (0—10 volts) across the battery terminals and an ammeter (0—10 amp.) between the battery negative terminal and the free ends of the wire resistance, using a crocodile clip to make the connection.

(3) Move the clip along the wires, making contact with both wires until the ammeter reading is numerically equal to the number of volts shown in the voltmeter. The resistance is then 1 ohm. Cut the wire at this point, twist the two ends together and wind the wire on an asbestos former approximately 2" (5 cm.) diameter so that each turn does not contact the one next to it.

ZENER DIODE CHARGE CONTROL

The Zener diode output regulating system which uses the coils of the alternator connected permanently across the rectifier, provides automatic control of the charging current. It will only operate successfully on a 12 volt system where it is connected in parallel with the battery as shown in the wiring diagram, page G17.

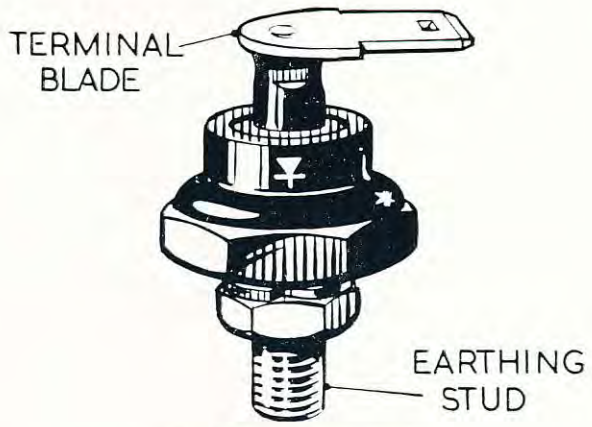


FIG. G9. *Zener diode.*

Assuming the battery is in a low state of charge its terminal voltage (the same voltage is across the diode) will also be low, therefore the maximum charging current will flow into the battery from the alternator. At first none of the current is passed by the diode because of it being non-conducting due to the low battery terminal volts. However, as the battery is quickly restored to a full state of charge, the system voltage rises until at 13·5 volts the Zener diode becomes partially conducting, thereby providing an alternative path for a small part of the charging current.

Small increases in battery voltage result in large increases in Zener conductivity until, at approximately 15·5 volts about 5 amperes of the alternator output is by-passing the battery. The battery will continue to receive only a portion of the alternator output as long as the system voltage is relatively high.

Depression of the system voltage, due to the use of headlamp or other lighting equipment, causes the Zener diode current to decrease and the balance to be diverted and consumed by the component in use.

If the electrical loading is sufficient to cause the system voltage to fall to 13·5 volts, the Zener

diode will revert to a high resistance state of non-conductivity and the full generated output will go to meet the demands of the battery.

Maintenance

The Zener diode is mounted within the electrical box at the front (see Fig. G1, page G2).

Providing the diode is kept clean, to ensure maximum efficiency, no maintenance will be necessary.

The "earthing" stud which secures the diode must not be subjected to a tightening torque greater than 24—28 lb./in. The electrical box lid acts as a heat sink and it is most important that the diode makes good contact with the mounting surface.

Checking performance of the Zener Diode

The battery should be fully charged before starting. If there is any doubt about the state of charge of the battery, it should be recharged before commencing the test.

Isolate the Zener Diode by disconnecting all leads from the 2MC capacitor.

Connect a D.C. voltmeter Black lead to the straight Lucar with the Brown/Blue cable and the voltmeter Red lead to earth. Connect a D.C. ammeter Red lead to the straight Lucar with the Brown/Blue cable, and the Black lead to the right angle Lucar with a Brown/Blue cable. Check that all electrical equipment other than the ignition is switched off. Start the engine and raise r.p.m. to approximately 3,000. Take a careful note of the readings.

As the system voltage rises to 12·75 volts no reading should occur on the ammeter. The voltage will then continue to rise and after 12·75 volts the ammeter should start to read. The next check occurs when the ammeter rises to 2 amps, at this point the voltmeter should read between 13·5 and15·5 volts.

Conclusions: The Zener Diode must be replaced if:—

(1) Current flow commences before 12·75 V. is reached.
(2) Voltmeter registers more than 15·5 V. before 2 amps is shown on the ammeter.

ELECTRIC HORN

The Lucas 6H horn is of a high frequency single-note type and is operated by direct current from the battery via the handlebar push-button. The method of operation is that of a magnetically operated armature, which impacts on the core face, and causes the tone disc of the horn to vibrate. The magnetic is made self-interrupting by contacts which can be adjusted externally.

If the horn fails to work, check the mounting bolts, etc., and horn connection wiring. Check the battery for state of charge. A low supply voltage at the horn will adversely affect horn performance. If the above checks are made and the fault is not remedied, adjust the horn as follows.

Horn adjustment

When adjusting and testing the horn do not depress the horn push for more than a fraction of a second or the circuit wiring may be overloaded.

A small adjustment peg situated near the terminals is provided to take up wear in the internal moving parts of the horn. To adjust, turn this peg anti-clockwise until the horn just fails to sound, and then turn it back (clockwise) about one-quarter to half a turn.

DIRECTION INDICATOR LAMPS

Access to the bulb is obtained by removing the lens, which is retained by two screws.

Before fitting a new bulb, check that the earthing (or ground) clip on the back of the bulb holder is in good contact with the inside of the lamp shell.

Important:—When tightening the pillar locknut against the lamp shell, it is essential that the torque loading is limited to 35—45 lb. ins. (0·41—0·52 kg. m.).

THE MASTER IGNITION SWITCH

The 149 SA switch incorporates a barrel-type lock using individual "Yale"-type keys and renders the ignition circuit inoperative when the switch is turned to the "off" position or parking position, and the key removed. It is advisable for the owner to note the key number so that a correct replacement may be obtained in the event of loss.

Ign. F5950
fork EJR32

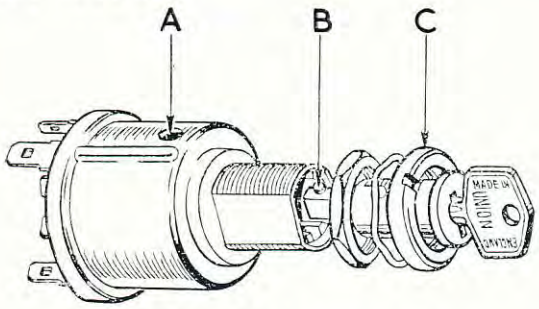


FIG. G10. *The ignition switch.*

The "Lucar" connections from the wiring harness should be checked periodically to ensure good electrical contact. The switch body may be released from its mounting by removing the plated nut "C", Fig. G10.

Before attempting to remove the switch the battery leads should be disconnected to avoid the possibility of a short circuit.

The lock is retained in the body of the switch by a spring-loaded plunger (B, Fig. G10). This may be depressed with a pointed instrument through a small hole in the side of the switch body (A) and the lock assembly withdrawn after the whole unit has been detached from the electric box.

HANDLEBAR SWITCH FUNCTIONS

The left handlebar switch connections

This switch controls (*a*) headlight dipping on the switch lever, (*b*) headlamp flash on the upper push-button and (*c*) horn on the lower push-button.

The lever on this switch has only two positions, upwards and horizontal.

(1) With the switch lever in the horizontal position and push buttons untouched, the only two cables connected are blue and blue/red (dip beam).

(2) Pressing the lower button connects the white lead to the purple/black (horn lead).

(3) Pressing the upper button connects the white lead to the blue/white lead (headlamp flasher).

(4) Raising the lever to its upper position connects the blue lead to the blue/white lead (main beam).

It is inadvisable to dismantle the switch because special equipment is required for reassembly.

The right handlebar switch connections

This switch controls (*a*) direction indicators on the lever and (*b*) ignition cut-out on the lower button.

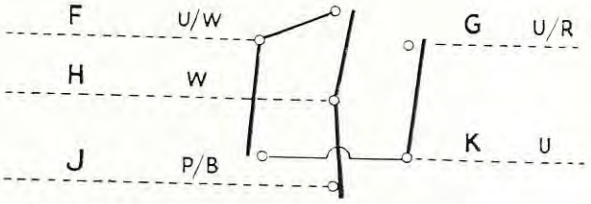


FIG. G11. *Left handlebar switch connections.*

(F) Main beam.
(G) Dipped beam.
(H) Feed.
(J) Horn.
(K) Main bulb feed.
(U) Blue.
(W) White.
(R) Red.
(P) Purple.
(B) Black.

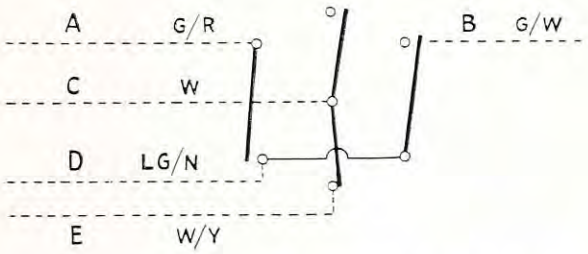


FIG. G12. *Right handlebar switch connections.*

(A) Left side indicator.
(B) Right side indicator.
(C) Ignition.
(D) Flasher unit.
(E) Ignition coils.
(G) Green.
(R) Red.
(W) White.
(LG) Light green.
(N) Brown.
(Y) Yellow.

(1) With the lever in the central position and push buttons untouched the only leads connected are white and white/yellow (ignition).

(2) Pressing the lower push button opens the white/yellow leads (ignition cut-out).

(3) Moving the switch lever to the upper position connects the green/brown lead to the green/red lead (L.H. indicator).
(4) Moving the switch lever to its lowest position connects the green/brown lead to the green/white lead (R.H. indicator).

It is inadvisable to dismantle this switch, because special equipment is required for re-assembly.

HEADLAMP

The headlamp is of the pre-focus bulb light unit type and access is gained to the bulb and bulb holder by withdrawing the rim and light unit assembly. To do this slacken the screw at the top of the headlamp shell just behind and adjacent to the rim and prise off the rim and light unit assembly.

The bulb can be removed by first pressing the cylindrical adaptor inwards and turning it anti-clockwise. The adaptor can then be withdrawn and the bulb is free to be removed.

When fitting a new bulb, note that it locates by means of a cut-away and projection arrangement. Also note that the adaptor can only be replaced one way, the tabs being staggered to prevent incorrect reassembly. Check the replacement bulb voltage and wattage specification and type before fitting.

Focussing with this type of light unit is neither necessary nor provided for.

Beam adjustment

When the motor-cycle carries its normal load, the headlamp full-beam should project straight ahead and parallel with the road surface.

To achieve this, place the machine on a level road pointing towards a wall a distance of 25 feet away. With a rider and passenger on the machine, slacken the flasher stanchion locknuts at either side and tilt the headlamp unit until the beam is correctly aligned. Do not forget that the headlamp must be on main beam during this operation. Tighten the nuts fully after adjustment.

TAIL AND STOP LAMP UNIT

Access to the bulb in the tail and stop lamp unit is achieved by unscrewing the two slotted screws which secure the lens. The bulb is of the double filament offset-pin type. Check that the two supply leads are connected correctly and check the earth (ground) lead to the bulb holder is in satisfactory condition.

When refitting the lens, do not over-tighten the fixing screws to avoid fracturing the lens.

OTHER LIGHT UNITS

The headlamp shell contains three warning lights and the parking light, access being gained to each of them by first removing the rim and light unit assembly.

The speedometer light is housed within the base of the speedometer head.

Each bulb holder is a push-fit into its respective component, and the bulbs are located by means of a bayonet fitting.

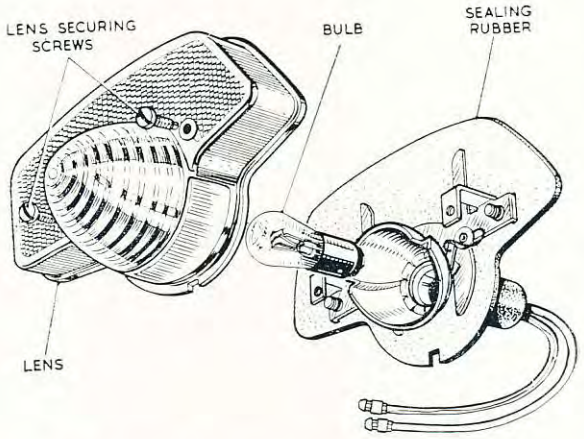
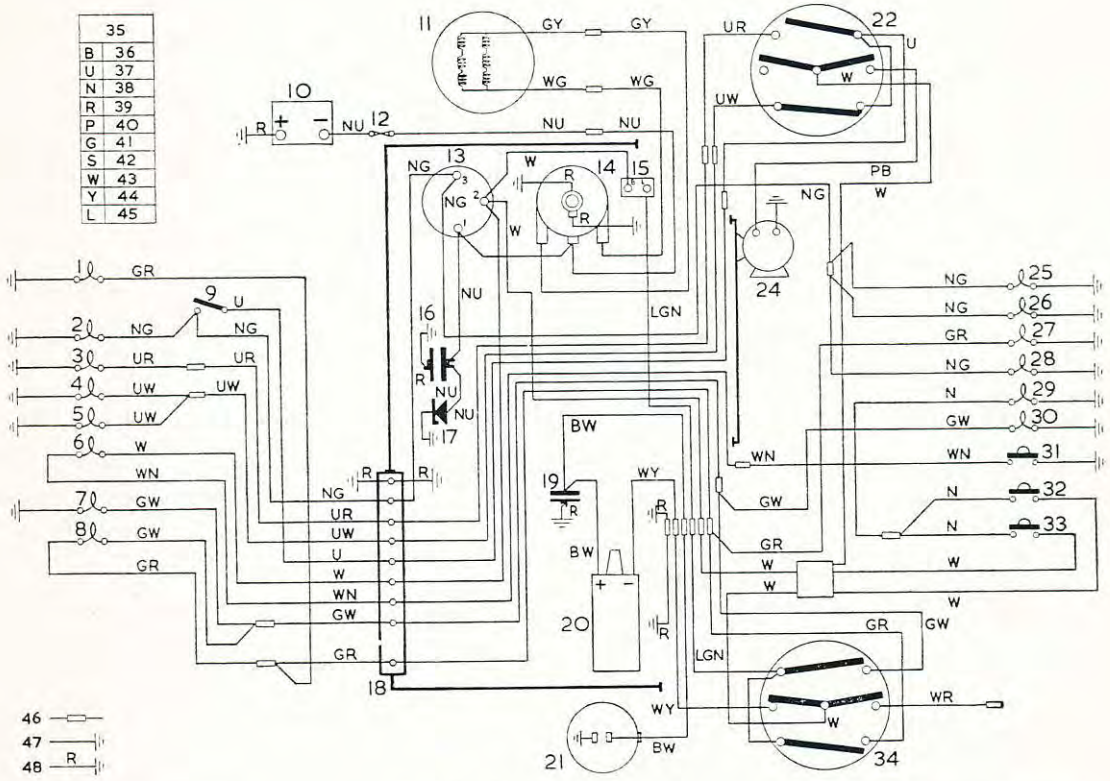


FIG. G13. *Stop and tail lamp dismantled.*



1. Left direction indicator.
2. Parking light.
3. Dipped headlight beam.
4. Main headlight beam.
5. Main beam warning light.
6. Oil pressure warning light (250 cm³ only).
7. Right direction indicator.
8. Direction indicator warning light.
9. Headlight switch
10. Battery.
11. Alternator.
12. Fuse.
13. Ignition/lighting switch.
14. Rectifier.
15. Direction indicator unit.
16. Capacitor (2.M.C.).
17. Zener-diode.
18. Plug and socket (9-pin).
19. Ignition capacitor.
20. Ignition coil.
21. Contact breaker.
22. Left handlebar switches.
23.
24. Horn.
25. Speedometer light.
26. Tachometer light.
27. Left direction indicator.
28. Rear light.
29. Stop light.
30. Right direction indicator.
31. Oil pressure switch (250 cm³ only)
32/33. Front and rear brake light switches.
34. Right handlebar switches.
35. Cable color code.
36. Black.
37. Blue.
38. Brown.
39. Red.
40. Purple
41. Green.
42. Slate.
43. White.
44. Yellow.
45. Light.
46. Snap connectors.
47. Ground (earth) connection via cable.
48. Ground (earth) connection via fixing bolt.

FIG. G14. *Wiring diagram.*

INDEX

PRIMARY CHAIN

Lubrication

The primary drive assembly runs in a totally enclosed oil bath within the engine, and adequate lubrication of the chain is therefore ensured provided that the correct oil level is maintained (see page A9).

An early indication that the primary chain is being starved of oil is the appearance at the joints of a reddish-brown deposit, and this should be taken as a warning that there is something amiss with lubrication. This could be caused by a leaking gasket or the fact that the oil seal behind the clutch is faulty; in both cases replacement parts should be fitted.

Adjustment

Adjustment of the primary chain is fully explained on page B18.

REAR CHAIN

Lubrication

Periodically, the chain should be removed, washed in paraffin, and, after allowing the paraffin to dry off, immersed in grease lubricant which has been heated in a container until liquid. After about ten minutes' immersion, during which the chain must be moved about with a stick to "work" the joints and ensure penetration of the lubricant, the latter is allowed to cool with the chain in it.

After cooling, the chain is removed and surplus grease wiped off. The chain may then be refitted to the machine after cleaning the sprockets. It should be noted that not all greases are suitable for heating to thinness without deterioration.

As there are a number of special chain lubricating preparations on the market we recommend that one of these be used. As an alternative a heavy oil of S.A.E. 140 grade may be used.

Adjustment

Adjustment of the rear chain is fully explained on page F6.

CHAIN MEASUREMENT

It is useful to know the extent of wear of a chain, and a simple test for this consists of measuring the chain with an ordinary foot-rule, steel for preference. Wear up to $\frac{1}{4}$" per foot of chain length is accommodated by the depth of hardening of the bearing surfaces, and when this limit is reached the chain must be replaced.

With a new $\frac{5}{8}$" pitch chain, sixteen pitches will come to the 10" mark on the rule, and a sufficiently accurate check for subsequent wear is to take a limit of 10-7/32" for sixteen pitches. For a $\frac{3}{8}$" pitch chain, twenty-four pitches of a new chain will come to the 9" mark on the rule, and the limit of $9\frac{3}{16}$" for twenty-four pitches should be taken as the maximum permissible wear for this size of chain.

Naturally, the test must be made carefully to obtain an accurate result. The chain must first be washed in paraffin to ensure that all joints are free, and laid unlubricated on a flat board. If it is anchored at one end by a nail, tension to pull it out to its fullest extent can be applied with one hand, while measuring between centres of the bearing pins with the other.

If it is found that the chain is still serviceable but the full amount of adjustment has been taken

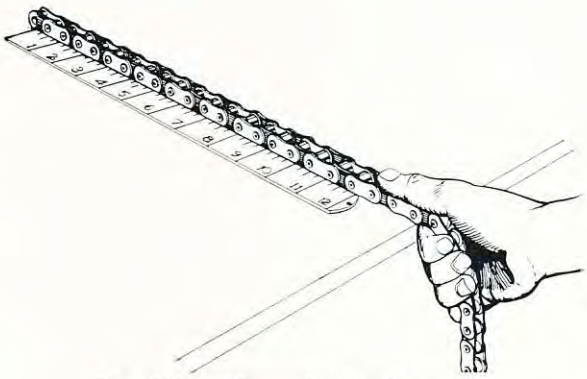


FIG. H1. *Measuring chain wear.*

up, then chain length may be reduced by either one or two pitches as detailed below.

CHAIN ALTERATIONS AND RENEWALS

To **shorten** a chain containing **an even number of pitches:** remove the shaded parts shown in Fig. H2A, replace by cranked double link and single connecting link, parts shaded in Fig. H2B.

To **shorten** a chain containing **an odd number of pitches:** remove the parts shown shaded in Fig. H2C, replace by single connecting link and inner link, parts shaded in Fig. H2D.

To **repair** a chain with a broken roller or inner link, remove the shaded parts shown in Fig. H2E, replace by two single connecting links and one inner link, parts shaded in Fig. H2F.

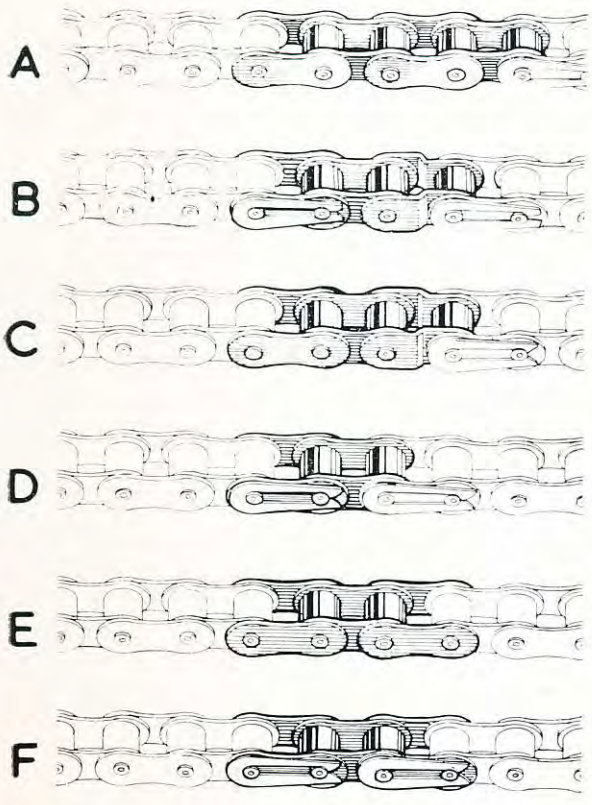


FIG. H2. *Chain alterations.*

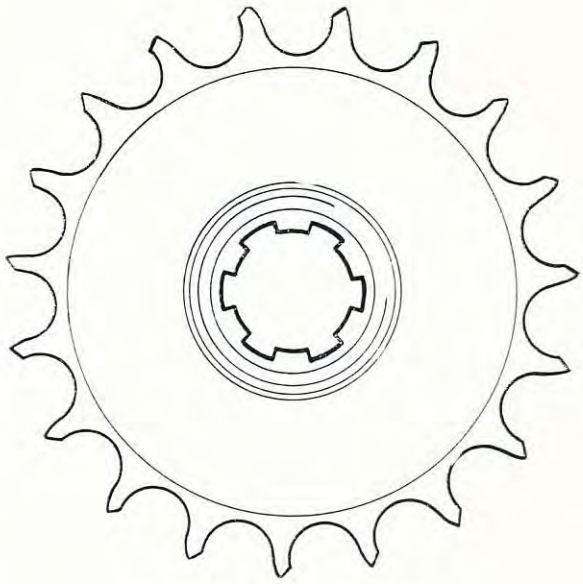


FIG. H3. *Worn sprocket.*

The illustrations show temporary repairs on the roadside: for permanent repairs, the parts should be replaced by a riveted outer link.

CHAIN AND SPROCKET INSPECTION

Sprockets on a new machine will be correctly aligned, but malalignment may arise in use. This may be due perhaps to slackened nuts, incorrect assembly after an emergency repair, or minor accidents. A periodical alignment check is therefore desirable, and is most easily done when the machine is undergoing overhaul, as removal of adjacent components makes the job easier.

A straight-edge across the sides of the teeth on the two sprockets should touch at four points, in any position of rotation of the sprockets. If the latter are in correct alignment, the inner plates of the chain will be slightly polished equally on their inner sides and this is not detrimental.

However, if one side shows considerably more wear than the other it indicates that the shafts are not parallel (as viewed from above) or not in the same plane (as viewed from the back of

the machine). If the inner plates on both sides of the chain show real wear as opposed to polishing, particularly after a comparatively short mileage, it is possible that one sprocket is further out on its shaft than the other.

Sprockets which are excessively worn assume a "hooked" appearance, as shown in Fig. H3.

The standard method of coupling a chain is by a spring connecting link, which is both simple and effective. On normal touring machines it is completely reliable but nevertheless should receive regular inspection, particularly in the case of more powerful models.

It may be advisable on such machines to replace the spring link at say 5,000 mile intervals, the reason being that, of necessity, the detachable plate on this link has to be a free-fit, and under heavy load some wear must occur, thus throwing an undue proportion of load on to the opposite (fixed) plate of the link. It is important to note that the closed end of the spring clip must face the direction of chain travel (see Fig. H4).

For competition machines a riveted linkshould be substituted for the spring link in the rear chain. This procedure involves a little extra trouble, but is a worthwhile insurance against losing the clip at a critical moment.

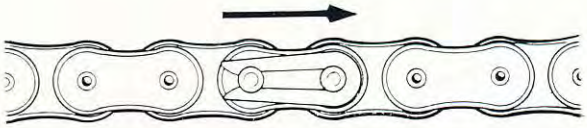


FIG. H4. *Correct fitting of the connecting link.*

Listed below are a number of nuts and bolts for which it has been found necessary to determine torque settings. It is most important that these settings are strictly adhered to. Over-tightening or non-uniform tightening of the cylinder head and barrel nuts for instance, will cause distortion, resulting in loss of compression, increased engine wear and poor fuel economy.

Application	Thread diameter and form	T.P.I.	Hexagon A.F.	Torque lb./ft.	Torque kg./m.
Auto-advance unit bolt ..	1/4" UN.F.	28	0·437"	6	0·8
Carburetter flange nuts ..	5/16" B.S.C.	26	0·525"	10	1·4
Clutch centre nut	1/2" B.S.C.	20	0·820"	55—60	7·6—8·3
Con-rod end cap nuts (B25) ..	5/16" U.N.F.	24	0·500"	22	3·0
Crankcase stud nuts	5/16" UN.F.	24	0·500"	16—18	2·2—2·5
Crankpin nuts (B50)	7/8" W.F.	20	1·480"	200	27·6
Crankshaft pinion nut (B25) ..	5/8" B.S.C.	20	0·920"	50—55	6·9—7·6
Crankshaft pinion nut (B50) ..	5/8" UN.F.	18	0·9375"	55	7·6
Cylinder head nuts (B25) ..	3/8" UN.F.	24	0·562"	26—28	3·6—3·9
Cylinder head nuts (B25) ..	5/16" B.S.C.	26	0·525"	18—20	2·5—2·8
Cylinder head nuts (B50) ..	5/16" UN.F.	24	0·500"	18—20	2·5—2·8
Cylinder head nuts (B50) ..	7/16" UN.F.	20	0·6875"	30—33	4·1—4·6
Flywheel bolts (B25)	3/8" UN.F.	24	0·500"	50	6·9
Kickstart ratchet nut	1/2" B.S.C.	20	0·705"	38—40	5·3—5·5
Oil pump stud nuts	1/4" UN.F.	28	0·437"	5— 7	0·7—1·0
Oil pressure release valve ..	7/8" UN.C.	16	1·00"	25	3·5
Rotor mounting nut (B25) ..	5/8" B.S.C.	20	1·010"	60	8·3
Rotor mounting nut (B50) ..	5/8" UN.F.	18	1·125"	60	8·3
Rocker box nuts	5/16" UN.F.	24	0·500"	8	1·1
Stator mounting nuts	1/4" UN.F.	28	0·4375"	5— 7	0·7—1·0
Gearbox sprocket nut ..	1 3/16" W.F.	20	1·479"	100	13·8
Timing and primary cover screws	1/4" UN.C.	20	—	3·5—4·5	0·5—0·6
Fork leg end cap nuts ..	5/16" UN.F.	24	0·687"	15	2·0
Fork leg top nuts	1 3/16" UN.S.	20	1·500"	50—55	6·9—7·6
Fork yoke pinch bolts	3/8" UN.F.	24	0·562"	23—25	3·2—3·5
Fork stanchion end plug ..	1 3/16" UN.F.	20	1·250"	25	3·5
Flasher stanchion to flasher body nut	7/8" UN.C.	14	—	3	0·4

Abbreviations:

A/F	Across Flats.	T.P.I.	Threads Per Inch.
B.S.C.	British Standard Cycle.	U.N.C.	Unified Coarse.
U.N.F.	Unified Fine.	W.F.	Whitworth Form.
		U.N.S.	Unified Special.

The torque figures listed above cannot always be directly applied, because of the inaccessibility of certain nuts. For example, to facilitate tightening of the cylinder head nuts, it will be necessary to make an extension wrench with adaptors, one of which fits the nuts, the opposite end fitting the torque wrench.

A suggested extension is made from a ring spanner, to the other end of which has been welded a short piece of hexagon bar, of a size suitable for the socket of the torque wrench, see Fig. J.1.

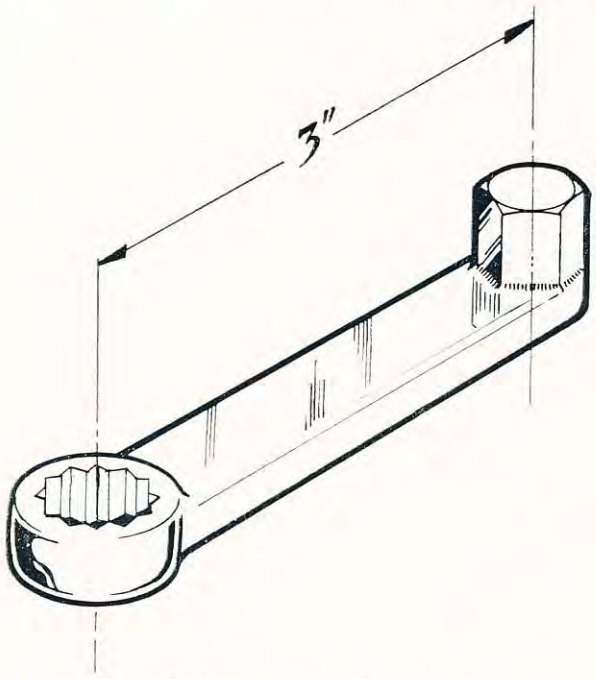


FIG. J1. *Torque wrench extension.*

When an extension of this type is used, the mechanical advantage is increased and it is therefore necessary to calculate a reduced torque loading (because of the increased leverage) to avoid over-tightening the nuts and the corresponding consequences.

A torque wrench graduated in lb/ft. usually gives readings obtained with a leverage of 1 ft., and this will be referred to as the "original length" in calculations for levers of a different length.

HOW TO CALCULATE THE REVISED TORQUE SETTING

$$\frac{\text{Original length } 12'' \text{ (1 ft.)} \times \text{required torque, say 30 lb./ft.}}{\text{Original length } 12'' \text{ (1 ft.)} + \text{additional leverage of say } 3''} = \frac{12 \times 30}{15} = \frac{360}{15} = 24 \text{ lb./ft.}$$

Consequently, when using a 3" extension with a torque wrench graduated in lb/ft. it would be necessary to set the wrench to a reading of 24 lb./ft., in order to obtain a torque of 30 lb./ft. at the nut.

However, it must be realised that only in cases where the extension is used in line with the torque wrench is the full amount of additional leverage applied. If the extension is fitted to the wrench at an angle, the effective length of the extension is reduced and a fresh calculation would be necessary. The effective length of the extension must be measured on a parallel with the torque wrench.

In cases where an extension must be used, but cannot be fitted in line with the torque wrench, fit the extension at right angles to the wrench so that no increased leverage is achieved. This will avoid unnecessary calculation.

Note.—When the torque is quoted as a number of lb./ft., the leverage **must** be measured in feet, otherwise the result of the calculation will be incorrect.

INDEX

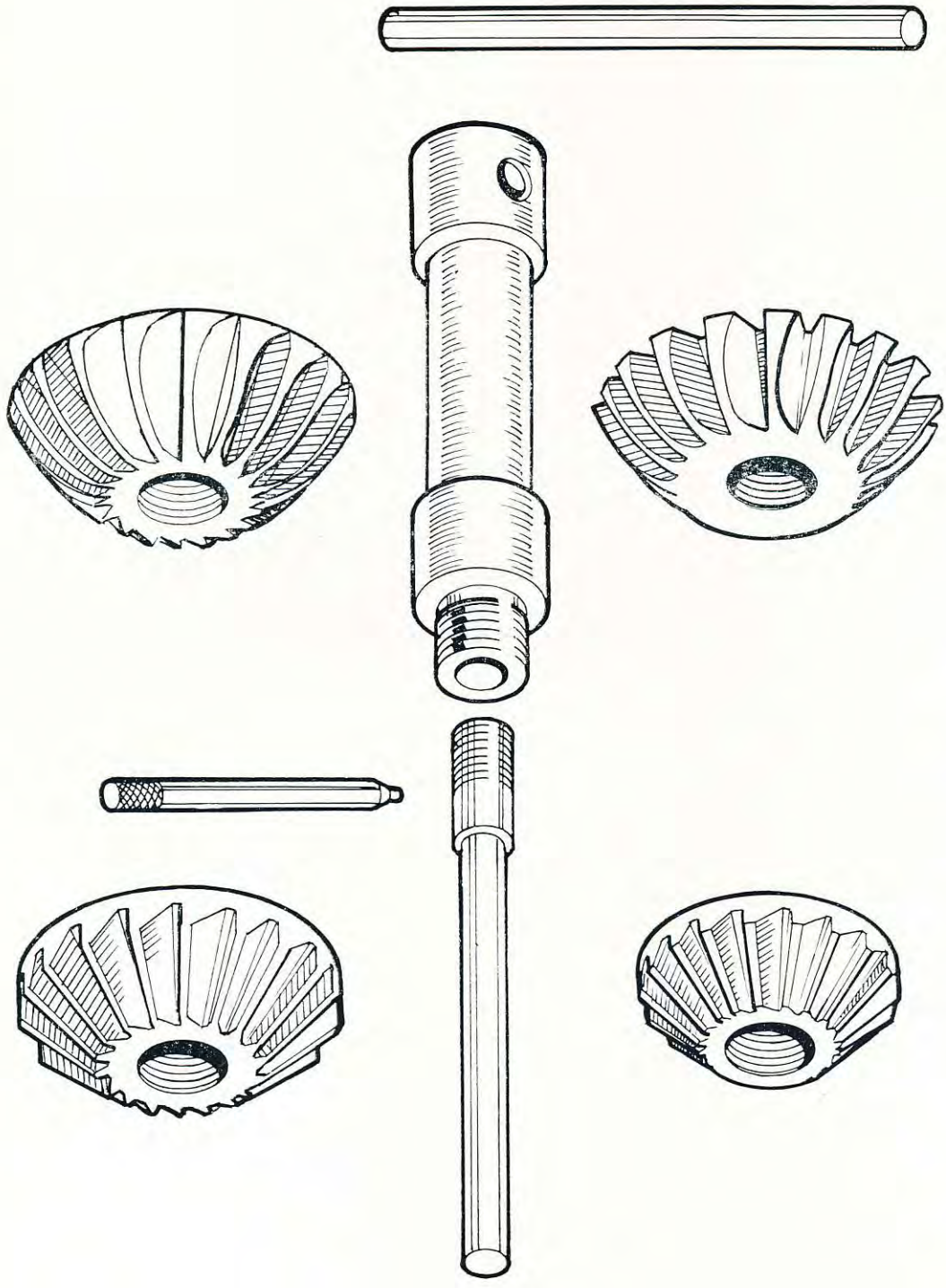


FIG. K1.

60–1863 *Cutter holder and pilot set.*
60–1832 *Valve seat cutter* (small)
60–1833 V*alve seat cutter* (medium)
60–3769 *Valve seat cutter* (large)
60–1835 *Valve seat blender* (small)
60–1836 *Valve seat blender* (large)

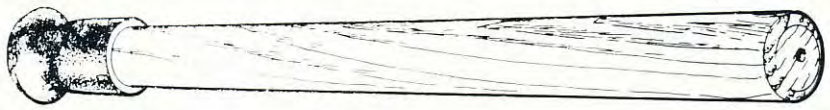


FIG. K2.
61–5035
Valve grinding tool.

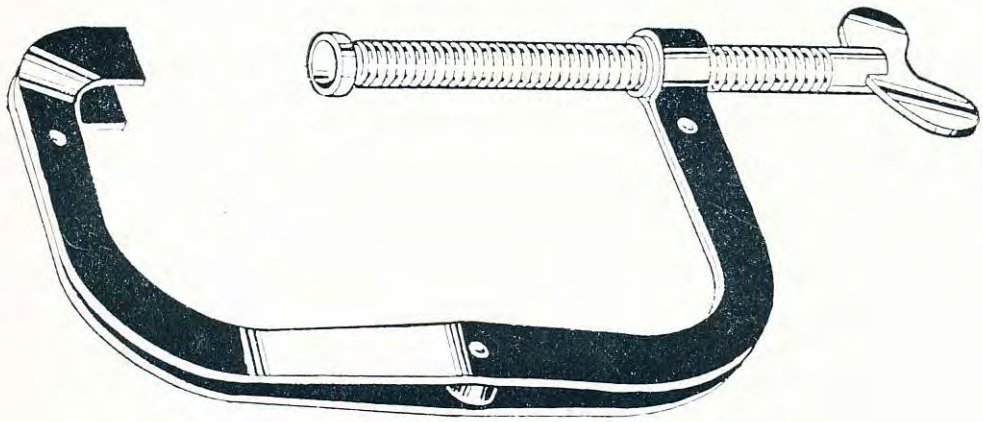


FIG. K3.
61–3341
Valve spring compressor.

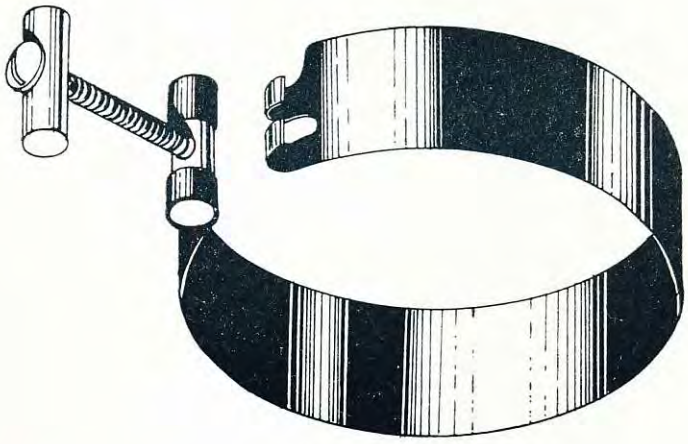


FIG. K4.
Piston ring slipper.
(B25) 61–3682, 65—70 mm.
(B50) 61–6112, 80—85 mm.

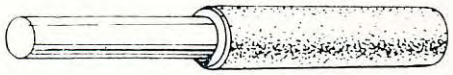


FIG. K5.
61–3382
Valve guide fitting and extracting punch.

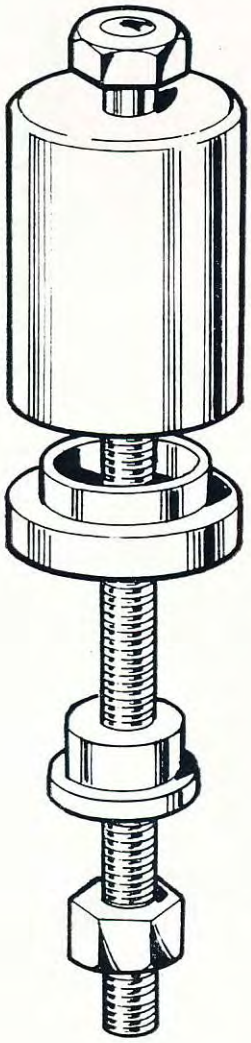


FIG. K6.
Small-end bush extractor.
(B50) 61–3653

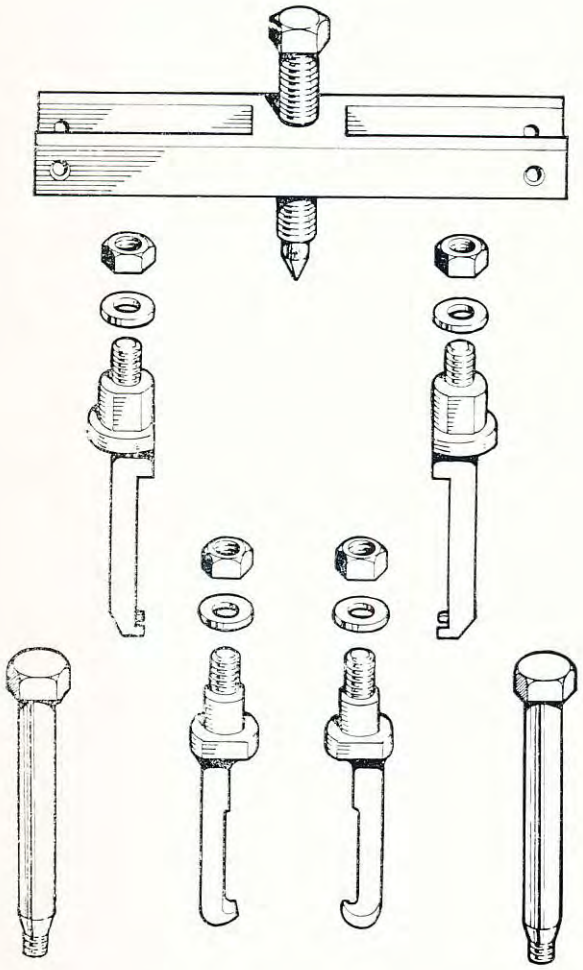


FIG. K7.
Pinion extractor set
61-3773

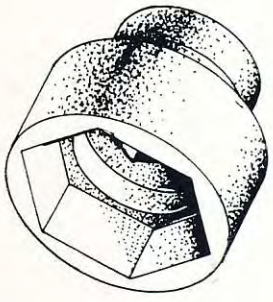


FIG. K8.
(B50) 61–3770
Crankpin nut socket.

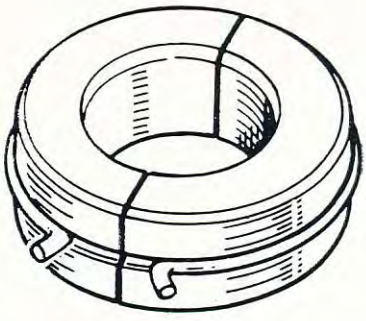


FIG. K9.
(B25) 61–6124
Crankshaft balance weight.

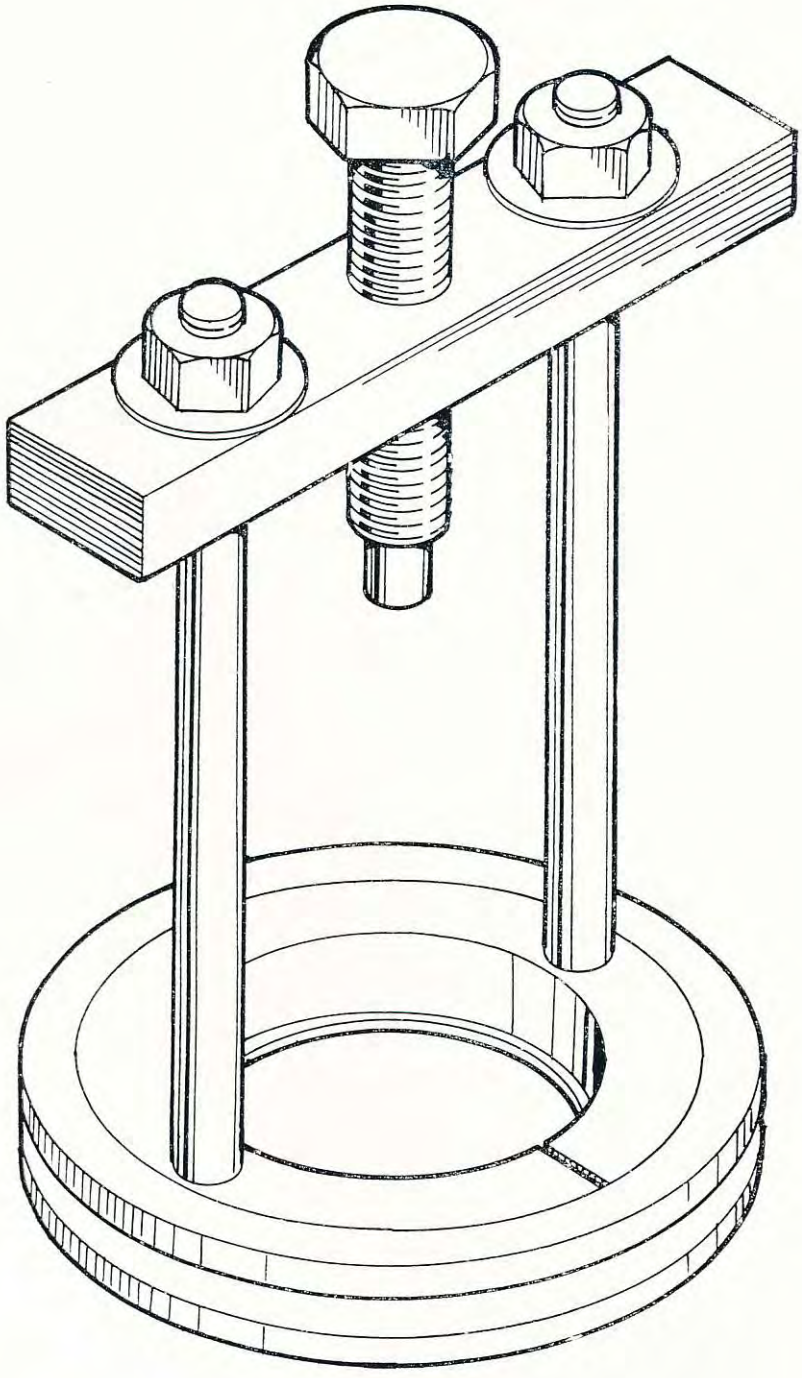


FIG. K10.
61–3778
Main bearing inner race extractor.

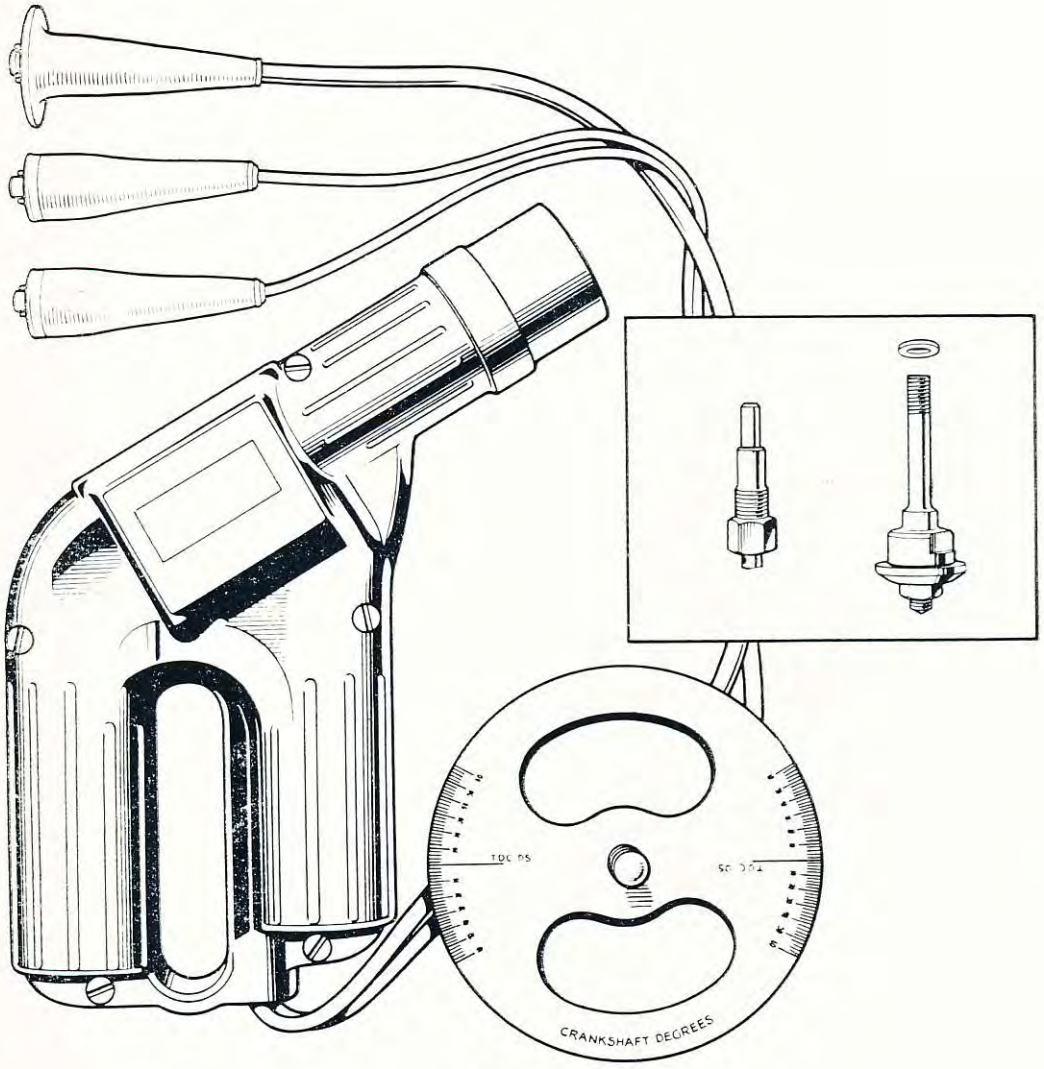


FIG. K11.
00–5177
Stroboscope timing light kit.

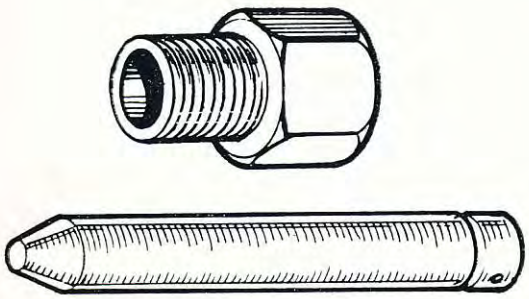


FIG. K12.
60–1859
Ignition timing tool.

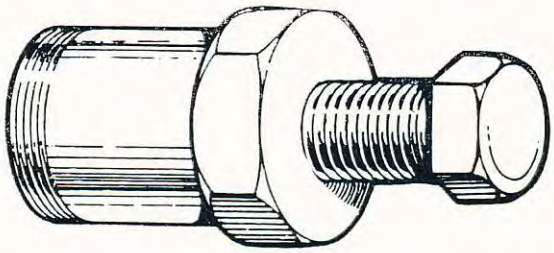
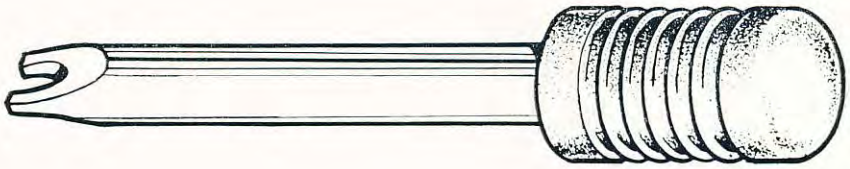


FIG. K13.
61–3583
Clutch sleeve extractor.

FIG. K14.
61–3700
Clutch nut screwdriver.



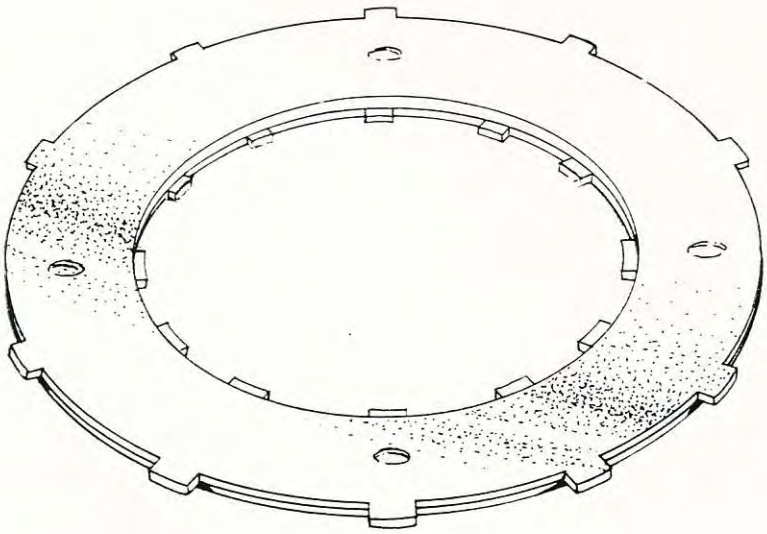


FIG. K15.
61–3774
Clutch locking tool.

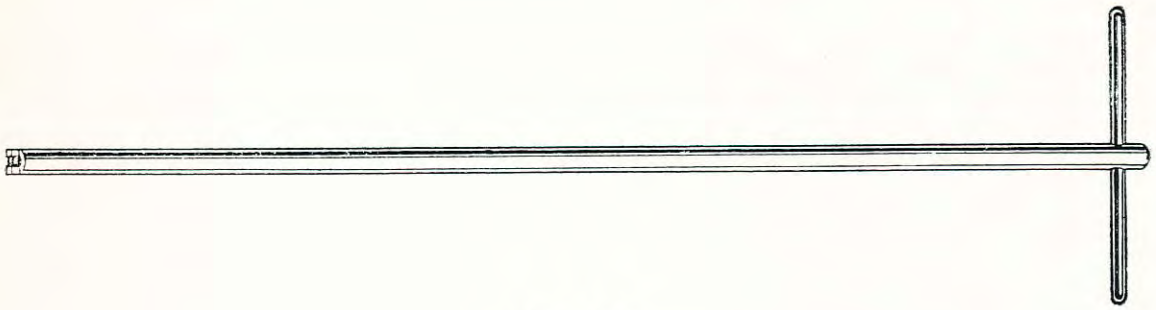


FIG. K16.
61–6113
Fork damper valve tool.

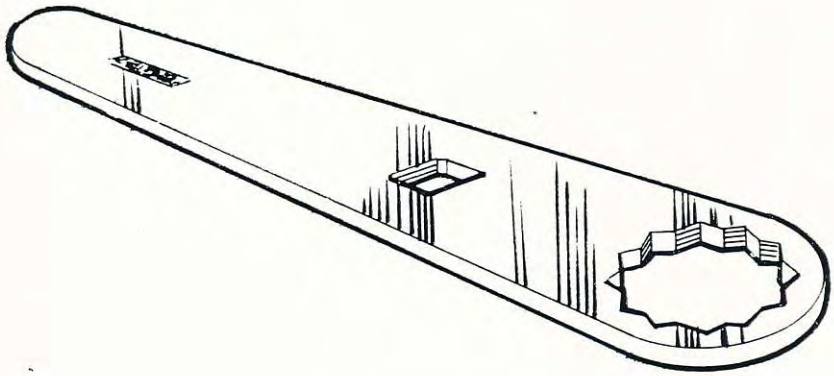


FIG. K17.
60–0779
Fork top nut spanner.

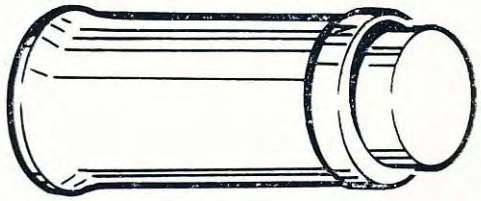


FIG. K18.
61–6121
Steering head bearing drift.

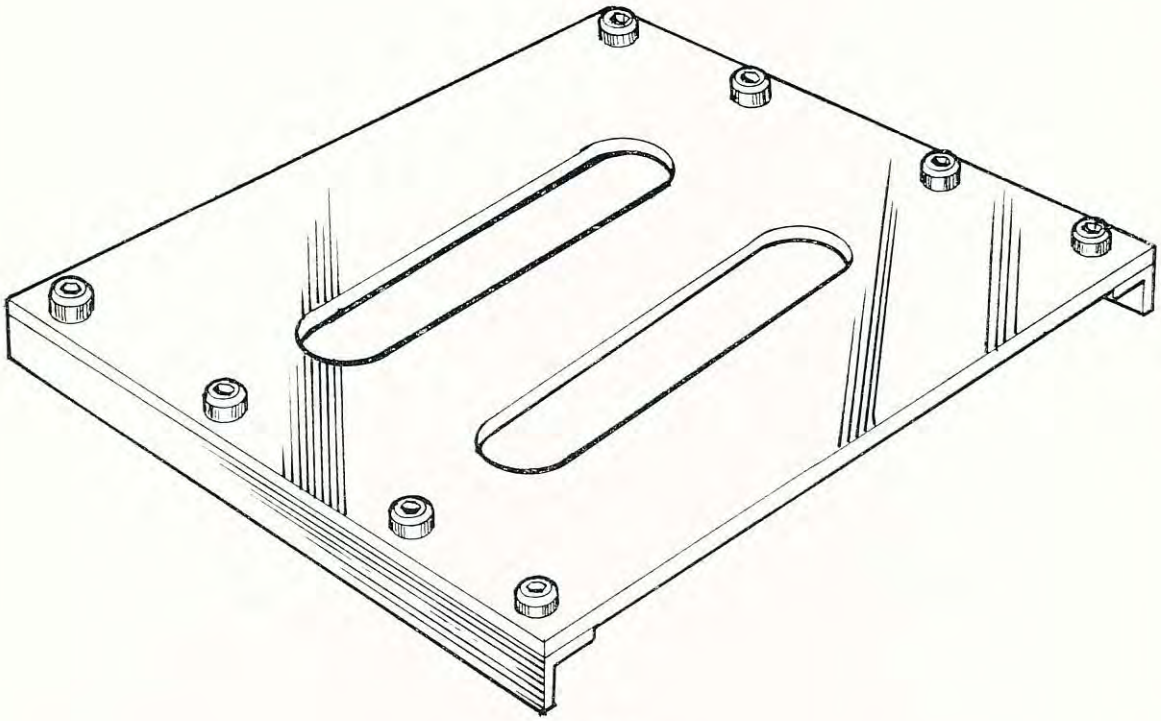


FIG. K19.
61–6025
Fork alignment gauge.

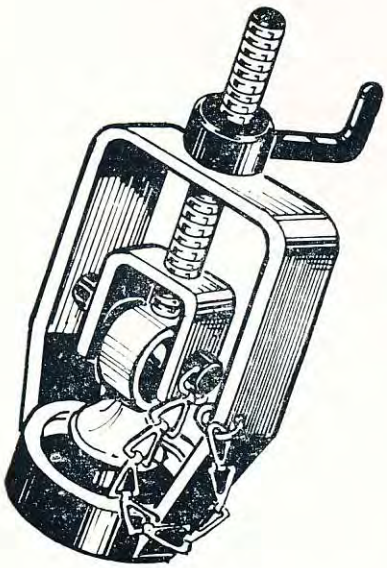


FIG. K20.
61–3503
Rear damper dismantling and assembly tool.

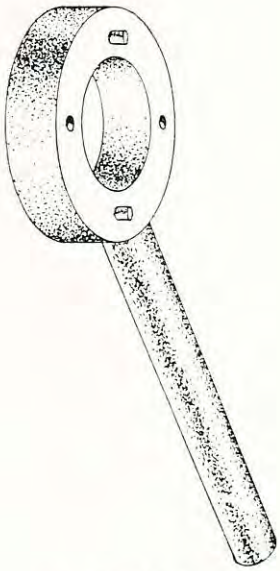


FIG. K21.
61–3694
Wheel bearing retainer peg spanner.

INDEX

INCHES TO MILLIMETRES

Inches	0	10	20	30	40
0		254.0	508.0	762.0	1016.0
1	25.4	279.4	533.4	787.4	1041.4
2	50.8	304.8	558.8	812.8	1066.8
3	76.2	330.2	584.2	838.2	1092.2
4	101.6	355.6	609.6	863.6	1117.6
5	127.0	381.0	635.0	889.0	1143.0
6	152.4	406.4	660.4	914.4	1168.4
7	177.8	431.8	685.8	939.8	1193.8
8	203.2	457.2	711.2	965.2	1219.2
9	228.6	482.6	736.6	990.6	1244.6

ONE INCH — 25.399978 millimetres.

ONE METRE — 39.370113 inches.

ONE MILE — 1.6093 kilos.

ONE KILOMETRE — .62138 miles.

To convert sqr. inches to sqr. cm. multiply the sqr. inch figure by 6·4516

DECIMAL FRACTIONS OF AN INCH TO MILLIMETRES

1/1000	
Inches	Mm.
.001	.0254
.002	.0508
003	.0762
.004	.1016
.005	.1270
.006	.1524
.007	.1778
.008	.2032
.009	.2286

1/100	
Inches	Mm.
.01	.254
.02	.508
.03	.762
.04	1.016
.05	1.270
.06	1.524
.07	1.778
.08	2.032
.09	2.286

1/10	
Inches	Mm.
.1	2.54
.2	5.08
.3	7.62
.4	10.16
.5	12.70
.6	15.24
.7	17.78
.8	20.32
.9	22.86

FRACTIONS OF AN INCH TO DECIMALS AND MILLIMETRES

FRACTIONS			DECIMALS	MM.
		1/64	.015625	.3969
	1/32		.03125	.7937
		3/64	.046875	1.1906
1/16			.0625	1.5875
		5/64	.078125	1.9844
	3/32		.09375	2.3812
		7/64	.109375	2.7781
1/8			.125	3.1750
		9/64	.140625	3.5719
	5/32		.15625	3.9687
		11/64	.171875	4.3656
3/16			.1875	4.7625
		13/64	.203125	5.1594
	7/32		.21875	5.5562
		15/64	.234375	5.9531
1/4			.25	6.3500
		17/64	.265625	6.7469
	9/32		.28125	7.1437
		19/64	.296875	7.5406
5/16			.3125	7.9375
		21/64	.328125	8.3344
	11/32		.34375	8.7312
		23/64	.359375	9.1281
3/8			.375	9.5250
		25/64	.390625	9.9219
	13/32		.40625	10.3187
		27/64	.421875	10.7156
7/16			.4375	11.1125
		29/64	.453125	11.5094
	15/32		.46875	11.9062
		31/64	.484375	12.3031
1/2			.5	12.7000

FRACTIONS			DECIMALS	MM.
		33/64	.515625	13.0969
	17/32		.53125	13.4937
		35/64	.546675	13.8906
9/16			.5625	14.2875
		37/64	.578125	14.6844
	19/32		.59375	15.0812
		39/64	.609375	15.4781
5/8			.625	15.8750
		41/64	.640625	16.2719
	21/32		.65685	16.6687
		43/64	.671875	17.0656
11/16			.6875	17.4625
		45/64	.708125	17.8594
	23/32		.71875	18.2562
		47/64	.734375	18.6531
3/4			.75	19.0500
		49/64	.765625	19.4469
	25/32		.78125	19.8437
		51/64	.796875	20.2406
13/16			.8125	20.6375
		53/64	.828125	21.0344
	27/32		.84375	21.4312
		55/64	.859375	21.8281
7/8			.875	22.2250
		57/64	.890625	22.6219
	29/32		.90625	23.0187
		59/64	.921875	23.4156
15/16			.9375	23.8125
		61/64	.953125	24.2094
	31/32		.96875	24.6062
		63/64	.984375	25.0031
1				25.4000

MILLIMETRES TO INCHES

MM.	0	10	20	30	40
0		.39370	.78740	1.18110	1.57480
1	.03937	.43307	.82677	1.22047	1.61417
2	.07874	.47244	.86614	1.25984	1.65354
3	.11811	.51181	.90551	1.29921	1.69291
4	.15748	.55118	.94488	1.33858	1.73228
5	.19685	.59055	.98425	1.37795	1.77165
6	.23622	.62992	1.02362	1.41732	1.81103
7	.27559	.66929	1.06299	1.45669	1.85040
8	.31496	.70866	1.10236	1.49606	1.88977
9	.35433	.74803	1.14173	1.53543	1.92914

MM.	50	60	70	80	90
0	1.96851	2.36221	2.75591	3.14961	3.54331
1	2.00788	2.40158	2.79528	3.18891	3.58268
2	2.04725	2.44095	2.83465	3.22835	3.62205
3	2.08662	2.48032	2.87402	3.26772	3.66142
4	2.12599	2.51969	2.91339	3.30709	3.70079
5	2.16536	2.55906	2.95276	3.34646	3.74016
6	2.20437	2.59843	2.99213	3.38583	3.77953
7	2.24410	2.63780	3.03150	3.42520	3.81890
8	2.28347	2.67717	3.07087	3.46457	3.85827
9	2.32284	2.71654	3.11024	3.50394	3.89764

DECIMAL FRACTIONS OF A MILLIMETRE TO INCHES

1/1000	
MM.	INCHES
0.001	.000039
0.002	.000079
0.003	.000118
0.004	.000157
0.005	.000197
0.006	.000236
0.007	.000276
0.008	.000315
0.009	.000354

1/100	
MM.	INCHES
0.01	.00039
0.02	.00079
0.03	.00118
0.04	.00157
0.05	.00197
0.06	.00236
0.07	.00276
0.08	.00315
0.09	.00354

1/10	
MM.	INCHES
0.1	.00394
0.2	.00787
0.3	.01181
0.4	.01575
0.5	.01969
0.6	.02362
0.7	.02756
0.8	.03150
0.9	.03543

DRILL SIZES

LETTER DRILLS

LETTER	SIZE	LETTER	SIZE
A	.234	N	.302
B	.238	O	.316
C	.242	P	.323
D	.246	Q	.332
E	.250	R	.339
F	.257	S	.348
G	.261	T	.358
H	.266	U	.368
I	.272	V	.377
J	.277	W	.386
K	.281	X	.397
L	.290	Y	.404
M	.295	Z	.413

NUMBER DRILLS

NUMBER	SIZE	NUMBER	SIZE	NUMBER	SIZE	NUMBER	SIZE
1	.2280	14	.1820	27	.1440	40	.0980
2	.2210	15	.1800	28	.1405	41	.0960
3	.2130	16	.1770	29	.1360	42	.0935
4	.2090	17	.1730	30	.1285	43	.0890
5	.2055	18	.1695	31	.1200	44	.0860
6	.2040	19	.1660	32	.1160	45	.0820
7	.2010	20	.1610	33	.1130	46	.0810
8	.1990	21	.1590	34	.1110	47	.0785
9	.1960	22	.1570	35	.1100	48	.0760
10	.1935	23	.1540	36	.1065	49	.0730
11	.1910	24	.1520	37	.1040	50	.0700
12	.1890	25	.1495	38	.1015	51	.0670
13	.1850	26	.1470	39	.0995	52	.0635

WIRE GAUGES

No. of Gauge	Imperial Standard Wire Gauge		Brown & Sharpe's American Wire Gauge	
	INCHES	MILLIMETRES	INCHES	MILLIMETRES
0000	.400	10.160	.460	11.684
000	.372	9.448	.410	10.404
00	.348	8.839	.365	9.265
0	.324	8.299	.325	8.251
1	.300	7.620	.289	7.348
2	.276	7.010	.258	6.543
3	.252	6.400	.229	5.827
4	.232	5.892	.204	5.189
5	.212	5.384	.182	4.621
6	.192	4.676	.162	4.115
7	.176	4.470	.144	3.664
8	.160	4.064	.128	3.263
9	.144	3.657	.114	2.906
10	.128	3.251	.102	2.588
11	.116	2.946	.091	2.304
12	.104	2.641	.081	2.052
13	.092	2.336	.072	1.827
14	.080	2.032	.064	1.627
15	.072	1.828	.057	1.449
16	.064	1.625	.051	1.290
17	.056	1.422	.045	1.149
18	.048	1.219	.040	1.009
19	.040	1.016	.035	.911
20	.036	.914	.032	.811
21	.032	.812	.028	.722
22	.028	.711	.025	.643
23	.024	.609	.023	.573
24	.022	.558	.020	.511
25	.020	.508	.018	.454
26	.018	.457	.016	.404
27	.0164	.416	.014	.360
28	.0148	.375	.012	.321
29	.0136	.345	.011	.285
30	.0124	.314	.010	.254

B.S.F. SCREW THREADS

DIA. OF BOLT (INCH)	THREADS PER INCH	DIA. TAP DRILL (INCH)	CORE DIA. SQ. IN.	AREA AT THD. ROOT	PITCH DIAMETER NUT MAX.	PITCH DIAMETER NUT MIN.	PITCH DIAMETER BOLT MAX.	PITCH DIAMETER BOLT MIN.	HEX. FLATS (MEAN)	HEX. CORNERS	NUT THICKNESS (MEAN)
7/32	28	.1770	.1731	.0235	.2018	.1980	.1960	.1922	.412	.48	.166
1/4	26	.2055	.2007	.0316	.2313	.2274	.2254	.2215	.442	.51	.195
9/32	26	.238	.2320	.0423	.2625	.0586	.2565	.2527			
5/16	22	.261	.2543	.0508	.2897	.2854	.2834	.2791	.522	.61	.245
3/8	20	.316	.3110	.0760	.3495	.3450	.3430	.3385	.597	.69	.307
7/16	18	3/8	.3664	.1054	.4086	.4039	.4019	.3372	.707	.82	.370
1/2	16	27/64	.4200	.1385	.4670	.4620	.4600	.4550	.817	.95	.432
9/16	16	.492	.4825	.1828	.5295	.5245	.5225	.5175	.917	1.06	.495
5/8	14	35/64	.5335	.2235	.5866	.5813	.5793	.5740	1.006	1.17	.557
11/16	14	39/64	.5960	.2790	.6491	.6438	.6418	.6365	1.096	1.27	.620
3/4	12	21/32	.6433	.3250	.7044	.6986	.6966	.6908	1.196	1.39	.682
13/16	12	32/32	.7058	.3913	.7669	.7611	.7591	.7533			
7/8	11	25/32	.7586	.4520	.8248	.8188	.8168	.8108	1.296	1.50	.745
1	10	57/64	.8719	.5971	.9443	.9380	.9360	.9297	1.474	1.71	.870
1-1/8	9	1	.9827	.7585	1.0626	1.0559	1.0539	1.0472	1.664	1.98	.995
1-1/4	9	1-1/8	1.1077	.9637	1.1876	1.1809	1.1789	1.1722	1.852	2.15	1.115
1-3/8	8	1-15/64	1.2149	.1593	1.3041	1.2970	1.2950	1.2879	2.042	2.37	1.240
1-1/2	8	1.358	1.3399	.4100	1.4291	1.4220	1.4200	1.4129	2.210	2.56	1.365
1-5/8	8	1-31/64	1.4649	1.6854	1.5541	1.5470	1.5450	1.5379	2.400	2.78	1.400

B.S.W. SCREW THREADS

DIA. OF BOLT (INCH)	THREADS PER INCH	DIA. TAP DRILL (INCH)	CORE DIA.	AREA AT THD. ROOT SQ. IN.	PITCH DIAMETER NUT MAX.	PITCH DIAMETER NUT MIN.	PITCH DIAMETER BOLT MAX.	PITCH DIAMETER BOLT MIN.	HEX. FLATS (MEAN)	HEX. CORNERS	NUT THICKNESS (.005)
1/4	20	.1968	.1860	.0272	.2245	.2200	.2180	.2135	.522	.61	.245
5/16	18	1/4	.2412	.0458	.2836	.2789	.2769	.2722	.597	.69	.307
3/8	16	5/16	.2950	.0683	.3420	.3370	.3350	.3300	.707	.82	.370
7/16	14	23/64	.3460	.0940	.3991	.3938	.3918	.3865	.817	.95	.432
1/2	12	13/32	.3933	.1215	.4544	.4486	.4466	.4408	.917	1.06	.495
9/16	12	15/32	.4558	.1632	.5169	.5111	.5091	.5033	1.006	1.17	.557
5/8	11	17/32	.5086	.2032	.5748	.5688	.5668	.5608	1.096	1.27	.620
11/16	11	37/64	.5711	.2562		.6313	.6293		1.196	1.39	.682
3/4	10	41/64	.6219	.3038	.6943	.6880	.6860	.6797	1.296	1.50	.745
13/16	10	45/64	.6844	.3679		.7506	.7485				
7/8	9	3/4	.7327	.4216	.8126	.8059	.8039	.7972	1.474	1.71	.870
15/16	9	3/16	.7952	.4966		.8684	.8664				
1	8	55/64	.8399	.5540	.9291	.9220	.9200	.9129	1.664	1.93	.995

B.S.C. (FORMERLY C.E.I.) SCREW THREADS

Diameter Bolt (inch)	Thds. Per Inch		Pitch (inch)	Depth of Thread (inch)	Basic Diameters (inch)		
	Normal Series	20 T.p.i. Series			Major	Effective	Minor
1/8	40		0·02500	0·0133	0·1250	0·1117	0·0984
5/32	32		0·03125	0·0166	0·1563	0·1397	0·1231
3/16	32		0·03125	0·0166	0·1875	0·1709	0·1543
7/32	26		0·03846	0·0205	0·2188	0·1983	0·1778
1/4	26		0·03846	0·0205	0·2500	0·2295	0·2090
9/32	26		0·03846	0·0205	0·2813	0·2608	0·2403
5/16	26		0·03846	0·0205	0·3125	0·2920	0·2715
3/8	26		0·03846	0·0205	0·3750	0·3545	0·3340
7 16	26		0·03846	0·0205	0·4375	0·4170	0·3965
		20	0·05000	0·0266	0·4375	0·4109	0·3843
1/2	26		0·03846	0·0205	0·5000	0·4795	0·4590
		20	0·05000	0·0266	0·5000	0·4734	0·4468
9/16	26		0·03846	0·0205	0·5625	0·5420	0·5215
		20	0·05000	0·0266	0·5625	0·5359	0·5093
5/8	26		0·03846	0·0205	0·6250	0·6045	0·5840
		20	0·05000	0·0266	0·6250	0·5984	0·5718
11/16	26		0·03846	0·0205	0·6875	0·6670	0·6465
		20	0·05000	0·0266	0·6875	0·6609	0·6343
3/4	26		0·03846	0·0205	0·7500	0·7295	0·7090
		20	0·05000	0·0266	0·7500	0·7234	0·6968

UNIFIED SCREW THREADS

FINE (UN.F.)

Diameter (inch)	Threads Per Inch	Depth of Thread (inch)	Basic Dimensions (inch)		
			Major Dia.	Effective Dia.	Minor Dia.
1/4	28	0·0217	0·2457	0·2241	0·2022
5/16	24	0·0254	0·3078	0·2824	0·2569
3/8	24	0·0254	0·3703	0·3449	0·3194
7/16	20	0·0305	0·4321	0·4016	0·3710
1/2	20	0·0305	0·4946	0·4641	0·4334
9/16	18	0·0341	0·5568	0·5227	0·4886
5/8	18	0·0341	0·6193	0·5852	0·5511
1	28	0·0219	0·9955	0·9736	0·9517
1 1/4	28	0·0251	1·250	1·2202	1·2144

COARSE (UN.C.)

1/4	20	0·0304	0·2448	0·2145	0·1839
5/16	18	0·0338	0·3070	0·2722	0·2391
3/8	16	0·0382	0·3690	0·3309	0·2925
1/2	13	0·0471	0·4930	0·4460	0·3988
9/16	12	0·0535	0·5625	0·5064	0·4554
7/8	16	0·0426	0·8735	0·8328	0·7921
1	16	0·0407	0·9985	0·9554	0·9170

B.A. SCREW THREADS

NO.	DIA. OF BOLT	THDS. PER INCH	DIA. TAP DRILL	CORE DIA.	AREA AT THD. ROOT SQ. IN.	PITCH DIAMETER NUT MAX.	PITCH DIAMETER NUT MIN.	PITCH DIAMETER BOLT MAX.	PITCH DIAMETER BOLT MIN.	HEX. FLATS	HEX. CORNERS	NUT THICKNESS
0	.2362	25.4	.1960	.1890	.0281	.2165	.2126	.2126	.2087	.413	.47	.236
1	.2087	28.2	.1770	.1661	.0217	.1908	.1875	.1878	.1838	.365	.43	.209
2	.1850	31.4	.1520	.1468	.0169	.1693	.1659	.1659	.1626	.324	.37	.185
3	.1614	34.8	.1360	.1269	.0126	.1472	.1441	.1441	.1409	.282	.33	.161
4	.1417	38.5	.1160	.1106	.0096	.1290	.1261	.1261	.1231	.248	.29	.142
5	.1260	43.0	.1040	.0981	.0075	.1147	.1119	.1119	.1091	.220	.25	.126
6	.1102	47.9	.0935	.0852	.0057	.1000	.0976	.0976	.0953	.193	.22	.110
7	.0984	52.9	.0810	.0738	.0045	.0893	.0869	.0869	.0845	.172	.20	.098
8	.0866	.59.1	.0730	.0663	.0034	.0785	.0764	.0764	.0742	.152	.18	.087
9	.0748	65.1	.0635	.0564	.0025	.0675	.0656	.0656	.0636	.131	.15	.075
10	.0669	72.6	.0550	.0504	.0021		.0587	.0587		.117	.14	.067
11	.0591	81.9	.0465	.0445	.0016					.103	.12	.059
12	.0511	90.9	.0400	.0378	.0011					.090	.10	.051
13	.0472	102.0	.0360	.0352	.0010					.083	.09	.047
14	.0394	109.9	.0292	.0280	.0006					.069	.08	.039
15	.0354	120.5	.0260	.0250	.0005					.061	.07	.035
16	.0311	133.3	.0225	.0220	.0004							

MILES PER GALLON (IMPERIAL) TO LITRES PER 100 KILOMETRES

10	28.25	15	18.83	20	14.12	25	11.30	30	9.42	25	8.07	40	7.06	50	5.65	60	4.71	70	4.04
10½	26.90	15½	18.22	20½	13.78	25½	11.08	30½	9.26	35½	6.89	41	6.89	51	5.54	61	4.63	71	3.98
11	25.68	16	17.66	21	13.45	26	10.87	31	9.11	36	7.85	42	6.73	52	5.43	62	4.55	72	3.92
11½	24 56	16½	17.12	21½	13 14	26½	10 66	31½	8 97	36½	7.74	43	6.57	53	5.33	63	4.48	73	3.87
12	23.54	17	16.61	22	12.84	27	10.46	32	8.83	37	7.63	44	6.42	54	5.23	64	4.41	74	3.82
12½	22.60	17½	16.14	22½	12.55	27½	10.27	32½	8.69	37½	7.53	45	6.28	55	5.13	65	4.35	75	3.77
13	21.73	18	15.69	23	12.28	28	10.09	33	8.56	38	7.43	46	6.14	56	5.04	66	4.28	76	3.72
13½	20.92	18½	15.27	23½	12.02	28½	9.91	33½	8.43	38½	7.34	47	6.01	57	4.96	67	4.22	77	3.67
14	20.18	19	14.87	24	11.77	29	9.74	34	8.31	39	7.24	48	5.89	58	4.87	68	4.16	78	3.62
14½	19.48	19½	14.49	24½	11.53	29½	9.58	34½	8.19	39½	7.15	49	5.77	59	4.79	69	4.10	79	3.57

GALLONS (IMPERIAL) TO LITRES

	0	1	2	3	4	5	6	7	8	9	
—		4.546	9.092	13.638	18.184	22.730	27.276	31.822	36.368	40.914	—
10	45.460	50.005	54.551	59.097	63.643	68.189	72.735	77.281	81.827	86.373	10
20	90.919	95.465	100.011	104.557	109.102	113.649	118.195	122.741	127.287	131.833	20
30	136.379	140.924	145.470	150.016	154.562	159.108	163.645	168.200	172.746	177.292	30
40	181.838	186.384	190.930	195.476	200.022	204.568	209.114	213.660	218.206	222.752	40
50	227.298	231.843	236.389	240.935	245.481	250.027	254.573	259.119	263.605	268.211	50
60	272.757	277.303	281.849	286.395	290.941	295.487	300.033	304.579	309.125	313.671	60
70	318.217	322.762	327.308	331.854	336.400	340.946	345.492	350.038	354.584	359.130	70
80	363.676	368.222	372.768	377.314	381.860	386.406	390.952	395.498	400.044	404.590	80
90	409.136	413.681	418.227	422.773	427.319	431.865	436.411	440.957	445.503	450.049	90

PINTS TO LITRES

	0	1	2	3	4	5	6	7	8
—	—	.568	1.136	1.705	2.273	2.841	3.410	3.978	4.546
¼	.142	.710	1.279	1.846	2.415	2.983	3.552	4.120	4.688
½	.284	.852	1.420	1.989	2.557	3.125	3.694	4.262	4.830
¾	.426	.994	1.563	2.131	2.699	3.267	3.836	4.404	4.972

POUNDS PER SQUARE INCH TO KILOGRAMS PER SQUARE CENTIMETRE

	0	1	2	3	4	5	6	7	8	9	
—		0.070	0.141	0.211	0.281	0.352	0.422	0.492	0.562	0.633	—
10	0.703	0.773	0.844	0.914	0.984	1.055	1.125	1.195	1.266	1.336	10
20	1.406	1.476	1.547	1.617	1.687	1.758	1.828	1.898	1.969	2 039	20
30	2 109	2.179	2.250	2.320	2.390	2.461	2.531	2.601	2.672	2.742	30
40	2.812	2.883	2.953	3.023	3.093	3.164	3.234	3.304	3.375	3.445	40
50	3.515	3.586	3.656	3.726	3.797	3.867	3.937	4.007	4.078	4.148	50
60	4.128	4.289	4.359	4.429	4.500	4.570	4.640	4.711	4.781	4.851	60
70	4.921	4.992	5.062	5.132	5.203	5.273	5.343	5.414	5.484	5.554	70
80	5.624	5.695	5.765	5.835	5.906	5.976	6.046	6.117	6.187	6.257	80
90	6.328	6.398	6.468	6.538	6.609	6.679	6.749	6.820	6.890	6.960	90

FOOT POUNDS TO KILOGRAMMETRES

	0	1	2	3	4	5	6	7	8	9	
—		0.138	0.277	0.415	0.553	0.691	0.830	0.968	1.106	1.244	—
10	1.383	1.521	1.659	1.797	1.936	2.074	2.212	2.350	2.489	2.627	10
20	2.765	2.093	3.042	3.180	3.318	3.456	3.595	3.733	3.871	4.009	20
30	4.148	4.286	4.424	4.562	4.701	4.839	4.977	5.116	5.254	5.392	30
40	5.530	5.668	5.807	5.945	6.083	6.221	6.360	6.498	6.636	6.774	40
50	6.913	7.051	7.189	7.328	7.466	7.604	7.742	7.881	8.019	8.157	50
60	8.295	8.434	8.572	8.710	8.848	8.987	9.125	9.263	9.401	9.540	60
70	9.678	9.816	9.954	10.093	10.231	10.369	10.507	10.646	10.784	10.922	70
80	11.060	11.199	11.337	11.475	11.613	11.752	11.890	12.028	12.166	12.305	80
90	12.443	12.581	12.719	12.858	12.996	13.134	13.272	13.411	13.549	13.687	90

MILES TO KILOMETRES

	0	1	2	3	4	5	6	7	8	9	
—		1.609	3.219	4.828	6.437	8.047	9.656	11.265	12.875	14.484	—
10	16.093	17.703	19.312	20.922	22.531	24.140	25.750	27.359	28.968	30.578	10
20	32.187	33.796	35.406	37.015	38.624	40.234	41.843	43.452	45.062	46.671	20
30	48.280	49.890	51.499	53.108	54.718	56.327	57.936	59.546	61.155	62.765	30
40	64.374	65.983	67.593	69.202	70.811	72.421	74.030	75.639	77.249	78.858	40
50	80.467	82.077	83.686	85.295	86.905	88.514	90.123	91.733	93.342	94.951	50
60	96.561	98.170	99.780	101.389	102.998	104.608	106.217	107.826	109.436	111.045	60
70	112.654	114.264	115.873	117.482	119.092	120.701	122.310	123.920	125.529	127.138	70
80	128.748	130.357	131.967	133.576	135.185	136.795	138.404	140.013	141.623	133.232	80
90	144.841	146.451	148.060	149.669	151.279	152.888	154.497	156.107	157.716	159.325	90

POUNDS TO KILOGRAMS

	0	1	2	3	4	5	6	7	8	9	
—		0.454	0.907	1.361	1.814	2.268	2.722	3.175	3.629	4.082	—
10	4.536	4.990	5.443	5.897	6.350	6.804	7.257	7.711	8.165	8.618	10
20	9.072	9.525	9.079	10.433	10.886	11.340	11.793	12.247	12.701	13.154	20
30	13.608	14.061	14.515	14.968	15.422	15.876	16.329	16.783	17.237	17.690	30
40	18.144	18.597	19.051	19.504	19.958	20.412	20.865	21.319	21.772	22.226	40
50	22.680	23.133	23.587	24.040	24.494	24.948	25.401	25.855	26.308	26.762	50
60	27.216	27.669	28.123	28.576	29.030	29.484	29.937	30.391	30.844	31.298	60
70	31.751	32.205	32.659	33.112	33.566	34.019	34.473	34.927	35.380	35.834	70
80	36.287	36.741	37.195	37.648	38.102	38.855	39.009	39.463	39.916	40.370	80
90	40.823	41.277	41.731	42.184	42.638	43.091	43.545	43.998	44.452	44.906	90

PUBLISHED BY SERVICE DEPARTMENT, B.S.A. MOTOR CYCLES LTD, ARMOURY ROAD, BIRMINGHAM 11, ENGLAND.
Printed in England at the B.S.A. Press.