WORKSHOP MANUAL

for D14/4 models

BANTAM SUPREME

BANTAM SPORTS

BUSHMAN

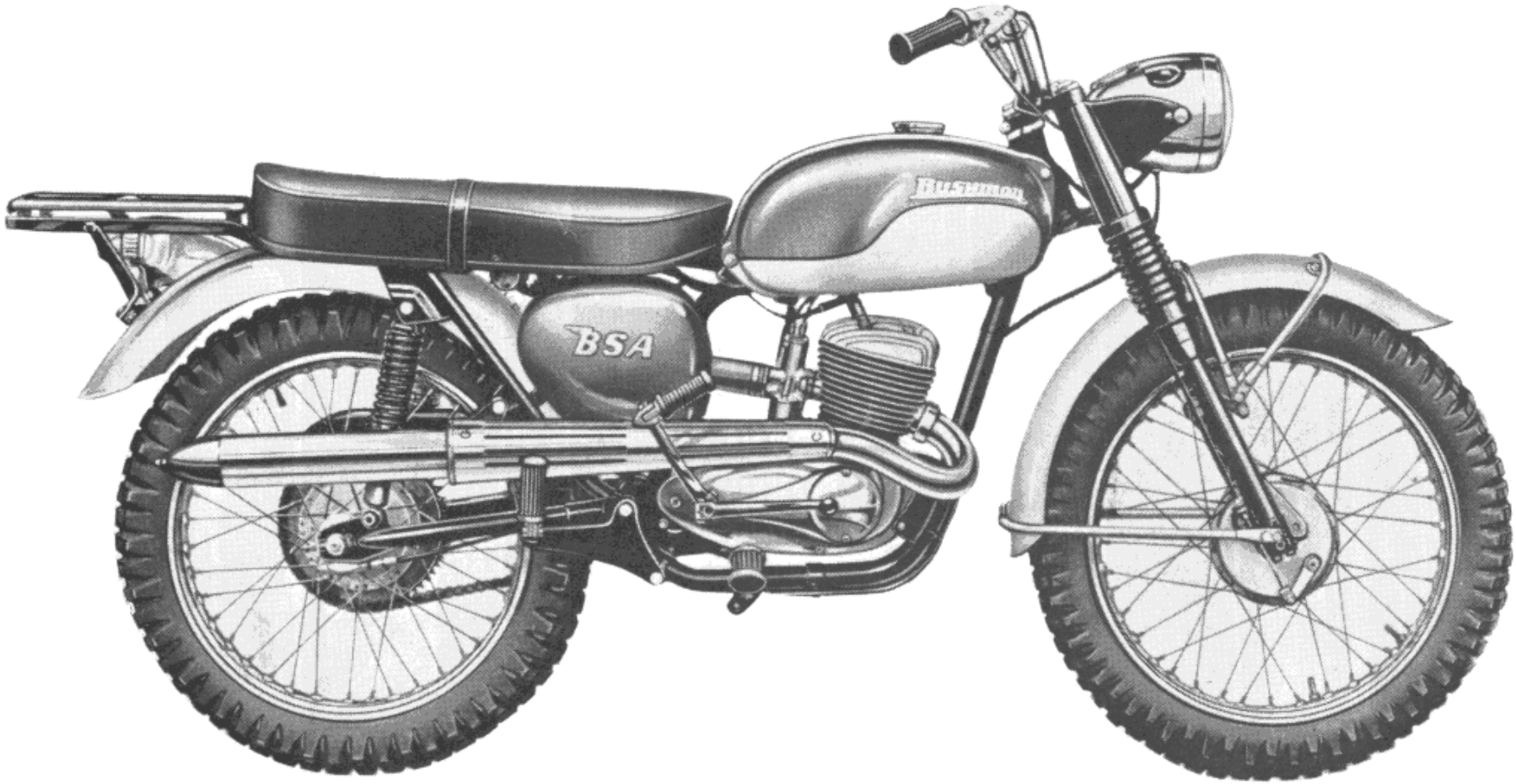
Service Department Telephone **021-772 2381**
B.S.A. MOTOR CYCLES LTD. **ARMOURY ROAD**
BIRMINGHAM 11

Publication Reference 00-4152/4/69

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 D14 175 c.c. BUSHMAN

BSA 175 c.c. BANTAM SPORTS (SPORTSMAN U.S.A.)

BSA 175 c.c. BANTAM SUPREME

INTRODUCTION

The object of this manual is to provide comprehensive service information for both the B.S.A. owner, and the workshop fitter, wishing to carry out either basic maintenance or major repair work. As some of the repair work described requires specialised skills and workshop equipment, the inexperienced owner is strongly advised to consult his B.S.A. dealer should he doubt his own ability to carry out a satisfactory job.

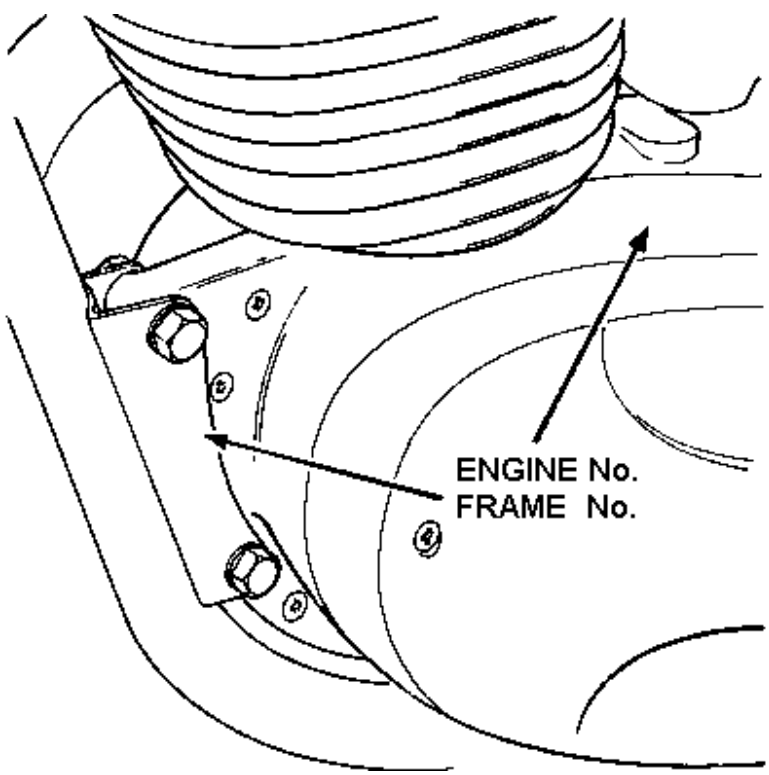
This manual is divided into sections, each dealing with a major assembly, and these are sub-divided into the individual operations required for maintenance or repair. It is hoped that by using this arrangement not only will the manual be useful to the inexperienced mechanic, but it will also serve as a reference book for the skilled mechanic.

The information given in this manual is correct at the time of publication, but in the course of constant development it is inevitable that there will be changes in specification. Anyone finding the information given in this manual to be at variance with the machine in his possession is advised to contact the B.S.A. Motor Cycles Service Department, where up-to-date information will be provided.

ENGINE AND FRAME NUMBERS

Both the 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.

The engine number is stamped on top of the crankcase immediately below the cylinder. The frame number is stamped on the front engine mounting plate.



Factory Service Arrangements
(UNITED KINGDOM)

REPLACEMENT PARTS

B.S.A. replacement parts are distributed through a national network of B.S.A. dealers, each of whom holds a stock of fast moving parts. Approximately 200 of these dealers have been selected for appointment as specialist B.S.A. replacement part stockists and each of these stockists holds a comprehensive stock of B.S.A. replacements. List of appointed stockists are available on request, and their names are printed in every B.S.A. parts catalogue.

GUARANTEE CLAIMS

In the interests of all concerned it is best that any owner of a new motor-cycle wishing to claim assistance under the guarantee should do so through the dealer from whom his machine was purchased. All B.S.A. dealers are familiar with the procedure designed by B.S.A. 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 unnecessary expense and inconvenience, and the possibility of the machine being damaged in transit to or from the works for repair.

Should your B.S.A. dealer decide that Service Department attention is required he will know best how to make suitable arrangements with the factory. It is important to remember that no machine can be accepted at the works without a prior appointment. This appointment can be made either by letter or telephone.

Labour time will be greatly reduced if proprietary articles such as legshields, safety 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.

Where parts such as cylinders, petrol tanks etc., are forwarded for repair, they should be packed securely so as to avoid damage in transit.

All parts sent to the Service Department for repair should be clearly labelled with the owners name and address, and should have attached a label giving full instructions.

TECHNICAL ADVICE

B.S.A. Service Department staff have long experience 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 11.
Telephone No. 021-772 2381

In all communications the model must be quoted with full engine and frame numbers together with all prefix or suffix letters.

SERVICE ARRANGEMENT OVERSEAS

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

PROPRIETARY PARTS

Equipment not of our manufacture, fitted to our motor-cycles, is of the highest quality and is guaranteed by the manufacturers and not by us. Any complaints or repairs should be sent to the manufacturer concerned or their accredited agents who will give every possible assistance. The following are the manufacturers concerned:—

CARBURETTERS	Amal Limited, Holdford Road, Witton, BIRMINGHAM 6.
CHAINS	Renold Chains Limited, Wythenshawe, MANCHESTER.
ELECTRICAL EQUIPMENT	Wipac Group Sales Limited, London Road, BUCKINGHAM. Joseph Lucas Limited, Gt. Hampton Street, BIRMINGHAM 18.
REAR DAMPERS	Girling Limited, Birmingham Road, WEST BROMWICH, Staffs.
SPARK 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 ARRANGEMENT

REPLACEMENT PARTS

B.S.A. replacement parts are available through a national network of B.S.A. dealers covering the entire United States.

These B.S.A. motor-cycle dealers are listed under "Motorcycles" in the yellow pages of your local telephone directory.

All requests for parts must be made through franchised B.S.A. dealers, they are not sold directly to B.S.A. by the two factory branches.

GUARANTEE CLAIMS

In the interest of all concerned the owner of a new motor-cycle wishing to claim assistance under the 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: **B.S.A. INCORPORATED,**
639 Passaic Avenue,
Nutley,
NEW JERSEY 07110

WESTERN: **B.S.A. MOTORCYCLES—WESTERN,**
2745 E. Huntington Drive,
Duarte,
CALIFORNIA 91010

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

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ENGINE

PISTON

Material	"Lo-ex" aluminium	
Compression ratio	10 : 1	
Clearance (bottom of skirt)	0·0038—0·0039"	(0·096—0·099 mm.)
Clearance (top of skirt) *(both measured on major axis)*	0·0077—0·0078"	(0·195—0·198 mm.)

PISTON RINGS

Material	Cast-Iron	
Width	0·097—0·102"	(2·463—2·590 mm.)
Depth	0·0615—0·0625"	(1·562—1·587 mm.)
Clearance in groove	0·0025"	(0·0635 mm.)
Fitted gap (maximum)	·013"	(·3302 mm.)
Fitted gap (minimum)	·009"	(·2286 mm.)

CYLINDER BARREL

Material	Close-grained cylinder iron	
Bore size (standard)	61·5 mm.	
Stroke	58 mm.	
Oversizes	·020" & ·040"	(·508 mm. & 1·016 mm.)
Inlet port size	1"	(25·4 mm.)
Exhaust port size	1¼"	(32 mm.)

IGNITION TIMING (Fixed)

Crankshaft (before top dead centre)	16·5º	
Piston (before top dead centre)	0·060"	(1·524 mm.)

CARBURETTER (Concentric)

Type	Amal R626/12	
Main jet	160	
Pilot jet	25	
Needle jet size	·105"	(2·667 mm.)
Needle position	3	
Throttle valve	3	
Nominal choke size	26 mm.	
Throttle slide return spring (free length)	3-1/16"	(78 mm.)

BEARING DIMENSIONS

Crankshaft bearing (left- and right-hand)	·75 × 1·875 × ·5625" (19·05 × 47·625 × 14·2875 mm.)	
Crankshaft bearing outer (right-hand)	17 × 40 × 12 mm.	
Layshaft bush, left- and right-hand (bore)	·6105—·6115"	(15·507—15·532 mm.)
Gearbox sleeve pinion bearing	·875 × 1·875 × ·375" (22·225 × 47·625 × 9·525 mm.)	
Mainshaft final drive gear bush (bore)	·4965—·4975"	(12·611—12·636 mm.)
Mainshaft diameter (gear-side)	·6247—·6250"	(15·867—15·944 mm.)
Mainshaft diameter (drive-side)	·498—·499"	(12·649—12·675 mm.)
Layshaft diameter (left- and right-hand)	·6095—·6100"	(15·481—15·608 mm.)
Gearbox mainshaft bearing	·625 × 1·5625 × ·4735" (15·875 × 39·6875 × 11·1125 mm.)	
Big-end roller (18)	4 × 8 mm.	
Small-end bearing	·5625 × ·75 × ·625" (14·2875 × 19·05 × 15·875 mm.)	
Gudgeon pin diameter	·5617—·5620"	(14·267—14·275 mm.)

TRANSMISSION

CLUTCH

Type	Multi-plate	
Number of plates	7	
Driving (bonded segments)	4	
Driven (plain)	3	
Overall thickness of driving plates and segments	⅛"	(3 mm.)
Clutch springs	6	
Free length of springs	1-9/64"	(29 mm.)
Clutch push rod, short (length)	1·998—2·002"	(50·75—50·85 mm.)
Clutch push rod, short (diameter)	·186—·188"	(4·7244—4·7752 mm.)
Clutch push rod, long (length)	5·778—5·782"	(146·76—146·86 mm.)
Clutch push rod, long (diameter)	·180—·182"	(4·57—4·62 mm.)

SPROCKETS

Engine	17 teeth
Clutch	38 teeth
Gearbox	16 teeth
Rear wheel	47 teeth

CHAIN SIZE

	0·500 × 0·205 × 120 links

GEAR RATIOS

Gearbox—(top)	1·0	:1
—(third)	1·301	:1
—(second)	1·831	:1
—(first)	2·843	:1
Overall —(top)	6·57	:1
—(third)	8·55	:1
—(second)	12·03	:1
—(first)	18·68	:1

FRAME AND FITTINGS

FRONT FORKS

Type	Coil spring, hydraulically-damped	
Springs:		
(free length)	17¼"	(43.8 cm.)
(spring rate)	35 lb./in.	
(number of coils)	82	
Shaft diameter (top)	1·045—1·046"	(26·543—26·568 mm.)
Shaft diameter (base)	1·000—1·001"	(25·4—25·425 mm.)
Sliding tube bore	1·125—1·129"	(28·575—28·677 mm.)
Upper bush (outer diameter)	1·121—1·122"	(28·473—28·499 mm.)
Upper bush (bore)	1·058—1·059"	(26·873—26·899 mm.)
Working clearance	0·013"	(0·330 mm.)
Lower bush (outer diameter)	1·118—1·119"	(28·397—28·425 mm.)
Lower bush (bore)	1·000—1·001"	(25·4—25·425 mm.)
Working clearance	0·006—0·011"	(0·152—0·279 mm.)
Length (upper and lower)	1"	(25·4 mm.)

REAR DAMPERS

Type	Coil spring, hydraulically-damped	
Springs:		
(fitted length)	5·7"	(144·78 mm.)
(spring rate)	100 lb./in.	
(colour identification)	Yellow/tan	

SWINGING ARM

Bush material	Phosphor-bronze	
Bush (outside diameter)	·993—·994"	(25·22—25·24 mm.)
Bush (bore)	·860—·865"	(21·84—21·97 mm.)
Housing diameter	·990—·991"	(25·14—25·17 mm.)
Interference fit on spindle	·0085—·014"	(·215—·355 mm.)
Spindle diameter	·8735—·8740"	(22·187—22·200 mm.)

WHEELS, BRAKES AND TYRES

WHEELS

Rim size and type (front and rear)	WM1-18	
Spoke sizes:		
(front, left-hand)	12 s.w.g. × 8-1/16"	(2·641 × 204·78 mm.)
(front, right-hand, inner)	12 s.w.g. × 6½"	(2·641 × 165·1 mm.)
(front, right-hand, outer)	12 s.w.g. × 6-9/16"	(2·641 × 166·69 mm.)
(rear, right-hand)	10 s.w.g. × 7-5/16"	(3·251 × 201·612 mm.)
(rear, left-hand, inner)	10 s.w.g. × 6½"	(3·251 × 165·1 mm.)
(rear, left-hand, outer)	10 s.w.g. × 6½"	(3·251 × 165·1 mm.)

WHEEL BEARINGS

Front:		
(left-hand)	15 × 35 × 11 mm.	
(right-hand)	17 × 40 × 12 mm.	
Spindle diameter (at ground portions):		
(right-hand)	·6687—·6692"	(16·985—16·998 mm.)
(left-hand)	·5899—·5904"	(14·9835—14·9962 mm.)
Rear:		
(left- and right-hand)	17 × 40 × 12 mm.	
Spindle diameter (at ground portions):	·6687—·6692"	(16·985—16·998 mm.)

BRAKES

Front and rear (diameter)	5½"	(139·7 mm.)
Front and rear (width)	1"	(25·4 mm.)
Lining thickness	5/32"	(·4 mm.)
Total lining area (front and rear)	20 sq. in.	(129 sq. cm.)

TYRES

Size (front and rear)	3·00 × 18"	
Pressure (front)	17 p.s.i.	(1·2 atm)
Pressure (rear)	22 p.s.i.	(1·5 atm)

(*see also page F12)*

ELECTRICAL EQUIPMENT (6 volt)

Battery	Lucas 6 volt PUZ5E/11
Alternator type	Wipac 1G1768
Contact breaker unit	Wipac S0584
Ignition coil	Wipac S0769
Rectifier	Wipac S2642
Bulbs:	
(headlight, main)	30/24 watt pre-focus
(headlight, pilot)	3 watt M.E.S.
(stop/tail light)	6/18 watt S.B.C. staggered pin
(speedometer light)	0·6 watt B.A. 7S lug cap
Horn	Clearhooter HF900

CAPACITIES

Petroil proportion	See page A3	
Fuel tank	1·875 gallons or 2·25 U.S. gallons	(8·5 litre)
Gearbox	¾-pint	(0·5 litre)
Front fork (each leg)	⅛-pint	(0·07 litre)

BASIC DIMENSIONS

Wheelbase	50·0"	(127 cm.)
Overall length	77·5"	(196·85 cm.)
Handlebar width	27·75"	(70·49 cm.)
Seat height (unladen)	31"	(78·74 cm.)
Overall height (approximate)	40·0"	(101·6 cm.)
Ground clearance	6·75"	(17·15 cm.)

WEIGHTS

Machine (unladen)	215 lbs.	(97·5 kg.)
Engine/gearbox unit (less carburetter)	51 lbs.	(23 kg.)

D14 BANTAM SPORTS MODELS

All general data is the same as that given in preceding pages for the Supreme models except for the following:—

CARBURETTER

. . . . .	Concentric R626/13	

FRONT FORKS

Shaft diameter	1·248—1·249"	(31·70—31·72 mm.)
Sliding tube bore	1·475—1·477"	(37·46—37·51 mm.)

BUSHES

Upper bush (outside diameter)	1·4750—1·4755"	(37·465—37·477 mm.)
Upper bush (bore)	1·250—1·251"	(31·750—31·775 mm.)
Working clearance	0·001—0·003"	(0·025—0·076 mm.)
Length	2⅛" overall	(28·5 mm.)
Lower bush (outside diameter)	1·473—1·474"	(37·44—37·41 mm.)
Lower bush (bore)	1·2485—1·2495"	(31·714—31·737 mm.)
Working clearance	0·001—0·004"	(0·025—0·102 mm.)
Length	1¼" overall	(31·75 mm.)

WHEELS

Spoke sizes:		
(front, left-hand)	12 s.w.g. × 6-21/32"	(2·641 × 169·069 mm.)
(rear, right-hand)	10 s.w.g. × 6-9/16"	(3·251 × 166·687 mm.)

BASIC DIMENSIONS

Seat height (unladen)	30·5"	(77·47 cm.)
Handlebar width	23"	(58·42 cm.)
Overall height (approximate)	37·5"	(95·25 cm.)

WEIGHT

Weight	221 lbs.	(100·24 kg.)

CAPACITY

Front forks (each leg)	⅓ pint	(0·175 litre)

D14 BUSHMAN MODELS

All general data is the same as that given in preceding pages for the Supreme models except for the following:—

BEARING DIMENSIONS

Forks	As Bantam Sports models

CARBURETTERS (Concentric)

Type	Amal R626/12

TRANSMISSION (Standard D14 Bushman models)

GEAR RATIOS

As Bantam Supreme models

CHAIN SIZES

Transmission	·500 × 0·205" × 120 links

TRANSMISSION (D14 Bushman Pastoral models)

GEAR RATIOS

Gearbox	As Bantam Supreme models
Overall—(top)	8·10 :1
—(third)	10·54 :1
—(second)	14·83 :1
—(first)	23·03 :1

SPROCKETS

Rear wheel	58 teeth

CHAIN SIZES

Transmission	·500 × 0·205" × 126 links

WHEELS, BRAKES AND TYRES

WHEELS

Rim size and type (front)	WM1-19	
Rim size and type (rear)	WM2-19	
Spoke size:		
(front, left-hand)	12 s.w.g. × 8⅞"	(2·641 × 225·42 mm.)
(front, right-hand, inner)	12 s.w.g. × 7-1/16"	(2·641 × 179·38 mm.)
(front, right-hand, outer)	12 s.w.g. × 7"	(2·641 × 177·8 mm.)
(rear, left-hand)	10 s.w.g. × 6-29/32"	(3·251 × 175·42 mm.)
(rear, right-hand)	10 s.w.g. × 8¾"	(3·251 × 222·25 mm.)

TYRES

Size (front and rear)	3·00 × 19"	
Pressure (front)	17 p.s.i.	(1·2 atm)
Pressure (rear)	22 p.s.i.	(1·5 atm)

ELECTRICAL EQUIPMENT (Direct Lighting)

Alternator type	Wipac 1G1791
Contact breaker unit	Wipac S0584
Ignition coil	Lucas 3E.T.
Bulbs (headlight, main)	24/24 watt pre-focus

(The battery, rectifier, headlight pilot bulb and horn are not fitted to these models)

BASIC DIMENSIONS

Overall length	78"	(198 cm.)
Handlebar width	28·5"	(72 cm.)
Seat height (unladen)	30·5"	(77·5 cm.)
Ground clearance	10"	(25 cm.)
Overall height (approximate)	40·5"	(103 cm.)

WEIGHT

Machine (unladen)	222 lbs.	(100·5 kg.)

I N D E X

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REGULAR MAINTENANCE

Regular maintenance is essential if the machine is to have a long and trouble-free life. The following list of items requiring attention will also serve as a guide to the periods of time between servicing. The correct method of performing each operation will be found under the appropriate headings in later chapters.

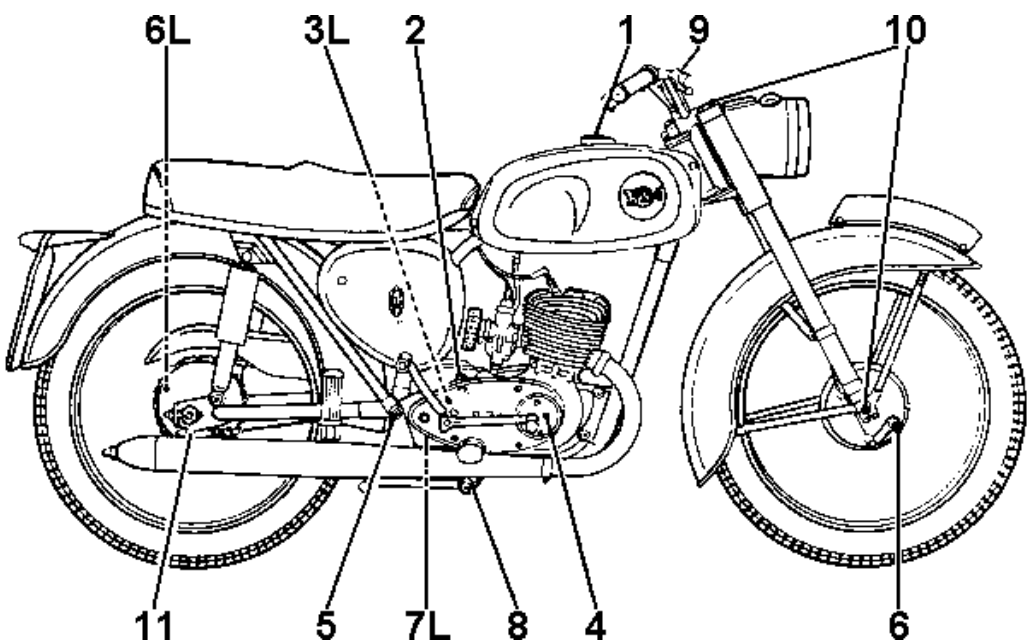

FIG. A1.

Ref. No.

Weekly

7 Oil brake pedal pivot.

9 Oil exposed cables and control joints.

Every 1,000 miles (1,600 km.)

2 Check oil level in gearbox.

5 Grease swinging arm pivots (2).

3 Grease clutch control.

8 Oil central stand pivots.

Ref. No.

Every 2,000 miles (3,200 km.)

2 Change oil in gearbox.

6 Grease brake cams.

Every 5,000 miles (8,000 km.)

11 Grease speedometer drive cable.

4 Lubricate contact breaker cam.

Every 10,000 miles (16,000 km.)

10 Drain and refill front forks.

— Grease wheel bearings.

— Grease steering head bearings.

RECOMMENDED LUBRICANTS

BRAND	OIL		GREASE POINTS	FRONT FORKS
	Engine	Gearbox		
Castrol	Castrol Two -Stroke Oil	Castrol XXL	Castrolease LM	Castrolite
Shell	2T Two-Stroke Oil	Shell X100-40	Shell Retinax A	Shell X100-20
Esso	Esso Two-Stroke (2T) Motor Oil	Esso Extra Motor Oil 40/50	Esso Multipurpose Grease H	Esso 20W/30
Mobil	Mobil-Mix TT	Mobiloil A	Mobilgrease MP	Mobiloil Artic
B.P.	Energol Two-Stroke Oil	Energol S.A.E. 40	Energrease L2	Energol S.A.E. 20
Regent	Motor Oil 2T	Havoline S.A.E. 40	Marfak Multipurpose 2	Havoline S.A.E. 20W

All the engine oils listed above are self-mixing and must be used in the proportion of one part oil to twenty-four parts petrol (*i.e.,* 4 per cent mixture).

NOTE:—For running-in purposes, a twenty parts, one part oil mix, may be used.

If standard (non-self-mixing) oil is used, this must be S.A.E. 40 grade and the mixture proportion is one part to thirty-two parts petrol (*i.e.,* 3 per cent mixture).

ENGINE LUBRICATION

The lubrication of the engine is provided by the oil mixed with the petrol supply, forming a mixture commonly known as “petroil”. The correct proportion of oil to petrol is given on this page.

For efficient running of the engine, and adequate lubrication it is essential that the oil be completely mixed with the petrol.

It is preferable to use one of the self-mixing two-stroke oils specified in the list of recommended lubricants or alternatively ready-mixed petroil can be obtained from most filling stations.

Because the engine is dependent solely on the fuel mixture for its lubrication, avoid coasting the machine downhill for long periods with the throttle shut, as the engine may seize through lack of oil.

The engine mainshaft bearings are lubricated from the chaincase on the drive-side, and from the gearbox on the generator side. Special oil seals prevent this oil entering the crankcase.

GEARBOX LUBRICATION

The gearbox, though built in unit with the engine, is self-contained with regards to lubrication. The oil used for lubricating the gears also serves the primary drive, and the main bearings.

It is therefore essential that the correct oil level be maintained.

To check the gearbox oil level remove the level screw and filler plug, and pour oil into the filler until it just begins to flow from the level hole. Replace the screw after filling, having first checked the condition of its fibre washer.

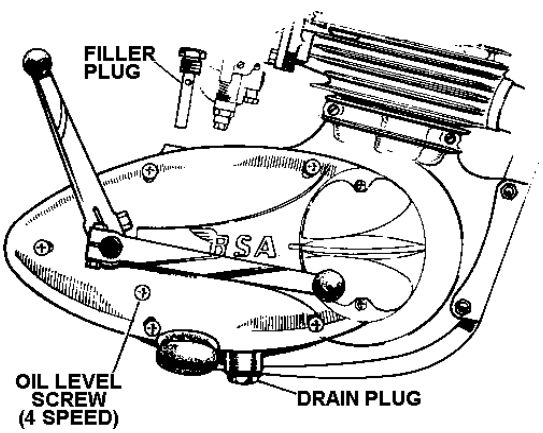

FIG. A2.

It is important that S.A.E. 40 grade oil be used, not any of the self-mixing oils recommended for the engine. As the clutch is lubricated from the same supply, special anti-friction additives should not be mixed with the gearbox oil.

Changing the oil in the gearbox is best done after a run, as the oil is warm and therefore more fluid. Take out the filler plug, and unscrew the drain plug underneath the gearbox. Allow all the oil to drain into a suitable receptacle before cleaning the gearbox with flushing oil. Replace the drain plug and refill the gearbox to the correct level as described above. The condition of the drain plug fibre washer is important; over-tightening will damage it.

CONTACT BREAKER

The contact breaker is mounted on the right-hand engine shaft and is housed within the primary cover.

It is essential that no engine oil is allowed into the contact breaker housing and to prevent this, an oil seal is fitted behind the contact plate.

Periodical lubrication of the contact breaker cam however, is necessary. Provision is made for this in the form of a grease-soaked wick.

The grease (preferably of the high-melting point type) should be applied sparingly to the wick every 5,000 miles (8,000 km.). Avoid using the grease excessively, otherwise the contact points may become contaminated, resulting in misfiring and difficult starting.

REAR CHAIN

It is a good practice to periodically remove the rear chain and clean it thoroughly in petrol or paraffin. When dry, gently warm the chain in a mixture of grease and graphite, allow to cool and wipe off any excess grease. Before replacing the chain, clean both the rear wheel and gearbox sprockets. Remember that the chain connecting link must be fitted with the closed end of the spring fastener pointing in the direction of chain travel (*i.e.,* on the lower run of the chain, the closed end should be rearward).

See section H for further information.

STEERING HEAD

The steering head bearings are packed with grease on assembly and should only require repacking at the intervals quoted on page A2. Full details of removing and replacing the steering assembly can be found on pages E8 & E9 in the fork section.

Wipe out all the old grease from the bearing cups and clean the ball bearings by rolling them in a clean rag. After cleaning, carefully examine the bearings, cups and cones for pitting, corrosion or cracks, and renew if necessary.

The fresh grease will hold the ball bearings in position during re-assembly. Check that the grease is as quoted on page A3.

The correct number of ball bearings for each cup is twenty-four.

FRONT FORK (D14 Supreme)

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

The need for renewal of the oil may be indicated by excessive movement of the forks, but it should only be necessary at the intervals quoted on page A2.

Prise out the cap on top of the fork leg; a small hole is provided in the cap to facilitate this. With the aid of a tubular spanner, unscrew the small nut which is now exposed then remove the large nut which carried the cap. Disconnect the mudguard stay at the lower end of the fork leg and unscrew the drain stud, allowing the oil to drain out into a suitable receptacle. Whilst standing astride the machine, apply the front brake and slowly depress the forks a few times to expel any remaining oil in the system.

Repeat the operation on the other fork leg and replace the drain studs and new fibre washers.

Pour an eighth-pint of an S.A.E. 20 oil into each fork leg and replace the top nuts and caps.

FRONT FORK (Sports and Bushman)

The procedure for draining and refilling the forks fitted to the D14/4 Sport and Bushman is much the same as above, except that the filler is a single cap nut on the top of the fork leg, and a drain screw is provided at the bottom of the fork leg adjacent to the wheel spindle.

The capacity also is different being a third pint (175 c.c.) S.A.E. 40 oil to each leg.

WHEEL BEARINGS

The wheel bearings are packed with grease on assembly and should only require repacking at the intervals given on page A2.

The bearings should first be removed as detailed in pages F3 and F4, after which they must be washer thoroughly in paraffin and, if possible, an air line should be used to blow out any remaining grit or paraffin.

After assembling the first bearing, pack from inside with the correct grade of grease (see page A3). Do not over-pack the bearings, as not only is this wasteful, but there is a risk of grease finding its way on to the brake linings. Avoid handling brake shoes with greasy hands.

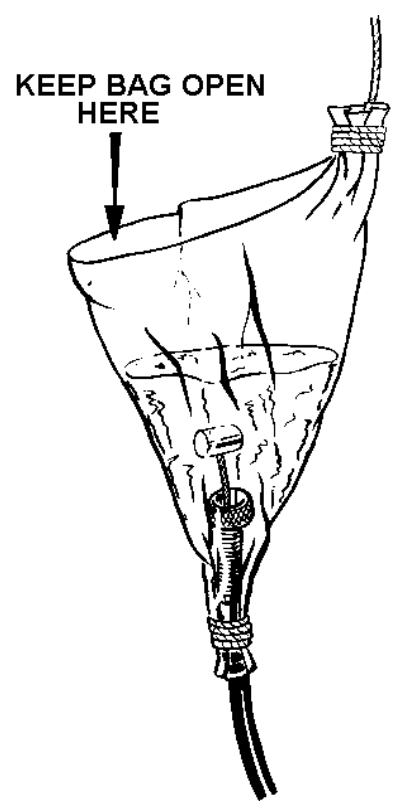

FIG. A3.

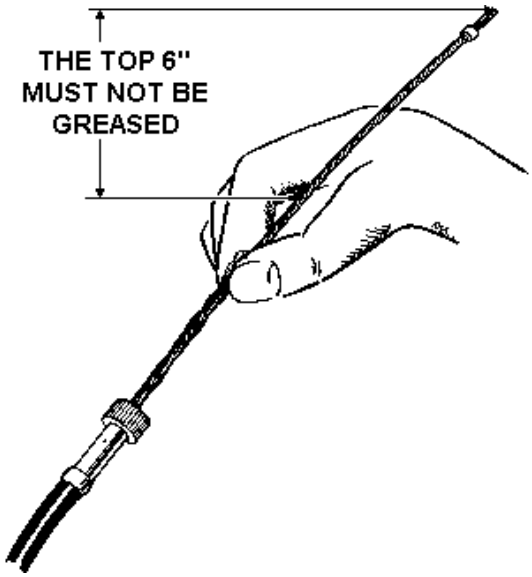

FIG. A4.

CONTROL CABLES

Exposed sections of inner control cables should be lubricated weekly with an oilcan. The most satisfactory way of lubricating a cable, however, is to include a flow of oil between the inner cable and the casing by using a simple oil reservoir as shown in Fig. A3, and leaving the cable for several hours.

During their manufacture, the inner cables are greased with a molybdenum-based grease which forms a semi-permanent lubricant and should therefore give long service before needing attention.

SPEEDOMETER CABLE

It is necessary to lubricate the speedometer cable to prevent premature failure of the inner wire, though care must be taken to avoid over-zealous greasing which may result in the lubricant entering the instrument head. To gain access to the inner wire, simply unscrew the cable nut at the speedometer gearbox, when the wire can be withdrawn. The grease should be applied sparingly to the wire but the top 6" (near the instrument head) must not be greased.

REAR SUSPENSION

Each of the two suspension dampers comprise a telescopic damper unit and a coil spring. During their manufacture, the damper units are sealed and therefore require no attention whatsoever. If they are damaged or become ineffective, they must be replaced.

NOTE:—Should the damper bushes become noisy and squeaky do not lubricate them with oil. A small quantity of hydraulic brake fluid will be found to be most effective and will not harm the rubber bushes.

The swinging arm pivot is provided with grease nipples and must be thoroughly lubricated every 1,000 miles.

CLEANING AND POLISHING

Regular cleaning and polishing will protect the finish of the motor-cycle, and maintain it in the best possible condition.

The enamelled parts of the machine must never be dry cleaned as this would lead to a scratched and dull surface, they should first be washed in warm water. Do not use detergents. Tar spots should be removed using a cloth moistened with turpentine.

After washing and drying the enamelled parts they should then be polished with one of the well known brands of car polish, obtainable from any good accessory dealer.

All chromium-plated parts should be washed and dried as described for the enamelled parts, and then polished with a soft duster. Stains can be removed with any well known brand of chromium cleaner. Do not use metal polish, as this will ruin the plating.

The dualseat cover should always be cleaned with warm soapy water, never use detergents or chemical cleaners which might be harmful to the material.

The engine unit, hubs and spokes using any well known oil and grease solvent. Take care when applying and washing off the solvent to avoid the possibility of water entering the carburetter or electrical equipment.

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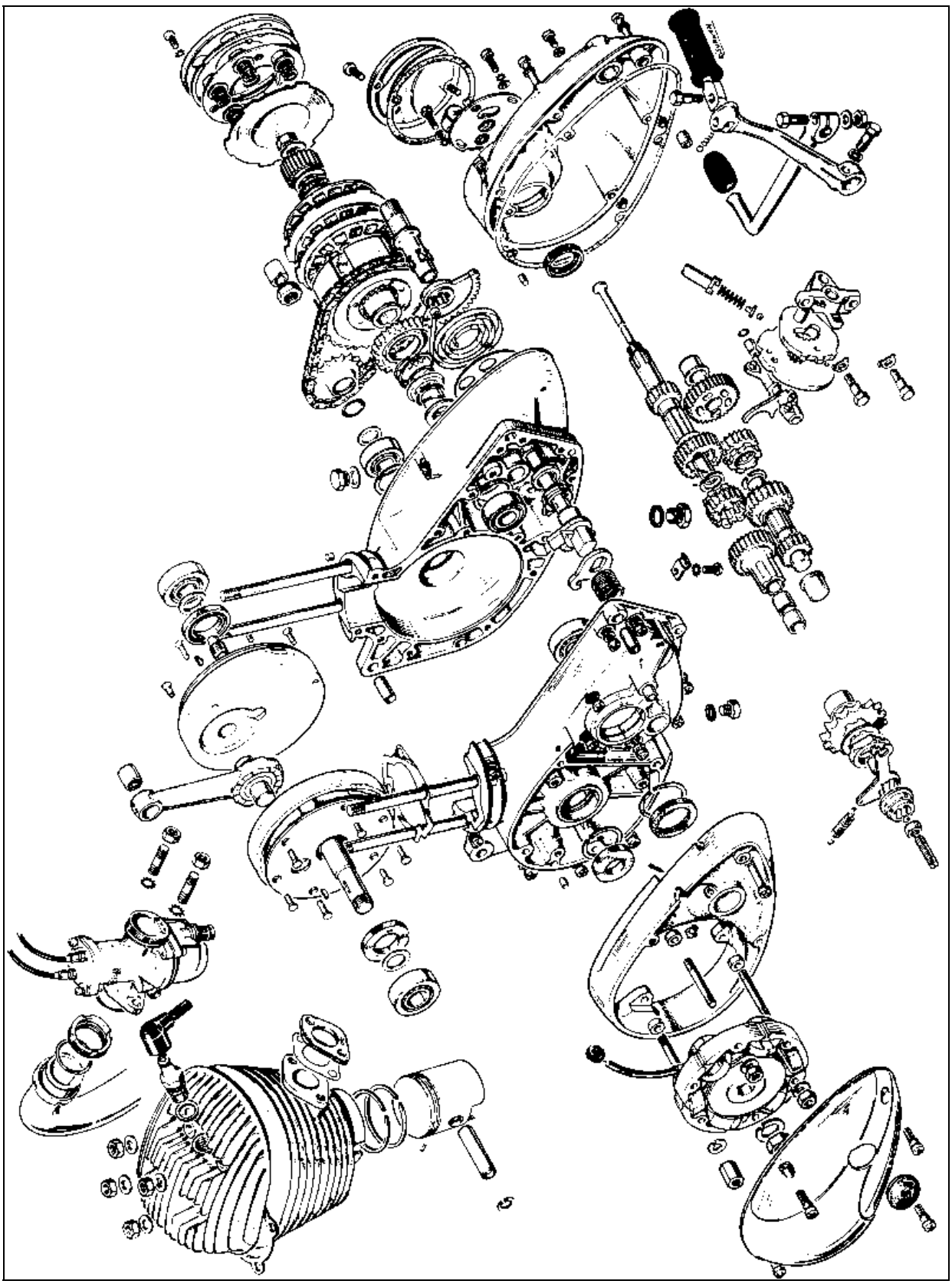

FIG. B1. *Engine exploded.*

OPERATION OF THE TWO-STROKE ENGINE

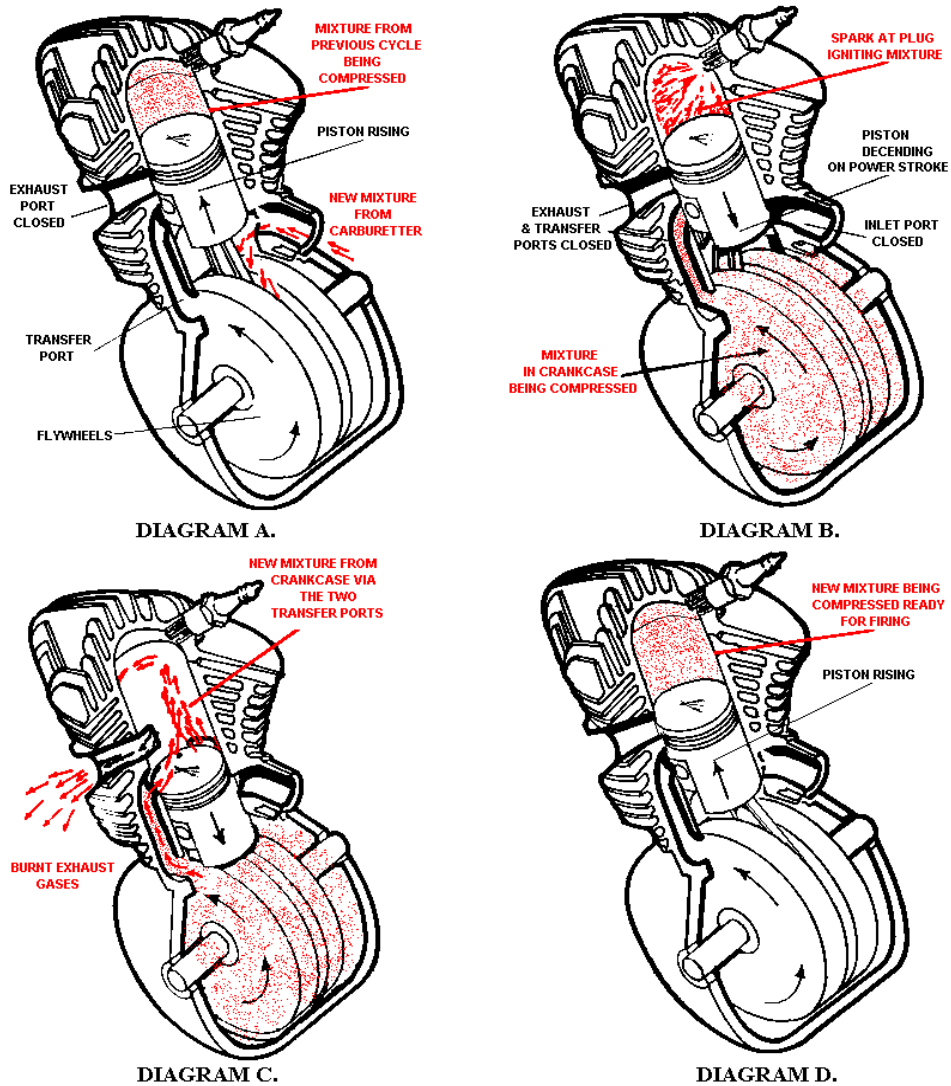

FIG. B2.

Diagram A. Shows the piston nearing the top of its stroke, compressing a charge of mixture from the previous cycle, ready for firing. The inlet port is uncovered and a fresh mixture of petroil/air is induced through the carburetter into the crankcase, filling the vacuum caused by the ascending piston.

Diagram B. The compressed charge has just been ignited by the sparking plug and as the burnt gases begin to expand, the piston is rapidly forced downward on what is know as the firing stroke. The fresh charge of mixture is compressed by the piston as it descends.

Diagram C. Shows the piston at the end of its downward stroke, leaving the exhaust port completely uncovered to enable the burnt gases in the cylinder to escape through the exhaust system. The transfer ports are also open, allowing the compressed mixture in the crankcase to force its way into the cylinder. Each transfer port (only one is shown in the diagram) is so arranged that the stream of incoming mixture is directed to the rear of the combustion chamber. As they sweep upwards under the cylinder head, they assist in forcing out any remaining burnt gases through the exhaust port. This particular stage of events is known as "scavenging."

Diagram D. Shows the piston rising, so compressing the charge of mixture ready for firing. The upward movement of the piston in the cylinder is also creating a partial vacuum in the gas-tight crankcase which will draw in a fresh mix of petroil/air from the carburetter when the inlet port is uncovered.

The two-stroke is so called because a firing stroke occurs on one out of every two strokes of the piston, unlike the four stroke engine which fires once every four strokes of the piston. Induction and exhaust ports in the cylinder wall replace the valves, springs, cams and tappets normally used in a four-stroke engine. The upper portion of the cylinder is linked to the crankcase by two transfer ports, the purpose of which is detailed on page B3.

These notes, when read in conjunction with the corresponding diagrams, should acquaint the inexperienced mechanic with the basic principles of the two-stroke engine.

DESCRIPTION

The 175 c.c. two-stroke engine is of unit construction and has a single cylinder barrel of close grained cast-iron mounted on an airtight, two-piece crankcase. The domed "Lo-ex" aluminium piston is "pegged" to prevent the compression rings from revolving in the bore and is carried on an oval section connecting rod, employing a needle roller small-end. Housed between the two disc-faced flywheels is the big-end bearing, consisting of eighteen plain rollers.

The generator rotor is secured to the keyed shaft of the left-hand flywheel and is protected by a circular cover containing a six-coil stator unit. Mounted on the right-hand shaft is the engine sprocket and contact breaker unit, which, because the engine operates on the two-stroke principal, revolves at engine speed.

From the engine sprocket the drive is taken, via the primary chain, to the clutch assembly. Here the transmission is controlled by a series of spring-loaded friction plates before passing through the four-speed constant-mesh gearbox to the gearbox sprocket.

DECARBONISING

Internal combustion of the petroil mixture in the engine produces normal carbon deposits on the piston crown, rings, cylinder head and ports.

These deposits are not harmful providing they are not allowed to become too heavy and cause pre-ignition and other defects which would impair the performance of the engine.

The usual symptoms indicating an excessive build-up of carbon, are an increased tendency for the engine to "pink" (metallic knocking sound) when under load, erratic running and a tendency for the engine to run much hotter than usual. A general decrease in power will also be apparent, this usually being caused by heavy carbon deposits in the exhaust port restricting the natural flow of exhaust gases. This interferes with the scavenging which takes place in the combustion chamber, making it impossible for an efficient transfer of combustible mixture from the crankcase.

Decarbonising is quite a simple task, so, to ensure constant efficiency from the engine, it is advised that the operation be carried out every 2,000 to 4,000 miles.

SILENCER

It should be noted that the exhaust system contributes a great deal to the efficiency of a two-stroke engine. When decarbonising the engine therefore, do not omit to clean the silencer baffles and exhaust pipe bore.

The baffles in the rear of the D14 silencer are detachable. Access is gained by removing the silencer end cap, retained by two nuts and a spring washer.

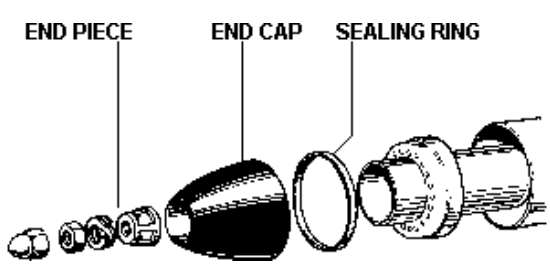

FIG. B3.

Remove these parts, then with a pair of pliers pull the baffles from inside the silencer and soak in caustic soda solution to dissolve the carbon. Take care not to splash your eyes or clothing with the solution which is very corrosive. Reassembly is in the reverse manner. Ensure when reassembling, that the sealing ring is correctly located before replacing the end cap.

Before starting work on the engine ensure you have a clean bench or area in which to work, and somewhere to place the parts as they are removed.

REMOVAL OF CYLINDER

First turn off the fuel supply and disconnect the fuel pipe union at the float chamber. Do not attempt to pull the pipe off the union unless it is in need of replacement. Disconnect the air cleaner, undo the two nuts securing the carburetter to the cylinder flange studs and tie the carburetter out of the way.

Using a suitable "C"-spanner, release the exhaust pipe union nut at the front of the barrel. If any difficulty is encountered in unscrewing the nut, apply a few drops of penetrating oil to the threaded portion and allow to soak before attempting to unscrew it any further. Disconnect the high-tension lead and remove the sparking plug.

Take off the four large fixing nuts from the top of the cylinder head and lift the head clear. Note that on early D14 models two cylinder head gaskets of 0·025" thickness were fitted. Later these were replaced by a single gasket of 0·050" thickness. Always check the gasket thickness when fitting, as two must be fitted if of the thinner type. Before attempting to remove the cylinder barrel, first unscrew the two petrol tank front fixing bolts, loosen the rear fixing bolt and raise the tank slightly to provide sufficient clearance. The petrol tank on the Bushman models must be removed completely. Care must be taken, when sliding the barrel off the studs, to support the piston as it emerges from the end of the bore, otherwise it may be damaged as it falls clear.

Should the barrel be found difficult to remove, it may help if the two crankcase joint screws below the bottom fin of the barrel are slackened.

PISTON

After placing the cylinder head and barrel safely to one side, the piston can now be examined. Unless the piston or small end bearing is to be removed, the piston need not be disturbed. Should it be necessary to remove the piston, first prize out one of the gudgeon pin circlips with a suitably pointed instrument.

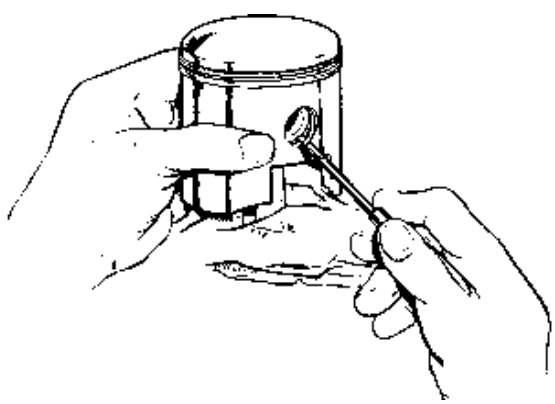

FIG. B4. *Removing circlip*

Before withdrawing the gudgeon pin it is advisable to first warm the piston by wrapping it in a rag that has been soaked in hot water. Application of this rag will cause the aluminium alloy piston to expand more than the steel gudgeon pin, allowing the pin to be extracted more easily. Care must be taken not to damage the small-end needle rollers in the connecting rod when removing the gudgeon pin.

Scrape off any carbon which has accumulated on the piston crown, being careful not to damage the surface of the metal. A stick of tinsmiths solder, flattened at one end, makes an ideal scraper tool and will not score the piston. After removing the carbon, wipe the piston clean with an oily rag.

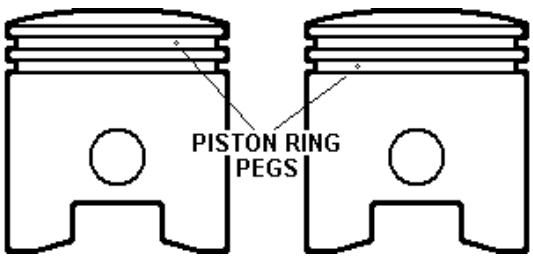

FIG. B5.

PISTON RINGS

Examine the piston rings and note that they are prevented from turning in their grooves by means of pegs which locate in the piston ring grooves.

The outside face of each piston ring should posses a smooth metallic surface and any signs of heat discolouration indicates that the rings are in need of replacement. The rings should also retain a certain amount of "springiness" so that when released, the free gap is considerably greater than the gap measured when the ring is in the bore.

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 the carbon from the groove and the inside face of the ring. A broken piece of piston ring, ground as a chisel, will provide a useful tool for removing carbon deposits from the ring grooves. Care is necessary to permit only a minimum amount of movement when removing the rings as they are very brittle and can be broken easily.

To check the piston ring gaps, place each ring in the least worn part of the cylinder bore (usually 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 gap should be between ·009" (·2286 mm.) and ·013" (·3302 mm.) and although an increase of a few thousandths of an inch is permissible, any large increase to, say, ·025" indicates the need for replacement rings.

See also that there is sufficient clearance between the inner portion of the gap and the locating peg in the groove. This can be checked by closing the ring in the groove until the gap closes, proving that there is clearance at the peg below. If the gap cannot be closed, indicating that the steps are binding on the peg, use a smooth file to ease the steps down.

It is advisable to check the gap of a new ring before fitting, and if the gap is found to be less than 0·07" (1778 mm.) the ends of the ring must be carefully filed to the correct limit.

Protect the crankcase mouth with a piece of clean rag and proceed to decarbonise the cylinder head and barrel.

CYLINDER HEAD AND BARREL

Remove all carbon deposits from the cylinder head, again bearing in mind that the aluminium is soft and can easily be damaged if the decarbonising tool is carelessly applied, and carefully wipe away all loose particles.

As explained at the beginning of this section, most of the carbon deposit likely to have accumulated in the cylinder will be in the exhaust port and it is most important that this is removed. Carefully scrape out the carbon, taking care not to let the tool slip out of the port and damage the surface of the bore. Examine the transfer and inlet ports for the presence of carbon, although this is unlikely to be excessive, and finally wipe the ports and cylinder bore absolutely clean.

SMALL-END BEARING

The needle roller small-end bearing, because of its obvious advantages over a plain bush, should not be subjected to a great deal of wear. However, should it be necessary to change the bearing, the old bearing can be pushed out whilst at the same time, the new bearing is pressed in with service tool No. 61-3791. Check that the diameter of the gudgeon pin is as quoted in General Data. If appreciable wear is detected, the gudgeon pin will have to be renewed.

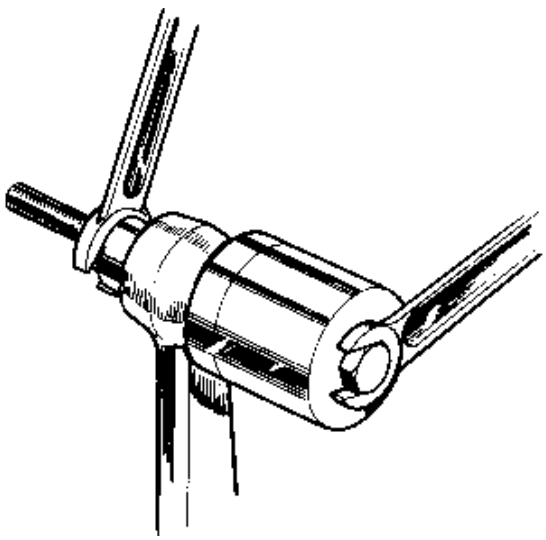

FIG. B6. *Using service tool No.* 61-3791.

BIG-END BEARING

While the cylinder is off, opportunity should be taken to test the big-end bearing for wear. This can be achieved by taking hold of the connecting rod and pulling it upwards until the crank is at top dead centre. Whilst holding it in this position, try gently but firmly to push and pull the connecting rod in the direction of its travel, in order to detect any play. If the big-end is in good condition there should be no free movement in this direction, although it may be possible to move the rod sideways, *i.e.,* at right angles to the axis of the machine. Should vertical play in the big-end be detected and you do not feel qualified to assess whether the amount in evidence is permissible or not, then you should seek expert advice. This point is not likely to give much trouble however, providing that the engine has been carefully used and adequately lubricated, for the big-end bearing is of ample dimensions for the work it has to do. If the big-end has deteriorated as the result of neglect or abuse, it should be replaced as detailed on page B12, though unless you have the necessary experience and facilities for this type of work it is preferable to hand the job over to an expert repairer.

REASSEMBLY AFTER DECARBONISING

If the piston was removed from the connecting rod, replace it in its original position, (*i.e.,* with the piston ring gaps at the front). Before fitting the gudgeon pin, smear it with oil and do not forget to replace the circlips. Remember that if the circlips should come adrift or if one is omitted, the cylinder barrel may be seriously damaged.

Before attempting to replace the cylinder barrel over the piston, smear the piston sides generously with clean engine oil. Fit a new gasket and place the barrel over the piston carefully manipulating the rings into the base of the bore and seeing that they enter freely without the application of force. When the barrel is correctly fitted, replace the cylinder head and gasket. Note that on early D14 models two cylinder head gaskets of 0·025" thickness were fitted. Later these were replaced by a single gasket of 0·050" thickness. Always check the gasket thickness when fitting as two must be fitted if of the thinner type. Fit the washers and nuts on to the fixing studs and tighten the nuts in diagonal order so as to avoid distortion.

Examine the sparking plug and refit if sound. Check that the rubber sealing ring on the carburetter flange is undamaged and finally reconnect the exhaust pipe, carburetter, petrol pipe and re-fix the petrol tank.

REMOVAL OF ENGINE

Turn off the fuel supply and disconnect the fuel pipe union at the carburetter float chamber. Do not attempt to pull the pipe off the union unless it is going to be renewed. The air cleaner hose should now be disconnected from the carburetter. Undo the two nuts securing the carburetter to the cylinder flange studs and tie the unit out of the way.

Using a suitable "C"-spanner, release the exhaust pipe union nut from the cylinder barrel.

If any difficulty is encountered in unscrewing the nut, apply a few drops of penetrating oil to the threaded portion and allow to soak before attempting to unscrew it any further.

Disconnect the contact breaker lead at the snap connecter under the primary chaincase. The gearbox should now be drained by removing the filler and drain plugs and allowing the oil to drain into a suitable receptacle.

Detach the sparking plug lead, and disconnect the generator leads at their snap connectors. The clutch cable should now be disconnected as detailed in D12.

Remove the chainguard as detailed on page D9, and take off the rear chain, noting the correct fitting of the spring link, *i.e.,* closed end pointing forwards on top run of chain.

Unscrew the two bolts fixing the petrol tank at the front and loosen the rear fixing bolt. The tank can now be raised slightly to provide sufficient clearance of the engine.

The engine is held in the frame by two nuts and bolts and the front and two at the rear. One of the rear fixing bolts is situated beneath the engine.

Remove the four fixing bolts and carefully lift the engine out of the frame.

When a prop stand has been fitted as an optional extra (not applicable to Bushman models), it will be released on removal of the front fixing bolts. On Bushman models, the front fixing bolts also retain the crankcase shield.

The kickstart and gearchange pedals can now be taken off in preparation for engine dismantling, described below.

ENGINE DISMANTLING

Perfect cleanliness is essential to ensure the success of any service task, so before starting work make sure you have a clean bench or working area in which to operate, and somewhere to place the parts as they are removed.

Before starting work on a complete strip-down of the engine unit it is advisable to have the following tools and replacements available.

(1 off)	00-3311	Gasket set
(3 off)	90-0749	Oil seal
(1 off)	90-0147	Oil seal
(2 off)	57-3621	Main bearing
(1 off)	90-0010	Main bearing
(2 off)	90-1386	Gudgeon pin circlip

The following service tools are also needed.

61-3191	Clutch spring compressor
61-3786	Engine sprocket extractor

The following notes give in detail the correct procedure for dismantling the engine/gearbox unit.

It will be assumed that the engine unit has been drained of oil, removed from the frame, and dismantled for decarbonising as described in the previous pages.

The primary cover is held in place by five Phillips-head screws, each of which is fitted with a fibre washer. It is not necessary the oil level screw, painted red. Place a suitable tray under the joint to catch any oil, and gently tap the cover with a hide-mallet to break the joint.

The primary cover can now be lifted away complete with the contact breaker cover which is held in place by two screws. Mark the position of the contact breaker plate in relation to the case with a scriber to assist assembly. Remove the plate fixing screws, and contact breaker mounting plate.

Carefully unscrew the contact breaker cam screw on the end of the drive shaft. Before the screw reaches the end of its thread the head will bear against the circlip and further rotation of the screw should release the cam from its taper. It may, however be necessary to lightly tap the cam to free it from the taper.

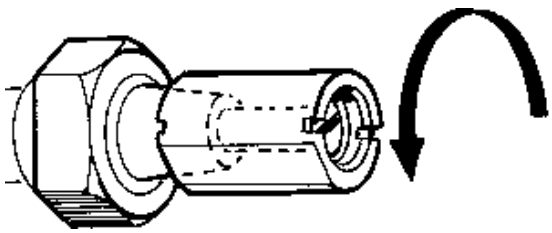

FIG. B7.

Now take out the four small Phillips-head screws securing the generator cover, and remove the cover.

To remove the inner cover, first take out the one Phillips-head screw at the back, then unscrew the three generator cover stator nuts. Tap the cover gently around its edges to release, and withdraw the cover complete with stator. Take care not to loose the three small spacers that are located on the fixing studs between the stator and inner cover. The inner cover carries the clutch actuating lever and adjuster. If this mechanism requires attention, unclip the return spring, unscrew the adjuster locknut and press the lever out of its bush. The push rod ball is loosely located in the lever boss. Withdraw the push rod and rubber sleeve.

The gearbox sprocket is held to thee sleeve pinion by one large left-hand threaded nut, and a tab-washer. Flatten the washer, and locking the sprocket with a length of chain, unscrew the nut.

Pass a length of bar through the small-end bearing, and, taking care not to damage the crankcase top joint face, turn the engine until it is locked solid.

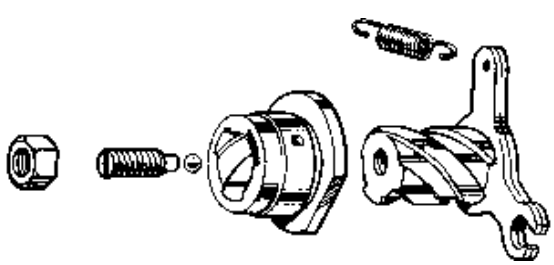

FIG. B8.

The generator rotor is secured to the keyed engine shaft by one large nut and spring washer. Undo this, pull off the rotor and extract the Woodruff key from the shaft.

Using the same method remove the self-locking nut securing the engine sprocket. Remove the chain by releasing the spring link and threading it out.

CLUTCH PLATE DISMANTLING

Take off the clutch cover plate, retained by three small screws with spring washers. Now, using service tool No. 61-319 (as shown in B9) compress the clutch springs to allow the large plate retaining circlip to be removed.

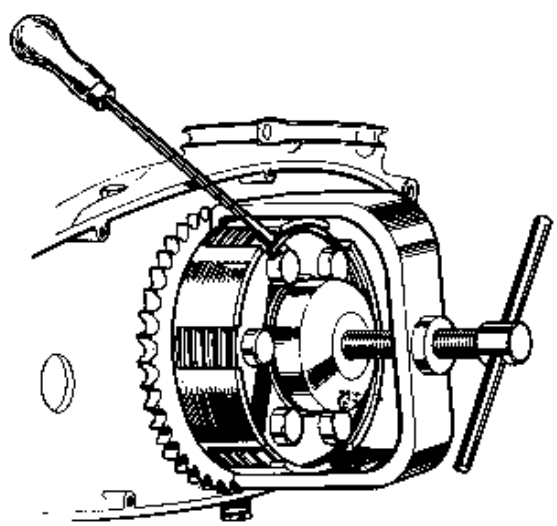

FIG. B9.

Remove the tool, and lift off, and lift off the retaining plate complete with springs and cups. The pressure plate, and friction plates can now be taken out for inspection. Take care not to loose the mushroom-headed push rod which fits in the end of the mainshaft. If the clutch plates or springs are the only items requiring attention the clutch not be dismantled any further.

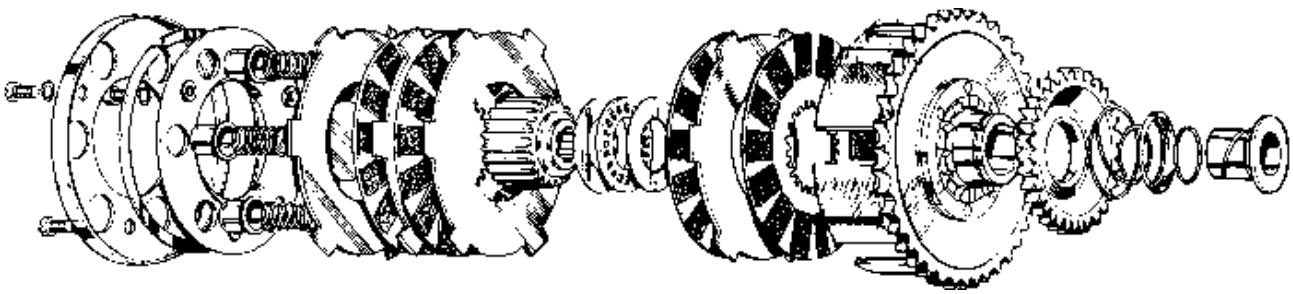

FIG. B10.

New clutch springs have a free length of 1-9/64" (29 mm.) and if this length has reduced by more than 1/32" (0·8 mm.) it is recommended that a new set be fitted.

The four driving plates have segments of a special friction material securely bonded to the metal.

All these segments should be complete and unbroken. Even if there appears to be no damage to the plates or segments, the overall thickness of each segment should be measured. The thickness of a new driving plate is ⅛" (3·2 mm.) and if the wear is excessive the plates should be renewed.

The tags on the outer edges of the plates should be a reasonable fit in the housing slots. If there are any burrs on the tags, renew the complete plate.

The three plain driven plates should be free from score marks, and must be perfectly flat. To check the latter lay the plate on a piece of plate-glass, or other known flat surface: if it can be rocked it is obviously buckled and must be replaced with a new one.

Service tool No. 61-3796 must now be used to pull the engine sprocket off the tapered shaft, but do not forget to first screw in the protector bolt, as the end of the shaft is easily damaged. After removing the sprocket, tap out the small Woodruff key, and take off the rubber oil seal and steel collar.

The crankcases are now about ready for splitting. First take out the twelve Phillips-head screws from around the outer edge of the case on the generator side, two of which are to be found below the cylinder barrel flange, and then remove the four screws from around the gearbox sprocket.

Tap out the two hollow dowels from each end of the case, through the upper engine bolt holes, using a suitable drift.

The crankcase halves can now be parted by gently tapping with a hide-mallet. Under no circumstances should any attempt be made to lever the crankcase halves apart as this will cause irreparable damage to the joint face.

When the crankcases have been separated the sleeve pinion can be tapped out of the bearing in the left-hand crankcase. Check for any shims stuck to the main bearing.

The flywheels can now be removed from the right-hand half, by tapping the crankcase with a hide-mallet taking care not to damage the joint faces. Take careful note of the number and positions of any shims on either of the flywheel shafts.

GEARBOX DISMANTLING

First take off the loose fitting light coil spring, and lift the selector plate off the gearchange spindle. Withdraw the spindle, complete with return spring from the case.

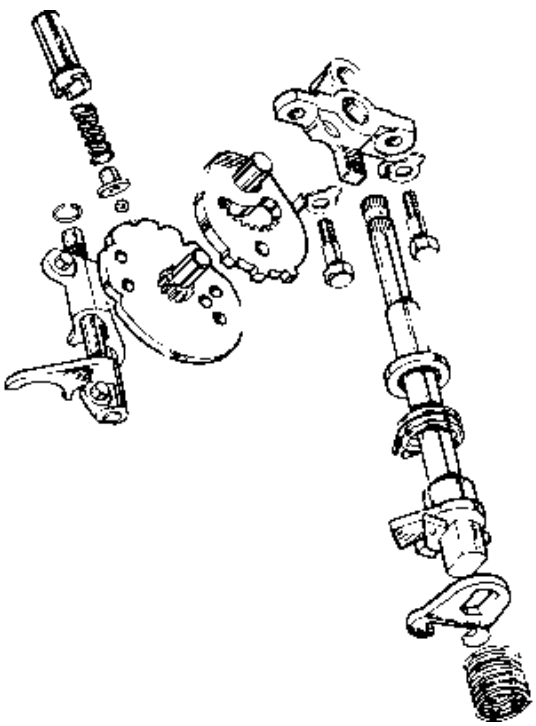

FIG. B11.

The kickstart mechanism can now be removed from behind the clutch, by releasing the clock-type spring and lifting the quadrant clear.

Gently withdraw the layshaft with its fixed top and second gear, and lift out the remaining layshaft second and bottom gear.

To enable the mainshaft gears to be removed it will be necessary to take off the cam plate mounting bracket. Bend back the tab washers and take out the two fixing bolts. Carefully lift out the cam plate, mainshaft sliding gear and selector forks, taking care not to lose the two loose fitting rollers which locate the selector forks in the cam track.

The cam plate plunger spring, seating and ball are a loose fit in their socket at the back of the case, and should be removed now to prevent any loss of parts.

Hold the crankcase assembly firmly in a soft-jawed vice gripping the gearbox mainshaft.

REMOVAL OF CLUTCH HUB

With the gearbox mainshaft held firmly in a soft-jawed vice, remove the clutch centre nut and washer, which will release the clutch centre pinion, thrust bearing and two washers and the clutch chainwheel.

The kickstarter ratchet pinion is held on to the chainwheel by a circlip which, when removed, releases the pinion, spring and retainer.

The gearbox mainshaft complete with its fixed first gear, and third gear, can now be withdrawn.

GEARBOX INSPECTION

The mainshaft third gear is held against the mainshaft first gear by a circlip. This gear should spin freely on the shaft without excess play.

The layshaft second gear is held against the layshaft fixed gear by a similar circlip, and this gear should also spin freely without excess play.

All dogs and teeth should be free from signs of excess wear and pitting, and the sliding gears should be a good sliding fit on their splines. The diameters of the shaft that run in bushes should be smooth and polished, free from signs of seizure and picking up.

The selector forks should be lightly polished on their forks, and should run freely in their sliding gears.

The selector fork rod should be a good fit in the right-hand crankcase and should be straight. The selector forks should slide up and down the shaft, if it is suspected that the shaft is bent it can be checked by rolling on a surface plate or a piece of plate-glass.

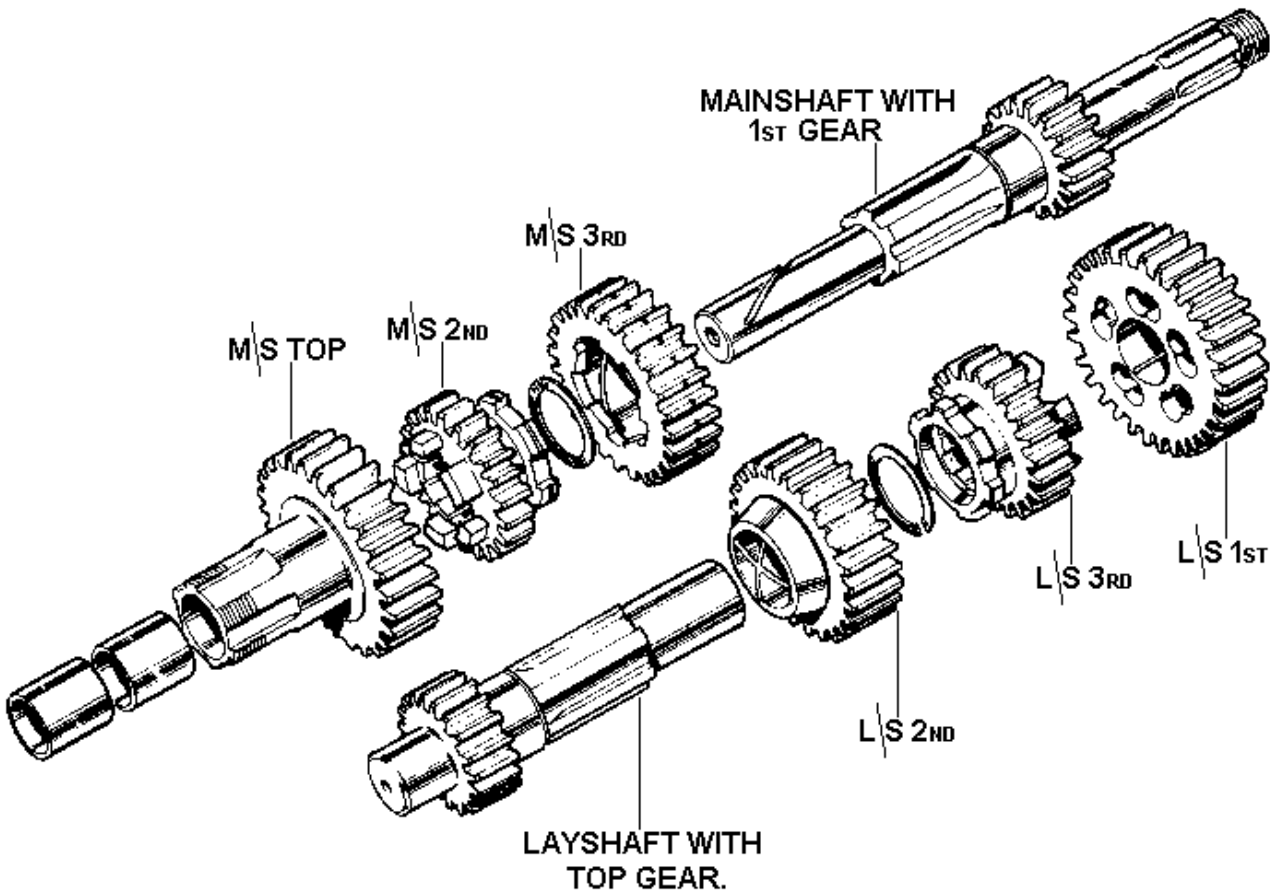

FIG. B12.

The pegs in the cam plate and quadrant should be secure and the dogs on the quadrant and the corresponding claws on the selector plate should be in good condition.

ATTENTION TO FLYWHEELS

Whilst at this stage it is advisable to check the big-end for signs of wear. Hold the connecting rod at its highest point of travel and try gently but firmly to push and pull the rod in the direction of travel. If the big-end is sound there should be no play in this direction though it may be possible to rock the rod sideways. The sideways play is permissible provided the connecting rod does not catch on the flywheels at any point, but if any vertical play is detected it must be decided if the amount is permissible or not.

The bearing is of ample dimensions for the work it has to do and, provided that the engine has been carefully used and adequately lubricated, the bearing is unlikely to need replacement.

If the bearing has noticeably deteriorated as the result of neglect or abuse, the flywheels must be parted to gain access to the bearing.

The flywheels are a press-fit on to the ends of the crankpin and no attempt should be made to part them unless the services of an expert mechanic and a fully equipped workshop are available.

To part the flywheels first place the assembly in the bolster and position the stripping bars as shown in Fig. B13. Using the punch, drive out the crankpin and take off the uppermost flywheel. Reverse the assembly in the bolster and again drive out the crankpin, releasing the other flywheel.

To reassemble the flywheels, place the left-hand flywheel into the bolster and, using a suitable hand press, insert one end of the new crankpin.

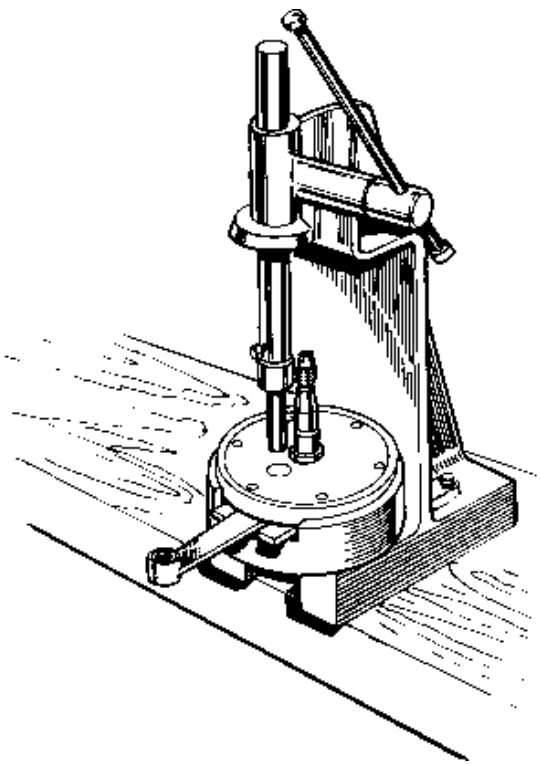

FIG. B13. *Parting the flywheels.*

Position the second flywheel over the crankpin and, using one of the stripping bars as shown in Fig. B14, press the flywheel on to the crankpin.

The flywheel assembly must now be aligned within the necessary limits. Two of the actual or similar bearings used in the engine should be fitted to the shafts and the assembly mounted in vee-blocks as shown in Fig. B15. Using a dial micrometer, measure the accuracy of the assembly. Any necessary should be made by the careful use of a mallet or lead hammer. The wheels should be brought within the limit of ·004" on the rims, ·006" on the inner faces and a maximum of ·002" on the shafts.

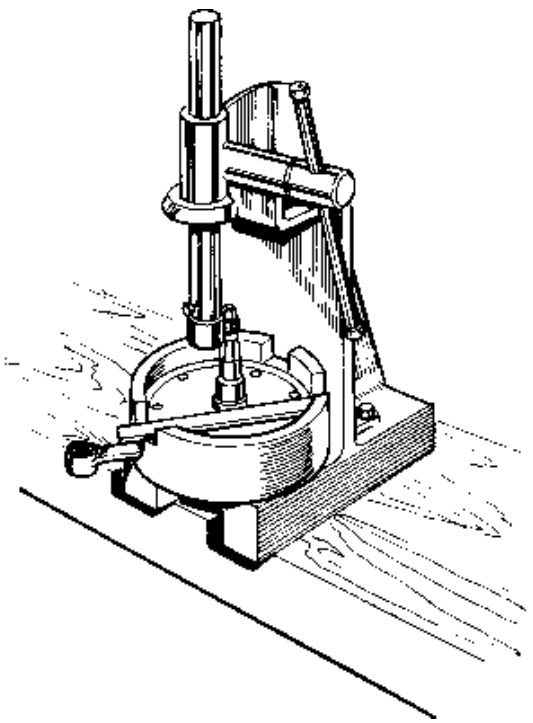

FIG. B14. *Reassembling the flywheels.*

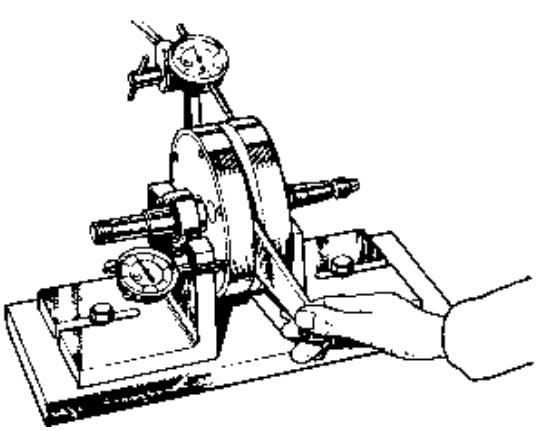

FIG. B15.
Checking the flywheel assembly.

Having checked the flywheels for concentricity, it will now be necessary to check the end float of the shafts. Place a ·010" shim on the right-hand spindle and insert it through the main bearings and oil seal in the case. Fit the left-hand oil seal, bearing and case, and temporarily screw the case halves together. Measure the amount of end float on the flywheel shafts, which should be between ·004" and ·006". Remove the left-hand crankcase and fit the required shims to the shaft, next to the flywheel. The shims are available in the following sizes: ·001" (90-0152), ·004" (90-0153), ·005" (90-0154), and ·010" (90-0155). Part numbers are shown in brackets.

If, during dismantling, the flywheel assembly was not disturbed, the standard ·010" shims can be replaced in their original positions.

BEFORE ASSSEMBLY

Before assembly all components should be thoroughly cleaned and checked for signs of wear. All joint faces should be cleaned of all old jointing compound, and if possible the crankcase halves should be lightly lapped together to check for distortion. Carefully examine all threads, bushes and bearings.

The flywheel assembly runs on three ball bearings, two on the drive-side and one on the generator side. Before trying to remove these bearings it is advisable to warm the crankcase halves. The bearing on generator side, and the outer bearing on the drive-side are both retained by circlips, and can therefore only be knocked out from one side.

Whenever the engine is stripped it is advisable to replace all oil seals.

ENGINE ASSSEMBLY

Fit the gearbox mainshaft through its bearing in the right-hand crankcase, and grip the mainshaft in a soft-jawed vice.

Assemble the clutch drum and kickstart ratchet pinion, having first checked the ratchet teeth for signs of wear.

The kickstarter ratchet engages on the clutch drum and is followed by a spring, a retainer, and the circlip. Check that the ratchet spins freely on the clutch drum.

Slide the hardened steel thrust washer over the mainshaft, followed by the cylindrical mainshaft bush. Replace the clutch drum. Grease the thrust bearing, the two large steel washers and assemble the "sandwich" on to the clutch centre. Slide the assembly carefully on to the mainshaft splines taking care not to trap the needle trust bearing. Fit the steel washer and nut and taking care that the clutch drum spins freely, fully tighten the clutch center nut.

If it was removed, replace the gearchange cam plate plunger socket together with spring, ball, and a little grease.

Place the layshaft first gear in position and prepare to assemble the selector forks. The forks are handed, and when the two flat edges are together the roller pegs should be in line. Lightly grease the rollers, and assemble on the pegs and fit the selector forks on to the selector fork spindle.

Assemble the cam plate, quadrant and mounting bracket, ensuring that the center of the gear lines up with the centre line of the small hole in the quadrant, and the neutral slot.

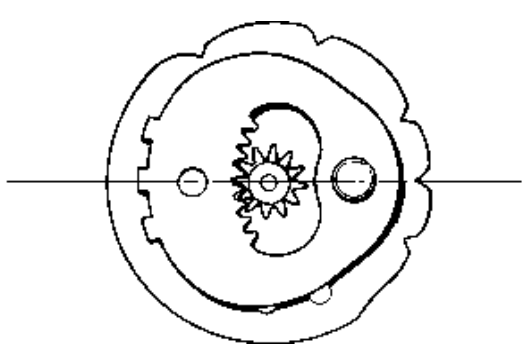

FIG. B16.

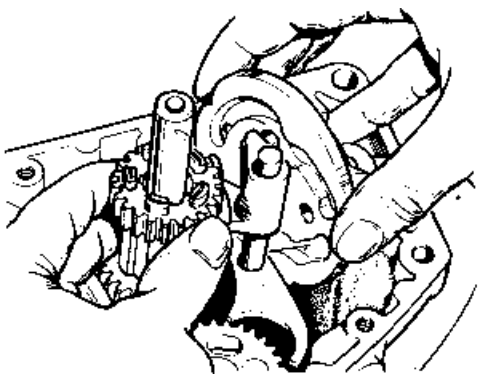

FIG. B17. *Assembling gearbox.*

Loosely assemble the mainshaft sliding gear, identified by saw cuts around the dogs, its selector fork, and the cam plate. Pass the sliding gear over the mainshaft and slide the assembly into position.

Engage the layshaft sliding gear in its selector fork and the selector fork rollers in their tracks, and secure the cam plate in position with two bolts and tab washers. Insert the layshaft complete with the free pinion retained by a circlip, and pass it through the layshaft sliding gear, and first gear, into its bush in the crankcase.

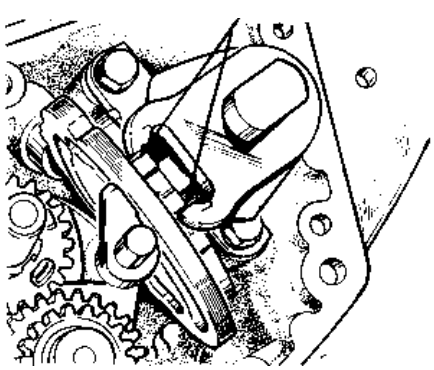

FIG. B18. *Centralising the selector claw.*

Refit the return spring to the gearchange spindle. The ends of the spring locate over a projection on the cam plate mounting bracket, acting as a centralising device for the claw. Place the distance piece below the spring and replace the spindle in the case. Locate the selector claw, if it is not central it must be adjusted by bending the spring.

The operation of the gearbox should be checked by spinning the gears, and trying to select all four gears and neutral.

Withdraw the gearchange spindle, and turning to the other side of the engine, place the kickstart in position. Fit the clock-type spring on to the kickstarter quadrant shaft, and the circular distance plate between the case and the spring. Give the spring one turn of tension, and push the kickstarter quadrant home in its recess, with the quadrant against its stop below the dowel hole. Replace the dowel to stop the quadrant unwinding the spring. Replace the gear selector shaft from the other side, not forgetting the spacer below the spring.

Fit the sleeve pinion, complete with its two mainshaft bushes, into its bearing in the left-hand crankcase. Lightly grease the distance piece to assist its passage over the oil seal, and replace with chamfer innermost. Fit the sprocket, lockwasher, and nut, then locking the sprocket with a length of chain held in a vice, tighten the nut. Check that the assembly spins freely. Bend the edge of the washer over the flat of the nut to secure.

Apply a liberal coating of oil to the flywheel shafts, and fit the assembly complete with the correct shims, into the right-hand crankcase half.

Paint the joint faces of both crankcase halves with a good sealing compound and fit the cases together. Spin the gearbox as the layshaft enters its bush, to prevent burring. Do not use excess force to fit the cases together. If any difficulty is experienced part the cases and check.

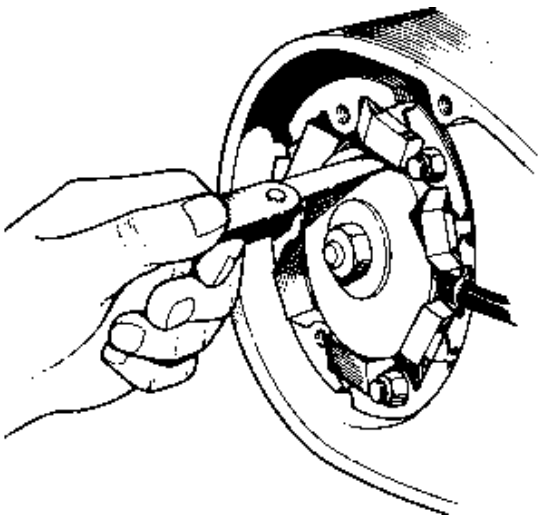

FIG. B19.

Insert the hollow dowels into each end of the case. Replace the twelve short Phillips screws round the crankcase edge on the generator side, the three screws round the gearbox sprocket, and the long screw in the machined face above the gearbox sprocket. Note that spring washers are fitted under the heads of all crankcase fixing screws except the short screw in the upper rear engine mounting lug, and the long screw above the gearbox sprocket set into the inner generator cover joint face.

Before fully tightening the screws it is advisable to check the operation of all gears and ensure that the flywheels rotate freely.

Replace the Woodruff key in its shaft and fit the generator with its marked face outwards. Using a suitable bar through the connecting rod small-end, tighten the fixing nut on to its spring washer.

Check the long clutch push rod to see if it is bent by rolling it along a flat surface. Insert the long push rod with its rubber sleeve, into the hollow gearbox mainshaft. The inner cover, complete with clutch actuating lever, can now be replaced and held in position with one screw at the rear, and a solid dowel at the front.

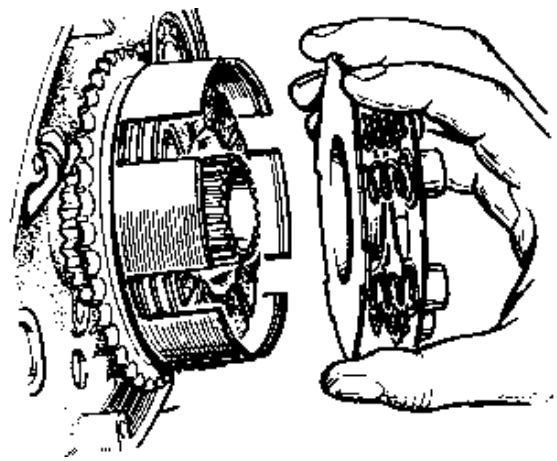

FIG. B20.

Fit the distance pieces over each generator stud, and replace the stator. The stator is correctly fitted when the cable assumes a three-o'clock position and is outward. Replace the fixing nuts with their spring washers noting that the special nut is fitted at the front. It is essential that the air gaps between the rotor and stator are equal, and are a minimum of 0·008" (0·2 mm.). Use a feeler gauge to check the gaps, correcting any discrepancies by slackening the fixing nuts, inserting a feeler in the tight side, and retightening the nuts.

The outer cover need not be replaced until the clutch has been adjusted, as detailed on page B19.

Now turning to the primary drive-side of the engine replace the steel collar, rubber oil seal ring, and key, and then fit the engine sprocket on to its tapered shaft. Fit the self-locking nut, and with engine locked by a bar through the small-end, fully tighten.

Insert the small mushroom-headed push rod into the centre of the mainshaft from the clutch side. Fit the plates, starting with one bonded friction plate, plain plate, and a bonded plate alternately. Assemble the caps and springs in the retaining plate, and the domed pressure plate, and fit on to the clutch hub.

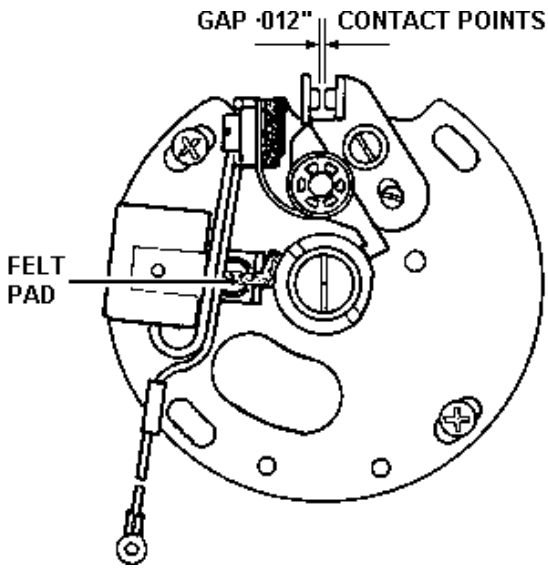

FIG. B21. *The contact breaker.*

Using service tool No. 61-3191 compress the clutch springs and fit the large plate retaining circlip. Replace the cover plate and secure with three screws. Details of adjustment are given on page B19.

Fit the primary chain over the sprockets, and join the ends with a connecting link. Note that the spring link should be fitted with its closed end pointing in the direction of travel. Because the primary chain operates on short fixed centres no provision has been made for adjustment. If an appreciable amount of slack is evident, the chain should be renewed.

Replace the primary cover after fitting a new gasket, and secure with five fixing screws. Ensure that the contact breaker oil seal is not displaced as the cover is fitted.

Replace the contact breaker plate with the points at the top. See that the screws are centrally located in the elongated holes to allow for adjustment either way. Refit the cam on the shaft, but do not fully tighten the screw.

Engine assembly from this point should proceed as detailed in Reassembly, after decarbonising, on page B7.

IGNITION TIMING

Contact Breaker Gap

In order to maintain correct ignition timing the contact points must be set to the specified gap when in the fully open position. Rotate the cam (if free) or the engine, until the heel of the moving contact is at the highest point of the cam, when the points will be fully open. Using a feeler gauge, check the gap is ·012" (·3 mm.). If it is found to be incorrect, loosen the fixed contact screw and turn the eccentric pin until the correct gap is obtained. Finally, tighten the fixing screw and re-check the setting.

It is most important that the contact breaker gap is accurately set and regularly maintained, as any variation in the setting tends to alter the ignition timing. Widening the points gap advances the ignition; closing the gap retards the ignition.

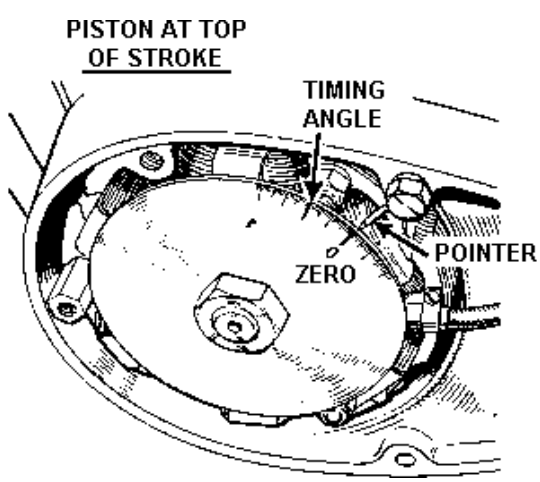

FIG. B22. *Degree plate.*

Piston Position
Before checking the ignition timing, the piston must first be set at the recommended position before top dead centre on its compression stroke. This position can be accurately set with the aid of a degree plate. The outer timing cover should first be removed and the degree plate mounted centrally on the engine shaft, against the rotor. A suitable pointer should then be attached to some convenient part of the engine with the point adjacent to the plate (see Fig. B22). Rotation of the engine through several degrees near the top dead centre position produces very little piston movement, making the actual top dead centre very difficult to find. It is a good point therefore to use a suitable stop (such as a dummy plug with a projection into the cylinder head) so that the piston can be brought gently against it.

Bring the piston slowly up to the stop by rotating the engine as far as it will go, first in a clockwise direction, then in an anti-clockwise direction. Take degree plate readings at each position and calculate the point midway between them. The result will give you an accurate top dead centre of the piston. Loosen the timing disc retaining nut and turn the disk until the zero mark corresponds with the pointer.

From this position, rotate the engine **backwards** to obtain the desired reading of 16½° on the plate.

Setting the Ignition Timing
With the piston at 16½° before top dead centre, the contact points should just be separating.

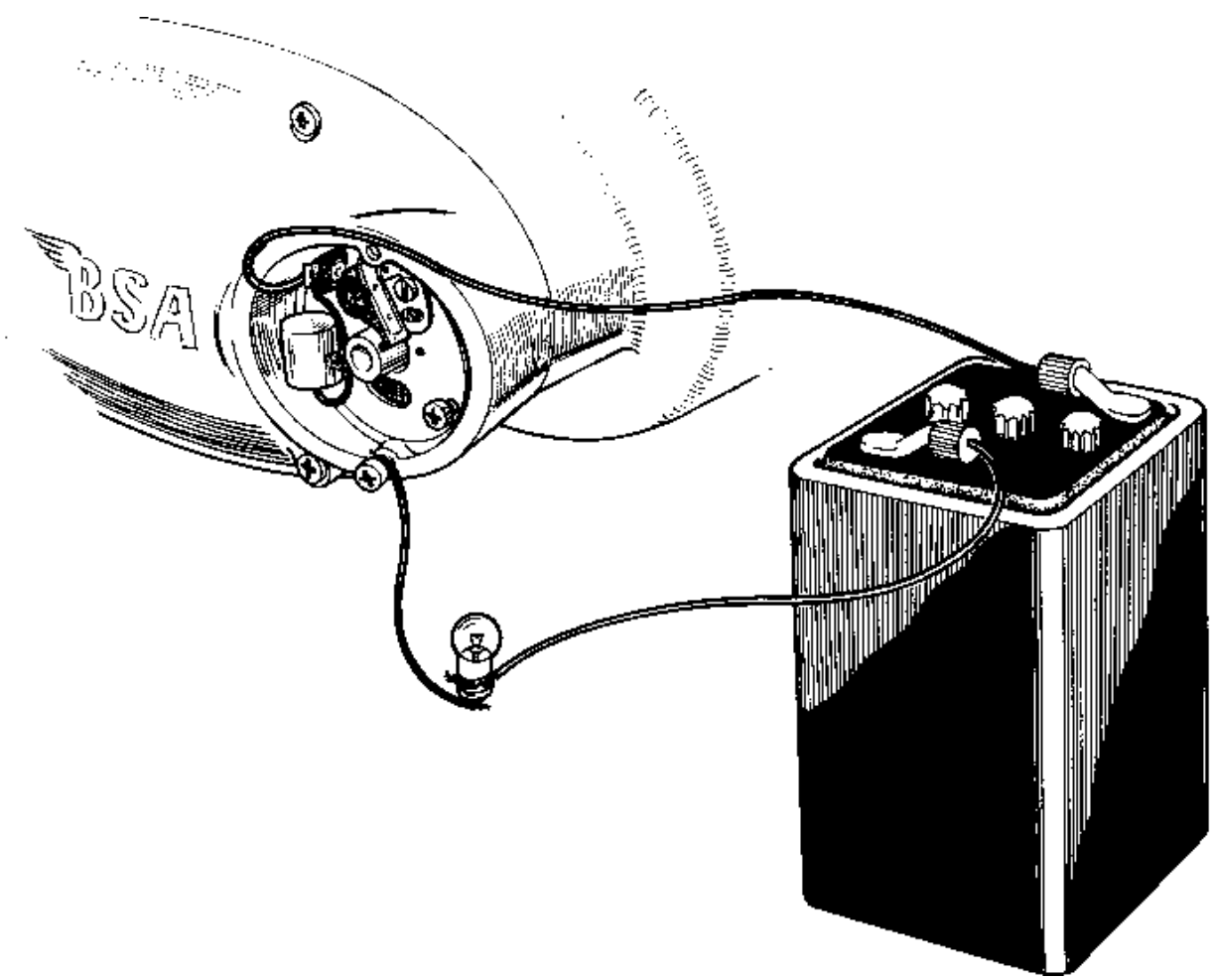

FIG. B23. *Setting the ignition timing.*

An accurate means of checking the opening of points can be made by connecting a battery and bulb in circuit with the points, as shown in Fig. B23. Attach one lead between the moving contact spring and the battery terminal. Take a second lead from the other battery terminal to a bulb, then from the base of the bulb to a good earthing point on the machine. As soon as the contact points open, the circuit will be instantly broken and the light will go out.

With the fixing screw loosened, turn the central cam until the points are just opening, then lock in position by tightening the screw fully.

Re-check the setting and make any finer adjustments by turning the contact plate. Finally tighten all the fixing screws and replace the circular cover with its gasket.

CLUTCH ADJUSTMENT

Provision for clutch adjustment has been made at the sprocket end of the gearbox mainshaft an consists of an adjusting pin, screwed into the actuating lever boss, and a locknut. The adjusting pin presses against a steel ball, located on the end of the clutch push rod which passes through the hollow mainshaft.

Access is gained through the hole in the cover blanked off with a rubber plug.

In order to ensure that the clutch springs exert their full pressure on the friction plates, the operating mechanism must be adjusted so that there is a slight amount of play between the pin, the steel ball and the push rod.

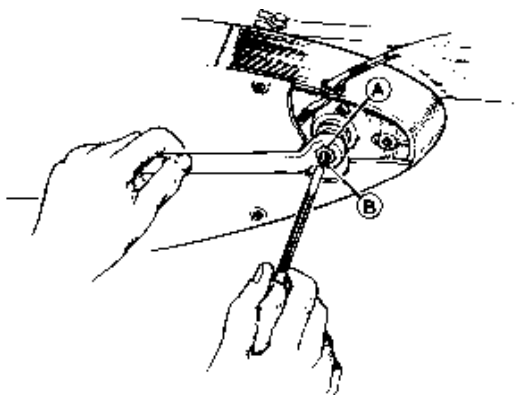

FIG. B24. *Clutch adjustment.*

If there is insufficient play between these items, the clutch will continually tend to slip, owing to lack of spring pressure. This will cause rapid overheating and eventually, serious damage to the clutch. However, if the play is allowed to become excessive, difficulty will be experienced in changing gear, as the clutch may not fully disengage.

To adjust the clutch, release the locknut (*A*) and unscrew the adjusting pin (*B*) one or two turns with a screwdriver. Now, whilst holding the locknut with a spanner, slowly screw in the adjusting pin until it is felt to meet some resistance, then unscrew it half a turn. Holding the pin in this position, retighten the locknut. After correctly making the adjustment in the described manner, a small amount of free movement at the clutch lever will be felt before the spring pressure is taken up during the action of declutching.

Note that a grease nipple is provided in the cover to facilitate regular lubrication of the clutch mechanism at the intervals quoted on page A2.

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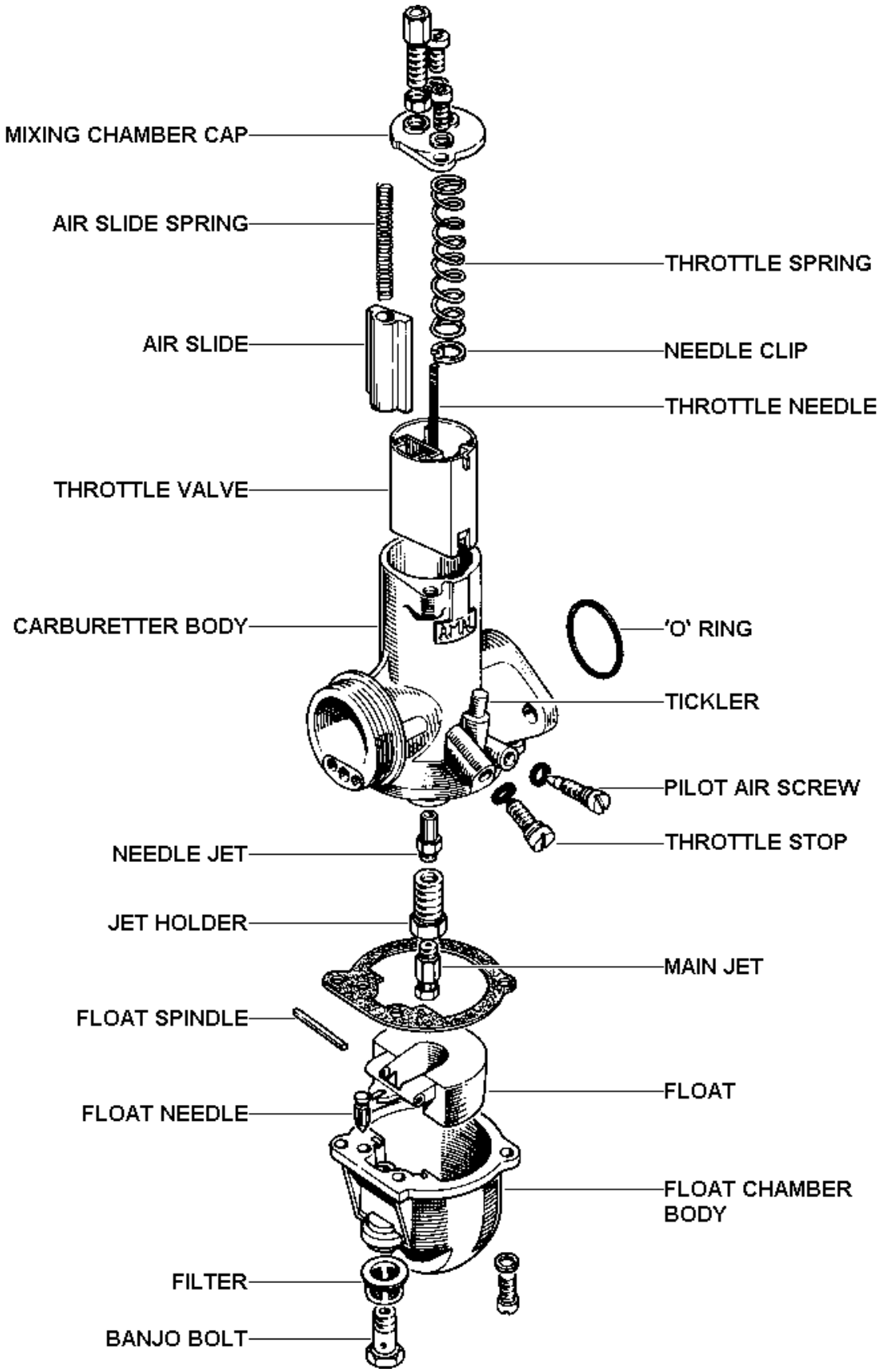


FIG. C.1. *Concentric carburetter exploded*

DESCRIPTION

All the D14 Bantam models are fitted with an Amal carburetter having a concentric float chamber and a cable operated air valve. The only variation between the models is in the lengths of the control cables.

The carburetter, because of the sizes of its jets and choke bore, proportions and atomises just the right amount of petroil and air, to provide the mixture for combustion and give adequate lubrication.

The float chamber maintains a constant level of fuel at the jets and incorporates a valve to cut off the fuel supply when the engine is stopped.

The throttle, opened from the handlebar twist grip, controls the volume of mixture and therefore the power.

At tick-over the mixture is controlled by the pilot jet. As the throttle is opened this is added to by a supply from the main jet, controlled by the needle in the needle jet until, at three-quarter throttle, the main jet takes over.

The pilot supply is controlled by a small jet, situated in the base of the mixing chamber within the float chamber.

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 petroil/air mixture through the primary air choke, into the main air choke. This primary air choke has a compressing 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.

The carburetter also has an independently operated mixture control known as an air slide, for use when starting from cold. This slide partially blocks the passage of air through the main choke, enrichening the mixture.

DISMANTLING AND REBUILDING (Concentric Float Chamber)

Unscrew the two fixing nuts and withdraw the carburetter from its mounting studs; it will not be necessary to detach the cables from the handlebar controls.

Take out the two Phillips-head fixing screws and remove the carburetter top cover complete with throttle valve and air slide 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. Take care not to lose the needle clip when taking off the spring.

To release the air slide, compress the spring and slip the nipple out of the base of the slide.

Unscrew the "banjo" bolt which secures 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 is a press-fit into the chamber body and that the needle is retained in position by the rear forked end of the float.

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

Take out the throttle stop adjusting and pilot air adjusting screws and ensure that the small rubber "O"-ring on each screw is in good condition before replacing. These "O"-rings are necessary to retain any adjustments made with the screws.

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 (gasoline). Hard deposits on the carburetter body are best removed with a light-grade wire brush. After washing the parts in clean petrol, allow to dry and ensure that all holes or small drillings are free from dirt. A hand pump is ideal for "blowing through" and blockages in the drillings. Inspect the component parts for wear and check that the jets are in accordance with the recommended sizes in General Data.

Reassembly is simply a reversal of the above instructions but remember to replace any gaskets or "O"-rings that appear unserviceable. Refer to fig. C1 for guidance.

INSPECTING THE CARBURETTER COMPONENTS

The parts most liable to show wear after considerable mileage are the throttle valve slide and the 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 slide should be renewed; be sure to fit valve with correct degree of cut-away (see General Data).

(2) See that the air slide has not been subjected to excessive wear and that it is a good fit in the jet block. Ensure also that the valve return spring is serviceable.

(3) Check the throttle return spring for efficiency. Check also that it has not lost its compressive strength by measuring the free length and comparing it with the figure given on page GD3.

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

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

(6) Ensure that the float is not punctured by shaking it to see if it contains any fuel. Do not attempt to repair a damaged float. A new one can be purchased at a small cost.

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

HINTS AND TIPS

Throttle Cable
See that there is a minimum of backlash when the twist grip is turned back and that any movement of the handlebar does not cause the throttle to open.

Use the adjuster on the cable to obtain the correct setting and ensure that the throttle valve shuts down freely.

Fuel Feed
Unscrew the float chamber "banjo" 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. To check fuel flow before replacing the "banjo", turn on fuel tap momentarily and see that the fuel gushes out.

Flooding
This may be due to a worn needle or a punctured float, but is more likely due to impurities (grit, fluff etc.) in the tank. This trouble can sometimes be cleared by periodically cleaning out the float chamber. If, however the trouble persists, the fuel tank must be drained and swilled out.

Carburetter Air Leaks
Erratic slow-running is often caused by air leaks between the joints at the carburetter flange and the cylinder and can be detected by applying oil around the joints.

Eliminate by fitting new joint washers and tightening the flange nuts evenly to a torque wrench setting of 10—12 lb./ft.

Also check that the rubber sealing ring in the carburetter flange is undamaged and located correctly.

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

Banging in Exhaust
This may be caused by too weak a pilot mixture when the throttle is closed or nearly closed. It may also be caused by too rich a pilot mixture and an air leak in the exhaust system. The reason in either case is that the mixture has not fired in the cylinder but has fired in the hot silencer.

If the banging occurs when the throttle is fairly wide open, the trouble will be traced to ignition, not carburation.

Excessive Fuel Consumption
If this cannot be corrected by normal adjustments, it may due to flooding caused by impurities from the fuel tank lodging on the float needle seat, so preventing its value from closing. The float needle should also be checked for wear or damage.

High consumption can also be caused by a worn needle jet and may be remedied or improved by lowering the needle in the throttle. If this method is unsatisfactory, then a new needle and needle jet will have to be fitted.

There are many other causes of high fuel consumption and it should not be assumed that the fault lies in the carburetter alone.

Air Filters
If a carburetter is first set with an air filter and then the engine is run without, the jet setting may be affected and care must be taken to avoid overheating the engine due to a weak mixture. Testing with the air control will indicate if a larger main jet and higher needle position are required.

Air Control
The air control should at all times be kept open except when starting from cold. When the engine fires, the control must be opened.

Repeated operation of the kickstart pedal with the air valve closed results in an accumulation of liquid petrol in the crankcase and until this has been drained away, it will be quite impossible to start. The crankcase drain plug is the smaller of the two plugs under the crankcase. If poor starting re-occurs, then the fault will most likely be found in the ignition system.

Effect of Altitude on a Carburetter
Increased altitude tends to produce a rich mixture; the greater the altitude, the smaller the main jet required. Carburetters ex-works are suitably set for use in altitudes up of to approximately 3,000 feet. Carburetters used constantly in altitudes of between 3,000 to 6,000 feet should have a reduction in main jet size of 5 per cent. 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 of weakness of petroil/air mixture.

Indications of Richness
Black smoke in exhaust.
Fuel spraying out of carburetter.
Two-strokes, four-stroking.
Heavy lumpy running.
Sparking plug sooty.

Indications of Weakness
Spitting back in carburetter.
Erratic slow-running.
Over heating.
Engine goes 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 the jets and passages are clear, that filter gauze in float chamber "banjo" connection is not choked with foreign matter, and that there is ample flow of fuel. Also ensure there is no flooding.

(2) Air leaks — usually at the flange joint.

(3) Defective or worn parts — such as loose fitting throttle valve, worn needle jet, loose jets.

(4) Air cleaner choked up.

(5) An 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 is no air leaks etc., check the ignition. Now test to see if the mixture is rich or weak by partially closing the air valve and noting how the engine runs. If the engine runs better, weakness is indicated, but if the engine runs worse then the mixture is too rich.

To remedy, proceed as follows:—

To Cure Richness

Position 1. Fit smaller main jet.
Position 2. Screw out pilot air adjusting screw.
Position 3. Fit a throttle with a larger cut-away (see paragraph E, page C7).
Position 4. Lower needle one or two grooves (see paragraph D, page C7).

To Cure Weakness

Position 1. Fit larger main jet.
Position 2. Screw pilot air adjusting screw in.
Position 3. Fit a throttle with a smaller cut-away (see paragraph E, page C9).
Position 4. Raise needle one or two grooves (see paragraph D, page C7).

(Positions 1, 2, 3 and 4 refer to positions of throttle openings as shown in figure C3, page C8.)

NOTE:—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

Figure C2 is a sectioned diagram of the concentric carburetter body, showing the throttle adjusting screw (*A*), and the pilot air adjusting screw (*B*).

PARAGRAPH "A" — **Throttle Adjusting Screw** Set this screw to hold the throttle open sufficiently to keep the engine running when the twist grip is shut off.

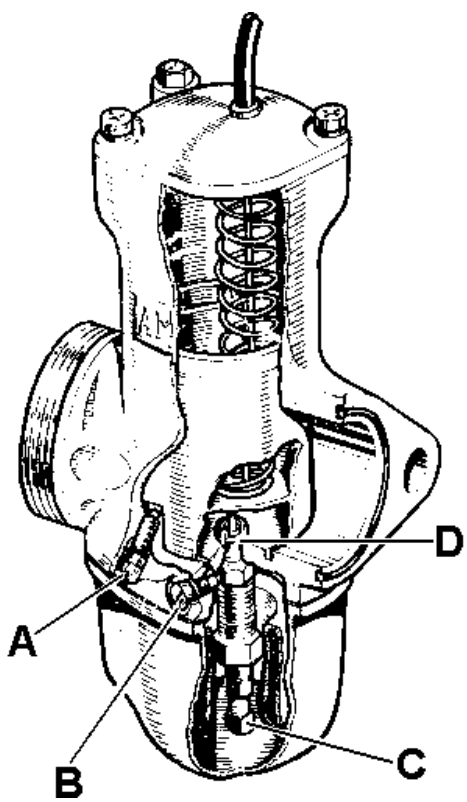


FIG. C2.

PARAGRAPH "B" — **Pilot Air Adjusting Screw** This screw regulates the strength of the pilot mixture for "idling" and for the initial opening of the throttle. The screw controls the depression on the pilot jet by metering the amount of air that mixes with the fuel.

PARAGRAPH “C” — **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, get another the right size. The bigger the number the bigger the jet.

To gain access to the main jet, the concentric float chamber must first be removed (two screws).

PARAGRAPH “D” — **Needle and Needle Jet**
The needle is attached to the throttle valve and being taper — either allows more or less fuel to pass through the needle jet as the throttle is opened or closed throughout the range, except when idling or nearly full throttle. The taper needle position in relation to the throttle opening can be set according to the mixture required by fixing it to the throttle valve with the jet needle clip in a certain groove, thus either raising or lowering it. Raising the needle richens the mixture and lowering it weakens the mixture at throttle openings from one-quarter to three-quarters open.

PARAGRAPH “E” — **Throttle Valve Cut-away**
The atmospheric side of the throttle is cut-away to influence the 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 throttle valve, *viz.,* 389/3½ means throttle valve type 389 with number 3½ cut-away; larger cut-aways, say 4 and 5, give weaker mixtures and 2 a richer mixture.

PARAGRAPH “F” — **Air Valve**
This is only used for starting the engine, and for experimenting with air supply. It must be fully open when the engine is running.

PARAGRAPH “G” — **Tickler or Primer**
This is a small spring-loaded plunger, in the float chamber wall. When pressed down on the float, the needle valve is allowed to open and so "flooding" is achieved. Flooding temporarily enrichens the mixture until the level of the fuel subsides to normal.

TUNING THE CARBURETTER

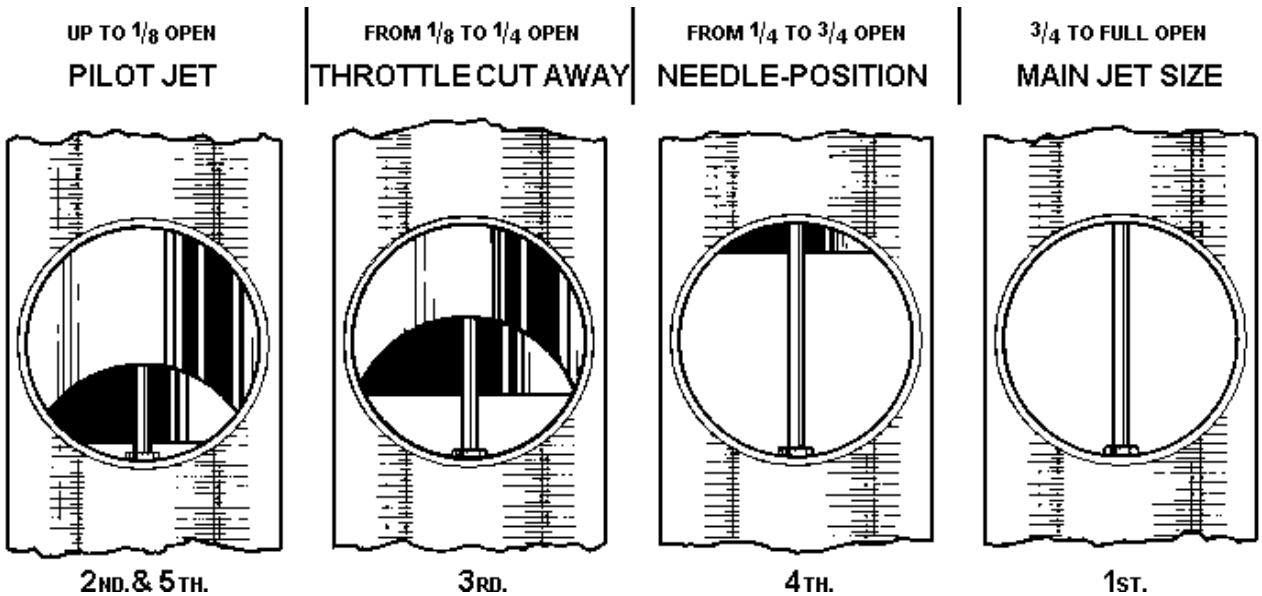
Tune-up in the following order
Read remarks in sections above for each tuning device and get the motor going perfectly on a quiet road with a slight up-gradient so that on test the engine is pulling under load.

FIRST — **Main jet** with throttle in position 1, Fig. C3. 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 or the air valve is slightly closed, then the main jet is too small.

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

If testing for speed work, ensure that the main jet size is sufficient for the mixture to be rich enough to maintain a cool engine. To verify this, examine the sparking plug after taking a fast run, declutching and stopping the engine quickly. If the sparking plug has a cool appearance the mixture is correct; if sooty, the mixture is rich; if however, there are signs of intense heat, the plug being very white in appearance, the mixture is too weak and a larger main jet is necessary.

SECOND — **Pilot jet** (Fig. C3) with throttle in positions 2 and 5. With engine idling too fast with the twist grip shut off and the throttle shut down on to the throttle adjusting screw, and ignition set for best slow-running; (1) screw out throttle adjusting screw until the engine runs slower and begins to falter, then screw pilot air adjusting screw in or out, to make engine run regularly and faster.



SEQUENCE OF TUNING
FIG. C3.

(2) now gently 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.

THIRD — **Throttle cut-away** with throttle in position 3 (Fig. C3). If, as you take off from the idling position, there is an objectionable spitting from the carburetter, slightly richen the pilot mixture by screwing in the air screw. If this is not effective, screw it back again, and fit a throttle 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 lower throttle cut-away is required to cure richness.

FOURTH — **Needle** with throttle in position 4 (Fig. C3). The needle controls a wide range of throttle openings and also the acceleration. Try the needle in as low a position as possible, *viz.,* with the clip in a groove as near the top as possible; if acceleration is poor and with the air control partially closed, the results are better, raise the needle by two grooves; if very much better then try lowering the needle by one groove and leave it where it is best. If mixture is still to rich with clip in groove number one nearest the top, the needle jet probably wants replacement because of wear. If the needle itself has had several years of use, replace it also.

FIFTH — **Finally,** go over the idling again for final touches.

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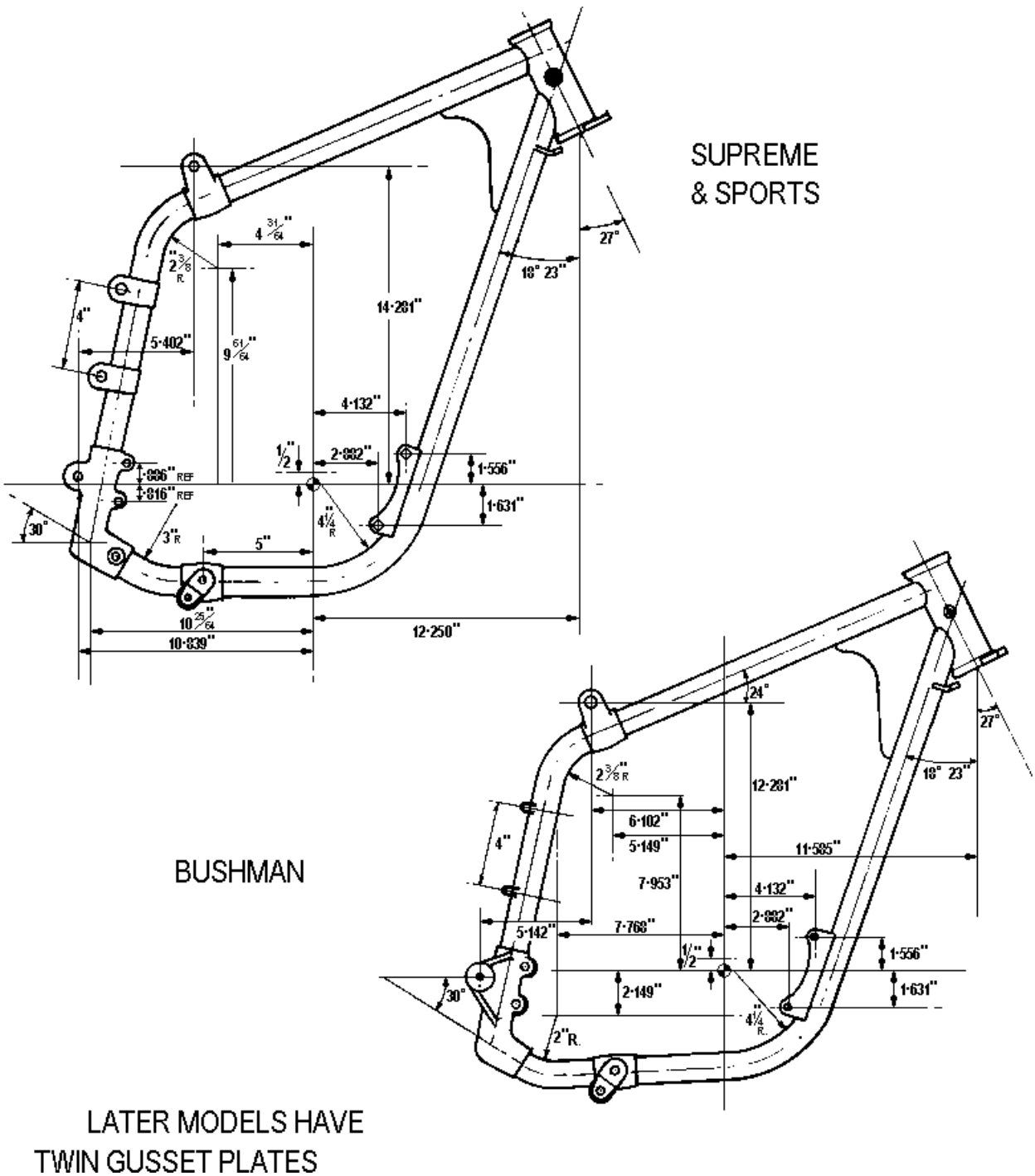

FIG. D1. *Frame dimensions.*

FRAME ALIGNMENT

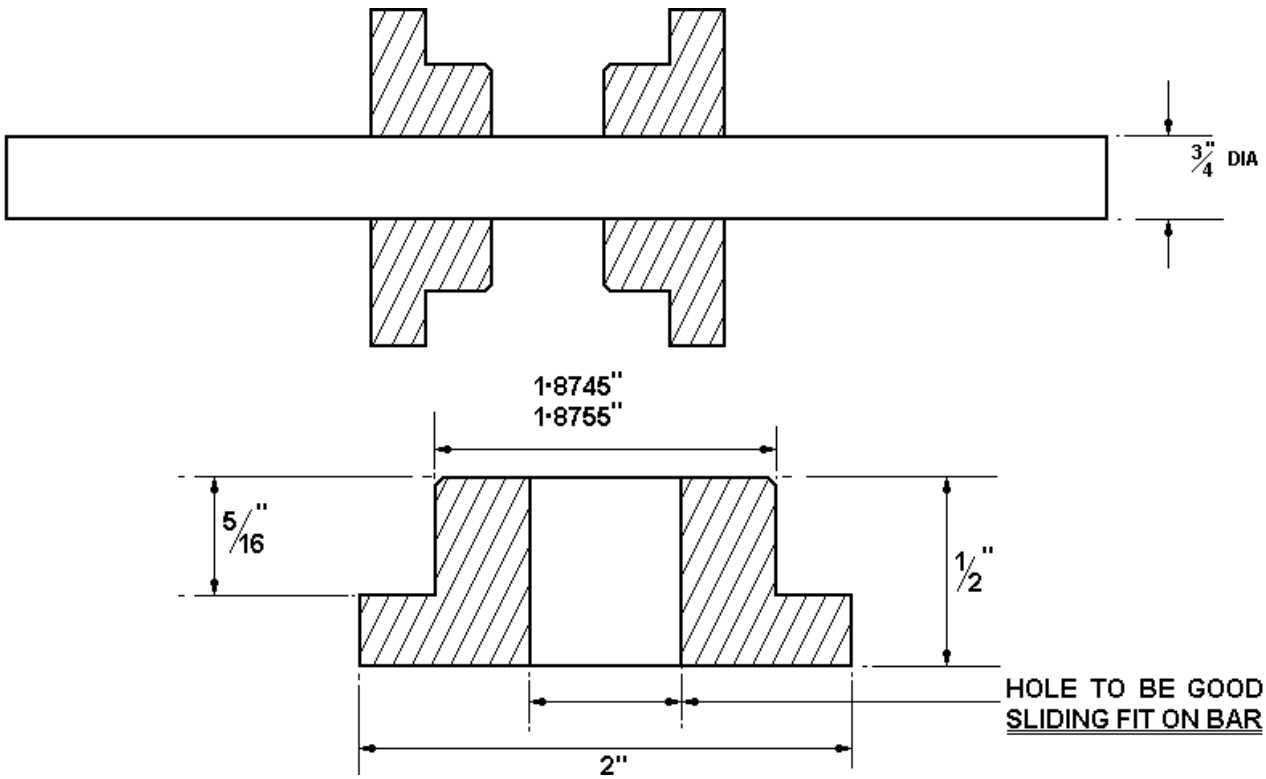

FIG. D2.

The only satisfactory way of checking the D14 Bantam frame for correct alignment is on an engineer's setting-out table. In addition to the table, which should be approximately five feet by three feet, the following equipment will also be necessary.

One mandrel and two blocks for the steering head, as in Fig. D2.

One set-square.

One 18" Vernier height gauge or large scribing block.

One pair of large vee-blocks and several adjustable height jacks.

If a scribing block is used in preference to an Vernier height gauge, then an 18" steel rule will also be required. All mandrels must be perfectly straight and round, otherwise measurements will be affected.

Figure D3 shows the basic set-up for checking the D14 Bantam frame, though variations can be used, according to the facilities available.

Place the blocks into the steering head, insert the mandrel and support with the vee-blocks at one end to ensure that it is parallel with the surface of the table. Insert the swinging arm spindle through its pivot hole in the rear frame member.

Now, using jacks or packing pieces, set the frame horizontal to the table so that checks taken at (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.

Sometimes, if the machine has been subjected to a frontal impact, the main tubes may remain parallel at points (A) but will be bent as shown in Fig. D4. A straight-edge made from piece of good quality hardboard can be used for checking purposes, but the actual checking edge must be quite straight.

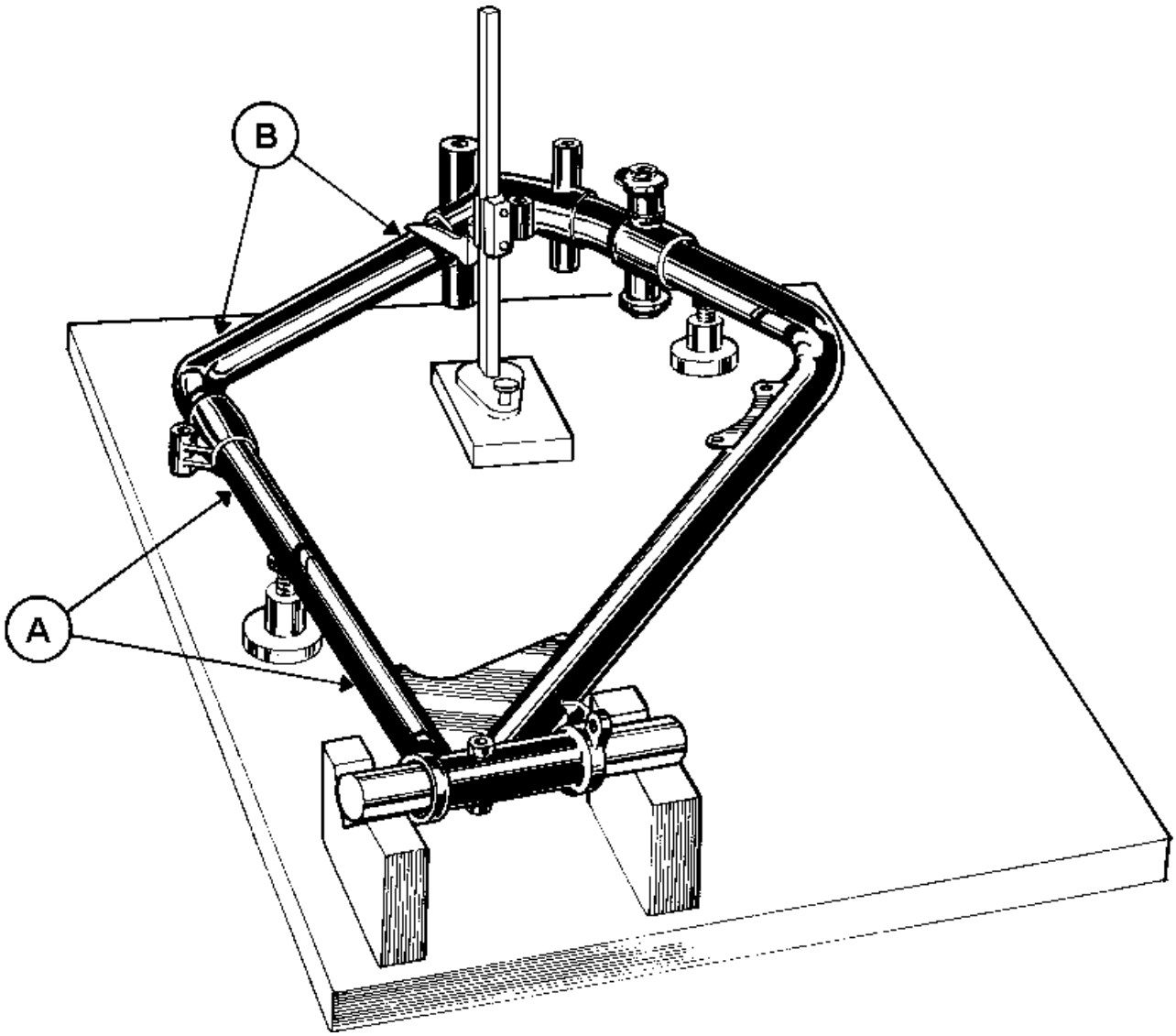

FIG. D3. *Frame on setting-out table.*

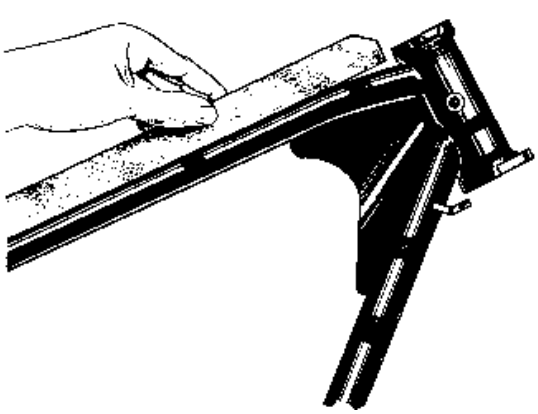

FIG. D4. *Showing bent top tube.*

When the frame is set parallel to the surface of the table, the swinging arm pivot spindle should be vertical. This can be checked using the set square and internal calipers or a slip gauge between the spindle and the square.

Find the frame tube centre line and make a thorough check at all points to ensure that the frame is not twisted. A check must also be taken at the engine mounting lugs. Errors at any point should not exceed 1/32" (•79 mm.).

SWINGING ARM

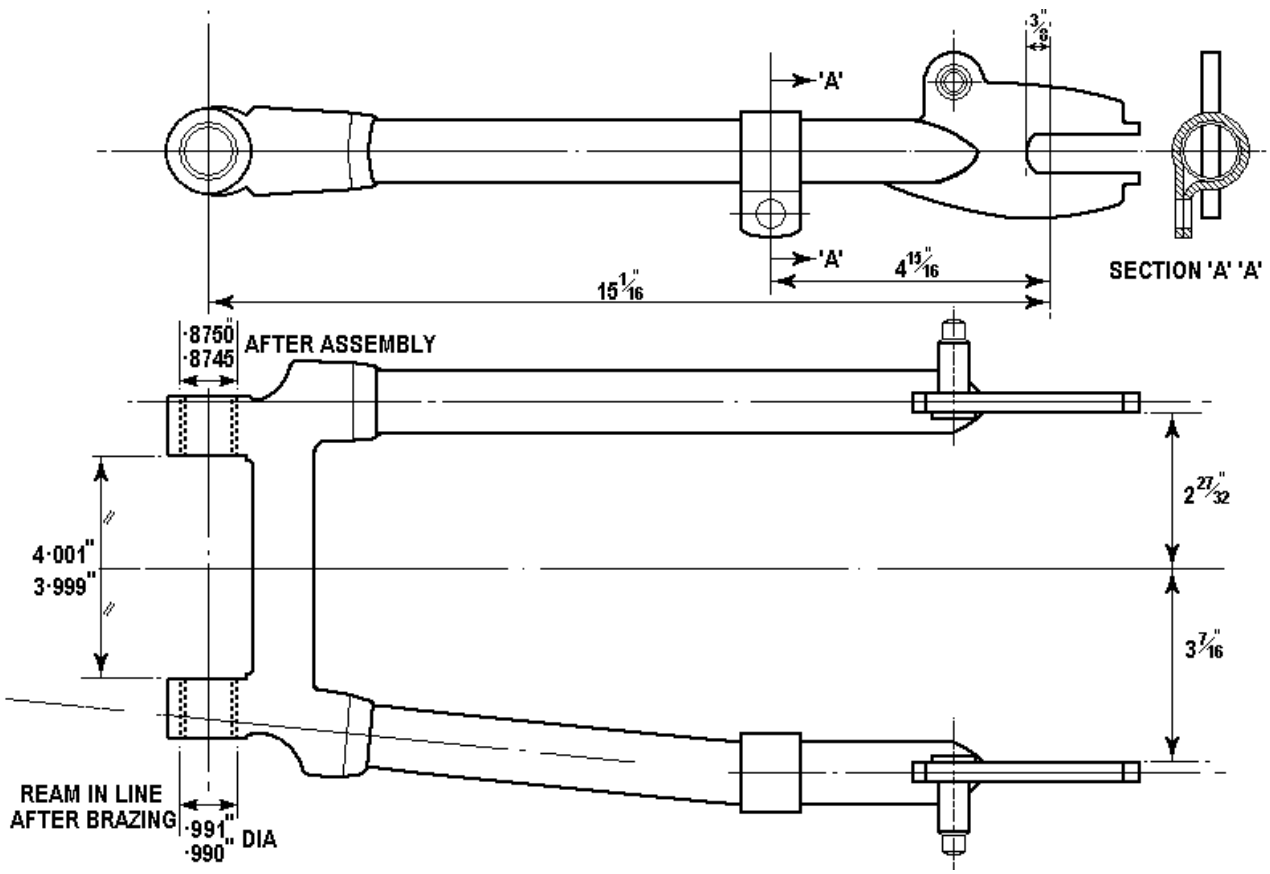

FIG. D5. *Swinging arm dimensions.*

Removal

Take off the rear wheel, mudguard, dampers and chainguard, as described on pages F3, D9, D6 and D9 respectively.

Release the silencer bracket from the right-hand sub-frame down tube (Bushman and Sports models).

Remove the pillion footrest brackets (not fitted to Bushman Pastoral models) and note that the lower fixing bolt on each bracket is fitted with a spacer tube. To facilitate removal of the left-hand bracket, it will be necessary to take off the brake pedal and to disconnect the brake light switch at its snap connectors. The brake pedal is retained by a pivot bolt with nut and a return spring.

On Bushman models only, the prop stand must also be removed, the bracket for which is held by two nuts and bolts.

Removal of the special bolts at the top of the brackets also releases the ends of the sub-frame or saddle support which can be tied up out of the way to provide more access. Note that the bolts are each fitted with a grease nipple to enable the bushes to be lubricated.

The pivot spindle can now be extracted with a suitable drift and a raw-hide mallet should then be used to tap the swinging arm away from the frame lugs. When finally withdrawing the swinging arm, note the location of any spacing shims which may have been fitted.

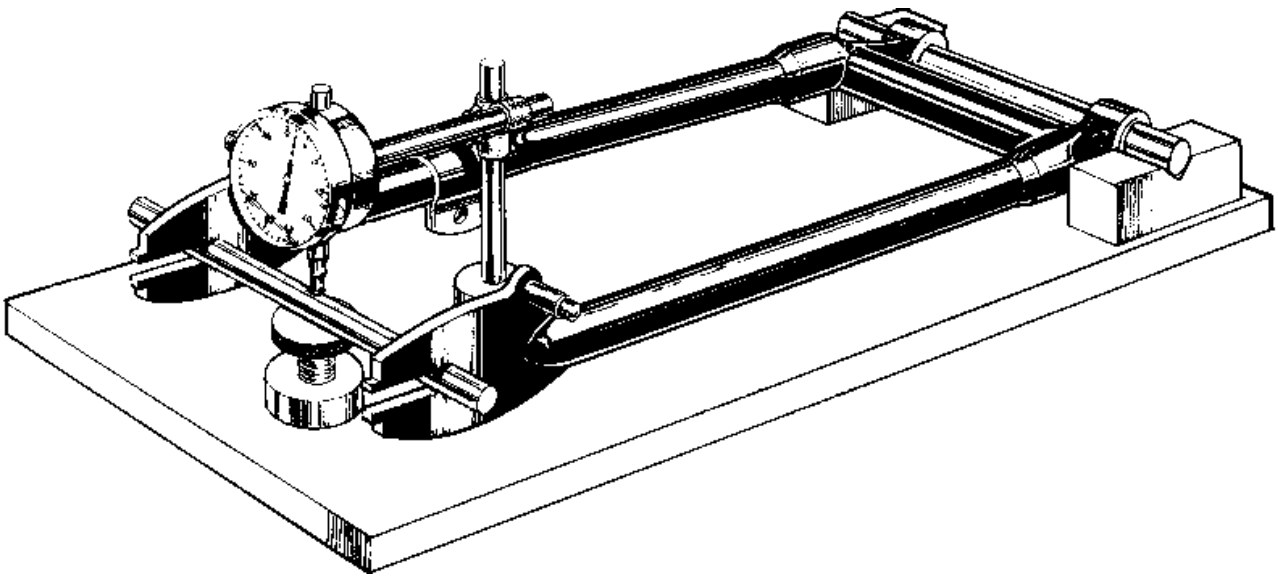

FIG.D6. *Checking the swinging arm.*

The two phosphor-bronze bushes can be tapped out of the swinging arm pivot lugs with a suitable drift.

Alignment

Before a proper check of the swinging arm can be made, it must be established that the bushes are in good condition.

Insert the wheel spindle through the pivot bushes and set the swinging arm in vee-blocks as shown in Fig. D6. Place a suitable mandrel in the fork ends and use small adjustable height jacks to set both the mandrel and the pivot spindle parallel to the surface table. If a mandrel for the fork end is not available, then the rear wheel spindle can be used.

Now, using a Vernier gauge, check the forks ends for alignment. Should there be less than ¼" (6•35 mm.) malalignment, it is permissible to correct it by means of a suitable lever. Care must be taken, however, to avoid causing further damage.

To check that the forks are square to the pivot, they must be swept up at 90° to the position illustrated, so that the pivot is vertical. Next, find the centre of the pivot and check that all measurable points are in accordance with the dimensions shown in Fig. D5.

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

REAR DAMPERS

The rear dampers or shock absorbers, are of the coil spring type, hydraulically damped and are mounted on bonded rubber bushes at each end. The actual damping units are a sealed assembly and the only service work that can be carried out on the dampers is for the renewal of the springs.

To remove a damper, take out the top fixing bolt with nut and washers then unscrew the lower fixing nut. Pull the damper off the stud at the bottom and withdraw from the top frame bracket.

The removal and replacement of the mounting bushes will be found much easier if a little liquid soap is applied.

The spring is retained at its base by split collets and, to enable the spring to be removed the collets must be extracted. Assemble service tool No. 61-5064, as shown in Fig. D7, and screw down the nut until the spring is sufficiently compressed to allow the collets to be extracted through the apertures in the tool. The spring will be released when the tool is removed.

FIG. D7.
Using service tool No. 61-5064.

Having renewed the spring, reassemble in the reverse manner, again using the service tool to compress the spring.

The dampers fitted to the Sports and Bushman models, have no spring cover, but are dismantled in the same manner.

When refitting the dampers to the machine, note that the top fixing bolts also retain the ends of the dualseat bracket.

PETROL TANK

Turn off the petrol tap and detach the petrol pipe at its union on the float chamber.

Take out the two fixing bolts from the front of the tank and note that the large washers are fitted between the tank brackets and the steering head lugs. Loosen the rear fixing bolt; it will not be necessary to remove this bolt. The petrol tank can now be withdrawn from the front.

Take note of the way in which the chrome beadings are fitted. These are loosely located over the tank and are held at each end by the fixing bolts.

The petrol tap is screwed into the base of the tank and is fitted with a fibre washer. If the washer appears unserviceable, replace it to avoid any leakages.

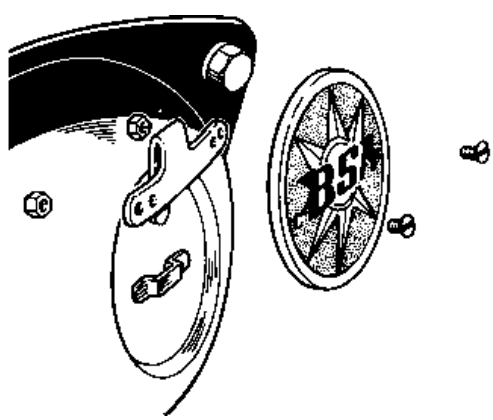

FIG. D8. *Petrol tank badge.*

To remove one of the tank badges, loosen the two fixing screws and pull the badge upwards to disengage from the clip. The Bushman models are not fitted with badges of this sort.

DUALSEAT

Should it be found necessary to remove the dualseat, first loosen the damper top fixing bolts sufficient to allow the ends of the seat bracket to be released. Raise the seat at the rear and withdraw rearwards to disengage the front clip from the frame tie bar. The bracket is held to the base of the seat by two nuts with washers.

Replace in the reverse manner but ensure that the damper top fixing bolts are tightened firmly.

Some Bushman Pastoral models are fitted with a single seat, being held to the sub-frame at the rear by two clips.

SIDECOVERS

The left-hand sidecover is held in place by two "Oddie" studs which only require a half-turn to release.

The sidecover can now be removed to reveal the tool roll (Bushman) or to give access to the battery (Supreme). To remove the battery, lift the tag on top of the battery carrier and lift the battery out.

To remove the left-hand back plate on the Supreme, unscrew the two large nuts at the front of the plate.

Now remove the single small nut and bolt from the top right-hand corner of the plate, also slacken the bolt behind the mudguard, and remove back plate.

Access will now be gained to the coil and rectifier, both being dealt with in the Electrical section. The coil retaining clip is fixed to the top of the rear mudguard by two nuts and bolts.

A single nut secures the rectifier to its bracket. Care must be taken when tightening this nut, and the bolt head should be held firmly with a second spanner to prevent it from turning. If this precaution is not taken, the rectifier plates may twist and break the internal connections.

To remove the right-hand sidecover and back plate on the Supreme models, first unscrew the two chrome-headed screws in the cover, these have a circlip fitted on them behind the cover to prevent them from falling out. When the cover is removed, unclip the rubber band from around the air cleaner element and remove.

Behind the element is one of the fixing bolts.

Remove the two nuts from the left-hand side back plate and withdraw the bolts from the right-hand side releasing battery carrier and horn. There are four spacers fitted between the back plates and the frame brackets, the two on the left-hand side being shorter.

Now slacken off the bolt behind the mudguard and remove the small nut and bolt from the top left-hand corner.

Slacken the clip securing the air cleaner hose on to the carburetter intake, and remove back plate complete with hose.

Replacement of all sidecover components is the reverse of removal.

Bushman Pastoral models

Since these models are not fitted with a battery, battery carrier or horn, the sidecovers are of a much simpler design. The toolbox cover on the left-hand side is retained by two "Oddie" studs. These studs need only half a turn to release and on removal of the cover it will be seen that a large spring clip holds the toolbag in place. Two large bolts with spacers secure the triangular plate to the frame lugs, and the tag at the base is held by one of the mudguard fixing bolts. The plate and the air cleaner cover on the right-hand side are held together by two tie brackets, the smaller one being at the front.

To remove the air cleaner cover therefore, it will only be necessary to release the tie brackets (two small nuts and bolts) and to slacken the mudguard bolt that holds the lower tag.

CHAINGUARD

The chainguard is held by one nut and bolt to the rear mudguard. On Bushman models, only one bolt is used to secure the sidecover bracket, mudguard and chainguard to the sub-frame lug. Another fixing bolt holds the chainguard front to the crankcase, but this bolt need only be loosened.

Release the fixing bolts and carefully withdraw the guard from the rear.

With the exception of the Bushman, all models are fitted with a chainguard extension plate, being held to the left-hand pillion footrest by one small nut and bolt.

MUDGUARDS

Front — Supreme models

Remove four nuts and bolts holding the mudguard to the support stays. Release one nut and bolt securing each guard bracket to the fork legs and note that the left-hand bolt also retains the licence holder. Having removed the fixing bolts, the mudguard can now be withdrawn from the front.

The support stays are each secured to the base of the fork legs by one nut with washers.

Two nuts retain the number plate from below the mudguard. When refitting, ensure that the rubber beading is correctly located beneath the plate.

Front — Bushman models

On these particular models it is conventiently possible to remove the mudguard without disturbing the support stays, though, with the exception of the Bushman Pastoral model, the number plate must first be taken off. After releasing its five fixing nuts and bolts, the mudguard can be drawn away from the front.

Rear

The rear mudguard is fixed to the lugs on the sub-frame down tubes, by two bolts from inside. Two nuts and bolts hold the guard at the top, to the saddle support rail brackets.

Take off the left-hand sidecover and remove the coil, held by two nuts and bolts. Also take out one nut and bolt fixing the rectifier bracket to the top of the guard.

Disconnect the rear light cables at their connectors near the battery. The brown cable is connected to the brake light switch and the black cable joins the main harness.

Release the mudguard fixing bolts and take out the single nut and bolt from the chainguard top bracket, (not applicable on Bushman models), before finally withdrawing the guard from the rear.

On Supreme models, the rear light and number plate bracket is secured to the mudguard by three nuts and bolts. The rear light and number plate assembly on the Sports and Bushman models is of a different design, being fixed at the front by one nut with large washer, at the support bracket by two nuts and bolts and at the base of the number plate by a single nut. When replacing, do not omit to fit the rubber washer on to the rear fixing stud. Snap connectors are fitted to the rear light cables, below the bracket, to enable the unit to be removed.

AIR CLEANER

The air cleaner fitted to the Bantam Supreme and Sports models has a rubber-mounted wire mesh-covered felt element, and can be washed in petrol and allowed to dry at 5,000 miles (8,000 km.) intervals.

The air cleaner removal procedure is described on page D8, but before replacing check the condition of the element rubber surround, the rubber hose, and the retaining band. If any of these have perished they should be replaced.

Failure to clean the unit regularly will result in the element becoming choked, causing abnormally high fuel consumption and a deterioration in performance.

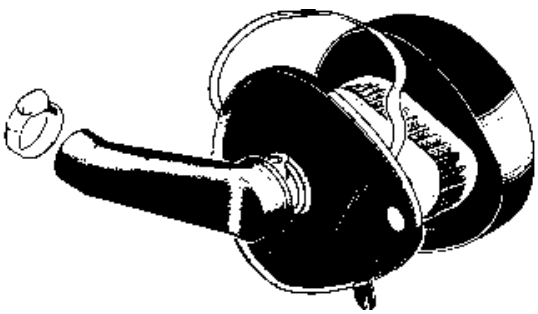

FIG. D9. *Air cleaner assembly.*

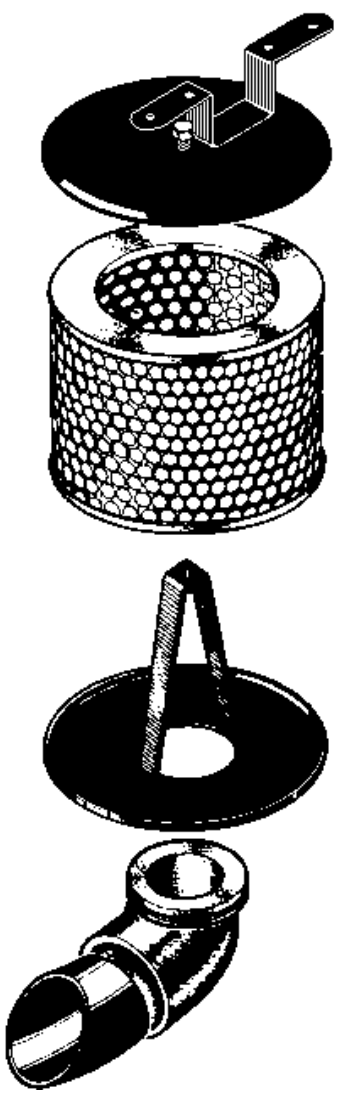

FIG. D10. *Air cleaner (Bushman).*

Before replacing the air cleaner, check that the rubber "O"-ring fitted on the carburetter intake, is undamaged and fit for further use.

Bushman Pastoral models
These particular models are fitted with a special dry-element air cleaner which should be regularly examined at intervals of 1,000 miles (1,600 km.).

The unit is mounted on the sub-frame, directly below the single seat and is protected by a shaped cover on the right-hand side of the frame. The cover is held by one nut and bolt at the front, by one nut and bolt at the top/rear and at its base by one of the mudguard fixing bolts which needs only to be loosened.

Reach below the seat at each side and release the bolts securing the air cleaner bracket to the sub-frame clips. Pull the adaptor hose from its location in the air cleaner base plate and withdraw the unit.

The air cleaner can be dismantled by first removing the clip screws which hold the perforated band. The element is composed of paper and it is therefore inadvisable to attempt to clean it. If it appears contaminated with excessive quantities of dirt, replace it with a new unit.

HEADLAMP REMOVAL

Supreme models
Loosen the single fixing screw at the top and withdraw the glass and rim assembly, complete with reflector.

Whilst supporting the unit, press in the main bulb holder and rotate anti-clockwise to release. Pull out the pilot bulb holder and place the headlamp unit to one side.

Detach the ignition switch and lighting switch cable sockets from the top of the cowl. These are simply a press-fit and are each retained by a spring clip. Pull out the speedometer bulb holder and unscrew the knurled ferrule, below the instrument head, to release the drive cable.

The headlamp cowl is fixed to the fork cover by four screws with nuts and can now be removed.

Two nuts and a bridge arrangement secure the speedometer head to the cowl. If it should be necessary to remove the instrument head, note that a black (earth) cable is fitted under one of the fixing nuts.

The glass and reflector unit is retained in the chrome rim by a number of equally spaced spring clips. The clips are quite strong and care should be taken when either removing or replacing them. Note that the glass is marked at the top, to ensure correct fitting.

The headlamp should be reassembled in the reverse manner but, if the cowl nacelle was disturbed, then the main beam must be readjusted as detailed on page G12.

Sports and Bushman models
Loosen the rim retaining screw at the base of the headlamp shell and take off the glass and rim assembly. Disconnect the switch sockets, bulb holders and speedometer drive cable. The procedure for these operations is the same as that of the Supreme models, detailed in the section above.

Proceed by displacing the large rubber grommet in the base of the headlamp shell so that the cable harness with sockets can be withdrawn.

Whilst supporting the unit, take out the two bolts holding the shell to the fork leg brackets. Note on removal, that a spacer is fitted between each fixing bracket and the shell.

CONTROL CABLE REPLACEMENT

Throttle Cable
First turn the twist grip to open the throttle, then, whilst pulling the cable sleeve, release the grip to allow the slotted cable stop to be removed. Now 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.

Proceed by detaching the cable from the frame clips. To gain more access, it may be found necessary to temporarily remove the petrol tank (detailed on page D7).

Take out the two Phillips-head fixing screws and withdraw the carburetter top cover complete with throttle valve and air slide assembly. Compress the throttle spring, raise the needle with clip and after making careful note of its position, 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. Take care not to lose the needle clip when taking off the spring and top cover.

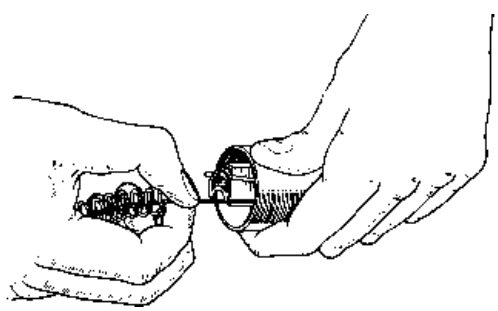

FIG. D11. *Renewing throttle cable.*

Before fitting the replacement cable, first slide the small rubber dust cover on to the outer cable, then pass the cable though the top cap, spring and needle clip. Whilst compressing the spring, insert the cable nipple through the valve needle hole and locate to one side. Fit the valve needle and secure with the spring clip in the correct needle groove (third from the top). Assemble the throttle valve and air slide to the carburetter body, making sure that the needle enters the needle squarely. Locate the peg on the throttle valve with the slot in the mixing chamber and fit the top cap. Do not tighten the cap fixing screws until the throttle valve and air slide have been checked for correct operation.

Finally attach the cable in the frame, replace the cable stop at the twist grip and adjust the cable as necessary (see page C4).

Air Control Cable — Concentric Carburetter
To replace an air control cable, first open the control lever to its fullest extent then, whilst pulling the cable, close the lever and release the cable nipple.

Take off the carburetter top complete with throttle valve and air slide assembly, as detailed on page D11.

Pull the air slide out of the throttle valve and compress the spring to release the cable nipple.

Fit the replacement cable in the reverse manner and proceed with the assembly as for the throttle cable.

Front Brake Cable
To remove the front brake cable, first unscrew completely the lower cable adjuster, then take out the nut and bolt holding the cable toggle to the lever on the brake cover plate. Now, slip the cable nipple out of the handlebar control lever and detach the cable from the clip fitted under the fork leg pinch bolt.

The replacement cable is supplied complete with its toggle and can be fitted in the reverse manner. Remember to re-adjust the brake cable and test the efficiency of the brake thoroughly before using the machine.

Clutch Cable
The cable must first be detached from the clutch actuating lever, situated behind the inner timing cover, next to the gearbox sprocket. As it will be necessary to work from below the machine, the machine should be carefully placed on to its right-hand side.

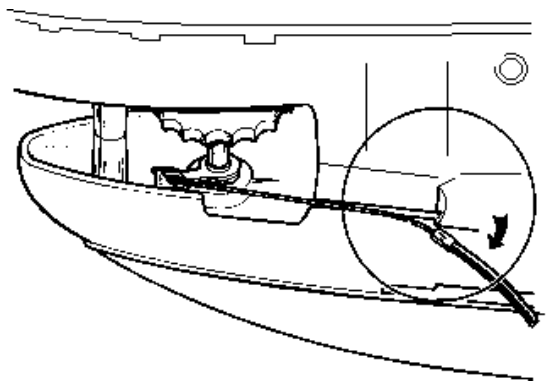

FIG. D12. *Removing clutch cable.*

Remove the rubber plug in the outer cover. Loosen the clutch adjuster locknut and unscrew the adjuster pin completely.

Pull the end of the outer cable from its location in the crankcase base and withdraw the inner cable from the slot, as indicated in Fig. D12. The cable will now be free, making it an easy task to release the nipple from the actuating lever.

Finally, detach the cable nipple from the handlebar control and withdraw the complete cable.

The replacement cable should be fitted in the reverse manner, starting at the handlebar control.

Adjust the clutch centre pin as detailed on page B18 to give correct operation.

INDEX

DESCRIPTION

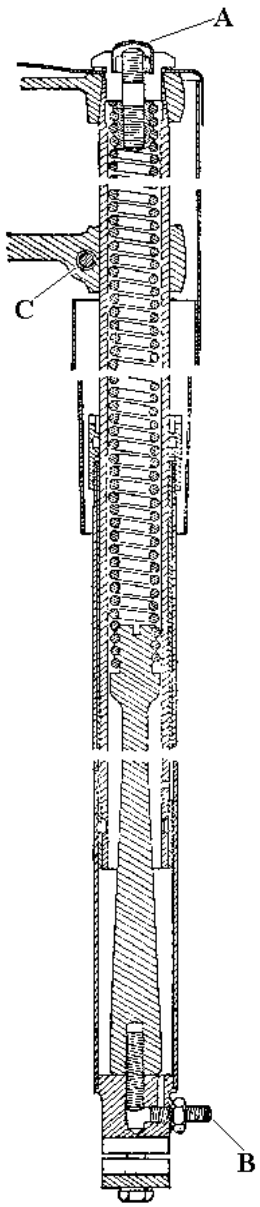

FIG. E1.

There are two basic designs of front fork fitted to the D14 Bantam range. The fork described on this page is fitted to the Supreme, and the fork fitted to the Sports and Bushman models as described on page E4.

HYDRAULIC DAMPING (Supreme)

Figure E1 opposite, is a sectioned illustration of a front fork leg fully extended.

When the fork leg is compressed the lower member rises, forcing the oil upwards around the top of the restrictor rod. The pressure of the oil increases as the gap narrows between the lower bush and the restrictor rod, progressively slowing the fork spring action. Eventually the point of maximum compression is reached and is cushioned by the remaining oil in the main reservoir. As the fork leg begins to extend again, a vacuum is created in the lower member, causing the oil above the restrictor rod to be drawn back into the main reservoir under great pressure, thus providing a smooth cushioned action.

It will be seen therefore, that to ensure a uniform damping action, each fork leg must contain the right amount of the correct grade oil (see page A3).

A holder containing an oil seal is screwed on to the top of the lower sliding member and prevents oil from seeping around the main tube when the forks are compressed.

REMOVING THE FORK LEGS

Before starting work on the forks it is advisable to have the following tools and replacements available:—

(2 off)	90-5230	Upper bush.
(2 off)	90-5229	Lower bush.
(2 off)	97-2557	Oil seal.
	61-3350	Service tool.
	61-3633	Service tool.

Remove the front wheel as described on page F2, then take off the front mudguard and unscrew the front brake cable adjuster. Drain the oil from each fork leg (see page A5) and slacken off the pinch bolts in the bottom yoke. Prise out the cap from the top of each fork leg and unscrew the small nuts holding the top spring scroll.

Remove the large top cap nuts and screw service tool No. 61-3350 (minus the large nut and washer), into the top of the fork leg. Take a firm grasp of the lower sliding member and strike the top of the service tool sharply with a mallet. This will release the leg from its taper-fit in the top yoke, allowing the complete leg to be withdrawn.

The fork leg top cover on Supreme models is secured to the bottom yoke by the pinch bolts and need not be disturbed.

DISMANTLING THE FORK LEGS

To assist in dismantling, hold the fork leg firmly in a soft-jawed vice, on the flats of the wheel spindle lug. Fit service tool No. 61-3633 around the main tube and engage the dogs with the slots in the top of the oil seal holder. Whilst pressing down firmly on the tool, turn anti-clockwise to unscrew the holder. The main tube can now be drawn upwards from the sliding member complete with its two bronze bushes, leaving the restrictor rod and spring still attached to the lower member.

If the fork spring is in need of replacement, it can be unscrewed from the top of the restrictor rod and withdrawn. The restrictor rod should not have been subjected to any wear, but can if necessary be unscrewed from the base of the sliding member.

The lower bush is a press-fit on to the end of the main tube and can be removed by first prising open the joint with a thin-bladed instrument, then tapping it off with a soft mallet. Ensure on replacement, that the holes in the bush coincide with the holes in the tube.

The upper bush is simply a push-fit into the top of the sliding member and is retained by the oil seal holder.

REBUILDING THE FORK LEGS

Before reassembling the fork legs, clean all the components thoroughly and check that the work bench is also clean. It will be assumed that the bushes and oil seal have been renewed as necessary. The oil seal is a press-fit into the holder groove.

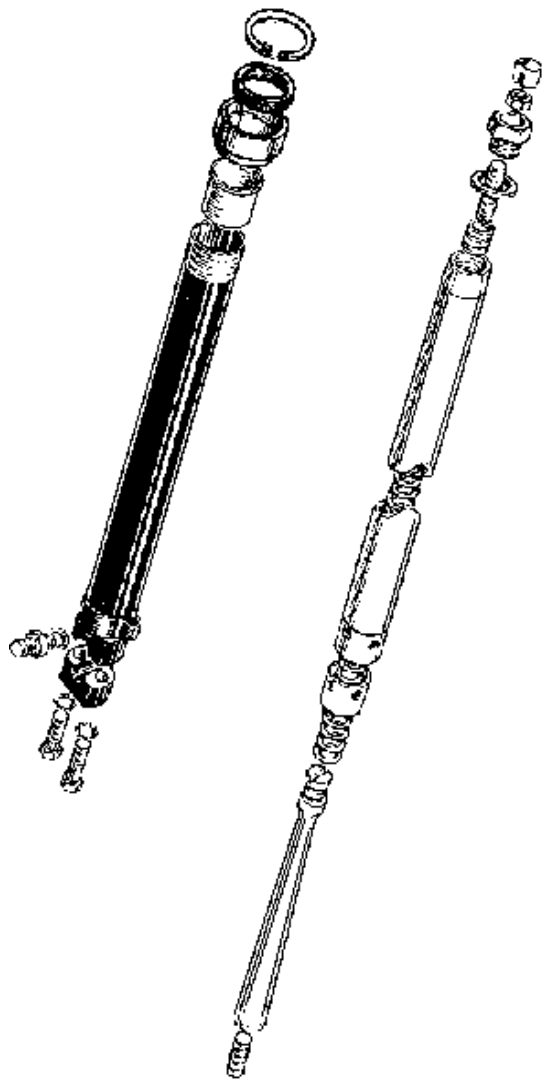

FIG. E2. *Fork leg exploded.*

Later models have a different sealing arrangement, using a thicker seal, retained by a circlip.

Slide the oil seal holder on to the main tube with its slots uppermost then pass the tube over the spring and restrictor rod in the lower sliding member. Holding the assembly in a vice, screw down the oil seal holder on to the top of the lower member with service tool No. 61-3633.

REPLACING THE FORK LEGS

Screw service tool No. 61-3350 (minus the nut and collar) into the top of the leg and pass the assembly up through the two yokes. Fit the collar and nut, then tighten the latter until the leg is drawn firmly home into its taper. Tighten the pinch bolt in the bottom yoke before removing the tool. Replace the large cap nut and its washer, followed by the small spring retaining nut and its cover.

Repeat the operations on the other fork leg and refill with the correct amount of oil (eighth-pint to each leg).

Finally, replace the front mudguard and wheel, adjusting the front brake as necessary.

FRONT FORKS (Bushman and Sports)

The front forks fitted to these models are of an even simpler design than those fitted to the Supreme. The fork spring is on the outside of the main fork tube, which dispenses with the need for restrictor rod and fittings.

HYDRAULIC DAMPING

The hydraulic damping on these forks is similar to that of the other type with the exception that when the lower member rises oil is forced up around the fork shaft and enters it through a small hole in the fork shaft. This hole limits by virtue of its size the quantity of oil that can escape. It is this pressure resistance that slows the fork action. On recoil, the retraction of the main shaft creates a vacuum which sucks the oil back through the hole under great pressure. It is this action that gives the smooth controlled fork action.

FORK DISMANTLING

Before starting work on the forks it is advisable to have the following tools and replacements available:—

(2 off)	65-5451	Oil seal.
(2 off)	65-5424	Top bush.
(2 off)	29-5347	Bottom bush.
	61-3006	Service tool.
	61-3007	Service tool.
	61-3350	Service tool.
		A length of No. 5 twine approximately 15" long.

Remove the front wheel as described on page F2, then remove the mudguard and support stays.

Drain the oil from the fork as described on page A5.

Pull the top of the rubber gaiter off the fork leg.

Slacken off the pinch bolts on the bottom yoke, and screw service tool No. 61-3350 (less the large nut and washer) into the thread at the top of the fork leg.

The tapered end of the fork shaft fits into a corresponding taper in the top yoke.

Hold the lower sliding member in one hand, and strike the top of the service tool with a hammer or mallet. Once the grip of the taper has been broken, it should be possible to draw the complete leg down through the yoke and remove it from the machine.

DISMANTLING THE LEG

To dismantle the lower section of the fork hold the sliding tube by gripping the wheel spindle lug in a soft-jawed vice.

To remove the oil seal holder slide service tool No. 61-3005 over the main tube and enter the dogs in the slots at the bottom of the oil seal holder.

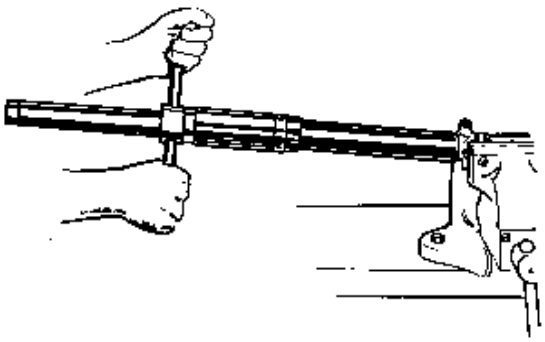

FIG. E3. *Removing oil seal holder.*

Pressing down firmly on the tool and turning anti-clockwise at the same time, unscrew the oil holder complete with the extension tube.

Remove the tool and slide the holder up the shaft until it becomes tight on the tapered section of the shaft, but do not use force or the oil seal may be damaged.

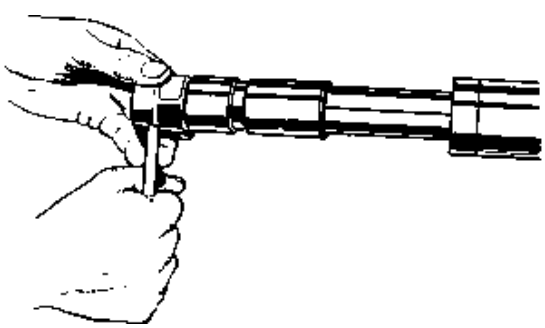

FIG. E4. *Removing lower nut.*

The main tube complete with bushes can now be withdrawn.

Grip the tube in a vice using soft clamps on the unground portion of the shaft and unscrew the nut at the lower end of the shaft.

This nut secures the lower bush and after its removal the oil seal holder, and bushes can be slid off the shaft.

OIL SEALS

If it is necessary to change the oil seal, place the lower edge of the holder on a wooden block and enter service tool No. 61-3006 into the top of the holder. Give the tool a sharp blow with the hammer and the seal will be driven out.

To fit a replacement seal, coat the outside with a good jointing compound and whilst still wet enter the seal squarely into the holder with the open side upwards and drive home with service tool No. 61-3007.

Great care is required to avoid damaging the feather-edge of the oil seal and this should be greased before reassembly.

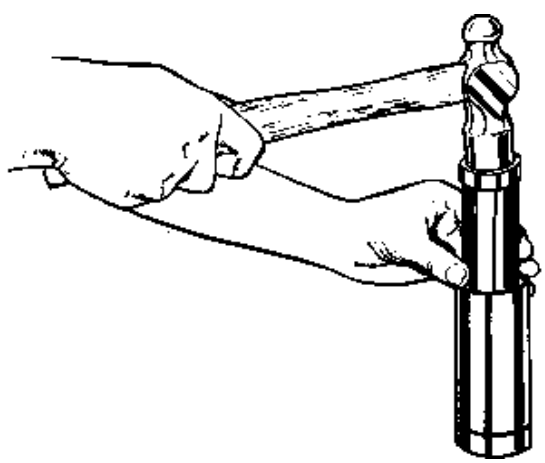

FIG. E5. *Removing oil seal.*

REBUILDING THE FORK LEG

Reassembly is carried out in the reverse order to dismantling.

Cleanliness is essential and before attempting to reassemble, clean all parts thoroughly and clear the work bench on which the fork legs have been dismantled.

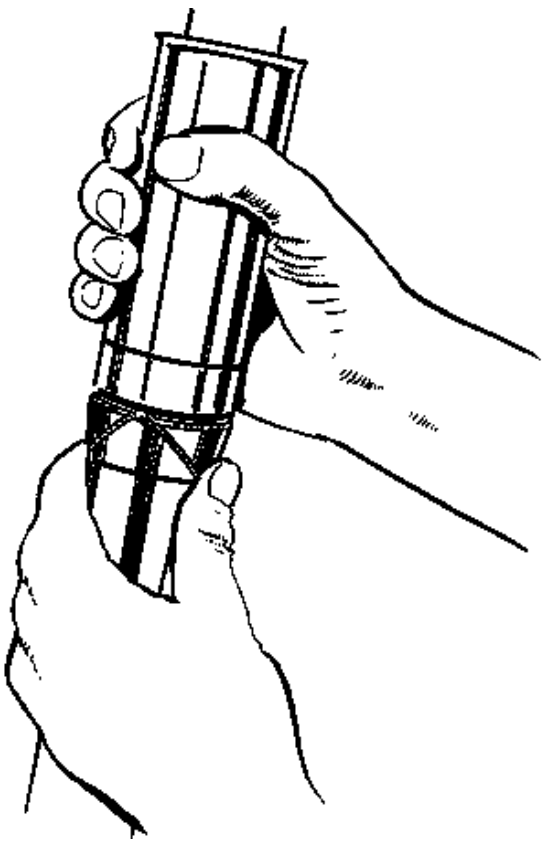

FIG. E6. Using the twine.

Slide the oil seal holder over the shaft until it is on the tapered section but do not use force or the seal may be damaged.

Place the top bush over the shaft followed by the bottom bush and bottom nut.

Tighten the nut securely, grip the lower sliding tube in the vice and enter the mainshaft, with the assembled parts, into the sliding tube.

Using service tool No. 61-3005, screw down the oil seal holder on to one turn of No. 5 twine round the groove at the end of the thread. This will provide an additional seal.

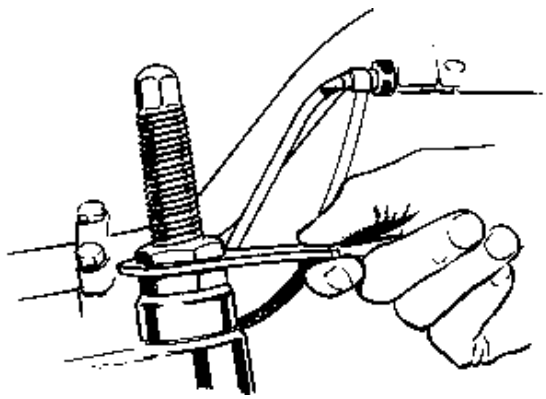

FIG. E7. Using service tool No. 61-3350.

Repeat the operations on the other leg. Before refitting the leg to the steering head, apply a liberal coating of grease to the spring and place the spring in position in the oil seal holder.

REPLACING THE FORK LEG

Now screw service tool No. 61-3350 minus the nut and collar — into the top of the tube and pass the tube up through the two yokes, fit the collar and nut and draw the tube firmly home into its taper.

Tighten the pinch bolt in the bottom yoke before removing the tool.

Repeat the operation on the other leg, then refill with the correct amount of oil (third-pint to each leg), see page A3 for grades, and replace the top caps.

Final assembly is simply the reversal of dismantling.

FORK ALIGNMENT

On replacing the fork legs it may be found that the fork assembly is incorrectly aligned, in which case the following instructions should be carried out.

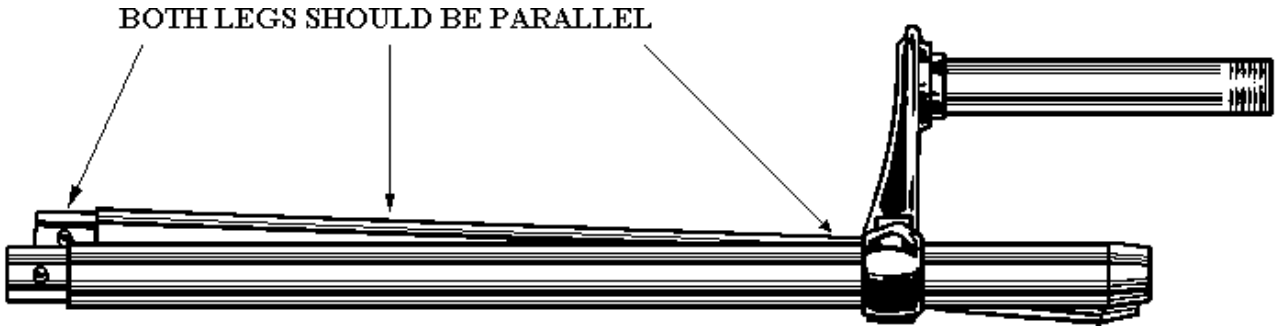

FIG. E8. *Bottom yoke twisted.*

First slacken the top cap nuts and the pinch bolts in both the bottom and top yokes, then loosen the wheel spindle retaining caps. The forks should now be pumped up and down several times to line them up. Tighten up the bolts, from bottom to top, that is, spindle retaining caps, bottom yoke pinch bolts, top cap nuts and finally, the steering stem pinch bolt in the top yoke.

If, after this treatment, the forks still do not function satisfactorily then either the fork main tubes are bent or one of the yokes are twisted.

The tubes can only be accurately checked for straightness with special equipment, including such items as knife-edge rollers and dial gauges. Special gauges are also necessary when checking the yokes. It is possible however, to make a reasonable 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 tube.

Should the tube be obviously bent but not kinked, then it may be possible to carry out a reasonable repair with a little care and patience. Find the highest point on the bend then, with a wooden block supporting each end, give the tube a sharp blow with a soft mallet and re-check. If a hammer is used, remember to protect the tube with a piece of wood. The measure of success when carrying out a repair of this nature, will of course depend on the extent of damage and the skill of the operator.

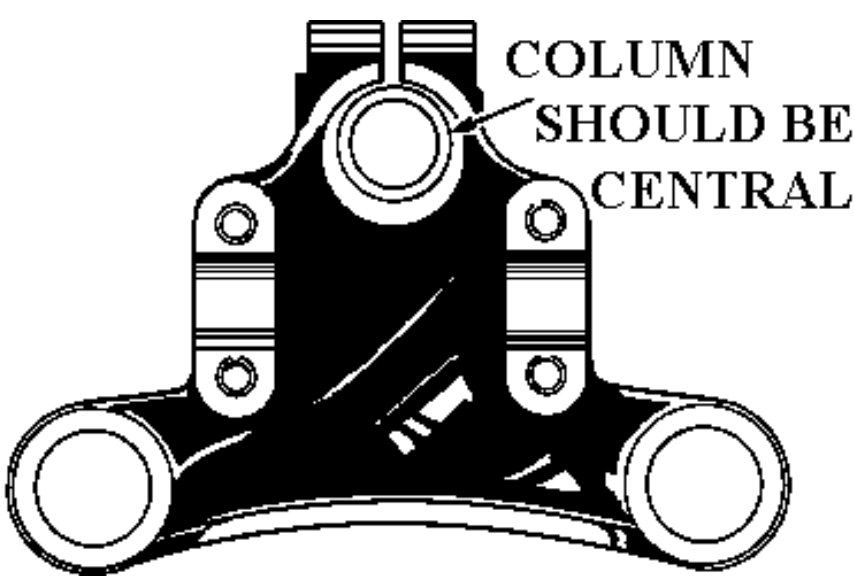

FIG. E9. *Bent steering column.*

The repair will be simplified and be very much better if a suitable press is available to the repairer.

Having checked the tubes for straightness and reset as necessary, a check can now be made of the top and bottom yokes. First, assemble both tubes into the bottom yoke so that a straight edge laid across the lower end touches all four edges of the tubes then, tighten the pinch bolts. Now view them from the side; both tubes should be quite parallel. Alternatively, the lower 12" of the tubes can be placed on to a surface plate, when there should be no rocking. Having checked the tubes this way, check the gap between them on the ground portion.

If the tubes are not parallel, as in Fig. E8, then the yoke must be reset, providing the error is not excessive.

To reset, hold one tube in a vice on the unground portion (using soft clamps) and reposition the other tube using a longer and larger diameter tube to obtain sufficient leverage.

The next step is to place the top yoke in position over the tubes, when it will be seen if the steering column is central. Figure E9, shows a bent column.

Finally, check that the tubes remain parallel when assembled into the top yoke only. In this case the bottom yoke can be fitted loosely on the tubes, acting as a pilot only.

Though it is possible to rectify slight errors in alignment by resetting, it is much safer to renew the part affected, especially when the malalignment is excessive.

ADJUSTING STEERING HEAD RACES

It is most important that the steering is always correctly adjusted and a check should be made in the following way.

Place a strong support under the engine so that the front wheel is raised clear of the ground then, standing in front of the wheel, attempt to push the lower fork legs backwards and forwards. Should any play be detected, it will be necessary to adjust the steering head races. It may not be possible to distinguish between play in the head races and play in the fork leg bushes, though in some cases there may be both. If possible, ask a friend to place the fingers of one hand lightly around the top head races whilst the forks are being pushed and pulled. Any play will be felt quite easily by the fingers.

To adjust the steering head races, slacken the clip bolt on each fork leg below the headlamp to enable the bottom yoke to take up a new position. Release the steering head clip bolt and tighten down the adjuster nut until the slackness has been eliminated. Avoid over-tightening the adjuster or the ball bearings will become indented into the races, making the steering extremely difficult and dangerous.

When the correct adjustment has been made, retighten the steering head clip bolt and finally, the fork leg bolts in the bottom yoke.

To check the setting, hold the handlebars lightly and move them round slowly, when the steering should be free and rotate smoothly.

If the movement feels "lumpy", indicating damaged races, the ball bearings, cups and cones must be removed for examination as described in the following section, and be replaced as necessary.

RENEWING STEERING HEAD RACES

If the only attention required is the examination or replacement of the steering head races, it will not be necessary to dismantle the forks completely. However, if sufficient slack can be obtained in the headlamp cable harness to allow the forks to be drawn away from the frame, then the harness must be detached as detailed in the section dealing with headlamp removal on page D10.

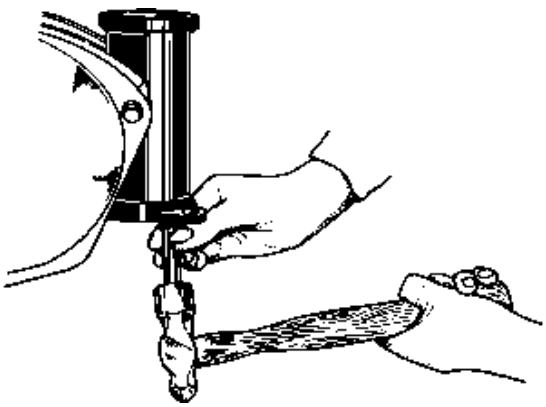

FIG. E10. Removing top cup.

The forks should now be drained as described in the Fork Lubrication section. Any remaining oil should be driven out by applying the front brake, and depressing the forks repeatedly. Replace the drain plugs and fibre washers.

Protecting the fuel tank with a piece of cloth, unscrew the four bolts securing the handlebar clips and place the handlebar on to the tank.

Remove the large nuts holding the main tubes to the top yoke. On the Supreme it will be necessary to prise off the cap at the top of each fork leg, and unscrew the small nut inside.

Slacken the top yoke pinch bolt and take off the steering stem cap nut.

On Supreme models, the top yoke cover must now be taken off. Whilst supporting the fork legs, strike the undersides of the top yoke with a raw-hide mallet to release from the tapered legs. Place the top yoke to one side and draw the steering stem down and out of the head, taking care not to lose the ball bearings which will be released as the stem is withdrawn.

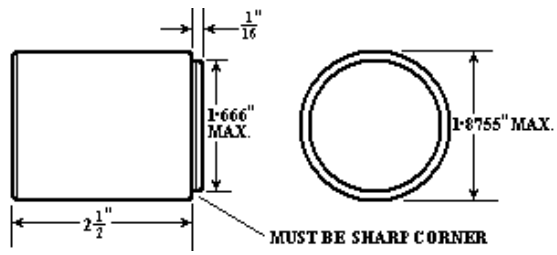

FIG. E11. Cup drift.

Remove the dust cap and prepare to examine the bearings. There should be twenty-four steel balls in each race (see page A3 for details on lubrication). The lower cone can be prised off the column but, when fitting the replacement, care must be taken to see that the cone is seated squarely. For this purpose, a length of heavy gauge steel tubing, long enough to clear the column and 1¼" in diameter is most useful for driving the cone on to its seating.

The cups can be driven out of the steering head using a suitable bar from inside the head tube (as shown in Fig. E10).

When fitting replacement cups, see that they enter their housings squarely. Do not drive the cup in with a drift against the radius of the ball-race as this will impose undue strain and is liable to fracture the cup. If possible, use a piece of steel bar or tube having a diameter slightly less than that of the cup sides. A suitable drift would be as shown in Fig. E11 above.

After replacing the cups and bottom cone, grease the cups and assemble twenty-four balls into each cup. Slide the column back into the head, replace the top cone and dust cover then refit the top yoke.

Reassembly from this point is simply a reversal of the procedure for dismantling. When complete, adjust the steering as detailed on page E8.

INDEX

FRONT WHEEL

Front Wheel Removal

With the machine on its centre stand, place a box or small wooden trestle underneath the crankcase so that the front wheel is raised clear of the ground.

Detach the brake cable toggle (*A*) Fig. F1, from the operating lever on the brake cover plate and the brake plate from the right-hand fork leg.

There are two alternative brake plates fitted to the bantam to suit the two different designs of front fork.

Whilst supporting the wheel, take off the fork end caps (*B*), each being held by two bolts, and withdraw the wheel.

When replacing the wheel ensure that the spindle ends are level with the sides of the fork end caps.

Front Hub Dismantling

The Sports model has the same internal details as the other Bantams, but the hub is fitted with a full-width outer casing.

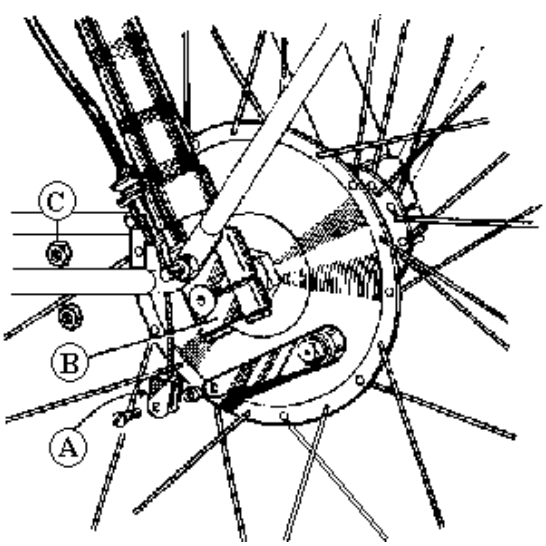

FIG. F1. *Front wheel removal.*

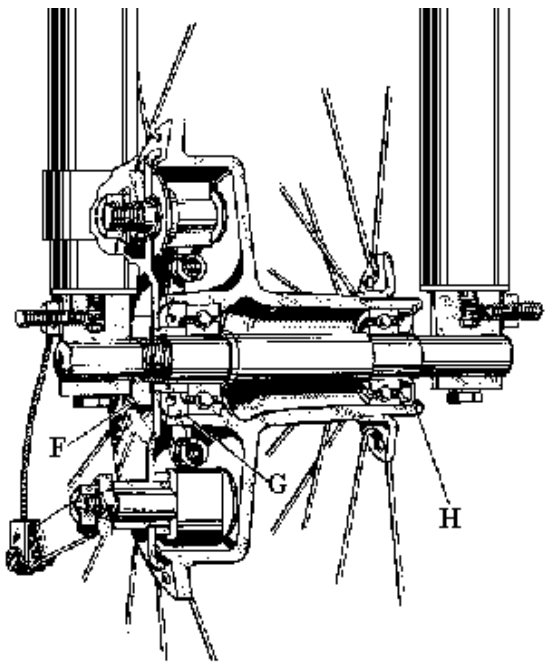

FIG. F2.

Unscrew the large nut (*F*) Fig. F2, from the wheel spindle. The spindle can be prevented from turning by applying the brake, using a short length of steel tubing over the operating lever.

Take off the cover plate complete with brake shoes, cam and fixed fulcrum pin, exposing the bearing retainer (*G*). This has a left-hand thread and is removed by unscrewing in a clockwise direction with a peg spanner (service tool No. 61-3644).

Having removed the retainer, drive out the right-hand or brake side bearing by striking the left-end on the spindle with a suitable mallet or copper hammer. If an ordinary hammer has to be used, protect the end of the spindle with a piece of hard wood. Note that a small shim is fitted between the bearing and the shoulder of the spindle.

To remove the left-hand bearing, first prise out the circlip (*H*), then insert the spindle from the right-hand side and drive out the bearing with its dust cover. Sports models will have a shim fitted between the dust cover and the bearing face.

Before checking the bearings, wash thoroughly in paraffin and, if possible, blow out with a high pressure air line. Examine carefully for signs of roughness and excessive play, indicating broken balls or damaged tracks.

Fitting New Bearings

Place the larger of the two bearings squarely in position on the right-hand side of the hub and, using a piece of tubing, drive in the bearing. It is essential that the force applied is on the outer ring of the bearing, not the inner ring. Screw in the bearing retainer in an anti-clockwise direction (left-hand thread), using a peg spanner.

Insert the wheel spindle, screwed end first with shim fitted, from the left-hand side and tap it gently home until the spindle shim rests on the inner ring of the bearing.

Apply a liberal coating of grease to the inner face of each bearing and fit the left-hand bearing over the spindle. Drive it into the housing until the dust cap will just clear the circlip groove and replace the dust cap and circlip. Do not omit to fit the shim between the dust cap and bearing (Sports models only).

Front Brake Shoes

After the brake plate has been removed from the wheel the brake shoes can be released by levering them outwards and upwards off the cam and fulcrum pin. The springs are very strong; so take care not to trap the fingers behind the shoes.

NOTE:—Avoid handling serviceable brake linings with greasy hands.

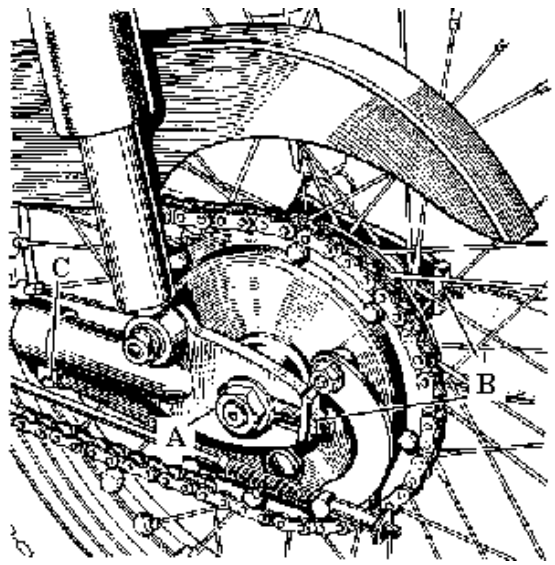

FIG. F3.

REAR WHEEL

Rear Wheel Removal

With the machine firmly supported on its centre stand, disconnect the rear chain at its spring link and unwind the chain off the rear wheel sprocket on to a sheet of clean paper. It is advisable to leave the chain in position on the gearbox sprocket.

Take off the brake rod adjuster, and unscrew the torque arm bolt (*C*) Fig. F3. Disconnect the speedometer cable from its drive unit and pull the inner cable clear.

Unscrew the spindle nuts (*A*) Fig. F3, and pull the wheel out of the fork ends, at the same time freeing the brake rod from the lever swivel pin. It may be found necessary to lean the machine slightly to the left to enable the wheel to be withdrawn from the right-hand side. Take care not to lose the distance piece fitted on the right-hand side of the spindle, next to the speedometer gearbox.

If possible, avoid disturbing the setting of the chain adjusters (*B*) while the wheel is out of the frame, and when replacing ensure that the adjusters are pressed firmly against the fork ends.

Check also that the spring clip of the chain connecting link is correctly fitted and has its closed end pointing in the direction of travel (*i.e.,* rearwards on the bottom run).

For details of chain adjustment, see page F5.

Rear Hub Dismantling
After first applying the brake to lock the spindle, unscrew the large nuts (*A*) Fig. F4, at each end of the spindle.

Take off the brake cover plate complete with brake shoes and then the speedometer drive gearbox, noting its distance piece and driving dogs.

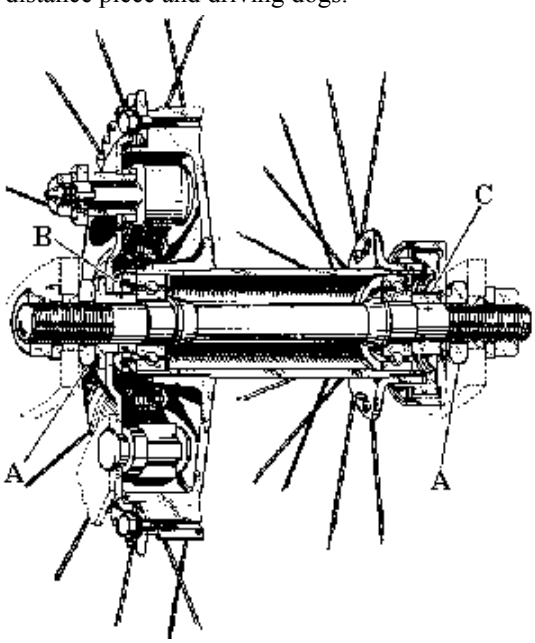

FIG. F4.

It will now be possible to unscrew the bearing retainer (*B*) which has a normal right-hand thread, using a peg spanner.

The wheel spindle should now be driven through the brake side bearing with a soft mallet, so pushing out the right-hand bearing.

The brake side bearing and thrust washer can now be driven out from the opposite side using a drift against the outer race of the bearing.

Fitting New Bearings
New bearings must be fitted in the reverse manner but care must be taken to see that the thrust washer is fitted behind the drive-side bearing and that the bearing is seated well up to the hub shell abutment and the shoulder on the spindle.

After fitting the drive-side bearing and its retainer, insert the spindle from the right-hand side and drive in the right-hand bearing to the spindle shoulder. Fit the distance piece (*C*) Fig. F4, on to the spindle, then the speedometer gearbox taking care to mesh the driving dogs.

When the brake cover plate has been fitted the spindle nuts (*A*) can be replaced and tightened.

Rear Brake Shoes
These are dealt with in the same manner as described for the front wheel on page F3, and are interchangeable with the front shoes.

Chainwheel
If the chainwheel teeth appear to be hooked or damaged in any way it is advisable to replace it, since excessive chain wear will occur.

The chainwheel is secured to the brake drum by eight bolts fitted with spring washers.

BRAKE ADJUSTMENTS

The brakes must be adjusted to give maximum efficiency at all times and for this to be maintained, the shoes should be just clear of the drum when the brake is off, and close enough for immediate contact when the brake is applied. The brakes must not be adjusted so closely, however, that they are in continual contact with the drum; excessive heat may be generated, resulting in deterioration of braking efficiency.

The front brake adjuster is situated on the lower right-hand fork leg. Rotation of the screwed sleeve alters the effective length of the cable so adjusting the position of the shoes in the drum. The locknut should be tightened after each adjustment.

The rear brake is adjusted by turning the self-locking sleeve. To open the shoes in the drum the effective length of the brake rod must be shortened by turning the sleeve in a clockwise direction (viewed from the rear of the machine).

Note that if maximum efficiency is to be obtained, the angle between the brake cable or rod should not exceed 90º when the brake is fully applied.

REAR CHAIN ADJUSTMENT

The chain should be adjusted with the machine on its centre stand so that the rear wheel is at its lowest position in the rear suspension travel.

Rotate the rear wheel slowly until the tightest point of the chain is found, then check that the total up and down movement is ¾" in the centre of the chain run. If the chain tension requires adjustment first slacken off the brake adjuster sleeve, the wheel spindle nuts, and the bolt retaining the torque arm. Tighten both chain adjuster nuts evenly until the correct chain setting is obtained but make sure that the adjusters are pressed firmly against the fork ends.

After adjustment, tighten the wheel spindle nuts and the torque arm bolt. Re-check the setting of the chain and adjust the rear brake as described opposite.

NOTE:—It is strongly recommended that the wheel alignment is checked after any adjustment to the rear chain has been made; full details of this are given on page F7.

RENEWING BRAKE LININGS

Holding the brake shoe in a vice, cut off the peened-over portion of the rivet with a good sharp chisel, as shown below.

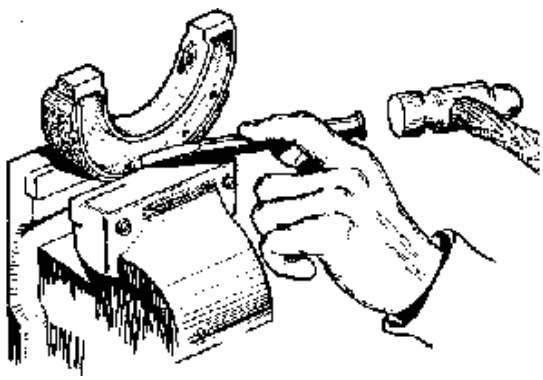

FIG. F5.

Drive out the rivets with a suitable pin punch and discard the old oil lining. Reverse the shoe in the vice and draw-file the face to remove any burrs.

Clamp the new lining tightly over the shoe and, using the shoe holes as a jig, drill straight through the lining with a No. 31 (·120") drill. Remove the clamps and, holding the lining carefully in a vice, counterbore each hole to no more than two-thirds the thickness of the lining, *i.e.,* if the lining is 3/16" thick, then the counterbore must not be deeper than ⅛".

Having prepared the linings for riveting, start at the centre and position the lining with one or two rivets.

Place a suitable mandrel in the vice, clamp the linings to the shoes with either small "G" or tool-makers clamps and peen-over the rivets as shown in Fig. F6, working alternately outwards from the centre.

The mandrel used in the vice must be flat on one end, the diameter of which should be no more than that of the rivet head. It will also help if a hollow punch is used to bed the rivets down before peening.

NOTE:—Providing that the clamps are used correctly, that is, next to the rivet being worked on, the linings can be fitted tightly to the shoe. If this is not carried out correctly, a gap may occur between the lining and the shoe, resulting in inefficient or "spongy" braking.

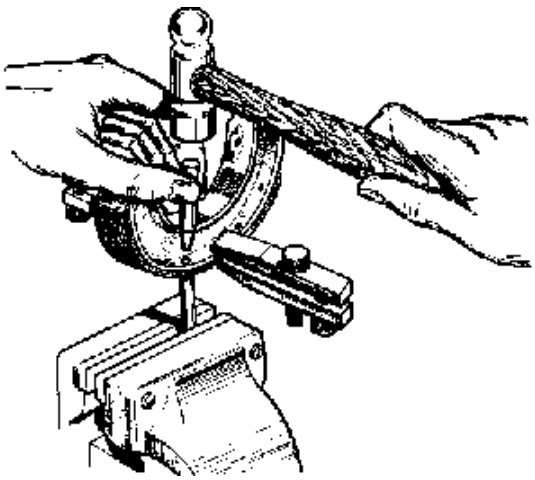

FIG. F6.

When the riveting is completed, file a good chamfer at each end of the lining to approximately half its depth and lightly draw-file the face of the lining to remove any fraze caused by the drilling.

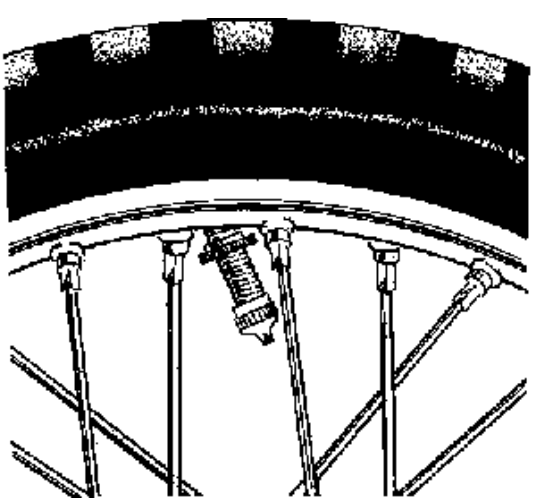

FIG. F7. *Tyre creeping.*

SECURITY BOLTS

Sometimes, particularly if a tyre is under-inflated, it will creep around the rim taking the tube with it. If this is not stopped, the valve will ultimately be pulled from the tube. It has been found necessary therefore, to fit a security bolt to the rim of each wheel on the Bushman models. Before attempting to remove or replace a tyre, the security bolts must be completely loosened.

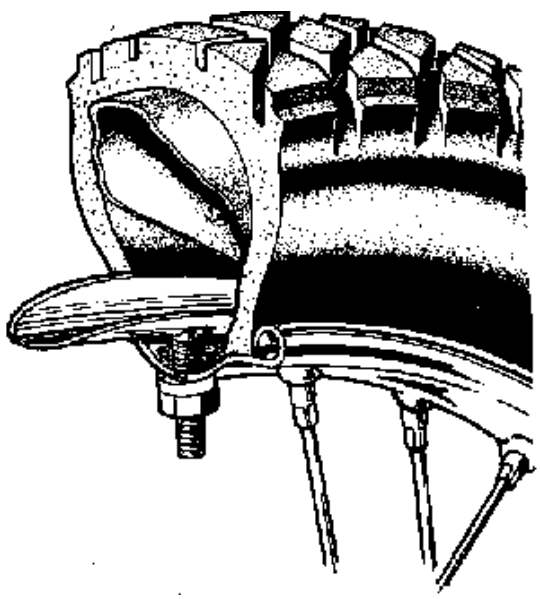

FIG. F8. *Security bolt.*

WHEEL BUILDING

This is a job which is best left to the specialist as it is essential that the wheel is laced correctly and that when truing, the spokes are correctly tensioned.

It is however, possible for the less experienced to avoid trouble by periodically examining the wheels. As spokes and nipples bed-down the tension will be lost and unless this 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 finger 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 through the rim 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 the tension at another part of the wheel in order to maintain its truth.

It will therefore be obvious that spoke replacement, spoke tensioning or wheel truing are not operations to be treated lightly.

Careful examination of the wheel will show that for every spoke there is another pulling in the opposite direction and that the adjacent spoke goes to the opposite side of the hub.

Increasing the tension tends to pull the rim so, to counteract this, it is sometimes necessary to increase the tension on the spoke or spokes either side to maintain the truth of the wheel.

With a little care and patience it is possible for the unskilled to at least re-tension the spokes but, turn each nipple only a little at a time as, once the spoke is under tension only a fraction of a turn is sometimes sufficient to throw the rim badly out of truth.

WHEEL BALANCING

When a wheel is out of balance it means that there is more weight in one part than in another. This is very often due to variation in the tyre and at moderate speeds will not be noticed but at high speeds it can be very serious, particularly if the front wheel is affected.

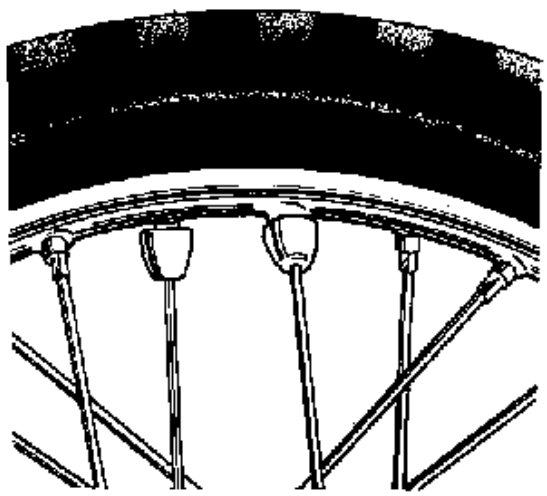

FIG. F9. *Balance weights.*

Weights are available for attaching to the spokes to counteract any out-of-balance but, before starting, ensure that the wheel is absolutely free and revolves quite easily. If the rear wheel is being treated remove the driving chain.

With the wheel clear of the ground spin it slowly and allow it to stop on its own. Now mark the top of the wheel or tyre and repeat two or three times to check.

If the wheel stops in the same place the 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 sticking small pieces of plasticine to the nipples and re-checking until the wheel will stop in any position without moving.

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.

WHEEL ALIGNMENT

Steering will be affected if the wheels are the slightest bit out of alignment (out of track).

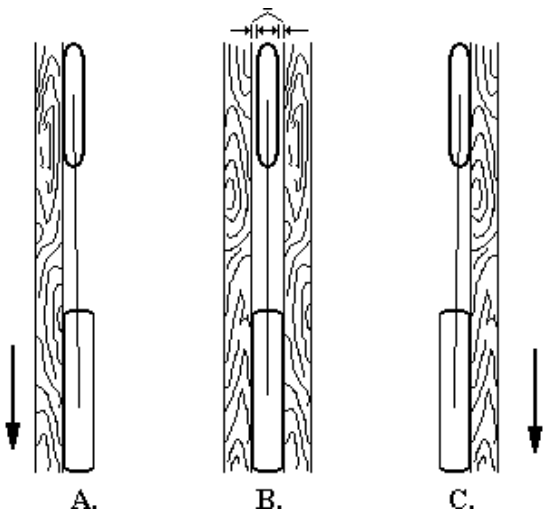

FIG. F10. *Checking alignment*

Since the front wheel cannot be adjusted in this respect, it is the rear wheel which must be aligned to the front wheel. This adjustment will be necessary whenever the chain is adjusted or the wheel removed. It is also necessary to adjust the rear brake whenever re-alignment has been carried out.

To check the alignment of the wheels a straight edge of timber or steel is required approximately 80" long.

The straight-edge should be laid on blocks four to six inches high (alternately) each side of the machine.

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.

If the front tyre is of smaller section then it should be as drawing (*B*) Fig. F10.

If the alignment is as either (*A*) or (*C*) then the rear chain adjusters must be moved as indicated by the arrows to correct the alignment.

Assuming that the chain adjustment is correct the movement of the rear wheel will be made on the right-hand side chain adjuster which should be screwed in or out as necessary after the spindle nuts have been slackened off.

A machine suffering accidental damage may have wheels so out of alignment that they cannot be corrected in this way. Frame, fork or wheel geometry may be basically upset, in these cases a specialist repairer can probably reset any offending assembly using information in section "D."

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 simpler if the beads are pressed right down into the well of the rim except at the point being “worked”. The well is in the centre section.

(3) The tyre beads will slip over the rim quicker 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 are designed 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.

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.

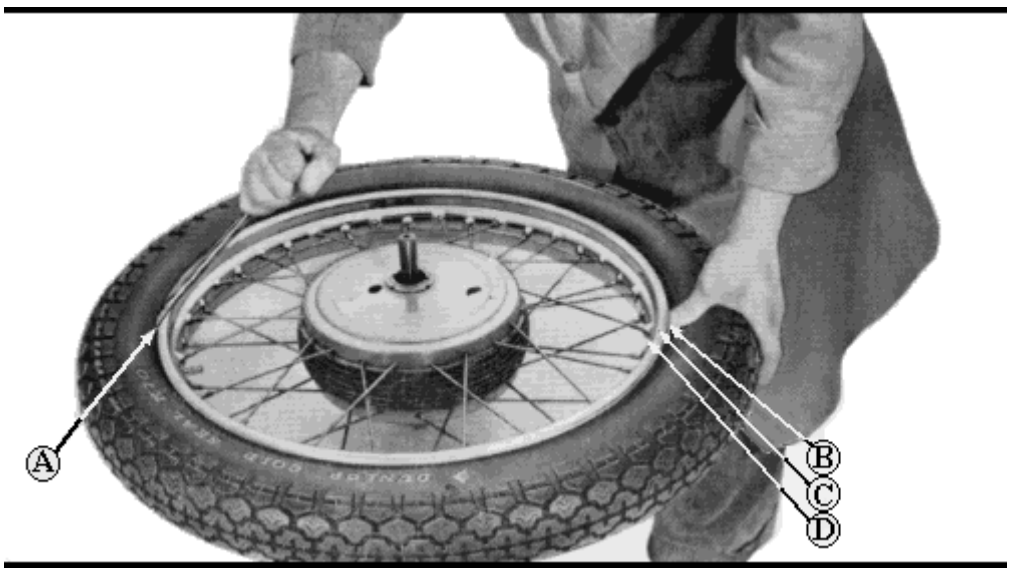

FIG. F11.

It will not be possible to pull the cover bead at (*A*) Fig. F11 over the rim flange until the cover bead at (*B*) is pushed off the bead seat (*C*) down into the well (*D*). Then the cover bead at (*A*) comes over the rim flange easily.

Insert a second lever close to the first and prise the bead over the flange holding the free part with the other lever.

Remove one lever and insert further along the tyre continuing every two to three inches until the bead is completely removed (see Fig. F12).

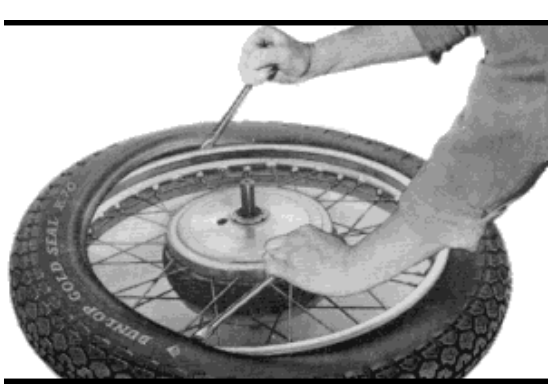

FIG. F12. *Removing the first bead.*

FIG. F13.

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 pull the cover back over the flange as in Fig. F13. Do not forget to press the bead diametrically opposite the lever into the centre of the rim and to apply a soapy solution to the rim flange.

TYRE REPLACEMENT

Before a tyre, new or used, is replaced, ot 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 see 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. This will ensure a very high degree of tyre balance.

If the spokes have been tensioned, or replaced, see that they are not projecting through the nipples. File flush any that are showing through. Replace the rim tape with the rough side next to the rim.

FIG. F14.
Cover and tube assembled ready for fitting.

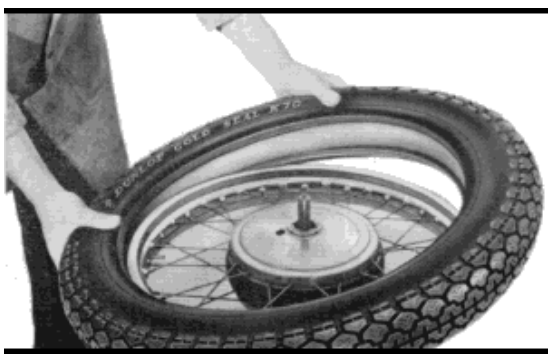

FIG. F15. *Commencing to fit the tyre.*

Fit the tube in the tyre and inflate just sufficient to round it out without stretch.

Too mush air makes fitting difficult, and too little will make the tube more liable to be nipped by the levers. Dust the tube and inside the cover with dusting chalk.

Lubricate the cover 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—5" each side the valve as in Fig. F14.

Squeeze the beads together at the valve to prevent the tube slipping back and offer the cover to the rim as shown in Fig. F15, at the same time passing the valve through the holes in the tape and rim.

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. F16). If necessary use a tyre lever for the last few inches as in Fig. F17.

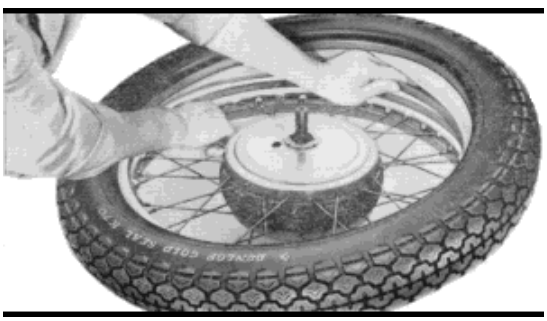

FIG. F16. *Fitting the first bead.*

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.

Insert a lever as close 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. F18).

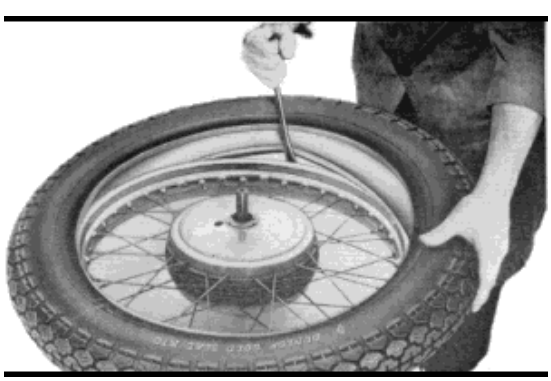

FIG. F17.
Completing the fitting of the first bead.

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.

Before inflating, check that the fitting line on the tyre wall just above the bead on each side is concentric with the rim.

If necessary bounce the wheel to help seat the tyre but, see that there is adequate pressure to prevent damaging the tyre or tube and only use moderate force. If the tyre will not seat, it is better to release the pressure, apply soap solution to lubricate and re-inflate.

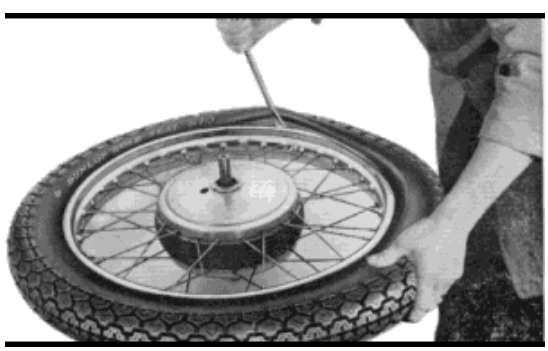

FIG. F18.
Completing the fitting of the second bead

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.

See that the valve protrudes squarely through the valve hole before screwing down the knurled nut and replace the dust cap.

TYRE PRESSURES

The recommended inflation pressures of 17 p.s.i. for the front and 22 p.s.i. for the rear tyre, are based on a rider's weight of 140 lb. If the rider's weight exceeds 140 lb, the tyre pressures should be increased as follows:—

Front Tyre:
Add 1 lb. per square inch for every 28 lb. in excess of 140 lb.

Rear Tyre:
Add 1 lb. per square inch for every 14 lb. in excess of 140 lb.

If additional load such as a pillion passenger or luggage is to be carried, the actual load bearing upon each tyre should be determined and the inflation pressures increased in accordance with the Dunlop Load and Pressure Schedule.

INDEX

INTRODUCTION

The lighting and ignition systems of the Wipac alternator equipped model Bantam consists of a simple six-pole alternator generating set which supplies current through a metal plate rectifier to a battery, which then feeds the ignition system, lights, horn etc. The alternator ring carries six coils which are connected in three sets of two in series, as illustrated in the schematic diagram Fig. G2.

By using one set of two coils in series, a certain output is obtained for daylight running and when the pilot or parking lights are switched on. When the headlight is brought into circuit, all six coils are connected as three pairs in series parallel as shown in Fig. G2, giving maximum output, most of which is absorbed by the headlamp bulb but still leaving sufficient current for maintaining the state of charge of the battery.

Alternating current supplied by the generator is converted to direct current by means of the rectifier which is of the very efficient full wave bridge connected type.

The main connections in the wiring system are made by rubber socket connectors to the lighting and ignition switches and by individual rubber covered bullet-type push-in connectors. The latter are found most useful when making wiring checks or re-installing new cables. These connectors are not intended as plugs and sockets for frequent manipulation and should only be used when testing or fault-finding. It is important that they are making perfect contact as should all other connection points throughout the system.

BATTERY

The battery used on Bantam machines (with the exception of the Bushman Pastoral), is a Lucas six volt unit type PUZ5E/11.

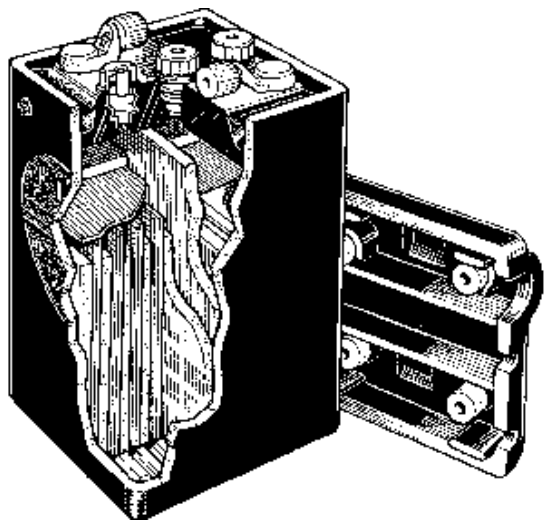

FIG. G1. *Cut-away view of battery.*

Charging the Battery

The battery leaves the factory in a fully "dry-charged" condition, but during storage some of the charge may be lost. In view of this, the following filling instructions must be carefully observed.

With the acid, battery and room temperature between 60°F., and 100°F. (15·5—37·7°C.), remove the vent plugs and fill each cell to the top of the separator guard.

Measure the temperature and specific gravity of the electrolyte in each of the cells.

Allow to stand for twenty minutes and then re-check the temperature and specific gravity of the electrolyte in each cell.

The battery is then ready for service unless the above checks show the electrolyte temperature to have risen by more than 10°F. (5·5°C.) or the specific gravity to have fallen by more than ten 'points', *i.e.,* by more than 0·010 specific gravity. In this event, it will be necessary to re-charge the battery at the appropriate charge rate (0·8 amperes) until the specific gravity values remain constant for three successive hourly readings and all cells are gassing freely.

During charging, keep the electrolyte in each cell level with the top of the separator guard by adding distilled water — **not acid.**

Routine Maintenance
Every 1,000 miles (1,600 km.) or monthly, or more regularly in hot climates, the battery should be cleaned as follows.

To gain access to the battery first take off the dualseat as detailed on page D8.

Remove the battery cover and clean the battery top. Examine the terminals: if they are corroded scrape them clean and smear them with a film of petroleum jelly, or with a silicone grease. Remove the vent plugs and check that the vent holes are clear and that the rubber washer fitted under each plug is in good condition.

The level of the electrolyte in each cell should be checked weekly or every 250 miles. Add distilled water until the electrolyte level reaches the top of the separator guard.

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, can be dangerously explosive.

The readings obtained from the battery electrolyte should be compared with those given in table "A" opposite. 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 freshening charges at the appropriate re-charge rate. These should be given fortnightly in temperate climates and weekly in the tropics.

Remember that a positive earth wiring system is employed on the bantam series and ensure that the battery is connected correctly, *i.e.,* with the positive (+) side of the battery connected to earth.

The coloured lead must be connected to the battery **negative** (—) terminal and the translucent (earth) lead to the battery **positive** (+) terminal.

Table "A"

Specific Gravity of Electrolyte for Filling the Battery

U.K. and Climates normally below 80°F. (26·6°C.)	Tropical Climates over 80°F. (26·6°C.)
Filling Fully charged	Filling Fully charged
1·260 1·270—1·290	1·210 1·210—1·230

To obtain a specific gravity strength of 1·260 at 60°F. (15·5°C.), add one part by volume of 1·840 specific acid to 3·2 parts of distilled water.

To obtain a specific gravity strength of 1·210 at 60°F. (15·5°C.), add one part by volume of 1·840 specific acid to 4·3 parts of distilled water.

Table "B"

Maximum Permissible Electrolyte Temperature During Charge

Climates normally below 80°F. (26·6°C.)	Climates normally above 80°F. (26·6°C.)
100°F. (38°C.)	120°F. (49°C.)

Notes:—The specific gravity of the electrolyte varies with the temperature. For convenience in comparing specific gravities, they are always corrected to 60°F., which is adopted as a reference temperature. This method of correction is as follows.

For every 5°F. below 60°F. deduct ·002 from the observed reading to obtain the true specific gravity at 60°F. For every 5°F. above 60°F. add ·002 to the observed reading to obtain the true specific gravity at 60°F.

The temperature must be indicated by a thermometer having its bulb actually immersed in the electrolyte and not the ambient temperature. To take a temperature reading tilt the battery sideways and then insert the thermometer.

EMERGENCY STARTING

The alternator equipment provides an emergency starting system which, when the ignition switch is put into the emergency position, connects all the six coils together and, providing the lighting switch is in the "off" position, gives full output in order to raise the voltage of a discharged battery and is effective in obtaining an immediate start under these conditions. The maximum charging current in the emergency position is very high as there is no drain against it by the lighting system. Therefore, the engine should not be run with the ignition switch in this position for more than 10—15 minutes. This type of emergency starting being entirely D.C. enables the machine to be run through the complete operational range of the engine.

FAULT FINDING

Before commencing the fault finding tests, it should be noted that the following equipment will be required.

(1) Wilkson test set.

(2) 6 volt, 3 watt bulb with holder and test leads, about 24" long.

(3) A well charged 6 volt battery.

If a Wilkson test set is not readily available, then the additional equipment listed below can be used as an alternative.

(1) A good quality moving coil A.C. voltmeter to be used in conjunction with a 1 ohm load resistor.

(2) 10—0—10 D.C. ammeter.

(3) 0—12 volts D.C. voltmeter.

Details of constructing a suitable 1 ohm load resistor will be found on page G8, but it is most essential that the resistor is accurate in order to obtain correct readings.

Charging Circuit

(1) Before commencing any tests, check the voltage of the battery and if completely exhausted, substitute one which is known to be capable of accepting a charge.

(2) Connect in series with the battery (easily done by disconnecting the brown negative lead from the double connector), the D.C. ammeter and check that the charge rates are as detailed below.

Ignition Switch	Lights Switch	Min. Charge Rates	R.p.m.
Ignition	Off	2·5 a.	3,000
Ignition	Low	·5 a.	3,000
Ignition	High	1·0 a.	3,000
Emergency	Off	4·5 a.	3,000

These figures should be checked when the engine is running at approximately 3,000 r.p.m. Charge rates will, of course, vary with engine speed and the state of battery charge, but the above figures will help to give a fair indication as to the correct functioning of the system.

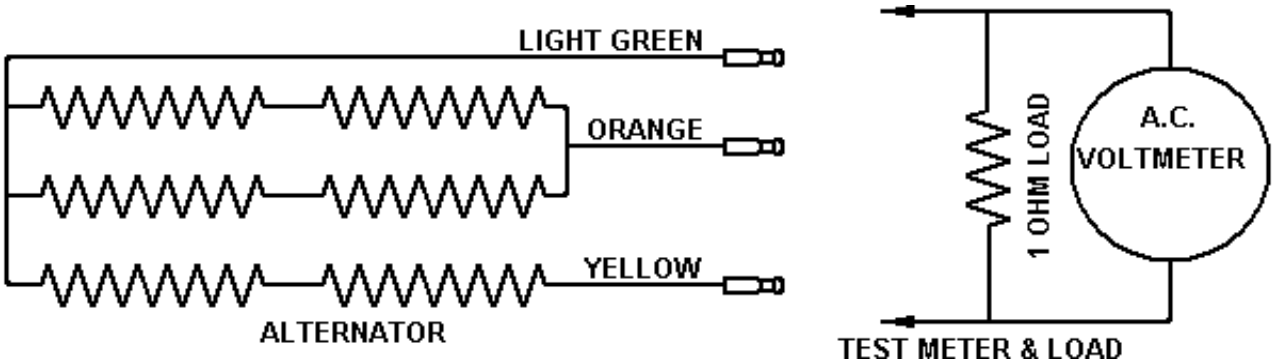

FIG. G2. *Generator testing.*

NOTE:—It is essential that bulbs of the correct wattage be used throughout the system, as any deviation will seriously upset the charge rates. See page GD6 for correct specification of each bulb.

If the meter readings are unsatisfactory, proceed as follows.

(3) Check the alternator output by disconnecting the yellow, orange and light green leads from the five-way connection, into which the alternator harness is plugged. It will be seen from the appropriate wiring diagram, on page G14 and from Fig. G2, that the light green lead from the alternator is common to all coils, whilst the yellow connects two coils only and the orange the remaining four. Connect one side of the Wilkson test meter (A.C. volts with 1 ohm load) or the A.C. voltmeter with 1 ohm load paralleled across it, to the green lead and the other side of the meter to the yellow and orange leads in turn.

Check with the table below:—

Check between	Revolutions per minute	Volts output
Yellow/green	2,000—3,000	4—4·75
Orange/green	2,000—3,000	7·5—8·5

A low reading on one group of coils would indicate coil failure and low readings on both groups of coils will, in all probability, be due to a low flux density in the magnetic rotor. No readings from both groups of coils indicates an open circuit in the green supply lead.

Winding resistance between:—

Yellow/green	0·25 ohms
Orange/green	0·4 ohms

NOTE:—During these series of tests, the importance of correct battery connections cannot be over-emphasised. The translucent lead should always be connected to the battery positive terminal, and the brown lead to the negative terminal. Reversal of these connections will invariably burn out the rectifier and, if the engine is run under these conditions, the generator rotor will become demagnetised.

(4) A further cause of low or no charge may be due to the alternator short-circuiting to earth. To check this, it is necessary to construct a simple continuity check circuit, *viz.,* a six-volt battery introduced in series with the D.C. voltmeter will amply suffice. Connect one end of the circuit to the green lead and the other end to the machine frame earth. If a reading is obtained on the voltmeter then the alternator is short-circuit to earth. It is desirable to carry out this check with both the generator stator rotor in position on the machine, the reason being that in isolated cases, careless handling of the stator may have caused one or more of the soldered coil link connections to have become displaced, thus making contact with the circumference of the rotor and short-circuiting all coils. Before condemning the alternator, therefore, it is wise to check that all connections are well clear of the rotor, gently easing back any which look a possible cause of future trouble.

Rectifier
A rapidly flattening battery necessitates an immediate check on both the rectifier and alternator.

Rectifier Test Procedure

Procedure	Battery Connections	Bulb Connections	Conclusions
Rectifier Check. Connect a 6 volt battery in series with a 6v., 3w. bulb across the rectifier terminals.	**Positive—** Light green White Brown Brown	Earthed Earthed Green White	Bulb lights rectifier o.k. Bulb does not light. Rectifier faulty, replace.
Reverse battery connections.	**Negative—** Light green White Brown Brown	Earthed Earthed Green White	Bulb does not light. Rectifier o.k. Bulbs light, rectifier faulty, replace.

(Refer to FIG. G3.)

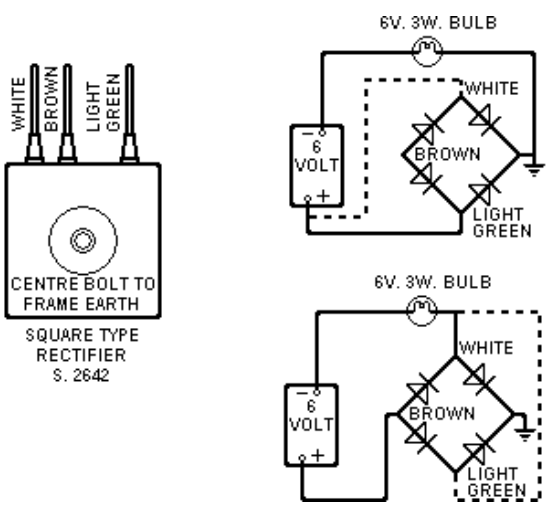

FIG. G3. *Rectifier test procedure.*

However, before attempting to carry out tests on the rectifier it is essential that the white, green and brown cables are disconnected from the unit at the plug sockets.

Check the rectifier as detailed in Fig. G3. Should it be found necessary to replace this component or to refit a proven good rectifier, ensure that it is rebolted securely to its mounting bracket, remembering that the case of the of the rectifier is D.C. positive. Take care when tightening the fixing nut and hold the bolt head firmly with a second spanner to prevent it from turning. If this precaution is not taken, the rectifier plates may twist and break the internal connections.

The cable snap connectors should be clean and tight, as poor connections can give rise to rectifier failure, owing to over-load or arc burning.

Switches
On all models except the Bushman Pastoral, both the ignition and lighting switches are mechanically identical. A faulty switch will invariably be detected if the procedure outlined below is adopted.

Remove the headlamp front and substitute the cable plugs from the ignition switch to the light switch and vice versa. If the switch is defective then the fault will be transferred from one circuit to the other. Replace the faulty switch.

Lighting Switch Continuity Test
Figure G4 illustrates a test for switch continuity.
Note that terminal No. 10 is the short pin.

Before testing, separate the switch completely from the harness and remove from headlamp. When the switch knob is is in the "off" position, there will be continuity between pin Nos. 1, 2 and 10, between 5 and 6 and between 8 and 9. Next rotate the switch knob clockwise to "H" position and continuity will occur between pin Nos. 1, 2 and 10, between 4 and 5 and between 7 and 8. Now rotate the switch knob anti-clockwise to "L" position and continuity will occur between pin Nos. 2, 3, 9 and 10 and between 6 and 7.

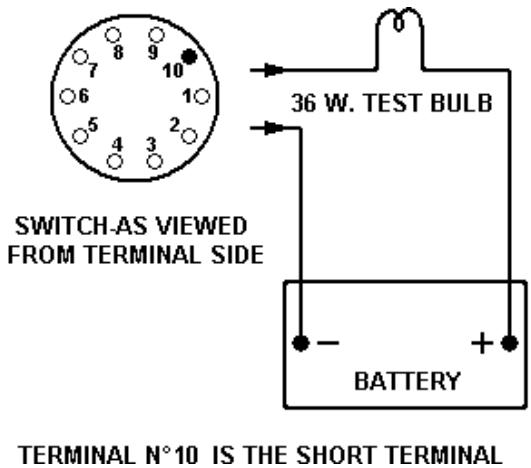

FIG. G4. *Lighting switch continuity test.*

Finally there should be no circuit between any switch pin and earth (earth body) in any switch position selected.

Premature Bulb Failure
Premature bulb failure involving all or many of the light bulbs at one time on a full D.C. battery system is caused by a defective connection in the battery "line."

The following should be checked:—

(1) Battery positive terminal.

(2) Battery negative terminal.

(3) All connections in the four-hole connector into which the battery negative lead is fitted.

(4) Rectifier earth lead (translucent).

(5) Harness frame earth.

(6) Both ends of the short link wire in ignition switch joining brown lead from lighting switch to brown lead from main body of harness.

(7) Check battery acid level and top-up if necessary.

Contact Breaker
Check the contact breaker points gap and adjust to the recommended setting of ·012", as detailed on page B17. Check cleanliness of contact faces, these, if in good order, should have a light grey frosted appearance. Where fine matter, *e.g.,* oil and grease have been present, the contacts may have a blackened, burnt appearance. Should the condition not appear serious, then a light application of fine grade emery will restore them. If in doubt replace the whole breaker unit. Check the action of the breaker arm on the pivot, as any sticking of this arm can cause intermittent difficulty.

On no account should the star-shaped retaining washer on the breaker arm be removed from the pivot as the amount of end float is strictly controlled, and is essential to the correct functioning of the contact breaker.

Condenser
Should the capacity be suspect, first check for good contact to earth and security to the contact breaker plate. Secondly, a quick check can be made for short-circuit to earth; the battery and bulb is a simple and quick test, but first remember to disconnect from the contact breaker plate. Visual recognition of a defective condenser or its connections is vivid blue arcing at the contacts when an attempt is made to start the engine or when the engine is actually running.

Where an Avometer is available, a more conclusive check can be made. This is done by firstly, disconnecting the condenser lead from the contact breaker. Select the Avometer to the ohms by 100 range and, using the test prods from the meter, connect one to the condenser lead and the other to the condenser case. The needle on the Avometer will move rapidly and return to infinity immediately. Remove the test meter prods and wait fifteen seconds. Re-apply the prods and the needle should not again move. If it does the condenser requires replacement. It should be noted that a very small white spark across the contact breaker points when running is normal.

Ignition Coil
Firstly, completely disconnect the ignition coil from the motor-cycle circuit, and connect the D.C. voltmeter across the six-volt battery to produce a continuity check. The meter should register the battery voltage. Now break this circuit at any point and across this break connect the two small screw terminals of the ignition coil. This test will indicate continuity to prove that the primary winding is intact. Likewise, one lead of the test circuit connected to either one of the primary terminals and the other to the high-tension pick-up will again show continuity. A lower reading can be expected due to the higher resistance of the secondary windings.

The third and last check is to ensure that the coil is not earthing out. Leave one lead attached to one of the primary terminals and connect the other to the coil case, when no reading should show. Similar results should be noted at the high-tension pick-up point.

Where an ohm meter is available, check the resistance as below:—

Primary resistance	1·3 ohms
Secondary resistance	4,500 ohms

A defective primary winding may continue to produce a weak spark whereas intermittent performances will invariably be caused by a faulty secondary. Should there be any possible doubt about the ignition coil, however, a final check can be made by substitution.

Constructing a 1 ohm Load Resistor
The resistor used in the above tests must be accurate and constructed so that it will not over-heat otherwise the correct values of current or voltage will not be obtained.

A suitable resistor can be made from 4 yards (3¾ metres) of 18 s.w.g. (·048", *i.e.,* 1·2 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 six-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.

BUSHMAN PASTORAL MODELS

The Pastoral models are not fitted with a battery and the electrical equipment will only function when the engine is running.

The electrical system is fed by a Wipac series 114 six-pole alternator comprising a six-pole magnetic rotor and a laminated stator plate fitted with six feed coils. Issuing from the alternator is a group of five wires, translucent, brown/black, maroon, brown and dark red. The translucent lead is common to all coils.

A schematic diagram of the alternator is shown in Fig. G5.

(1) The headlight, tail light and speedometer light take their supply between the translucent and dark red leads utilising two of the six alternator coils.

(2) The stop light is fed between the brown and translucent lead utilising one alternator coil.

(3) The ignition system which operates on an energy transfer basis is fed between the maroon and translucent leads and uses one alternator coil.

(4) Provision is made for the operation of an A.C. horn which is operated by two alternator coils between the brown/black and translucent leads. No provision is made for parking lights.

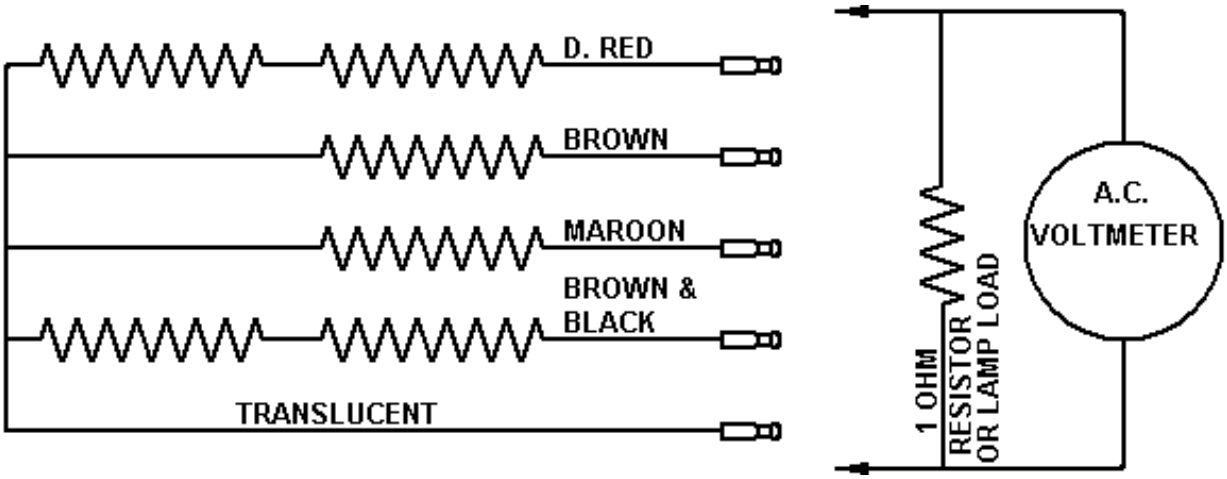

FIG. G5. *Generator testing (Bushman Pastoral models only).*

Generator Testing

The following table will apply in checking the alternator outputs and the readings should be taken only under loaded conditions as detailed in column 3 and column 4. The table embraces values associated with the lights, horn and stop light circuits. The ignition feed coil is dealt with separately. The voltmeter used in these tests should be a good quality moving coil instrument and the 1 ohm resistance must be accurate otherwise correct results cannot be obtained. With respect to column 3, the light should, of course, be switched on before checking these output figures and care should be taken to see that the correct bulbs are fitted with in the lamps at the time of testing. When testing in accordance with column 4, be sure the lighting witch is in the "off" position.

Column 1. Readings taken across wire colours	**Column 2.** Value of lamp load or open circuit (see Column 3)
Dark red/trans.	30·6 w., 2,000/4,000 rpm
Brown/trans.	10·0 w., 2,000/4,000 rpm
Brown and black trans.	30·6 w., 2,000/4,000 rpm

Ignition Feed Coil

The ignition feed coil operates between the maroon and translucent (earth) lead. A useful check in the case of misfiring is to start the machine and check between the maroon lead at the four-hole connector and earth. At 3,000 r.p.m., nine volts should be attained. Where a machine will not start, a test can be made by unplugging the maroon lead from the four-hole connector and checking with the voltmeter between the maroon lead and earth. At kick-over, *i.e.,* approximately 1,000 r.p.m., the meter will read 4·5—5·0 volts. The resistance of the feed coil is 1·85 ohms.

Column 3. A.C. volts across lamp or open circuit	**Column 4.** A.C. volts across 1 ohm resistance
From To	From To
5·5 — 7·0	5·0 — 5·75
5·0 — 6·25	3·0 — 3·5
5·0 — 6·5	4·5 — 5·0

Premature Bulb Failure
The current feeding the bulbs when the headlights are in use is alternating current, provided direct from the generator. The correct bulb loading under these conditions is of the utmost importance. To ensure that the rear lamps do not blow and consequently overload the headlamp and speedometer units, a "carry-over" type of dip switch is used. This means that during the change over from head to dip and vice versa both headlamp filaments are alight thus ensuring that the heavy bulb loading is not transferred to the small tail light bulb and speedometer bulb which would result in failure. Firstly, then, check that the dipper switch is functioning correctly and, secondly, check that all bulb holder contact spring tensions are satisfactory as intermittent open-circuiting of the bulbs could again lead to circuit overload. Where premature bulb failure does take place, on no account should twelve-volt bulbs be substituted as this would only aggravate the complaint.

Dipper Switch
The dipper switch fitted to the Pastoral is a Wipac Tricon switch. This switch embodies headlight dipper switch, engine cut-out (red button) and horn push (black button). The alternator, wiring harness and switching incorporates leads for a horn where fitted. The horn should be of the A.C. buzzer type.

SPARKING PLUG

It is recommended that the sparking plug be inspected, cleaned and tested every 5,000 miles (8,000 km.) and a new one fitted every 10,000 miles (16,000 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 petrol (gasoline) 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 discharged battery, faulty contact breaker, coil or condenser defects, or a broken or worn out 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 petroil mixture is incorrect.

To rectify this type of fault the above mentioned items should be checked with special attention given to carburation system.

Over-heating of the sparking plug electrodes is indicated by severely eroded electrodes and a white, burned or blistered insulator. This type of fault can be caused by weak carburation although a plug which has been operating whilst not being screwed down sufficiently can easily become over-heated due to heat that is normally dissipated 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 crown failure. Unnecessary damage can result from over-tightening the plug. 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.

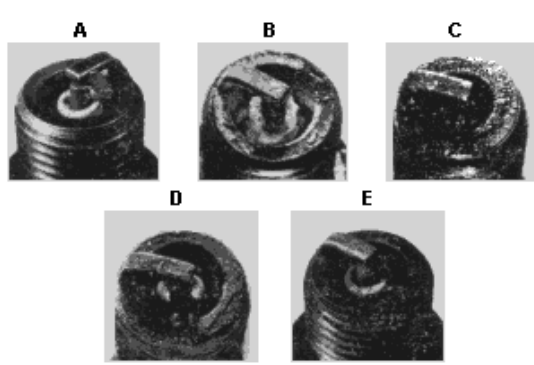

FIG. G6. *Sparking plug diagnosis.*

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 too is "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 the 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. The makers instructions for using the cleaner should be followed carefully.

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 has completed its useful life and a new one should be fitted.

Finally, before refitting the sparking plug the electrode should be adjusted to the correct gap setting of ·025" (·635 mm.). To prevent the possibility of thread seizure occurring, it is advisable to clean the threads of the plug with a wire brush then smear a minute amount of graphite grease on to the threads.

If the ignition 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. This possibility must be checked thoroughly before taking any further action. When it is certain that none of the above mentioned faults are the cause of over-heating then the plug type and grade should be considered.

Normally the type of plug quoted 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 is readily available to solve these problems from the plug manufacturer who should be consulted.

NOTE:—If the machine is of the type fitted with an air filter or cleaner and this has been removed it will affect the carburation of the machine.

HEADLAMP

Description

The headlamp glass, together with the reflector and bulb assembly is secured to the main casing by means of a slotted screw either above or below the lamp rim. To gain access to the bulb therefore, it is only necessary to loosen the screw until the rim can be withdrawn.

To replace the double-filament bulb, press the bulb retainer inwards and turn slightly anti-clockwise, to release, enabling the bulb to be removed.

Replacement bulbs automatically provide correct relationship of the filaments and focusing, therefore, is unnecessary. Check the replacement bulb voltage and wattage specification and type before fitting.

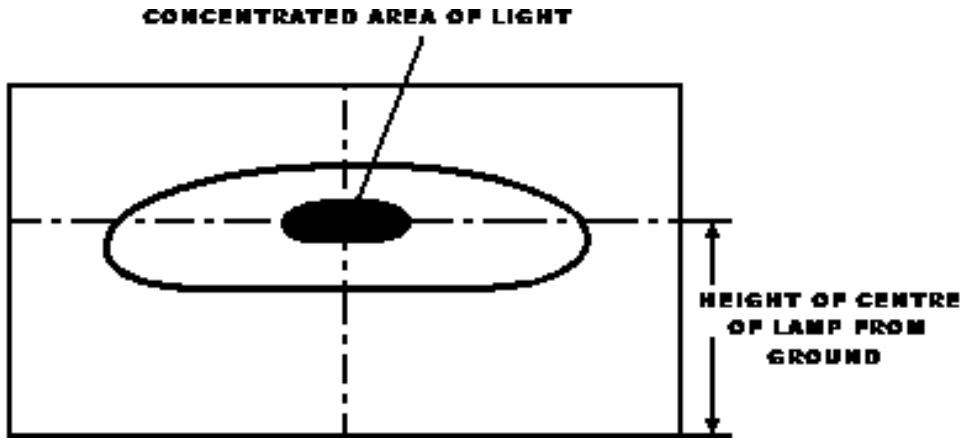

FIG. G7. *Beam adjustment.*

The headlamp has a reflector with an extremely efficient reflecting surface provided by the now widely adopted aluminisation process in which a thin film of aluminium is deposited on the reflector under vacuum. This reflecting surface should not be touched or cleaned in any way and it will retain its brilliance indefinitely. The bulb is a pre-focus twin-filament type giving correct beam length and spread in main and dip positions.

Beam Adjustment

The headlamp beam must at all times be set as specified by local lighting regulations. For the United Kingdom, The Transport Lighting Regulations read as follows:—

> *"A lighting system must be arranged so that it can give a light which is incapable of dazzling any person standing on the same horizontal plane as the vehicle at a greater distance than 25 feet from the lamp, whose eye level is not less than 3 feet 6 inches above that plane."*

Of course these instructions may vary with overseas lighting regulations.

The headlamp must therefore be set so that the main beam is directed straight ahead and parallel with the road when the motor-cycle is fully loaded. To achieve this place the machine on a level road, facing a wall at a distance of 25 feet away. With a rider and passenger seated on the machine, slacken the two screws on the nacelle rim (Supreme models), or the lamp fixing screws (Sports, and Bushman models), and move the lamp until the correct setting is obtained, *i.e.,* the height of the beam centre on the wall should be the same height of the centre of the headlamp from the ground. Tighten the fixing screws and re-check the setting. Do not forget that the headlamp should be on "full-beam" lighting when carrying out the above adjustment.

TAIL AND STOP LAMP

Access to the double-filament, tail and stop lamp bulb, is achieved by removing the red plastic lens, secured by two countersunk screws.

The bulb is of the offset pin type, thus ensuring that the replacement is fitted correctly into its housing.

Ensure that both the black (tail lamp) and brown (stop lamp) supply leads are properly connected and see that the earth lead to the bulb holder is in satisfactory condition. When refitting the lens, avoid over-tightening the fixing screws or the lens may fracture.

The stop lamp switch is operated by the brake rod through a spring. Periodically clean any mud or grease from the switch and lubricate the operating mechanism with a few drops of thin oil.

HORN

Description

The horn (not fitted on Bushman Pastoral models) is of a high-frequency single-note type and is operated by direct current from the battery. The method of operation is that of a magnetically operated armature, which impacts on the cone face, and causes the tone disc of the horn to vibrate. The magnetic circuit is made self-interrupting 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 above checks are made and the fault is not remedied, then 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 over-loaded.

A small serrated adjustment screw situated near the terminals is provided to take up wear in the internal moving parts of the horn. To adjust, turn this screw anti-clockwise until the horn just fails to sound, and then turn it back (clockwise) about one-quarter to half a turn.

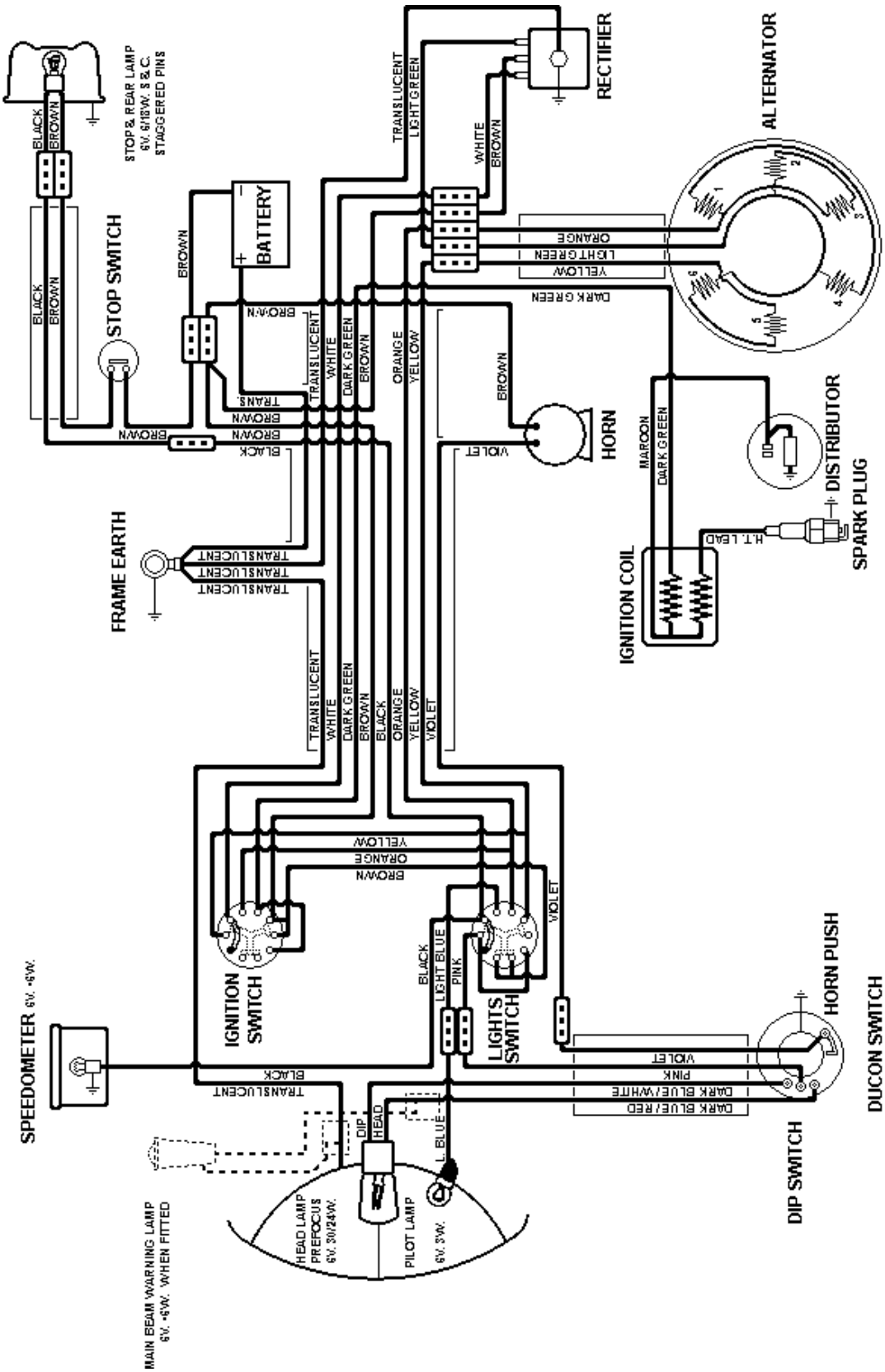

FIG. G8. *Wiring diagram (all models except Bushman Pastoral).*

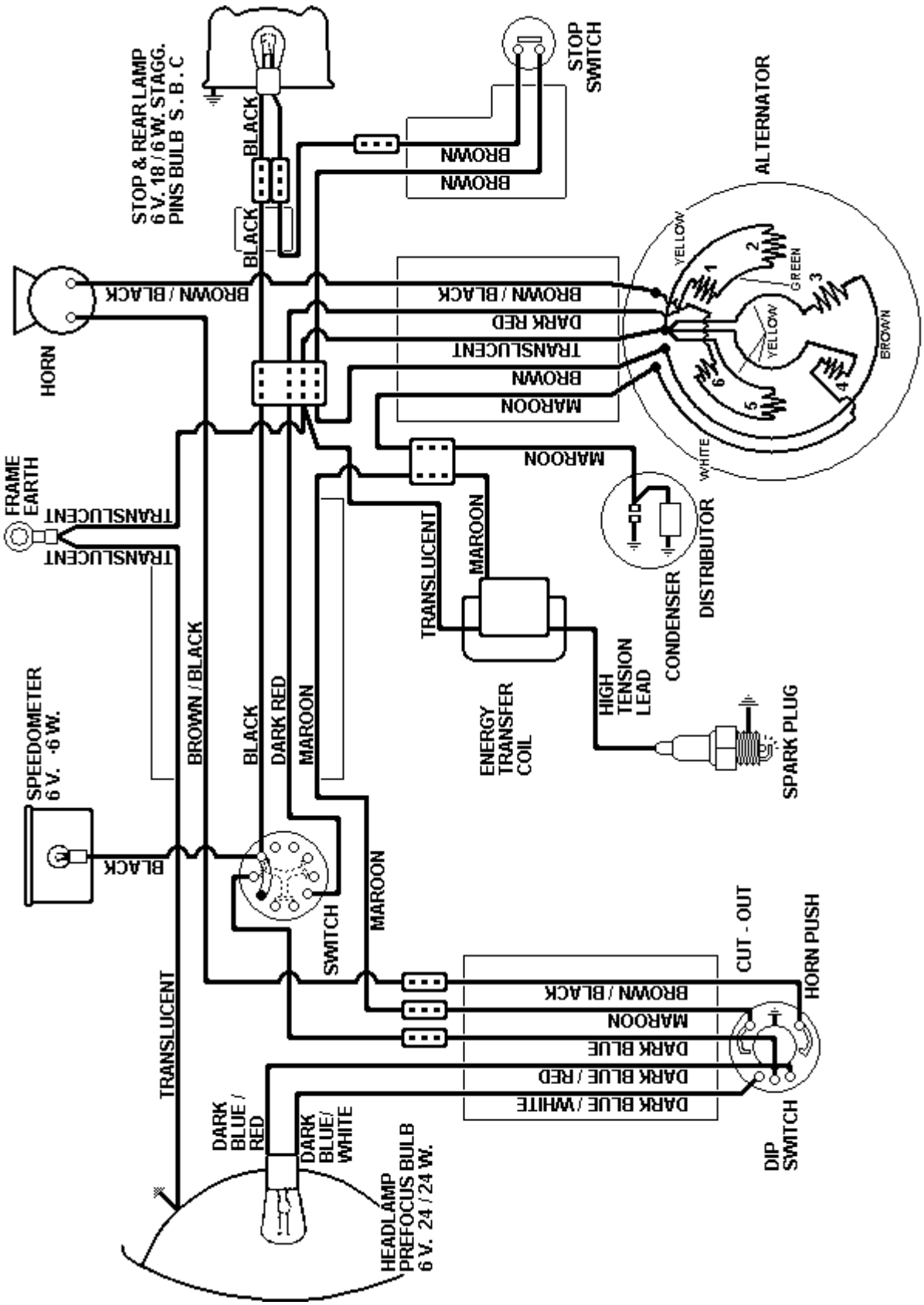

FIG. G9. *Wiring diagram (Bushman Pastoral models).*

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CHAINS

An early indication that the chain is being starved of oil is the appearance at the joints of a reddish-brown deposit. For chain lubrication details refer to page A4.

The standard method of coupling a chain is by a spring connecting link, which is simple and effective. It is important to note that the closed end of the spring clip must point in the direction of chain travel.

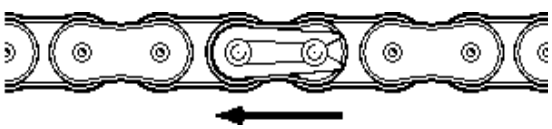

FIG. H1. *Spring link.*

CHAIN MEASUREMENT

It is useful to know the extent of wear, and a simple test for this consists of measuring the chain with an ordinary foot-rule, steel for preference. Wear up to ¼" per foot of chain length is accommodated by the depth of hardening of the bearing surfaces, and when this limit is reached the chain should be replaced.

With a new ¼" pitch chain, 23 pitches will come to the 11½" mark on the rule, and a sufficiently accurate check for subsequent wear is to take a limit of 11¾" for 23 pitches.

Naturally, the test should be made carefully to obtain an accurate result. The chain is first washed in kerosene to ensure that all joints are free, and laid unlubricated on a flat board. If it is anchored at one end by a nail the necessary tension to pull it out to its fullest extent can be applied with one hand, while measuring between the centres of the bearing pins.

If it is found that the chain is still serviceable but the full amount of adjustment has been taken up, then the chain length should be reduced by either one or two pitches as detailed below.

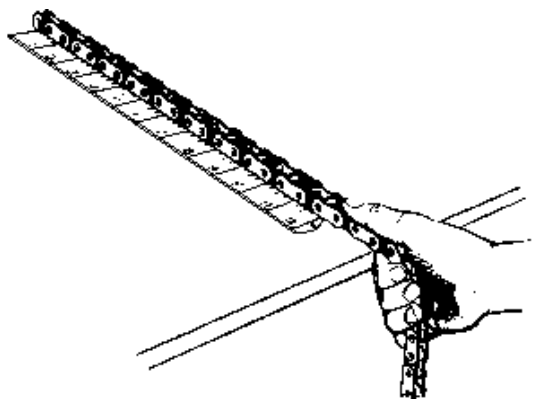

FIG. H2. *Measuring the chain.*

CHAIN ALTERATIONS AND RENEWALS

The illustrations show temporary repairs on the roadside; for permanent repairs, the parts should be replaced by a riveted outer link.

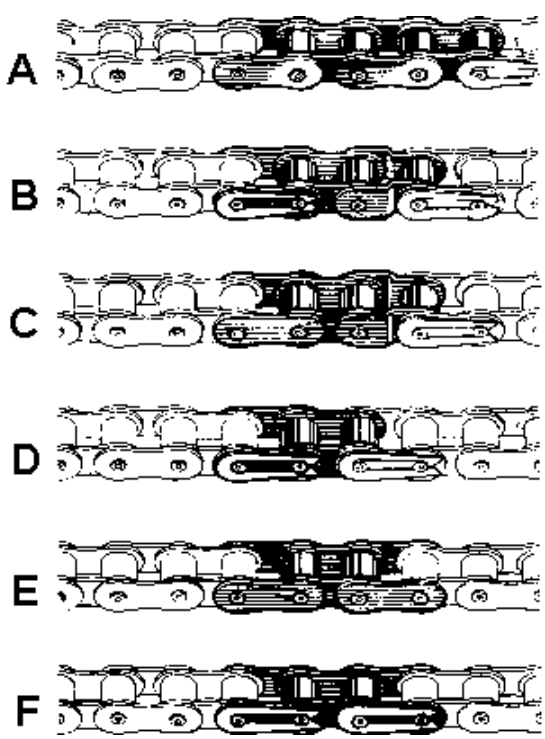

FIG. H3.

To **shorten** a chain containing an **even** number of pitches: remove the parts shown (*A*) Fig. H3, replace by cranked double link and single connecting link, parts shown (*B*) Fig. H3.

To **shorten** a chain containing an **odd** number of pitches: remove the parts shown (*C*) Fig. H3, replace by single connecting link and inner link, parts shown (D) Fig. H3.

To **repair** a chain with a broken roller or inner link, remove the parts shown (*E*) Fig. H3, replace by two single connecting links and one inner link, parts shown (*F*) Fig. H3.

CHAIN AND SPROCKET INSPECTION

Chain sprockets on a new machine should be correctly aligned but malalignment may arise in use. This may be due perhaps to slackened nuts, incorrect reassembly after say, an emergency repair, or minor spills. A periodical alignment check is therefore desirable, and is most easily done when the machine is undergoing overhaul as removal of adjacent components facilitates the job.

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 lightly 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 the 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 probable that one sprocket is further out on its shaft than the other.

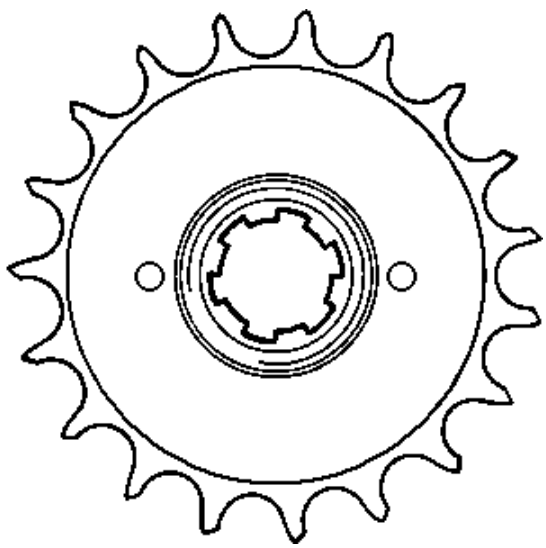

FIG. H4. *Worn sprocket.*

Sprockets which are excessively worn assume a "hooked" appearance, as shown above. When they are replaced check the new ones for accuracy. A new chain should fit completely round the teeth with a snug fit, neither too slack nor having a tight "springy" feel. The sprocket bore must be concentric, otherwise the chain will tend to slacken and tighten as the sprockets are rotated.

With the sprocket in position, a pointer fitted adjacent to the teeth edges will detect such faults, if any show up, the sprocket should be rejected, assuming that the wobble is not caused by a bent shaft. Failure to correct such faults will cause the chain to wear quickly and unevenly.

TORQUE WRENCH SETTINGS (DRY)

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, can 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 SETTINGS	
				Foot Pounds	Kilogram-metres
Carburetter stud nuts	0·3125" B.S.C.	26	0·525"	10/12	1·383/1·659
Clutch centre nut	0·50" B.S.F.	16	0·820"	40/49	5·530/5·945
Cylinder head & barrel stud nuts	0·3125" B.S.F.	22	0·525"	18/20	2·489/2·765
Fork leg pinch bolts	0·3125" B.S.F.	22	0·525"	14/16	1·936/2·212
Gearbox sprocket nut	0·8750" W.F. (L/H)	20	1·200"	50/55	6·913/7·604
Rotor fixing nut	0·6250" B.S.C.	20	1·010"	55/60	7·604/8·295
Stator fixing nuts	0·250" B.S.F.	26	0·445"	6/8	0·830/1·106
Steering column pinch bolt	0·3125" B.S.F.	22	0·525"	14/16	1·936/2·212

Abbreviations:

A/F	Across Flats.	L/H	Left-hand Thread.
B.S.C.	British Standard Cycle.	T.P.I.	Threads Per Inch.
B.S.F.	British Standard Fine.	W.F.	Whitworth Form.

CHEMICAL LOCKS

The use of "Locktite AVV Red" is recommended on the clutch centre nut.

TORQUE WRENCH EXTENSIONS

The torque figures listed overleaf, indicate the load exerted at the end of a torque wrench. In some cases where space is restricted, the direct application of a torque wrench may be found impossible and a suitable extension or adaptor must be used.

When using an extension however, the wrench dial reading must be altered according to the following formula, in order to achieve the recommended torque load.

$$\text{Wrench dial reading} = \frac{\text{Recommended torque load} \times \text{length of torque wrench (in.)}}{\text{Length of torque wrench (in.)} \times \text{length of extension (in.)}}$$

For example:—To obtain a torque load of 30 lb./ft. when using a two foot long wrench with a six inch extension, the dial reading would be calculated in the following manner:—

$$\text{Wrench dial reading} = \frac{30 \times 24}{24 \times 6} \qquad \text{Therefore} = 24 \text{ lb./ft.}$$

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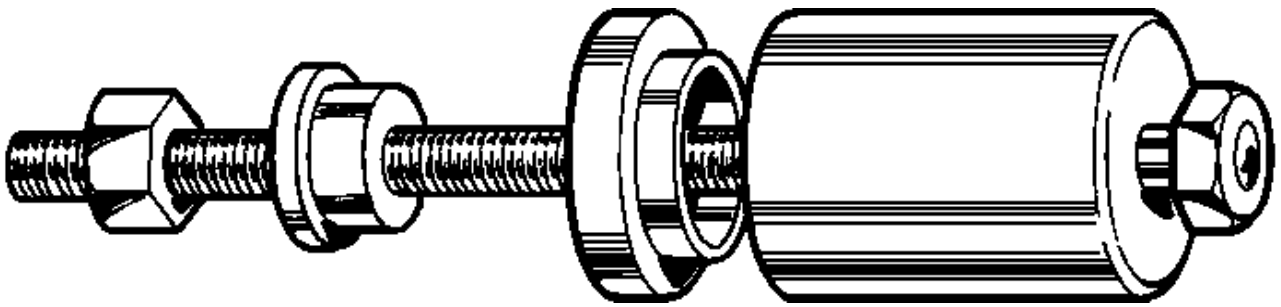

FIG. K1.
61-3791 *Small-end Bearing Extractor.*

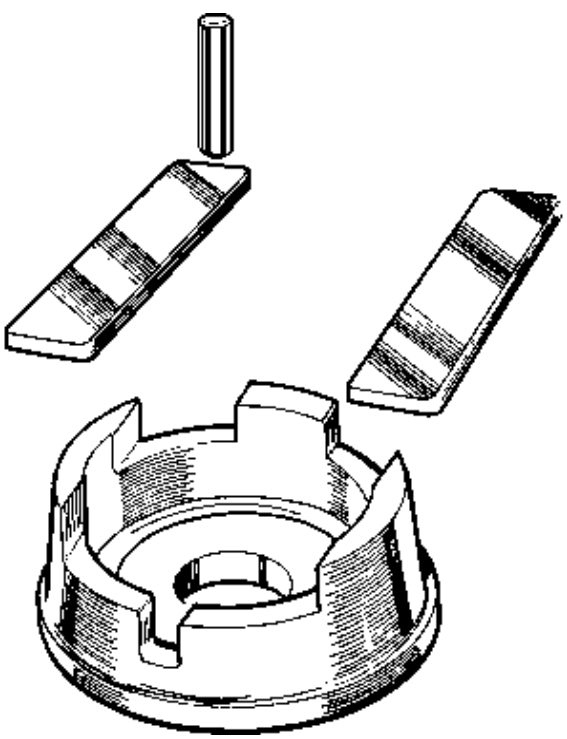

FIG. K2.
61-3206 *Flywheel Bolster.*
61-3209 *Flywheel Punch.*
61-3208 *Flywheel Stripping Bars* (2).

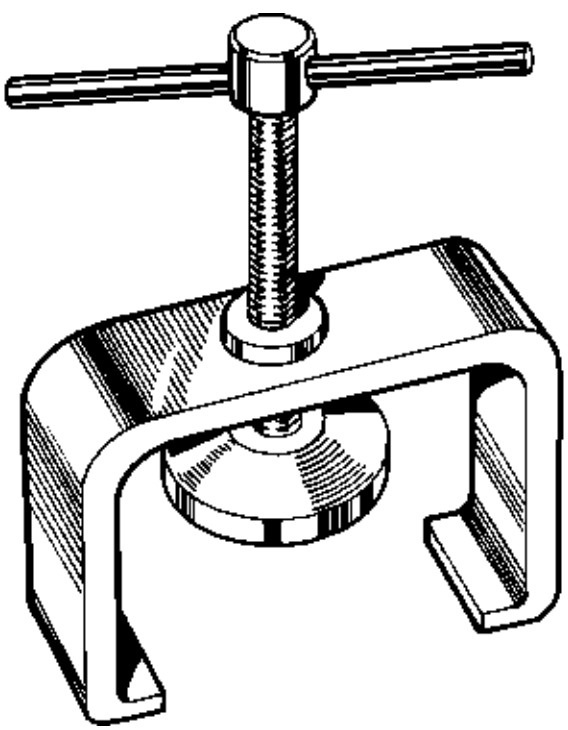

FIG. K3.
61-3191 *Clutch Spring Compressor.*

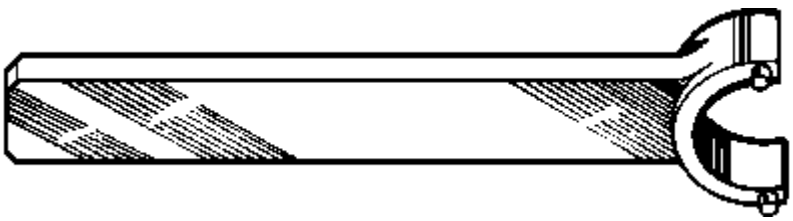

FIG. F4.
61-3644 *Wheel Bearing Retainer Peg Spanner.*

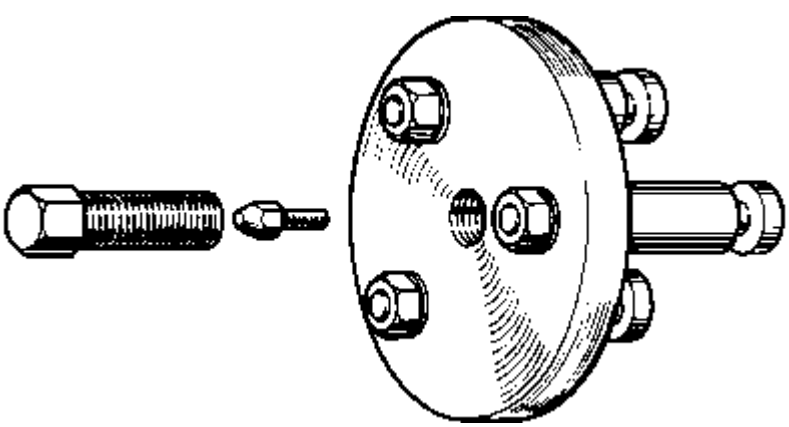

FIG. K5.
61-3796 *Engine Sprocket Extractor.*

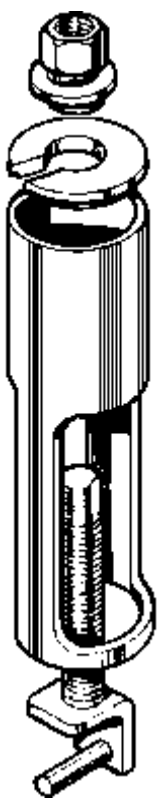

FIG. K6.
61-5064 *Rear Damper Tool.*

FRONT FORKS

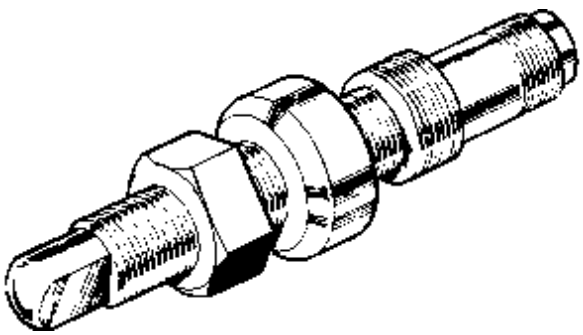

FIG. K7.
61-3824 *Fork leg removal tool.*

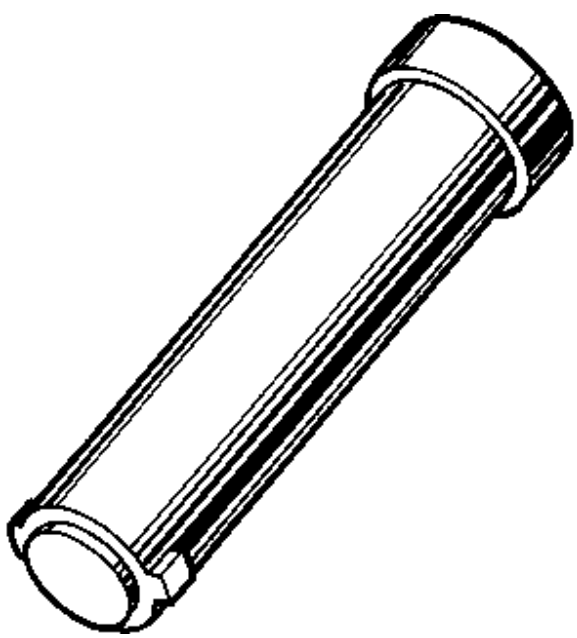

FIG. K8.
Oil seal extractor punch No. 61-3006.

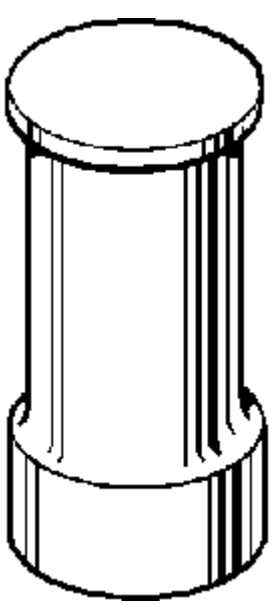

FIG. K9.
Oil seal assembly tool No. 61-3007.

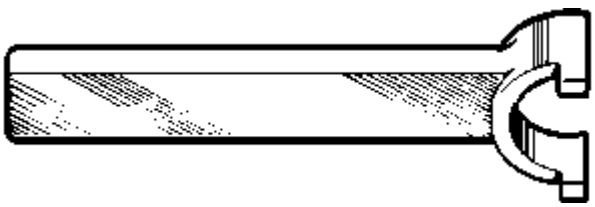

FIG. K10.
61-3633 *Fork Leg Oil Seal Holder Tool.*

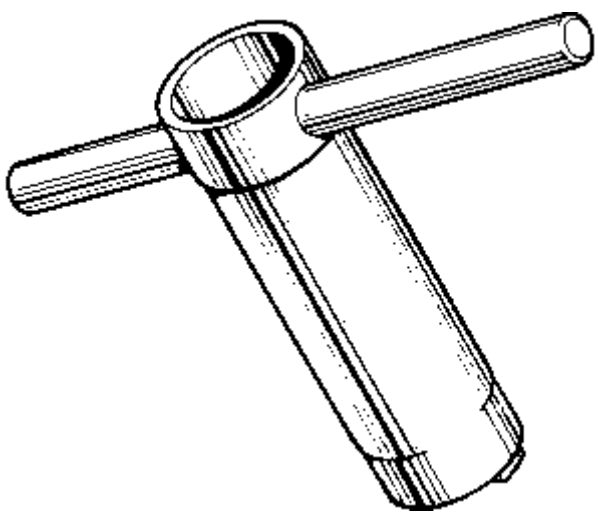

FIG. K11.
Oil seal holder fitting and removal tool No. 61-3005.

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INCHES TO MILLIMETRES — UNITS

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 KILO - .62138 miles.

DECIMALS TO MILLIMETRES — FRACTIONS

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 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 — UNITS

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

MILLIMETRES TO INCHES — FRACTIONS

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

1/1000	
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

1/1000	
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	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	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.	AREA AT THD. ROOT SQ. IN.	PITCH DIAMETER				HEX.		NUT THICKNESS (MEAN)
					NUT		BOLT		FLATS (MEAN)	CORNERS	
					MAX.	MIN.	MAX.	MIN.			
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	23/32	.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				HEX.		NUT THICKNESS (MEAN)
					NUT		BOLT		FLATS (MEAN)	CORNERS	
					MAX.	MIN.	MAX.	MIN.			
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. SCREW THREADS

DIA. OF 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.
¼	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
½	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
1¼	28	0·0251	1·250	1·2202	1·2144

COARSE (UN.C.)

¼	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
½	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	.0863	.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 KILOMETERS

10	28.25	15	18.83	20	14.12	25	11.30	30	9.42	35	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	12.73	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	109.103	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 KILOGRAMETRES

	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