SERVICE INSTRUCTION MANUAL

STANDARD CARS 1939 - 1946 MODELS

AND

TRIUMPH CARS

TYPES 18T and 18TR

1946 MODELS

THE STANDARD MOTOR COMPANY LIMITED

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STANDARD I.F.S. CARS
1939 - 1946 MODELS

AND

TRIUMPH CARS
TYPES 18T and 18TR

1946 MODELS

SECOND EDITION

THE STANDARD MOTOR COMPANY LIMITED
CANLEY, COVENTRY
Telephone : 3181 Coventry (14 lines). Telegrams : " Flywheel, Coventry."

SERVICE AND SPARES DEPARTMENT
FLETCHAMSTEAD HIGHWAY · COVENTRY
Telephone : Coventry 62471

LONDON SERVICE DEPOT
STANDARD ROAD, CHASE ESTATE, PARK ROYAL, LONDON, N.W.10
Telephone : Elgar 6511-6

FOREWORD

This manual has been divided into two parts. Part I deals with current Standard cars and certain pre-war models which have not, up to date, been covered by the issue of a manual. The second part of the book deals with the two Triumph models, which are just commencing to come off the assembly line. Cross references are possible between the two parts, in view of the many similarities with the two ranges of vehicles.

Each part of the manual is split up into Sections, which comprise, in the main, the various component assemblies. The Sections are indexed and each has its own list of contents.

In compiling the manual we have given the procedure for dismantling and re-assembling the various components, giving particular attention to points which may give rise to difficulties. The necessary steps for overcoming certain difficulties are also described.

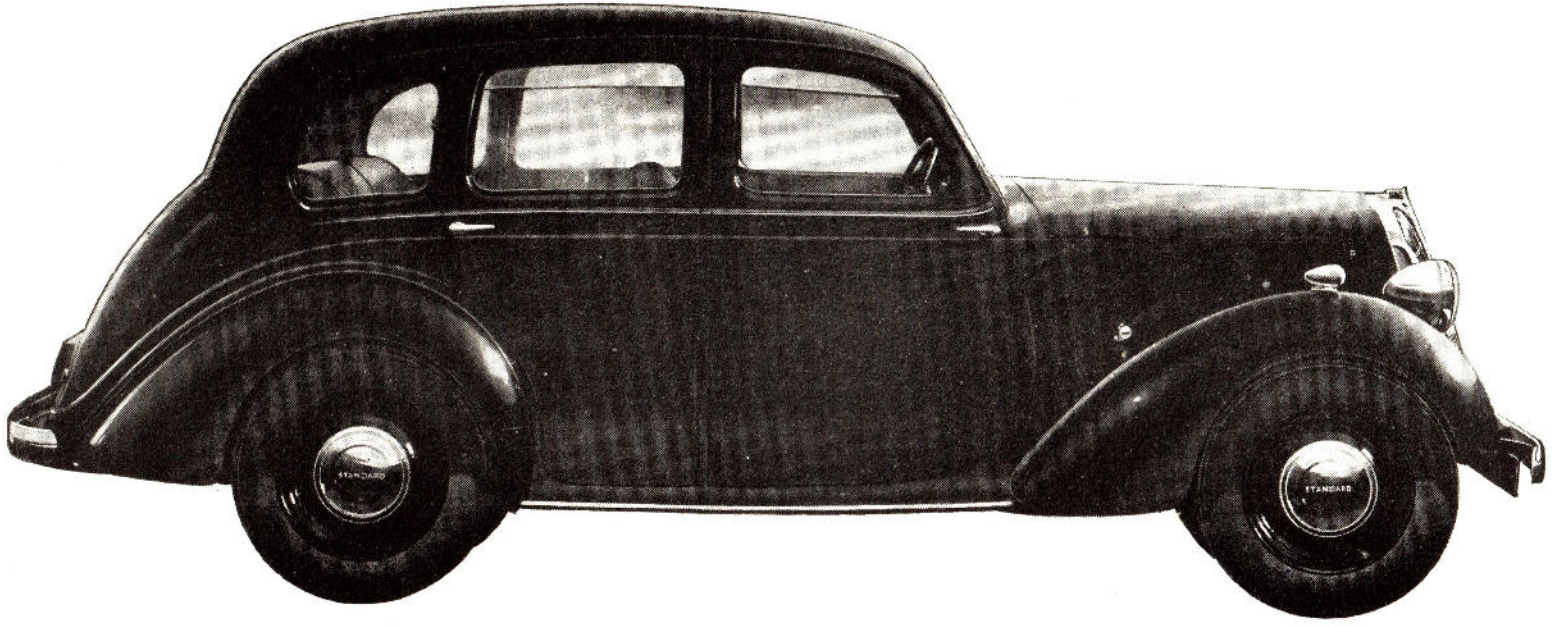
A list of useful dimensions and tolerances are also given with new clearances and particulars of permissible wear. These details should prove of practical assistance when dealing with the repair of any particular component.

At the end of Part II will be found a list of Lucas Service Agents and Depots, details of our Overseas Distributors are also given.

PART I

STANDARD INDEPENDENT FRONT SUSPENSION MODELS 1939—1946

CONTENTS



12 CD Saloon

GENERAL DATA

INDEX

VEHICLE DATA

ITEM	4.8A	8A	12CD	12C	10C	14/12CD
Bore and Stroke	56.7 m/m 100 m/m	57 m/m 100 m/m	69.5 m/m 106 m/m	69.5 m/m 106 m/m	63.5 m/m 100 m/m	73 m/m 106 m/m
Cubic Capacity	1009 c.c.	1021 c.c.	1609 c.c.	1609 c.c.	1267 c.c.	1776 c.c.
R.A.C. Rating	7.97 H.P.	8.06 H.P.	11.98 H.P.	11.98 H.P.	9.99 H.P.	13.23 H.P.
Carburettor Settings :—						
Choke	21	21	24	24	22	26
Main Jet	100	95	120	120	105	125
Pilot Jet	45	45	45	45	45	50 DD
Needle Valve	1.5	1.5	2.0	2.0	1.5	1.5
Air bleed to Pilot	1.5	1.5	1.5	1.5	1.5	1.5
Air Correction	220	220	200	200	220	220
Starter Setting	GA 4 GS 95	GA 4 GS 95	GA 4.5 GS 105	GA 4.5 GS 105	GA 4 GS 100	GA 5 GS 125
Speed Jet	—	—	—	—	—	50
Compression Ratios	6.7	6.7	6.5	6.5	6.5	6.5
Ignition Setting (full retard)	T.D.C.	T.D.C.	T.D.C.	T.D.C.	T.D.C.	T.D.C.
Sparking Plug Gap	0.025"	0.025"	0.040"	0.040"	0.040"	0.040"
Distributor make and break gap						
Gauges supplied	0.010"— 0.012"	0.010"— 0.012"	0.010"— 0.012"	0.010" — 0.012"	0.010" — 0.012"	0.010"— 0.012"
Tappet clearance inlet and exhaust (cold)	0.015"	0.015"	0.015"	0.015"	0.015"	0.015"
Oil Pressures—Engine hot	40—60 lbs. per square inch at normal speeds					
Tyre Pressures—Front	24 lbs. per sq. in.	24 lbs. per sq. in.	26 lbs. per sq. in.	28 lbs. per sq. in.	28 lbs. per sq. in.	26 lbs. per sq. in.
Rear	26 lbs. per sq. in.	26 lbs. per sq. in.	28 lbs. per sq. in.	28 lbs. per sq. in.	28 lbs. per sq. in.	28 lbs. per sq. in.
Clutch Toggle clearance measured at pedal pad	$\frac{5}{8}$"	$\frac{5}{8}$"	$\frac{5}{8}$"	$\frac{5}{8}$"	$\frac{5}{8}$"	$\frac{5}{8}$"
Between Toggle levers and throw-out	$\frac{1}{16}$"	$\frac{1}{16}$"	$\frac{1}{16}$"	$\frac{1}{16}$"	$\frac{1}{16}$"	$\frac{1}{16}$"
Oil Capacities—Engine Sump	7½ pints	7½ pints	13 pints	13 pints	10 pints	13 pints
Gearbox	2 pints	1¼ pints	2 pints	2 pints	2 pints	2 pints
Rear Axle	1½ pints	1½ pints	2 pints	2 pints	1½ pints	2 pints
Rad. water temperatures (normal running)	75—85°C.	75—85°C.	75—85°C.	75—85°C.	75—85°C.	75—85°C.
Water capacity (Radiator and Engine)	11 pints	11 pints	16 pints	16 pints	13 pints	18 pints
Petrol Tank capacity	6 galls.	6 galls.	10 galls.	8 galls.	7 galls.	10 galls.
Acceleration figures—10 to 30 m.p.h.	13 secs.	13 secs.	14 secs.	11 secs.	11 secs.	12 secs.
30 to 50 m.p.h.	19 secs.	19 secs.	17 secs.	13 secs.	15 secs.	15 secs.
Max. Speed—Top m.p.h.	60 m.p.h.	60 m.p.h.	65 m.p.h.	70 m.p.h.	63 m.p.h.	70 m.p.h.
3rd m.p.h.	43 m.p.h.	—	48 m.p.h.	50 m.p.h.	45 m.p.h.	52 m.p.h.
2nd m.p.h.	22 m.p.h.	40 m.p.h.	28 m.p.h.	30 m.p.h.	25 m.p.h.	30 m.p.h.
Stopping distance from 30 m.p.h.	30 feet	30 feet	30 feet	30 feet	30 feet	30 feet
Turning circle, L. and R.H.	32 feet	34 feet	38 feet	38 feet	35 feet	35 feet
Petrol Consumption—						
Normal running	45 m.p.g.	45 m.p.g.	28 m.p.g.	28 m.p.g.	30 m.p.g.	25 m.p.g.
Oil Consumption—						
Normal running	1000—1500 m.p.g.	1000—1500 m.p.g.	1000—1500 m.p.g.	1000—1500 m.p.g.	1000—1500 m.p.g.	1000—1500 m.p.g.

In introducing the 1945 range of cars, the Standard Motor Company have had to rely on the development of two pre-war models and to limit modifications in the interest of a prompt return to something like a pre-war level of production. It is for this reason that some of the modifications, which have been suggested as a result of our experience during the past years, have, on the score of difficulty of supplies, been left over for introduction as and when the necessary materials become available.

DIFFERENCES IN SPECIFICATION OF 4-8A AS COMPARED WITH 8A CHASSIS 1939 MODELS

Engine.

The cylinder bore is now 56.7 m/m instead of 57 m/m giving a cubic capacity of 1009 as compared with 1021 with the 8A model. This modification in capacity brings the 4-8A into the 1000 c.c. category of vehicles and was introduced in anticipation of an alteration in the basis for taxation.

Pistons are of the split skirt variety as opposed to a solid skirt type used originally on the 8A model.

A larger main jet, 100 instead of 95, is fitted to compensate for the reduction in bore.

Clutch.

The clutch driven plate is now provided with 4 Damper springs instead of the 3 used with the earlier model. The clutch housing is now separate from the gearbox casing instead of being an integral part of this.

Gearbox.

A 4-speed gearbox replaces the 3-speed one used on the 8A model. The casing of this gearbox is slightly different to that previously used, but in other respects the gearbox largely agrees with the previous other types of our 4-speed gearbox.

This gearbox is not interchangeable with the 3-speed unit fitted to the 8A model, as it entails a modified chassis frame and other alterations to fittings.

Propeller Shaft.

This is necessarily shorter than with the 8A model to allow for the accommodation of the 4-speed gearbox.

There is now provision for lubrication of the journal assemblies, two additional greasing points being provided, one at either end of the shaft.

Split pins are no longer used for the bolts in the driving flanges, Simmons self-locking nuts now being employed. Where Simmons nuts have to be removed for any reason they should be soaked in water before refitting, in order to recondition the fibre inserts. These nuts should be replaced after their fourth application.

Brakes.

A modified brake countershaft is now fitted, which gives a greater ratio of front wheel braking than was the case with the 8A model. This modified countershaft is used in conjunction with different lengths of operating cables.

Chassis Frame.

This has been modified to accommodate the 4-speed gearbox, the cross member having been moved further towards the rear axle.

Front Suspension.

The diameters of shackle pins have been increased and the "H" pieces and shackles have been modified to accommodate modified shackle pin heads, which are now provided with two flats instead of one.

The adjustable bearing has now been dispensed with, and the Top Outer Shackle pins are now accommodated in concentric bearings, which are provided with phosphor bronze thrust washers on either side.

The front spring is now secured to the cross member by 6 bolts instead of the 4 previously used.

Exhaust System.

A longer exhaust pipe from manifold to silencer is used and the pipe from the latter to air is correspondingly shorter. These alterations are necessitated by the different positioning of the chassis cross member.

Road Wheels.

Road wheels are now supplied with six holes at the hub instead of three and a triangular cut-away portion.

The three larger holes are provided to give access to the brake adjuster, instead of depending on the triangular cut-away portion for this purpose, as with the 8A model.

DIFFERENCES IN SPECIFICATION OF 12CD MODEL AS COMPARED WITH 12C MODEL (1939 MODEL)

Engine.

Apart from the standardising of a split skirt type piston in place of the solid skirt type first used on the 12C model, this unit remains substantially the same as with the 12C.

Gearbox.

A slightly different gearbox casing, which is interchangeable with that fitted on the 4/8A model, is used, but otherwise the items are identical with the 12C model. The alteration to the casing has been made to enable the fitting of a thrust washer at either end of the countershaft.

Chassis Frame.

The chassis frame is wider to accommodate a 3" wider body, which is now fitted, and is provided with an additional tubular cross member, at the forward end, to give added rigidity and enable the carrying of the heavier and larger body fitted.

Front Suspension.

The diameter of the shackle pins has been increased and modifications made to the shackles and " H " pieces to accommodate the heads of the shackle pins, which are now provided with two flats instead of one.

The shackles have been strengthened up and the adjustable bearing which previously accommodated the top outer shackle pins on the 12C model, has now been replaced by an ordinary concentric bearing, with phosphor bronze thrust washer on either side.

The front spring has now a greater number of leaves and has been increased from a 1200 lb. to a 1270 lb. spring. It is secured to the cross member of the chassis by 6 bolts instead of 4 with the 12C model.

Shock Absorbers—Rear.

These are slightly modified and are coupled with one another by a torsion bar, the function of which being to prevent any tendency of the vehicle to roll, with the wider and heavier body.

Steering.

The steering is no longer adjustable for length and this dimension has been decreased. The two tone horn previously used has now been replaced by a single tone one.

Rear Axle.

A thrust pad is now fitted on the N/S of the pinion housing. This pad bears lightly on the back of the crown wheel opposite the teeth, thus counteracting the side thrust caused by the bevel pinion.

Brakes.

A modified brake countershaft is now fitted, which gives a greater ratio of front wheel braking than was provided with the 12C model. The modified countershaft necessitates different length cables to those used with the 12C model.

Automatic Lubrication.

Automatic chassis lubrication has been dispensed with and is now carried out by hand. This alteration means detail modifications to parts previously lubricated automatically.

DIMENSIONS AND TOLERANCES

1939 8 H.P. MODEL

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Crankshaft.					
Journal Diameter	2·000 $^{+0.000''}_{+0.0005''}$	1·998″	0·001″ to 0·002″	Dry to 0·006″	0·002″ wear is allowed on journals and 0·003″ on bearings, governed by permissible worn clearance.
Bearing Dia.(Int.)	2·000 $^{+0.0015''}_{+0.002''}$	2·005″			
Crankshaft End Float.					
Rear Journal Length	1 $\frac{19}{32}$ $^{+0.001''}_{-0.000''}$	1·598″	0·004½″ to 0·006″	0·008″	Worn end float of 0·008″ allowed in whole assembly.
Rear Bearing Cap width plus 2 Thrust Washers	1·586″ 1·582″	1·581″			
Big End.					
Crank Pins Dia.	1·750″ $^{+0.0000''}_{-0.0012''}$	1·748″	0·000½″ to 0·002″	Dry to 0·0006″	0·002″ wear is allowed on crank pins and 0·003″ on bearings, governed by permissible worn clearance.
Bearing Dia. (Int.)	1·7495″ $^{+0.001''}_{+0.0015''}$	1·752″			
Regrind Crank Pins (with tolerances similar to those above).	1st—0·020″, 2nd—0·030″ and 3rd—0·040″				Under size bearings are available to fit each regrind size.
Big End Float.					
Crank Pin	1 $\frac{1}{8}$″ $^{+0.0007''}_{-0.0002''}$ 1·115″	1·128″	0·008″ to 0·010″	0·012″	Total wear allowed 0·006″ Maximum.
Con. Rod Width	1·117″	1·107″			
Ovality.					
Journals and Crank Pins	—	0·002″			Min. Dia. to be such that the permissible worn clearance for the bearings is not exceeded.
Taper, Journals and Crank Pins	—	0·002″			
Little End.					
Bore for Bush	0·680″ $^{+0.0005''}_{-0.0002''}$	0·681½″	See Remarks		Type. Split Rolled Bush. A press fit in Little End reamed in position to size 0·625 ± 0·0002″. To fit oversize bush, bore out Little End to 0·689″, press bush into position. Ream to size given above. To fit oversize pin in existing bush ream to +0·005″ to suit pin to be selected to leave 0.003″ clearance at 68° Fahr. when new.
Bush, Ext. Dia.	0·685″				
Bush, Int. Dia.	0·625″ $^{+0.0002''}$	0·626″	See Remarks		
Gudgeon Pin, Dia.	0·625″ $^{+0.000''}_{-0.0003''}$	0·624″			
Oversize Pins	0·630″ $^{+0.000''}_{-0.0003''}$				

GENERAL DATA—Dimensions and Tolerances

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Piston Rings.					
Compression Ring Width	0·0787″ 0·0777″	0·076″	0·001″ to 0·003″	0·005″	Allow increase in side clearance of 0·003″ Mean.
Groove Width	0·0787″ $^{+0.001″}_{+0.002″}$	0·082″			
Scraper Ring Width	0·1575″ 0·1565″	0·155″	0·001″ to 0·003″	0·005″	
Groove Width	0·1575″ $^{+0.001″}_{+0.002″}$	0·160″			
Ring Gap in Cylinder	—	—	0·003″ to 0·007″	—	
Pistons and Cylinders.					
Dia. of Cylinders	2·2441″ $^{+0.0005″}_{-0.00025″}$	—	0·002″ to 0·003″	0·007″ At Top.	
Top of Skirt (Pressure Face)	2·2420″ 2·2415″				Tin coated when new.
Bottom of Skirt (Pressure Face)	2·24325″ 2·24275″	2·239″	0·001″ to 0·002″	0·005″	
Top Land Dia.	2·232″ 2·230″	—	0·012″ to 0·014″	0·002″	
Gudgeon Pin Hole	0·625″	0·626″	0·014″	0·002″	Pins to be selected to have 0·000¼″ clearance at 68° Fahr. when new.
Oversize Pistons	+0·015″, +0·020″ and +0·030″ (with similar tolerances to those above).				
Oil Pump.					
Oil Pump Helical Drive Gears (Backlash)	—	—	0·002″ to 0·004″	0·010″	
Oil Pump Gears End Float			0·002″ to 0·004″	0·010″	
Camshaft.					
Front Journal Dia.	1 $\frac{11}{16}$″ $^{-0.003″}_{-0.004″}$	1·682″	0·003″ to 0·005″	0·008″	Camshaft Journals Maximum wear 0·003″. Bore dia. in cylinder block Maximum wear 0·003½″
Bore in Block.	1 $\frac{11}{16}$″ $^{+0.0007″}_{-0.0002″}$	1·692″			
1st Intermediate Journal	1 $\frac{15}{32}$″ $^{-0.003″}_{-0.004″}$	1·463″	0·003″ to 0·005″		
Bore in Block	1 $\frac{15}{32}$″ $^{+0.0007″}_{-0.0002″}$	1·473″			
2nd Intermediate Journal	1 $\frac{7}{16}$″ $^{-0.003″}_{-0.004″}$	1·432″	0·003″ to 0·005″		
Bore in Block	1 $\frac{7}{16}$″ $^{+0.0007″}_{-0.0002″}$	1·442″			
Rear Journal Dia.	1 $\frac{13}{32}$″ $^{-0.003″}_{-0.004″}$	1·400″	0·003″ to 0·005″		
Bore in Block	1 $\frac{13}{32}$″ $^{+0.0007″}_{-0.0002″}$	1·410″			
End Float			0·004″ to 0·007½″	0·012″	Permissible total wear 0·006″
Tappet Clearances Cold 0·015″					

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Main Line.					
Constant Pinion Shaft Bore	$\frac{5}{8}''^{+0.0005''}_{-0.0002''}$	—	0 ·000½″ to 0 ·002″		Allow 0 ·008″ clearance on assembly. This being the total play between constant pinion shaft and mainshaft spigot when assembled together (worn)
Constant Pinion Bush Outside Diameter	$\frac{5}{8}''^{-0.0007''}_{-0.0012''}$	—			
Constant Pinion Bush Bore	$\frac{1}{2}''^{+0.0005''}_{-0.0002''}$	—	0.0003″ to 0 ·0015″	0 ·003″	
Mainshaft Spigot	$\frac{1}{2}''^{-0.0005''}_{-0.001''}$	0 ·497″			
End Clearance	—	—	0 ·005″ 0 ·007″	0 ·015″	Controlled by thickness of thrust button.
2nd Speed Gear Bore Dia.	$1\frac{5}{16}''^{+0.0003''}_{-0.0002''}$		0 ·0003″ to 0 ·0013″	0 ·003″	
Bush Ext. Dia.	$1\frac{5}{16}''^{-0.0001''}_{-0.001''}$	0 ·315″			
Internal Dia. of Gear Wheel Bush (Bot.)	0 ·8495″ 0 ·849″		0 .000″ to 0 ·0005″		Push fit on shaft.
Mainshaft Diameter (Bottom).	$0 \cdot 850''^{-0.0005''}_{-0.001''}$				
Gear Wheel Bush Int. Dia. (Large).	1 ·000″ 0 ·998″		0 ·006″ to 0 ·010″		
Mainshaft Dia. (Large)	$1''^{-0.008''}_{-0.010''}$				
Synchronising Sleeve Axial Load.	38—42 lbs.				
Operating Sleeve 2nd and Direct Groove Width.	$\frac{3}{8}''^{+0.004''}_{+0.006''}$		0 ·006″ 0 ·014″	0 ·020″	See " Change Speed Fork Sides " above (x).
Speedo Bearing Internal Dia.	$\frac{1}{2}''^{+}_{-0.0005''}$		0 ·0005″ to 0.0025″		
Speedo Driven Gear Shaft Dia.	$\frac{1}{2}''^{-0.001''}_{-0.002''}$				
Countershaft Line.					
Shaft Dia.	$\frac{11}{16}''^{-0.005''}$		0 ·0005″ to 0 ·0012″		Bush a press fit in $0.812''_{0.81325''}$ housing in gear. When pressed into 0 ·813″ housing, bore dia. $0.677''_{0.683''}$. Ream bush with $\frac{11}{16}''$ reamer to fit countershaft.
Bush Inner Dia.	See Remarks				
Bush Outer Dia.	See Remarks				
Width of Gearbox Housing (Internal)	$5\frac{13}{32}''^{+0.002''}_{+0.004''}$		End Float 0 ·003″ to 0 ·011″		Allow 0 ·018″ Max. End Float.
Overall length of 1st Gear.	$5\frac{5}{32}''^{-0.003''}_{-0.005''}$				
Width of Thrust Washer.	0 ·124″ 0 ·126″				
Front Suspension.					
Swivel Pin Angle	10°	—	—	—	
Stub Axle Camber Angle	Vertical $\pm\frac{1}{2}°$	—	—	—	Camber up to 1° Positive will give satisfactory tyre wear.
Castor Angle	3°				

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Shackles and Shackle Pins (Front Suspension).					
Swivel Pin Bushes (Top and Bottom)	$\frac{11}{16}$″ +0.000″ −0.0005″	—	0·0001″ to 0·001″	—	Rough bore diameter 0·8125″. Diameter of bush 0·8155″. Ream when pressed in $\frac{11}{16}$″. Allow wear on assembly up to 0·008″.
Swivel Pin Dia.	$\frac{11}{16}$″ −0.006″ −0.0010″	—		—	
Shackle Pin (Top Inner) Dia.	$\frac{1}{2}$″ −0.0005″ −0.0012″	—	0·0003″ to 0·0014″	—	Allow wear up to 0·010″ on assembly.
Bush Int. Dia.	$\frac{1}{2}$″ ±0.0002″	—			
Bush Ext. Dia.	0·630″				Press fit in 0·6265″ housing.
Shackle Pin (Top Outer) Dia.	$\frac{1}{2}$″ −0.0007″ −0.001″		0·0002″ to 0·0016″	—	Allow wear up to 0·010″ in assembly.
Bearing, Internal Dia.	$\frac{1}{2}$″ ±0.0005″			—	
Bearing, Ext. Dia.	1 $\frac{1}{16}$″ x 20 TPI.		—	—	
Front Spring Shackle Pin	$\frac{1}{2}$″ −0.0005″ −0.0012″	—	0·0027″ to 0·001″		Allow 0·010″ wear on assembly.
Bush Int. Dia.	$\frac{1}{2}$″ +0.0015″ +0.0005″	—			
Bush Outer Dia.	$\frac{3}{4}$″				
Rear Axle.					
Differential Pinion Backlash between gears	—	—	—	—	Wear allowed to cause backlash up to 0·050″.
Axle Shaft End. Clearance	—	—	No end float		$\frac{5}{8}$″ between axle shaft inner extremities.
Spiral Bevel Backlash	—	—	—		Allow 0·006″.
Front Road Spring.					
Test Data.					
Eye Centres loaded	36$\frac{1}{2}$″	—	—	—	
Test Load	800 lbs.	—	—	—	
Camber (Free)	(+) 3$\frac{29}{32}$″ Positive	(+) 2$\frac{3}{32}$″ Positive	—	—	Camber is measured from centre line passing through spring eyes, to top face of the master leaf, adjacent to the spring centre bolt. These figures are for use with a spring testing machine.
Camber (Loaded)	$\frac{1}{8}$″ Negative	—	—	—	
Rear Road Spring.					
Test Data.					
Eye Centres Loaded	39″ ±$\frac{1}{8}$″	—	—	—	
Test Load	640 lbs. + 3%—		—	—	
Camber (Free).	(+) 4″approx. Positive.	(+) 3$\frac{1}{2}$″ Positive.			
Camber (Loaded)	(+) $\frac{1}{2}$″ Negative				

(+) $\frac{1}{2}$″ permanent sets allowed when springs settle down.

1939 12 H.P. MODELS

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Crankshaft.					
Journal Diameter.	2 ·479″ 2 ·479½″	2 ·477″	0 ·0010″ to	Dry	0 ·002″ is allowed on journals and 0 ·003″ on bearings governed by permissible worn clearance.
Bearing Dia. (Internal)	2 ·480½″ 2 ·481½″	2 ·484″	0 ·0025″	0 ·006″	
Regrind Journals : 1st—0 ·020″, 2nd—0 ·030″ and 3rd —0 ·040″					
Crankshaft End Float.					
Rear Journal length	1¾″ +0.001″ −0.000½	1 ·754″	End Float		
Rear Bearing Cap	1 ·739″	1 ·734″	0 ·004½″		Worn end float 0 ·008″
width plus 2 Thrust Washers	1 ·745″		to 0 ·006″	0 ·008″	allowed in whole assembly.
Big End.					
Crank Pin Dia.	1 ·893¾″ 1 ·894½″	1 ·892″	0 ·000½″ to	Dry	0 ·002″ wear is allowed on crank pins, and 0 ·003″ on bearings governed by permissible worn clearance.
Bearing Dia. (Internal)	1 ·895″ 1 ·896″	1 ·898″	0 ·002¼″	0 ·006″	
Big End Float.					
Crank Pin	1 3/16″ +0.000¾″ −0.000¼″	1 ·191″	End Float 0 ·005¾″ to	0 ·012″	Total wear allowed is 0 ·006″ Max.
Con. Rod Width	1 3/16″ −0.006″ −0.008″	1 ·177″	0 ·008¾″		
Ovality.					
Journals and Crank Pins	—	0 ·002″	—	—	Min. dia. to be such that the permissible worn clearance for the bearings is not exceeded.
Taper, Journals and Crank Pins	—	0 ·002″	—	—	
Little End.					Type. Split Rolled Bush. A press fit in Little End reamered in position to size ¾″ dia. ±0 ·000¼″. To fit oversize bush, bore out Little End to 0 ·814″ diameter and press bush into position. Ream to size given above. To fit oversize in existing bush ream +0 ·005″ Gudgeon pin to be selected to have 0 ·000¼″ clearance at 68° Fahr. when new.
Bore for Bush	0 ·802″ ±0.0005″	0 ·803½″	See remarks		
Bush Ext. Dia.	0 ·810″	—			
Bush Int. Dia.	¾″ ±0.0002″	0 ·751″			
Gudgeon Pin Dia.	0 ·75010″ 0 ·74985″	0 ·749″	See Remarks		
Oversize Pins (+0 ·005″)	0 ·755 ±0.0001″	0 ·754″			

GENERAL DATA—Dimensions and Tolerances

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Piston and Cylinder.	F / G / H			At Top	
Dia. of Cylinder.	2.7358″ / 2.7362″ / 2.7366″ 2.7361″ / 2.7365″ / 2.7369″	—	0·002½″ to 0·003¾″	0·007″	Pistons selected to suit individual bore dimensions. Marked "F," "G" or "H" on Piston Tops and on Cylinder block.
Top of Skirt, Pressure Face.	2.7331″ / 2.7334″ / 2.7338″ 2.7334″ / 2.7338″ / 2.7342″	—			
Bottom of Skirt, Pressure Face.	2.7346″ / 2.7349″ / 2.7353″ 2.7349″ / 2.7353″ / 2.7357″	—	0·001″ to 0·002¼″	0·005″	
Top Land Dia.	2·720″ 2·718″				
Gudgeon Pin Hole.	0·750″ +0.0001″ −0.0000″	0·751″	See Note	0·002″	Pins to be selected to have 0·000¼″ clearance at 68° F. when new.
Oversize Pistons	+0·020″ (With tolerances as above).				
Piston Rings.					
Compression Ring Width	0·0937″ 0·0927″	0·092″	0·001″ to 0·003″	0·005″	Allow increase in side clearance of 0·003″ Mean.
Groove Width	0·0937″ +0.001″ +0.002″	0·098″			
Scraper Ring Width	.187″ ·186″	0·184″	0·001″ to 0·003″	0·005″	
Groove Width.	0·187″ +0.001″ +0.002″	0·190″			
Oil Pumps.					
Oil Pump Helical Drive Gears (Backlash)	—	—	0·002″ to 0·004″	0·010″	
Oil Pump Gears End Float.	—	—	0·002″ to 0·004″	0·010″	
Camshaft.					
Front Journal Dia.	1½″ −0.003″ −0.004″	1·494″	0·002¾″ to 0·004¾″	0·008″	Camshaft Journals Max. wear 0·003″ Bearing Internal Dia. Max. wear 0·003½″. Permissible total wear 0·006″.
Bearing Bore.	1½″ +0.0003″ −0.0001″	1·504″			
2nd 3rd and Rear Journal Dia.	1 23/32″ −0.003″ −0.004″	1·712″	0·002¾″ to 0·004¾″	0·008″	
Bearing Bores.	1 23/32″ +0.0003″ −0.0001″	1·722″			
End Float.	—	—	0·004″ to 0·007½″	0·012″	
Tappet clearance Cold 0·015″					
Valves and Valve Guides.					
Inlet Stem Dia.	9/32″ −0.002½″ −0.003½″	9/32″ −0.006″	0·002″ to 0·004″	—	The clearance between valve stems and guide new is 0·002″ to 0·004″ corresponding to a sideways movement of the valve head, when just clear of its seat, of 0·008″. To obtain—rock valve.
Guide Dia.	9/32″ +0.0002½″	9/32″ +0.003″			
Exhaust Stem Dia.	5/16″ −0.003½″ −0.004½″	5/16″ −0.007″	0·003″ to 0·005″	—	
Guide Dia.	5/16″ +0.0002½″	5/16″ +0.003″			
Angle of Seating	45°				

GENERAL DATA—Dimensions and Tolerances

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Valve Springs.					
Fitted Length	1·75″	—	—	—	
Fitted Load.	34·5 + 2 lbs. 34·5 — 1 lb.	30	—	—	
Flywheel.					
Run out of clutch contact face at outer diameter.	Max. 0·003″	Max. 0·003″	—	—	Important to good clutch action.
Clutch.					
Operating Shaft.	$\frac{3}{4}$″ —0.002″ —0.003″	—	0·002″ to 0·003$\frac{3}{4}$″	—	Allow max. lift of shaft in bearing (worn) of 0·010″.
Bush Bore.	$\frac{3}{4}$″ +0.000$\frac{1}{2}$″ —0.0000″	—		—	
Gearbox.					
Top Cover.					
Striking Rod Dia.	$\frac{1}{2}$″ —0.001″ —0.002″	—	0·000$\frac{1}{2}$″ to 0·002$\frac{1}{2}$″		
Striking Rod Bearing Bore.	$\frac{1}{2}$″ +0.000$\frac{1}{2}$″	—			Allow 0·005″ clearance on assembly worn.
Plunger (Axial Load)	35 lbs.	—	—	—	
Change Speed Fork Sides.	$\frac{9}{32}$″ —0.006″ —0.010″	—	0·010″ to 0·016″	—	Allow 0·030″ clearance on assembly worn. See Synchro Sleeve below (x).
Main Line.					
Constant Pinion Shaft Bore.	1″ +0.001″ —0.000″	1·002″	0·000$\frac{1}{2}$″ to 0·002″	0·004″	Allow 0·0008″ clearance on assembly. This being the total play between constant pinion shaft and main shaft spigot when assembled together (worn). End float is controlled by thickness of thrust button in constant pinion bore.
Constant Pinion Bush Outside Diameter.	1″ —0.000$\frac{1}{2}$″ —0.001″	0·998″			
Constant Pinion Bush Bore.	$\frac{3}{4}$″ +0.000$\frac{1}{2}$″ —0.000$\frac{1}{4}$″	0·752″	0·000$\frac{1}{2}$″ to 0·001$\frac{3}{4}$″		
Mainshaft Spigot	$\frac{3}{4}$″ —0.000$\frac{3}{4}$″ —0.001$\frac{1}{4}$″	0·747″			
End Float.			0·005″ to 0·007″		
3rd & 2nd Speed Gear Bush Bore Dia.	1$\frac{1}{8}$″ +0.000$\frac{1}{2}$″ —0.000$\frac{1}{4}$″	1·127″	0·001″ to 0·003$\frac{1}{2}$″	0·005″	
Mainshaft Dia.	1$\frac{1}{8}$″ —0.001$\frac{1}{4}$″ —0.002$\frac{1}{2}$″	1·122″			
Synchronising Sleeve (Axial Load).	42—45 lbs.	—	—	—	
1st Speed Gear Wheel (Axial Load).	54—57 lbs.	—	—	—	
Synchronising Sleeve & 1st Speed Gear Fork Groove.	$\frac{9}{32}$″ +0.004″ +0.006″	—	0·010″ to 0·016″	0·030″	See "Change Speed Fork Sides" (x) above.
Speedo Bearing Internal Dia.	$\frac{1}{2}$″ +0.000$\frac{1}{2}$″		0·000$\frac{1}{2}$″ to 0·002$\frac{1}{2}$″		Allow 0·005″ wear on assembly.
Speedo Driven Gear Shaft Dia.	$\frac{1}{2}$″ —0.001″ —0.002″				

GENERAL DATA—Dimensions and Tolerances

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Countershaft Line.					
Shaft Dia.	$\frac{3}{4}''-0.000\frac{1}{2}''$ $-0.001\frac{1}{4}''$		0·000¼″ to 0·001¾″		Allow 0·008″ left in first speed gear (worn).
Bush, Inner Dia.	$\frac{3}{4}''+0.000\frac{1}{2}''$ $-0.000\frac{1}{4}''$				
Bush, Outer Dia.	$\frac{29}{32}''-0.000\frac{3}{4}''$ $-0.001\frac{1}{4}''$		0·000½″ to 0·001¾″		
1st Speed Gear Bore Dia.	$\frac{29}{32}''+0.000\frac{1}{2}''$ $-0.000\frac{1}{4}''$				
1st Speed Gear End Float			0·003″ to 0·011″		Allow 0·020″ Max. end float when worn.
Front Suspension.					
Swivel Pin Angle	$9\frac{1}{2}^{\circ}$	—	—	—	
Stub Axle Camber Angle	Vertical $\pm\frac{1}{2}^{\circ}$				
Castor Angle	3°				
Swivel Pin Bushes (Top & Bottom) Int. Dia.	$\frac{11}{16}''+0.000''$ $-0.0005''$	—	0·0001″ to 0·0010″		Allow 0·008″ wear on assembly.
Swivel Pin Dia.	$\frac{11}{16}''-0.0006''$ $-0.0010''$	—			
Shackle Pin (Top Inner) Dia.	$\frac{1}{2}''-0.0005''$ $-0.0012''$	—	0·0003″ to 0·0014″		Allow 0·010″ wear on assembly.
Bush Dia. (Int.)	$\frac{1}{2}''\pm0.0002''$	—			
Bush Dia. (Ext.)	0·630″	—	—	—	Press fit into 0·6265 housing.
Shackle Pin (Top Outer Diameter	$\frac{1}{2}''-0.0007''$ $-0.001''$	—	0·0002″ to 0·0015″	—	Allow 0·010″ wear on assembly.
Bush Dia. (Internal)	$\frac{1}{2}''\pm0.0005''$	—		—	
Bush Dia. (Ext).	$1\frac{1}{16}''$ x 20 TPI.	—	—	—	
Front Spring Shackle Pin Dia.	$\frac{9}{16}''-0.0005''$ $-0.0012''$	—	0·0027″ to 0·001″	—	Allow 0·010″ wear on assembly.
Bush Int. Dia.	$\frac{9}{16}''+0.0015''$ $+0.0005''$	—		—	
Bush Ext. Dia.	$\frac{13}{16}''$				
Rear Axle.					
Differential Pinions Backlash between gears	—	—	—	—	Wear allowed to give backlash up to 0·050″.
Axle Shaft End Float	—	—	0·003″ to 0·006″		
Spiral Bevel Crown Wheel Run out	—	—	—	—	Allow 0·004″
Spiral Wheel Backlash	—	—	—	—	Adjust to 0·006″
Road Springs.					
Front.					Camber is measured from centre line passing through spring eyes to top face of the master leaf adjacent to spring centre bolt. These figures are for use with a spring testing machine.
Test Data.					
Eye Centres, Loaded	$38''\pm0.015''$	—	—	—	
Test Load	$1200\pm\frac{1}{4}\%$ lbs.	—	—	—	
Camber (Free)	$4\frac{21}{32}''(+)$	$4\frac{5}{32}''(+)$	—	—	
Camber (Loaded)	$(+)\frac{3}{32}''$ Negative				
(+) ½″ permanent sets are allowed, when spring settles down.					

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Rear.					
Eye Centres, Loaded	39″ $\pm\frac{1}{8}$″	—	—	—	
Test Load	750 lbs.	$\pm 3\%$			
Camber (Free).	(+)$5\frac{1}{8}$″	(+) $4\frac{1}{4}$″			
Camber (Loaded)	(+) $\frac{1}{8}$″	Negative.			
(+) $\frac{1}{2}$″ permanent sets are allowed, when springs settle down.					

1939 10 H.P. MODELS

The dimensions and tolerances for this model are, in most instances, the same as one or other of the models already covered. The items concerned are dealt with as follows :—

Crankshaft.

The details for the 8 H.P. also apply to this model.

Little End.

The dimensions and tolerances given under the 12 H.P. models also apply to this model as to Gudgeon Pin details.

Pistons and Cylinders.

These differ from both models, the details are given below :—

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Dia. of Cylinder	2·500″ $^{+0.0005''}_{-0.00025''}$		0·002″	At Top	
Top of Skirt, Pressure	2·4980″		to	0·007″	
Face	2·4975″		0·003″	—	
Bottom of Skirt,	2·49925″	2·503″	0·0005″		
Pressure Face	2·49875″		to 0·00175″	0·005″	
Top Land Dia.	2·4875″		0·012$\frac{1}{4}$″		
	2·4850″		to 0·015$\frac{1}{2}$″	—	

Pistons and Rings.

Owing to the different cylinder bore employed these details are modified as under :—

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Compression Ring Width	0·0937″ / 0·0927″	0·092″	0·001″ to 0·003″	0·005″	Allow increase in side clearance of 0·003″ Mean.
Groove Width	0·0937″ $^{+0.001''}_{+0.002''}$	0·098″			
Scraper Ring Width	0·177″ / 0·176″	0·184″	0·001″ to 0·003″	0·005″	
Groove Width	0·177″ $^{+0.001''}_{+0.002''}$	0·190″			
Ring Gap in Cylinder			0·003″ / 0·007″		

Oil Pump.

Details are common to all models.

Camshaft.

Dimensions as for 8 H.P. models.

Valve Springs.

Similar to 8 H.P. model.

Flywheel.

Details given apply to all models.

Clutch.

Details are given as follows.

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Operating Shaft.	$\frac{5}{8}$″ −0.002″ −0.003″		0·000 to 0·007″		Allow maximum "lift" of shaft in bearing (worn) 0.010″.
Bush Bore	$\frac{5}{8}$″ +0.005″ −0.002″				

Gearbox.

Details are those given under the 12 H.P. Model.

Front Suspension.

Dimensions and tolerances are the same as those which apply to the 8 H.P. Model.

Rear Axle.

Details given for the 12 H.P. Model also apply to the 10 H.P. Model.

Road Springs.

Data for the 10 H.P. Model is as follows :—

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Front Spring.					Camber is measured from centre line passing through spring eyes to top face of the master leaf, adjacent to spring centre bolt. These figures are for use with a spring testing machine.
Eye Centres (Loaded).	$36\frac{1}{2}$″	—	—	—	
Test Load	950 +1% −4% lbs.	—	—	—	
Camber (Free).	$4\frac{15}{32}$″ (+)	$3\frac{31}{32}$″ (+)	—	—	
Camber (Loaded).	$\frac{3}{32}$″ Neg.	—	—	—	
Rear Springs.					
Eye Centres (Loaded)	39″ ±$\frac{1}{8}$″	—	—	—	
Test Load	670 lbs. ±3%	—	—	—	
Camber (Free).	4″ Approx.(+)	$3\frac{1}{2}$″(+)	—	—	
Camber (Loaded)	(+) $\frac{3}{4}$″ Neg.	—	—	—	

(+) $\frac{1}{2}$″ permanent sets allowed, when springs settle down.

14 H.P. MODELS

Where these differ from 12 H.P. Models

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearance, new.	Permissible worn Clearance.	Remarks.
Piston Rings.					
Comp. Ring Width	0·092¾″ to 0·093¾″	0·091″	0·001″ to 0·003″	0·005″	Allow increase in side clearance of 0·003″ Mean.
Groove Width	0·094¾″ to 0·095¾″	0·098″			
Scraper Ring Width	0·186″ to 0·187″	0·184″	0·001″ to 0·003″	0·005″	
Groove Width	0·188″ to 0·189″	0·191″			
Ring Gap in Cyl.	—	—	0·003″ to 0·007″	0·020″	
Piston and Cylinder.					
Bores	F: Min. 2.8746″ 2.8749″ G: Min. 2.8750″ 2.8753″ H: Min. 2.8754″ 2.8757″	—			
Top of Skirt (Pressure Face)	2.8718″ Over 2.8721″ 2.8721″ to 2.8725″ Over 2.8725″ to 2.8729″	—	0·002½″ to 0·003″	At Top 0·007″	Pistons selected to suit individual bore. Marked "F" "G" or "H" on Piston Tops and on Cylinder Block.
Bottom of Skirt (Pressure Face)	2.8733″ Over 2.8736″ 2.8736″ to 2.8740″ Over 2.8740″ to 2.8744″	—	0·001″ to 0·002″	0·005″	
Gudgeon Pin Face (Top)	2.8583″ Over 2.8576″ 2.8576″ to 2.8580″ Over 2.8580″ to 2.8584″	—	0·017″ to 0·018″	—	
Gudgeon Pin Face (Btm.)	2.8688″ Over 2.8681″ 2.8681″ to 2.8685″ Over 2.8685″ to 2.8689″	—	0·006½″ 0·007″	—	
Gudgeon Pin Hole	0·750″ +0·000¼″ —0·0000″	0·751″	See Note	0·002″	Pins to be selected to have 0·000¼″ clearance at 68° F when new.
Oversize Pistons.	+0·020″ and +0·030″ and +0·040″ with similar tolerances as size "G" above				

1945/46 MODELS agree with the foregoing dimensions and tolerances given for 1939 8 H.P. and 12 H.P. models, apart from the differences specified in the early portion of this section, and those given on the next page.

DIFFERENCES IN DIMENSIONS ON 1945 12 H.P. MODEL, AS COMPARED WITH THOSE GIVEN FOR 1939 12 H.P. VEHICLES

The dimensions for these two models in large part agree. There are, with the 1945 models, slight modifications to the road springs owing to the larger chassis used on the later model.

The dimensions of the front suspension shackle pins have been increased and corresponding alterations made to the bush dimensions. The tolerances and clearances remain unchanged.

The differences in dimension of shackle pins with 1945 models are as follows :—

Top Outer Shackle Pin $\frac{5}{8}$" diameter instead of $\frac{1}{2}$".

Front Spring Shackle Pin changes to $\frac{5}{8}$" diameter from $\frac{1}{2}$".

Top Inner Shackle Pin becomes $\frac{9}{16}$" diameter after 1st 5,000 vehicles.

Bush sizes are correspondingly modified but tolerances and clearances remain unchanged.

Road Spring details for 1945 12 H.P. models are as follows :—

Front Road Spring.

Eye centres loaded	$37\frac{1}{2}$"
Test load	1270 lbs.
Camber (Free)	Not specified
Camber (Laden)	$\frac{7}{16}" \pm \frac{1}{8}"$ (NEG.)

Rear Road Spring.

Eye centres loaded	$39" \pm \frac{1}{8}"$
Test Load	800 lbs.
Camber (Free)	Not specified
Camber (Loaded)	$\frac{1}{2}" \pm \frac{1}{8}"$ (NEG.)

Rear Road Spring (Coupe).

Eye centres loaded	$39" \pm \frac{1}{8}"$
Test Load	750 lbs.
Camber (Free)	Not specified
Camber (Loaded)	$\frac{3}{4}" \pm \frac{1}{8}"$ (NEG.)

DIFFERENCES IN DIMENSIONS ON 1945 8 H.P. MODEL AS COMPARED WITH THOSE GIVEN FOR 1939 8 H.P. VEHICLES.

The dimensions given for the 1939 largely apply to both models.

With the engine there is a slight decrease in cylinder bore from 2.2441" to 2.2323" this meaning a scaling down of all dimensions by the reduction. Tolerances and clearances remain the same.

Front suspension Shackle Pin dimensions differ from those given for 1939 in the following respect :—

Shackle Pin for Front Spring is increased in diameter from $\frac{1}{2}$" to $\frac{9}{16}$".

After the first 5000 cars, the diameter of the Top Inner Shackle Pin is increased from $\frac{1}{2}$" to $\frac{9}{16}$". Tolerances and clearances stand.

Front road spring details are slightly modified :—

Loaded centres become $36\frac{1}{4}$" instead of $36\frac{1}{2}$".

Test load	800 lbs.
Camber (free)	$4\frac{1}{2}$".
Camber (loaded)	$\frac{3}{16}" \pm \frac{1}{8}"$ (positive).

Rear Road Spring (Coupe) :

Test load	575 lbs.
Camber (free)	Not specified
Camber (loaded)	$1\frac{3}{8}" \pm \frac{1}{8}"$ (NEG.)

Gearbox.

A four-speed box is now fitted in place of the three-speed one used on pre-war models, dimensions and tolerances given under 1939 12 H.P. Cars applying in all cases. The gearbox fitted to this model largely agrees with that used on the current 12 H.P. model.

PERIODIC ATTENTIONS

(12CD, 12C, 4/8A, 8A and 10C Models.)

EACH 200 MILES.

1. **Engine Sump.** Check oil level with dipstick fitted on the O/S of engine. Replenish to level with oil. (See list of recommendations.)

AFTER FIRST 500 MILES.

2. **Engine Sump..** It is usually considered desirable that the engine oil should be changed after the first 500 miles has been

covered, subsequent changes being made after each 2,000 miles of running.

EVERY 1,000 MILES.

1. **Fan and Water Pump.** With the 12 H.P. Models, lubricate the two grease nipples fitted on fan and water pump with three or four strokes of the grease gun.
2. **Front Spring Shackle Pins.** Lubricate front spring shackle pins with three or four strokes of grease gun. (Automatic lubrication with 12C Model.)
3. **Front Suspension Shackle Pins.** Lubricate the shackle pins fitted at either end of each shackle with three or four strokes of the grease gun. Each of the four shackle pins is provided with a single greaser. (Automatic lubrication with 12C Model.)
4. **Two Steering Connecting Rods.** Apply grease gun to the grease nipples fitted at each end of the two steering rods, giving three or four strokes. (Automatic lubrication with 12C Model.)
5. **Front Axle Swivel Pins.** Lubricate the single grease nipple fitted on each stub axle with three or four strokes of the grease gun. (Automatic lubrication with 12C Model.)
6. **Distributor Oil Cup.** Fill with an oil can, the oil cup which is fitted externally on the N/S of the distributor.

EVERY 2,000 MILES.

1. **Engine Sump.** Drain oil from sump and refill with fresh supply.
2. **Wheel Hubs.** Remove hub caps and, in the case of the front hubs, replace the plugs fitted with the grease nipple supplied in the Tool Kit. Give each hub three or four strokes with a grease gun, remove nipple and replace plugs. Similarly apply the grease gun to the nipples which are already fitted to the rear hub.
3. **Filter Element.** Remove filter element and wash in petrol. (12 H.P. Model.)
4. **Controls under Bonnet.** Lubricate the joints of the various controls under bonnet.
5. **Direction Indicators.** Apply thin machine oil with a camel hair brush to the catch pin between the arm and the operating mechanism.
6. **Gearbox and Automatic Chassis Lubrication.** Check gearbox oil level with dipstick and, with "pre-war" 12 H.P. fitted with automatic chassis lubrication, refill automatic lubrication reservoir.

EVERY 5,000 MILES.

1. **Propeller Shaft.** Lubricate the three grease nipples (two are fitted at the front end and one at the rear end) with three or four strokes of the grease gun. "Pre-war" Models are only provided with one nipple.
2. **Clutch Shaft and Pedal Bearings.** Lubricate with an oil can each end of the clutch operating shaft, where this is accommodated in the housing. Similarly lubricate the clutch pedal bearings.
3. **Steering Box.** Fill steering box with oil as necessary, using a gun filled with oil applied to the nipple in the box lid, in the case of the 12 H.P. Models, with the 8 H.P. Models this nipple is slightly lower down.
4. **Door Locks, Hinges and Bonnet Fasteners.** Lubricate with oil can Door locks and hinges, also bonnet fasteners.
5. **Distributor Cam Bearing.** Smear Cam with oil. Remove distributor cover and withdraw rotor arm, applying a few drops of oil round screw then revealed. *The screw must not be removed.* Lightly smear cam with engine oil and apply one drop of thin engine oil to moveable contact arm pivot.
6. **Rear Axle.** Drain axle, by removal of drain plug in the base of banjo casing, with the oil warm. Refill axle (to level on dipstick) through the aperture left by the removal of the dipstick. The filling of the axle necessitates the removal of rear seat cushion and the metal domed cover, after which access to combined filler and dipstick is possible. DO NOT MIX DIFFERENT BRANDS OF AXLE OILS.
7. **Clean and Lubricate Road Springs.** Springs should be cleaned off with paraffin and afterwards sprayed with penetrating oil or painted with engine oil. The spring clips should be oiled with an oilcan.
8. **Brake Cables and Cross Shaft.** Apply grease gun to the nipples on 4 cable conduit nipples and give three or four strokes, using Special BENDIX Grease. Oil with oilcan the plates which carry the cross shaft and similarly lubricate the various connections in the operating linkage.

9. **Air Cleaner and Silencer. (12 H.P. Models).** Where an air cleaner is fitted, the filter should be removed and cleaned with petrol, being re-oiled before refitting.

EVERY 10,000 MILES.

1. **Replenish Shock Absorbers.** Remove the shock absorber from the chassis to replenish. Before removing the filler plug (situated on the side or cover plate according to Model), clean off all dirt or other foreign matter, to prevent the possibility of this finding its way into the shock absorber. Fill with SPECIAL LUVAX PISTON TYPE Fluid until this overflows from the filler plug at the side, or in the case of the type with filler plug in cover plate, comes to within $\frac{1}{4}''$ of the plug hole. DURING FILLING PROCESS, WORK SHOCK ABSORBER ARM THROUGH ITS FULL STROKE TO EXPEL AIR WHICH MIGHT OTHERWISE ENTER WORKING CHAMBER. KEEP SHOCK ABSORBERS UPRIGHT AS FITTED ON CHASSIS, WHEN HANDLING.
2. **Dynamo Wick.** Remove this from its container at the rear end of dynamo and soak in oil or saturate with vaseline.
3. **Engine Sump and submerged type of filter.** Remove sump, clean this, and where the submerged type of filter is fitted wash this in petrol. To remove the sump it is necessary to raise the engine with a jack, about 3 inches, to give access to the sump bolts. In order to permit of the engine being raised, it is first necessary to remove the nuts **or** set screws (according to Model) which secure the front and rear engine mountings and to detach exhaust pipe from manifold. Refit sump and refill with oil.
4. **Gear Box.** Drain off oil when warm, by removal of drain plug in base. Clean out with flushing oil and refill to level on dipstick.
5. **Oil Filter (External).** Renew filter element in " TECALEMIT " oil cleaner fitted to 12 H.P. Models.
6. **Distributor Automatic Advance.** The moving parts of the automatic timing control should be lubricated with a good grade of thin engine oil. Access to these parts may be obtained by removing the distributor cover, lifting off the rotor arm, then removing the contact breaker base moulding by withdrawal of the two contact securing screws.

RECOMMENDED LUBRICANTS

(All these Brands of Oil are equally satisfactory for the purposes as stated.)

Component	Vacuum Mobiloil	Wakefield	Essolube	Shell
Engine Winter	Mobiloil Arctic	Patent Castrolite	Essolube "20"	Single Shell
Summer	Mobiloil A	Patent Castrol XL	Essolube "30"	Double Shell
Gearbox	Mobiloil BB	Patent Castrol KKL	Essolube "40"	Triple Shell
Rear Axle and Steering Box—Extreme Pressure Lubricants	Mobiloil E.P.	Castrol Hi-Press	Essoleum Expee "90"	Sheel E.P. Spirax Heavy
Wheel Hubs and Water Pump	Mobilgrease No. 4	Castrolease Heavy	Esso Grease	Shell R.B. Grease
Propeller Shaft Spline Front Axle Swivels Steering Joints Front Spring Eyes and Independent Suspension Pivots	Mobilgrease No. 2 or No. 4	Castrolease Heavy	Esso Grease	Shell Retinax Grease or Shell R.B. Grease
Road Spring Blades and all parts affected by rust	Voco Penetrating Oil	Castrol Penetrating Oil	Esso Penetrating Oil	Shell Penetrating Oil
Hydraulic Shock Absorbers	SPECIAL LUVAX PISTON TYPE FLUID.			
Small Control Joints, Oil Cups and Body Parts (Oil Can)	Gargoyle Velocite Oil D	Oilit	Essolube "20"	Single Shell
Brake Cables	SPECIAL BENDIX GREASE.			
Upper Cylinder Lubricant	Gargoyle	Castrollo	—	Shell
Luvax Bijur Automatic Chassis Lubrication alternatives	LUVAX BIJUR CHASSIS OIL			
	Mobiloil BB or CW	Patent Castrol KKL	Essolube Gear Oil Medium	Golden Shell Extra Heavy

ENGINE

INDEX

ILLUSTRATIONS

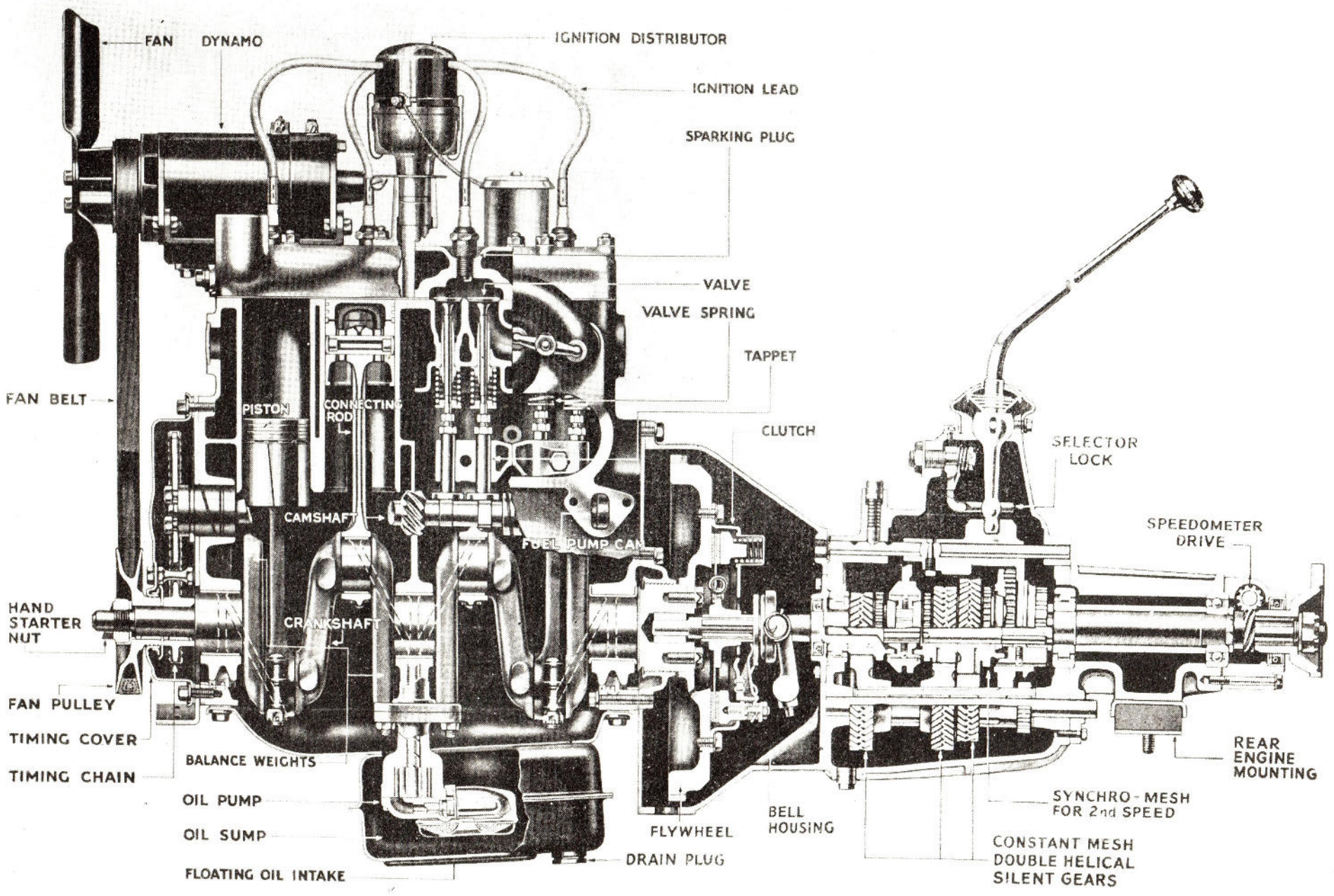


Fig. 1. 1946 — 8 H.P. Engine longitudinal section.

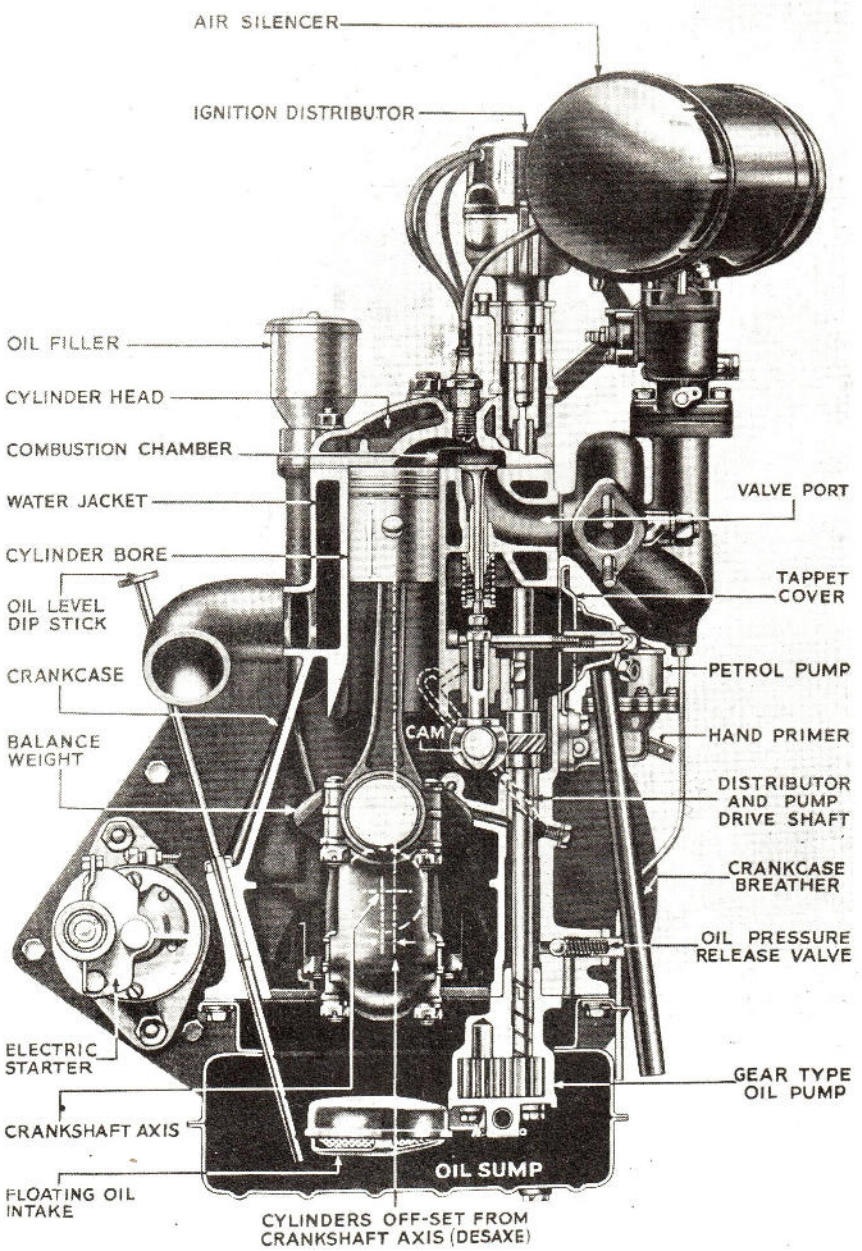


Fig. 2. **1946 — 8 H.P.** **Engine cross section.**

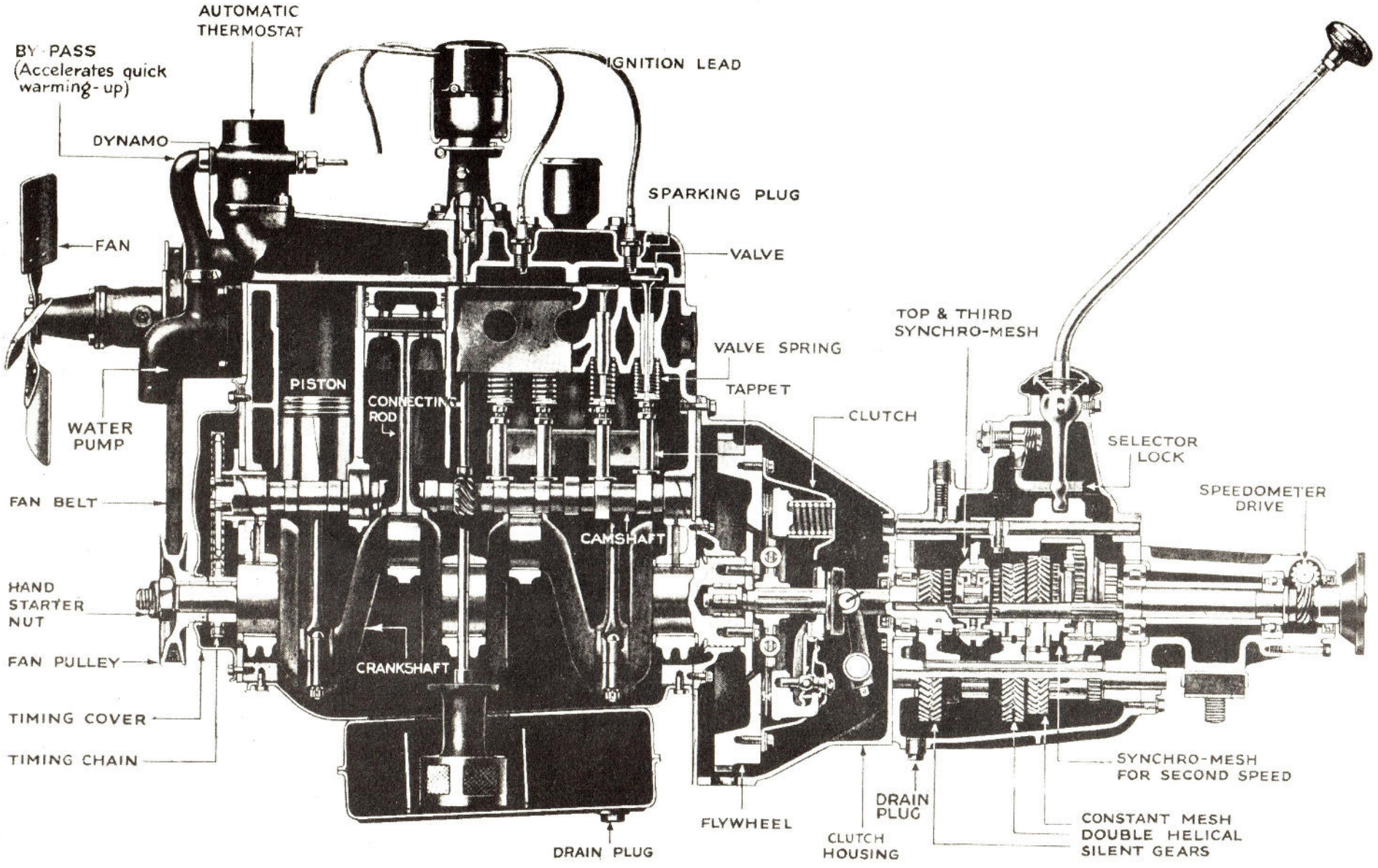


Fig. 3. Longitudinal section of 12 CD Engine.

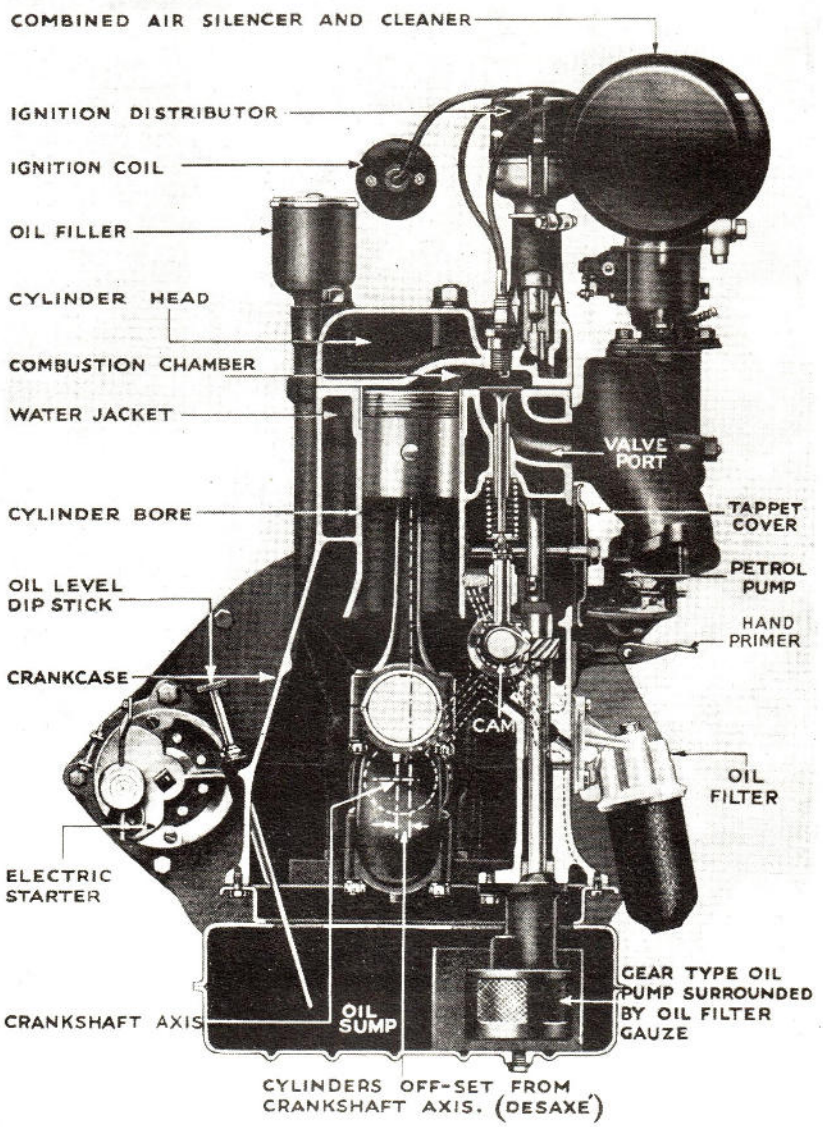


Fig. 4. Cross section of 12 CD engine.

ENGINE

GENERAL DESCRIPTION

Crankcase and cylinders are in one piece and are manufactured of chromium cast iron. In the case of the 12 H.P. models, short inserts of stainless iron are pressed into the upper part of the cylinder bores, where normally wear is at its maximum, this considerably reduces erosion and increases the mileage which can be covered before reboring is necessary.

Pistons are made of aluminium alloy and are specially heat treated to prevent distortion. The skirts are split and the split portion is fitted towards the camshaft, or the side of the engine where thrust is at a minimum. Two compression rings and a special type of oil scraper are used.

The connecting rods are of I section and are all of special steel, being provided with phosphor bronze small end bushes, and steel backed, white metal lined bearings for the crank pins. The connecting rods are linked to the pistons by means of case hardened tubular steel gudgeon pins, the pins being located by aluminium end pads.

The crankshaft is of Molybdenum Manganese steel, being supported by three main bearings. The bearings are of the Precision type as fitted to the crank pins. It is possible to change the bearings of this engine without the necessity of removing the engine.

The crankshaft thrust is taken by means of thrust washers, fitted on either side of the rear main bearings. The washers being of steel and white metal covered.

Case hardened, harmonic type cams are formed integrally with the camshaft and operate on tappets having flat chilled cast iron faces, offering great resistance to wear. The tappets are accommodated in detachable guide blocks, and lubricated under pressure from the main oil supply.

The camshaft embodies a helical gear, which meshes with a skew gear keyed on to a vertical shaft. The upper extremity of this shaft engages the distributor drive and the lower end is coupled to the oil pump. The oil pump is of the gear type, having one bronze and one steel wheel and the whole is submerged in the oil sump. The oil supply is drawn through a submerged type of filter in the case of the 8 H.P. and 10 H.P. models, whilst with the 12 H.P. and 14 H.P. engines, filtration is carried out on the delivery side of the pump externally.

The valves are of Silichrome steel and are accommodated in detachable cast iron guides which are pressed into the cylinder block.

The oil sump is of pressed steel and is provided with a baffle to prevent the oil pump being starved of oil, by surge when cornering.

The engine is connected to the gearbox by a separate bell housing in all models excepting the 8A, 1939 model. The bell housing also encloses the flywheel and clutch. With the 8A model the bell housing is cast integrally with the gearbox casing.

Engine Lubrication.

A pressed steel sump contains the oil supply and is bolted to the bottom face of the cylinder block. A circular baffle surrounds the gear type pump, which is supplied in the case of the 12 H.P. and 14 H.P. engines with a gauze primary filter. In the case of the 8 H.P. and 10 H.P. models, oil is drawn direct through a submerged type of filter, which is hinged at its attachment to the base of the oil pump, and rises and falls with the oil level, thus always drawing its supply of oil from the cleanest available source.

Oil passes from the oil pump through a hole provided in the pump body to an annular space around the vertical drive shaft, whence, in the case of the 12 H.P. and 14 H.P. engines, it is forced into the Tecalemit oil filter, which is bolted to the side of the crankshaft. The annular space around the vertical shaft is sealed at the top by means of the phosphor bronze bearing, in which the vertical shaft runs, this bearing being situated just below the driving skew gear. See Fig. No 6.

From the filter oil passes around a reduced portion of the distributor shaft bush, referred to in the last paragraph, into the oil gallery, which runs along the full length of the N/S of the engine.

Part sections are given in Fig. No. 6 to show (A) how the oil flows from the oil gallery hole to the camshaft intermediate bearings, and

(B) to the crankshaft and camshaft front and rear bearings. (The illustration is the 14 H.P. unit as fitted to the Beaverette Mark IV.)

A restrictor is fitted as shown in (A) to reduce the flow to the camshaft bearings, whilst small holes restrict the oil supply to the camshaft front and rear bearings as shown in (B).

The two intermediate camshaft bearings are provided with grooves to allow some oil to pass to the tappet guides as shown in (A).

Oil from the three main bearings is fed, via drilled passages in the crankshaft, to the crank pins. In the case of the 12 H.P. and 14 H.P. models, some of this oil passes through the drilled oil ways in the connecting rods to the gudgeon pins. The remainder of the parts are lubricated by the splash of oil escaping from the bearings and by oil mist in the crank-case. This provides efficient lubrication for pistons, cams, valves, timing chains and in the case of the 8 H.P. and 10 H.P. models, the gudgeon pins and bushes are so lubricated. Suitable oil return scrollings are embodied at the front and rear end of the engine to prevent oil leaking along the shaft.

In the case of the 8 H.P. and 10 H.P. models, which use the submerged, or floating type of filter, oil passes from the pump up the annular space around the distributor shaft and over a pressure release plunger (a ball with 1946 models), which is spring loaded and has its seating in the wall of the cylinder block. The oil passes direct to the oil gallery which, as with the larger models, runs the length of the cylinder block. The course of the oil from the oil gallery is the same as with the other models, with the exception of the fact that oil is not fed by pressure to the small ends with these models. Fig. No. 2 gives a cross section of the 8 H.P. engine and illustrates the release mechanism which is common with both 8 H.P. and 10 H.P. models.

Operation of Tecalemit Oil Filter.

This oil filter, which is shown in Fig. No. 5, is fitted to both 12 H.P. and 14 H.P. models, being bolted on to the side of the crank-case with the filter container suspended from its bracket.

Oil from the pump, entering the filter body, passes first over the relief valve orifice on its way to the element. This valve regulates the oil pressure, being spring loaded, at a given pressure release takes place returning unfiltered excess oil to the engine sump.

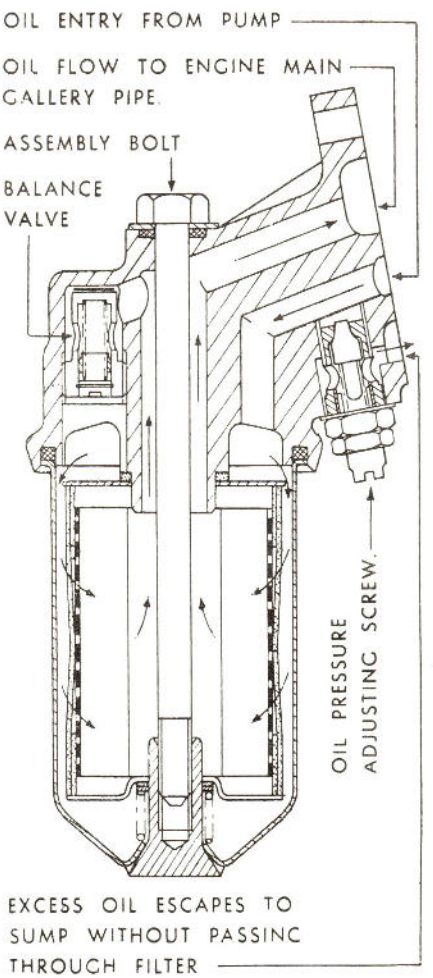


Fig. 5. Tecalemit Oil Filter.

The delivery of oil from the pump will increase with engine speed. At high engine speeds the bearings do not require the total output of the pump and consequently cause back pressure, which is of sufficient magnitude to operate the release valve, returning the unwanted oil to the engine sump. The bulk of the oil passes, under pressure to the outside of the filter element, which is located in a detachable container. By the design of the cleaner, the oil can only pass through the element from its periphery, being forced through the felt material of which it is composed, and leaving sludge on its outer surface. The clean oil passes up the centre tube of the cleaner to the oil gallery in the crank-case.

A spring loaded balance valve is provided which is subject to the full pressure of the oil entering the cleaner from the engine. The slightly lower pressure of the clean oil passing out of the filter element, acts on the other side of the valve and assists the spring to keep the valve on

[Turn to page 35

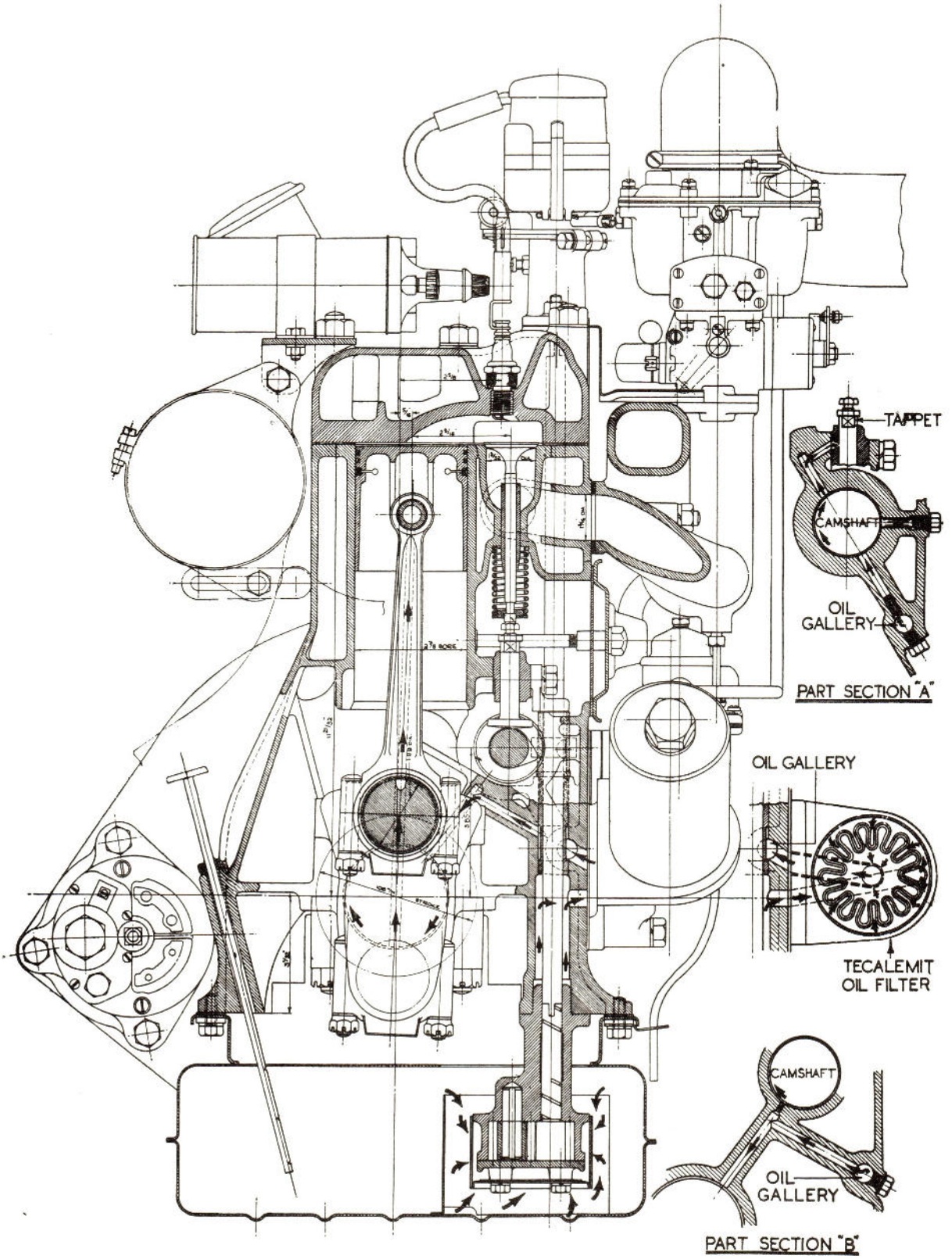


Fig. 6. **Engine lubrication diagram (lateral).** **12 and 14 H.P. models.**

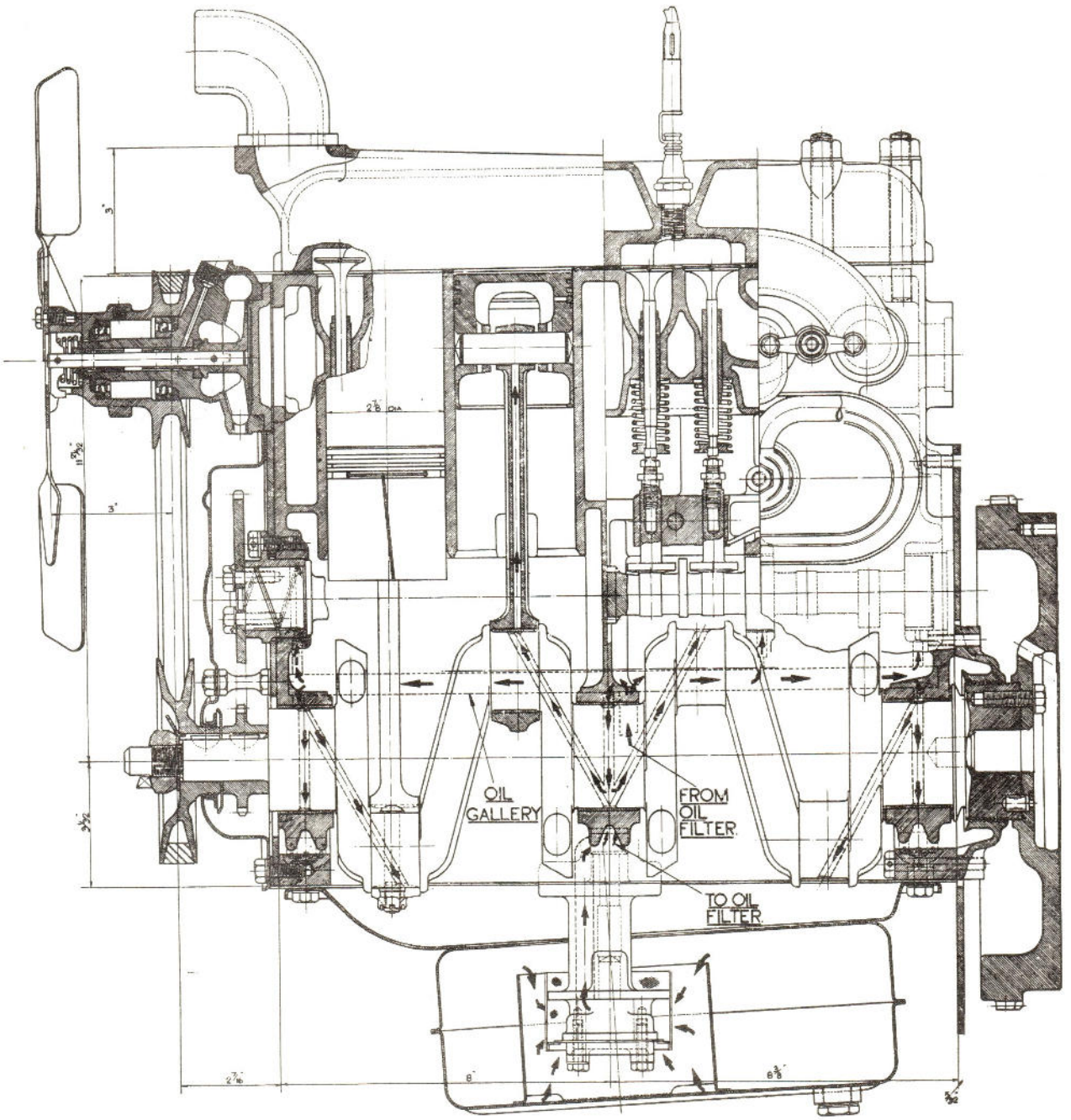


Fig. 7. Engine lubrication diagram (longitudinal). 12 and 14 H.P. models.

its seating, resisting the pressure of the oil as it enters the cleaner, prior to being filtered. Thus all oil passing to the engine is forced through the element so long as this is not clogged with dirt.

After some thousands of miles the filter becomes clogged with dirt, thereby decreasing its porosity and increasing the pressure required to force oil through it. This causes the filtered oil to be at a lower pressure, having used this up in passing the filter.

Ultimately this lower pressure, with the additional resistance provided by the by-pass valve spring, proves insufficient to balance the pressure of the incoming oil and the valve is lifted off its seating, allowing unfiltered oil to be fed direct to the engine.

It will be seen that the balance valve ensures that, even if the filter element is neglected, the engine will still get some oil, although this will be unfiltered.

The oil filter element should be cleaned in petrol each 2,000 miles and replaced by a new one at 10,000 miles, or at an earlier mileage if its condition justifies this.

TO REMOVE ENGINE FROM CHASSIS

Procedure.

1. Remove bonnet, radiator and tie rod.
2. Disconnect one terminal from accumulator.
3. Remove floor boards (with 8 H.P. models this is unnecessary).
4. Slacken set screws securing toe-boards.
5. Disconnect speedometer cable from gearbox.
6. Disconnect clutch operating rods from clutch housing end.
7. Remove bolts which secure driving flange on gearbox to that on propeller shaft.
8. Remove the two nuts which secure the gearbox rear mounting to chassis frame. (In the case of the 8 H.P. models, two set screws secure the rear end of the gearbox to cross member.)

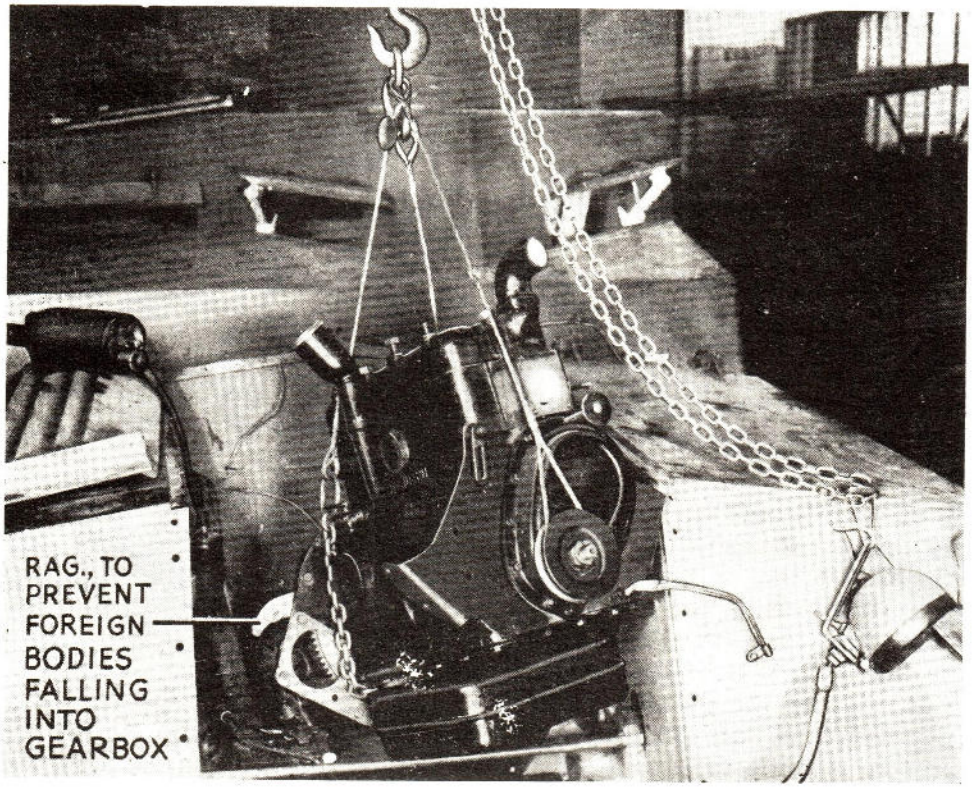


Fig. 8. **Method of applying sling to engine.**

9. Remove set screws securing gearbox cover. Set lever in neutral and remove top complete with lever. Cover gearbox with a piece of rag.
10. Disconnect exhaust downtake pipe and remove exhaust and inlet manifold complete with carburettor, air silencer and manifold drain pipe.
11. Disconnect earthing wire from the front engine bearer plate, in the case of the 12 H.P. models, and the clutch housing with the 8 H.P. and 10 H.P. models.
12. Detach petrol pipe from A.C. Pump.
13. Disconnect oil pressure gauge pipe from adapter in cylinder block.
14. Remove starter motor.
15. Disconnect sparking plug leads from sparking plugs and low and high tension leads from coil.
16. Remove distributor head and bracket by removal of two nuts securing this to the cylinder head. Do not lose the felt washer fitted in the recess in the cylinder head and avoid unnecessary removal of distributor driving shaft. Note any packing shims which are fitted under the distributor bracket for replacement on re-assembly.
17. Remove the two nuts, on either side of the engine, which secure the front bearer plate to the rubber mountings.
18. Remove engine from chassis using a lifting eye screwed on to the cylinder head stud, which is adjacent to the distributor. If such an eye is not available it will be necessary, in the case of the 12 H.P. and 14 H.P. engines to remove the water expeller and fan blade assembly, whilst with the 8 H.P. and 10 H.P. models the dynamo and fan assembly should be withdrawn. The application of a sling will now be possible and it is best employed as shown in Fig. No. 8.
19. Re-installation is the reverse procedure to the foregoing.

TO DISMANTLE ENGINE

Procedure.

Having removed engine complete with gearbox from chassis, continue to dismantle as follows :—

1. Disconnect gearbox and bell housing from engine by removal of nuts and bolts.
2. Remove clutch assembly from engine by unscrewing holding screws symetrically, a turn or two at a time.
3. Remove water expeller, dynamo and belt in the case of the 12 H.P. and 14 H.P. engines if these have not already been removed, to enable the use of a sling. With the smaller models it will be necessary to remove the dynamo and fan assembly if these are still in position.
4. Remove cylinder head, and where this is of aluminium, allow to cool off before withdrawal. Do not use a screwdriver between the cylinder face and that of the combustion head to prize these two items apart, as damage may be caused to the machined faces, also to the gasket. The damage to the gasket is of no particular significance unless it is impossible to obtain a new one, as it should be replaced normally as a matter of routine.

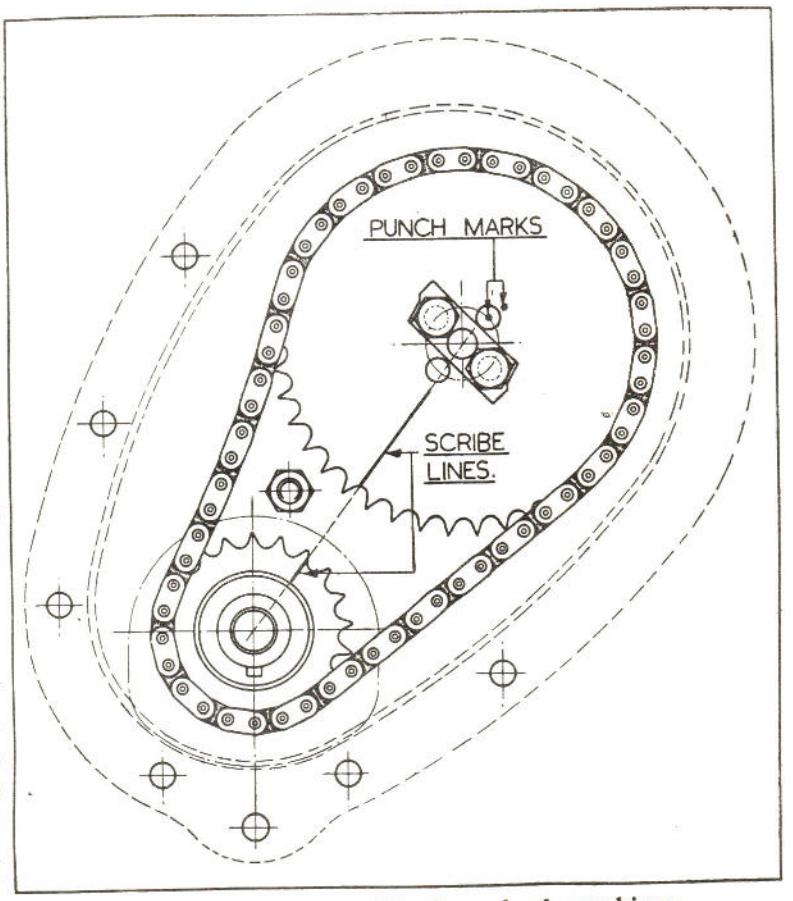


Fig. 9. **Timing wheel markings.**

9.

Operation 9. Page 37.

Place No.1 Piston on T.D.C. with both valves closed and on the assumption that the valve timing is correct (if this is not the case, timing will be reset as directed on. Page 41 under Valve Timing when re-assembling) proceed to mark the timing gear as follows:-

"Scribe a line across the surface of the two chain wheels, which if produced in both directions would pass through the respective centres. In addition, take a centre punch and mark a dot on th end of the camshaft through a set screw hole and similarly mark the face of the camshaft wheel adjacently".

It may be found that these markings have alredy been made, in which case, fresh markings will only be required if the existing ones are indistinct. See Figure No.9 which illustrates the method of marking these.

26.

Operation 18. Page 37.

Remove pistons, and connecting rods after removal of split pins and nuts securing big end caps. To draw out pistons, place crank-pin towards camshaft and then by turning the engine slowly anti-clockwise, as the piston concerned comes against the balance weight on the crankshaft, the assembly can be moved down clear of the shaft. (See Figure 10.) Replace bearing cap and the slotted nuts on their respective bolts. Each bearing housing should already be numbered on its offside face.

28.

Operation 20. Page 37.

Remove the two securing blocks and four filling pieces from over the front and rear main bearings. The front sealing block is secured by two vertical set screws, but in the case of that fitted over the rear main bearing, there are, in addition, two horizontal set screws which also assist to secure the rear oil retainer.

TO DISMANTLE ENGINE (Cont.d.)

29.

Operations 21 - 24. Page 38.

21. Remove rear oil retainer.

22. Remove rear engine bearer plate.

23. Remove main bearing caps and lower halves of thrust washers.

24. Lift crankshaft from the engine.

5. Remove tappet cover, oil filter assembly and petrol pump. (In the case of 8 H.P. and 10 H.P. models no filter is fitted externally.) With 8 H.P. and 10 H.P. models remove oil pressure release adjuster, plunger (or ball) and spring (a tufnel plunger was used on pre-war models, but has now been replaced by a steel ball).

6. Remove starting handle dog nut noting the number of shims fitted to give the correct position of starting handle.

7. Remove fan pulley and driving key.

8. Remove timing cover.

9. Place No. 1 piston on T.D.C. with both valves closed and on the assumption that the valve timing is correct (if this is not the case timing will be re-set as directed on Page 41 under Valve Timing when re-assembling) proceed to mark the timing gear as follows :—

   " Scribe a line across the surface of the two chain wheels, which if produced in both directions would pass through the respective centres. In addition, take a centre punch and mark a dot on the end of the camshaft through a set screw hole and similarly mark the face of the camshaft wheel adjacently."

   It may be found that these markings have already been made, in which case, fresh markings will only be required if the existing ones are indistinct. See Fig. No. 9 which illustrates the method of marking these.

10. Remove distributor shaft by gripping its projection at the upper end with a pair of pliers and twisting in an anti-clockwise direction, thus screwing the gear out of mesh with that on the camshaft. Draw shaft out of gear being careful not to lose the driving key.

11. Remove camshaft timing wheel and chain, also chain wheel on crankshaft and its woodruff key. Note the number of shims fitted between this latter wheel and the crankshaft to give correct alignment with camshaft wheel. Keep the shims together for re-assembly.

12. Remove tappet blocks complete with tappets also distributor driving shaft abutment after withdrawal of 4 set screws. Note the position of the *longer* pair through the inner end of each tappet block and the distributor shaft abutment.

13. Remove valves, valve springs, and collars. Ensure that these valves are marked, being numbered consecutively from the rear of the engine.

14. Remove camshaft locating plate and draw out camshaft. The 12 H.P. and 14 H.P. engines are fitted with camshaft bearings but rarely does the necessity for their replacement arise and where this is necessary, line reaming is required after fitting. It is only suggested that these bearings should be removed if they are seriously worn or " run " and only then if facilities exist for " line reaming." If suitable facilities do not exist for " line reaming " and replacements are required the block should be returned to us for the necessary work. For information as to the removal and fitting of these bearings, which are only used on the 12 H.P. and 14 H.P. engine, see Page 41.

15. Remove front bearer plate.

16. Remove engine sump after draining off oil.

17. Remove oil pump and primary filter in the case of the 12 H.P. and 14 H.P. engines. With the other models the floating oil filter is attached to the base of the oil pump.

18. Remove pistons, and connecting rods after removal of split pins and nuts securing big end caps. To draw out pistons, place crank-pin towards camshaft and then by turning the engine slowly anti-clockwise, as the piston concerned comes against the balance weight on the crankshaft, the assembly can be moved down clear of the shaft (See Fig. 10). Replace bearing cap and the slotted nuts on their respective bolts. Each bearing housing should already be numbered on its off-side face.

19. Remove flywheel and roller bearing (oilite brush in the case of 8 H.P. models).

20. Remove the two sealing blocks and four filling pieces from over the front and rear main bearings. The front sealing block is secured by two vertical set screws, but in the case of that fitted over the rear main bearing, there are, in addition, two horizontal set screws which also assist to secure the rear oil retainer.

1. Remove rear oil retainer.
2. Remove rear engine bearer plate.
3. Remove main bearing caps and lower halves of thrust washers.
4. Lift crankshaft from engine.
25. Replace bearing caps, bearings and half thrust washers to prevent loss and to keep in correct position.
26. Re-assembly is the reverse of the foregoing procedure, observing precautions directed below.

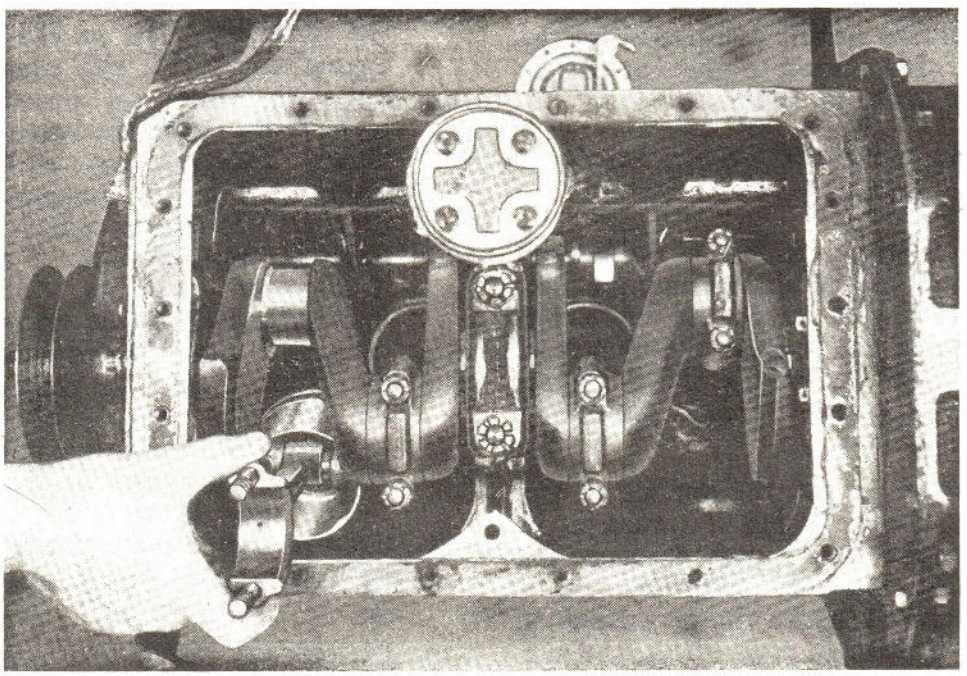


Fig. 10. **Removal of piston and connecting rod.**

PRECAUTIONS TO BE OBSERVED WHEN RE-ASSEMBLING ENGINE

1. If bearing failure has occurred the crankshaft oil ways should be cleared of any possible obstructions such as scraps of white metal. The crankshaft should also be examined for damaged journals and possible distortion.
2. *On no account must the main bearing caps be filed with the idea of letting down these to eliminate slackness. Such procedure will render the caps unserviceable for use with new bearings and replacement main bearing caps cannot be obtained from our Spares Department as they are line bored, bolted to their respective cylinder blocks during initial manufacture. Similarly big end bearing caps must not be filed, but in their case replacement rods can, of course, be obtained.*
   When replacing the rear oil retainer, it is necessary to centralize this cover with the crankshaft so that there is a clearance all round the shaft, unless this is done, oil may pass this point. A final check of the centralizing of this cover will have to be made after securing rear sealing block with the two bottom set screws. (A 0.002" feeler gauge should be used.)
4. When replacing the rear sealing block, first tighten the horizontal set screws before finally securing the vertical set screws.
5. Before replacing flywheel, insert roller race, or oilite bush for 8 H.P. models, in the crankshaft spigot. Pack roller race with grease.
6. Before refitting old bearings, ensure that the wear on these items and the crankshaft is not such as to justify the regrinding of the crankshaft and the fitting of under-

sized bearings. In this connection, refer to the list of Dimensions and Tolerances on Pages 10—21.

7. If excessive oil consumption has been experienced, or blow-by is noticeable from the breather pipe or oil filter cap, check bore and piston wear. See list of Dimensions. If bore wear is not beyond the limits prescribed, replace any seized or worn pistons and check piston ring clearances as given on Pages 11 and 16. Check connection rods for alignment. See Page 43.

8. If oil pump is dismantled be careful, when refitting the cover, to engage the dowel, which ensures that the oil entry hole is located diagonally opposite to the oil delivery hole. Check for wear in accordance with Page 11.

9. Replace any weak valve springs, replacing tappet guides as necessary, referring to Pages 10—21 for permissable wear. Worn valves should similarly be replaced. Valves should be carefully ground in and bad seats recut as directed on Page 46.

10. When refitting distributor shaft and gear, the engine should have No. 1 Piston on T.D.C. and the valves closed. The shaft and gear should then be engaged as indicated in Fig. 11.

11. When refitting timing wheel on camshaft, first place engine with No. 1. cylinder at Firing Point, *i.e.*, T.D.C. with both valves closed. Rest the camshaft timing wheel on

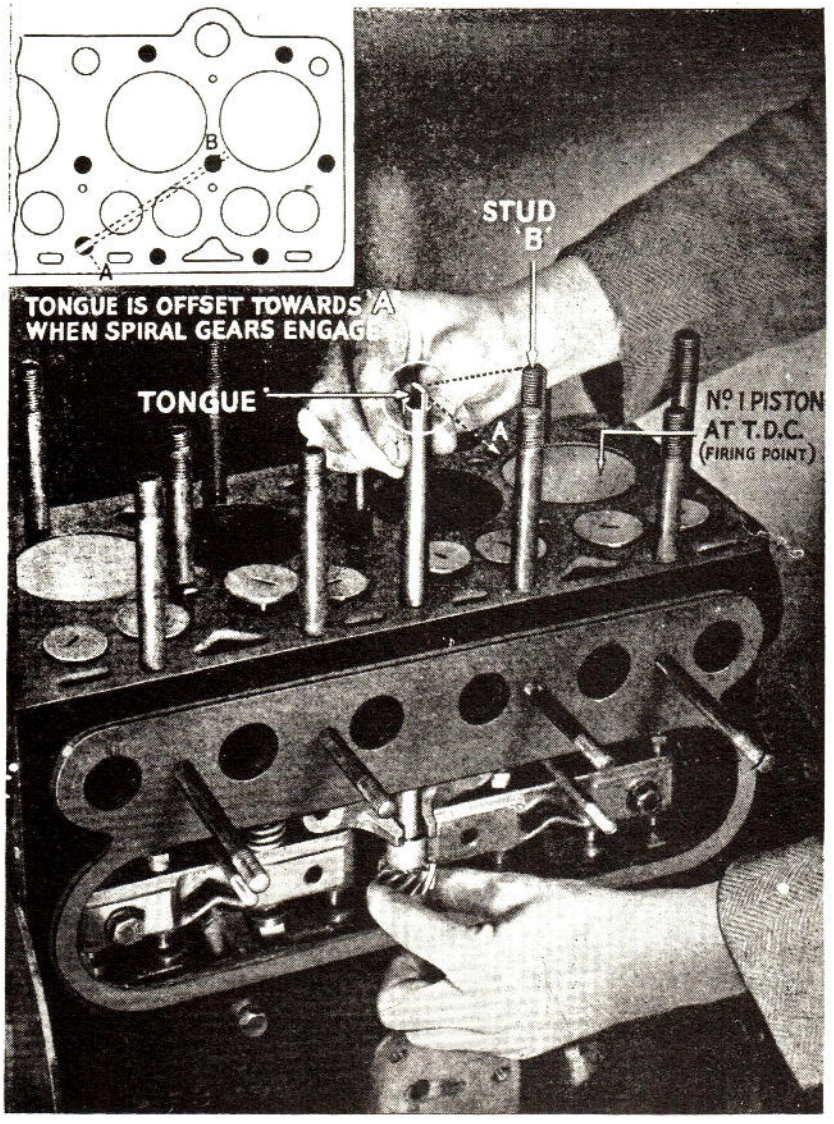


Fig. 11. **Engagement of spiral gears.**

the camshaft spigot, with the chain round this and the crankshaft wheel, and line up scribed marks. Turn the camshaft until the centre punch mark on the camshaft appears at the punch marked hole on the face of the camshaft wheel. The set screw holes of the wheel should be exactly in line with those on the camshaft. *Ensure that the driving side of the timing chain is tight when this lining up process is carried out.* Check Ignition timing and ensure that this occurs at T.D.C. In this connection refer next column.

12. When refitting timing cover, be sure to centralize this carefully in relation to the fan pulley boss. This centralizing may be carried out by partially tightening the securing set screws and fitting up the fan pulley, without its key, on a well oiled crankshaft, and by spinning this pulley and tapping the cover until there is no binding, thus ensuring a clearance around the boss. *The bottom bolt securing cover should have a lead washer fitted under steel washer to prevent oil leakage.*

13. Before replacing water expeller on a 12 H.P. model, ensure that a new packing gland is not required or that the bushes are worn and require replacing. See water Pump on Page 43.

14. When refitting tappet blocks and abutment bracket, *be careful to fit bracket offset towards the base of the engine and to use the longer pair of set screws for securing each side of this and the inner ends of the two tappet blocks.* Tighten up these set screws, and the other two securing the outer ends of blocks, evenly to avoid damage to these guides.

15. When refitting cylinder head always fit a new gasket and apply grease or jointing compound to both sides. Tighten cylinder head nuts up symetrically, a little at a time. The sequence for tightening is shown in Fig. 12. Cylinder head nuts should be re-tightened after a test run and again checked after a few hundred miles running.

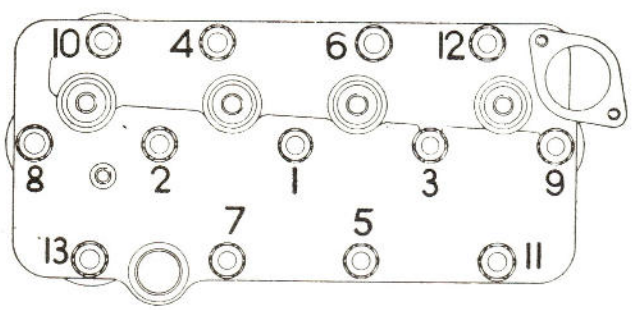


Fig. 12. Order of tightening cylinder head nuts.

TO SET IGNITION TIMING

1. Place No. 1 Piston on T.D.C. with both valves closed.
2. If the distributor head and bracket are removed, the offset on the distributor driving shaft should be towards the rear of the engine, and the tongue or projection, should be pointing approximately towards the second cylinder head stud in the centre row, see Fig. 11.
3. If the ignition timing was previously correctly set and the clamping bolt was not loosened it should be merely necessary to refit the bracket and distributor to the driving shaft in the position as described in paragraph 2. If the clamp bolt was slackened or doubt exists as to timing, the following procedure should be adopted.
4. Refit bracket and distributor head with clamp bolt loose.
5. Rotate distributor until points are fully open and check gap, which when correctly set, should be 0.010″—0.012″. To adjust setting, alter the position of the plate on which the fixed contact is mounted, by slackening the securing screws and moving plate until the desired gap is obtained, and the points when closed fit flush together. If the points are dirty or pitted, they should be cleaned with a fine carborundum stone and afterwards wiped with a petrol moistened cloth.
6. Having ensured the correct gap, which is important to enable correct timing, it is now necessary to rotate distributor in the opposite direction to that taken by distributor shaft, until the points just commence to separate with the rotor arm opposite No. 1 segment on cover. Now tighten up clamp bolt and test car on road, advancing ignition as far as possible, consistent with freedom from " pinking." To advance ignition it will be necessary to loosen clamp bolt and rotate distributor head as directed in the first part of this paragraph, or opposite to the direction in which the shaft rotates.

TO SET VALVE TIMING

1. Set tappets on No. 1 cylinder to 0.020″ with both valves closed on T.D.C., *i.e.*, with the tappets resting on the backs, or concentric portions, of cams. (The reason for setting the clearance at 0.020″ is that at this clearance the tappets make contact with the actual opening and closing points of the cam.
   The running clearance of 0.015″ allows 0.005″ take up for silence.
2. Turn the camshaft round until inlet and exhaust valves are equidistant from and just clear of their respective seatings, a feeler gauge should be used for this purpose.
3. With timing chain and camshaft wheel removed, turn crankshaft round until No. 1 cylinder is at T.D.C. If the cylinder head is fitted the position can be found by using a small diameter rod of 7″ to 8″ through the timing plug aperture provided over No. 1 cylinder.
4. Engage the timing chain with crankshaft wheel and fit the camshaft chain wheel to the chain in such a way that the wheel, when positioned on the camshaft spigot, allows the set screw holes in the camshaft wheel to be exactly in line with those in the camshaft, with the driving side of the chain tight. The position of the camshaft must not, of course, be altered, and it will be necessary to experiment with the two pairs of holes to bring these in line. The second pair of holes gives a half tooth adjustment, whilst turning the timing wheel back to front, a ¼ tooth range of adjustment becomes available.
5. Having checked timing with diagram given in Fig. 13 proceed to mark the timing wheels as follows :—
   " Place No. 1 piston on T.D.C. with both valves closed and then scribe a line across the face of the chain wheels in such a manner that, if this were produced, in each direction, it would intersect the wheel centres. Mark also, the end of the camshaft through a set screw hole with a centre punch and similarly indicate with a dot, an adjacent spot on the face of the chain wheel."
   Fig. 9 illustrates the method of marking.
6. Do not forget to reset tappet clearances on No. 1 cylinder to 0.015″.

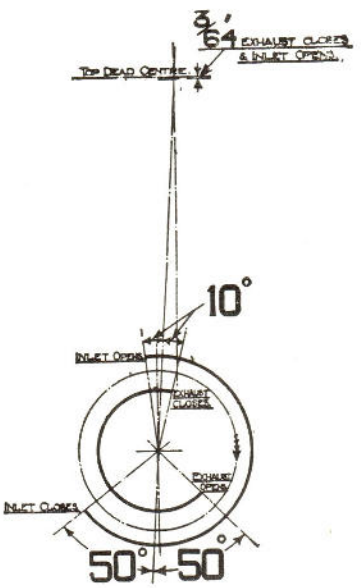


Fig. 13. Timing Diagram.

WHEN AND HOW TO FIT NEW CAMSHAFT BEARINGS

Only the 12 H.P. and 14 H.P. Engines have detachable bearings, the 8 H.P. and 10 H.P. models have the camshaft running direct in the cylinder block. With the former models four bearings are fitted, a cast iron bearing bolted to the front engine bearer plate and three precision type, steel backed white metal lined located in the cylinder block.

From experience, it has been found that the wear which takes place in these bearings, is rarely of sufficient dimensions during the normal life of an engine, to justify the fitting of replacements. For details of tolerances see Pages 10-22.

OVERSIZE BEARINGS ARE NOT AVAILABLE AND UNLESS THESE ITEMS ARE SERIOUSLY WORN OR " RUN " THEIR REPLACEMENT IS NOT RECOMMENDED.

A further restriction on the fitting of camshaft bearings in your workshop, is the necessity for " line reaming " the items in position. If you have no facilities for this work and consider the replacements are required, you are recommended to have the work done here in our works.

If it is decided to fit new bearings, the following procedure should be observed :—

1. Remove Timing Cover.
2. Remove Tappet Cover.

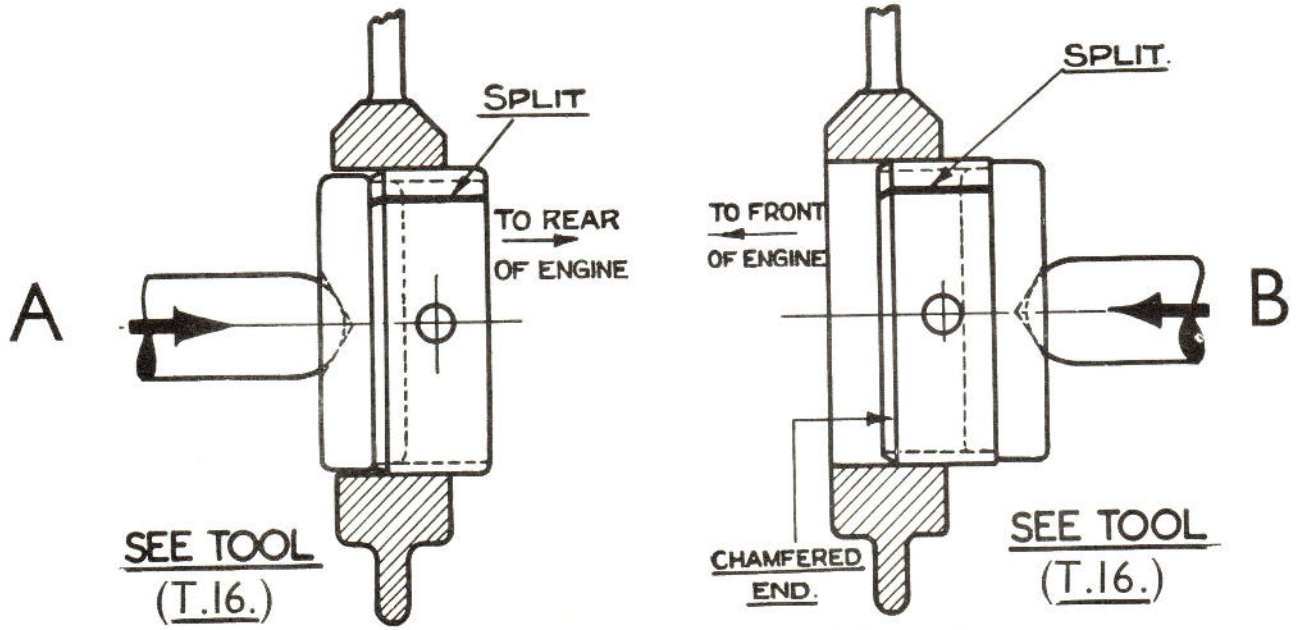


Fig. 14. Removal of camshaft bearings.

3. Remove Abutment and Tappet Guide Blocks.
4. Remove Petrol Pump.
5. Remove Distributor and Bracket.
6. Remove camshaft wheel and chain.
7. Remove two set screws securing front camshaft bearing.
8. Grip distributor shaft tongue with a pair of pliers and twist in an anti-clockwise direction to disengage helical gears. Do not lose driving key from distributor shaft.
9. Remove the three set screws, which are fitted on the N/S of the engine, and locate each bearing. Under the head of each set screw will be found a $\frac{1}{16}$" thick washer, which must, on no account, be omitted on re-assembly.
10. Remove expansion plug, which seals rear bearing hole. This may be done by drilling a hole centrally and levering out with a tommy bar.
11. Now tap out three precision bearings to the *Rear* and scribe on each housing to line up with "splits" in each bearing. A suitable shouldered punch for driving out these bearings is shown on Page 176 under "Tools." Removal of bearings is illustrated on Fig. 14.

Fitting New Bearings.

12. Fit each bearing from the rear, with the "split" uppermost and in line with markings on housings. Place the dowel holes outwards and in line with the set screw holes. The bearings are provided with chamfers to assist in fitting. Tap bearings into position utilizing suitable shouldered punch.
13. Refit locating set screws with plain $\frac{1}{16}$" washers under each head.
14. Line ream bearings in position.
15. Refit expansion plug, painting edge with shellac or other jointing compound.
16. Complete re-assembly as set out under "Re-assembly of Engine" Page 38.

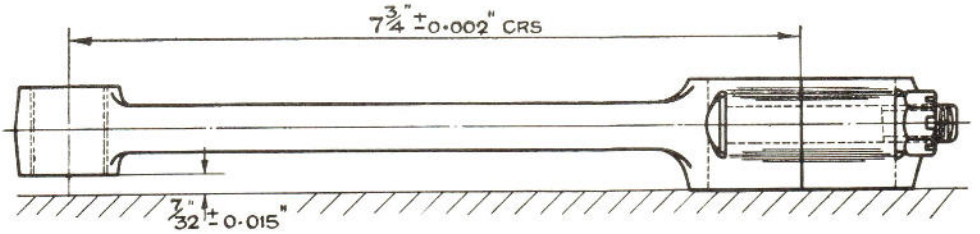


Fig. 15. Checking connecting rod offset.

ALIGNMENT OF CONNECTING RODS

First check the " offset " of the little end in respect to the big end on a surface plate. The illustration given refers to the 12 H.P. or 14 H.P. engine, but with the 8 H.P. and 10 H.P. models, the dimension of the offset is the same. In the case of the latter models, however, the centres are $7\frac{1}{4}'' \pm 0.002''$ instead of $7\frac{3}{4}'' \pm 0.002''$.

Having found the " offset " correct, proceed to align the axes of the big and little ends. To carry out this check, employ a suitable connecting rod aligner such as the type shown in Fig. 16. In the example illustrated, correct alignment obtains when all three lugs of the " Vee " block contact the vertical plate simultaneously. The rods must be " set " until correct alignment is obtained.

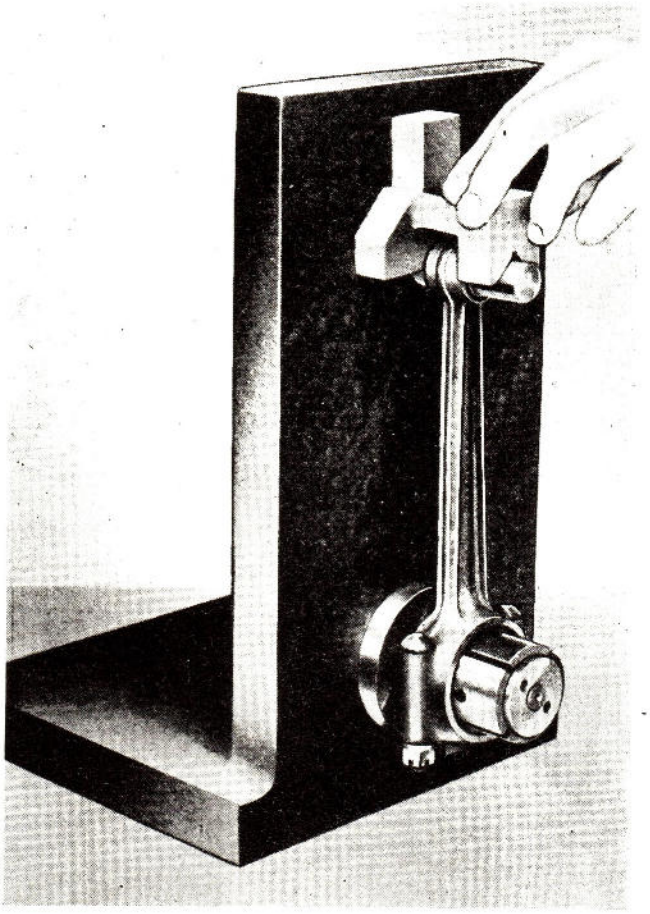


Fig. 16. Connecting rod alignment.

OVERHAUL OF WATER PUMP

Only the 12 H.P. and 14 H.P. engines are fitted with water pump. Having removed water expeller from engine proceed as follows :

1. Remove fan blades and wire balance weight to blades with a piece of wire and note position indicated by small drilled holes for re-assembly. Note length of set screws holding balance piece in comparison with other set screws and if any difference exists, regard this on re-assembly.
2. Drive out Mills pin securing driving piece to spindle.
3. Remove screws holding cover plate and tap gently to release this plate.
4. Tap spindle from front end to drive off plate.
5. Withdraw impellor and spindle disclosing gland packing.

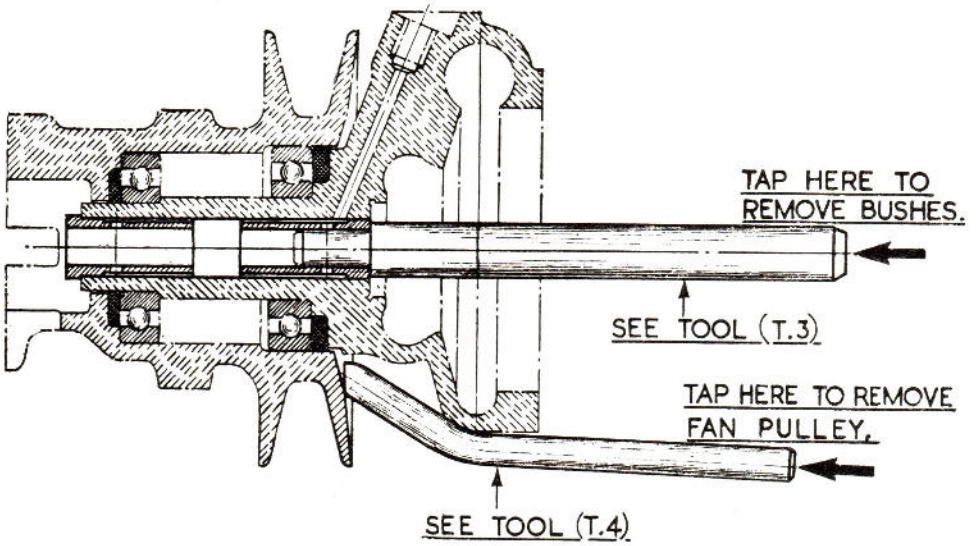


Fig. 17. Removal of fan pulley and spindle bushes.

6. Fan Bearings can be removed by tapping off pump body. (See Fig. 17).
7. Remove gland packing taking care not to damage recess.
8. Drive out spindle bushes utilizing a suitable shouldered punch as shown in Fig. 17. This punch is shown in the Section on Tools.
9. The same punch may be used for fitting new bushes. The bush adjacent to the gland packing should be driven in a little below the packing recess, to allow this gland to fit down squarely in this recess. After fitting these new bushes they will require reaming $\frac{3}{8}''$ +0.0007″−0.0017″.
10. Press gland packing squarely into recess afterwards cutting face with tool shown in Fig. 18 if available. Failure to use the seating cutter may cause some small initial leakage, but this will disappear after a little running.
11. Re-assemble water pump in the reverse order to that given above. Pay attention to the necessity for correct fitting of balance piece on fan and renew the washer between the cover plate and pump body.

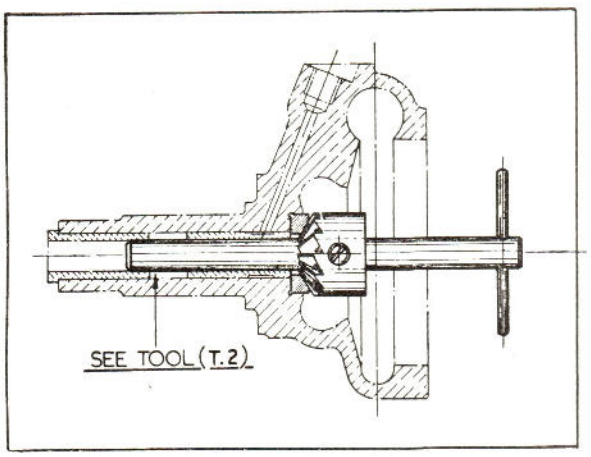


Fig. 18. Use of water pump gland seating cutter.

TO ADJUST TAPPETS

1. Remove Exhaust and Inlet manifold with carburettor.
2. Remove tappet cover.
3. Turn engine until No. 1 piston (that nearest the driver) is on T.D.C. of the compression stroke, *i.e.*, with both valves closed and thus their respective tappets are resting on the concentric portion of its cam.

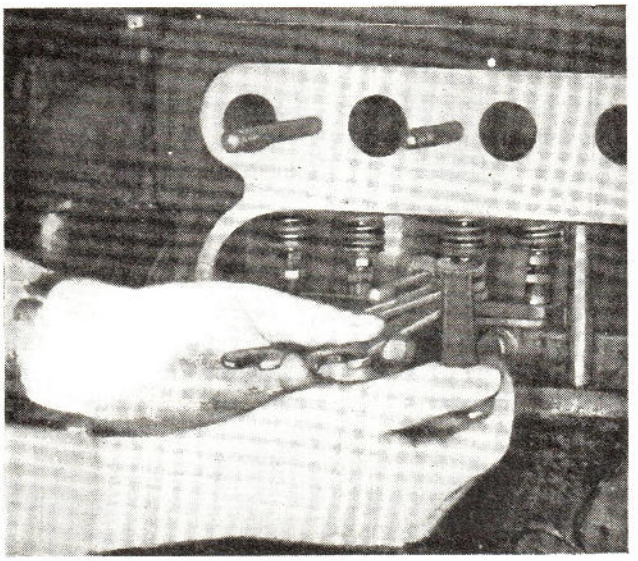


Fig. 19. Adjusting tappet clearance.

4. Test clearances between tappet adjuster and valve stem with a set of feelers, adjusting these clearances to 0.015″ by slackening off the lock nut and screwing out or tightening up the adjuster screw, to decrease or increase, respectively the clearance.

   Three spanners may be used as shown in Fig. 19 or alternatively the lower spanner may be dispensed with, and a piece of plate of a suitable width engaged with the flats on the pair of tappets, thus preventing their rotation.

5. Turn the handle through 180° thus bringing No. 3 piston to T.D.C. of the compression stroke. Having adjusted the tappets on this cylinder, rotate the crankshaft through 180° to bring the next cylinder, in order of firing, into the correct position for ignition.

6. Continue the process until the tappets for all four cylinders have been adjusted, regarding the fact that the order of firing, with all the models under review, is 1-3-4-2. Replace any worn adjuster screws and give special attention to the possibility of pitted heads on these.

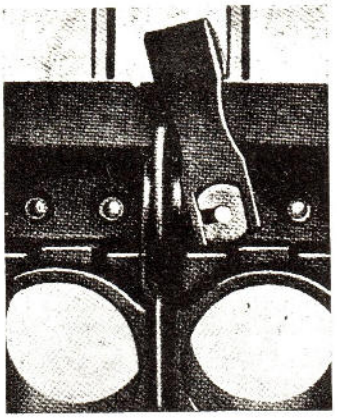


Fig. 20. Fitting valve spring compressor.

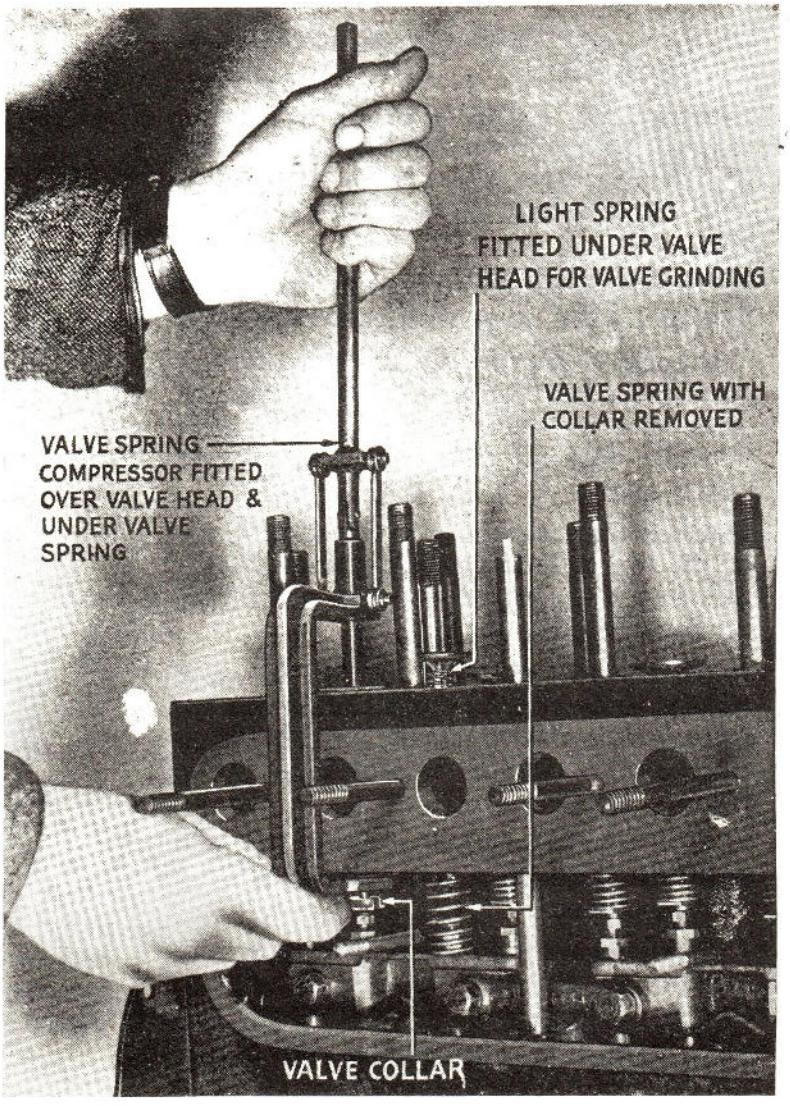


Fig. 21. Showing use of valve spring compressor without removal of tappets.

DECARBONISING AND VALVE GRINDING

This attention should be carried out initially after the first 1,000 miles and subsequently when compression and consequently power, deteriorates.

The following procedure should be adopted :—

1. Drain water from radiator saving anti-freeze mixture for future use.
2. Remove top water connections from cylinder head.
3. Detach strangler and throttle controls from carburettor, also petrol pipe.
4. Remove tappet cover.
5. Remove fan and dynamo belt.
6. Detach sparking plug leads from plugs and low and high tension leads from distributor.
7. Remove distributor and bracket from cylinder head, without slackening the clamp bolt, thus preserving the ignition timing. Be careful to avoid lifting the distributor shaft out of position and carefully remove felt washer from recess in cylinder head.
8. Partially slacken off the cylinder head nuts symetrically, and do not commence this operation until the head is cool. *Cases of cylinder head distortion are frequently caused by the removal of this item when hot and then placing it on an uneven surface.*
9. Remove the dynamo complete with bracket and place this aside out of the way.
10. Remove cylinder head and extract sparking plugs.
11. Remove tappet blocks and fill in the space left by the removal of these with pieces of

rag to prevent valve cups etc., falling into the engine sump.

12. Remove the valves utilizing a spring compressor as shown in Fig. 20 and Fig. 21. Keep valves in order as removed. The valves should be numbered from the rear.
13. Scrape all carbon from cylinder head and blow out water ways with compressed air.
14. Turn engine round until two cylinders are on T.D.C. and place pieces of rag in the other two cylinders and similarly cover up water ways adjacent to the two cylinders which are on T.D.C.
15. Place an old piston ring in the bore of one of the two cylinders which are on T.D.C., and scrape the carbon off the top of the piston within the ring.
16. Clean the carbon from around the valve seatings and ports, be careful not to damage valve seats and then repeat these operations for the other cylinder in which the piston is on T.D.C.
17. Turn the starting handle through 180° and treat the remaining two cylinders in a similar manner.
18. Carefully remove all traces of carbon with a compressed air jet.
19. Carefully examine the valves and measure wear, which has occured on the items, refer to Page 12 for valve limits. Replace any valves or guides which have worn seriously. Where the valve seats have become pitted, either reface before grinding in, or if too seriously damaged, replace. Where seatings in cylinder block are pitted re-cut as indicated in next column, using a 45° cutter or a 15° cutter, followed by one of 45°, depending on the wear which has occurred. Replace any weak or broken valve springs similarly renewing any worn or pitted adjusting screws.
20. Carefully grind in all valves using a fine carborundum paste (No. 360 is recommended). Wipe clean of all traces of grinding paste and refit.
21. Remove rag from over camshaft and replace tappet block assemblies after cleaning out oil recesses provided in these. Do not forget to fit the longer pair of set screws through the abutment and the inner ends of the tappet blocks.
22. Adjust tappets as described on Page 44.
23. Refit cylinder head employing a new gasket smeared on each side with grease, or jointing compound. Tighten down cylinder head nuts symetrically, and progressively and use the sequence shown in Fig. 12.
24. Clean and re-adjust sparking plugs setting gaps to 0.040". Plugs which have been in service for 10,000 miles are normally due for replacement. Plugs having cracked insulators and unduly worn electrodes should always be replaced.
25. Complete re-assembly of engine ensuring that distributor shaft is properly engaged, at its lower extremity, with oil pump and that felt washer is fitted in the recess in the cylinder head, through which the distributor shaft passes.
26. Cylinder head nuts should be re-tightened after the engine has been run for a short time to warm it up, and then again checked after covering a hundred or so miles.

TO RE-CUT VALVE SEATS

If the seats in the cylinder block are badly worn or pitted, they must be re-cut using a valve seat cutter. The extent to which a valve seat has become embedded in the face of the cylinder block will govern the angle of the cutter used.

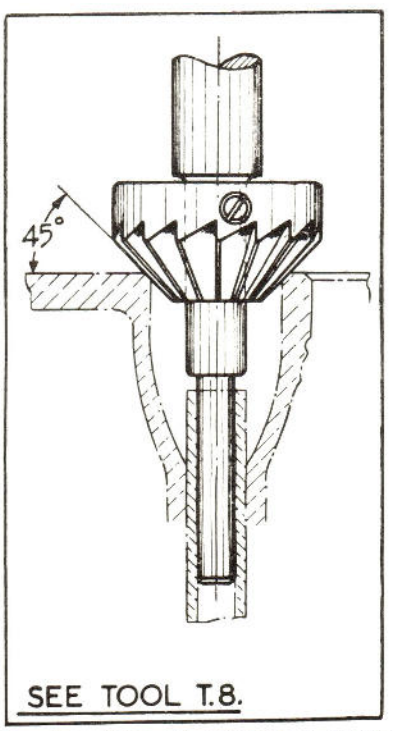


Fig. 22. Use of 45° valve cutter.

If the pitting and wear which has occurred is not abnormal, a 45° cutter as shown in Fig. 22 will do the work satisfactorily.

If the valve has become embedded in the cylinder block as shown in Fig. 23 however, it will be necessary to use a 15° cutter as shown in Fig. 22 afterwards following up with one of 45°.

Where it is found that, in order to remove the step in the cylinder block, the 15° cutter encroaches on the adjacent valve seat, then this cutter must be used on that seat also.

Where new guides or valves are fitted it is advisable to face lightly the seats, before grinding.

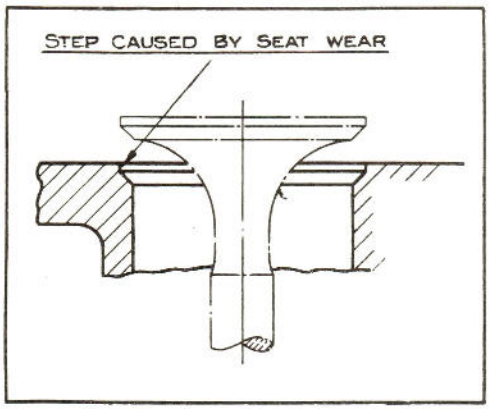


Fig. 23. **Sunken valve seat.**

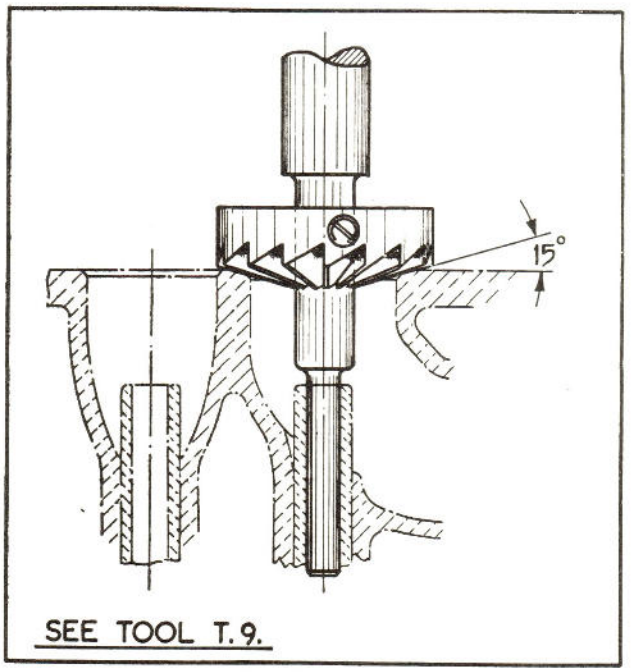


Fig. 24. **15° valve seat cutter.**

POSSIBLE CAUSES OF EXCESSIVE PETROL CONSUMPTION

Excessive petrol consumption may be ascribed to a variety of causes and, all too frequently, a test with a calibrated test tank proves the complaint to be unfounded.

It is recommended, therefore, where complaints of this nature are received, that it is first established with a proper consumption test. Having established the extravagant use of petrol, proceed as follows :—

1. Ensure that initial attention to the decarbonising and grinding in of valves has been carried out and that this attention is not again due for attention.
2. Eliminate all external sources of leakage such as carburettor flooding, caused by a poor needle valve and/or seating or excessive petrol pump pressure "this should not" exceed 2 lbs. per square inch and should be adjusted as described under "Pump Pressure" in "Fuel System" Section. Examine the possibility of a punctured float, or the existence of leaks at pipe unions or from the petrol tank itself.
3. The employment of an inferior grade of petrol will not give economical running.
4. Incorrect tappet adjustment or partially sticking valves due to the condition of the springs or stems will cause this complaint. Check these as directed on Page 44.
5. The possibility of incorrect valve and ignition timing should be checked as set out on Pages 40 and 41.
6. Clutch slip will cause excessive consumption. Adjust this as directed on Page 65
7. Brake "drag" due to incorrectly adjusted or partially seized brakes will cause heavy petrol consumption. These should receive attention as set out on Page 104.
8. The condition of the sparking plugs is important to the efficient running of the engine. These should be tested, the defective ones being replaced and all correctly adjusted to give a gap of 0.025".
9. Check for air leaks to the induction system caused by poor joints or worn valve guides. Such air leakage by tending to cause incomplete combustion will give rise to excessive petrol consumption.
10. Ensure that there has been no interference with the carburettor jet setting, and that this as set out for the model concerned on Page 7.

EXCESSIVE OIL CONSUMPTION

Excessive oil consumption is usually associated with general wear in the engine, always providing, of course, that there is no question of external leakages. The following points are recommended for attention :—

1. Ensure that a suitable grade of oil is being used.
2. Eliminate all sources of external leakages such as—
   (a) Leakage from pressure gauge pipe or external oil filter where fitted.
   (b) Tappet cover leakage due to faulty joint or over-tightening of securing nuts.
   (c) Leakage from sump due to poor joint or a fractured base.
   (d) Timing cover leakage due to poor joint or improper centralization. Centralize if necessary as directed on Page 40, also ensure that oil is not leaking past bottom bolt, due to an absence of a lead washer, which should be fitted.
   (e) Oil leakage past rear oil retainer due to improper centralization. See Page 38, paragraph 3.
3. If there is no question of external source of leakage, the complaint must be ascribed to the condition of the cylinder bore and/or pistons, also there is a possibility that the crankshaft journal and/or bearings are worn excessively.
4. Check bore wear with the limits given on Page 11 and if the limits set out are exceeded, the engine must be rebored and oversized pistons fitted. If the wear is within the limits prescribed the replacement of any worn or damaged pistons and rings should affect an improvement.
5. Crankshaft journals should be measured for wear and this compared with the list of tolerences and limits set out on Page 10. If the wear is within permissible limits, the replacement of worn or damaged bearings is all that is necessary, otherwise regrinding the crankshaft and the fitting of undersized bearings will be imperative to ensure reasonable consumption.

In the case of the 12 H.P. models, rebores in excess of +0.020″ are not recommended owing to the danger of breaking into the lead of the cylinder insert. Wear in excess of that figure should be met by the fitting of full length liners.

The following oversized pistons are available :—

+0.015″ and +0.020″ oversize all models.
+0.030″ 8 H.P., 10 H.P. and 14 H.P. models only.

The following undersized bearings are available.

— 0.020″ — 0.030″ and —0.040″.

LOW OIL PRESSURE

This complaint is not infrequently associated with heavy consumption of oil and when such is the case, nearly always indicates worn bearings and crankshaft journals. Where the drop in pressure has been progressive, over a period of weeks, it almost invariably indicates the fact that the bearings and crankshaft require attention.

Where a sudden drop in pressure is experienced, it may either be caused by a fault in the oil pressure release mechanism, or be the result of a bearing failure which would be accompanied by an audible engine knock.

It is naturally important that the correct level of a suitable oil be maintained at all times.

Where a complaint of low oil pressure is experienced, the following procedure should be adopted :—

1. Adjust oil pressure release after ensuring the condition of the ball or plunger spring and seating (30—40 lbs. per square inch at a speed of 30—40 m.p.h. in top gear is satisfactory).
2. Ensure that the oil filter is not " clogged." With the external type of oil filter, this should be cleaned each 2,000 miles and a new element fitted after 10,000 miles. With the submerged type of filter fitted on the 8 H.P. and 10 H.P. models, this should be cleaned each 10,000 miles.
3. Ensure that there is no question of a defective oil gauge or of loose connections or fractured pipe.

4. Oil pressure can be lost with the 12 H.P. models owing to leakage between the filter bracket and the cylinder block.

5. In very old engines, there is a possibility of the distributor shaft bush having become worn and causing loss of pressure.

6. The more likely explanation for this complaint, having regard to our earlier remarks, is the condition of the bearings and the crankshaft journals. In this connection, the crankshaft journals should be carefully examined and measured for wear, similarly the bearings should be inspected. If crankshaft wear exceeds that given as permissible in the List of Tolerances and Dimensions on Pages 10 and 15 the crankshaft will require regrinding and it will be necessary to fit undersized bearings. If the wear falls within allowable limits it will be merely necessary to replace excessively worn bearings or any which have been damaged in any way.

7. Where a complete engine seizure has been experienced or the engine has covered a large mileage, it is possible for the condition of the camshaft journals and/or bearings to cause low oil pressure. This remote possibility may be dealt with as directed on Page 41.

DIFFICULT STARTING

There are a number of factors which may contribute to this difficulty which is most frequently encountered with old vehicles, where the engines and electrical systems are in a generally dilapidated condition. In view of the variety of causes, which may contribute to this difficulty, it is thought wise to summarize as follows :—

1. The condition of the battery may be poor. If any doubt exists as to its condition, reference should be made to that portion of the Electrical Section dealing with " Batteries." (See Page 148.)

2. It is frequently found that the Self-Starter motor is badly neglected, if doubt exists as to its condition please refer to Electrical Section, Page 150, which deals with Starters.

3. Ignition and valve timing should be ensured. For method of setting refer to Pages 40—41.

4. If oil of an unsuitable grade is used, this may render the engine difficult to turn over until the engine is thoroughly warmed up.

5. If the sparking plugs are in a poor condition or if the insulators are coated with moisture or dust permitting external electrical leakage starting will be made difficult. Plugs should be tested and a correct setting of the points to 0.025″ ensured.

   Defective plugs should be replaced by new ones. For further information with regard to " Sparking Plugs " please refer to Page 156 under Electrical Section.

6. It is important that the condition of the high tension leads should be ensured as the insulation of these may have perished or been damaged, thus permitting " shorting " on some metallic portion of the engine.

7. Distributor cover should be free from moisture and cracks, which will permit leakage of current. " Tracking " of the distributor may permit leakage between the various segments or to other parts of the distributor in contact with the cap. " Tracking " may be recognized by the appearance of thin black lines on the face of the distributor or wherever it occurs. For more complete details, refer to Electrical Section, Page 158.

8. Ensure that the carbon brush moves freely in its holder and makes square contact with the metallic portion of the rotor.

9. Having ensured the " High Tension Circuit " proceed to check the " Low Tension Circuit " as directed below.

10. Remove distributor cover and check that the contact points are opening and closing properly and that when fully open a clearance of 0.010″ to 0.012″ is permitted. If the points are pitted or contaminated with oil or dirt, they should be cleaned and polished with carborundum stone and it ensures that when closed they fit flush together. Adjustments to the gap between these points may be made as directed on Page 155 of Electrical Section.

11. Turn engine round with switch on and note if there is a regular rise and fall in the ammeter readings with the closing and opening of the contact points. If the reading fluctuates in this way, then the

low tension circuit is in satisfactory condition. If, on the other hand, the reading remains steady, the Low Tension circuit should be traced from the battery to the distributor as directed on Page 158 of Electrical Section, employing a voltmeter 0-20 volts.

12. Having established the condition of the electrical equipment, which is by far the most likely explanation of the difficulty, proceed to investigate the other factors as directed below.
13. Ensure that petrol pump is delivering petrol to carburettor.
14. Incorrect tappet clearances should be adjusted to 0.015″ and it should be ensured that there is no question of any valves sticking due to the condition of the stems or springs.
15. Compressions should be checked and valves ground in if the necessity arises. Where seatings are in poor condition, they should be re-cut as described on Page 46.
16. Worn valve guides and/or valve stems will, by permitting extra air to enter the induction system, upset carburation. Poor manifold and carburettor joints should also receive attention for the same reason.
17. Ensure that the correct jet setting is being employed in the carburettor as set out under Vehicle Data on Page 7. Ensure that no jets are restricted by presence of foreign material.
18. The employment of a good grade of petrol is important.

DRUMMING NOISES FROM 4/8A ENGINE

With early engines of the 4/8A Model a clutch inspection cover was employed, which was secured by spring ears on its underside. At certain engine speeds, a vibration of this cover was permitted, which caused a particularly elusive " drumming " noise and appeared to emanate from the engine.

As a result of this complaint it was found necessary to modify the cover and the method of securing it.

The modified cover, which is felt lined, is secured by two $\frac{1}{4}$″ B.S.F. set screws with plain and spring washers. These set screws are accommodated by tapped holes in the two pads at either side of the aperture. The holes are $2\frac{5}{16}$″ from the vertical centre line of the pads themselves.

The parts required to carry out this modification, which may be obtained from our Service Department, are as follows :—

1	Clutch Cover	Detail	55223
2	$\frac{1}{4}$″ B.S.F. Set Screws	,,	SP.83D2
2	Spring Washers	,,	SP.48D
2	Plain Washers	,,	SP.44C

REBORING AND SLEEVING

Reboring.

Oversize pistons are available for all our models and are standardized in the following sizes :—

Plus 0.020″, plus 0.030″ and plus 0.040″.

With the 1939-1945 12 H.P. models employing front wheel suspension, where the engines are equipped with stainless iron cylinder inserts, reboring should not be carried out beyond plus 0.020″ owing to the danger of breaking into the insert " leads."

Reboring in excess of this dimension should be met by recourse to full length cylinder liners, these being inserted as instructed below.

Sleeving.

Where the cylinder block's wear is beyond the allowable limits for reboring as specified above, it becomes necessary to fit full length liners. The procedure for this operation is indicated below.

For the purpose of these instructions we are considering the BRICO Cylinder Liners which we employ in our works here. The address of the manufacturers is The British Piston Ring Co. Ltd., Holbrooks Lane, Foleshill, Coventry.

Procedure.

1. Bore out cylinder block to dimension " B " as given on chart on page 52. An ordinary portable cylinder boring bar may be employed for this operation. The interferences provided by the limits, as given in the chart, are those recommended by the manufacturers. In actual practice we find that it is wise to select your liners and bore limits, so as to use the smallest interference provided by the dimensions

given in the chart. If this choice of limits is not exercised, it may be found somewhat difficult to press the liners in the cylinder block with hand presses which may in many instances have to be employed for the purpose.

2. Clean out cylinder bores carefully after boring operations and remove all traces of swarf.

3. Carefully clean liners and immerse in clean paraffin before pressing into bores to assist insertion.

4. Place complete set of liners in position on the machined faces of cylinder block entering the chamfered extremities into the top of the respective bores.

5. Line up carefully with a straight edge ensuring that the slots provided in the liners are immediately above their respective cut away portions at the lower extremities of each bore. This lining up is of considerable importance in order to provide clearances on the connecting rods when the sleeves are pressed into position.

6. Employ Hydraulic Press if available—a hand press will suffice if careful selection of liners and bore limits is carried out as suggested in paragraph (1)—to press liners into their respective bores, sufficiently to allow the upper extremities of these to be flush with the machined face of the cylinder block. The face of the cylinder block should be subsequently given a few light strokes with a smooth file to remove any excrescencies.

7. Drill and tap liners for tappet block securing screws. Do not forget to fit the longer pair of set screws through the distributor driving gear abutment and inner end of each tappet block.

8. Rebore the liner to fit the piston, standard size for the model concerned—this information being given in column 1 of the chart.

We are in the position to supply these liners through our Spares Department.

A list of Messrs. Bricovmo's overseas agents is attached, from whom technical advice and liners may be obtained.

FITTING OF VALVE INSERTS

After considerable mileage, valve seats of an engine become so embedded in the cylinder block that further re-seating with a cutter proves unsatisfactory. Where this condition arises, new valve seats should be fitted as directed below.

For the purpose of these instructions we are applying our remarks to a manually operated machine which we use in our Repair Shop. This machine is manufactured by Sheep Bridge Stokes and Centrifugal Castings Co. Ltd., Sheep Bridge Works, Chesterfield.

There are naturally other manufacturers producing the same equipment and issuing their own operating instructions, as do Messrs. Sheep Bridge Stokes and Centrifugal Castings Co. Ltd., but of these we have had no experience.

We use inserts manufactured by the British Piston Ring Co. Ltd., Holbrooks Lane, Foleshill, Coventry. Where it is found necessary to fit these inserts owing to the condition of the cylinder block, the following procedure should be adopted.

1. Before commencing boring out operations fit new valve guides to ensure concentric boring of the valve seat recesses.

2. Set cutter to diameter of recess as indicated by figures in the 7th column of the chart given. As will be seen by comparison of these dimensions with those given in the 5th column a considerable interference fit is provided.

3. Ensure that the recess is free from swarf then tap the insert into position with a suitable drift (See Tool List). One sharp tap with a suitable drift should be sufficient to " start " the insert. Afterwards proceed with light taps with the drift until the insert registers with the bottom of the recess.

4. The insert should then be cut for the valve seat, employing a 45° cutter as directed on Page 46.

We are in the position to supply these inserts through our Spares Department.

A list of Messrs. Bricovmo's overseas agents is attached, from whom technical advice and liners may be obtained.

BRIVADIUM CYLINDER LINERS FOR REPLACEMENT PURPOSES

Model	Cyl. Block Det.No.	Nominal Sizes			As supplied by B.P.R. Co.			Conn. Rod Slots		Bore out Block B	Year	No. of slots	No. of Cyls.	Liner Det. No.	Iss. No.
		A	D	C	Turned A	Ground D	C	F	E						
4/8A	54340	56·7 m/m	2⅜″	6 5/16″	2·222″ 2·218″	2·378″ 2·377″	6·312″ 6·297″	1″ × 13/16 ×	1 7/16″ 11/16″	2·375″ 2·374″	1945	2	4	54544	2
12 C.D.	48514	69·5 m/m	2⅞″	6⅞″	2·727″ 2·723″	2·878″ 2·877″	6·875″ 6·860″	1″ ×	1¼″	2·875″ 2·874″	1945	1	4	48771	4
12/14 C.D.	54334	2⅞″	3 1/32″	6⅞″	2·863″ 2·861″	3·0345″ 3·0335″	6·875″ 6·860″	1″ ×	1 1/16″	3·031″ 3·030″	1945	1	4	48772	4
8A	48267	57 m/m	2⅜″	6 5/16″	2·234″ 2·230″	2·378″ 2·377″	6·312″ 6·297″	1″ × 1/16″	1 7/16″ 11/16″	2·375″ 2·374″	1939	2	4	48766	5
9A	44324	60 m/m	2½″	6 5/16″	2·352″ 2·348″	2·503″ 2·502″	6·312″ 6·297″	⅞″ ×	1⅜″ 7/16″	2·500″ 2·499″	1937	2	4	48767	5
9B	45994	60 m/m	2½″	6 5/16″	2·352″ 2·348″	2·503″ 2·502″	6·312″ 6·297″	⅞″ ×	1⅜″ 7/16″	2·500″ 2·499″	1938	2	4	48767	4
10AL	44325	2½″	2 31/32″	6 5/16″	2·490″ 2·486″	2·659″ 2·658″	6·312″ 6·297″	⅞″ ×	1⅜″ 7/16″	2·656″ 2·655″	1937	2	4	48768	4
10C & 10BL	45995	2½″	2 31/32″	6 5/16″	2·490″ 2·486″	2·659″ 2·658″	6·312″ 6·297″	⅞″ ×	1⅜″ 7/16″	2·656″ 2·655″	1938	2	4	48768	4
12B and 12BL	46345	69·5 m/m	2⅞″	6⅞″	2·727″ 2·723″	2·878″ 2·877″	6·875″ 6·860″	1″	1¼″	2·875″ 2·874″	1938	1	4	48771	4
14B	46228	2⅞″	3 1/32″	6⅞″	2·865″ 2·861″	3·0345″ 3·0335″	6·875″ 6·860″	1″	1 1/16″	3·031″ 3·030″	1938	1	4	48772	4
A10	42349	2½″	2 31/32″	6 11/16″	2·490″ 2·486″	2·659″ 2·658″	6·687″ 6·672″	1″	1 9/16″	2·656″ 2·655″	1936	1	4	49882	3
A9 R9	42375 36307	2⅜″	2 17/32″	5 31/32″	2·361″ 2·365″	2·534″ 2·533″	5·9687″ 5·9537″	¾″	1 3/16″	2·531″ 2·530″	1936	1	4	49995	3
10A	44457	2½″	2 31/32″	6⅞″	2·490″ 2·486″	2·659″ 2·658″	6·875″ 6·860″	1″ ×	⅝″ 1 9/16″	2·656″ 2·655″	1937	2	4	50780	3
A12 and A12S	42350	69·5 m/m	2⅞″	6 11/16″	2·727″ 2·723″	2·878″ 2·877″	6·687″ 6·672″	1″ ×	1″	2·875″ 2·874″	1936	1	4	50928	3
20A	45374	2⅞″	3 1/32″	6⅞″	2·865″ 2·861″	3·0345″ 3·0335″	6·875″ 6·860″	1″ ×	⅞″	3·031″ 3·030″	1937	2	6	51035	2
16A	45373	65·5″	2·7165	6⅞″	2·568″ 2·564″	2·719″ 2·718″	6·875″ 6·860″	1″ ×	1 5/16″	2·716″ 2·715″	1937	2	6	51032	2

BRICROMIUM VALVE SEAT INSERTS FOR REPLACEMENT PURPOSES

Model	Cyl. Block Det. No.	Type	V.S. INSERT AS SUPPLIED BY B.P.R.			BORE OUT BLOCK		Brico Insert No.	Insert Det. No.
			Bore "A"	O/Dia "B"	Width "C"	Dia. "D"	Depth "E"		
12 H.P.	46345	12 & 12BL	1·284″	1·5685″	·222″	1·5625″	·222″		48848
14 H.P.	46228	14B	1·278″	1·5675″	·219″	1·5615″	·219″		
9 H.P.	45994	9B							
10 H.P.	45995	10 BL	1·003″	1·1935″	·253″	1.1875″	·253″		
9 H.P.	44324	9A						VS ·226	48849
10 H.P.	44325	10AL	·997	1·1925″	·250″	1·1865″	·250″		
8 H.P.	48267	8A							
12 H.P.	46345	12B &12BL	1·128″	1·381″	·222″	1·375″	·222″	VS ·524	48850
14 H.P.	46228	14B	1·122″	1·380″	·219″	1·374″	·219″		
9 H.P.	45994	9B							
10 H.P.	45995	10BL	·878	1·0685″	·253″	1·0625″	·253″		
9 H.P.	44324	9A						VS ·224″	48851
10 H.P.	44325	10AL	·872″	1·0675″	·250″	1·0615″	·250″		
8 H.P.	48267	8A							

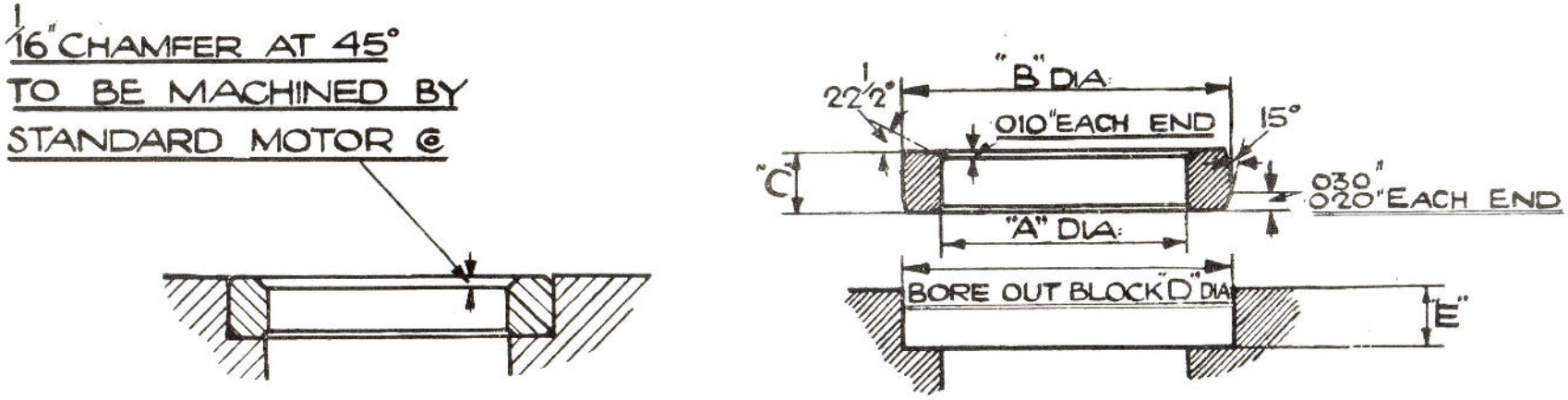


Fig. 25. Fitting valve inserts.

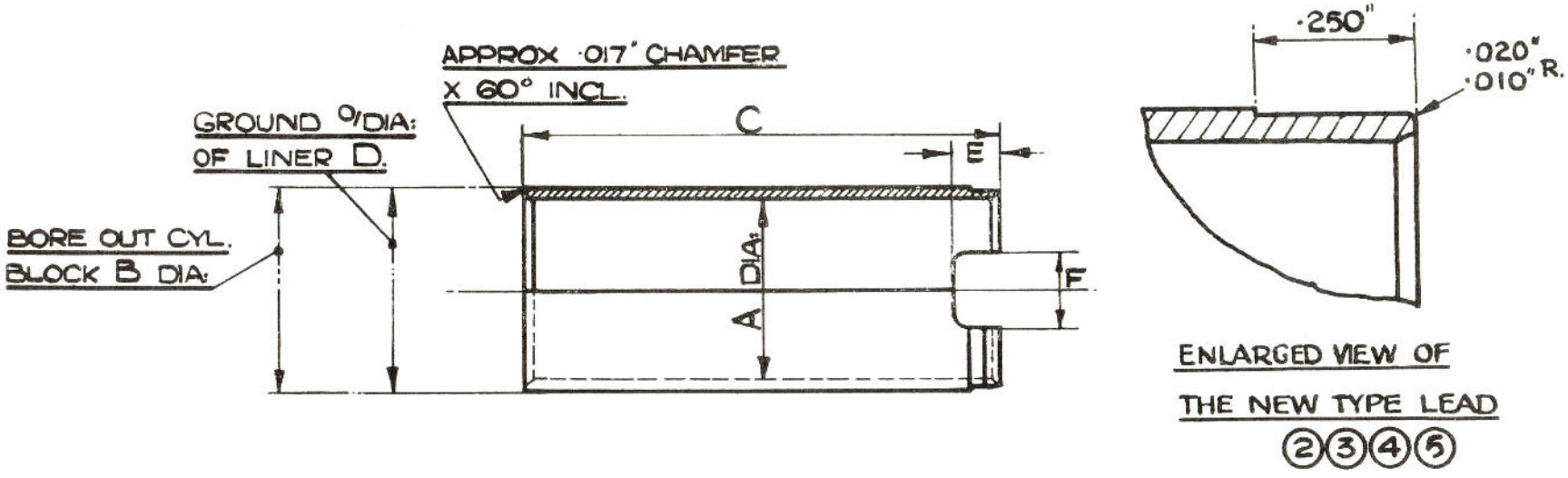


Fig. 26. Fitting cylinder liners.

ENGINE KNOCK

The most common explanation of " engine knock " with a new vehicle is that caused by " piston slap," which is frequently explained by slight seizure of the affected piston owing to, in most cases, lack of consideration on the part of the car's owner, during " the running-in period." To trace the offending piston, the plugs should be " shorted " with a screw-driver and the plug which cuts out the knock is fitted to the cylinder, with the damaged piston. This piston should be replaced by a new one.

The adjustment of tappets is of importance as is the elimination of sticking valves caused by the condition of the valve stems.

Where the vehicle has been in service for some time, the difficulty is probably caused by the necessity for a general engine overhaul and the following points are indicated for attention :—

1. **Worn Pistons and Bores.** Bore wear should be measured with a Bore Gauge as shown in Fig. 27. Wear will be at a maximum at the top of the bores and should therefore be measured there.
Permissible dimensions for wear are given on Pages 10—21. If the wear is not excessive, an improvement will be effected by replacing damaged or worn pistons and checking rings gap and side clearances in grooves. It is inadvisable to remove the carbon from the bottom of the grooves or leads unless new rings are to be fitted as such a procedure will tend to promote excessive oil consumption. Piston ring gap may be checked by positioning rings in cylinder bores about 2" from the top, locating the rings square by use of an inverted piston.

   Gudgeon pins should be checked for wear and this compared to the limits given on Pages 10—21. The condition of the small end bush and the fit of this part in the connecting rods should be ensured. If the bush is rotating in the connecting rod the latter should be reamed as directed on Page 10 and an oversize bush fitted. Where the gudgeon pin itself has worn, it should be replaced by an oversize pin and the existing bush bored out to suit the oversize gudgeon pin which is fitted. Reaming of these bushes which are of the rolled type is not very satisfactory and when new bushes are required they should be bored after fitting if a satisfactory job is required.

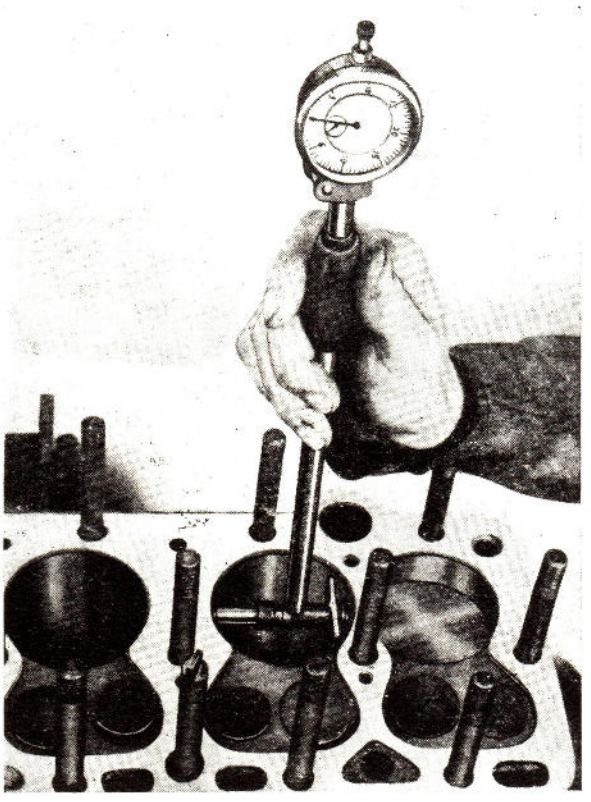


Fig. 27. **Use of bore gauge.**

2. **Worn crankshaft journals or excessive end float in Crankshaft.**
Crankshaft journals should be measured for wear and if in excess of the dimensions given on Page 15 regrinding and the fitting of undersized bearings will become necessary. If wear is not excessive the replacement of worn or damaged bearing should effect an improvement.

3. **Worn water pump bearings** will give rise to a knock, but such wear is usually associated with leakage of water, which becomes serious before the bearings are sufficiently worn to cause an audible knock. For repairs, see Page 43.

4. **Failure to centralize timing chain cover** in relation to fan pulley boss and thus allowing metallic contact between these two, will cause an elusive noise in engine. If such centralization requires attention refer to Page 40 paragraph 12 for necessary procedure.

BURNING OF EXHAUST VALVES

This difficulty is one which was particularly prevalent during that portion of the war when "Pool Spirit" of a fairly high octane number was used. It appeared to affect almost all engines and a number of special modifications were introduced by manufacturers to deal with this difficulty. Since the change over to lower octane fuel the difficulty has been reduced to a normal level again.

Where complaints of burnt valves are experienced, they are usually caused by one of the following points which should receive attention :—

1. Partially seized valves or sticking valves caused by the condition of the stems or valve springs.
2. Incorrect tappet clearances, these should be set to 0.015" as directed on Page 44.
3. Too late an ignition timing. Check and if necessary re-set as directed on Page 40 to T.D.C.
4. Too weak a mixture being used, thus promoting slow burning and incomplete combustion when the exhaust valves open. Sources of extra air ingress, such as worn valve guides and/or valve stems should receive attention as should the possibility of poor joints in the induction system. A check of the carburettor setting should be made against that given for the vehicle concerned on Page 7.
5. Ensure that a suitable grade of petrol is being used.

CLUTCH

INDEX

ILLUSTRATIONS

CLUTCH

GENERAL DESCRIPTION

The clutch is of the single driven plate type consisting of a **Driven Plate Assembly,** a **Cover Assembly,** and a **Graphite Release Bearing Assembly.**

With the 12 H.P. models, an 8″ driven plate is used, whilst the 10 H.P. model employs a $7\frac{1}{4}$″ plate and the 8 H.P. models are equipped with a $6\frac{1}{4}$″ driven member.

The clutches used with the 10 and 12 H.P. models, apart from dimensions, are similar in all essential details, but the smaller unit used with the 8 H.P. models differs slightly from these.

BORG & BECK TYPES $7\frac{1}{4}$″ A3-G and 8″ A6-G

(Fig. 28)

Description.

The **Driven Plate Assembly** consists of a splined hub, damper springs and retainer plate which are secured by means of stop pins and lock plates to a thin steel disc to which friction linings are riveted.

The Cover Assembly consists of a cover (4) pressure plate (18) thrust springs (5) release levers (12) anti-rattle springs (13) eye bolts (15) release lever floating pins (16) struts (17).

The Withdrawal Bearing Assembly. A graphite type of bearing is used, mounted in a metal cup (8) which is located in the operating fork and a release plate (10) is attached to the inner ends of release levers (12) by means of retainer springs (11).

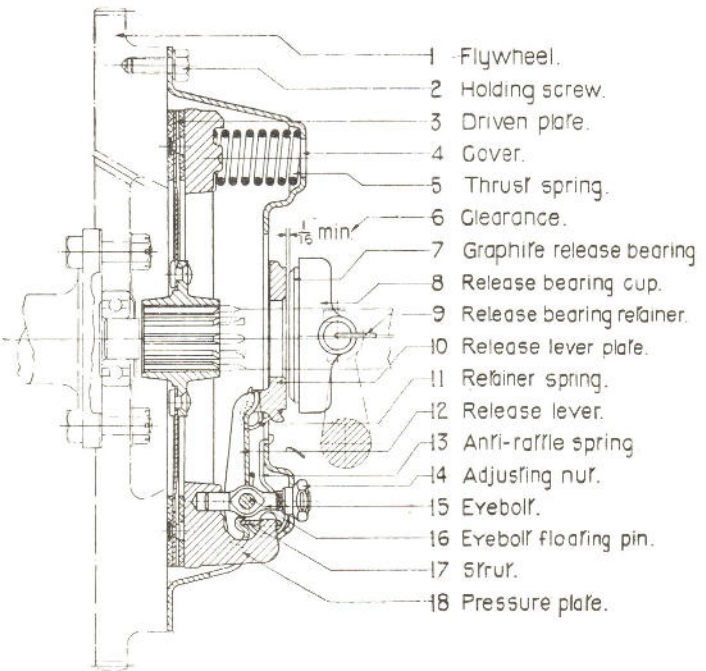


Fig. 28.

Running Adjustments.

The only adjustment necessary throughout the life of the driven plate facings, is to restore periodically the free movement of the clutch pedal. As the driven plate facings wear, the free movement of the pedal will gradually decrease. When it is reduced to $\frac{1}{4}$″ (measured at the pedal pad), adjustment must be made to restore the correct amount of free movement, which should be $\frac{5}{8}$″. To restore this clearance, adjust the nuts at the clutch end of the operating rod until the correct free movement exists at the pedal pad. *Do not disturb the adjustment of the upper rod which refers to the pedal adjustment and is correctly set for all time at the works.*

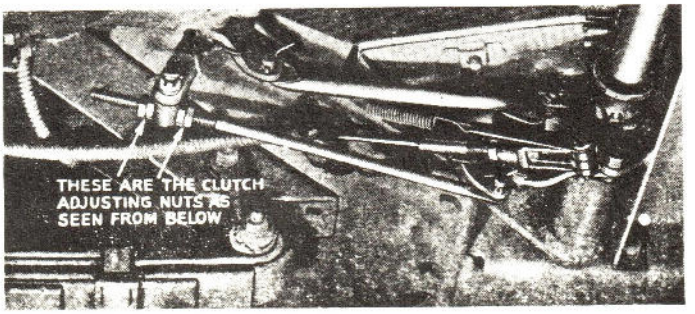


Fig. 29. **Clutch adjustment.**

TO REMOVE CLUTCH

(All Models)

See Fig. 30

1. Remove gearbox and clutch housing as instructed on Page 75. Do not allow gearbox to hang on constant pinion shaft during this operation.

2. Insert L shaped spacers (13) between release levers (6) and cover (3) and holding these spacers carefully in position, slacken holding screws (2) a turn at a time by diagonal selection until the spacers are gripped firmly between the levers and cover (this relieves the spring pressure on the holding screws).

3. Withdraw holding screws and lift clutch complete from flywheel after inserting spare constant pinion shaft or an adjustable mandrel into splined hub of driven plate to prevent this plate falling when clutch is removed.

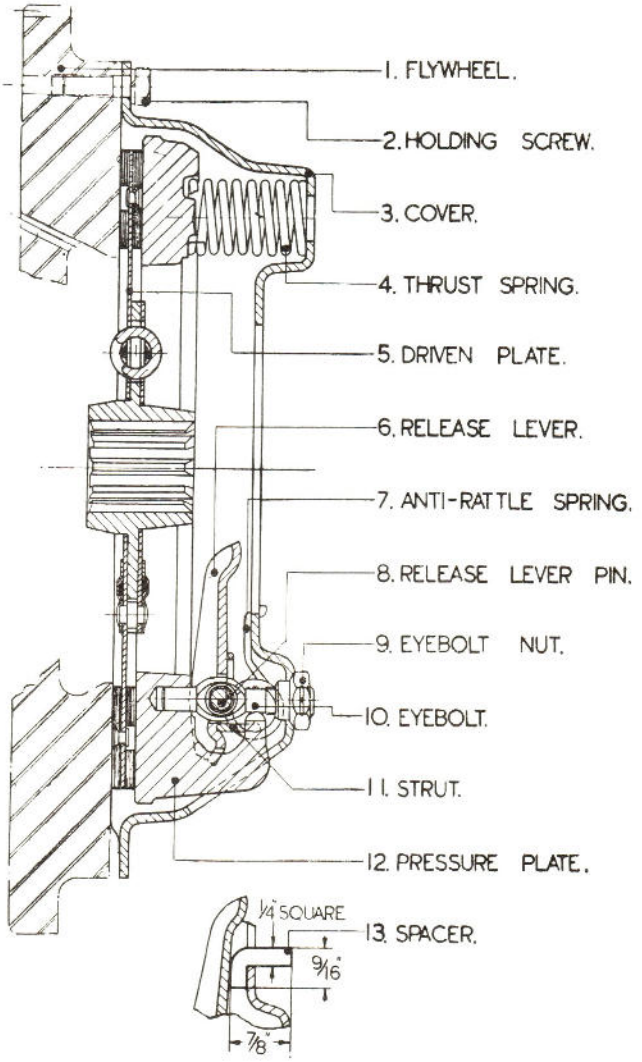


Fig. 30.

Sectional view of clutch.

TO DISMANTLE CLUTCH

(7¼" AG and 8" AG)

See Fig. 28

1. Suitably mark cover (4) pressure plate lugs (18) and release levers (12) in such a manner that they can be re-assembled in the same relative position to each other in order to preserve balance and adjustment.

2. Detach release lever plate (10) and place cover assembly under a press with pressure plate (18) resting on wood blocks so arranged that cover (4) is free to move down.

3. Place block of wood across top of cover, resting on the spring bosses (see Fig. 31).

4. Compress the cover with the spindle of the press, and, holding it under compression, remove split pins and eyebolt nuts (14) also the L shaped spacers previously inserted to hold spring pressure.

5. Release pressure gradually to prevent thrust springs (5) flying out.

6. Lift cover off which will expose all parts for inspection.

7. Remove release levers (12) by grasping the levers and eyebolt (15) between finger and thumb as shown in Fig. 31 so that the inner end of lever and threaded end of eyebolt are as near together as possible, keeping the eyebolt pin in position in lever.

8. The strut (17) Fig. 31 can be lifted over the ridge on the end of the lever making it possible to lift eyebolt (15) off pressure plate.

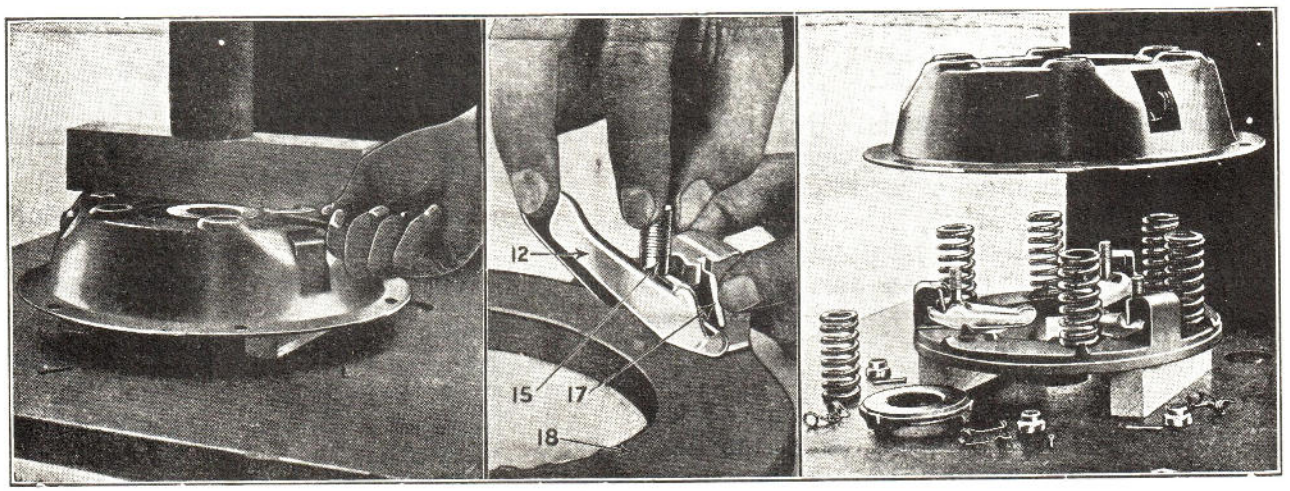


Fig. 31. **Showing assembly of $7\frac{1}{4}$" and 8" clutch.**

TO ASSEMBLE CLUTCH

(Types $7\frac{1}{4}$" AG and 8" AG)

See Fig. 28

1. Thoroughly clean all parts and replace any which show appreciable wear.

2. Place pressure plate (18) on blocks under press (as described under Dismantling) and place thrust springs (5) on it in a vertical position, seating them on the bosses on the pressure plate.

3. Assemble release levers, eyebolts and eyebolt pins holding the threaded end of eyebolt and inner end of lever as close together as possible. With other hand insert strut (17) in the slots of the pressure plate lug sufficiently to allow the plain end of eyebolt to be inserted in hole in pressure plate. Move strut (17) upwards into slots in pressure plate lugs and over the ridge on the end of the levers, and drop into the grooves formed in the levers.

4. Lay cover (4) over assembled parts, taking care that the anti-rattle springs (13) are in position shown in Fig. 31 and that the tops of the springs are directly under the seats in the cover. Also make sure, if using the original parts, that eyebolt nuts, eyebolt, pressure plate lugs and cover are assembled in their correct relative positions as marked when dismantling to ensure correct balance being maintained.

5. Place bar or wood block across cover and compress with press spindle taking great care to guide eyebolts and pressure plate lugs through correct holes in cover. Make sure also that thrust springs remain correctly in their seats.

6. Fit eyebolt nuts on eyebolts and secure with split pins.

7. Holding cover under compression place L shaped spacers between release levers and cover holding them carefully in position whilst pressure is carefully released until these spacers are gripped between levers and cover to hold spring pressure.

8. Fit release lever plate (10) on tips of levers (12) by means of retainer springs.

NOTE. The foregoing instructions apply where no new parts have been fitted which would upset the adjustment of the release levers. Where adjustment of these levers is required, the Borg & Beck gauge plate should be used as described under " To adjust Release Levers " below.

TO ADJUST RELEASE LEVERS

(All Models)

See Fig. 32

Satisfactory operation of the clutch is dependent on the accurate adjustment of the release levers. This must be carried out before clutch has been assembled to flywheel and should only be necessary where certain new parts have been fitted to the cover assembly. The maximum allowable difference in the height of release levers is 0.005". To obtain this accuracy most easily, use special Gauge Plate shown in Fig. 32 in conjunction with flywheel. (These gauges are obtainable direct from Messrs. Borg and Beck, Leamington Spa, specifying the diameter of the driven plate for which it is required.) The flywheel may be mounted on the engine or lying on the bench, whichever is the more convenient and proceeding as follows :—

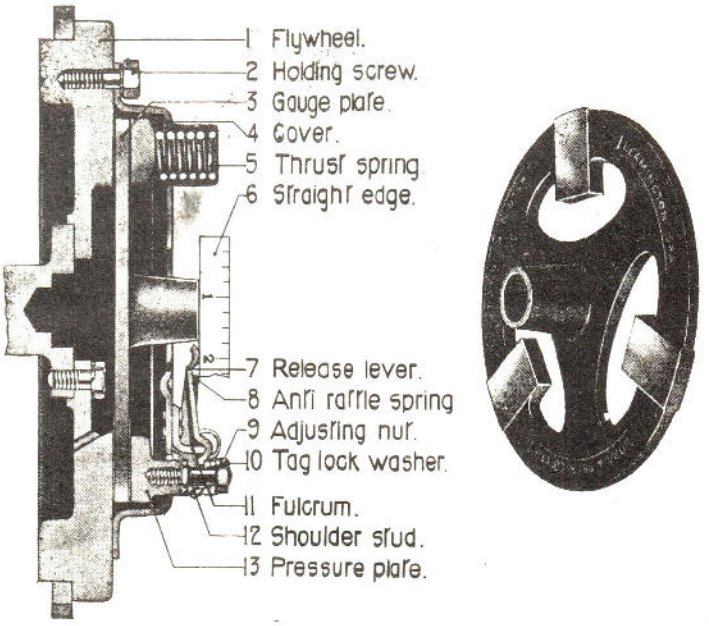


Fig. 32.

1. Place gauge plate centrally in flywheel as shown in Fig. 32 in place of driven plate.
2. Fit cover assembly to flywheel by the holding screws tightening them one or two turns at a time by diagonal selection until " L " spacers can be removed. Then fully tighten holding screws.
3. Place a straight edge across gauge plate boss and tip of one release lever as shown in Fig. 32.
4. Adjust release lever if necessary by turning eyebolt nut (adjusting nut with 8 H.P. models) until tip of lever is exactly level with top of gauge boss.
5. Adjust other levers in same manner. If carefully carried out setting should be within .005".
6. Insert a bar into the gauge plate boss to prevent it falling. Insert L shaped spacers between release levers and cover and slacken holding screws a turn or two at a time by diagonal selection, until spacers are gripped firmly to relieve spring pressure. Then remove holding screws fully and lift clutch complete from flywheel.
7. Remove gauge plate.
8. $\frac{1}{16}$" dia. holes should be drilled through each eyebolt nut (with 8 H.P. model stud nuts should be secured by bending tags up to engage with these) and eyebolt and a corresponding sized split pin inserted. Take great care not to disturb the position of nuts which would upset the adjustment.

TO REFIT CLUTCH

(All Models)

1. Place driven plate assembly in flywheel with chamfered end of hub facing away from flywheel.
2. Centralize driven plate by means of a dummy shaft or adjustable mandrel which fits the splined bore of the plate hub and the pilot bearing in the flywheel.
3. Fit cover assembly to flywheel by holding screws, tightening them one or two turns at a time by diagonal selection.
   Do not remove shaft or mandrel until all holding screws are securely tightened.
4. Remove " L " shaped spacers directly they become free, as the holding screws become tight.

5. Remove dummy shaft or mandrel.
6. Refit gearbox and clutch housing to engine in the opposite order to that given for its removal on Page 75. WHEN CARRYING OUT THIS INSTALLATION, THE GEARBOX WEIGHT MUST NOT BE ALLOWED TO HANG ON THE CONSTANT PINION SHAFT.

BORG & BECK — 6¼" AG

See Fig. 33

DESCRIPTION

The clutch, as with the types fitted to the 10 H.P. and 12 H.P. models, is of the single driven plate assembly. It consists of a driven plate assembly, cover assembly and a graphite release bearing assembly as with the other models.

The **Driven Plate Assembly.** As with the larger type of clutch a splined hub is provided and this transmits the drive through damper spring (4 are now used with 4/8A instead of 3 previously specified on the 8A models) to a thin steel disc to which are riveted the friction faces.

The **Cover Assembly.** This comprises, as with the other models, a pressed steel cover (4), a cast iron pressure plate but the six thrust springs are enclosed in pressed steel cups which protrude from the cover plate face. The pressed steel release levers rest on knife edge fulcrums and are held in position by bridge pieces located on stud extensions screwed into the pressure plate lugs (see Fig. 33). A release lever plate is attached to the ends of the levers by retainer springs as with the larger models.

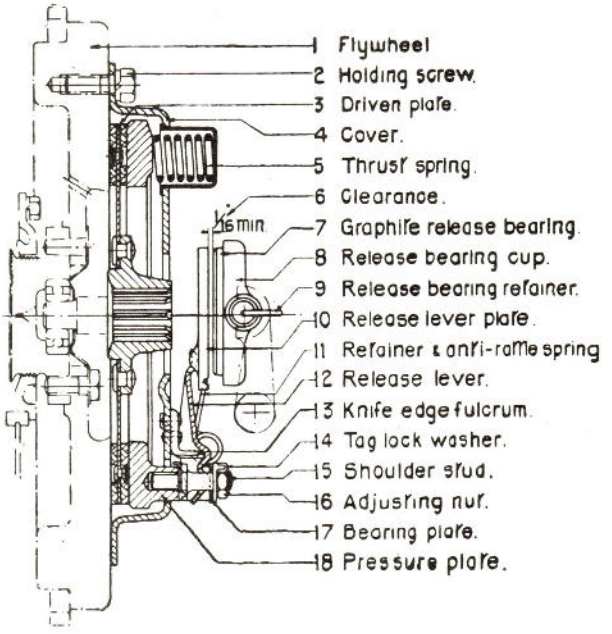


Fig. 33.

The **Withdrawal Bearing Assembly** consists of a graphite ring enclosed as with the other models in a metal cup which is attached to the operating fork by retainer wires.

RUNNING ADJUSTMENTS

Type 6¼" AG

The same provision for adjustment of this clutch is made to compensate for wear on the friction faces as with the other models (see Fig. 34).

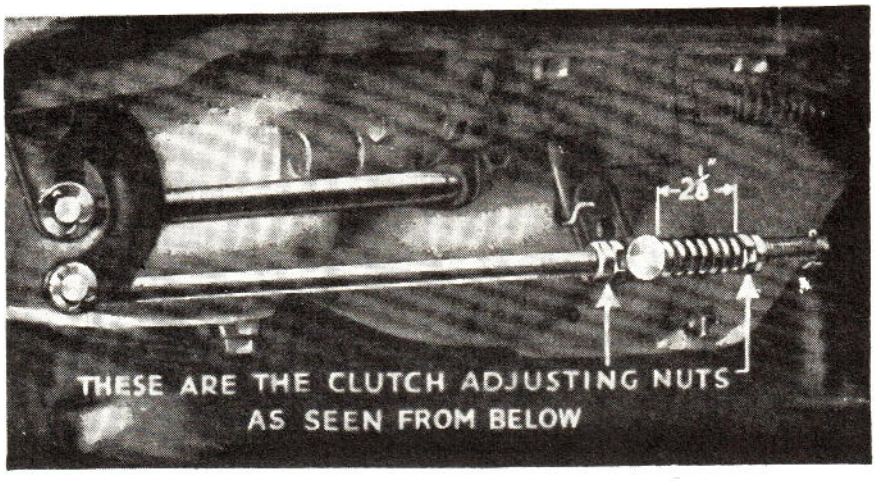


Fig. 34. **Clutch adjustment.**

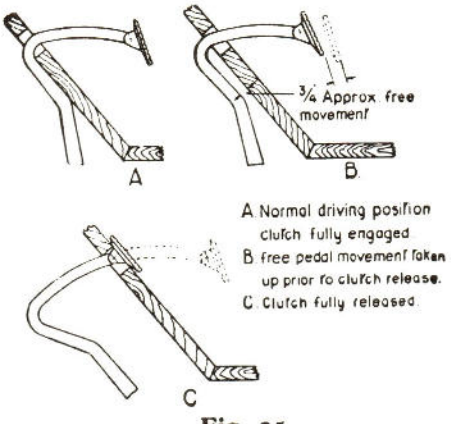


Fig. 35.

TO REMOVE CLUTCH

See Page 75

TO DISMANTLE CLUTCH

See Figs. 33, 36 and 37

1. Suitably mark the following parts, Cover (4), Pressure plate lugs (18), Release levers (12) in such a manner that they can be re-assembled in the same relative positions to each other in order to preserve balance and adjustment.
2. Detach release lever plate (10) from retaining springs (11) straighten bent arms of tag washers (14) and place cover assembly under a press with pressure plate (18) resting on wood blocks so arranged that cover (4) is free to move down.
3. Place three blocks of wood to form a bridge, the legs of which should rest on the outer rim of cover (4) as shown in Fig. 36.
4. Compress the cover with the spindle of the press on the centre of the wood bridge and holding it under compression remove adjusting nuts (16).
5. Release pressure slowly to prevent springs flying out.
6. Lift cover off exposing all remaining parts for inspection, Fig. 37.

TO ADJUST RELEASE LEVERS

See Page 61 where this attention is required owing to replacement of any parts likely to affect the setting of these levers.

CLUTCH

TO ASSEMBLE

Borg & Beck Type $6\frac{1}{4}''$ AG

See Figs. 33, 36 and 37

1. Thoroughly clean all parts and replace any which show appreciable wear.
2. Place pressure plate (18) Fig 36 on blocks under press as described under Dismantling, and place thrust springs (5) on it in a vertical position seating them on the bosses on the pressure plate. Place spring caps over their outer ends as shown in Fig. 37.
3. Mount the release levers (12) on cover and knife edge fulcrums (13) by slipping the inner ends of release levers under the

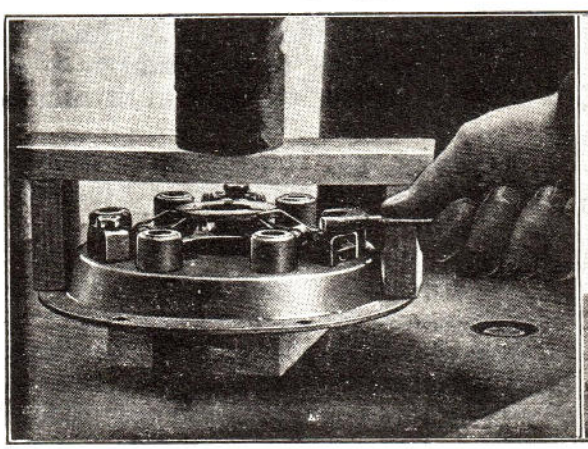


Fig. 36.

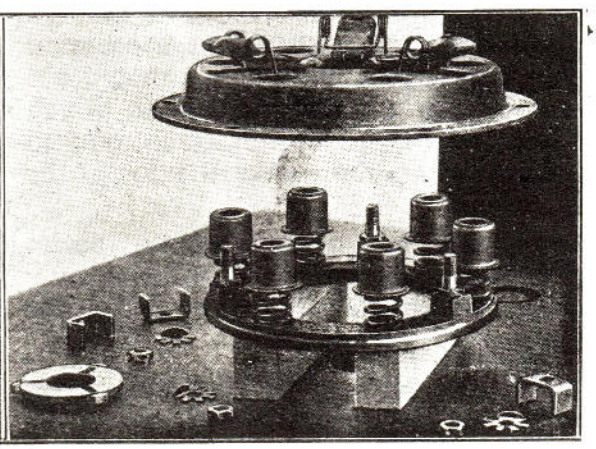


Fig. 37.

retainer springs (11) taking care that the release levers are properly seated and in the same positions as when dismantled. (A little graphite and oil should be applied to the short ends of the levers and to the knife edge fulcrums.)

4. Place the cover (4) over assembled parts as shown in Fig. 37 taking care that the machined portions of the pressure plate lugs are directly under the slots in the cover through which they have to pass. Make sure, if using original parts, that cover, pressure plate lugs and release levers are assembled in the same relative positions as marked when dismantling, to ensure correct balance is maintained.
5. Assemble wood bridge over cover as when dismantling, and compress with press spindle, taking care to guide pressure plate studs and spring cups through correct holes in cover, also that springs remain correctly on their seatings on pressure plate.
6. Bearing plates (17) and tag washers (14) are placed in position on studs (15) and adjusting nuts (16) fitted and screwed down until nuts are flush with tops of studs.
7. Remove clutch from press. If new parts have been fitted which affect the seating of the release levers, they should be reset as described on Page 61.
8. Turn up locking tag washers to secure adjusting nuts.
9. Fit release lever plate (10) to release levers (12) by means of retainer springs (11) taking care that projecting lugs engage correctly in slots in release lever ends.
10. Fit retaining springs (11) into grooves formed in the release lever plate.

TO REFIT CLUTCH

Refer to Page 61.

CONDITIONS OF CLUTCH FACINGS IN SERVICE

(All Models)

The possibility of further use of the Friction Facings of the clutch is sometimes raised because these have become very highly polished. Provided the facings are indeed polished and not glazed, these are then in an ideal condition to transmit maximum power.

A **polished** surface should be a common experience with clutch facings, but should not be confused with a **glazed** condition which may be due to a film or a condition introduced which entirely alters the frictional value of the facings.

Where oil in any quantity obtains access to friction faces, one or two conditions, or a combination of these, may arise, depending on the nature of the oil etc. :—

1. The oil may burn off and leave a carbon deposit on the surface which eventually assumes a high glaze causing clutch " slip." This gives a very definite, though very thin deposit, and usually hides the grain of the material.
2. The oil may partially burn and leave a resinous deposit on the friction surfaces which produces a fierce clutch or causes " drag " due to the tendency of adherence between the facings and driving members.
3. There may be a combination of (1) and (2) which is liable to cause " judder " during clutch engagement.

Wherever **" glazed "** friction faces are experienced (as distinct from polished surfaces through which the grain of the material can be clearly seen), the driven plate should be replaced by one fitted with new facings and the cause of oil penetration removed.

TROUBLE LOCATING CHART

SYMPTOM	CAUSE.	REMEDY.	See Page No.
1. Drag or Spin.	(*a*) Oil or grease on the Driven Plate facings.	Fit new plate.	59
	(*b*) Improper pedal adjustment not allowing free movement to release bearing.	Correct pedal adjustment.	58
	(*c*) Damaged pressure plate or clutch cover.	Replace defective part.	59—63
	(*d*) Driven plate hub binding on splined constant pinion shaft.	Clean up splines and smear with small quantity of grease.	59—63
	(*e*) Distorted driven plate due to the gearbox being allowed to hang on clutch plate during erection.	Fit new clutch plate.	59
	(*f*) Broken facings of driven plate.	New plates required.	59
	(*g*) Dirt or foreign matter in the clutch.	Dismantle clutch from flywheel and clean out the unit with dry rag, also see that all working parts are free.	59
2. Fierceness or Snatch	(*a*) Oil or grease on driven faces.	Fit new plate.	59
	(*b*) Binding of clutch pedal mechanism.	Free and lubricate bearings.	23
	(*c*) Worn out driven plate facings.	New driven plate required.	59
3. Slip.	(*a*) Oil or grease on the driven plate facings.	Fit new driven plate.	59
	(*b*) Weak thrust springs. If excessive slip is allowed to occur, the heat generated will soften the springs and aggravate the trouble.	Fit new thrust springs.	59—63
	(*c*) Binding of clutch pedal mechanism.	Free and lubricate bearings.	23
	(*d*) Improper pedal adjustment or pedal fouling floor boards so preventing full engagement.	Correct pedal adjustment.	58
4. Judder.	(*a*) Oil or grease or foreign matter on the driven plate facings.	Fit new driven plate.	59
	(*b*) Contact area of friction facings not evenly distributed. Note that 100% contact will not occur until clutch has been in use for some time but contact area should be evenly distributed round the facings.	Fit new driven plate.	59
	(*c*) Buckled driven plate.	Fit new driven plate.	59

TROUBLE LOCATING CHART—continued			
SYMPTOM	CAUSE.	REMEDY.	See Page No.
5. Rattle	(*a*) Damaged driven plate. (*b*) Worn parts in release mechanism. (*c*) Excessive backlash in transmission (*d*) Wear in transmission bearings.	Fit new parts as necessary.	59—63
6. Fracture of Driven Plate.	If the gearbox be allowed to hang with the shaft in the splined hub during assembly or dismantling, the driven plate may be disturbed leading to drag, metal fatigue and breakage.	Check plate for runout. Fit new driven plate.	59 59
7. Abnormal Facing Wear.	Usually produced by overloading and by the excessive slip when starting associated with overloading.	In the hands of the driver.	—

GEARBOX

INDEX

ILLUSTRATIONS

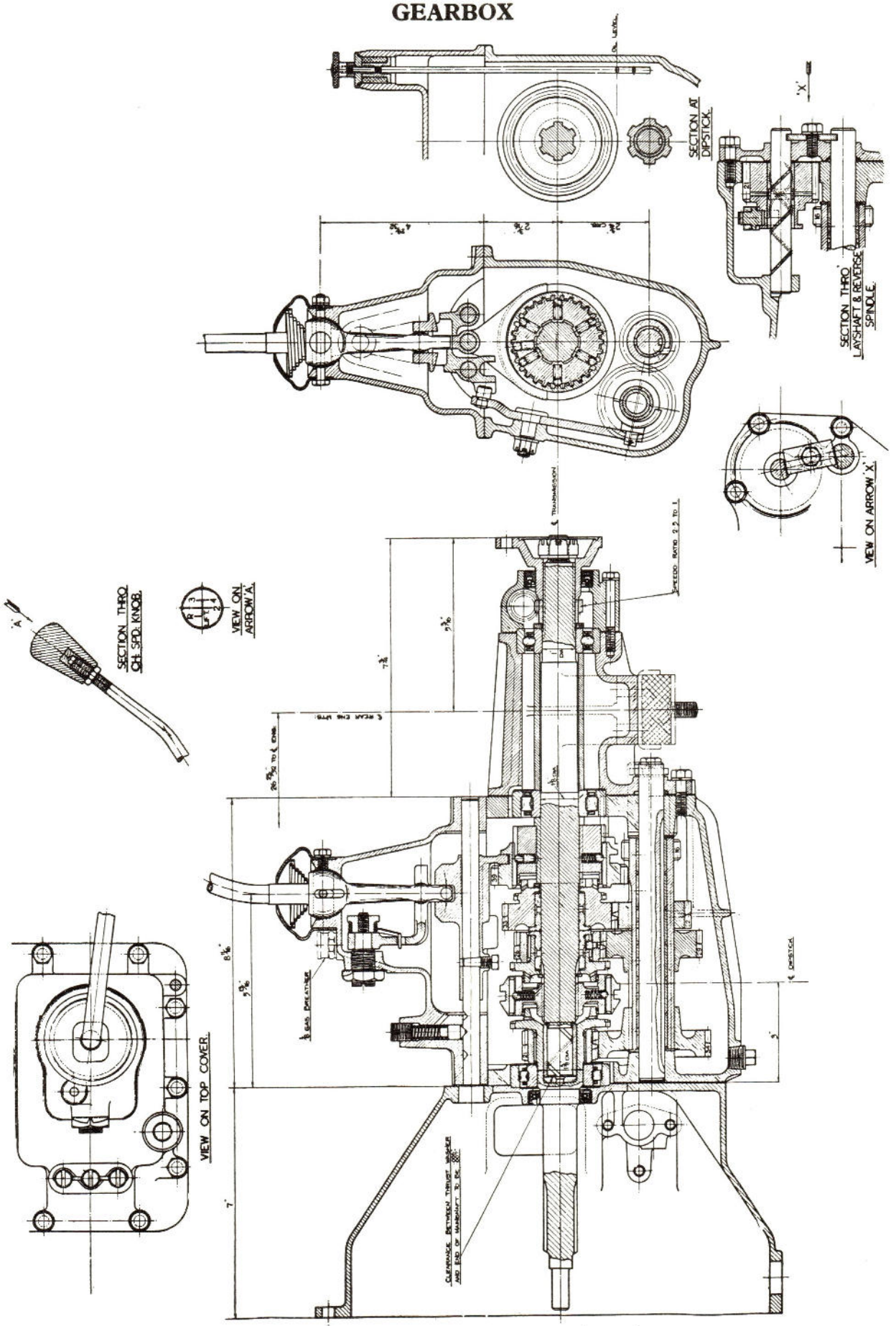


Fig. 38 **Four-speed gearbox arrangement.**

NOTATION FOR FIG. 39

Ref. No.	Description.
	GEARBOX AND COVERS.
1	Gearbox.
2	Drain Plug.
3	Gearbox Extension.
4	Washer for Extension.
5	Rear End Cover.
5a	Washer for Cover.
5b	Oil Seal, Rear End.
6	Front End Cover.
8	Washer for Cover.
9	Oil Seal, Front End.
10	Set Screw (drilled head).
	MAINSHAFT FLANGE AND SPEEDO. DRIVE.
11	Flange on Mainshaft.
12	Washer.
13	Slotted Nut.
14	Speedo. Driven Gear.
15	Speedo. Bearing.
16	Locking Screw.
	TOP COVER.
17	Top Cover.
18	Washer.
19	Dowel.
20	Plunger Springs.
21	Plunger.
22	Plugs.
23	Breather.
24	Dipstick.

Ref. No.	Description.
	CHANGE SPEED GEAR.
25	Swinging Fork.
26	Adjusting Screw.
27	Locking Washer.
28	Adjusting Nut.
29	Damper Spring.
30	Nut for Adjusting Screw.
	CHANGE SPEED LEVER.
31	Change Speed Lever.
32	Knob for Lever.
33	Locknut.
34	Spring for Lever.
35	Cap for Cover.
35a	Spring Retainer.
36	Bolt for Lever.
37	Nut.
38	Locking Plate.
39	Set Screw.
40	Rubber Cover for Change Speed Lever.
	STRIKING GEAR.
41	Striking Rod (1st and 2nd).
42	Striking Rod (3rd and Top).
43	Striking Rod (Reverse).
44	Change Speed Fork (1st and 2nd).
45	Change Speed Fork (3rd and Top).
46	Change Speed Fork (Reverse).
47	Taper Set Screw.

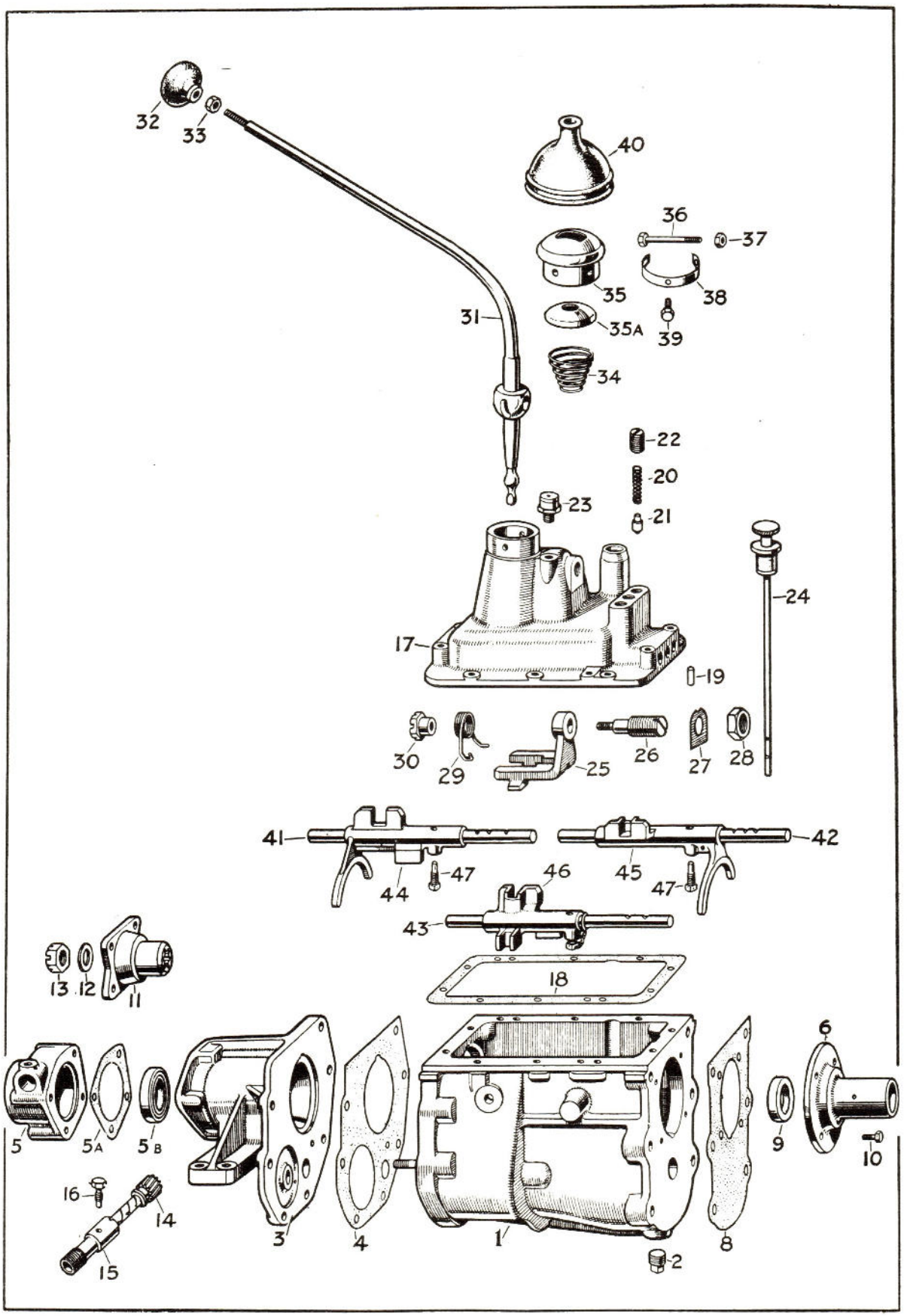


Fig. 39 **Gearbox details.**

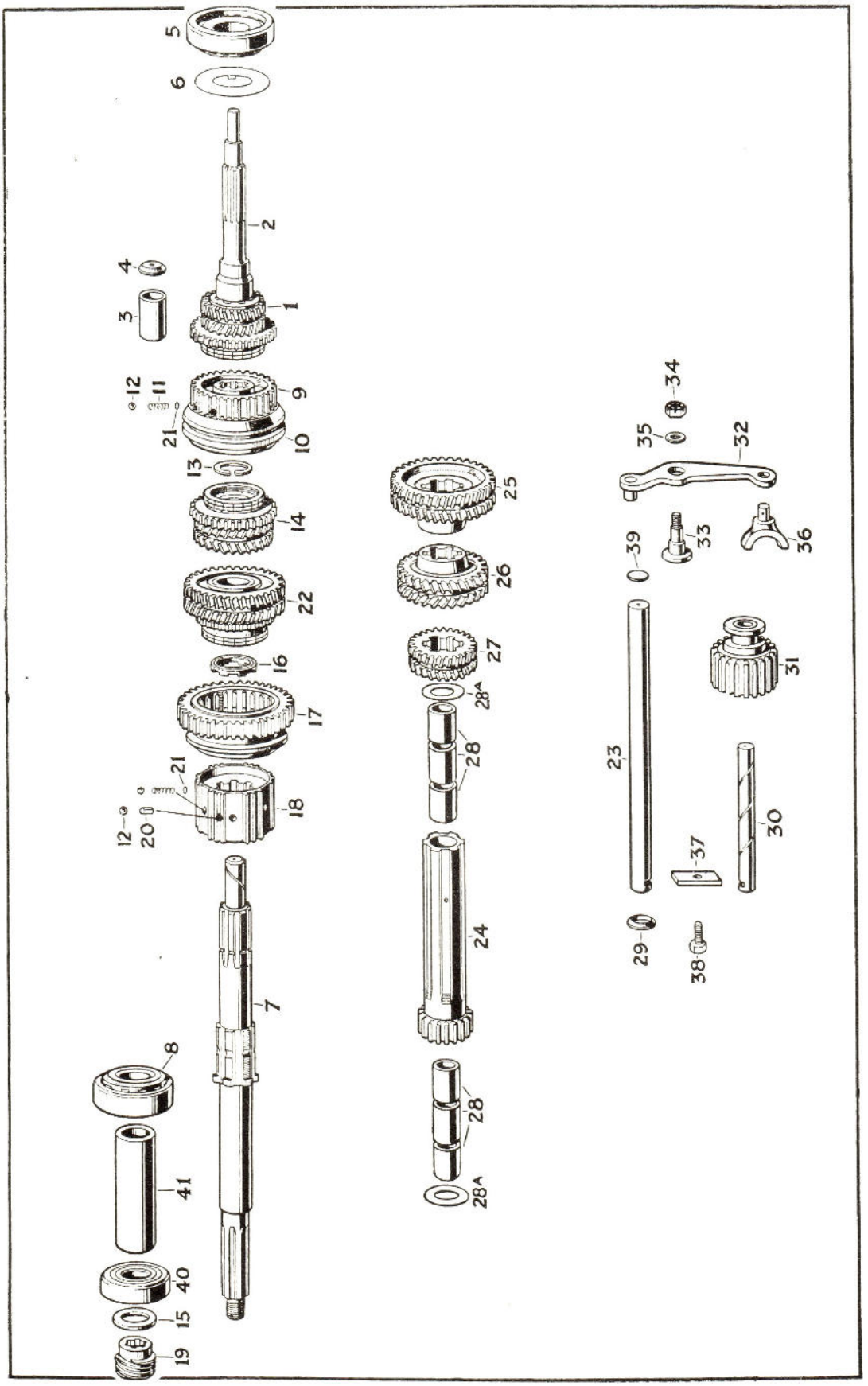


Fig. 40 Gear details.

NOTATION FOR FIG. 40

Ref. No.	Description.
	CONSTANT PINION.
1	Constant Pinion.
2	Constant Pinion Shaft.
3	Constant Pinion Bush.
4	Thrust Button.
5	Roller Bearing.
6	Oil Thrower.
	MAINSHAFT.
7	Mainshaft.
8	Roller Bearings.
9	Synchronising Sleeve (Top and 3rd Speed).
10	Operating Sleeve.
11	Spring for Synchronising Sleeve.
12	Ball.
13	Circlip.
14	Gear Wheel, 3rd Speed.
15	Distance Piece.
16	Washer for Mainshaft.
17	Gear Wheel, 1st Speed.
18	Synchronising Sleeve, 2nd Speed.
19	Speedo. Driving Gear.
20	Locating Peg.
21	Shim for Synchronising Spring.
22	Gear Wheel, 2nd Speed.

Ref. No.	Description.
	COUNTERSHAFT.
23	Countershaft.
24	Countershaft Gear (1st Speed).
25	Constant Wheel.
26	3rd Speed Wheel, Countershaft.
27	2nd Speed Wheel, Countershaft.
28	Bush for Countershaft.
28a	Thrust Washer.
29	Washer for Countershaft (Felt).
	REVERSE.
30	Reverse Spindle.
31	Reverse Wheel.
32	Operating Lever for Reverse.
33	Fulcrum Pin for Lever.
34	Slotted Nut.
35	Washer.
36	Reverse Slipper.
37	Locking Plate, Countershaft and Rev.
38	Set Screw for Locking Plate.
39	Washer for Countershaft (Fibre).
40	Ball Bearing.
41	Distance Piece.

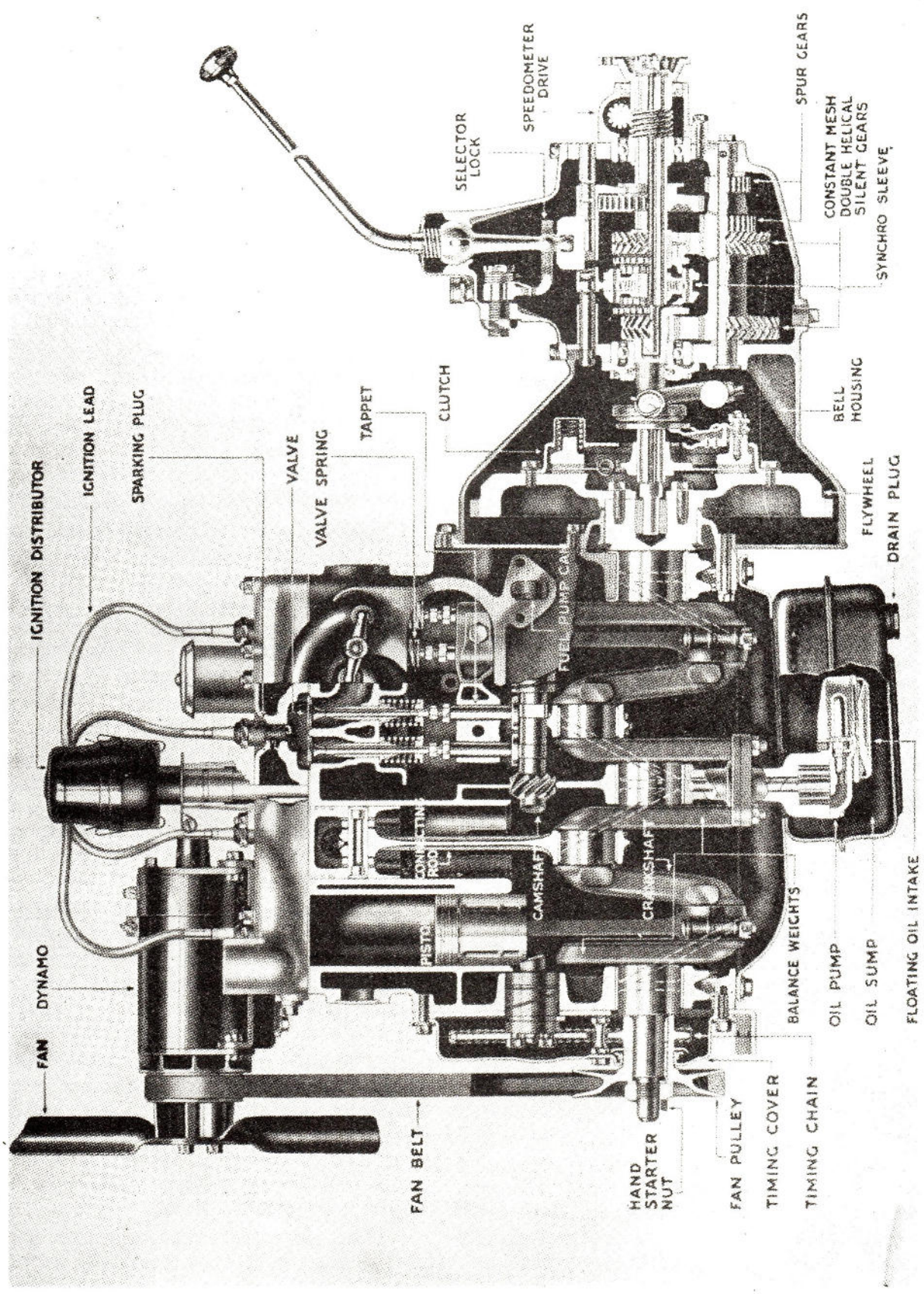


Fig. 40a. **1939 8 h.p. model showing engine and three-speed gearbox**

GEARBOX

GENERAL DESCRIPTION

4/8A, 10C, 12C, and 12CD Models

See Fig. 68

The gearboxes fitted to these models have four speeds forward and one in reverse. There are three constant mesh trains of **double helical** gears.

Straight **spur teeth** are used for first speed and reverse. These are used so that the reverse gear wheel may be able to slide into mesh with both the first speed gear and the countershaft gear, when the former is locked in its neutral position. This gives reversal of motion for the mainshaft. First speed is obtained by sliding the mainshaft first speed gear into mesh with the countershaft gear, whilst the reverse gear wheel lies to one side, out of mesh.

The speedometer is driven by a pair of helical gears set at right angles and fitted at the rear of the gearbox extension.

Synchro-Mesh is provided on Second, Third and Top. Synchronising cones and the female portions in the sleeves are of hard steel of which the gears and operating sleeves are manufactured. There are two units giving synchro-mesh engagement for " top," "third," and "second" gears. One " synchro " unit being double ended serves for both " top " and " third," whilst the other embodied in the first speed gear wheel assembly, provides " synchro " engagement for " second " speed.

Each synchro unit consists of an inner synchronising sleeve mounted to slide on splines on the mainshaft and having a coned surface to engage with the coned surface of the adjacent gear dogs. Mounted on the inner synchronising sleeve is the outer operating sleeve, also splined, which is arranged to slide and make positive engagement with the gear dogs. There is an elastic connection between the inner and outer sleeves, formed by the springs and balls, which operate as follows :—

> " When the outer sleeve is moved towards the gear, which is to be engaged, which occurs when the driver operates the change speed lever, the spring pressure on the balls carries the inner sleeve along with it, and the coned surfaces are brought into contact with a pressure controlled by the balls and springs. The cone clutch effect then brings the speed of the desired gear equal to that of the mainshaft to which the inner synchronising sleeve is splined. This synchronisation of speeds is achieved in one or two seconds. Then the outer synchronising sleeve slides fully into engagement with the driving dogs.
>
> At a point just before engagement of the dogs commences, the spring loaded balls ride over their mating grooves, thus releasing the cone pressure and allowing the chamfered ends of the dogs to engage freely with the chamfered ends of the outer synchronising sleeve splines."

The **constant pinion** shaft transmits the drive from the engine to the gearbox and is splined at the one end carrying the clutch floating plate. An extension of this shaft runs in a roller bearing, which is spigotted in the end of the crankshaft. At the other end is mounted the constant pinion. It is located by a roller bearing in which thrust is taken by lips formed on inner and outer races.

The **countershaft,** supported in the gearbox casing, carries the first speed countershaft gear. This shaft runs on bronze bushes, bronze thrust washers being fitted at each end. (These thrust washers were not originally specified for the 10C and 12C models.)

The **constant wheel** is splined on the countershaft gear as are the " second " and " third " speed wheels. All three of these wheels have double helical gear teeth and are free to locate themselves endways so as to line up with their mating gears on the mainshaft.

The **mainshaft** transmits the drive from the constant pinion shaft to the propeller shaft either directly through the " top and third " synchro unit or indirectly through the countershaft gears and their idling mating gears on the mainshaft, which latter are engaged by the appropriate synchro sleeve.

The **selector mechanism** is contained by the gearbox top cover and consists of three striking rods having forks, the rods being

located by spring loaded plungers. One fork operated "Top" and Third," the second "second" and "first" and the third "reverse." The forks are operated by the change speed lever.

A **locking device** is provided to prevent the possibility of two gears being engaged at the same time. This consists of a swinging fork which is fulcrummed in the top cover and operates with the change speed lever. At the lower extremity of this fork are lugs which interlock with two change speed forks whilst the third is engaged.

A locking **ball and plunger** is provided with the "second" gear synchro unit. These engage with the operating sleeve and the synchro sleeve respectively so as to lock the latter sleeve to the mainshaft when "first" gear is engaged, and thereby preventing any possibility of it engaging with the "second" speed synchronising cone.

8A Model (1939).

See Fig 40A.

The gearbox used with this model is of slightly different construction to the four-speed unit used with the other models. It is an integral casting with the clutch housing and has other detail differences which are dealt with lower.

There are three speeds forward instead of four, and two trains of constant mesh helicals as compared with the three used on the other unit.

As with the 4-speed box **spur teeth** are used for the "first" and "reverse" gears. The reverse pinion with this gearbox is constantly in mesh and reversal of motion of the mainshaft is provided by engaging this pinion with the first-speed gear on the mainshaft.

Helical gears set at right angles to one another are used to drive the speedometer and, as with the 4-speed box, are situated at the rear of the assembly.

Synchromesh is provided on "top" and "second" only, there being one double ended synchro unit alone. The construction of the synchro unit is similar to that employed with the other models, and its operation identical.

The constant pinion is of the same construction as with the 4-speed unit and carries out identical functions, running on a ball bearing instead of a roller bearing, and its extension being accommodated by an "oilite" bush instead of a roller bearing.

The countershaft construction is different to that used in the other assembly. The countershaft gear being mounted on four bushes on the spindle is provided with three sets of spur gears which are respectively employed from front to rear as follows :—

1. To carry the constant wheel.
2. To carry the "second" helical gear and to act as "first" gear.
3. To mesh with the reverse pinion.

Thrust washers are supplied one at either end of the countershaft.

The mainshaft gear carries out the same function as with the other model, it has, however, only one ball bearing, as compared with a roller bearing and deep grooved ball bearing with the 4-speed box.

The selector mechanism is differently arranged to that employed with the other model. The selector rods are fitted in the gearbox casing and the rods located by grub screws at the front end of the casing. The selector forks carry spring loaded plungers and are mounted on the selector rods, which are provided with recesses, with which the plungers engage. There are two forks one of which engages the "top" and "second" gears, whilst the other operates the "first" and "reverse."

As with the four-speed unit, the engagement of two gears at once, is made impossible by a swinging fork but the necessity for the locking ball and plunger does not arise.

REMOVING GEARBOX FROM CHASSIS
(All Models)

1. Remove front seats, carpet, front floorboard and toe-board.
2. Disconnect propeller shaft from gearbox and remove two nuts securing unit to cross member (Set screws in the case of 8A Models). Disconnect speedometer drive.
3. Disconnect clutch pedal links from withdrawal shaft and bracket on clutch housing.

4. Disconnect a lead from accumulator to break electrical circuit.
5. Remove the three bolts securing the starter motor and withdraw this.
6. Insert lifting jack under rear of engine and raise the jack sufficiently to permit the gearbox to clear cross member. (Before jacking up engine with the 8 H.P. and 10 H.P. models, remove fan blades.)
7. Undo nuts and bolts securing the gearbox to the engine and remove the gearbox and clutch housing. **Do not allow the assembly to hang on the constant pinion shaft.**

TO DISMANTLE GEARBOX

(All models with exception of 8A)

Procedure.

1. Remove change speed lever and gearbox lid.
2. Undo nut and withdraw flanged coupling from gearbox mainshaft.
3. Remove the locking plate from the rear of gearbox which secures in position the countershaft and reverse pinion shaft.
4. Remove the gearbox end cover containing the speedometer driving wheel.
5. Extract all the bolts at rear of gearbox and withdraw the gearbox extension (rear cover with 8A model).
6. Withdraw bolt which passes through the grooves in the clutch withdrawal shaft and retain it in its housing (on the 8 H.P. and 10 H.P. models two split pins, coil springs and collars have to be removed instead).
7. Remove set screw holding clutch operating fork on clutch shaft.
8. Remove the clutch withdrawal thrust block, fork and shaft.
9. Detach clutch housing from gearbox by withdrawal of six set screws.
10. Remove the wire passing through the holes drilled in the heads of the four $\frac{1}{4}$" bolts holding the front end cover on the gearbox and unscrew the bolts.
11. Withdraw front end cover from gearbox.
12. Withdraw the countershaft and reverse pinion shaft from gearbox (This will permit the countershaft gear-cluster to drop to the bottom of the gearbox.)
13. Tap the rear end of mainshaft axially with a lead hammer until the outer case of front roller bearing is released from its housing in the gearbox.
14. With outer race removed from the constant pinion shaft, tap back this shaft until the outer case of rear roller bearing is released. Ensure that the gears on mainshaft do not foul those on the countershaft whilst this operation is being carried out. It is a wise precaution to rotate the mainshaft as it is being driven back so as to ensure that the teeth on the two shafts are clear of one another.
15. Draw out constant pinion shaft complete with spigot bush and thrust button, afterwards remove the mainshaft through the

Fig. 41. Using tool T21 to remove mainshaft circlip

top of the gearbox. The inner roller race, oil thrower and constant pinion can now be removed by bumping the pinion shaft down on a hard wood or lead block.

16. Top and third synchro unit can now be removed from mainshaft revealing a circlip which retains the other gears on the shaft. This circlip should be removed, preferably with the extractor shown in Fig. 41.
17. Dismantle mainshaft gears noting the position of these for re-assembly. Reference to Figs. 38 and 40 will be of assistance when re-assembling the unit again.
18. Dismantle the two synchro units, place pieces of rag around them whilst disengaging the synchro springs and balls, to prevent these items being lost. Note number of synchro spring packing shims for re-assembly.
19. Unscrew the three screwed plugs on top of the gearbox cover and extract the coil springs and plungers.
20. Unscrew the set screws from the selector forks.
21. Drive out each selector rod, in turn, from its housing, after which the selector forks also may be removed.
22. Remove bolt and set screw from domed cover and lift out change speed lever complete with cover and coil spring.
23. The swinging fork is removable by extracting the adjuster screw and lock nut, but it is inadvisable to alter its position unless absolutely necessary.

DISMANTLING 8A MODEL GEARBOX

Proceed as with the other models with the following exceptions :—

Operation No. 1.

Remove change speed lever and gearbox lid. With this model the selector rods are fitted in the gearbox casing and no external form of locking plunger and springs are provided, these being carried in the selector forks. Remove the two grub screws which locate the respective selector rods. Drive out selector rods towards the *front* of the gearbox afterwards removing the two forks with locking plungers and springs. Care should be taken to avoid the loss of plungers and springs. Failure to drive the selector rods out through the front of the gearbox, would allow the locating recesses, at front end of these rods, to engage with the locking plungers when passing through the selector forks.

Operation No. 3.

It is necessary, instead, to remove a taper pin which passes through the reverse pinion shaft and the countershaft.

Operation No. 12.

Tap mainshaft axially towards the front, with a lead hammer, a sufficient distance to release front ball bearing on constant pinion shaft.

Operation No. 13.

Remove constant pinion shaft and race with bush and thrust button. The ball race, oil thrower and constant pinion can be removed by bumping the end of the shaft on a wooden or lead block, with the shaft held vertically. Tap mainshaft axially a sufficient distance to free ball race at the rear of mainshaft. Rest rear ball on gearbox casing and tap mainshaft axially towards front of gearbox so as to free race from mainshaft.

Operation No. 14.

Remove mainshaft complete with gears from gearbox casing.

Operation No. 15.

Remove " Second " and " Top " synchro unit complete from mainshaft. Three circlips are fitted with this model and whilst it is only necessary to remove two of these to release the other gears, all should be renewed on re-assembly. It will be necessary to twist these off with a pair of pliers or alternatively cut them off with a chisel as there is no extractor available for this purpose. An expander for refitting is available.

PRECAUTIONS TO BE OBSERVED WHEN RE-ASSEMBLING GEARBOX

(Four-speed box).

Re-assembly is the opposite procedure to that given above for dismantling, but the following precautions must be observed :—

1. The adjustment of the **swinging fork** should not be upset by altering the position of the adjuster screw unless this screw has to be replaced by a new item. In order to remove the swinging fork it is unnecessary to remove adjuster screw, it merely being necesssary to withdraw split pin securing nut (30—Fig. 39) and remove nut and damper spring, after which the swinging fork may be removed.

   If the **adjuster screw** is to be renewed proceed after removal of swinging fork to remove this screw from the outside of the gearbox top cover.

   To refit this adjuster screw, tighten up until the large screwed diameter protrudes $\frac{1}{16}$" on the inside of the cover, assemble the swinging fork, damper spring and nut. Tighten up nut until fork is locked ensuring that the position of the adjuster screw is not altered. Slacken nut back a quarter of a complete turn and insert the split pin. This should allow the fork to swing freely and to assume the correct position in relation to the selector fork.

2. When refitting selector rods, locking plungers and springs, ensure the condition of these items and renew any weak springs or damaged plungers. The correct axial load which should be required to free the selector forks from the selector locking plungers can be accurately tested as shown in Fig. 42, this should be 35 lbs. with the four-speed box and 35 lbs. These axial loads are important where jumping out of gear is experienced.

3. When **re-assembling the synchro units** it is particularly important to replace any synchro spring packing shims which were originally in position to ensure correct resistance to relative motion between the two sleeves. **When fitting up the "First" and "Second" (Four Speed Box) Synchro unit, insert the coned end of the synchro sleeve with the ball and plunger hole "B" in line with the relieved spline "A" (Fig. 43) of the operating sleeve and leave over the fitting of the ball and plunger until this unit is fitted to the mainshaft.**

   The re-assembly of these units will be greatly assisted by the employment of a spare operating sleeve as shown in Fig. 47.

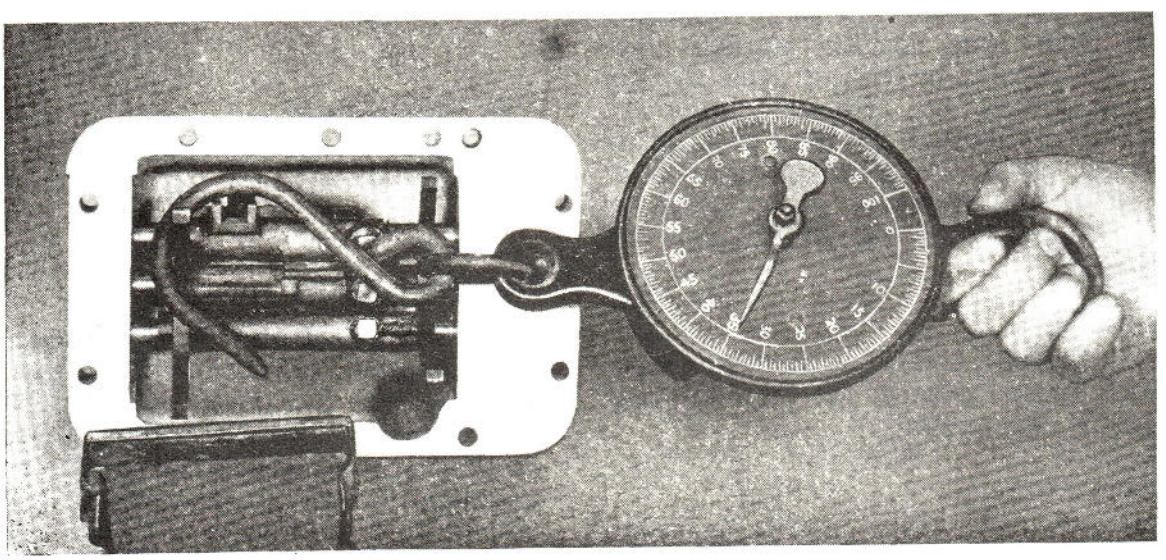


Fig. 42. **Testing axial load to move change speed fork.**

(Using medium load spring balance.)

After the building up of these synchro units the axial load required to release synchro balls and springs should be tested. A mechanic thoroughly conversant with this type of gearbox should be able to judge this load accurately enough by manual means. A more accurate way of testing this load is the employment of special rings in conjunction with spring balances as shown in Fig. 44 and 45. The spring balance reading for the top and Third (Four-Speed Box) should be 42-45 lbs., whereas with the " Second " and " First " on the same gearbox this should be 54-57 lbs. To increase the loads required to effect release, add packing shims beneath the synchro springs. The correct adjustment of axial loads is important in the case of a complaint of bad synchronisation of gears.

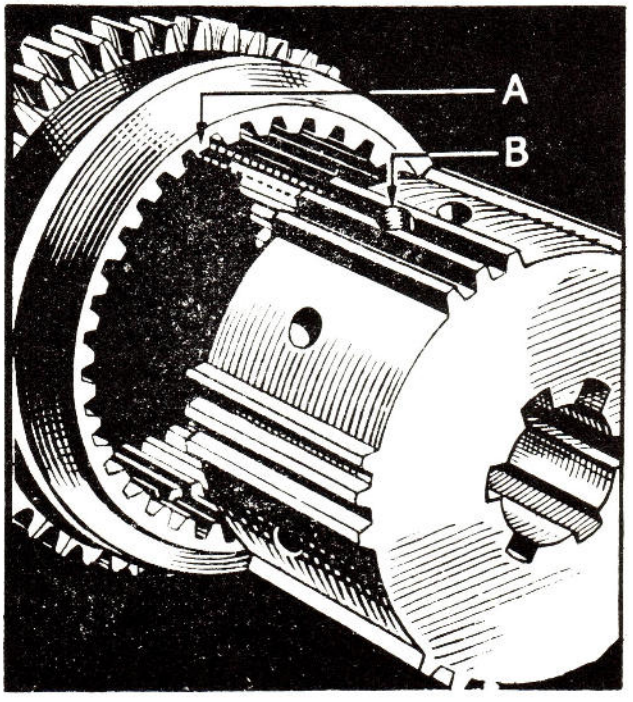


Fig. 43. Engagement of gear wheel and second-speed synchronising sleeve.

4. The condition of the coned surfaces in the synchronisation mechanism is particularly important to its proper operation. Where these surfaces show signs of seizure or roughening they should be ground-in together carefully with grinding paste (No. 360 Carborundum is recommended). Grinding paste should be used sparingly and all signs of it wiped away with a petrol moistened rag upon completion of the grinding-in process.
5. All gears should be carefully examined for wear and worn items should be renewed.
6. When refitting " First " and " Second " synchro unit to mainshaft first insert ball and then the plunger into hole " B " (See Fig. 43) with the flat end of the plunger against the ball, fit these from the inside of the synchro sleeve. Smear these items with grease to secure in position whilst the unit is being re-assembled on mainshaft. **Failure to fit this ball and plunger will tend to allow the synchro sleeve to creep into engagement with the cone on the " Second " gear and if these are not correctly aligned with the relieved spline on the operating sleeve there will be difficulty with engagement of " Second " gear.**

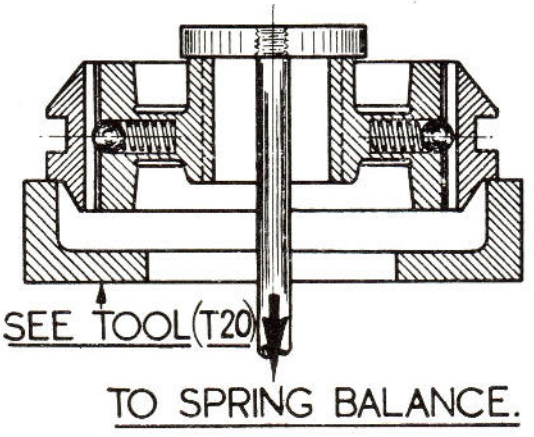


Fig. 44 Testing " Top and Third " synchro sleeve axial load.

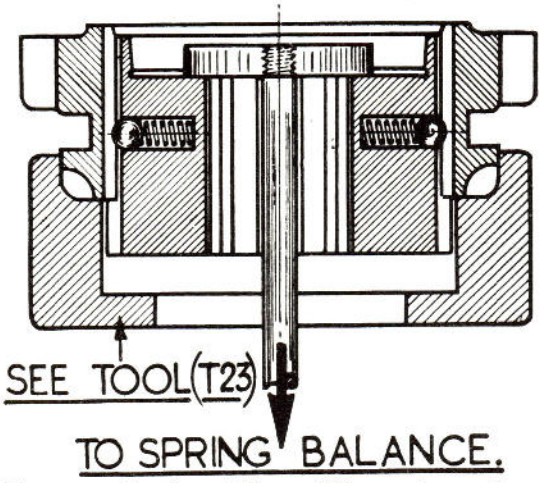


Fig. 45 Testing " Second " speed synchro sleeve axial load.

7. A new circlip should be used when re-assembling mainshaft. This circlip should be fitted with a proper expander, such an expander is shown being used in Fig. 48. These expanders may be obtained from our Spares Department.
8. When fitting a new constant pinion on its shaft, so select the splines for engagement as to align the oil holes in the gear with those on the shaft.
9. Before finally fitting up the mainshaft and constant pinion shaft adjust the end float of the latter to 0.005″—0.007″. This is adjustable by varying the thickness of the thrust button. Be certain when fitting the constant shaft in gearbox that the thrust button is correctly placed with the chamfer towards the front also that the chamfer in the bush is facing the rear.
10. Before assembling the mainshaft and constant pinion shaft in the gearbox casing assemble the countershaft gears in their correct position as given in Fig. 49. Fit

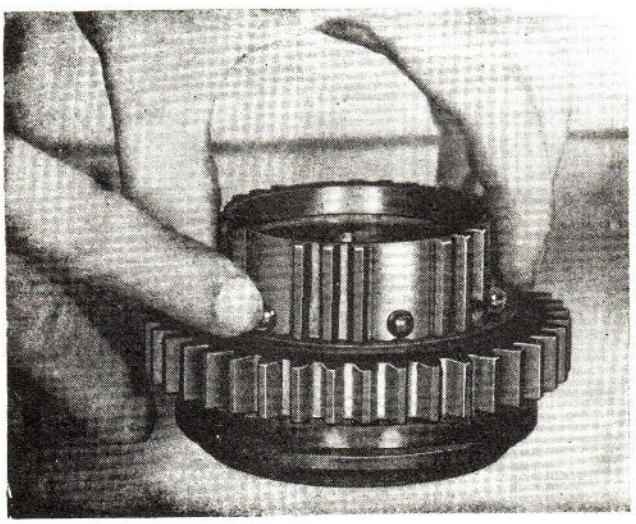


Fig. 46 **Fitting balls into synchro sleeve (second-speed).**

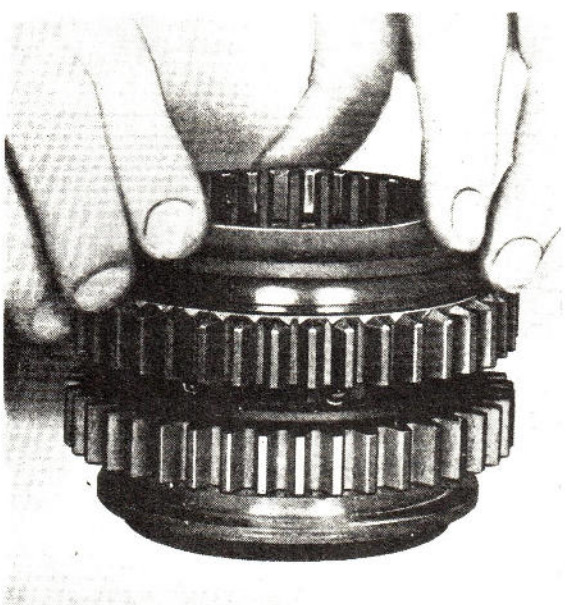


Fig. 47 **Employment of spare gear wheel to fit balls.**

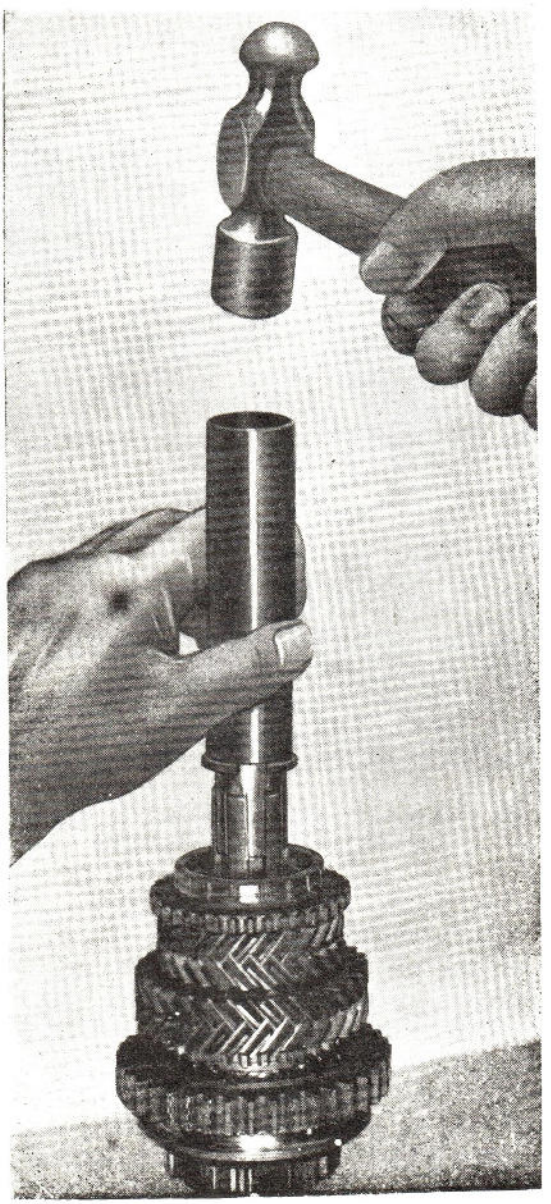


Fig. 48 **Using circlip fitting tool.**

the bushes in the countershaft gear and grease the thrust washers and assemble in the gearbox. Thread a $\frac{3}{8}$" rod through the gears, which is long enough to protrude at either side of the gearbox so as to prevent the thrust washers dropping out of position (See Fig. 50).

11. Fit the assembled mainshaft with inner portion of roller bearing.

12. Fit the constant pinion shaft complete with inner race, oil thrower, constant pinion, bush and thrust button. Ensure that thrust button does not turn over in its housing whilst being assembled. Position for re-assembly of bush and thrust button is shown in Fig. 52.

13. Fit the outer races of the two roller bearings, engaging them with the rollers before making contact with the gearbox casing. Each outer race, when fitted, should protrude not less than $\frac{3}{16}$" from the respective gearbox end faces.

14. With a screwdriver or tommy bar reposition the countershaft gears so that they are correctly in line with their mating gears on the mainshaft. Drive out the $\frac{3}{8}$" rod by a large one as shown in Fig. 51 and follow this tool up with the countershaft. RE-CHECK THE ALIGNMENT OF THE GEARS ON THE COUNTERSHAFT WITH THOSE ON THE MAINSHAFT ENSURING THAT THE WHOLE BREADTH OF THE RESPECTIVE PAIRS OF GEARS ARE IN MESH.

15. Renew all paper washers and ensure condition of oil seals. When engaging speedometer gears, rotate mainshaft to ensure correct meshing of these gears.

16. When replacing front end cover, position this so that the milled slot on the inner face is towards the bottom.

17. Complete re-assembly in the opposite sequence to that used for dismantling the unit.

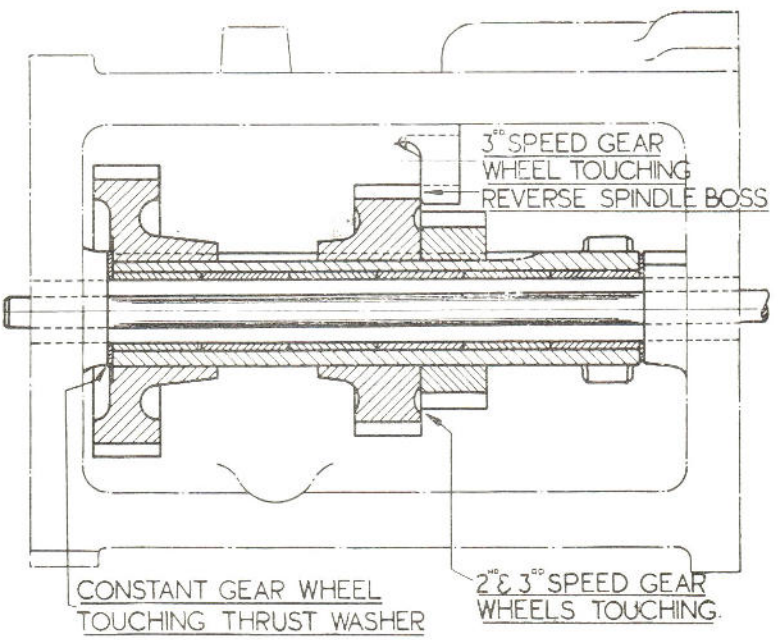


Fig. 49 **Position of countershaft gears prior to engagement with mainshaft.**

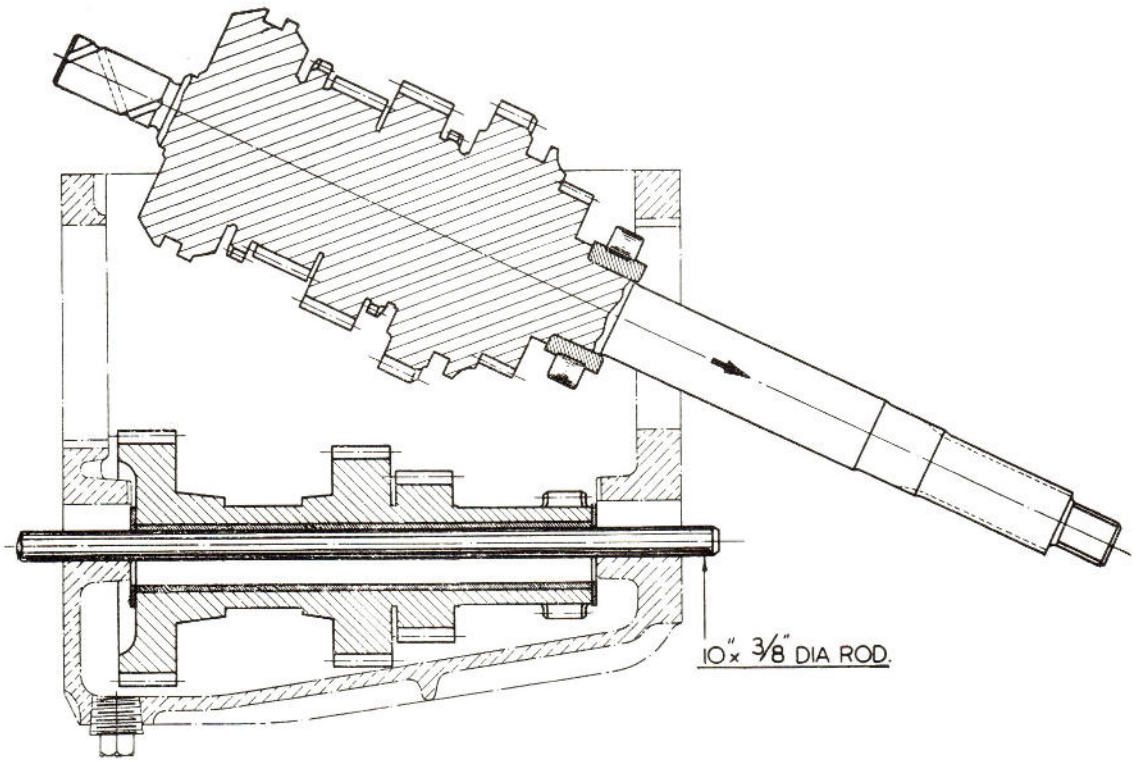


Fig. 50 Fitting mainshaft assembly into gearbox.

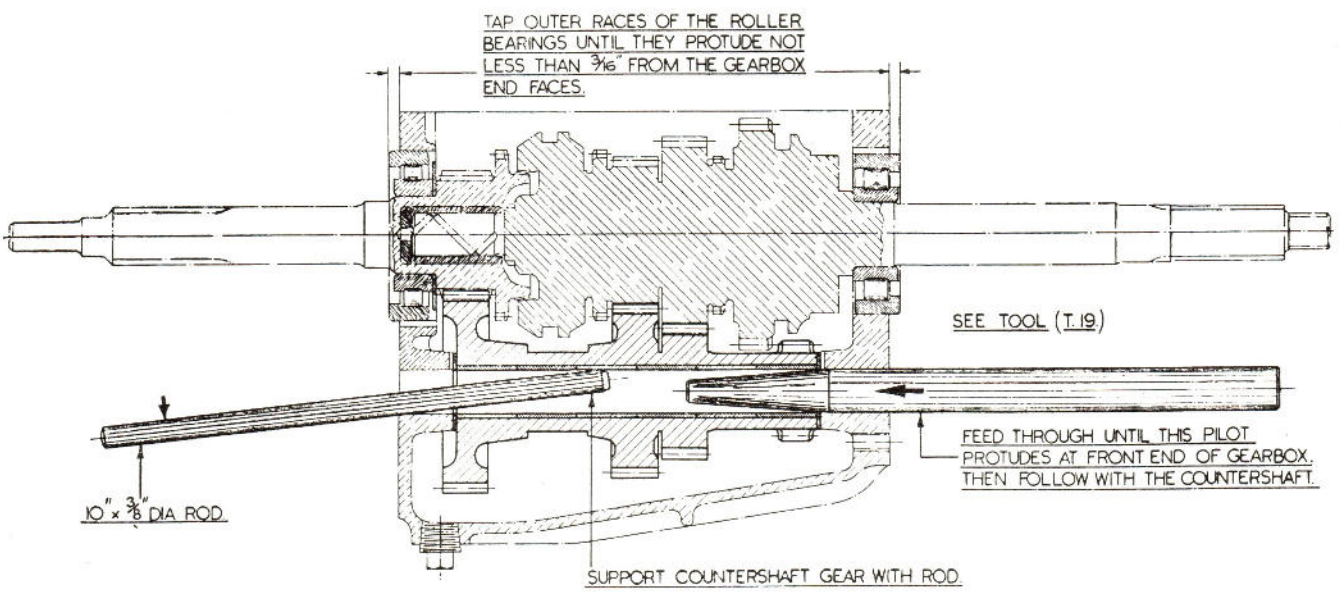


Fig. 51 Fitting countershaft and positioning bearing outer races.

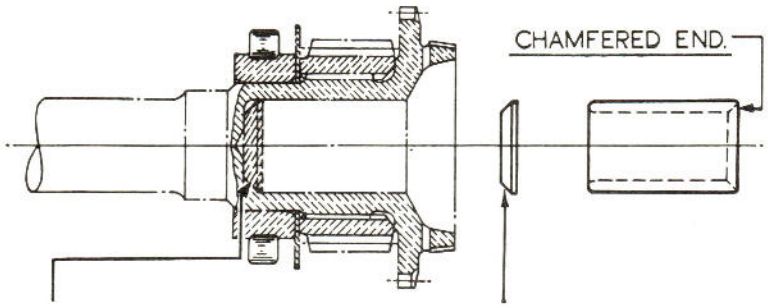


Fig. 52 **Positioning the thrust button and bush in the constant pinion shaft.**

Thrust button is chamfered to clear radius in bottom of bore in constant pinion shaft. Check after fitting to ensure position as shown. The bush chamfer must be towards the rear.

PRECAUTIONS TO BE OBSERVED WHEN RE-ASSEMBLING GEARBOX

(Three-Speed Box). (See Fig. 40.A).

Re-assembly is approximately the opposite procedure to that given for dismantling, but the following precautions must be observed when carrying out this work :—

1. The same precautions with regard to the **swinging fork** should be observed as that given to this part with the Four-Speed unit as set out in Paragraph 1, Page 78.

2. When refitting selector rods to gearbox ensure the condition of the locking plungers and springs, renewing any weak springs and replacing damaged plungers. Ensure also the condition of the locking grub screws which engage the recesses at the front end of the two rods, and if these screws are worn so as to permit float in the rods they must be renewed.

   Where **" jumping out of gear "** has been experienced the axial load required to release selector forks from locking plungers must be adequate, whilst an experienced mechanic should be able to judge this to a reasonable degree of accuracy, the method shown in Fig. 42 may be preferred. The correct axial load with this box is 35 lbs. The selector forks should be examined for wear on the faces and replaced if this is in any way appreciable. There have been instances where such wear has allowed persistent disengagement of gears.

3. When re-assembling synchro unit as with the four-speed box, the condition of the synchro springs and balls should be ensured and packing shims, originally in position, replaced.

   The same procedure for checking axial load required to release synchro springs and balls, may be used as with the four-speed box (See Page 79 Paragraph 3), either judging this by manual means or making a ring similar to that used with the four-speed unit as shown in Figs. 44 and 45. The axial load which is required to release synchro sleeve with this gearbox is from 38 to 42 lbs.

4. The **condition of the coned surfaces** in the synchromesh mechanism is important if good synchronisation is to be obtained. Any of these faces which have " picked up " or become roughened in any way should be ground in with carborundum paste (No. 360 is recommended), applying this sparingly and carefully removing all traces with a petrol moistened rag, on completion.

   This attention is particularly important where difficulty is experienced with synchronisation of gears.

5. **Worn gears** should be replaced and particular attention given to the second mainshaft gear and the bush on which this is mounted. This from experience, is sometimes found to be one of the factors contributing to " jumping " out of gear. The condition of the dogs both on the 2nd gear and constant pinion should be ensured as should the corresponding splines in the operating sleeve. Any of these which

show signs of wear should be replaced, particularly where difficulty with the **disengagement of gears** is being experienced.

6. New circlips should be fitted when reassembling mainshaft gears. A proper expander for this purpose can be obtained from our Spares Department.
7. The countershaft gears and reverse pinion must be assembled in the gearbox casing before fitting the mainshaft and constant pinion shaft. The countershaft gear should be fitted with the small gear engaged with the reverse pinion. When fitting countershaft to gear assembly be careful to engage the tabs of the thrust washers in the recess in the shaft. Position reverse pinion shaft and countershaft so that taper locating screw can be fitted through these two shafts and fit this screw. Fit felt washer at end of countershaft and seal this with end plate having first applied shellac to its outer edge.
8. Fit the assembled mainshaft and constant pinion shaft complete with pinion, oil thrower, bush and thrust button. The ball races will necessarily have to be fitted to the seshafts after they have been positioned in the gearbox. **Ensure that the thrust button in the constant pinion is fitted the correct way round, so that the chamfer on this is towards the front of the car and also the chamfer in the bush is towards the rear of the chassis.**
9. Position the " second " countershaft gear so that the helicals on this are permitted a full breadth of engagement with the mating gear on the mainshaft.
10. Fit ball races after ensuring their condition, and complete re-assembly of gearbox, fitting new paper washers between front and rear cover and replacing defective oil seals. Ensure the existance of clearance between constant pinion thrust button and end of mainshaft. This can be checked by ensuring free movement when rotating the constant pinion shaft with one hand and holding the mainshaft with the other. Adjustment of clearance is made by varying thickness of thrust buttons used.

JUMPING OUT OF GEAR WITH 8A MODELS

Three-Speed Box. (See Fig. 40.A)

Some instances of this complaint have been reported, which naturally in most cases, refer to vehicles which have covered a considerable mileage. In the case of a car which has covered a large mileage, the difficulty must be ascribed to the development of general wear and a complete overhaul of the gearbox is recommended along the lines suggested on Page 77. Where the complaints refer to a vehicle recently overhauled or where such a car has only covered a small mileage, the following points should be investigated :—

1. Examine selector locking plungers ensuring the condition of these items and replacing by new parts as necessary. Check axial load required to release selector forks as suggested in Paragraph 2 Page 78. Examine selector fork faces and where these show appreciable signs of wear replace by new ones.

   In order to remove the selector rods and forks from the gearbox in " situ " it will be necessary to withdraw the cover, remove grub screws, locating rods, tap the rods to the rear sufficiently to reveal the recesses with which the grub screws engage, fill these recesses with a suitable " D " washer or wrap with wire and then tap through forks to the rear of the gearbox. It is imperative that the recesses in the rods are filled, otherwise these will be engaged by the locking plungers and prevent their passage through forks.
2. Ensure that the two selector rods are positively located by the grub screw at the front end of each and that there is no question of these having worked loose, or owing to wear, permitting fore and aft movement to take place.
3. Another possible cause, although a remote one, is the possibility of the nut on the end of the mainshaft, which secured the driving flange, having been overtightened and thus caused spring of the circlips on

the mainshaft. This nut should be tightened up dead tight and then slackened back a quarter of a turn **but no more.**

4. If attention to the foregoing points does not effect a cure it will be necessary to dismantle the mainshaft as directed on Page 77 and proceed as instructed below.

5. Examine the ball race on which the mainshaft is fitted, also that on which the constant pinion shaft is mounted and replace either of these which disclose any suspicion of wear or failure. Ensure also that the bush in constant pinion is not worn.

6. In the case of a vehicle where jumping out of " top " gear is being experienced, examine the dogs on the constant pinion shaft and the splines in the operating sleeve with which these engage. Fit replacements as required.

   Where the " second " gear is affected ensure the condition of the dogs on the " second " mainshaft gear and the splines in the operating sleeve with which they engage. Renew as necessary. Examine this mainshaft gear for slackness on the mainshaft bush, also for any evidence of play between the bush splines and those on the mainshaft.

7. Where jumping out of " first " gear is experienced, in addition to the attentions suggested in paragraphs 1—5 inclusive, the condition of the affected mainshaft gear and of the countershaft gear should be ascertained and appropriate action taken.

JUMPING OUT OF GEAR

(Four-Speed Units).

This complaint is very rarely experienced with this gearbox and, even where it is reported, is usually explained by general wear and slackness consequent upon having covered a considerable mileage. Such cases, as are explained by general wear, can only be overcome by a complete gearbox overhaul as suggested on Page 78.

Where complaints are experienced after a repair or when a comparatively small mileage only has been covered, the difficulty is usually explained by a fault in the selector locking mechanism, which is situated in the gearbox lid with this model. The condition of the selector locking plungers and springs should be ensured and the axial load necessary to release the selector forks tested as directed in Paragraph 2 of Page 78. If the load required is beneath the 35 lbs. level prescribed, the tension of the appropriate coil spring should be increased by screwing the plug, which secures this spring, into the gearbox lid. Having ensured the employment of suitable spring tensions the vehicle should be tested under loaded conditions on the affected gear.

If, in spite of the selector mechanism being in good order, the trouble persists the offending gears should be examined and replaced as necessary.

DIFFICULTY OF ENGAGING SECOND GEAR

(Four-Speed Box).

Where such a difficulty arises following a repair to the gearbox, it is usually explained by the incorrect assembly of the " second " and " first " synchro assembly. This synchro sleeve should be inserted into the operating sleeve with the coned end leading and with the plunger and ball hole, which is drilled radially right through one half of the sleeve, in line with the relieved spline in the operating sleeve. See Paragraph 6, Page 79.

POOR SYNCHRONISATION OF GEARS

(All Models)

Where this complaint arises it should first be ensured that the clutch is not out of adjustment and that the difficulty is being caused by plate " drag." See Page 65.

If the trouble is established in the gearbox, the most likely explanation will be the condition of the " coned " faces of the synchro-mesh mechanism, alternatively incorrect tension in the six synchro springs will upset the timing of the synchro sleeves' release and thus prevent proper synchronisation.

It is possible to correct slight irregularities between the cones and cups without recourse to dismantling the gearbox. The procedure to adopt in such cases, being as follows :—

> " With the engine running in neutral gear at a fast idling speed, the clutch engaged and with the handbrake applied ; move the gear lever towards the offending gear sufficiently to engage the cone and cup, but without actually meshing the gear. The cone and cup should only be kept engaged momentarily, the gear lever being moved backwards and forwards, thus disengaging and re-engaging the coned surfaces and lapping them in together. Continue this pendlum-like movement for several minutes."

Where the foregoing attentions fail to effect a cure the gearbox should be removed from the chassis, as instructed on Page 75 and the unit dismantled as necessary to deal with the gears affected.

The " coned " surfaces should be ground-in together using a fine carborundum paste (No. 360 is recommended) sparingly and wiping clean with a petrol moistened rag when both show a uniform matt surface.

The tension of the six synchro springs should be ensured as instructed in Operation 3, Page 83.

OIL LEAKAGE FROM GEARBOX END COVERS

(All Models)

When this complaint arises it will be explained by either the employment of too high an oil level or be caused by a defective oil seal.

Reference to the gearbox general arrangement as shown in Fig. 38 clearly shows the positioning of these two oil seals, the front oil seal being accommodated in the front cover and that at the rear in the rear cover.

The extending lips of these oil seals should face inwards towards the centre of the box and great care should be taken to prevent damage to the face of this lip. Tool T17 shown in Tool Section is devised as a means of preventing damage when fitting front seal. Alternatively a sheath of well greased paper will provide protection during installation. The new oil seal should be soaked in warm oil for about 15 minutes before fitting.

To replace these oil seals the end covers will require removing which, in the case of the front one, will require the removal of gearbox from the chassis.

PROPELLER SHAFT

INDEX

ILLUSTRATIONS

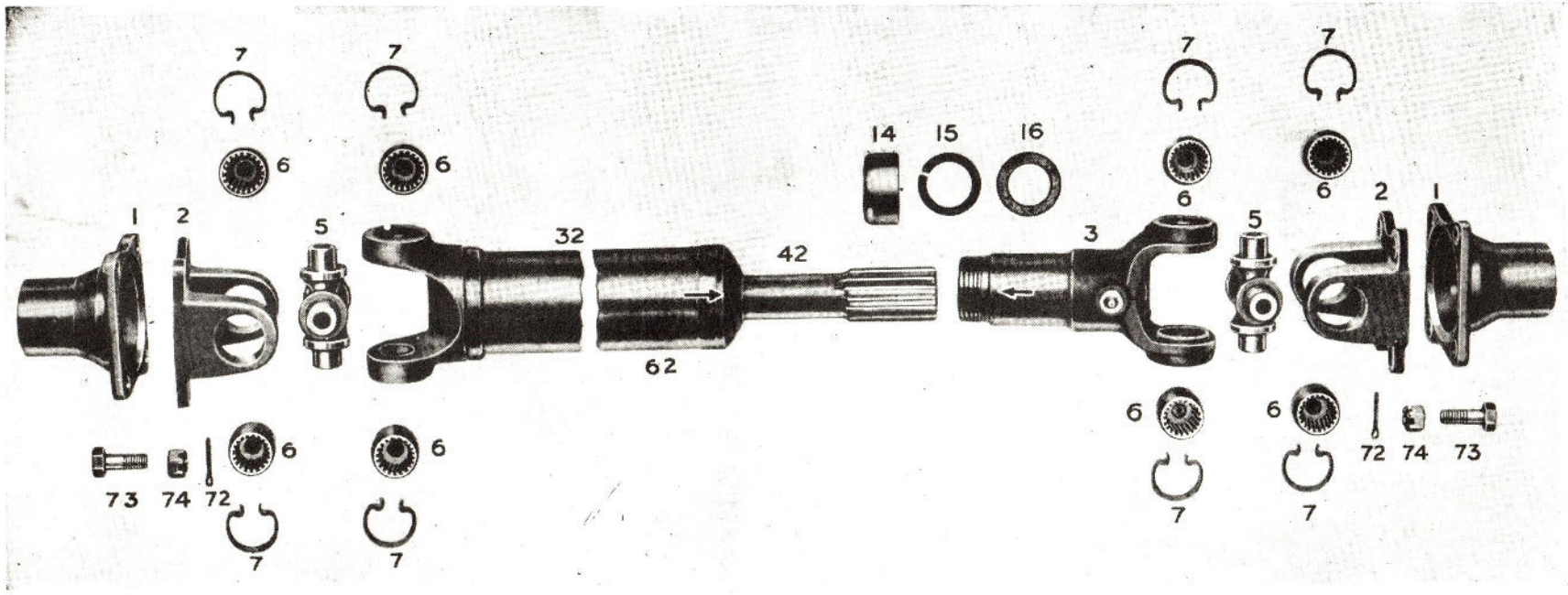


Fig. 53 **Propeller shaft details.**

NOTATION

No.
1 Companion Flange
2 Flange Yoke
3 Sleeve Yoke Assembly
5 Spider Journal Assembly
6 Bearing Race Assembly
7 Snap Ring

No.
14 Dust Cap
15 Steel Washer
16 Cork Washer
32 Tube
42 Slip Stub Shaft

No.
62 Tubular Shaft Assembly, comprising Part Nos. 26, 32, 42.
72 Split Pin
73 Flange Bolt
74 Flange Bolt Nut

PROPELLER SHAFT

TYPES AND DESCRIPTIONS

The propeller shaft and universal joints are Hardy Spicer. The following types being used with the models as stated :—

8A	.....	Type 1110.
4/8A	.....	Type 1110.
10C	.....	Type 1100.
12C	.....	Type 1250
12CD	.....	Type 1250.

The lengths of the propeller shafts fitted to the two 8 H.P. models are different, owing to the fact that the current model is equipped with a four-speed model and the chassis cross member has been moved further towards the rear of the frame.

Sliding splines are provided at the front end of the propeller shaft to provide for the difference in length between the radius of the rear axle's arc of movement and that of the propeller shaft itself.

Each joint consists of a central spider having four trunnions, four needle roller bearings and two yokes as may be seen from Fig. 53.

LUBRICATION

With the 8A, 10C and 12C models no lubricator is fitted to the universal joints, the hollow spider being packed with lubricant on assembly and no additional lubricant should be required until the assembly is dismantled for overhaul.

In practice it has been found that overhaul of the assembly has been neglected and the manufacturers have now made provision for external lubrication which is required each 5,000 miles. With the 4/8A and 12CD models, three grease nipples are fitted to these shafts, two at the front end, one for the sliding splines and the second for the journal assembly, and one only for the spider at the other end. The pre-war models are provided with a single grease nipple at the front end for lubrication of the splined sleeve.

MAINTENANCE, REPAIR AND ASSEMBLY

Wear in the journal assemblies should be very small if proper attention is given to the periodic necessity for lubrication. With the post-war models and, in the case of the earlier vehicles, overhaul is carried out after each 20,000 miles.

The existence of wear on the thrust faces may be established by testing the lift by hand, whilst excessive rotary movement of the shaft in relation to the flange yoke indicates wear in the needle assemblies or between the sliding splines.

Where the existence of wear is established by the methods given in the previous paragraph the propeller shaft should be removed for overhaul.

To remove the propeller shaft after jacking up the rear wheels, it is merely necessary to withdraw the four bolts which secure each of the two flanged faces to the gearbox flanged joint and that on the rear axle pinion shaft respectively. Pre-war models are provided with split pinned nuts and bolts to secure these flanged joints but with current models Simmonds self-locking nuts are used with the bolts.

After cleaning off the propeller shaft ensure that the "arrow" markings are in existence at the splined end of the shaft as shown in Fig. 53. If these are not readily decipherable they should be clearly indicated to enable the re-assembly in the correct position.

Unscrew dust cap 14 in Fig. 53 noting the steel washers and cork washer for replacement, renewed as required. Remove all snap wires employing special pliers (see Tool T24 in Tool Section) and prising with a screwdriver. If

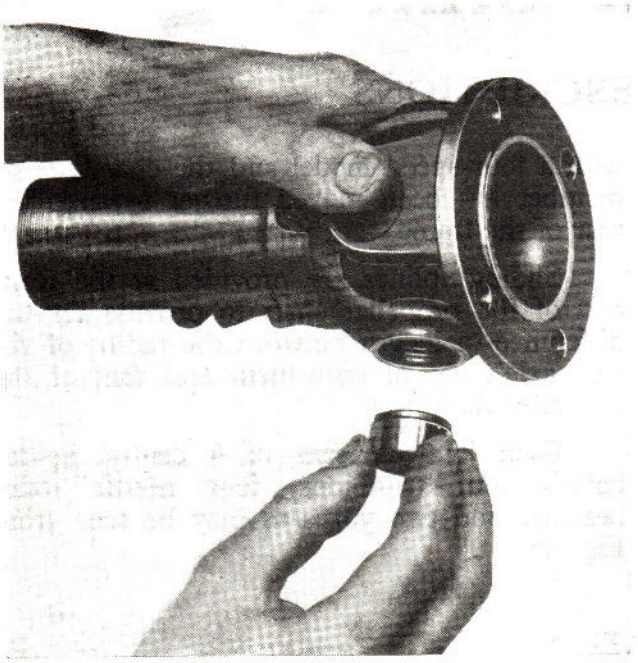


Fig. 54 **Removing bearing race by hand.**

ring does not snap out of groove readily, tap end of bearing race lightly inwards to relieve the pressure against ring. Holding joint in left-hand with splined sleeve yoke lug on top, tap yoke arms lightly with soft hammer. Top bearing should begin to emerge, turn joint over and finally remove with fingers (see Fig. 54).

If the bearing is too tight to remove by hand, wrap a small piece of fine emery cloth around the protruding portion of the bearing and grip with pliers to remove it. If necessary

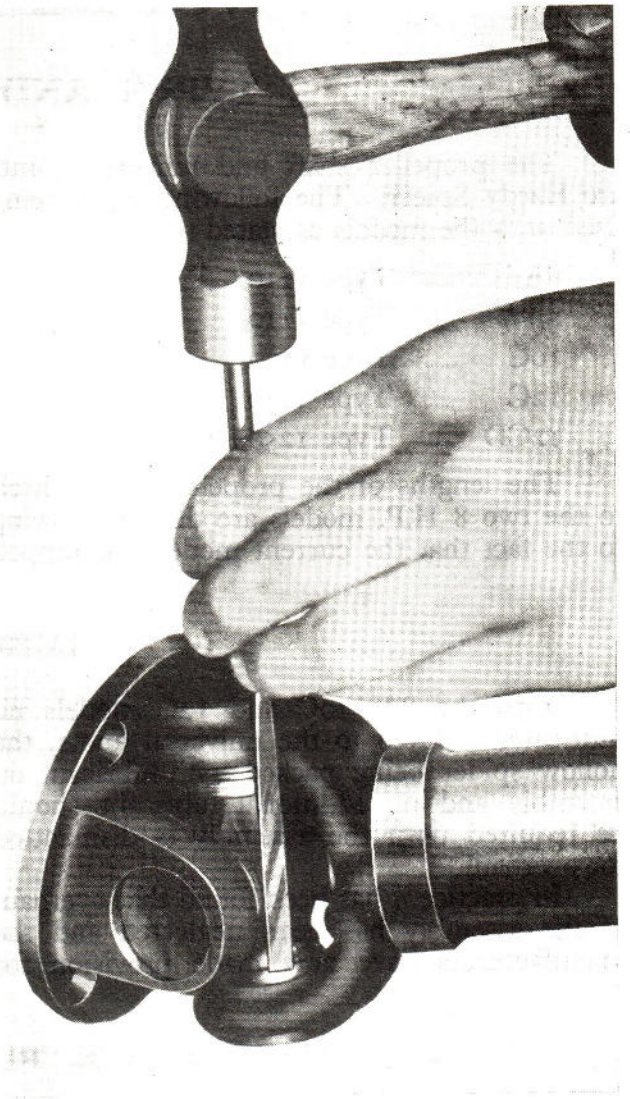


Fig. 55 **Removing bearing race with special punch.**

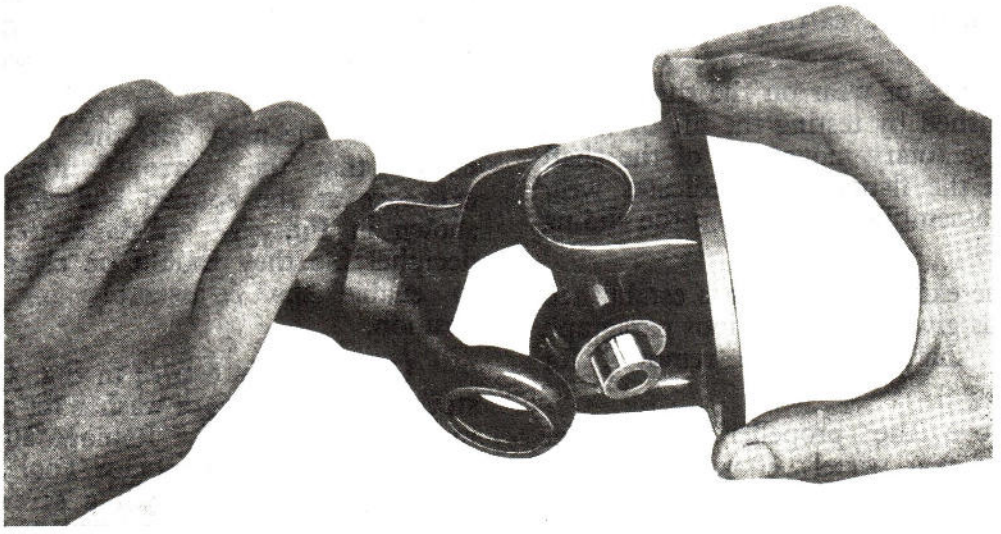


Fig. 56 **Removing the yoke.**

tap bearing race from inside with small diameter bar, as shown in Fig. 55 taking care not to damage the bearing race. This operation will naturally destroy the oil seal which will need to be renewed when parts are re-assembled.

Keep joint in this position whilst removeing bearing race to avoid dropping the needle rollers. Repeat the operation for the opposite bearing. The splined sleeve yoke can now be removed (See Fig. 56).

Rest the two exposed trunnions on wood or lead blocks, then tap flange yoke with a soft hammer to remove the two remaining races.

TO EXAMINE AND CHECK FOR WEAR

The condition of the spider journals should be ensured also that of the needle bearings. It is important that the bearing races are a light drive fit in the yoke and if slackness exists here it is almost certain that the holes have worn in an oval fashion and must therefore be renewed. IF DESIRED A REPLACEMENT MAY BE OBTAINED ON OUR SERVICE EXCHANGE SCHEME OF THE WHOLE ASSEMBLY.

In the event of wear of the cross holes in a fixed yoke, which is part of the tubular shaft assembly it should be replaced by a complete tubular shaft assembly. The other parts likely to shown signs of wear are the splines of the sleeve yoke, or splined stub shaft. A total of 0.004″ circumferential movement, measured on the outside diameter of the spline should not be exceeded. Should the splined stub shaft require renewing this must be dealt with by fitting a replacement tubular shaft assembly.

RE-ASSEMBLY

See that all drilled holes in trunnions are cleaned out and pack needle assemblies with one of the recommended brands of grease, which will also retain the needle rollers in place.

It is recommended that cork gaskets and gasket retainers (oil seals) fitted on the trunnions should be replaced.

Insert spider in flange yoke, then using a soft nosed drift about $\frac{1}{32}$″ smaller in diameter than the hole in the yoke, tap the bearing into position. It is essential that bearing races are a light drive fit in the yoke holes. Repeat this operation for the other three bearings.

Refit snap wires using special pliers T24, and taking care that rings engage properly with their grooves. If joint appears to bind, tap lightly with a soft hammer, which will relieve any pressure of the bearings on the ends of the trunnions.

WHEN REPLACING SLIDING JOINT ON SHAFT BE SURE THAT SLIDING AND FIXED YOKES ARE IN THE SAME PLANE AS SHOWN IN FIG. 53.

A single joint does not transmit uniform motion when the driving and driven shafts are out of line, but when two joints are used, as in the case of a propeller shaft, the errors of one are cancelled out by those of the other, and uniform motion is thereby transmitted. Hence the importance of re-engaging the splines correctly when they have been separated.

REAR AXLE

INDEX

ILLUSTRATIONS

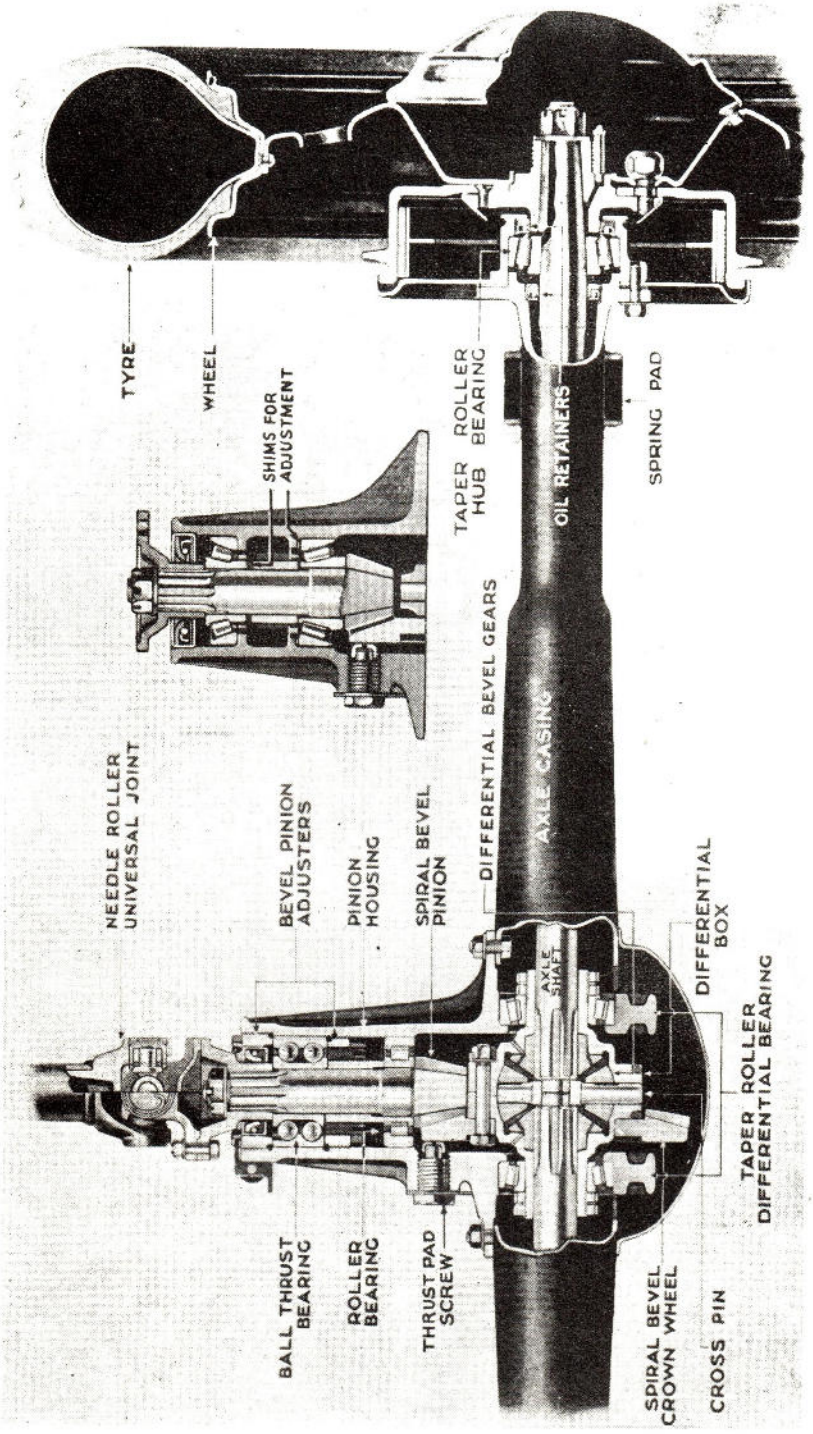


Fig. 57 Section of 12 H.P. and 14 H.P. rear axle.

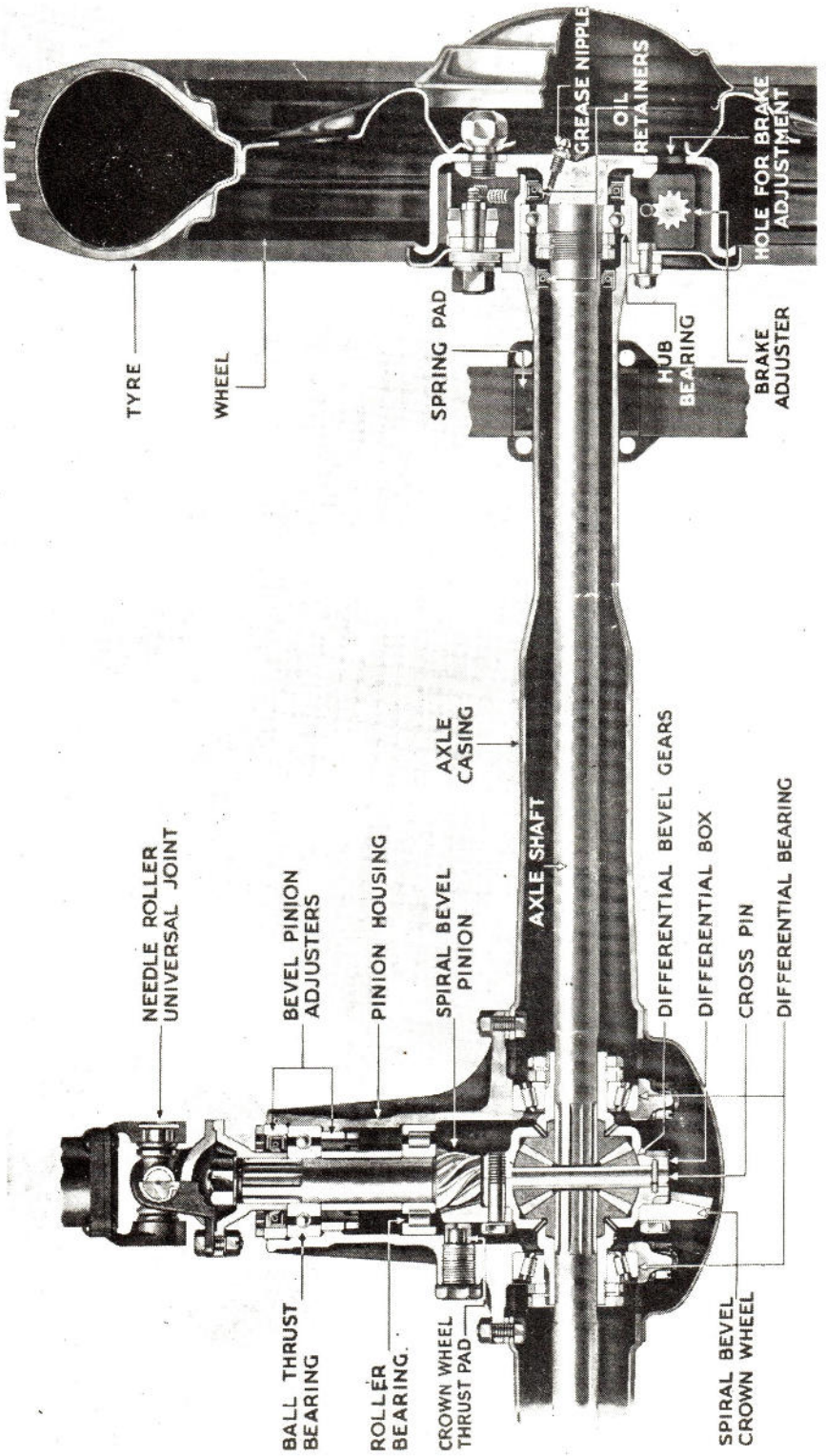


Fig. 58 Section of 8 H.P. rear axle

REAR AXLE

DESCRIPTION

See Fig. 57

The drive to the rear axle is by spiral bevel gear. The spiral bevel pinion (which is mounted on two bearings), the crown wheel and the differential gear being mounted as an assembly in a detachable housing or nosepiece. This nosepiece assembly being attached to a banjo casing which comprises the main rear axle housing and is in turn secured by U bolts to the two rear road springs.

The bevel pinion is provided with a means of adjusting its endwise movement to vary the depth of engagement with the crown wheel. This consists of an adjuster ring at either side of the ball bearing.

The crown wheel is bolted (set screws are used with 8 H.P. models) to the differential unit which has its boss extensions supported by taper roller bearings. These bearings are accommodated in housing which are a part of the detachable nosepiece assembly referred to above. The position of the differential housing and thus the crown wheel may be adjusted in relation to that of the bevel pinion by slackening off and tightening up of the opposite ring nuts on either side of the taper roller bearings.

The differential gear consists of planet bevel gears—two in the case of 8 H.P. models and four with the others—mounted on a spider piece, the outer extremities of which are accommodated in the differential casing. The planet gears which are free to rotate about their own axes, engage with two sun wheels, which are splined internally to fit the two axle shafts, these abutting in the hollow centre of the spider (with the 8 H.P. models they abut against the cross pin). The axle shafts are keyed to the rear hubs with all models except the 8 H.P. models where integral construction of these latter two items is adopted. The axle shafts are semi-floating the hubs being mounted on bearings (taper roller bearings used with the exception of 8 H.P. models where ball bearings are employed) in a housing which is bolted to the flanged ends of the banjo casing. Thrust from a road wheel passes from one axle to the other and is taken by opposite hub bearing.

The drive is transmitted to the crown wheel by the bevel pinion, the crown wheel carrying the differential housing round with it and consequently the sun and planet wheels. The driving torque transmitted to each axle shaft will always be equal and under normal conditions the differential gear will rotate solidly with the crown wheel and the housing. The differential gear will come into operation when cornering and thus road wheels are revolving at different speeds this being permitted by self-rotation of the planet gears about their respective axes and about the sun wheels.

Brake back plates are attached to each flanged end of the axle casing by the six bolts which also secure the hub bearing housings.

Oil seals are fitted between the hub and its bearing as also are they fitted in each axle sleeve. These oil seals, if kept in good order, will prevent any possibility of oil finding its way on to the brake liners. An oil seal is also fitted at front end of pinion shaft in outer adjuster.

A combined oil filling and dip-stick aperture is provided on top of the O/S of the nosepiece and a plug is fitted at the bottom of the central portion of the banjo casing for draining off oil.

LUBRICATION

Extreme pressure oils are used for lubrication of this unit and one of these recommended on Page 25 should be used. Oil should be drained each 5,000 miles and different brands of extreme pressure oils should not be mixed.

Hub bearings call for greasing each 5,000 miles, grease nipples being provided for this purpose.

TO REMOVE NOSEPIECE ASSEMBLY FROM CHASSIS

Where it is necessary to remove this assembly from the chassis the following procedure should be adopted :—

1. Jack up the rear of the car.
2. Detach propeller shaft flanged joint from that fitted on the pinion shaft by withdrawal of the four bolts which secure these. With pre-war models split pins and castellated nuts are used, but with current models Simmonds self-locking nuts are employed.
3. Remove road wheels and detach brake drums by withdrawal of grub screws which secure these to the rear hubs.
4. Remove the six bolts which secure each bearing housing and brake back plate to the flanged end of the axle casing.
5. Draw out the axle shafts complete with hub and bearing housing. Take care not to damage the oil seals fitted in the axle sleeves when removing these axle shafts.
6. Remove the ten nuts which secure the nosepiece assembly to the banjo casing and withdraw unit.
7. Re-assembly is the opposite procedure to the above taking care to fit a new nosepiece paper washer.

TO REMOVE REAR AXLE COMPLETE FROM CHASSIS

1. Proceed as directed in operation 1—5 (inclusive) for " Removal of Nosepiece Assembly."
2. Remove brake back plates after detaching the brake cables from cam levers, removing set screw which secures cable abutment and drawing out cable.
3. Remove " U " bolts securing banjo casing to rear springs. Disconnect shock absorbers and remove bridge pieces for rear axle rebound buffers.
4. Lift axle assembly out of chassis.
5. Re-assembly—installation is the opposite procedure to that given above.

TO DISMANTLE NOSEPIECE ASSEMBLY

This work can rarely be justified in view of the facilities which exist for the supply of a Nosepiece Assembly complete under our SERVICE EXCHANGE SCHEME.

Where it is found necessary for any reason to carry out this work, the following procedure should be adopted :—

1. Having removed Nosepiece Assembly from chassis as directed above, remove the four nuts from bearing cap studs and lift off bearing caps.
2. Lift out differential housing complete with crown wheel and taper roller bearings.
3. Extract taper roller bearings off differential casing. Do not change the relation of the outer and inner portions of taper roller bearings.
4. Remove the eight bolts (six set screws with 8 H.P. models) which secure the halves of the differential box and the crown wheel.
5. Separate the halves of differential case thus exposing the differential gear.
6. Remove castellated nut and driving flange from bevel pinion shaft and force pinion shaft out at the rear of assembly.
7. Remove the locking plate and pin from the outer adjuster and unscrew collar, removing this with oil seal.
8. Drive out through the rear with a suitable drift the roller bearing which supports the rear end of the pinion shaft. Remove distance piece.
9. Remove plate and locking pin which secures the inner adjuster. This is located on the top of the pinion housing.
10. Unscrew inner adjuster and drive out remaining race from the pinion housing, removing this from the front of the assembly.

PRECAUTIONS TO BE OBSERVED ON RE-ASSEMBLY OF NOSEPIECE

1. Examine all parts and replace by new items any of those which are not in a thoroughly serviceable condition, renewing all locking plates and paper washers as a matter of routine. It should be noted that the crown wheel and bevel pinion can only be supplied as a pair.
2. Re-assemble in the opposite order to that given under " Dismantling " adjusting bevel pinion until the end face of this is in line with the inner edge of the teeth on the crown wheel. Adjustment being made by slackening off outer adjuster and rotating **inner** adjuster clockwise or anti-clockwise as necessary to insert further or withdraw pinion from engagement, afterwards following up with the outer adjuster. Do not refit locking plates yet or secure the ring nuts on each side of differential assembly with locking plates.
3. Attach a clock gauge to the pinion housing if such is available (otherwise manual means of judging should give reasonable accuracy) with the gauge contact on the flange of one of the crown teeth at its periphery.
4. Rotate the crown wheel backwards and forwards so as to use up the existing back-lash which should be indicated on the gauge. Adjust the position of the nuts until back-lash is 0.006". Tap each end of differential case to ensure that the outer races are against their respective adjuster nuts and that a good seating of the taper roller bearings is obtained.

   Should an adjuster nut be screwed too far in, it will be necessary to unscrew it further than would normally be required to re-adjust. Tap the end of the other half of differential case to force the bearing outer race back until it makes contact with the adjuster nut. Re-adjust nut into the correct position. Do not **yet** refit locking devices.

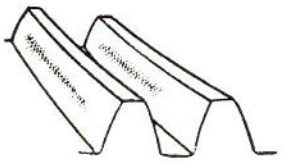
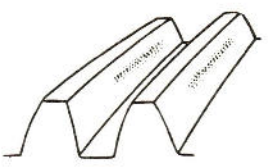
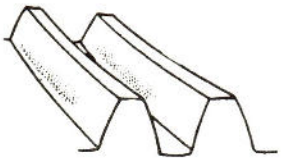
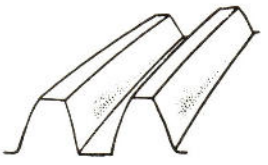
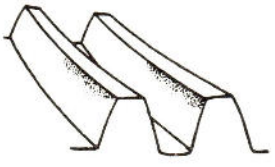
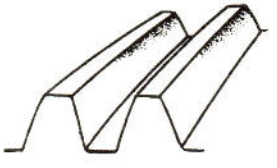
DRIVE SIDE	OVERRUN SIDE	REMARKS
1 	1 	This is the correct marking when gears are mounted in rigid bearings.
2 	2 	Pinion too near centre of crown wheel. Move pinion away from crown wheel and adjust crown wheel for backlash, to obtain correct marking.
3 	3 	Pinion too far away from centre of crown wheel. Move pinion towards crown wheel and adjust crown wheel for backlash, to obtain correct marking.

Fig. 59 **Spiral bevel crown wheel tooth markings.**

Paint a few of the crown wheel teeth with rouge or other suitable marking material. Rotate the crown wheel backwards and forwards so that the teeth on the bevel pinion traverse the painted teeth on the crown wheel. Compare the marking obtained on the crown wheel teeth with those illustrated in Fig. 59 and re-adjust position of bevel pinion by means of the adjusters provided in the light of the " Remarks " column of the quoted illustration. AFTER EACH ADJUSTMENT OF BEVEL PINION RE-ADJUST THE BACKLASH OF TEETH TO 0.006" BY ALTERING THE POSITION OF ADJUSTER NUTS ON EACH SIDE OF DIFFERENTIAL ASSEMBLY, AND WITH END FLOAT IN THE ROLLER BEARINGS JUST ELIMINATED.

6. Having obtained the correct teeth marking (as illustrated in Fig. 59) and a backlash of 0.006" with end float in bearing just eliminated, secure locking plates on adjuster nuts and the locking devices to inner and outer bevel pinion adjusters. Complete re-assembly of Nosepiece.

POINTS TO BE OBSERVED BEFORE RE-FITTING NOSEPIECE

Examine and ensure condition of hub bearings and oil seals. If doubt exists as to the condition of these, the bearings and hubs should be removed from the axle shafts. It is important that the oil seal fitted in each axle sleeve is not rotating in the axle sleeve and that this oil seal together with the one fitted to each shaft has its lip pointing towards the centre of the assembly. If it is necessary to replace any of these oil seals they should be soaked for quarter of an hour before fitting and when fitting the oil seals suitable steps should be taken to prevent damage to the leather or fabric faces. The insertion of a well greased sheath of brown paper between the seal and the part over which it is being threaded is a suitable precaution.

With all models employing taper roller bearings on the hubs (8A and 4/8A fit ball races) it is necessary to ensure the correct end float of axle shafts which should be 0.003"—0.006". This is adjusted by the shims fitted between the brake back plates and the flanged ends of the axle casing. When checking end float of axle shaft first tap each axle shaft screwed end to ensure good seating of the rollers in the respective bearings. It is only necessary to check the end float of one shaft as they butt together in the centre. The end float can be judged accurately enough by manual means but if it is desired a dial gauge may be employed as illustrated in Fig. 60. When " shimming " the brake back plates space the shims required between the two sides to ensure the correct positioning of the brake shoes in relation to the drums. With 8 H.P. models shims are not called for as ball races are fitted, out the existance of clearance between the inner ends of shafts and differential cross piece should be ensured by testing the turning of the respective axle shafts.

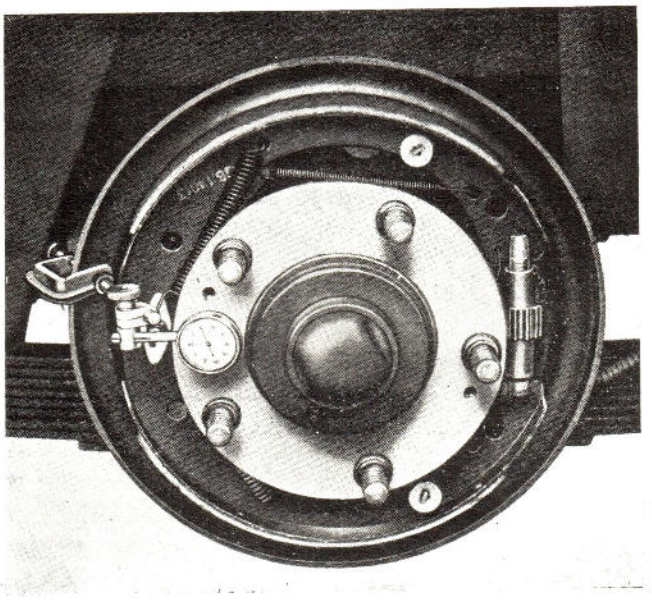


Fig. 60 Measuring rear axle shaft end float

3. Examine brake liners and details, replacing as necessary. If new liners are required it will be necessary to replace those at the front as well.
4. Refit nosepiece assembly to axle and complete installation in opposite sequence to that for " Removal " given on Page 96.
5. Where new brake parts are fitted, it will be necessary to adjust these as directed on Page 104.

NOISY REAR AXLE

Where a noisy axle is experienced, this may be sometimes caused by improper meshing between the bevel pinion and crown wheel, generally as a result of the bevel pinion being too deeply in mesh. In view of the likelihood of the pinion being too deeply engaged always try first the effect of moving pinion away from crown wheel. Proceed, therefore, as follows :—

1. Remove plate from front adjuster and slacken back this slightly.
2. Remove plate and pin from top of pinion housing and with a suitable lever rotate the inner adjuster one castellation in an anti-clockwise direction (looking towards the rear of the car).
3. Refit locking plate and pin to inner adjuster. Tighten up outer adjuster, refit locking plate and test car on road.
4. If an improvement is observed after making this adjustment the effect of a further withdrawal of one serration of the adjuster is permissible but no **more.**
5. If on the other hand the adjustments mentioned in operations 3 and 4 do not affect the noise or make this worse, the effect of increasing the depth of engagement should be tried by slackening off outer adjuster and rotating the inner adjuster clockwise 3 serrations (a net adjustment of one serration) towards the crown wheel. Test car on road and if no improvement is effected either by this adjustment or the earlier withdrawal of bevel pinion from crown wheel it will be necessary to replace the crown wheel and pinion as a pair (or obtain a Nosepiece Assembly under our Service Exchange Scheme). Half serrations of adjustment may be obtained by turning locking plate end for end.

   WHEN ADJUSTING ENGAGEMENT OF BEVEL PINION WITH CROWN WHEEL, ALWAYS SLACKEN OFF OUTER ADJUSTER BEFORE ATTEMPTING TO MOVE INNER ADJUSTER.

OIL LEAKAGE FROM REAR AXLE

Providing the correct oil level is maintained and the oil seals, to which reference has been made above, are in good order, there is no possibility of any difficulty in this direction. The oil seal fitted on the bevel pinion is the most likely to require replacement, but apart from the actual loss of oil it will have no other adverse effect. Leakage past the two oil seals fitted in the axle sleeves and between the rear hubs and the bearings will possibly have more serious consequences, adversely affecting the brakes and if not dealt with immediately new liners may be required to replace those contaminated with oil.

TO REMOVE AND REFIT OIL SEAL IN BEVEL PINION HOUSING

1. Disconnect rear end of propeller shaft by withdrawal of bolts securing two flanged faces together.
2. Remove castellated nut securing flanged joint and withdraw this coupling.
3. Remove locking plate from adjuster and unscrew this latter together with the oil seal.
4. Soak new oil seal for a quarter of an hour in warm oil.
5. Place a sheath of well greased brown paper around pinion shaft and thread oil seal and outer adjuster over this.

   FIT OIL SEAL WITH PROTRUDING LIP TOWARDS CENTRE OF AXLE.

TO REMOVE AND REFIT OIL SEALS IN AXLE SLEEVES AND THOSE ON AXLE SHAFTS

1. Remove axle shafts as directed in operation 1—5 inclusive Page 96.

2. Extract oil seal from mouth of each axle sleeve and remove hubs from axle shafts afterwards withdrawing bearing housing with outer race of taper roller bearing and oil seal (with 8 H.P. models remove two ring nuts afterwards withdrawing bearing housing complete with ball bearing and oil seal). Remove ball race and oil seal.

3. Remove oil seal from bearing housing.

4. Soak the new oil seals in warm oil for a quarter of an hour.

5. Fit new oil seal in bearing housing (in the case of the 8 H.P. model fit ball race). Re-assemble housing, outer race and oil seal on axle shaft avoiding damage to oil seal. (In the case of an 8 H.P. model thread housing complete with bearing and oil seal on to shaft protecting the oil seal from damage. Replace ring nuts.) Refit rear hubs to axle shaft.

6. Renew oil seals in axle sleeves as necessary ensuring that those fitted are a tight fit in the casing and cannot rotate relative to this.

7. Refit axle shafts complete with hubs and bearing housings to axle casing avoiding damage to oil sleeves in axle sleeves.

8. Complete re-assembly of axle in the opposite order to that employed to dismantle.

BRAKES

INDEX

ILLUSTRATIONS

BRAKES

DESCRIPTION

Bendix brakes are fitted to all our models under review. One pair of lined shoes being supplied to each wheel; these shoes being operated by hand or foot.

The **Brake Assembly** (See Fig. 61) consists of a pressed steel back plate (8) which carries the two brake shoes for each wheel, and is bolted to the axle.

The shoes are self-energised by the rotation of the brake drum which results in powerful braking being achieved with little effort on the part of the driver.

The arrangement of the shoes causes self-energising of both the primary and secondary shoes in either forward or reverse directions of braking. The anchor pin (4), which is the fulcrum of the brake shoe, is located at the same point as the cam lever (11) which operates the brakes. Thus, when the brakes are applied, both shoes tend to leave the anchor pin, but due to the brake drum rotation, one shoe is pressed into contact with the anchor pin so that only the remaining shoe (the primary for forward braking) is actually operated by the cam lever. This effect is accentuated in practice by the arrangement of shoes to anchor springs (13) and (14), which allow the primary shoe to lift away more readily than the secondary shoe.

The primary shoe is the leading shoe in forward braking, whilst the secondary shoe is that which remains in contact with the anchor pin. This latter shoe does the greatest amount of work, excepting when the brakes are very lightly applied, because of the increased load applied to the top of the shoe compared with that to which the primary shoe is subjected.

The **Operation** is by enclosed cables which are not affected by oscillation of the road wheels or by steering of the front wheels. They are non-compensated, being connected directly to the brake cross shaft levers.

LUBRICATION

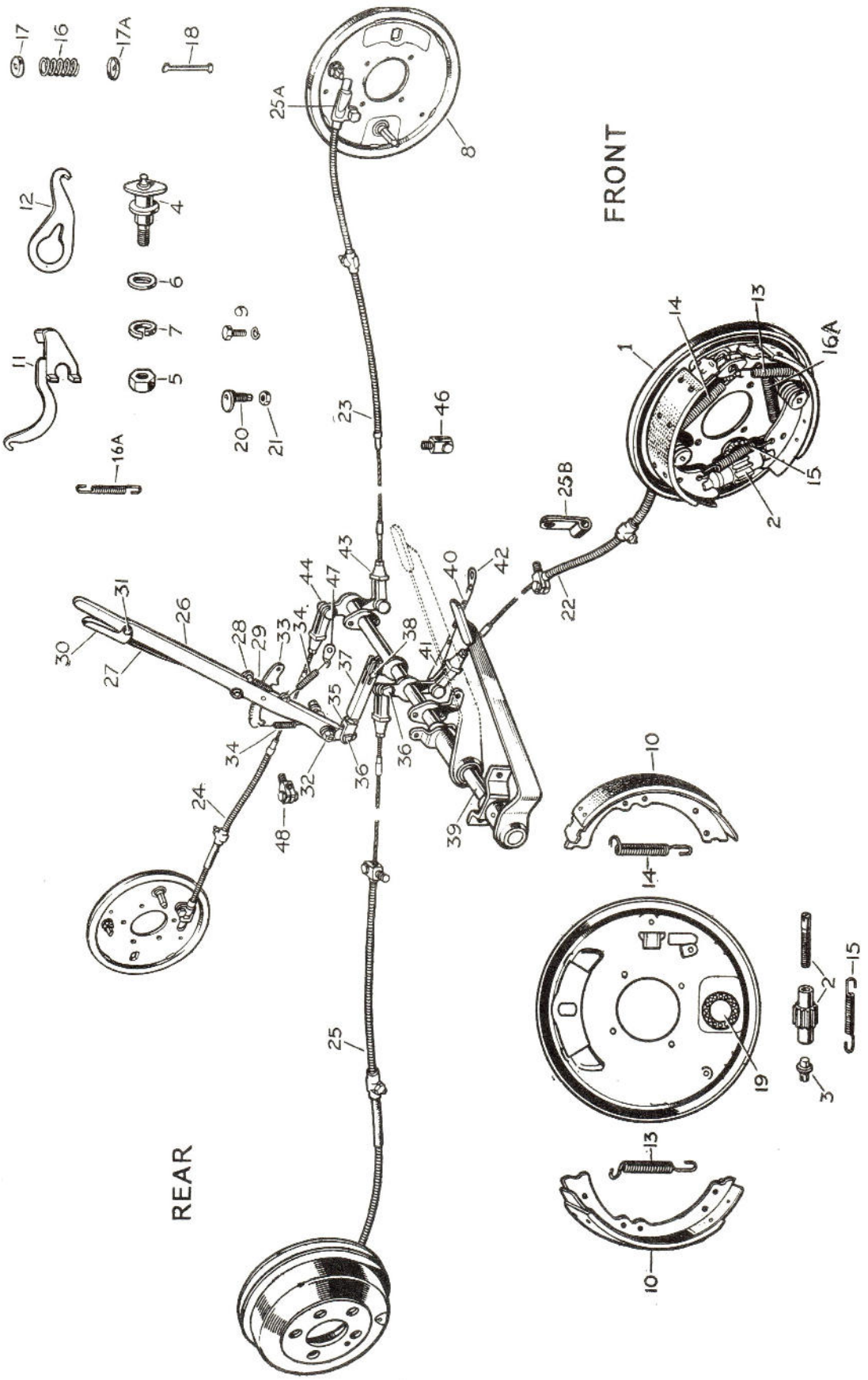
Periodic attention should be given to lubrication as indicated on Page 22. If the greasing of the cables and conduits are neglected, not only will difficulty be experienced with sticking brakes, etc., but also, in frosty weather, there will be a tendency, owing to ingress of water to conduits, for brakes to " freeze on " and to fail to operate.

BRAKE ADJUSTMENT

Each brake is supplied with an adjuster which, in the case of all models, with the exception of the 8 H.P. models, is located on the back plate as shown in Fig. 61. With the 8 H.P. models it is necessary to remove the name plate and to operate the adjuster with a screwdriver through an aperture which is supplied in the brake drum. See Fig. 62.

NORMAL BRAKE ADJUSTMENT

To adjust brakes, the adjusters should all be tightened up solid with the hand brake and foot brake in the " off " position. Then each front adjuster should be slackened off " **eight clicks** " whilst the rear adjusters should be released **" ten clicks."** This release of adjusters should ensure that there is no question of any brake drag and that a little lost movement is present, both in the brake pedal and handlever. It is a wise precaution after this adjustment to jack up all four wheels to ensure that there is no question of any brake rub.



Brake details as used with Beaverette Armoured Car.
For Notation see Page 219

Fig. 61

The brakes should be tested for **balance** after adjustment set out above. To check this, first see that the tyre pressures are correct. Take the car on a quiet road driving at about 25 m.p.h. apply the foot brake hard, the "tightest" brakes will cause their tyres to leave a mark on the road providing that the tyre treads are equally worn. The brakes should then be adjusted accordingly. Slacken off the "tight" brakes to balance them.

Never balance (or equalise) by adjusting up the "slack" brakes as this may result in continuous light rubbing of the brakes when in the "off" position, so leading to overheating also causing loss of speed. If the brakes "pull" to off-side and "off-side" rear wheel leaves no mark, then the tight wheel is probably the off-side front and similarly for the near side. When the brakes are balanced, it should be possible to apply them hard, yet without deviation of the car to one side or the other. **Remember to keep a lookout for approaching traffic before applying brakes.**

PARTIAL OVERHAUL OF BRAKES

(Each 5,000 Miles.)

1. Jack up all four wheels.
2. Detach the four cables from the cross-shaft.
3. Check and if necessary tighten spring "U" bolts, backing plate bolts, steering connections and wheel bearings.
4. Make sure that cables are free in their conduits and well lubricated with Bendix cable grease, that the cross-shaft is well lubricated and operating freely, also that the foot pedal and hand brake lever are in position against their respective stops.
5. Lock shoes in drums by means of adjusters.
6. Adjust cable lengths by screwing fork end further on the screwed end of brake cables just sufficiently to take up all slack without applying undue tension. It should be possible to insert clevis pins easily by hand.
7. Slack off brakes until wheels are just free. Equalise by freeing off "tight" wheels.
8. Balance wheels by taking car on road as described earlier.

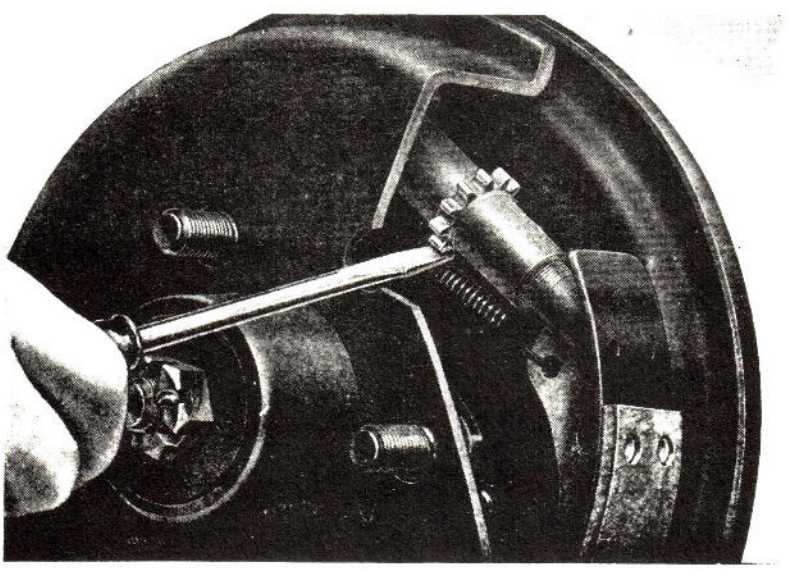


Fig. 62 **Adjustment of 8 H.P. brakes**

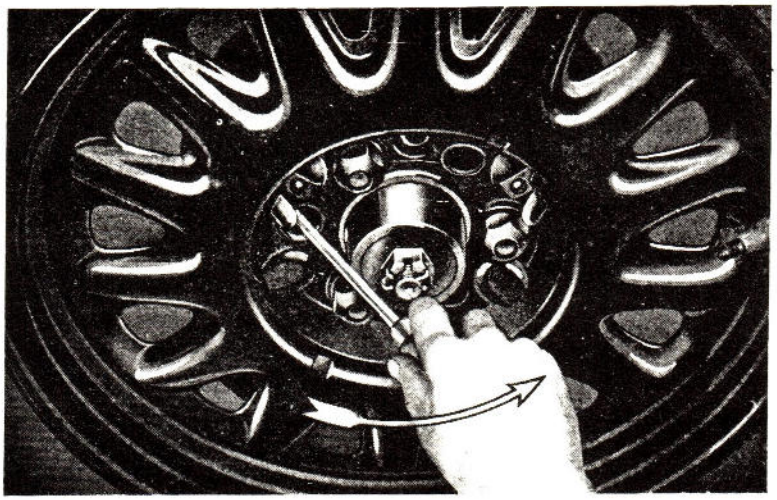


Fig. 63 **Adjustment of 8 H.P. brakes**

COMPLETE BRAKE OVERHAUL

Remove wheels and brake drums and examine brake linings. If linings are worn to rivets or, through previous incorrect adjustment, are unevenly worn, new replacement should be fitted.
Oil or grease soaked liners should invariably be replaced. Scored drums should be skimmed out on a lathe before replacing. **Do not re-line Bendix shoes but fit genuine Bendix lined replacement shoes.**

Where replacement shoes are fitted, the shoe to drum clearance should be checked and set to 0.008″ as follows :—
Slacken off shoe adjusters and loosen anchor pin lock nut sufficiently to just enable the anchor pin to be moved by a light tap with a soft faced hammer. Adjust the position of the anchor pin by light taps with a soft faced hammer as necessary to give a clearance of 0.008″ at either end of the secondary shoe. The clearance should be checked with a feeler gauge introduced through the slot which is provided for the purpose on the brake drum.

Tighten up anchor pin lock nut as tight as possible avoiding any interference with the position of this pin, re-checking clearance after re-tightening lock nut to ensure original clearance.

Brake cables should be examined for " Fraying " after release of conduits from abutments on chassis and from brake back plates. If fraying has occurred or the conduits themselves reveal damage the cables and conduits should be removed by withdrawal of bolts from abutment brackets and unhooking of cables from the cam levers. All worn or frayed cables should be renewed and the cables and conduits thoroughly lubricated. Lubrication of these parts should not be over-done and should be carried out until grease appears at the aperture which is provided for each cable at the brake drum end. Over-lubrication is liable to allow the shoe liners to become contaminated with oil, necessitating their ultimate renewal.

5. Tighten shoes against drums by means of shoe adjusters. Refit cables and conduits in the reverse order of that given for their removal inserting the clevis pins without applying undue tension to the cables (See " Partial Overhaul " Page 104).

6. Slacken off brake adjusters until the brakes are just free. Equalise by freeing off tight wheels, afterwards balancing the brakes on the road as described on Page 102 under Normal Brake Adjustment.

Important.

WHEN BRAKE LINERS ARE DUE FOR REPLACEMENT, FIT BENDIX FACTORY LINED SHOES. DO **NOT** ATTEMPT TO RELINE EXISTING SHOES. BENDIX REPLACEMENTS HAVE CORRECT LININGS WHICH ARE PROPERLY FITTED AND MILLED TO FINE LIMITS.

FUEL SYSTEM

INDEX

ILLUSTRATIONS

FUEL SYSTEM

PETROL PUMP

TYPE AND DESCRIPTION

The AC-Sphinx fuel pump type " T " is operated mechanically from an eccentric on the engine camshaft. Fig. 64 gives a sectional view of the pump, the method of operation being as follows :—

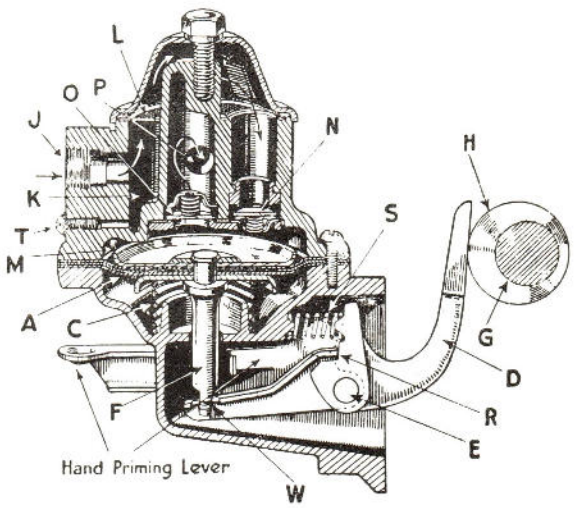


Fig. 64 **Petrol pump in section**

As the engine camshaft (G) revolves, the eccentric (H) lifts pump rocker arm (D) pivoted at (E) which pulls the pull rod (F) together with the diaphragm (A) downwards against spring pressure (C) thus creating a vacuum in the pump chamber (M).

Petrol is drawn from the tank and enters at (J) into sediment chamber (K) through filter gauze (L) suction valve (N) into the pump chamber (M). On the return stroke the spring pressure (C) pushes the diaphragm (A) upwards forcing petrol from chamber (M) through the delivery valve (O) and opening (P) to the carburettor. When the carburettor bowl is full the float will shut the needle valve, thus preventing any flow of petrol from the pump chamber (M). This will hold diaphragm (A) downward against spring pressure (C) and it will remain in this position until the carburettor requires further petrol and the needle valve opens. The rocker arm (D) operates the connecting link by making contact at (R), and the construction allows idling movement of the rocker arm when there is no movement of the fuel pump diaphragm.

Spring (S) keeps the rocker arm (D) in constant contact with eccentric (H) to eliminate noise.

PUMP PRESSURE

It will be seen that petrol is forced to the carburettor float chamber, by the spring (C) acting on the diaphragm. The pressure which the pump can exert, depends on how much the spring is compressed by the cam and lever, during the pump suction stroke. This pressure is balanced by the buoyancy of the carburettor float, which causes a corresponding pressure at the needle valve seat.

As petrol rises in the float chamber, the needle is forced up with greater pressure until it reaches a maximum, corresponding to the pressure of the spring (C) in its most compressed position. Conversely, as petrol is delivered by the carburettor, the petrol level in the float chamber begins to fall, reducing the buoyancy, and so enabling the spring (C) to operate on the diaphragm and force fresh petrol unto the chamber.

Immediately this happens the lever no longer idles, but now pulls down the diaphragm filling the pump chamber ready to continue the supply. When the engine is running, this is a continuous process.

Due to the above reasons, it will be seen that the thickness of packing fitted between the pump and crankcase, should not be varied, otherwise the petrol level in the float chamber will vary. A thinner packing would cause the spring (C) to be more greatly compressed, requiring a greater buoyancy of the float, to balance the pressure, thus resulting in a higher level of petrol in the float chamber. A thicker packing has the opposite effect, resulting in a lower level.

TO CLEAN FILTER

Refer to page 110.

The filter should be examined every 1,000 miles and cleaned if necessary. Under conditions of dust laden atmosphere this mileage interval should be reduced as conditions dictate.

Access to the filter is gained by removing the dome cover, after unscrewing the retaining screw, when the filter gauze itself may be lifted off its seating.

Remove the drain plug and clean out the sediment chamber. Clean filter gauze in air jet or in petrol.

The cork gasket under the filter cover should be replaced if broken or if it has hardened.

When refitting the cover, make certain that the fibre washer is replaced under the head of the screw. Tighten the filter cover retaining screw just sufficiently to make a petrol tight joint. Overtightening will either destroy the cork gasket, crack the cover, or fracture the main casting.

Check set screws securing pump to engine, for tightness, and petrol pipe unions.

TO TEST IN POSITION ON ENGINE

With the engine stopped and switched off, the pipe to the carburettor should be disconnected at the carburettor end, leaving a free outlet from the pump. The engine can then be turned over by hand, when there should be a well defined spurt of petrol at every working stroke of the pump, namely, once every two revolutions of the engine.

TO REMOVE FROM ENGINE

It is easier to clean the filter and sediment chamber with pump removed.

Firstly, the pipe unions should be disconnected. The two set screws fixing the fuel pump at the engine crankcase should then be unscrewed, after which the fuel pump will come away readily.

TO DISMANTLE PUMP

Before commencing dismantling, clean the exterior of the pump and make a file mark across the two flange edges for guidance in re-assembling in the correct relative positions. After separating the two main castings the further dismantling of the components associated with each is quite straightforward. The diaphragm and pull rod assembly can be withdrawn by first of all turning it through 90°. See Fig. 65. No attempt should be made to separate the four diaphragm layers from their protective washers and pull rod, as this is at all times serviced as a complete assembly, being permanently riveted together.

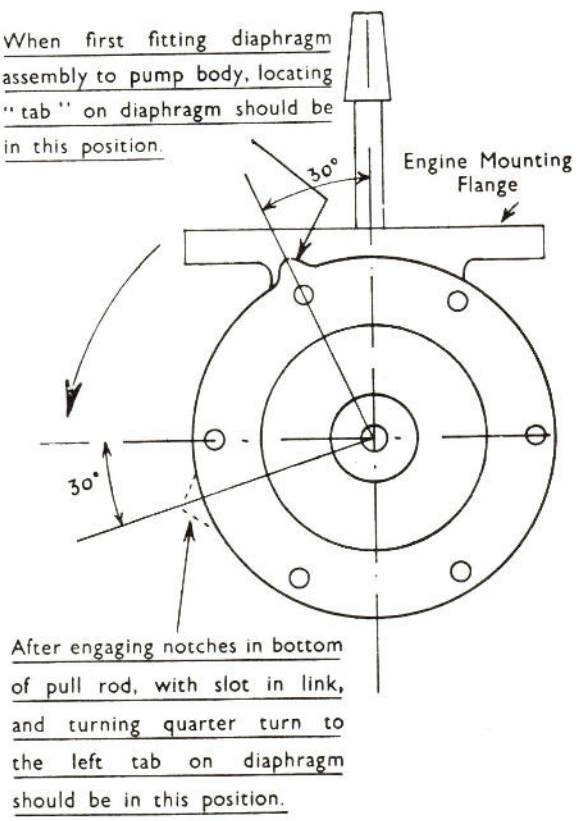


Fig. 65. Fitting Diaphragm to Petrol Pump.

INSPECTION OF PARTS

Reference Numbers apply to Fig. 66

Firstly all parts must be thoroughly cleaned to ascertain their condition. Wash all parts in the locality of the valves in a clean paraffin bath separate from that employed for the other and dirtier components.

Diaphragm and pull rod assemblies should normally be replaced unless in entirely sound condition without any signs of cracks or hardening.

Upper and lower castings should be examined for cracks or damage, and if diaphragm or engine mounting flanges are distorted these should be lapped to restore their flatness. Where hand priming lever (10) incorporated in lower casting, is broken, the parts should be replaced, the outer end of the spindle being riveted over by hand tools after correctly locating the various components.

All badly worn parts should be replaced, and very little wear should be tolerated on rocker arm pins (13), the holes and engagement slot in links (9), holes in rocker arms (12). On the working surface of the rocker arm which engages with the engine eccentric slight wear is permissible, but not exceeding 0.010 in depth. The valve seat incorporated in valve plate (24) should be examined and, if at all roughened, should be carefully lapped flat on a smooth carborundum stone. Similarly, the corresponding outlet valve seat incorporated in the upper casting (22) should be examined and, if worn unevenly to the slightest degree, both the upper casting and valve seat assembly must be replaced. It is not practicable to refit new valve seats into the casting as this calls for special equipment. Fuel pump valves (23) should be replaced if at all worn, although in an emergency they can be turned over to provide a fresh surface to the valve seat. Valve spring (21) should preferably be replaced, although they can be refitted providing they do not bear undue evidence of rubbing away on the outside diameter. In no circumstances should valve springs be stretched in an endeavour to increase their strength. Diaphragm springs (18) seldom call for replacement, but where necessary ensure that the replacement spring has the same identification colour and consequently the same strength as the original. All gaskets and joint washers should be replaced as a matter of routine.

NOTATION FOR FIG. 66

Ref. No.	Description.	Ref. No.	Description.
2	Diaphragm Assembly	18	Diaphragm Spring
3	Body	19	Rocker Arm Spring
4	Dome Cover	20	Spring
5	Filter Gauze	21	Valve Spring
6	Washer	22	Upper Casting
7	Fibre Washer	23	Fuel Pump Valve
8	Cork Gasket	24	Valve Plate
9	Link	25	Valve Plate Gasket
10	Hand Priming Lever	26	Screw
11	Drain Plug	27	Outlet Valve Spring Retainer
12	Rocker Arm	28	Lock Washer
13	Rocker Arm Pin	30	Oil Seal Washer Spring
14	Retaining Clip	31	Oil Seal Washer
15	Packing Washer	32	Elbow
16	Retaining Screw	33	Washer
17	Cover Screw	34	Rocker Arm Stop Screw

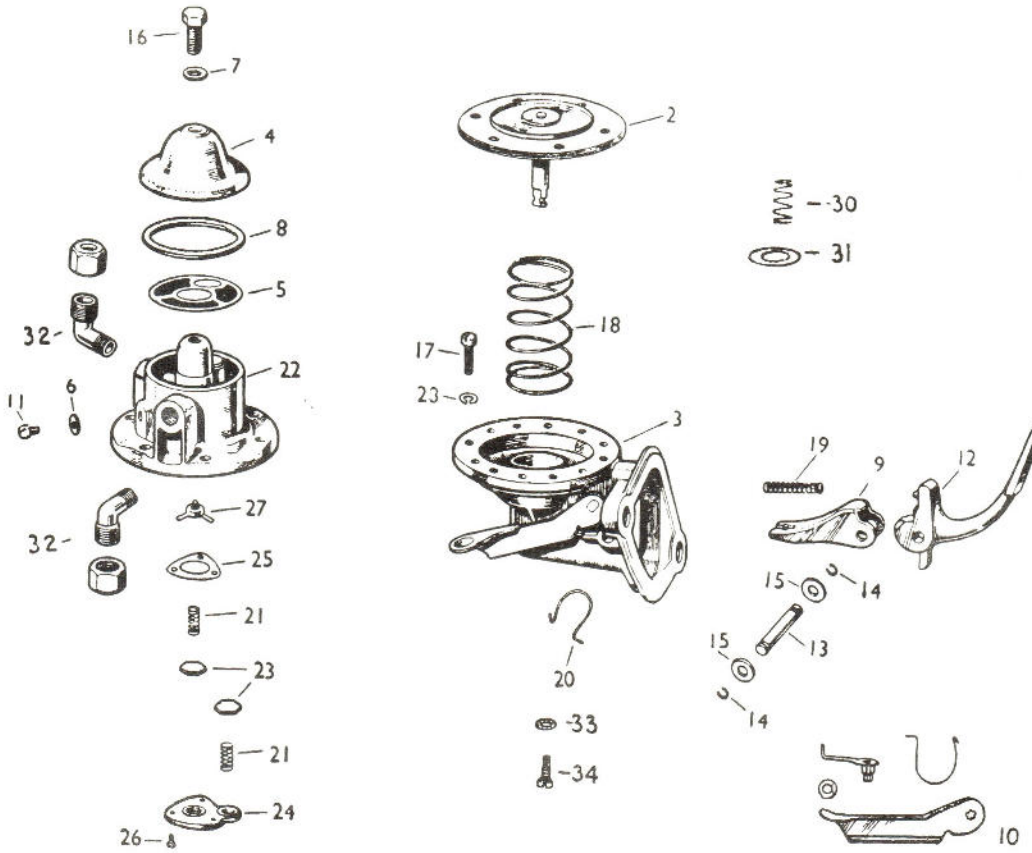


Fig. 66 Petrol Pump Details.

TO RE-ASSEMBLE PETROL PUMP

(a) Upper Portion.

The following procedure should be adopted : dealing with the upper portion of the pump first :—

Place outlet valve spring retainer (27) in pump upper casting (this is the small three-legged pressing which retains the outlet valve spring), taking care not to distort the legs.

Place valve plate gasket (25) in position. Valves should be swilled in clean paraffin before re-assembly. Apart from the cleaning effect this improves the sealing between the valve and seat.

Place outlet valve (23) on spring.

Place inlet valve (23) on valve seat located in the upper casting.

Place valve spring (21) on centre of inlet valve.

Place valve plate (24) in position and secure with the three screws (26). (The inlet valve spring must be centred properly in the spring seat formed in the valve plate.) Place filter gauze (5) in position on top of casting, making certain that it fits snugly. Fit cork gasket, cover, fibre washer, and retaining screw as previously detailed (on page 108).

(b) Lower Portion.

To assemble, proceed as follows :—

Assemble link (9), packing washers (15), rocker arm (12) and rocker arm spring(19) in the body (3).

Insert rocker arm pin (13) through hole in the body, at the same time engaging the packing washers, link, and the rocker arm, then spring the retaining clips into the grooves on each end of the rocker arm pin. The rocker arm pin should be a tap fit in

the body, and if due to wear it is freer than this, the ends of the holes in the body should be burred over slightly.

NOTE.—The fitting of the rocker arm pin arm can be simplified by first inserting a piece of 0.240" diam. rod through the pin hole in one side of the body far enough to engage the rocker arm washers and link, and then pushing the rocker arm pin in from the opposite side, removing the temporary rod as the pin takes up its proper position.

(c) **To fit diaphragm assembly to the pump body.**

On pumps where they are fitted thread oil seal washer spring (30) and oil seal washer (31) on to pull rod and turn washer 90 to keep it in position.

Place the diaphragm spring (18) in position in the pump body.

Place the diaphragm assembly (2) over the spring, the pull rod being downwards, and centre the upper end of the spring in the lower protector washer.

Press downwards on the diaphragm, at the same time turning the assembly to the left in such a manner that the slots on the pull rod will engage the fork in the link, ultimately turning the assembly a complete quarter turn to the left, which will place the pull rod in the proper working position in the link, and at the same time permit the matching up of the holes in the diaphragm with those on the pump body flanges. When first inserting the diaphragm assembly into the pump body, the locating " tab " on the outside of the diaphragm should be at the 11 o'clock position. After turning the diaphragm assembly a quarter turn to the left the " tab " should be at the 8 o'clock position. These positions are shown in Fig. 65.

(d) **To assemble sub-assemblies.**

The two sub-assemblies of the pump are now ready for fitting together, and this is carried out as follows :—

Push the rocker arm (12) towards the pump until the diaphragm is level with the body flanges.

Place the upper half of the pump into the proper position as shown by the mark made on the flanges before dismantling.

Instal the cover screws (17) and lock washer (28) and tighten only until the heads of the screws just engage the washers. Release, and push the rocker arm away from the pump so as to hold the diaphragm at the top of the stroke, and while so held tighten the cover screws diagonally and securely. On pumps fitted with rocker arm stop screws (34) and washer (33) these should be removed for the operation and afterwards refitted.

TO TEST PUMP AFTER ASSEMBLY

(a) **With Special Apparatus.**

The best method is by using an AC-Sphinx bench stand, on which the suction side of the pump is piped to a tin of paraffin at floor level and the outlet side of the pump connected to a stop tap and pressure gauge.

First, flush the pump through to wet the valves and seats, and then completely empty it again by continuing to operate the rocker arm by hand with the suction pipe clear of the paraffin. Again operate pump. Not more than 20 strokes should be necessary to secure delivery of paraffin from the pump outlet.

With the same apparatus a second test can be made by working the pump with the tap on the delivery side closed, pressure then being recorded on the gauge. After ceasing to work the pump it should take several seconds for this pressure to return to zero, thus denoting that the valves are seating properly. Also, while there is pressure, the outer edge of the diaphragm—visible between the two clamping flanges—should be carefully examined for leakage and the retaining screws tightened if necessary. When working the pump by hand a somewhat longer stroke is obtained and the pressure developed is apt to be higher than when fitted to the engine.

(b) **Without Special Apparatus.**
When the above apparatus is not available the pumps should be tested, using a pan of clean paraffin as follows :—
Firstly, flush the pump by immersing it in the paraffin and working the rocker arm half a dozen times, then empty the pump by continuing to operate it while held above the bath. Then with the pump clear of the paraffin bath place the finger over the inlet union (marked " in ") and work the rocker arm several times. Upon removing the finger a distinct suction noise should be heard, denoting that the pump had developed a reasonable degree of suction. Afterwards the finger should be placed over the outlet union, and after pressing the rocker arm inwards the air drawn into the pump chamber should be held under compression for two or three seconds ; this should also be done with the pump immersed in paraffin and the clamping flanges of the diaphragm watched for any signs of air leakage.

TO REFIT TO ENGINE

Reverse the procedure outlined for removal from engine. **Ensure that the rocker arm is correctly positioned against the eccentric on the camshaft, as particularly when pumps are inaccessibly mounted there is a possibility of inadvertently getting the rocker arm under the eccentric or to one side, when damage will result after the pump set screws are tightened.** The gasket between the pump and the crankcase should be renewed if unsound.

After refitting to the engine, the pump should be run for a short time and pipe unions and pump examined for the possibility of fuel leakage.

CARBURETTOR

SOLEX CARBURETTOR TYPE F.A.I. AND A.I.C.

(8 h.p. and 12 h.p. Models)

DESCRIPTION (Main Carburettor)

The models FAI and AIC Solex Carburettors incorporate the bi-starter principle, in which the hand-operated mixture enrichment device for starting from cold has two positions, a very rich one for cold starting purposes, and an intermediate one in which the petrol proportion is considerably reduced, and on which the car can be immediately driven away without any possibility of over-dosing.

Describing the main carburettor first of all, reference to the sectional diagram will reveal the following :—

" T " is the main jet carrier, screwed in the rear of which is the main jet itself (G). This meters petrol from the float chamber into the horizontally-disposed channel leading from the jet to the well (A) of the spraying assembly.

Down the middle of this well will be observed an emulsion tube (et) which is located on a conical seating near its upper part, and held thereon by the correction jet (a) which surmounts the whole and locks the emulsion tube immovably.

Main Jet Operation.

The metered petrol from the main jet (G) passes into the well (A), where it meets air drawn downwards via the calibrated air connection jet (a). This passes out through the small holes into the annulus, where an emulsion is formed with the petrol, and the resulting mixture rises to four large spraying orifices, of which two are shown (oo) in the waist of the choke tube. Here the emulsion is caught up in the main air current and passes down to the manifold via the throttle (V).

Pilot Jet Operation.

The idling is effected by petrol drawn from the main jet well via a small channel which will be seen emerging therefrom immediately

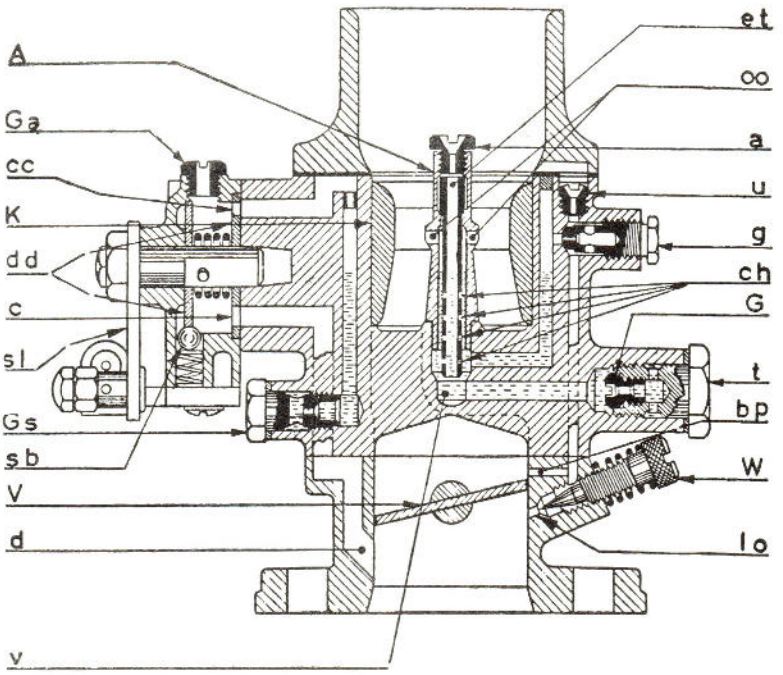


Fig. 67 **Diagrammatic section of 8 h.p and 12 h.p. carburettor**

above the larger horizontal lead from the main jet. This, it will be noted, turns upwards and eventually passes through the pilot jet (g) into the downwardly-disposed channel, communicating with the idling orifice (io) controlled by the spring loaded and knurled-headed taper screw (W).

It will be noted that this orifice is on the engine, and therefore suctional, side of the throttle. A branch lead communicates with another orifice (bp) which enters the airway slightly on the atmospheric side of the almost closed throttle.

When the throttle is in the idling position, the duct in question which we term the " bye-pass," acts as an air bleed upon the idling petrol supply, and therefore prevents over-richness when actually idling. Directly the throttle opens, however, the vane passes to the atmospheric side of the orifice in question, so that both " bp " and " io " function as delivery orifices, thereby proportionately enrichening the output at the transfer position between the pilot and main supplies and thus preventing lean flat spot which might otherwise take place.

Choice of Jet Sizes.

The adjustment of the F.A.I. and A.I.C. type carburettors follows the general lines of all the other Solex models, and consists in the selection of a choke tube (K) of suitable diameter, a main jet (G) of suitable size to correspond with the choke tube characteristic, and a pilot jet (g) to handle the idling end of the mixture curve, which is in turn assisted in effecting a perfect transfer by the air bleed (u) and eventually by the volume screw (w) which determines the idling mixture strength at all points below the actual output value of the jet itself (g).

Sizes of Choke Tubes, Jets, etc.

The sizes of jets and choke tube for use with the various models is given in the General Data Section under " Vehicle Data." As these jet sizes were only determined after a great deal of research they must on no account be altered without reference to Messrs. Solex Ltd.

Jets must not be reamed, nor should wire be used to remove obstructions, which should be done by the employment of air pressure, if swilling petrol fails to dislodge the foreign matter.

Before condemning a jet setting as being responsible for excessive petrol consumption, the difficulty should be investigated as directed on Page 47 and the various possible causes eliminated. Rarely, in our experience, can the carburettor be blamed for excessive petrol consumption, unless it is out of adjustment.

BI-STARTER

DESCRIPTION

Reference to the diagram will show the bi-starter as a disc valve controlled chamber fed via the petrol jet (Gs) and the air jet (Ga), and put into operation by the lever (sl) which rotates the spring loaded disc (dd) until the drillings in the right hand disc register with the ducts (cc) by which the petrol enters and (c) by which the eventual mixture passes into the airway below the throttle at (d).

There is provided a very rich mixture which will ensure easy starting under the coldest conditions, and then, by pushing the lever back a short distance, another very much smaller drilling in the inner disc comes into operation, its effective position being located by the spring-ball (sb) which makes contact with a corresponding notch in the outermost disc. This cuts down considerably the mixture strength and permits either of prolonged " semi-idling " for warming-up purposes or of the engine being driven straight away under load without any fear of fuel over-dosing.

When the temperature has reached the point where the assistance of the intermediate starting mixture is no longer necessary, the actuating knob is pushed fully home and the holes in the right-hand disc fail any longer to correspond with the channels (c) and (cc).

As in the case of the main setting, the bi-starter is adjusted to suit the needs of the engine by a suitable selection of the air jet (Ga) and the petrol jet (Gs).

DISMANTLING THE CARBURETTOR

In evolving models F.A.I. and A.I.C., the principles of simplicity and accessibility have been followed.

It will be seen that in either model, the pilot jet (g), the main jet (G), the starter air jet (Ga) and the starter petrol jet (Gs) are all accessible from the exterior without dismantling the carburettor.

Access to the interior is quite easy and obvious. In both cases the air cleaner should be removed.

In the case of the 30 m/m F.A.I. carburettor, two slotted square-headed bolts, and in the case of the A.I.C. three, will be found securing the top casting to the remainer of the carburettor.

Removal of these will allow the top to be removed, exposing the float chamber, air correction jet (a) and pilot jet air bleed (u).

It will be seen that the float can be lifted out quite easily, and only a small well fitting screwdriver is required to withdraw (a) and (u) should it be necessary to remove these for cleaning.

N.B. In the 35 and 40 m/m F.A.I. carburettors, the float may be withdrawn after removal of the cover plate and its five (in the latest models, six) securing set screws. When replacing see that the gasket is undamaged and tighten set screws evenly.

THE STARTING DEVICE

The air jet (Ga) and the petrol jet (Gs) are determined by experiment to suit the engine for which the carburettor is issued, and it is very seldom that an alteration is required.

Should adjustment be needed, however, due to change of climate or altitude, never alter the air jet without consulting Messrs. Solex Ltd., or one of their Service Stations, for this is determined once and for all on a cylinder capacity basis.

Use a larger or smaller (Gs) as indicated by symptoms :—

1. If starting from cold is not practically instantaneous, or the engine stalls immediately after starting, a size larger (Gs) is required.
2. If black exhaust fumes occur, or there are other signs of over-richness such as "hunting" immediately after the engine is started, particularly when the knob is pushed half-way in, a smaller (Gs) is required.

MAIN CARBURETTOR

Slow Running Adjustment.

The idling or pilot jet (g) provides the necessary output for idling.

The slow-running screw mounted on the abutment plate of the throttle lever, limits the closing of the throttle, and thus fixes the idling speed of the engine. By screwing in this part the engine speed will rise and vice versa.

The mixture adjustment screw (W) permits the richness of the idling mixture to be varied. By turning it in **an anti-clockwise** direction, enrichment takes place, up to the limit of the pilot jet output and conversely, by clockwise rotation the mixture is weakened.

Poverty of mixture is recognized by the irregular behaviour of the engine and the tendency to stall. Over-richness will cause the engine to " hunt " and tend to stall when the " hunt " becomes excessive.

In order to perfect the slow-running, adjust first the screw on the abutment plate, so as to fix approximately the speed of the engine.

Then experiment with the screw (W) until even running is obtained.

As this operation will generally alter the speed, it will be seen that finally a nice adjustment of both the screw on the abutment plate and the mixture regulating screw (W) will determine the results.

Do not make the mistake of trying to adjust the idling to too slow a speed.

Modern engines with substantial valve overlap and mounted on rubber blocks, do not permit the clock-like tick-over of earlier days to be obtained, about 400 to 500 r.p.m. is the normal idling speed of to-day.

Adjustment for General Running.

Generally speaking, the choke tube fitted to the carburettor is correct, and should not require altering, unless a special performance is required.

To determine what change from " standard " is necessary, it must be understood exactly how correction of main jet output is effected.

The following details will be more easily grasped by reference to the diagram.

When the engine is at rest, the assembly is filled with petrol to a position closely approaching the spraying orifices (oo) but directly the throttle opens and creates a draught in the choke tube (K) two things happen.

The petrol output from below increases in virtue of the rising depression in the choke tube waist, and if not corrected would do so by a gradually rising curve. In other words, it would become automatically richer as the speed rose. It is, therefore, the function of the emulsion tube (et) to adjust this mixture to the needs of the engine, and it is done by varying the size of the correction jet (a).

The bigger the correction jet, the greater is the volume and velocity of correctional air, which passes vertically downwards and out into the annular or reserve well (v).

Here it meets with the petrol, which it emulsifies, and reduces the mixture strength by a curve which runs in direct opposition to the rising curve of an uncorrected output, in virtue partly of its relieving progressively the air depression, and partly on account of the mechanically obstructive effects which it exercises on the petrol flow.

The main virtue, however, of this layout is that, whereas by ordinary correctional means the whole of the curve is affected, the opposite directions which the fuel and air respectively follow in " Assembly 20 " have the effect of making each member, *i.e.*, the main jet and the correction jet, more or less independent within its own particular sphere of operation. Thus, if we want a rich area at the lower part of the curve, we increase the main jet size without touching the correction jet.

If, on the other hand, we wish only to cut down, or increase the mixture strength at the top of the curve, without interfering with the bottom end, we increase or decrease the size of the correction jet, which gives us the required results without altering the low speed mixture.

By this means therefore, a particularly flexible method of control is obtained, and facilities are thereby given for adjusting correctly, the carburation for engines having unusual characteristics which are apt to be outside of the range of ordinary methods of carburation correction.

To give a practical illustration, let us assume we are carburetting an engine which normally takes a standard combination of :—

25	120	240
(Choke Tube)	(Main Jet)	(Correction Jet)

It may be found in a particular instance that all round results are good, but for bottom end performance, main jet is 120 unnecessarily large, for fitment of size 115 gives equally good results from the point of view of acceleration and flexibility.

With main jet 115, however, we note that there is a falling off in power and speed at major throttle openings, indicating, of course, an insufficiently rich mixture.

In such a case, reduction of the correction jet to size 220 or 200 will almost certainly give the desired results, with obviously greater economy, since a smaller main jet is now in use.

Taking an opposite example, we will assume the following setting is normally required :—

25 (Choke Tube) 115 (Main Jet) 240 (Correction Jet)

It is found in this instance that acceleration is poor, there may even be a definite " flat-spot," but all-round performance apart from this defect is satisfactory.

We require obviously, therefore, a richer bottom end " mixture, so we substitute main t size 120. Results are now satisfactory, but we id petrol consumption has suffered, particularly at high speed running. This means that e " top end " mixture is now too much. Raise the size of the correction jet to 260 or 280 and satisfactory results will be immediately forthcoming.

It will be seen from these examples that " Assembly 20 " is easily handled, and that refined carburation is speedily obtained with a minimum of trouble and time.

All adjustments to the idling and main mixtures must be carried out when the engine is at normal working temperature.

We particularly warn users against ever attempting to ream jets.

General Notes

During cold weather, when the engine has remained at rest for a lengthy period, it is advisable to give it a few turns by hand to break the oil film **before switching on the ignition and before pulling out the dashboard knob of the Solex starting device.**

After a long period of disuse, it is advisable to make use of the priming lever, fitted on the petrol pump, to fill the carburettor float chamber before attempting to start the engine.

Similarly, if the car has been standing for some time, say two or three days, the petrol in the float chamber may have become stale. Difficult starting may result during cold weather, and it is well, therefore, to pump in a fresh supply before attempting to start the engine.

SOME NOTES ON THE STARTING DEVICE

The auxiliary carburettor forming the arting device, is constituted as already exained to give :—

A mixture which is richer proportionately as the temperature is lower, in order to ensure instantaneous starting from cold.

A means of weakening off the mixture rapidly by pushing in the dashboard control half-way as soon as the engine will " take it," thus avoiding all possibility of " piling up " as the engine temperature rises.

..B. For **absolute cold starting,** the dashboard control is pulled out fully and the **main carburettor throttle is allowed to remain in its normal closed idling position.**

We draw special attention, however, to the fact that with the F.A.I. and A.I.C. Solex it is only necessary to pull out the control half-way, *i.e.*, to the Bi-Starter position, when the engine is partially warm.

The Solex Starting device has a secondary function, viz., to assist the main carburettor when driving away immediately after starting the engine, and should not be put out of action until the engine is sufficiently warm to function satisfactorily on the main carburettor, usually within half a mile of driving away.

Thus there are three stages in the use of the latest Solex Starting device :—

(a) Dashboard knob pulled fully out to start.
(b) Dashboard knob pushed in half-way as soon as possible. This stage is effected whilst driving away.
(c) Dashboard knob pushed fully " home " after driving a few hundred yards.
Under no circumstances should the dashboard control be used for starting the engine when hot.

DIAGNOSIS OF FAULTS

There is never any question of definite failure with this carburettor. It is simply a matter of finding the mistake either of fitting or adjustment.

It is well always to approach the diagnosis systematically and avoid doing more than one thing at a time, for if this is not done, it is impossible to ascertain from the eventual results, which was the successful factor.

FLOODING

Loose Joints.

It is easy to see whether any of the extension joints are loose.

The first thing to do, therefore, when a carburettor floods is to verify these various joints.

Grit on the Needle Seating.

This does not, as a rule, occur in the case of carburettors, provided with a filter, and generally only within the first few miles after fitting, in which case, it is usually due either to stray particles of packing material or to particles of oxide or solder which are apt to get loose inside the petrol pipe. Remove the needle valve and clean same by carefully blowing it out and noting by suction test that it is hermetic, after which replace it and be sure that the washer is perfect and the tightening adequate.

N.B. Never attempt to " grind in " a needle valve. In cases where damage to seating is only small, a new seating can be made by removing the complete needle valve assembly from the carburettor, placing it on a hard surface, and lightly tapping the needle " home " rotating it between every two or three taps.

Punctured Float.

If any petrol gets into the float, its weight is, of course, increased, with the consequence that the level is raised and flooding occurs via the jets. In such a case one must either change the float or locate if possible, the point of leakage, and solder same. To do this, immerse the float under boiling water, when the emergence of bubbles will disclose the puncture, and cause the petrol to evaporate. The hole can thus be soldered as a temporary measure only, as the solder will unbalance and overweight the float. A new float should be obtained as soon as possible.

Too much Fuel Pressure.

26 and 30 m/m carburettors are normally fitted with needle valves of which the diameter of the seating is 1.5 m/m.

With mechanical and electric fuel pumps, it sometimes happens that the pressure developed by them is in excess of normal, and flooding or excessive petrol consumption results.

In such cases, the correct procedure, of course, is to have the fuel pump tested, and adjusted if delivering at above the prescribed pressure (See " Pump Pressure " under " Fuel System," Page 107), but the difficulty can sometimes more easily be overcome by fitting a needle valve one size smaller than standard, if a size larger than 1.5 m/m is fitted, as may occasionally be found.

It will be realized, however, that this is merely a compromise, and that to be certain of freedom from trouble, the fuel pump should be checked.

Pressure should not exceed approximately 2 lbs. per square inch. Normal needle valve size for 35 and 40 m/m carburettors is 2.5 m/m.

Stoppage in Petrol Supply.

It is advisable at the commencement to assure oneself that the petrol tap is turned on, that there is petrol in the tank, and by unscrewing the petrol pipe at its union, that the pipework is clear of obstruction.

It often happens, especially after first fitting, that an air lock occurs in the pipe. This is cured in the ordinary way either by removing and priming same or by the temporary application of air pressure to the filler cap.

Vapour locks can also be produced by a petrol pipe too near the exhaust manifold.

A frequent cause of difficult starting is leakage at the pipe unions connecting the fuel pump with the petrol tank. Do not overlook this possibility when endeavouring to diagnose the cause of difficult starting.

Bad Slow Running.

Ascertain that the adjustment is correct. If, even then, good slow running is not obtained, air leakage at some point of the induction

system, probably via worn inlet valve stems in their guides. In this case try a slightly larger auxiliary jet, but not too large, for then the engine will " hunt " when idling. Where there is any choice between two jets which give approximately the same results, always use the smaller one.

Before making any jet alterations, it is well to assure oneself in every case that the jet is clear of obstruction.

If, in spite of trying various auxiliary jets, regular slow running is not possible, excessive induction leakage is certainly indicated, assuming the ignition to be in order and the valve timing normal. The engine in this case will not idle regularly and when one attempts to reduce the idling speed, it will generally stall.

One must realize that slow running is, in such a case, impossible for the engine is actually inspiring, via various sources of leakage, a greater quantity of air than that entering via legitimate channels, so that the correct slow running mixture becomes unobtainable.

BAD ACCELERATION

Bad Adjustment.

Assure oneself by reference to special directions for the particular engine, that the carburettor is adjusted in an average manner.

If the performance is still bad in spite of this, a larger main jet than is normally necessary, may, in some cases, be required, owing to the individual " characteristic " of the engine, but the choke tube as a rule should not be changed.

Defective Ignition.

In the case of battery ignition, note that the accumulators are in good order, but where ignition is by magneto one must recollect that the spark intensity diminishes with the speed and as a rule is aggravated by retarding.

Complete Impossibility of Acceleration.

Assuming that starting and idling are impossible, this can only be caused by obstruction of the main jet, weak ignition, or other engine irregularities.

Butterfly not opening fully.

Note that when the accelerator is depressed fully, the butterfly opens to its greatest extent. This can be checked by observing the position of the limit screw which should be in contact with the boss cast on the outside of the throttle chamber.

Insufficient Ignition Advance.

This is a prevalent cause both of heavy petrol consumption and insufficient top speed and can usually be recognized by inability to make the engine knock on a hill when slowing up with fully advanced spark. In such a case, if advancement at the coupling is easy, it is well to try the effect of setting the ignition, 10 or 15 degrees forward.

Defective Petrol Supply.

This can always be recognized by standard acceleration up to a certain speed at which periodic hesitations and back firing occur, curable always by a slight throttle reduction. For confirmation, make a special test with an independent test tank placed as high as possible on the car so as to ensure a good head.

Silencer Choked.

In certain designs of silencer, this trouble can easily occur after the car has covered a fair distance. It is generally easy to recognize it by the absence of a clearly marked exhaust note at the tail pipe and instead a steady rush of hot gas. To confirm, make a test with the exhause pipe disconnected from the silencer.

OVERHEATING

It is seldom that the carburettor is the cause of this, even in air-cooled engines, and it is definitely, strictly speaking, when water-cooling is concerned.

Too much petrol, or on the other hand, an excessively weak mixture, can certainly raise the temperature, but in no case should it nearly approach the margin of cooling that should be provided by the water-cooling under normal conditions.

Apart from a major examination, the most likely directions in which to work are reducing the mixture, but not to an unduly weak condition, and advancing the ignition as far as possible, consistent with the avoidance of knocking.

A retarded spark will always raise appreciably the engine temperature as will over-weakening the mixture.

A most frequent and unsuspected cause of overheating is furred radiators and water jackets.

When overheating insistently develops, from no external cause that can be located, obtain from a steam engineer, a supply of ordinary boiler de-furring compound with instructions how to use it, and this will almost certainly effect a cure, especially if the car has been used in a district where the water supply is very "hard."

KNOCKING

Knocking is similarly the result of various causes, which as a rule have nothing to do with carburation, such as pre-ignition due to defective plugs, excessive carbonisation, excessive ignition advance, or to mechanical noises which can easily be confused therewith, such as loose bearings, worn pistons, etc.

When knocking is actually caused by carburation, it can only be due to weak mixture and if not curable by one size bigger main jet, other causes must be sought out.

EXCESSIVE CONSUMPTION

Note first that there is no leakage either at the carburettor, the pipework or the petrol tank. Be sure then that the estimation of fuel consumption is correct.

To confirm this, it is always advisable, if possible, to make a definite test over a known mileage in average country with a measured quantity of petrol, either in the main tank, if it is of the type from which all the petrol can be drained, or by the use of an externally placed test tank. The longer the test, the more accurate will the reading be, assuming a non-stop run.

Never estimate petrol consumption either from the speedometer readings or from supposedly accurate quantities delivered from petrol pumps, either of which are subject to appreciable errors.

Insufficient Advancement.

This is a most frequent cause of heavy consumption as mentioned above and it is always well to run with the spark as far forward as is consistent with the avoidance of knocking.

It is well, of course, to note that there is no sign of misfiring and that the carburettor is not flooding, or petrol being lost through other sources of leakage.

Bad Condition of Engine.

The state of the motor has, of course, a very considerable effect upon economy.

It is easy to realize that if compression is lost via worn piston rings or pitted valves, quite an abnormal amount of fuel can in some cases be used to obtain a normal performance. An increase of as much as 100 per cent in consumption can easily result from this cause.

It is, however, as a rule, readily detectable owing to the general lack of power exhibited and in such cases it is useless to attempt to remedy matters at the carburettor.

MECHANICAL FUEL PUMPS

These can explain wastage of fuel where the pressure developed is excessive. The trouble can generally be presumed when flooding occurs whilst descending a hill against the engine and causes fresh petrol to be smelt from the front seats.

If ordinary tests fail to disclose any leakage, a short run with a pint or quart test tank and the pump out of action will confirm if the latter is the cause.

There is also a possibility of air leaks between the rear tank and the pump, which will delay the delivery of petrol to the carburettor.

TROUBLES CAUSED BY AIR FILTERS

An air filter with too small a section of filtering medium will frequently raise the consumption owing to the increased vacuum imposed upon the jet thereby. If this is suspected, make a comparative test with the air filter removed. Should the cause be located here, first clean carefully the filtering medium and try again, but if the consumption is still bad, it is probably the result of the filter itself being too small.

A FINAL WORD

Statistics show that 80 per cent of breakdown and engine troubles are due to ignition faults. Apart from stoppage in the petrol supply, which may be due to a choked jet, it is extremely unlikely that a sudden loss of efficiency is attributable to carburation. Let the carburettor be the last item for examination, therefore, and much time will be saved.

SOLEX CARBURETTOR—TYPE F.A.I.E.

(14 h.p. Engines and Triumph Type 18T and 18TR.)

This type of carburettor is fitted to the 14 H.P. engines which are used with the 14/12 CD Models.

This model is similar in construction and operation to the other models described, but an additional refinement is the incorporation of an economy device, the operation of which is described lower.

The operation of the main jet and pilot jet is similar to that with the F.A.I. and A.I.C. types and a comparison of Fig 68 and Fig. 67 reveals constructional likenesses.

Economy Device.

Figs. 69 and 70 must be considered together in order to obtain a clear picture as to the functioning of this device.

From Fig. 69 it will be seen that the device comprises a spring PS, two diaphragms " b " mounted on a shaft, at the end of which is a valve PV, the whole assembled in a chamber having two sections, PP and PA.

The section PA of the chamber is connected by the channel DT with the sub throttle area, and is therefore under suction when the throttle is closed. In such circumstances, the diaphrams are sucked to the left against the thrust pressure of the spring, and petrol passes through the valve RS into the chamber section PP, the valve PV meanwhile seating itself, and so confining the petrol in the chamber.

Now refer to Fig. 69. When accelerating, the throttle opens of course, thereby relieving the suction in channel DT and the chamber PA. The spring then takes charge, thrusting the diaphragms to the right. The valve PV lifts from its seating and the petrol contained in PP displaces an equal volume in the well PW, which is discharged via the jet PJ into the channel X and Y, finally emerging at the point Z.

From the foregoing it will be seen that in the ordinary course of driving, release of the throttle pedal allowing the throttle to close, or partially so, creates suction once more in the chamber PA so preparing the way for another discharge of petrol from PP when it is desired to accelerate.

There is, however, a secondary and equally important function of this unit.

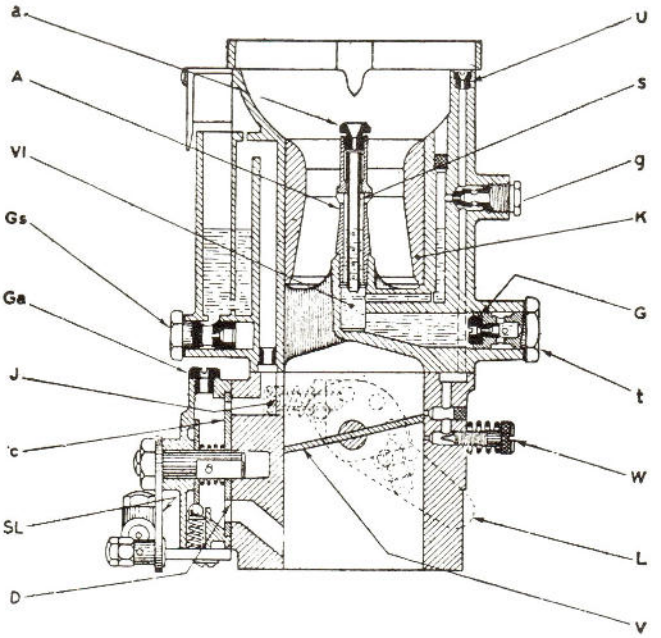


Fig. 68 **Bi-starter and main carburettor (Sectional diagram)**

It will be seen that having fulfilled its duty in supplying auxiliary petrol output for acceleration, petrol is free, at full throttle opening, to flow from the float chamber to the passages PP and PW through the jet PJ to XY and Z.

The point Z, it will be seen, emerges at the common well for supplying the main spraying assembly (See Fig. 70).

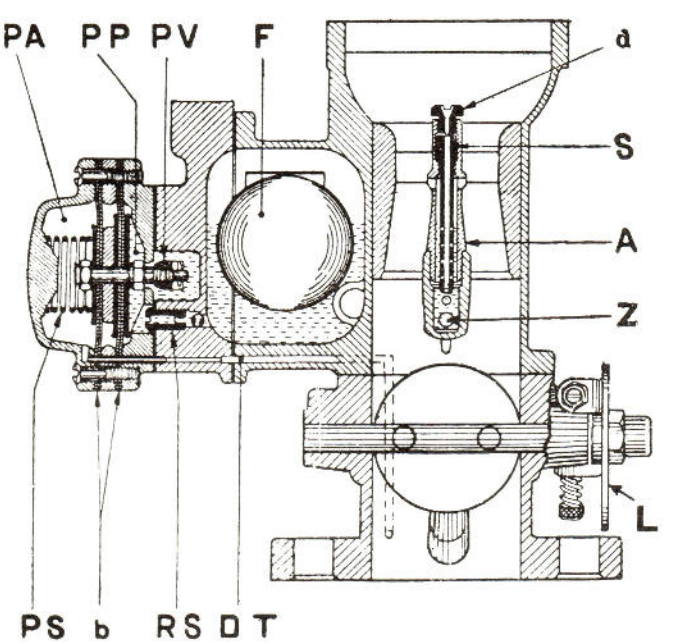


Fig. 69 **Accelerating economy device**

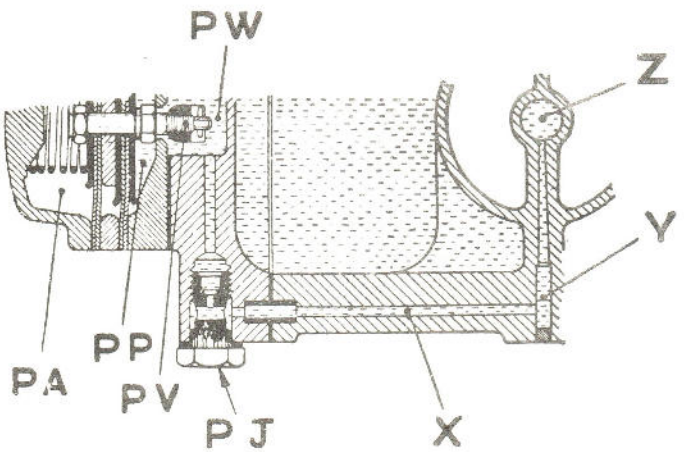


Fig. 70 Plan section, pump and channel

At full throttle opening the combined delivery output of both main jet G and the jet PJ affords a supply of petrol adequate for maximum power, but it will be realized that until the predetermined point at which the jet PJ commences to function as a supplementary static discharge orifice, only the main jet G is in action.

Whilst, therefore, the function of the jet PJ is two fold in supplying extra petrol for acceleration and maximum speed, its operation permits the use of a much smaller main jet G (Fig. 68) than would be possible otherwise, hence the reason for the description " Economy Device."

Adjustment.

The adjustment of F.A.I.E. carburettor follows the lines of the two other models described on Page 112.

Bi-Starter.

The remarks referring to this device on the other types of carburettor apply equally to this model which operates in identical fashion.

Dismantling the Carburettor.

The construction of the model being similar to that of the other models covered in this Manual; an understanding of the procedure for dismantling the carburettor already set out on page 114 will cover the type under consideration as well.

Slow Running Adjustment.

As with the F.A.I. and A.I.C. type carburettor the adjustment of slow running is carried out by suitable rotations of the mixture regulating screw W (Fig. 68) and adjustment in the position of the slow running screw on the abutment plate of the throttle lever. Anti-clockwise rotations of the mixture screw enriches the gas up to the limit of the pilot jet output and clockwise rotations have the reverse affect.

Use of the Dashboard Mixture Control.

The same precaution as those specified on Page 116 for the other model carburettors should be exercised when using starting device and making as quick as possible change over to the normal mixture provided by the main carburettor.

STEERING

INDEX

ILLUSTRATIONS

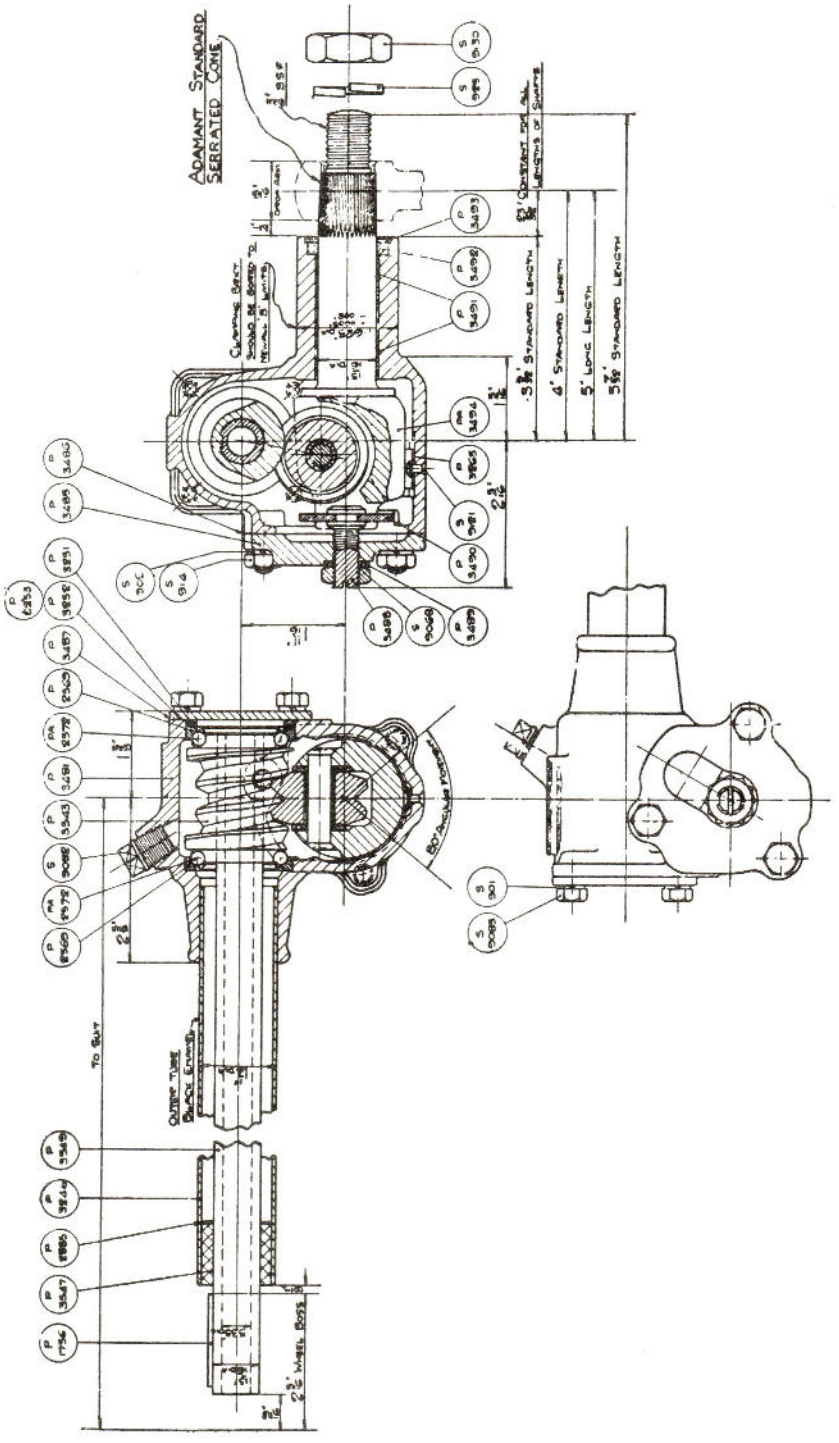


Fig. 71 Marles Steering Gear in Section (as used with 12 H.P., 14 H.P. and Triumph models)

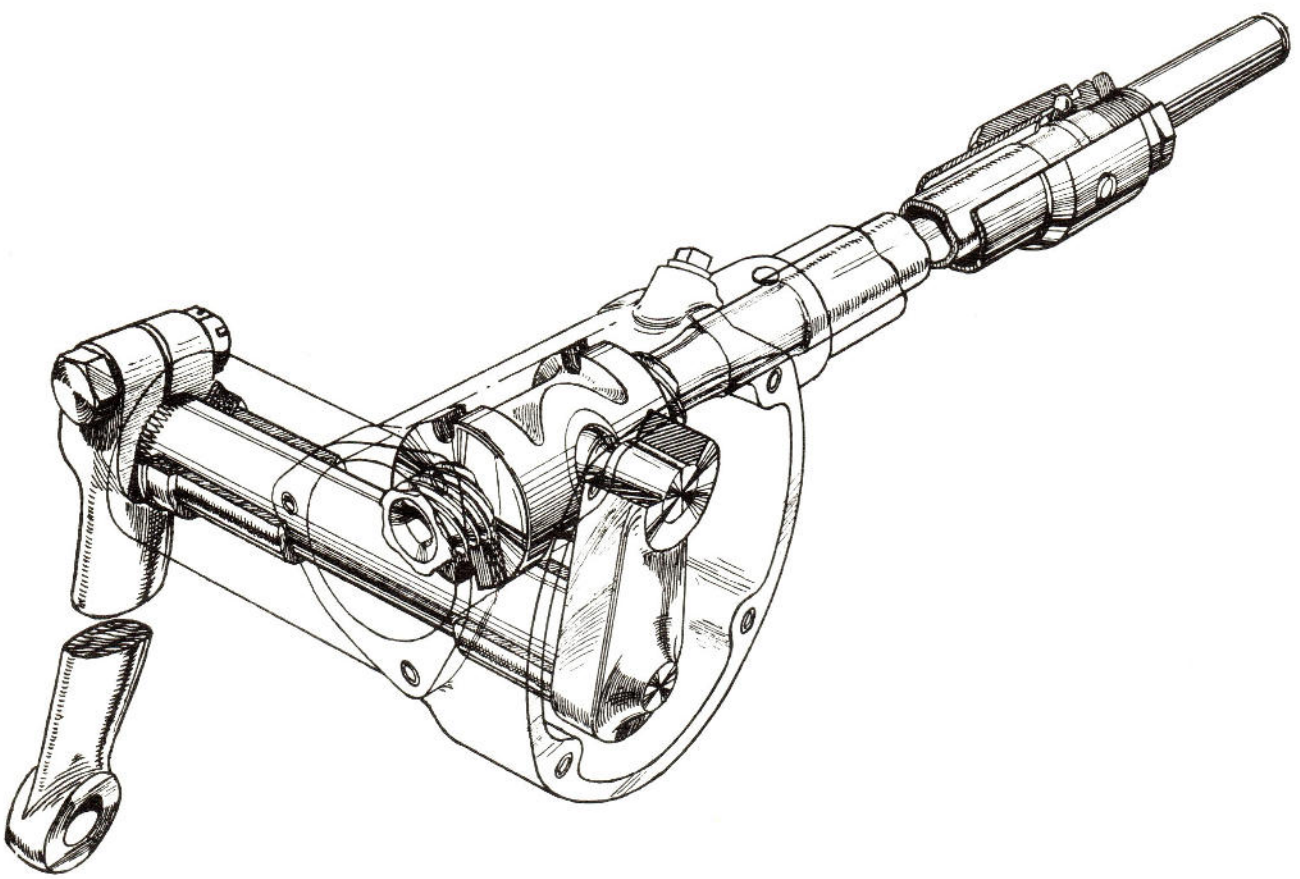


Fig. 72 Steering unit fitted to 8 H.P. and 10 H.P. models

STEERING

DESCRIPTION

(12 h.p. Models (*See Fig.* 71)

The steering gear used with these models is the Marles Cam and Roller type. With this steering gear the cam is mounted on the shaft which carries the steering wheel and the lever, which is provided with a hardened double roller mounted on needle bearings, is carried on the rocker shaft, to which the drop arm operating the steering rods is fixed.

The cam is mounted between two ball bearings. At the upper end of the steering column shaft a third bearing is provided, which consists of a rubber bush which eliminates the possibility of dust entering. The rocker shaft is carried on a large phosphor bronze bearing.

ADJUSTMENT FOR WEAR
(12 h.p. and 14 h.p. Models)

If vertical play in the steering column shaft developes, it may be eliminated by removal of a sufficient number of paper packings from between the steering box and its end cover. These packings are of two thicknesses, namely 0.005″ and 0.010″, the thicker packings being coloured white and the others black.

After a considerable mileage, wear may allow excessive backlash between the roller and cam. In order to carry out the necessary adjustments to remove this backlash it will first be necessary to remove the steering box from the chassis. Before removing the drop arm suitably mark this and the rocker shaft to ensure its correct engagements with the splines on refitting.

Having removed the steering box from the chassis, place the steering in the straight ahead position, which can be found by halving the total number of steering wheel rotations in moving from lock to lock. After slackening off the lock nut on the set screw in the steering box lid and raising the locking washer from its engagement with the stop face on the cover plate, adjust the set screw clockwise with a screwdriver until roller is felt to be engaging with cam.

The set screw must then be slackened back sufficiently to permit the locking washer to engage its stop face on the cover.

The steering gear should then be checked for backlash and in the central or straight ahead position, where clearance is at a minimum, lost motion on the drop arm should not exceed $\frac{1}{32}$″. It should be appreciated, that as the rollers movement is that of an arc of circle, on the extreme locks maximum clearance between the roller and cam exists. In the mid position of movement, there should only be a bare clearance, sufficient to prevent binding.

IT IS IMPORTANT THAT BACKLASH SHOULD BE CHECKED IN THE MID-POSITION OF ROLLERS TRAVEL AND THAT ANY ADJUSTMENT SHOULD BE MADE IN THIS NEUTRAL POSITION.

BURMAN DOUGLAS STEERING GEAR
(8 h.p. and 10 h.p. Models)

DESCRIPTION

The steering gear used with these models is the Burman Douglas worm and nut type (See Fig. 72). The gear consists of a multi-screw or worm, cut on the steering column shaft, engaging in a cylindrical nut. The nut is free to move axially in the main steering box housing, whilst in the side of the nut is accommodated a hardened steel bush in which operates a ball-headed extension of the rocker shaft.

It will be seen therefore, that when the steering column shaft is rotated, the nut moves along its axis and is, in turn, controlled by the rocker shaft ball peg to which it imparts a semi-rotary movement. All end thrusts are taken by a deep grooved journal race on the top end of the steering column, which, being some distance from the worm and nut, allows a partial floating action of these parts.

ADJUSTMENT FOR WEAR (Burman Douglas)

Only one adjustment is provided with this type of steering gear which consists of an adjustable deep grooved journal at the upper end of the steering column. This journal race takes all end thrusts from the steering gear and should be adjusted so as to remove all vertical lift out of the steering column shaft without placing this in tension. Lift in the steering column shaft may be checked by lifting on the steering wheel.

To adjust this journal race, remove the pinch bolt securing the steering wheel to the splines on the steering column shaft, then raise this, after slackening the clamp bolt at the bottom of the steering column, sufficiently to allow access to the adjusting nuts. (Where telescopic steering column is provided the short portion only need be raised.) Having raised the steering wheel slacken off the lock nut and tighten down the adjuster nut sufficiently to remove all lift but not so as to strain the steering column shaft.

After considerable running wear will occur between the worm and nut and may also take place between the ball headed extension of the rocker shaft and the hardened steel bush. The bush in which the rocker shaft rotates will also wear as may the shaft itself. The most satisfactory way of dealing with general wear in this assembly is to obtain a replacement under our **Service Exchange Scheme.**

POSSIBLE CAUSES OF ERRATIC STEERING

(1) **Assembly loose in chassis.**
Check tightness of cross bolt which secures the steering box to the chassis and ensure that bracket at the top of the steering column is firmly secured.

(2) **End play in steering column shaft.**
Where this exists it can be confirmed by lifting on the steering wheel. Adjustment should be carried out as instructed in " Adjustments for Wear " under the appropriate steering gear.

(3) **Play in steering rod ball joints.**
Check steering rod ball joints by moving the steering wheel backwards and forwards, so as to use up backlash, with the road wheels on the ground. Watch for excessive movement at ball joints. Replace any ball joints which are worn by new ones.

(4) **Loose drop arm or steering levers.**
Examine steering levers and ensure that these are not loosely attached to respective stub axles. Similarly check the drop arm for possible slackness on rocker shaft. Normal backlash at rim of steering wheel should be approximately $1\frac{1}{2}$" to 2".

(5) **Play in swivel pin Bushes or Road Wheel Bearings.**
Jack up chassis so that both wheels of the pair under examination are clear of the ground. Rock wheels on swivel pins, and if appreciable wear has occurred replace by new parts. Where play exists in the wheel bearings, it may possibly be mistaken for swivel pin wear, it is politic therefore to adjust these bearings before checking swivel pins bush wear. With all models excepting the 8 H.P. vehicles, where ball bearings are used in the front hubs, a small amount of end float is necessary to prevent the generation of heat and thus over-loading of the bearings. The slotted nuts on the stub axles should be tightened up and then slackened back approximately 3 slots, which will ensure the existence of the necessary end float required with those models using taper roller bearings.

(6) **Bent or damaged rods or levers.**
Bent or damaged levers are best replaced by new parts and under no circumstances

should heat be applied to these owing to the method of heat treatment used originally.

(7) **Wheel and Tyre Pressure.**
Wheels slould be checked for tightness on the respective hubs and rims examined for run-out (See Wheel Rim Damage, Page 144).

(8) **Loose Front Springs.**
Check the front spring securing bolts and if these are loose and have permitted spring movement, the spring should be carefully aligned with the bottom jaw of each " H " piece. If a pair of locators described in the Tool Section are available they should be used to position the spring (See Front Suspension, Page 134).

(9) **Binding on Ball Socket Assemblies.**
Cases of stiff steering have been traced to the ball socket assemblies in as much as these assemblies have been positioned incorrectly in the steering rod ends. The quickest method to employ to correct this is to jack the front wheels up and with the pinch bolts slack at each end of the two steering rods spin the steering wheel backwards and forwards from lock to lock, afterwards tightening up the pinch bolts on the respective steering rods. This method should ensure the socket assemblies assuming that position in which least resistance is offered to movements of the steering wheel. (See also Page 129). Adjust track as necessary following this adjustment.

STEERING GEOMETRY

WHEEL CAMBER

Wheel Camber.

With pre-war models, employing independent front suspension, an adjustment was provided with which the camber could be varied within narrow limits. From experience in the works here we have found that the best results are achieved by setting the adjusters in such a position as to give the maximum positive camber (*i.e.*, wheel inclining outwards at top). By adopting this adjustment as far as possible, the necessity for the use of a camber gauge does not arise and if a check is made it will be found to provide a camber within the prescribed limits of $\pm \frac{1}{2}^\circ$ of the vertical position (with the car laden).

With current models, the camber adjustment was dispensed with and providing the front spring is correctly assembled and a periodic check is carried out on the tightness of the securing bolts, there should be no occasion for variation, other than damage due to accident. The camber with these models also should fall within the limits prescribed in previous paragraph.

CASTOR ANGLE

A castor angle of 3° Positive is used with all the models under consideration and providing there is no question of front spring misplacement, there can be no alteration to the original setting except that caused by accidental damage.

The castor angle controls the amount of " come-back " on the steering and insufficient castor will tend to cause wander and where a solid axle beam is used too much castor may produce steering wobble.

TO MEASURE CASTOR ANGLE

With the type of front suspension used with the models under review, the measurement of castor angle cannot be carried out without the use of special instruments. The instruments required to calculate this angle being a wheel camber gauge and some form of " Wheel Turning Measure " such as that manufactured by Weaver. In the Experimental Shop here we have evolved a special $\pm 20^\circ$ gauge which is **shown** and we usually employ a Dunlop Camber gauge which is also **illustrated.** (See Fig. No. 74).

With the use of the above mentioned tools and the employment of a given constant, the castor angle can be readily obtained by applying the principle given below.

WHEN CASTOR ANGLE IS PRESENT, THEN THE ROAD WHEEL CAMBER WILL CHANGE AS THE WHEEL IS SWIVELLED ON THE SWIVEL PIN PIVOT.

If arrangements are made for individual front wheels to be turned through an arc of 40° (± 20°) then the castor angle is given by multiplying by 1.5 the difference in camber measured at —20° and ± 20° respectively. As previously indicated the front wheels require accurate positioning with some form of Wheel Turning Measure, an illustration of one we have evolved in our Experimental Department is shown in Figs. 73 and 75.

Proceed as follows.

(1) Place the wheels in the straight ahead position.
(2) Turn wheel (wheels must be treated independently) inwards to —20° and take camber reading.
(3) Turn wheel outwards through 40° to +20° position and take second reading.
(4) Subtract camber reading obtained in paragraph 2 from that obtained in paragraph 3 and multiply by 1.5.
(5) The same procedure should now be repeated for the other wheel.

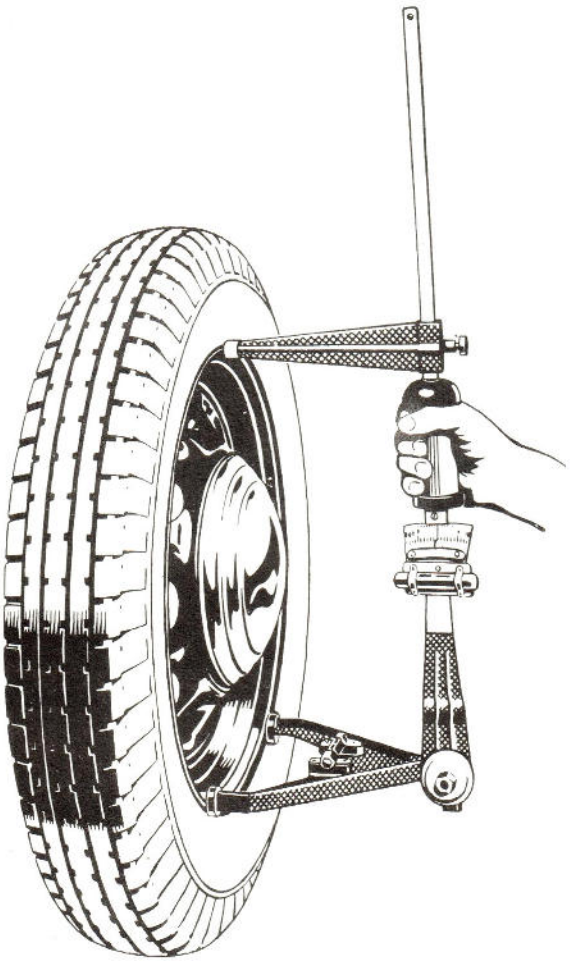


Fig. 74 **Showing use of Dunlop gauge**

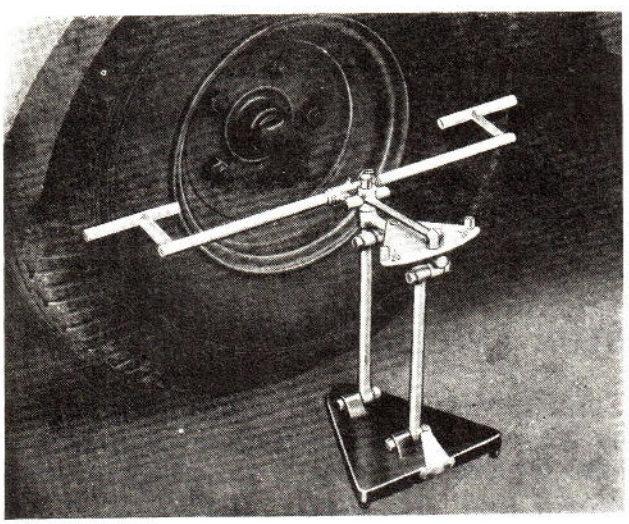


Fig. 73 **Showing use of ±20° Gauge**
In straight-ahead position.

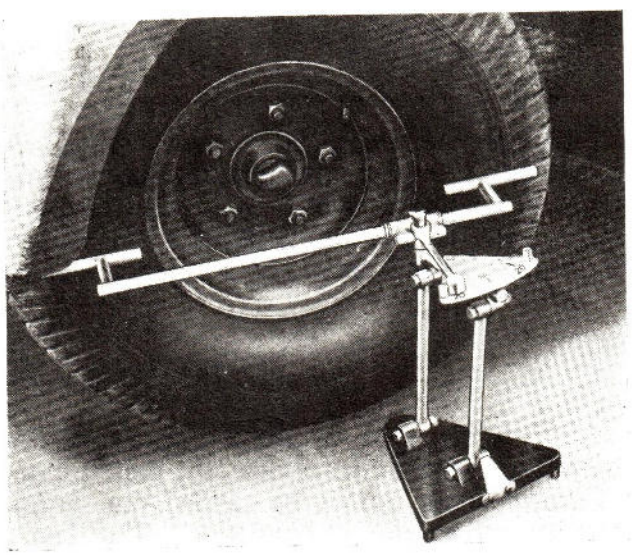


Fig. 75 **Showing use of ±20° Gauge**
In –20° position.

NOTE: It is important that the road wheels should not be allowed to rotate on their bearings whilst these measurements are being made. If this is allowed a constant datum is not maintained and there may be appreciable discrepancies, due to possible wheel rim " run out," in the camber readings taken on different positions on the rim.

An example of these readings is given below for guidance :—

EXAMPLES :	A	B	C
First (—20° reading)	+2°	—½°	+½°
Second (20° reading)	+4°	+1½°	—1½°
Difference Trend	+2°	+2°	—2°

	A	B	C
Castor Angle	+2° ×1.5= 3° Positive	+2° ×1.5= 3° Positive	—2° ×1.5= 3° Negative

NOTE: When the castor angle is positive then the camber increases as the wheel is swung outwards from —20° to +20°. If negative camber is being used the camber will decrease for the same movement of the road wheels.

IF THE CHANGE IN CAMBER IS TOWARDS A MORE POSITIVE POSITION AS IN EXAMPLES " A " AND " B " THE CASTOR ANGLE IS POSITIVE AND VICE VERSA.

HEAVY STEERING WITH 12CD MODEL (1945/46)

Complaints of heavy steering have arisen with early vehicles of this type, which have been explained by the incorrect fitting of the off-side steering tie-rod.

The position of this tie-rod is important and it should be so fitted as to ensure the correct working of the steering from lock to lock, without the ball joints reaching the limits of their designed angular movement.

When making adjustments to the position of the tie-rod, to correct heavy steering, first place the steering in the straight ahead position and slacken clamp bolts on tie-rod. Place tie-rod in such a position as to bring the respective ball joints in the centre of their available movement and position clamp bolts, before tightening these, so that there shall be no question of their fouling the chassis on full lock or due to rebound.

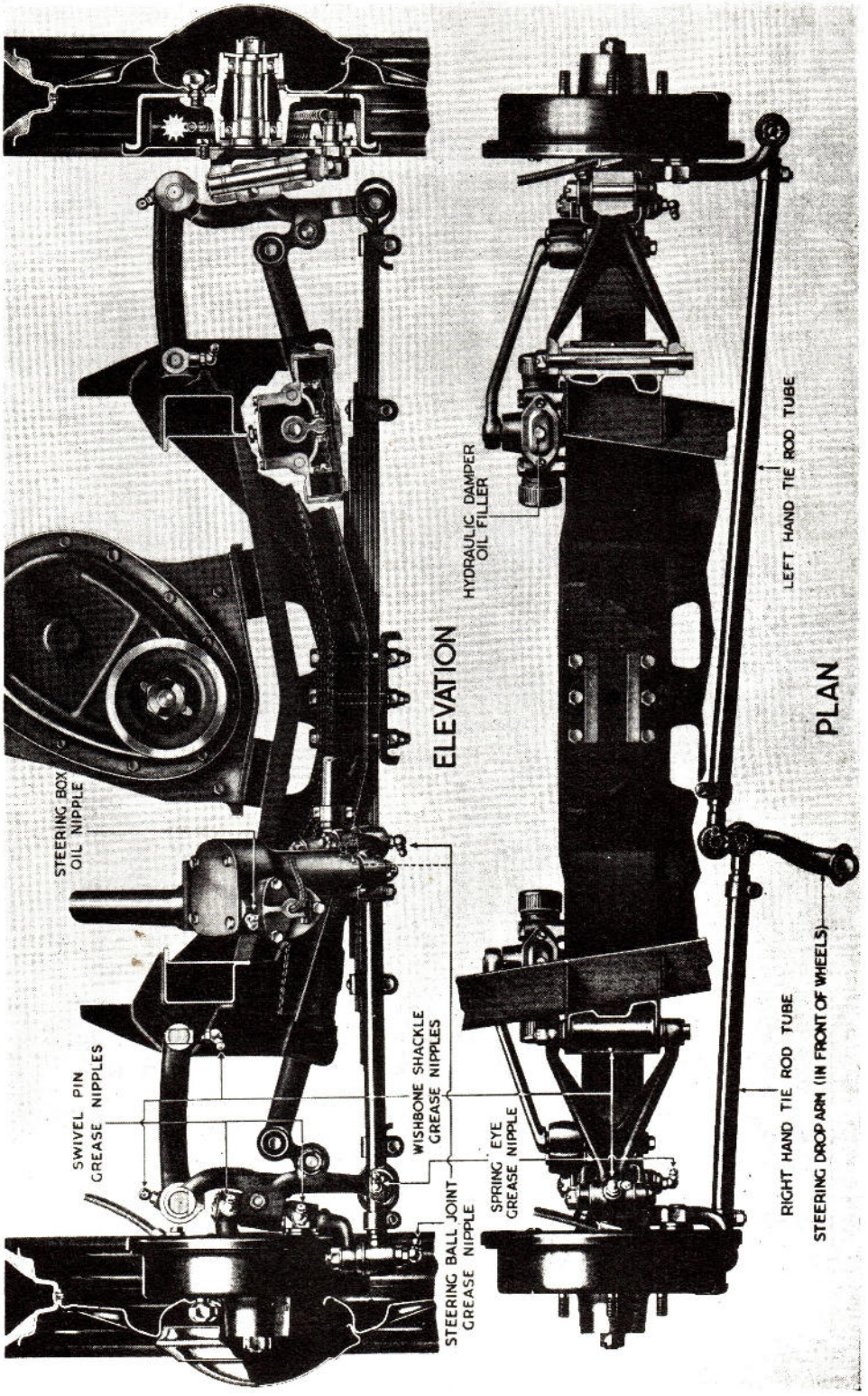
Any alteration which is made to the position of the off-side tie-rod will affect the wheel alignment and should be compensated for by adjustments to the near-side tie-rod. The specified road wheel alignment with the car unladen, should allow a front wheel setting of from parallel to $\frac{1}{16}$" " toe-out." **Adjustments of front wheel alignment should always be made on the near-side tie-rod which is straight.**

FRONT SUSPENSION

INDEX

ILLUSTRATIONS

FRONT SUSPENSION



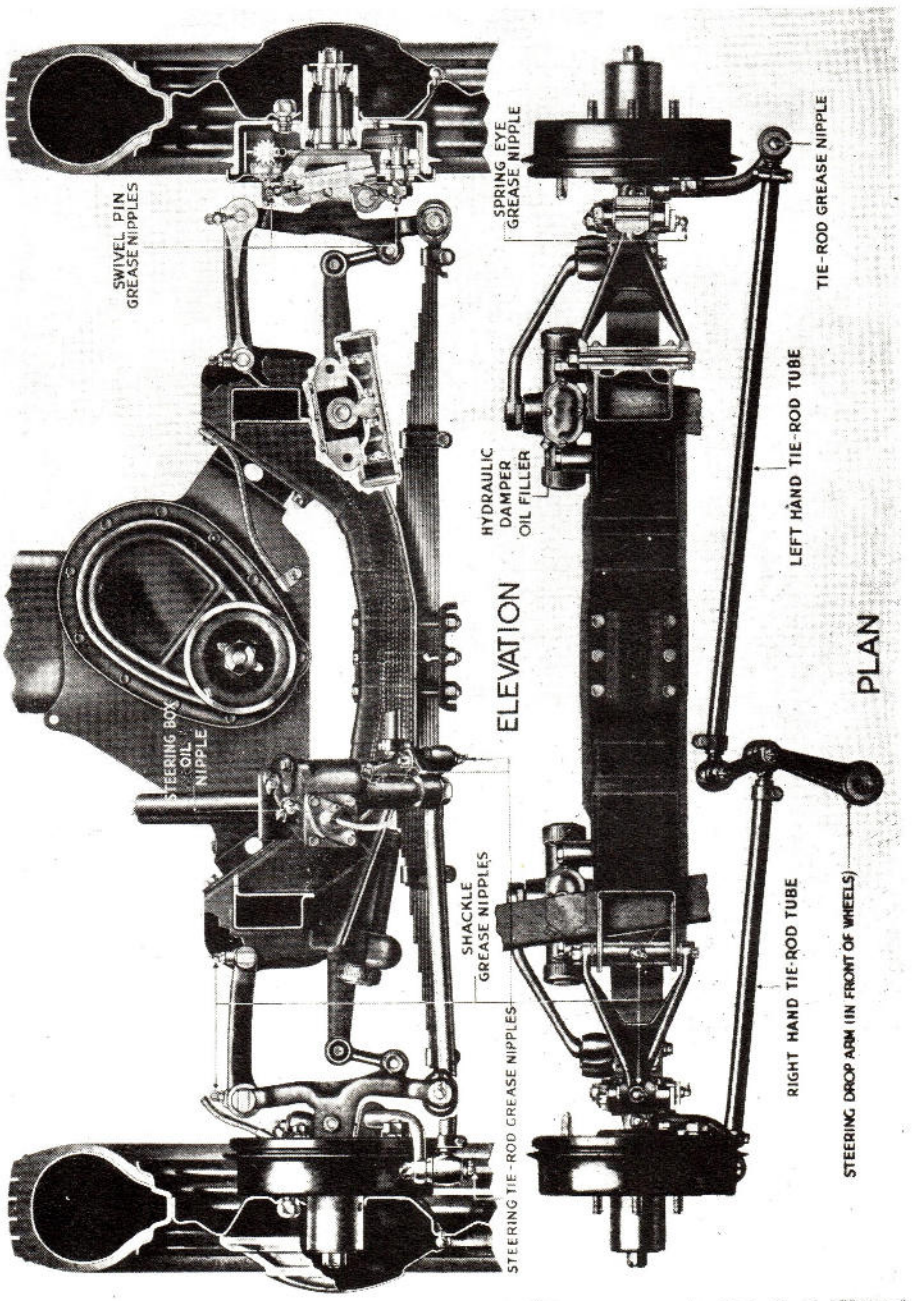


Fig. 77 **12 H.P. front suspension unit**

FRONT SUSPENSION

DESCRIPTION

The front suspension unit consists of a transverse laminated spring, which is bolted to a cross member of the chassis frame and is linked to the frame at either extremity by means of " H " Pieces and shackles. The " H " Pieces carry the stub axles and approximately vertical movements of the road wheels are provided for all normal spring deflections. Spring deflections are controlled by dampers mounted on the chassis frame and attached to eyes on the " H " Pieces by links.

Front Springs.

This spring is bolted to a cross member of the chassis frame by six bolts (with pre-war models four only were employed) a dowel on the bottom of the spring registers with a hole in the clamping plate. The spring eyes are bushed to accommodate the shackle pins which link each extemity to the bottom jaw of the respective " H " Pieces.

" H " Pieces.

These stampings are provided with a pair of jaws at each extremity. The upper pair of jaws accommodates the outer end of the shackle being linked to this by means of a pin passing through a phosphor bronze bush housed in the shackle and separated from the eyes of the jaw by phosphor bronze thrust washers (with pre-war models an adjustable phosphor bronze bearing was used in conjunction with two composition thrust washers). The bottom pair of jaws accommodate the spring eye being linked to this by means of a shackle pin, passing through the bushed eye.

Relative motion between the shackle pins and the eyes in the respective jaws is prevented by projections on the pins which engage with flats on the shackle pin head.

Towards the bottom pair of jaws on each " H " Piece, an eye is provided to which the dampers are attached.

Shackles.

These are of wish bone construction being bushed at the outer end to accommodate the shackle pin which passes through the upper pair of jaws of the " H " Piece (pre-war models were provided with an adjustable bearing).

The inner extremity of the shackle is attached to the chassis frame by means of a shackle pin passing through bushings accommodated in an extension of the cross member upon which the road spring is mounted. The shackle pins are prevented from working in the shackle by means of projecting lugs on the shackle which engage with flats on the head of the shackle pin.

ADJUSTMENT OF CAMBER

With the pre-war models, as already stated above, an adjustable bearing was provided for the Top Outer Shackle pin in the shackle, but with current models no such provision is made.

In actual practice, it was found with our pre-war models that the best position for the adjustable bearing is the one which allows the maximum possible positive camber and this is obtained by offsetting the shackle pins as far as possible from the centre of the chassis. This position has the advantage of giving a setting which can be found without recourse to the use of a camber gauge which may not always be available. Where a camber gauge is available the camber with the vehicle laden should be vertical or within the limits of $\pm \frac{1}{2}^{\circ}$ of that position (for pre-war models), or $1\frac{1}{2}$ to 2 degrees positive for current models.

The fitting of the front road springs is of considerable importance, as upon this, to a large extent, depends the correct steering geometry. Once having fitting the spring, it is similarly important that no relative movement of the spring should occur with its seating and that there is no possibility of this being allowed by slack securing bolts.

In order to fit the front springs we employ a pair of locaters which are listed for inclusion amongst our list of specialised tools.

These locaters are hinged to the side members by application to the bushings provided for the Top Inner Shackle pins and their bottom extemities are then used to align the spring eyes. If these fixtures are not available the spring should be aligned by utilising the jaws of the respective " H " pieces.

With the current models camber is fixed and should require checking only when accidental damage is suspected or to confirm the possibility of front spring movement which would allow a different camber on each front wheel. With both the 4/8A and 12 CD models the camber should be between $1\frac{1}{2}^{\circ}$ and 2°.

TO REMOVE AND REFIT FRONT AXLE ASSEMBLIES

The following sequence of operations should be regarded when carrying out this work :—

1. Jack up front of car.
2. Remove front spring as instructed on Page 141 under " Chassis Suspension."
3. Remove brake drums after removal of securing grub screws.
4. Remove set screws securing brake cables to back plates and subsequently withdraw cables after unhooking these from the operating levers.
5. Disconnect shock absorber arms from their attachment to the respective " H " pieces by withdrawal of nut securing each arm and driving out pins towards the rear with a soft faced hammer.
6. Disconnect the two steering connections from the steering levers by removal of nuts and driving out ball pins, whilst supporting the levers from below to prevent damage to these items.
7. Remove the nuts at the rear end of each Top Inner Shackle Pin afterwards driving these pins out with a suitable drift. The removal of these pins and thrust washers will permit the removal of the shackles and the stub axle assemblies from the chassis frame.
8. Continue to dismantle the assemblies by removal of the Top Outer Shackle Pins, thrust washers and their respective bearings. Pre-war models are provided with eccentric bearings whilst with post war models these are concentric. The eccentric bearings permitted adjustment of camber within small limits. The correct camber setting for all models should be from vertical to approximately 2 degrees positive, when laden. To obtain this camber, it will generally be necessary to place the adjustable bearing, provided with pre-war models, in its outermost position so as to place the shackle pins as far as possible from the centre of the chassis. With post war models the camber angle is fixed by design within the limits specified above.

Fig. 78 Showing use of front spring locator.

9. Dismantle the front hubs after withdrawal of nut and removal of " D " washers from the end of the respective stub axles. Note position of various items for re-assembly.
10. Drive out swivel pins after withdrawal of securing cotter pins.
11. Examine steering levers for damage and only remove where distortion has occurred. **No attempt should be made to apply heat to these levers as this will adversely affect their strength. Slight** damage may be rectified by cold " sets " but the better course is to replace the damaged item by a new part.

Precautions to be observed when Re-assembling.

Re-assembly is approximately the reverse procedure to that set out above paying attention to the following points :—

1. Examine swivel pins, bushes and thrust washers for wear and effect replacements as necessary. For limits, Tolerances see Pages 14 and 18.
2. Examine the front wheel bearings and replace damaged or worn items replacing oil seals as a matter of routine. When assembling front wheel bearings ensure that the outer races " bottom " properly in their respective recesses. Refit assembly to stub axle.
3. Refit " D " Washer and tighten up respective slotted nuts subsequently slackening back approximately 3 slots, afterwards inserting split pins.
4. Ensure the condition of the ball joints and their sockets at each end of the two steering rods, also examine the connecting rods for distortion, not forgetting that the shorter arm of the two is provided, by design, with a bend towards either extremity. These rods, where damaged, may be straightened provided they are not badly " kinked."
5. Examine all shackle pins, bushes and thrust washers for wear replacing these as necessary. Refer to Pages 14 and 18 for tolerances and limits. Do not refit shackle pins and shackles until after the front spring has been fitted and lined up **if locating jigs are to be used,** as these are designed for application to the bushings provided for the Top Inner Shackle Pins.
6. Before refitting front road spring ensure that this is in good order. " Spring Data " is given on Pages 14 and 18. It is most important that when the front spring is refitted that the eyes at each extremity are properly centralized in relation to the respective jaws of the " H " pieces, in this connection reference should be made to instructions given for fitting front road spring on Page 141.
7. Having ensured the proper fitting of the front road spring the re-assembly operations may be continued regarding, in the case of the pre-war models, the off-setting of the adjustable bearings to give maximum possible positive camber which is generally necessary to fulfil prescribed limits.
8. Having completed re-assembly operations the front wheel tracking should be checked and adjustments to the length of the **long steering** rod made, as necessary to provide a setting of the wheels from parallel to $\frac{1}{16}$" " Toed Out." **Adjustments of Track should always be made on the long rod which is straight.** Do not forget to tighten up the clamp bolts and to place these so that there can be no question of their fouling the chassis on full lock or due to rebound.

CHASSIS SUSPENSION

INDEX

ILLUSTRATIONS

CHASSIS SUSPENSION

DESCRIPTION

Springs.

Semi-elliptic laminated springs are employed, one at the front and two at the rear. The front spring is mounted transversely and is bolted to a cross member of the frame by means of a pad and six bolts (four with pre-war models). The rear springs are fitted under the axle banjo and are secured by " U " bolts.

The front spring forms part of the independent front suspension unit and each eye is bushed and accommodates the hardened shackle pin which passes through the bottom pair of jaws on each " H " piece.

The rear springs are anchored at the front to the chassis side members and are shackled at the rear end. Both rear springs are fitted with " Silentbloc " rubber bushes. These rubber bushes consist of an outer and inner steel tube, between which, rubber under compression is introduced (See Fig. 79) which shows in dotted line the shape the rubber would assume in its normal state.

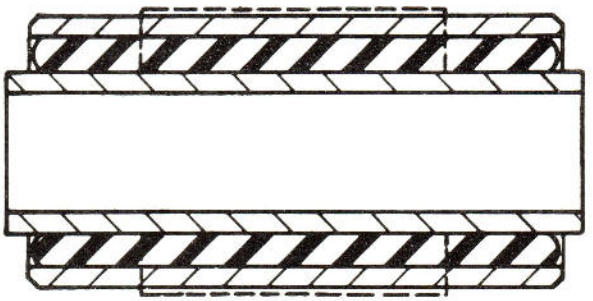


Fig. 79. Silentbloc bush

Shock Absorbers or Dampers.

The inter-leaf friction supplied by the laminated road springs requires supplementing by dampers. With the vehicles under consideration a piston type shock absorber is used which offers greater resistance to rapid oscillations, than to slow ones, and this feature makes them most suitable for damping out axle vibrations.

With the 12CD models a recuperating type of damper is used in conjunction with a torsion bar stabilizer in the case of the rear units. The shock absorbers are dealt with in more detail below.

DAMPERS (SHOCK ABSORBERS)

DESCRIPTION

The " dampers " (the word "absorber " is now discontinued owing to inaptness) fitted to all models described in this manual are of the piston type. The dampers used with current models introduce certain refinements, but the instructions for maintenance and servicing apply equally to all dampers used on the models under review.

Whilst the dampers fitted to pre-war models were of the double acting variety, with the current 12 h.p. models we use a damper which is of a differential type, offering greater resistance to compression than to recoil.

The 1945 8 H.P. models still employ double acting dampers, where the same resistance is offered to both compression and recoil.

Owing to amalgamations, and change of name of the manufacturers of these units, they are now known as the Luvax Girling Hydraulic Dampers.

With the 1945 8 H.P. model, as previously indicated double acting dampers are used. The rear shock absorbers being of the **Pressure Recuperation** type, where a baffle plate is incorporated in the top cover, which prevents the surge of fluid and causes it to be transferred only to the opposite cylinder, ensuring thereby complete recuperation and quietness of operation. This is one of the refinements mentioned above with the later type of damper.

With the 1945 12 H.P. models, as already stated, the dampers used provide more resistance to compression than to recoil and as with the 8 H.P. model pressure recuperation is employed with those dampers fitted to the rear axle.

The type of shock absorber fitted to the various models under review are as set out in the chart given below and an illustration of the damper is given in Fig. 80.

The following features of the piston type damper are summarised as follows :—

(1) Quietness, quick valve operation, absence of frothing and rapid recuperation at all temperatures and speeds.

(2) A baffle plate is incorporated in the top cover, with the Pressure Recuperation Type, which prevents the surge of fluid and causes it to be transferred only to the opposite cylinder, thus ensuring complete recuperation, and quietness of operation.

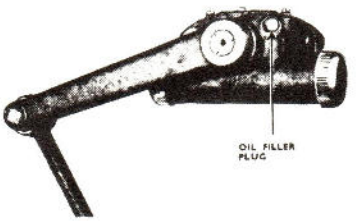


Fig. 80. Shock absorber filler plug.

SERVICING OF DAMPERS

(1) The servicing is similar to that required for the earlier type of piston damper and no provision is made for adjustment, nor is this required.

(2) No attempt should be made to dismantle the movement. A serrated type of lever arm is used and replacement units are therefore supplied complete with arms.

(3) The only attention required on the chassis is the periodical examination of the anchorage to the frame, the fixing bolts being tightened as required.

(4) Connecting link bearings will last for very considerable periods, but are normally renewed when complete overhauls are being carried out. Details of these operations are given later in these instructions.

(5) Dampers should be topped up with Girling Brake Fluid occasionally.

TESTING OF DAMPERS

When the question of vehicle suspension is under consideration, the chassis springs and tyre pressures should be checked.

If the dampers do not appear to function satisfactorily, an indication of their resistance can be obtained by carrying out the following check :—

(a) Remove the dampers from the chassis.

(b) Place in a vice (hold by fixing lugs to avoid distortion of cylinder body).

(c) Move the lever arm up and down through its complete stroke, an even resistance throughout the full stroke should be encountered.

(d) If the resistance is erratic, and free movement of the lever arm is noted, it may indicate the presence of air or lack of fluid.

(e) If the addition of fluid, whilst working the arm, fails to improve the damper action, a replacement should be fitted.

(f) Too much resistance, when it is not possible to move the lever arm slowly by hand, possibly indicates a broken internal part, or a seized piston, in which case the assembly should be exchanged for a new one.

TOPPING UP WITH FLUID

When topping up the dampers with fluid they should always be removed from the chassis, the following procedure being observed :—

(1) Remove complete assemblies from chassis. Retain damper's normal upright position when handling, otherwise air may enter the fluid.

(2) Place in vice, gripping by the fixing lugs, to prevent distortion of assembly.

(3) Use only Girling Thin Piston Type Fluid.

(4) Whilst adding fluid, the lever arm must be worked throughout its full stroke to expel air from the pressure chamber.

(5) Fill absorbers to the bottom of the filler plug hole.

(6) When refitting damper to the chassis, after bolting in position, but before re-connecting links, work the arm through the full stroke several times to make sure no air is present.

BEARING REPLACEMENTS

The special tools as shown in these instructions are required for fitting bearings and a hand press also will be necessary. The tools used for this work will shortly be available from Messrs. Luvax Girling or through our Spares department.

Dismantling Linkage.

Before dismantling the connecting link from the lever arm, the position in which it is fitted, in relation to the lever, should be noted.

With the front assemblies the links are "handed" and although the front and rear units are similar in appearance, they are not interchangeable, the length of the rear links being greater than the front.

It will be noted that the link is fitted inside the lever arm (nearest the damper movement).

Proceed as follows to dismantle linkage :—

(1) Disconnect the links from the lever arm by pressing out the end of the link from the bearings.

(2) Press out the old bearing from the boss end of the lever arm.

(3) The lever arm is a permanent fixture, and no attempt should be made to remove it from its serrated fixing to the rocker shaft.

(4) Press out the pin from the link bearing and the old bearing from boss end of link.

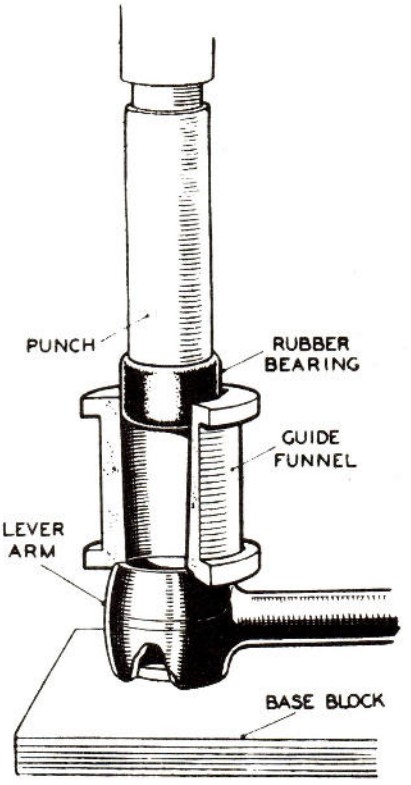
Bearing Assembly—to lever Arm and Connecting Link.

(1) Wash out the boss end of the lever arm and connecting link to eliminate any dirt or grease.

(2) Rest the boss end in position on the base block as illustrated in Fig. 81.

(3) Place the guide funnel in position on the boss end.

(4) Damp the outside of the rubber bush in Benzine (if this is not available petrol or paraffin will serve the purpose) and insert in the open end of the guide funnel.



ASSEMBLING BEARING TO BOSS END

Fig. 81.

(5) With a quick action, force the bearing through the tapered bore of the guide funnel into position in boss end, using the punch or pressure tool as shown in Fig. 81.

To Assemble Pin to Connecting Link Rubber.

(1) Place the boss end, with the assembled rubber, in position on the base block. See Fig. 82 below.

(2) Smear the face of the rubber with petroleum jelly.

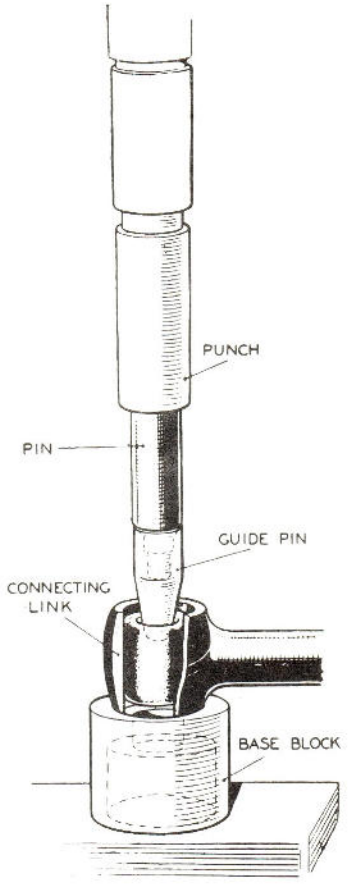


Fig. 82. METHOD OF FITTING PIN

(3) Fit the screwed end of the pin into the tapered guide tool.

(4) Insert the tapered guide tool, together with the pin into the bearing.

(5) With a quick action, force the assembly complete with pin into the bearing.

(6) Remove the tapered guide through the base tool.

Fitting Connecting Link to Lever Arm.

When fitting the link to the lever arm the same procedure will be adopted as was used when fitting the pin to the link. This is illustrated in Fig. 83.

Fitting Tubes (where employed) to Assembled Rubber.

(1) Place the boss end in position on base block as shown in Fig. 84 below.

(2) Smear the face of the rubber with Petroleum jelly.

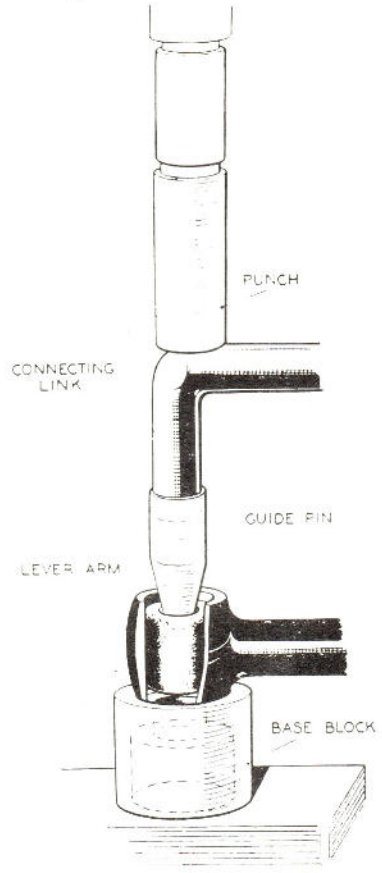


Fig. 83. METHOD OF FITTING CONNECTING LINK

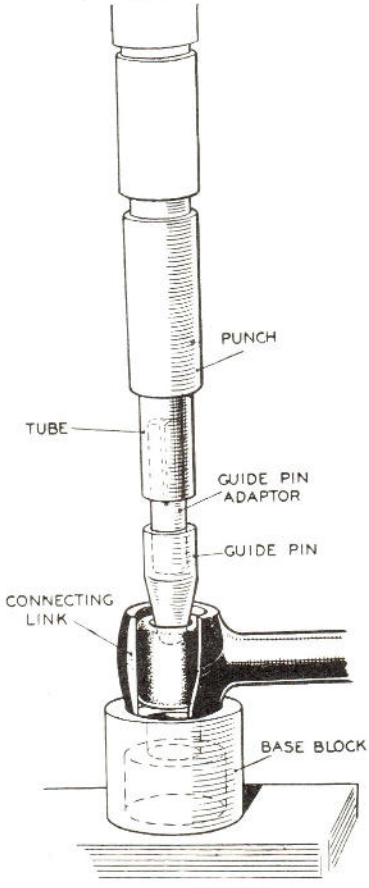


Fig. 84. METHOD OF FITTING TUBE

(3) Fit the guide pin adaptor into the guide pin.

(4) Fit the tube over the split end of the adaptor.

(5) Insert the tapered guide with its assembled adaptor and tube, into the rubber, and with a quick action force the guide pin adaptor, and tube, into the bearing.

(6) The guide pin and adaptor can then be withdrawn through the base.

TO REMOVE ROAD SPRINGS AND REFIT

Front Spring.

To remove this spring the following procedure should be adopted.

(1) Jack up front of chassis frame.

(2) Remove road wheels.

(3) Remove spring shackle pins.

(4) Withdraw the 6 bolts securing the spring to the cross member (with pre-war models 4 bolts were used).

To Refit Front Spring.

Is the reverse procedure to that given above but steps should be taken to ensure the proper positioning of the front spring. In our Repair Shops at the factory we use a special pair of fixtures to locate these. These fixtures are obtainable through our Spares Department and will be included in the Specialized Tool Catalogue which is in the course of preparation. (See Tool Section.)

It is appreciated that in many instances the fixtures referred to in the last paragraph may not be available and in such cases the front spring eyes should be properly centralized in the bottom jaws of the vertical links (" H " pieces) before finally securing. It is a worth while precaution to make a periodic check of the tightness of the bolts securing the front springs to prevent displacement.

Rear Springs.

To remove these springs proceed as follows :

(1) Jack up rear of chassis.

(2) Remove road wheels.

(3) Take the weight of the rear axle on jacks.

(4) Remove " U " Bolts securing rear axle to springs.

(5) Remove front shackle pins. Occasionally trouble may be experienced with the removal of these pins owing to the seizure of the inner sleeve of the Silentbloc on the pin and in extreme cases it will be found necessary to cut this sleeve off the pin with an oxy-acetylene flame, after similarly dealing with the spring eye.

(6) Drop front of rear springs and remove the castellated nuts securing springs to fixed pins and drive springs off these pins complete with shackles.

To Refit Springs.

When refitting springs the reverse procedure for that of removal should be used, but the tightening up of nuts on shackle pins should be delayed until the road wheels have been refitted and the supports removed from under the axle and frame. This method of delaying the tightening up of the shackle nuts until the weight of the vehicle is on the springs is so that the Silentblocs will be secured in their neutral position of twist.

SHOCK ABSORBER CHART

Car Model.	Damper.	Position.	Double Acting or Differential.	Pressure Recuperation
1939/8 H.P.	P5	FRONT N/S	Double Acting.	No.
	P5	FRONT O/S	Double Acting.	No.
	P5	REAR N/S	Double Acting.	No.
	P5	REAR O/S	Double Acting.	No.
1939/10 H.P.	P5	FRONT N/S	Double Acting	No.
	P5	FRONT O/S	Double Acting.	No.
	P5	REAR N/S	Double Acting	No.
	P5	REAR O/S	Double Acting.	No.
1939/12 H.P.	P6	FRONT N/S	Double Acting.	No.
	P6	FRONT O/S	Double Acting.	No.
	P6	REAR N/S	Double Acting.	No.
	P6	REAR O/S	Double Acting.	No.
1945/8 H.P.	P5	FRONT N/S	Double Acting.	No.
	P5	FRONT O/S	Double Acting.	No.
	PR5	REAR N/S	Double Acting.	Yes.
	PR5	REAR O/S	Double Acting.	Yes.
1945/12 H.P.	P6	FRONT N/S	Differential.	No.
	P6	FRONT O/S	Differential.	No.
	PR6	REAR N/S	Differential.	Yes.
	PR6	REAR O/S	Differential.	Yes.

WHEELS AND TYRES

INDEX

WHEELS AND TYRES

Fitting Road Wheels.

Much damage to wheels is caused by careless fitting. Mounting a wheel with partially tight nuts allows the wheel to work on the studs damaging these studs and elongating the holes in the wheels. Quite apart from the possibility of the wheel leaving the hub and causing an accident, the damage to the hub studs and the hole in the wheel is frequently of sufficient consequence to necessitate new replacements being fitted.

The wheels should be fitted by first loosely securing the nuts and afterwards tightening these up progressively and alternatively on opposite sides. Tightening up one nut and leaving the remainder slack tends to prevent these other nuts seating properly and thus allowing them to work loose.

Wheel Rim Damage.

Run-out at wheel rims should be checked periodically by jacking up the wheels and spinning the wheel round and measuring the maximum run-out which should not exceed $\frac{1}{8}$". Run-out in excess of that figure justifies the truing up of the existing rim or its replacement by a new one if this is beyond repair.

Damage to wheel rims is frequently caused by careless driving, the wheel rims being struck by kerbs or other similar obstructions.

Fitting and Removal of Tyres.

The fitting of tyres and tubes to a well based rim is a perfectly simple operation, but is frequently made arduous by adopting the incorrect procedure when doing the job.

It will be found that fitting will be greatly assisted by using a mixture of soft soap and water on the tyre beads, applying this solution immediately prior to installation. The solution can be made of one part of soft soap to about ten parts of water, mixing it until all soap is dissolved.

The following routine should be adopted when **fitting** a tyre and tube :—

1. Inspect inside of tyre and ensure that the wheel rim is clean and free from dirt and undamaged. Dust the inside of the tyre lightly with French chalk.
2. Lay wheel flat on the ground with the valve hole uppermost.
3. Place the tyre over the wheel with one side of the lower bead in the rim well.
4. Steady wheel with one foot, whilst gradually easing on the remainder of the lower bead with the aid of a tyre lever.
5. Inflate tube slightly and insert the tube in the tyre with the valve pointing upwards and adjacent to the valve hole. Insert valve in hole provided in rim ensuring that there is no side pull in it.
6. Now fit the upper bead over the rim so that it rests in the well, at a point opposite the valve. Hold this bead down into the well in the rim with a knee or foot and ease the remainder of the bead over the rim with the aid of a tyre lever, finishing near the valve. Don't insert the lever directly over the valve or this may suffer damage. It is usually possible to force the last part of the bead over the rim with a foot or knee without recourse to the use of a tyre lever.
7. Inflate the tyre to correct pressure and ensure that the edges of the tyre are seated evenly around the rim, adjusting as necessary to obviate any possibility of a trapped tube or displaced tyre bead.
8. After fully inflating, deflate by removal of valve core. Finally re-inflate to the recommended pressure. This double inflation tends to smooth out any wrinkles in the tube.

When **removing** the tyres from the wheel rim, proceed as follows :—

(1) Remove all valve parts and loosen tyre beads from rim with the heel or if these are too tight for this method it will be necessary to use a press or a special tyre lever.

(2) Push both beads into the rim well at the point diametrically opposite to the valve.

(3) Lever the tyre bead near the valve over the rim, using two levers placed about 6" apart. Kneel or stand on the cover opposite the valve to force the bead into the well and prise the bead over the rim flange.

(4) Remove the tube carefully, never pulling it out by the valve. Stand tyre upright keeping beads in the well of the rim. Lever head over the rim flange at the same time pushing the wheel away from cover with the other hand.

CARE AND MAINTENANCE OF SYNTHETIC RUBBER TYRES AND TUBES

Synthetic rubber tyres and tubes which are supplied by us with cars of our manufacture, may be readily identified by a red medallion on the covers and a red or blue disc on the tubes close to the valve.

As these tyres are more susceptible to failure from abuse, particular care in mounting and repair is necessary and the standard of general maintenance must be high if reasonable service is to be expected.

Tyre pressure should be checked at least weekly and with our current models be maintained at 26 lbs. per square inch front and 28 lbs. per square inch at the rear.

With synthetic tyres heat is more quickly generated and they offer less resistance to cuts and tears than do natural rubber covers. It is important, therefore, to carry out more frequent inspections for tyre injuries so that these repairs may be dealt with immediately and thus prevent more serious damage to the casing.

Special care in mounting synthetic tubes is essential in order to obtain the maximum length of life possible and to remove the danger of premature failure. The following is a summary of recommendations when fitting on Well Base rims :—

(1) Dust the inside of the cover evenly with French chalk.

(2) Inflate the tube until it begins to round out : then insert this in cover.

(3) Apply a frothy solution of soap and water generously around the entire base of the tube, extending upwards between the tyre beads and the tube itself for at least 2" on both sides. Also apply the solution to the bottom and outside of the tyre beads. Do not allow solution to run into crown of tyre. A satisfactory solution for this purpose may be prepared by mixing one table spoonful of soft soap with one quart of hot water and stirring thoroughly until the whole of the soap is dissolved. The solution should be of a " slimy " or " slippery " consistency when tested by rubbing between the hands.

(4) Mount the tyre on the rim immediately after its treatment with soap solution and whilst it is still wet.

(5) Before inflating BE SURE the tyre beads are clear of the well of the rim.

(6) Inflate slowly until beads are fully seated.

(7) Remove valve core to DEFLATE TUBE COMPLETELY. Do not disturb the beads of the cover.

(8) Re-inflate to correct working pressure. THIS PROCEDURE MUST BE FOLLOWED WHENEVER A TUBE IS REFITTED.

The object of double inflation is to permit stretched portions of the tube to re-adjust themselves to the cover and thereby to relieve any strains in the tube.

French chalk may be used in an emergency only, as a substitute for the soap solution. The practice of its use is not recommended.

Repairing Tubes.

Punctures and injuries should be vulcanised. Cold patches should be used only for emergencies.

ABNORMAL TYRE WEAR

Normal tyre wear should be smooth and even on the centre tread ; any irregularity in the destruction of the tread pattern calls for investigation. The following are the causes of abnormal tyre wear and as such should be explored in cases of difficulty :—

1. Incorrect Tyre Pressures.

It is important that the correct tyre pressures are maintained as given under " Vehicle Data " on Page 7.

Wear, associated with **excessive tyre pressure,** occurs on the crown of the wheel and is uniform around the whole of the tread appearing as the arc of a circle in section. The employment of too high a tyre pressure also renders the tyre more susceptible to concussion bursts such as may occur when a careless driver hits the kerb or other such obstruction.

The employment of too low a pressure is probably the most common cause of tyre

destruction. Tyre wear in this case is uneven around the whole tread giving high and low areas. With this type of complaint the wear is very frequently associated with frayed ply-cords thus rendering a replacement cover necessary.

2. Misalignment.

The most common form of misalignment is that caused by **incorrect front wheel "tracking."** This incorrect "tracking" is associated with irregular wear on the inside or the outside of the tread patterns depending on whether excessive or insufficient "toe-out" is being employed. This type of wear is also recognisable by the appearance of small up-standing fins on one side of each bar or block in the tread pattern. **The correct track setting should allow the front wheels to be parallel to $\frac{1}{16}$" toed-out. Always make adjustments on N S tie-rod when the vehicle is unladen.**

Where abnormal tyre wear is experienced following an accident this indicates the possibility of a damaged frame or axle and should therefore receive attention accordingly.

3. Incorrect Camber.

This is a very rare explanation for tyre erosion, but it may arise due to moving of the front road spring on its mounting and in such cases a different camber would be given to each front wheel. It is also possible, with pre-war models where an adjustment of camber was provided that this has not been correctly set (see Front Suspension).

4. Brake Adjustment and Condition.

Where brakes are in bad adjustment or condition unequal tyre wear will frequently be experienced. Where brakes are grabbing badly due to mal-adjustment or condition of the liners and drums, a series of "flats" will appear on the tread pattern. When these symptoms are experienced the condition and adjustment of the brakes should be ensured (see Brakes, Page 104).

5. Dampers.

Incorrect balance of dampers caused by an improperly functioning unit can cause unequal tyre wear, although it is a comparatively rare explanation for the complaint. (See Dampers, Page 138).

ELECTRICAL EQUIPMENT

INDEX

ILLUSTRATIONS

ELECTRICAL EQUIPMENT

MAINTENANCE

The instructions given for the servicing of electrical equipment has, as a matter of policy, not been over-elaborated, it being desired to encourage our agents, and the trade in general, to avail themselves of the facilities offered by Messrs. Lucas' Service Depots and Service Agents.

Messrs. Lucas operate a prompt and efficient Service Exchange Scheme at all their Service Depots, whereby reconditioned units can be obtained in exchange for practically all those requiring overhaul and repair.

The following instructions give the procedure for normal day to day maintenance and repairs or overhauls which exceed the scope of the remarks should be referred to the most convenient Lucas Service Depot or Agent (a list of whom is given on Pages 220—226).

THE BATTERY

Topping up.

About once a month remove the vent plugs from the top of the battery and top up each cell with distilled water to bring the acid solution level with the tops of the separators. Do not use tap water and do not use a naked light when examining the conditions of the cells. If acid has been spilled from any of the cells, it should be replaced by an acid solution of the same specific gravity as that of the solution in the cell to which it is to be added.

Terminals.

Examine the battery terminals and see that they are quite tight. Keep them smeared with vaseline to prevent corrosion. Keep the top of the battery clean and dry. Take care not to spill water on it when adjusting the level of the electrolyte, or when taking specific gravity readings.

Testing the condition of the Battery.

This is usually carried out by means of a hydrometer. Voltmeter readings of each cell do not provide a reliable indication of the condition of the battery unless special precautions are taken.

Before measuring the specific gravity of the acid solution by means of the Hydrometer see that the acid is at the correct level. Readings should be taken for each of the cells in turn after a run on the car.

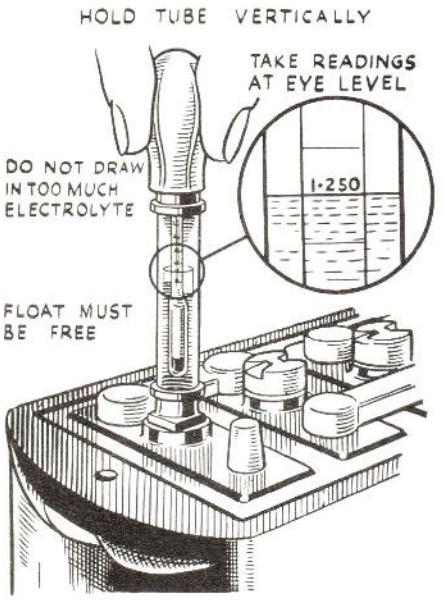


Fig. 85. Testing battery condition

The specific gravity reading and their indications are as follows :—

1.285—1.300	Battery fully charged.
About 1.210	Battery about half discharged.
Below 1.150	Battery fully discharged.

The readings given are for a temperature of 60° F. The readings of all cells should be approximately the same. If one cell gives a reading very different from the rest the acid may have spilled or leaked from this particular cell, or there may be a short circuit between the plates. In this case the battery must be examined by a Lucas Service Agent or Depot.

Storage of a Battery.

Never leave a battery in a discharged condition for any length of time. Have it fully charged and every fortnight give it a short refreshing charge. In no circumstances must the electrolyte be removed from the battery and the plates allowed to dry.

THE DYNAMO

Lubrication.

About every 10,000 miles unscrew the lubricator from the commutator end bracket and remove the spring and felt. If the felt is dry, refill the lubricator cap with petroleum jelly and refit. The bearing at the driving end is packed with grease and requires no attention until the dynamo is taken down for an overhaul.

Commutator.

About every 10,000 miles remove the cover band to inspect the brushes and commutator.

The commutator should be clean, free from oil or dirt and should have a polished appearance. If it is dirty, clean it by pressing against it a fine dry duster while the engine is slowly turned over by hand. If the commutator is very dirty moisten the cloth with petrol.

Brushgear.

Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If the brush is inclined to stick remove it from its holder and very lightly polish the sides of the brush on a smooth file. Be careful to replace brushes in their original positions in order to retain the bedding. If the brushes become worn so that they will not bear on the surface of the commutator, or if the end of the flexible connector becomes exposed on the running face, new brushes must be fitted. New brushes must be bedded to the commutator as follows :—

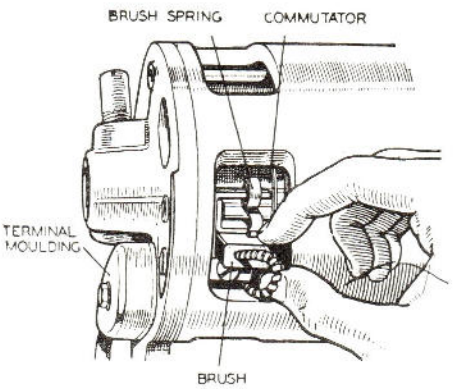


Fig. 86. Removal of brush.

Pass a thin strip of very fine glass paper between the commutator and each of the brushes so that the abrasive surface is towards the brush faces. Turn the armature in its normal direction of rotation for a few minutes and then remove the glass paper. Wipe or blow away any carbon or glass paper dust after the operation.

CUT-OUT, REGULATOR AND FUSE BOX TYPES RF. 91.

This unit houses the cut-out and dynamo voltage regulator together with two fuses.

The fuses incorporated in this unit protect the auxiliary accessories (*i.e.*, the electric horn, windscreen wiper, etc.).

The cut-out, regulator and fuses are protected by a moulded cover which can be withdrawn by moving aside the securing spring clip.

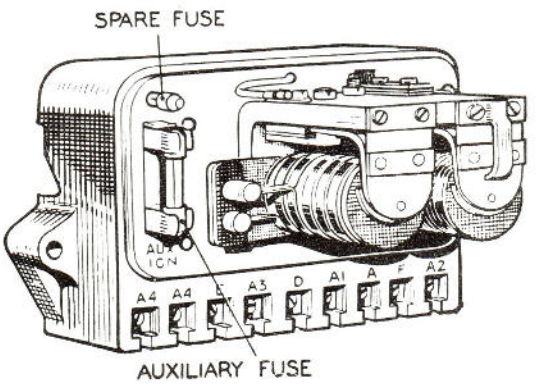


Fig. 87. Regulator with cover removed.

The cut-out and regulator are accurately set before leaving the Works and they must not be tampered with. Take care not to close the cut-out contacts when removing or replacing the cover, as this may cause damage to the equipment. Should they become inadvertently closed when the engine is stationary, carefully pull them apart.

Fuse marked " Aux."

This fuse protects the accessories which are connected so that they operate whether the ignition switch is on or off.

Fuses marked " Aux. Ign."

This fuse protects the accessories which are connected so that they operate only when the ignition is switched on (*e.g.*, Stoplamp, Trafficators, etc.)

CUT-OUT, REGULATOR AND FUSE BOX TYPE RF91

Replacement.

A blown fuse will be indicated by the failure of all the units protected by it and is confirmed by examination of the fuse. If it has blown, the broken ends of the wire will be visible inside the glass tube. Before replacing the fuse, inspect the wiring of the units that have failed for evidence of a short circuit and remedy the cause of the trouble.

The various units of the electrical equipment are connected together by different coloured cables bound in a protective sheathing. These may be identified by referring to the wiring diagram applicable to your car.

To replace a fuse it is necessary only to withdraw it from the spring clips in which it fits. Spare fuses are provided and it is important to use only the correct replacement fuse—the fusing value being marked on a coloured clip inside the fuse.

THE STARTER

About once every 10,000 miles remove the starter cover band and examine the brushes and commutator.

Check that brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If the movement is sluggish, remove the brush from its holder and lightly polish the sides of the brush on a smooth file. Replace the brushes in their original positions. If the brushes are worn so that they do not bear properly on the commutator, or if the ends of the flexible connectors are exposed on the running face, they must be renewed by a Lucas Service Depot or Agent.

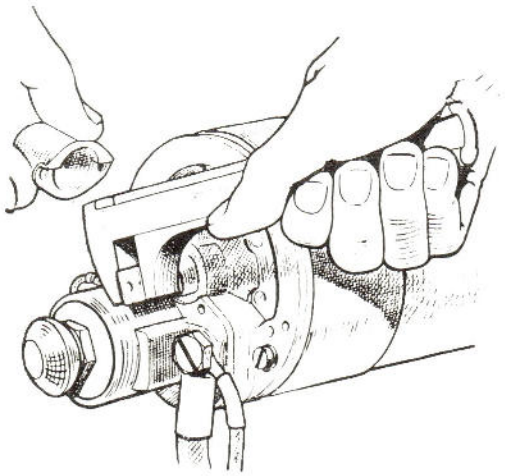


Fig. 88. Releasing " jammed " starter pinion.

The commutator must be clean and free from oil and should have a polished appearance. If it is dirty, clean it by pressing a soft dry cloth against it while the starter is turned by hand. The square shaft extension at the commutator end can be used to rotate the starter. If the starter is very dirty, the cloth should be moistened with petrol.

If the starter drive is exposed, examine it to make sure that the pinion can move freely on the screwed sleeve. If necessary, wash the sleeve with paraffin and afterwards give it the merest trace of thin machine oil. A dirty or greasy sleeve is often the cause of the pinion failing to engage with the flywheel.

The starter is provided with a shaft extension at the commutator end by means of which the starter can be rotated to free the pinion in the event of it becoming jammed in mesh with the flywheel for any reason. The shaft extension is accessible when the metal cap, which is secured by two screws, is removed.

Check that all connections are firmly secured.

HEADLAMPS, PASSLIGHTS AND FOGLAMPS

Setting.

Ministry of Transport Lighting Regulations.

The Lighting Regulations state that 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 ft. 6 ins. above that plane."

To comply with the regulations the lamps must be set as shown. Check the setting by placing the car in front of a blank wall at the greatest possible distance, taking care of course, that the surface on which the car is standing is not sloping relative to the wall.

Headlamps.

The headlamps must be set so that the beams of light are parallel with the road and with each other. This will ensure that when the " Dip and switch " reflectors are operated the lamps will give a non-dazzling light.

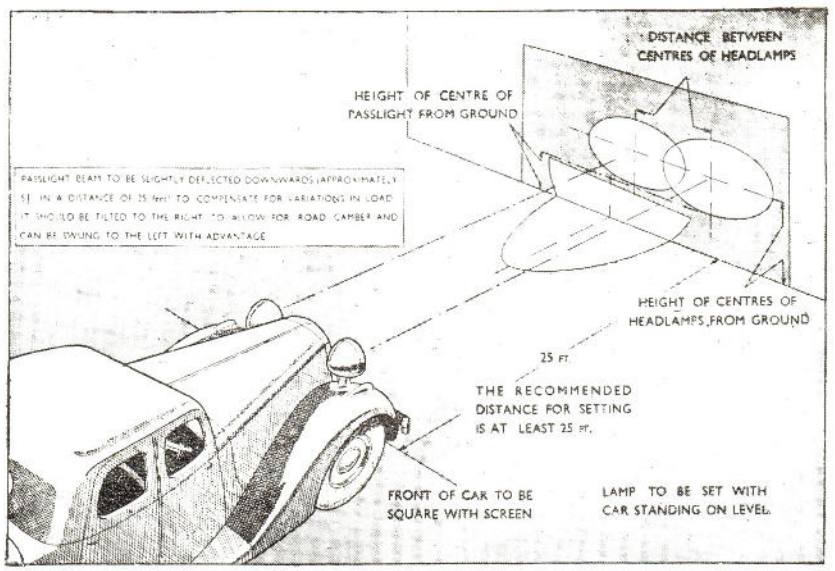


Fig. 89. **Focusing headlamps.**

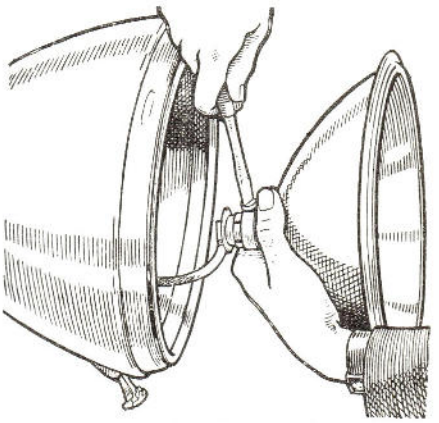


Fig. 90. **Method of focusing.**

If adjustment is necessary, slacken the single fixing nuts at the base of the lamp and move the lamp on its adjustable mounting to the required position. Finally, tighten the locking nut.

Foglamps and Passlights.

The lamp must be set so that the beam does not rise above the horizontal when the car is standing on level ground. To ensure this, dip the lamp very slightly to compensate for road inequalities or an extra heavy load in the rear of the car, and also tilt the lamp to the right to allow for road camber. In addition the lamp can be swung slightly to the left in order to give additional illumination on the nearside of the road. If adjustment is necessary, slacken the single fixing nut and move the lamp on its adjustable mounting to the required position. Finally, tighten the locking nut.

Focusing.

In order that the lamps shall give the best results, the bulb filament must be as near as possible to the focus of the reflector. If the bulb is out of focus, the lamps will have a poor range, and will cause dazzle to approaching traffic.

Method of Focusing.

Before lamps leave the works, the bulbs are focussed to give the best results, and provided that genuine Lucas Spare Bulbs are fitted as replacements, it should not be necessary to alter the setting. If, however, an ordinary bulb has to be fitted, it may be necessary to refocus by moving the bulb backwards or forwards until the best lighting is obtained.

When focusing foglamps, adjust the position of the bulb until any top light is removed, and until the semi-circular beam of light is of the greatest concentration, *i.e.*, the area of the beam must be as small as possible.

When focusing headlamps, it will be found an advantage to cover one lamp while testing the other. If the lamp does not give a uniform long range beam, without any dark centre, the bulb needs adjusting. To do this, remove the lamp front and reflector. Slacken the clamping clip at the back of the reflector, and slide the bulb holder backwards or forwards. After each adjustment, note the effect with reflector and front refitted.

When the best position for the bulb holder has been found, the clamping screw must be tightened.

Dipping Reflectors.

The headlamps are fitted with the electrically operated " dip and switch " scheme in which the nearside reflector is arranged to dip to the left, while at the same time the offside headlamp is switched off.

The dipping reflector is protected by a fuse which is fitted at the back of the reflector together with a spare fuse. The indication of this fuse blowing will be the failure of the dipping reflector to function. The cause of the trouble may be a faulty connection inside the lamp, or

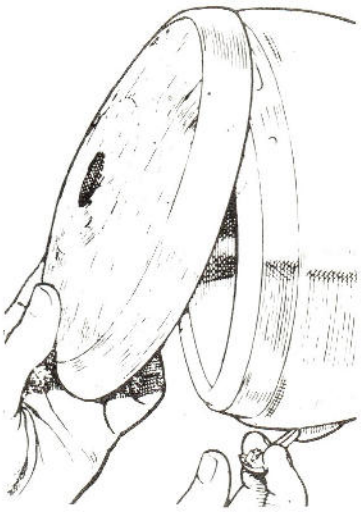


Fig. 91. Removing headlamp front.

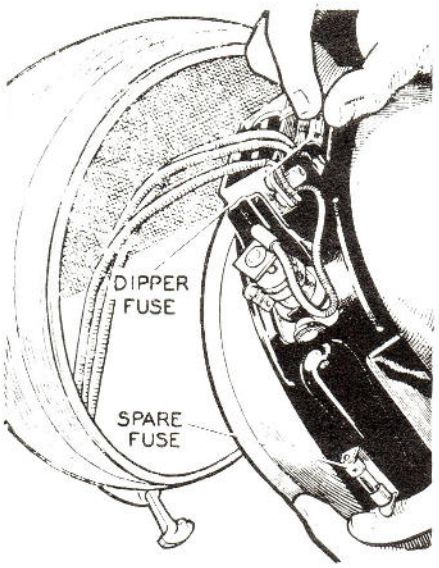


Fig. 92. Changing dipping reflector fuse.

it is possible that the cables may be fouling the reflector. The reflector can be rocked by the fingers without damage to the reflector as any finger marks can be removed by polishing with a chamois leather. It is thus possible by rocking the reflector, to see if it is working freely. If it is stiff apply the merest trace of thin machine oil to the moving plunger of the dipper unit and to the bearings on which the reflector rocks.

Removing Headlamp Fronts and Reflectors. M Type Lamps—Fitted to all cars other than 8 h.p.

To remove lamp front, pull forward the fixing catch at the bottom of the lamp and swing it out of its location. Remove the front from the bottom of the lamp first. When replacing locate the top of the lamp first, then press on at the bottom and secure by springing the catch into its location.

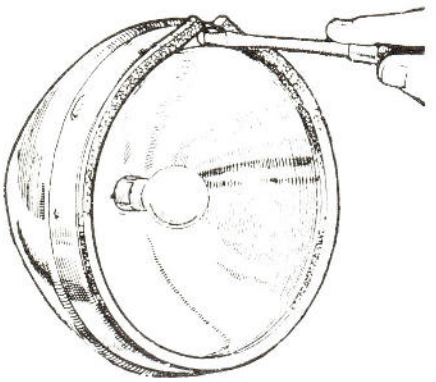


Fig. 93. Showing location of headlamp rim (8 h.p. model).

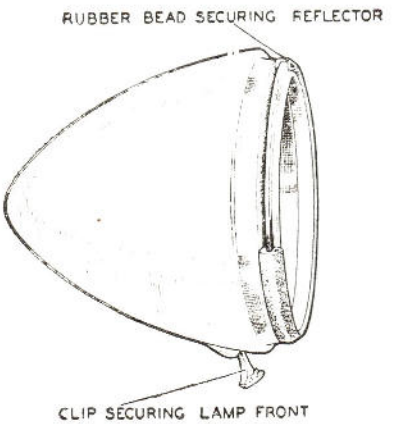


Fig. 94. Location of headlamp rim (12 h.p. model).

The reflector is held in the lamp body by means of a rubber washer or bead and can be withdrawn when the rubber bead is removed. When replacing the reflector the projection on the rim must fit into the left hand location at the top of the lamp body. Secure the reflector by fitting the rubber bead so that its thinner lip locates between the reflector rim and the edge of the lamp body.

L Type Lamps—Fitted to 8 h.p. cars.

Remove the lamp front as described for M type lamps above.

To remove the dipping reflector from the nearside headlamp, take out the fixing screws from the back of the lamp body, and withdraw

the reflector by disengaging the tongues of the two fixing brackets, fixed to the reflector rim, from the slots in the lamp body.

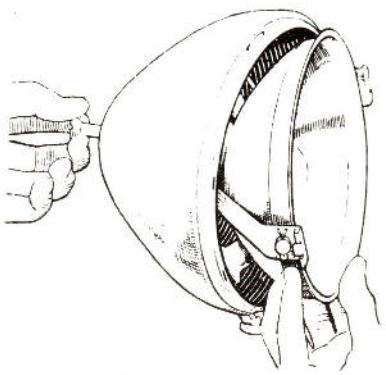


Fig. 95. Removing dipping reflector from N/S headlamp.

To remove the reflector from the offside headlamp, turn back the ends of the cork washer fitted in the reflector rim and remove the screw at the top of the reflector rim. Turn the reflector until the marking " O " stamped on the reflector rim and lamp body coincide and then withdraw it. When replacing the reflector, engage it with the lamp body and then turn it until the screw hole in the rim is opposite the left-hand screw hole on top of the lamp body. Secure the reflector by means of the screw.

Cleaning Lamps.

Care must be taken when handling reflectors to prevent them from becoming finger marked. If they do become marked, however, a transparent and colourless protective covering enables any finger marks to be removed by polishing with a chamois leather or very soft dry cloth. *Do not use metal polish on reflectors.*

No metal polishes must be used for cleaning chromium plated lamp bodies. They must be washed with plenty of water and when the dirt is completely removed, the lamp bodies must be polished with a chamois leather or a soft dry cloth. Black or coloured lamp bodies may be cleaned with a good car polish.

Replacement of Bulbs.

When replacing a bulb, it is important not only that the same size bulb is fitted, but also that the bulb has a high efficiency and will focus in the reflector. Cheap and inferior bulbs often have the filament of such a shape that it is impossible to focus correctly. This will cause dazzle and will result in loss of range and light efficiency.

Lucas Genuine Spare Bulbs.

These bulbs are specially tested to ensure that the filament is in the correct position to give the best results with Lucas lamps. To assist in identification, Lucas bulbs are marked on the metal cap with a number. When fitting a replacement see that it is the same number as the original bulb.

It is advisable to replace bulbs after long service before they actually burn out, as often the filaments sag, making it impossible for them to be focused properly.

Bulbs fitted.

HEADLAMPS.

8 h.p.	Other models.
Lucas No. 70 6 volt. 24 watt.	Lucas No. 54 12 volt. 36 watt.

SIDE, STOP AND TAIL LAMPS.

Lucas No. 200 6 volt. 3 watt.	Lucas No. 207 12 volt. 6 watt.

Trafficators.

If the arms become stiff at any time, raise each arm and apply a drop of thin machine oil to the catchpin between the arm and the oper-

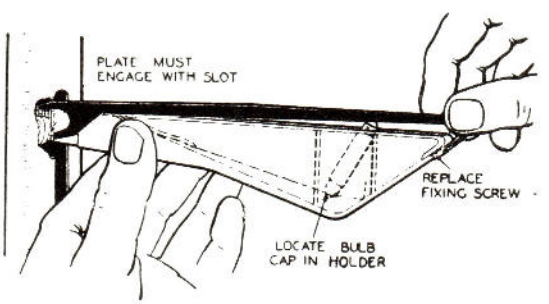


Fig. 96. Changing bulb in trafficator.

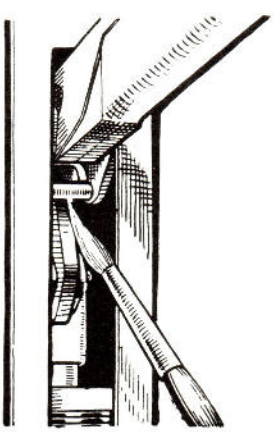
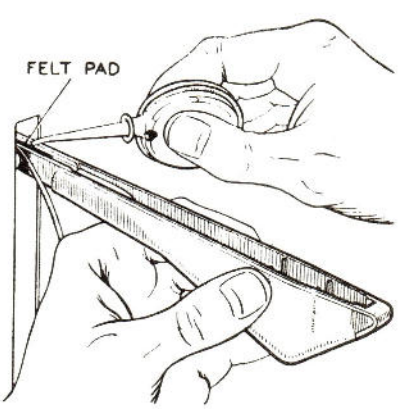


Fig. 97.



Lubricating trafficator.

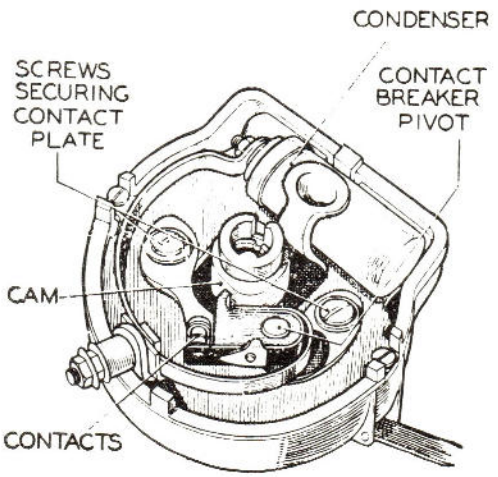


Fig. 99. Showing distributor with cover removed.

(b) **Cam and Contact Breaker Pivot.** Lightly smear the cam with a small amount of Mobilgrease No. 2 or clean engine oil and place a small amount of the same lubricant on the contact breaker pivot.

(c) **Automatic Timing Control.** Add a few drops of clean medium grade engine oil through the hole in the contact breaker base through which the cam passes. Do not allow any oil to get on to the contacts.

Cleaning.

Wipe the inside and outside of the distributor moulding with a soft dry cloth, paying particular attention to the space between the terminals. Clean the electrodes inside the moulding and also the electrode on the rotor arm with a petrol moistened cloth. See that the small carbon brush moves freely in its holder.

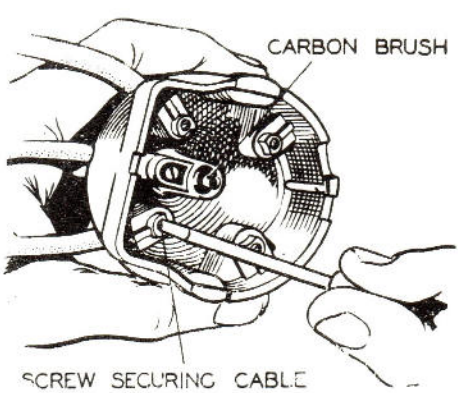


Fig. 100. Securing high-tension cables.

The contacts must be kept clean and free from oil or grease. If they are burnt or blackened or pitted, clean with a fine carborundum stone or with very fine emery cloth. Afterwards wipe away any trace of dirt or metal dust with a petrol moistened cloth. If the contacts are badly worn or pitted, a replacement contact set must be fitted and the gap set to the gauge.

Checking and Adjusting the Contacts.

To check the setting, turn the engine by hand until the contacts are fully opened and insert the gauge having a thickness of .010—.012″ between the contacts. The gauge should be a sliding fit if the setting is correct. If the gap varies considerably from the gauge, it should be adjusted. Keep the engine in the position to give maximum opening of the contacts and slacken the two screws securing the plate carrying the fixed contact. Move plate until gap is set to thickness of gauge and afterwards tighten the two screws.

Renewing the High Tension Cable.

The high tension cables are those connecting the coil to the distributor and to the sparking plugs. When these cables show signs of perishing or cracking, they must be replaced by 7 mm rubber covered ignition cable.

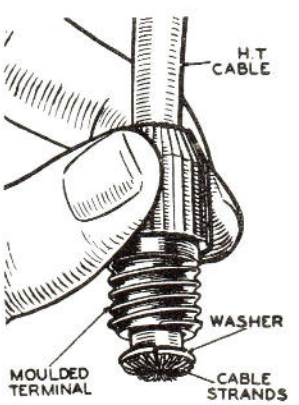


Fig. 101. Connecting high-tension lead to coil.

The method of connecting the cable to the coil is to thread the knurled moulded nut over the lead, bare the end of the cable for about $\frac{1}{4}$″, thread the wire through the brass washer provided, and bend back the strands. Finally screw the nut into its respective terminal.

The distributor cables are held in position by a moulded cover which is secured by means of screws. The cables, which are cut off flush to the required length, are located in recesses in the distributor moulding and are pressed on to pointed terminal studs which pierce the insulation to make good contact with the cable core.

Ignition Switch and Warning Light.

The ignition switch, besides forming a means of stopping the engine, is provided for the purpose of preventing the battery being discharged by the current flowing through the coil windings when the engine is stopped. A warning lamp is provided in the instrument panel which gives a red light when the ignition is switched on and the car is running very slowly or is stationary, thus reminding you to switch off.

Should the warning lamp bulb burn out, this will not in any way affect the ignition system, but you should replace it as soon as possible in order to safeguard your battery.

The bulb used is a Lucas No. C.252A.

SPARKING PLUGS

Type.

Champion No. N.8.
Thread Diameter. 14 m/m (System International 1.25 m/m) pitch.
Reach. $\frac{3}{4}$".
Gap Setting. 0.038" to 0.040".

Description.

The sparking plugs are of one piece construction and cannot be dismantled. One of the two electrodes is a part of the plug body and consequently earthed, the other is insulated from the body by " Sillimanite " insulator and is capable of retaining the high tension current in the central electrode and thus guaranteeing a good spark across the plugs when contact breaker points separate.

It is important that none but the type of plug which is recommended should be used. This type of plug was only decided upon after prolonged tests and has proved the most satisfactory plug for all round use.

MAINTENANCE

Insulator—Cleanliness and freedom from moisture.

The condition of this portion of the plug is naturally of considerable importance having regard to the voltages of the current concerned.

The portion of the insulator which protrudes from the body of the plug must be kept clean and free from moisture as either of these conditions can allow the high tension currents, supplied to the central electrode, to leak to earth via the plug body.

It may frequently occur, where a car is kept in a garage which is susceptible to damp, that formations of moisture on the plug insulators make initial starting up each day a difficult task. Where such a difficulty is experienced the plug insulators should be wiped dry before an attempt to start up the engine is made. Failure to take this precaution merely saturates the plug electrodes and combustion head with petrol and necessitates the removal and drying out of the plugs before the engine will start.

Insulator—Damage.

If the insulators have cracked, the high tension current will be able to escape to earth via the plug body and cause erratic sparking or complete failure.

Wherever an insulator discloses a crack either externally or internally the plug should be discarded as of no further use and replaced by another of the correct type.

Copper Washers.

These should be replaced by new ones from time to time, as they become hardened by repeatedly removing the plugs and subsequent re-tightening and hence lose their gas tight properties.

The functions of these washers are twofold, namely to prevent gas leakages and to transmit heat from the plug to the cylinder head and thence to the cooling water.

Misfiring.

Misfiring, especially at high speeds and under heavy pulling at low speeds, almost invariably indicates that the gap setting of the plugs is too wide, whilst erratic slow running can be accounted for by too close a gap setting. If the insulator is cracked either internally or externally the plug will behave erratically and as directed under " Insulator Damage " should be replaced. Care should be exercised when removing sparking plugs not to damage the insulator—damage frequently being caused when carrying out the operation.

Auto-Ignition.

This produces continued running of the engine after the ignition has been switched off. It is caused by an excessively hot spot in the combustion chamber following very hard running with the cooling water just boiling.

This cause does not lie in the sparking plugs, which are designed to leave a margin on heat capacity under these conditions. The auto-ignition occurs due to the hot exhaust valve and is normal under *very severe* conditions. It causes the engine to run for a few seconds until the exhaust valves cool down after switching off. Therefore do not diagnose this condition as indicating faulty sparking plugs, when the correct type is fitted.

Plug Cleaning and Testing Machine.

Oily, dirty and worn out plugs mean weak sparks. A weak spark means a low initial temperature of combustion and results in a reduced rate of burning and consequent incomplete combustion when the exhaust valves open. Incomplete combustion causes overheating, burning of valves and, by leaving unburnt fuel, leads to crank case dilution.

Current workshop practice is to clean plugs by means of a jet of fine abrasive material forced under air pressure on to the lower portion of the insulator and shell, effectively removing in a few seconds all carbon or other deposit. This should be done every 5,000 miles.

The type of plug cleaning equipment illustrated in Fig. 102 comprises both cleaner and tester mounted on one stand. The cleaner is operated from a compressor storage tank, provision being made for " blowing out " after cleaning to ensure that no loose particles of carbon or abrasive remain on the working surfaces. It is advisable to dip badly oiled plugs in petrol and dry them out on the blow-out before cleaning.

Fig. 102. Sparking plug cleaning and testing machine.

Approximately 300 plugs can be cleaned with one charge of compound.

Testing under pressure comparable to engine compression enables the operator to verify that cleaning has been carried out thoroughly and to single out plugs that have given their useful life. The plug is screwed into a compression chamber, air applied, and regulated by reference to the gauge provided, and high tension current being passed across the firing point, the intensity and colour of the sparking being observed in a mirror.

Plugs with wide gaps (0.040") used with high voltage coils are tested by closing the gap to the standard setting as for ordinary coil (0.025"). If satisfactory reset gap to 0.040".

To Set Plug Gap.

Gaps should always be adjusted by bending the electrode attached to the plug body, never by bending the central electrode, which would almost inevitably crack the insulator.

LOCATION OF ELECTRICAL FAULT IN IGNITION CIRCUIT

Uneven Firing (High Tension Circuit).

(a) To Test in Position and Locate Cause.

With the engine running at fairly fast idling speed, with normal position of carburettor mixture control on dash board in use, short the sparking plugs individually with a wooden handled screwdriver. Having located the cylinder which is causing the irregularity, detach sparking plug lead and hold this so that the end of the cable is separated by about $\frac{3}{16}$" from the cylinder head. If the sparking is strong and regular the fault probably lies in the sparking plug, it being assumed that the possibilities of a mechanical defect has already been eliminated. Remove sparking plug, clean and adjust points to 0.040" or alternatively replace plug by a new one if it is found to be beyond adjusting.

(b) Cable.

If there is no spark or if it is weak and irregular examine the cable from sparking plug to distributor. After a prolonged period of service, the rubber insulation is likely to crack or become perished and thus allow " earthing " of the current. Similarly if the insulation has become damaged owing to contact with a hot surface electrical leakage will occur. In such instances the cables must be replaced as directed above.

(c) Tracking.

Finally, examine the moulded distributor cap and cable cover wiping the inside and outside with a clean dry cloth, see that the carbon brush moves freely in its holder and examine the moulding for signs of breakdown.

After prolonged service, the moulding may have become " tracked " or in other words a conducting path may have formed between two or more of the electrodes or between one of the electrodes and some part of the distributor in contact with the cap. Evidence of a cracked cap is shown by the presence of a thin black line or burnt track in the place where this occurs. In such cases a replacement distributor cap must be fitted.

Uneven Firing (Low Tension Circuit).

(a) To Test in Position.

Remove the moulded cap and rotor. The rotor can be removed if it is a tight fit, by careful levering with a small screwdriver. Check that the contacts are clean and free from pits, burns, oil or grease as directed above under " Cleaning." Check contact breaker gap when fully open and set as directed above to give a clearance when fully open of between 0.010"—0.012". Make sure that the contact breaker points are opening and closing properly. Switch on the ignition and turn the engine round with the starting handle whilst the ammeter is observed, which should rise and fall as the points close and open respectively. If the current fluctuates in this manner the low tension circuit is in order.

(b) To Locate Fault.

Having determined, as described above, that the fault lies in the low tension circuit, switch on the ignition and turn the crankshaft *until the contact breaker points are fully opened.* Refer to the appropriate wiring diagram and check the circuit with a voltmeter (0—20 volts) as described below : —

Note.—If the circuit is in order, the reading on the voltmeter should be approximately 12 for the 10, 12 and 14 H.P. engines and 6 for 8 H.P. Models.

1. Battery to Ammeter.

Yellow and black cable. Connect voltmeter to ammeter terminal " B " (Negative terminal for positive earthing of accumulator). No reading indicates a damaged cable (yellow and black) or loose connection.

2. Ammeter.

Connect voltmeter to ammeter terminal " A " (Positive) and earth. No reading indicates a fault in ammeter which should then be replaced.

3. Ammeter to Control Box Terminal " A."

Connect voltmeter to control box terminal " A " and earth. No reading indicates a

fault in (white and purple) cables connecting ammeter to control box, or a loose connection at the ammeter.

4. **Control Box.**

Connect voltmeter to control box terminal " A " and earth. No reading indicates a loose connection to terminal " A " or a defective regulator series winding.

5. **Control Box to Terminal " A " on Lighting and Ignition Switch.**

Connect voltmeter to switch terminal " A " and earth. No reading indicates a loose connection or damaged (white and black) cable between control box and ignition switch.

6. **Switch Box.**

Connect voltmeter to switch box terminal " IG " and earth. No reading indicates a fault in switch box.

7. **Switch Box to Ignition Coil Terminal " SW."**

Connect voltmeter to ignition coil terminal at " SW " and earth. No reading indicates a damaged cable (white) or loose connection at switch box.

8. **Ignition Coil.**

Connect voltmeter to ignition coil terminal at " CB " and earth. No reading indicates fault in primary winding of the coil.

9. **Ignition Coil to Distributor.**

Connect voltmeter to distributor low tension terminal and earth. No reading indicates a faulty cable or loose connection.

10. **Contact Breaker and Condenser.**

Connect the voltmeter across the Contact Breaker points. No reading indicates a faulty condenser.

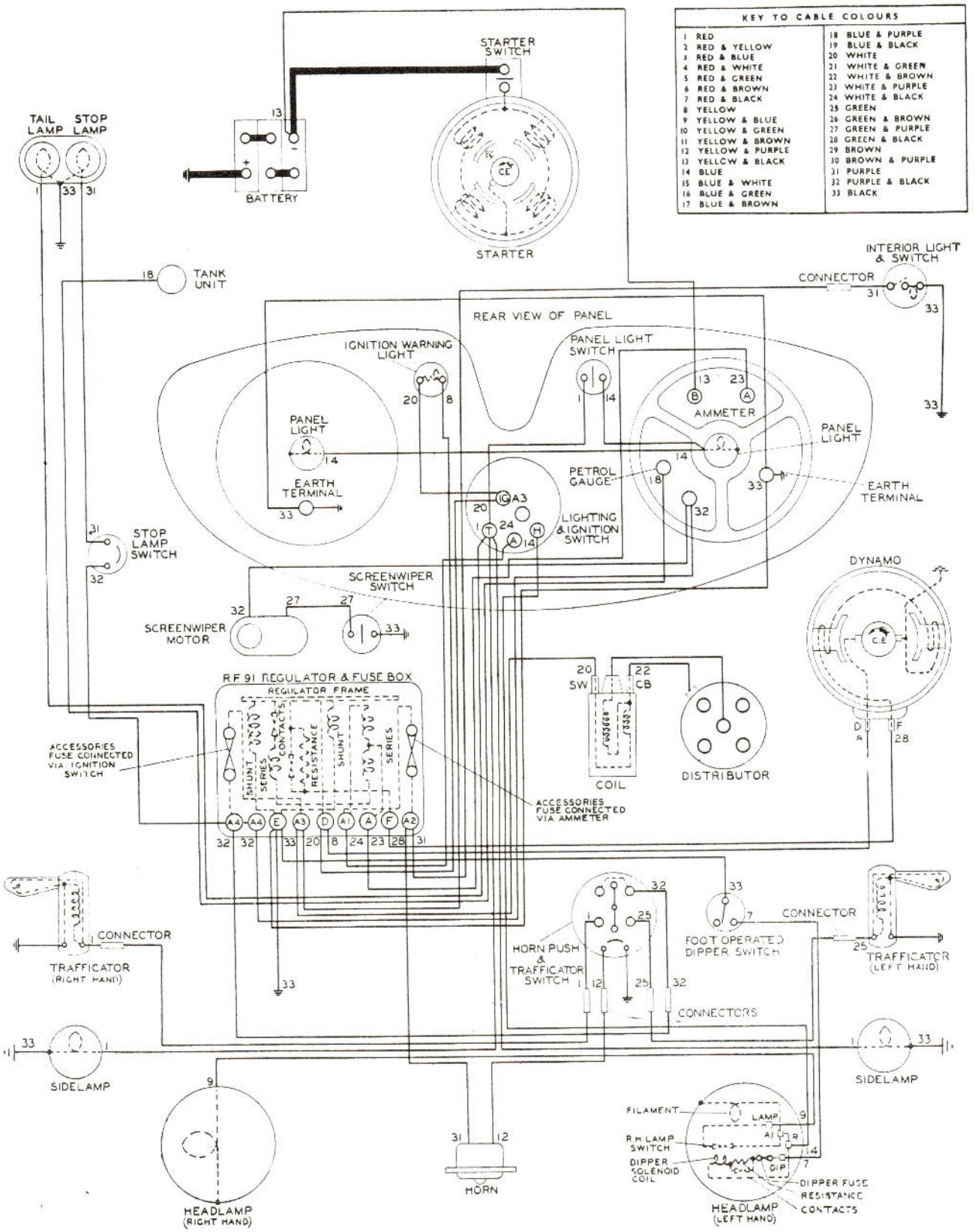


Fig. 103. **Wiring diagram for 8 h.p. saloon.**

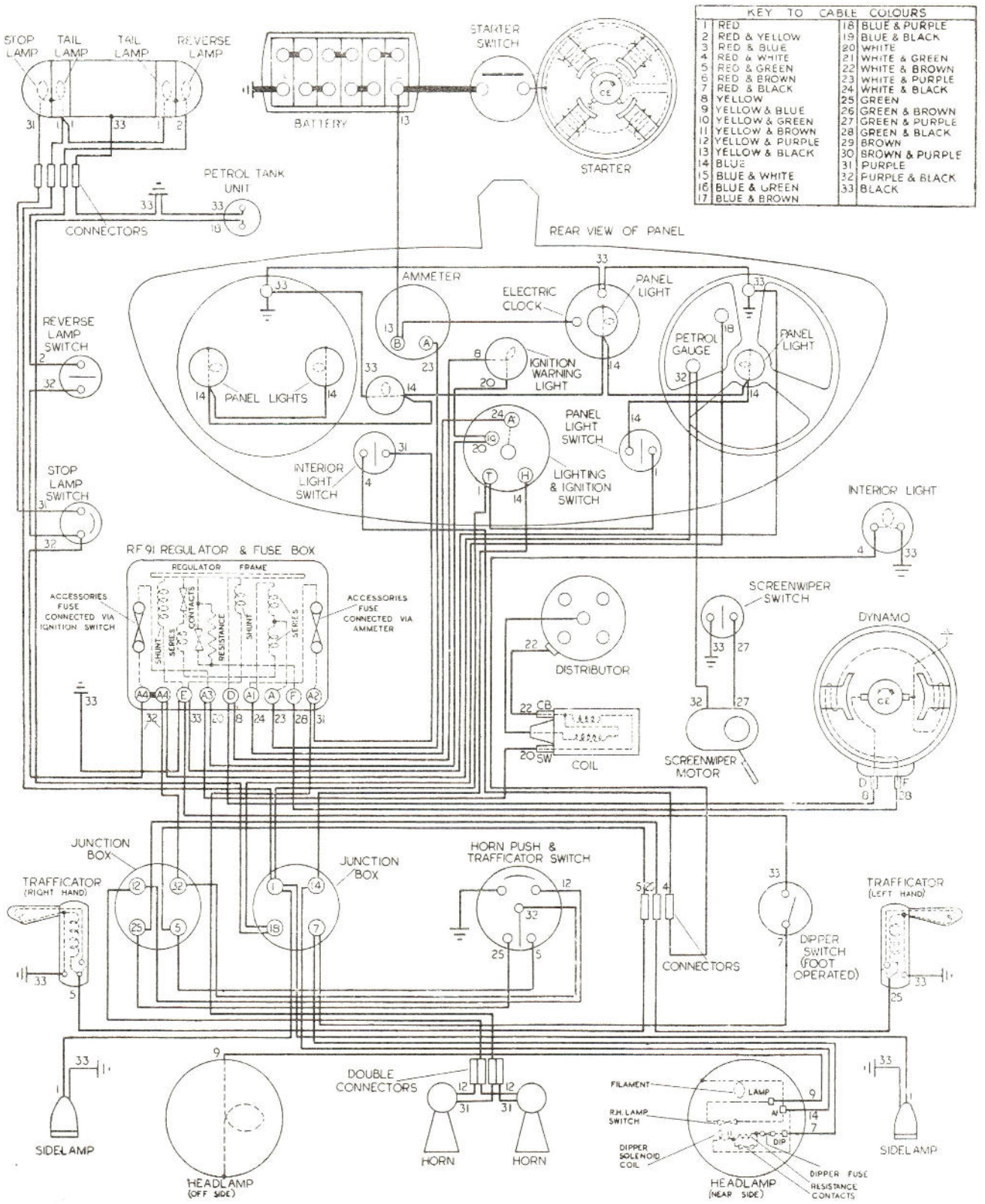


Fig. 104. **Wiring diagram for 12 h.p. (1945)**

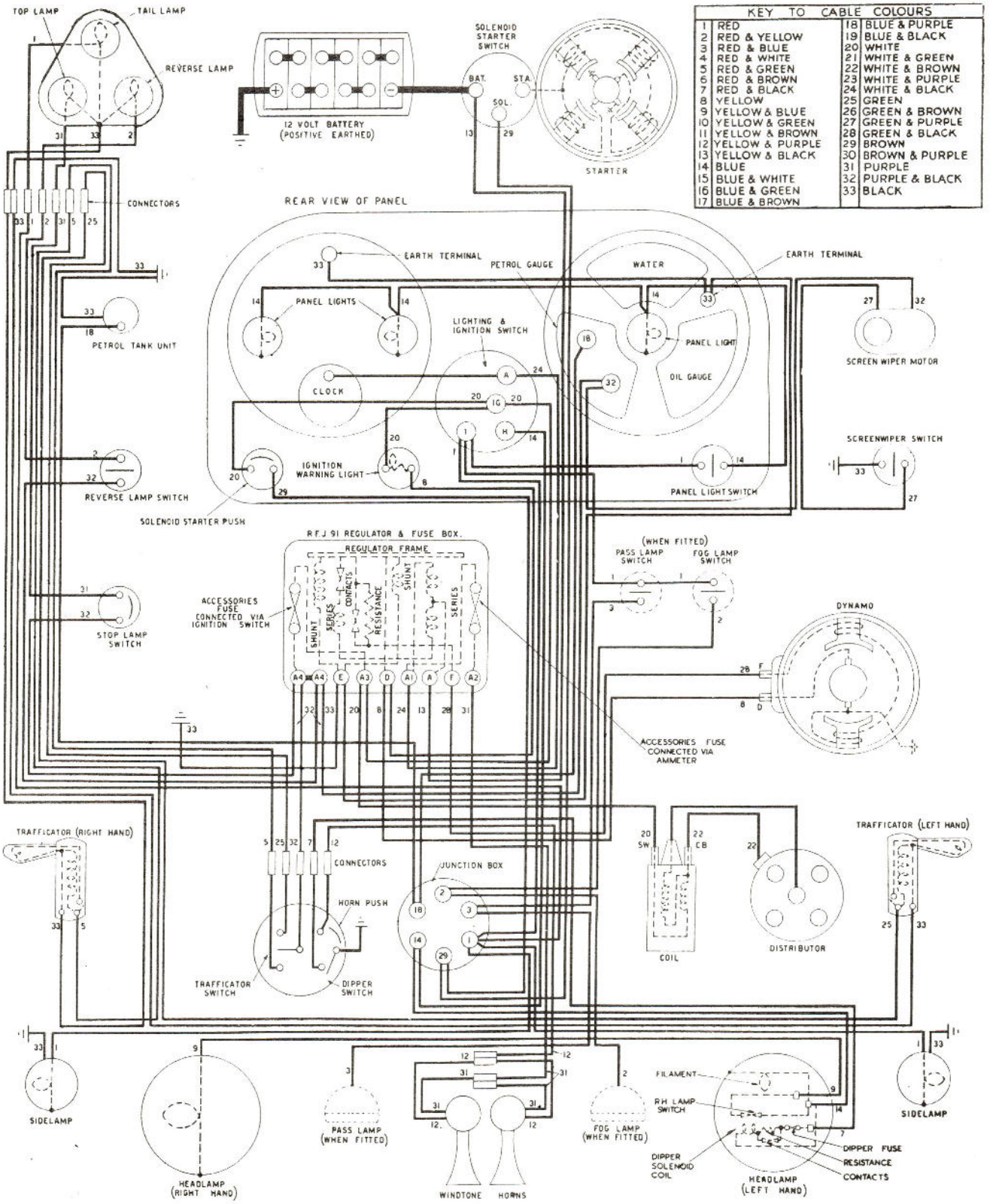


Fig. 105. **Wiring diagram for Triumph Roadster (1945).**

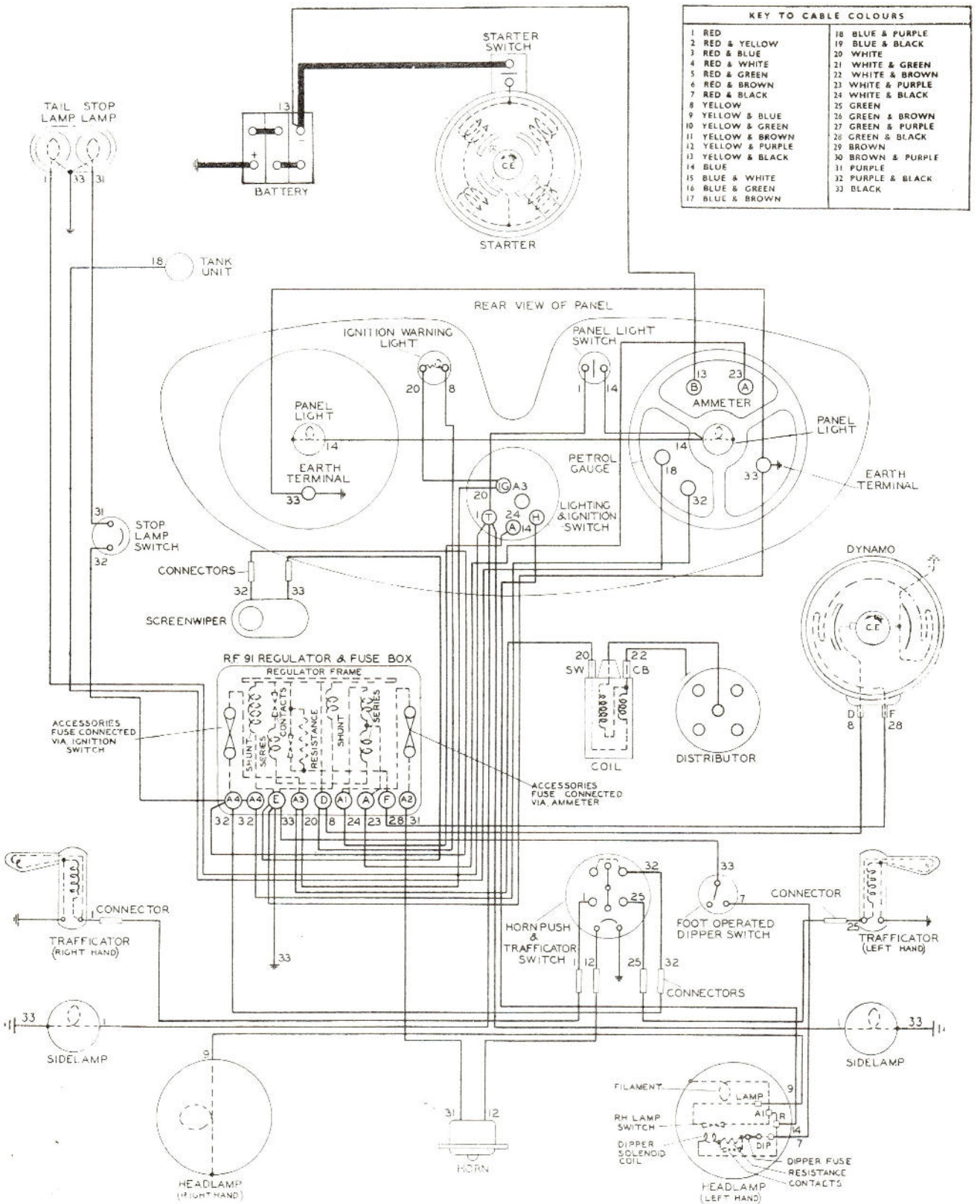


Fig. 106. **Wiring diagram for 8 h.p. Tourer.**

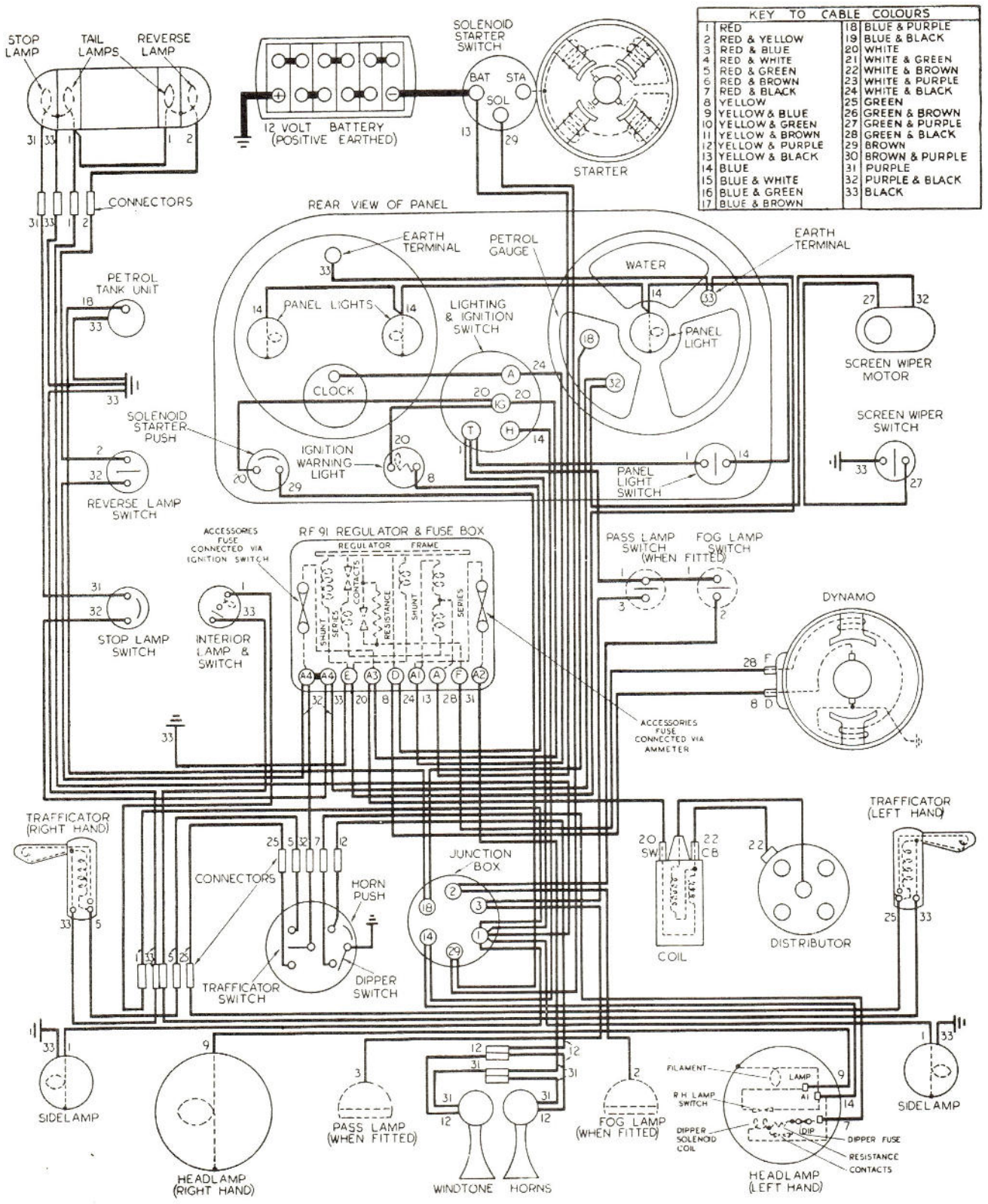


Fig. 107. **Wiring diagram for Triumph Saloon (1945).**

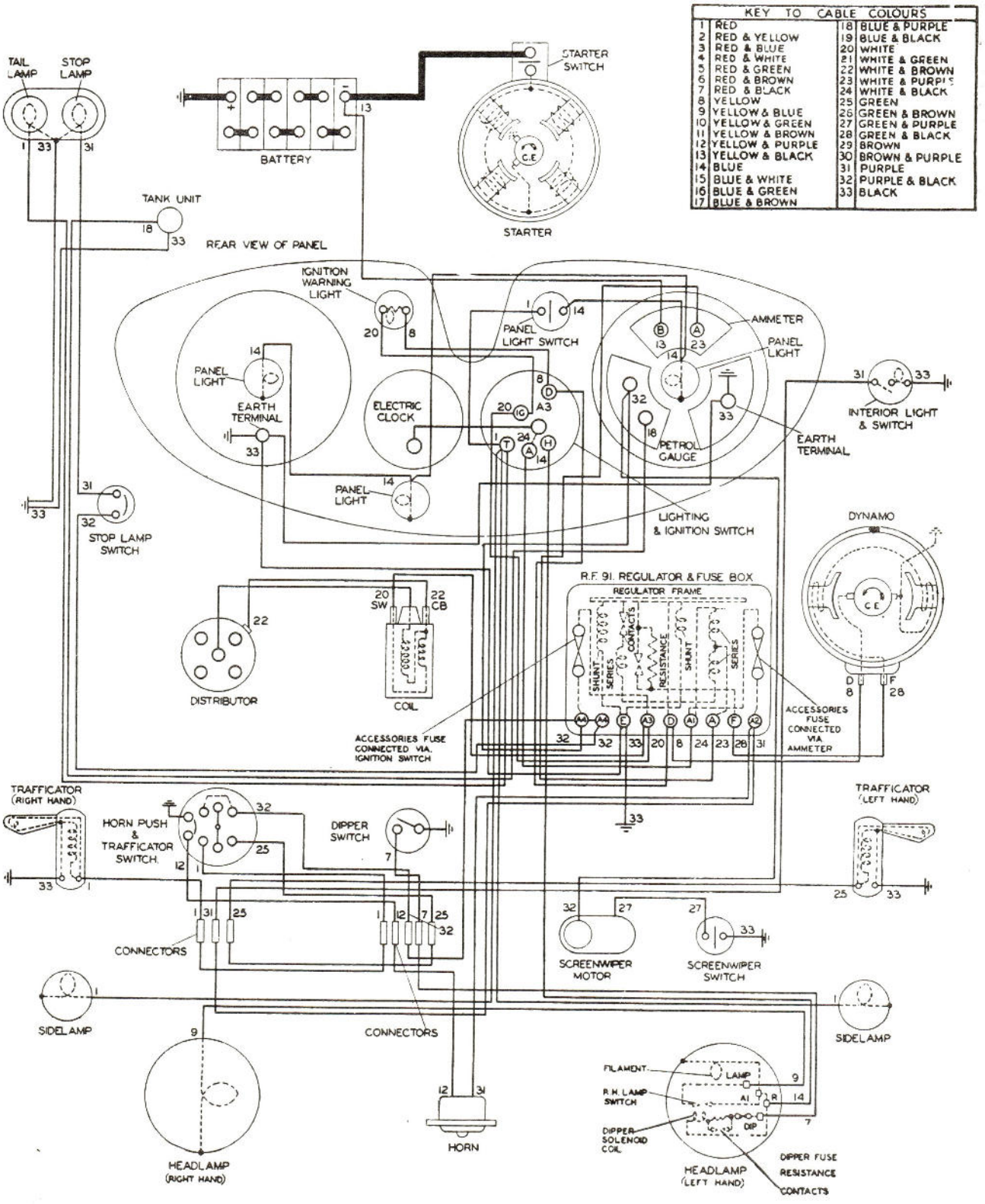


Fig. 108. **Wiring diagram for 10C Saloon.**

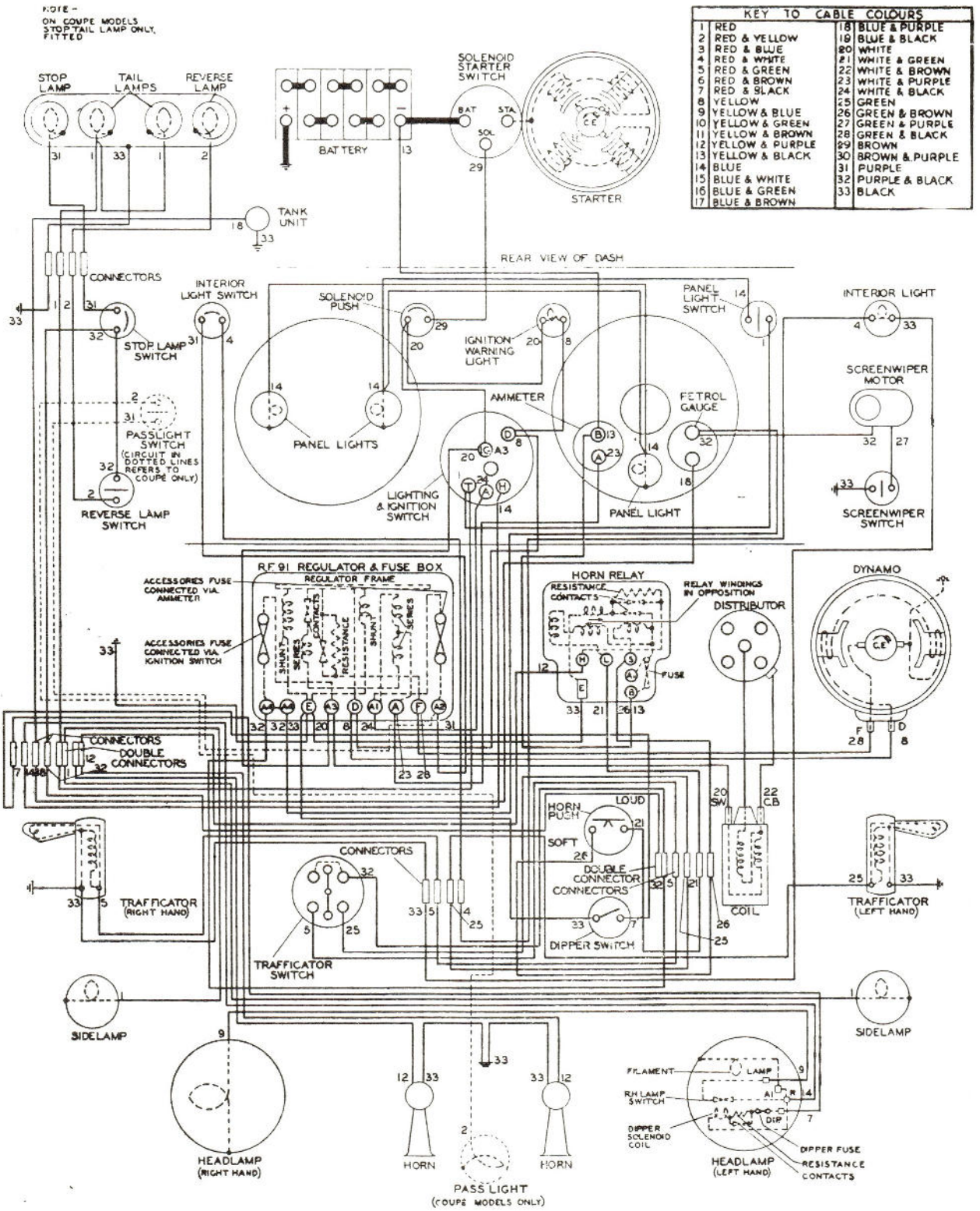


Fig. 109. Wiring diagram for 12CD model.

COACHWORK

INDEX.

COACHWORK

DISMANTLING INSTRUCTIONS

To Remove front door windows (All current models).

To carry out this work adopt the following procedure :—

(1) Remove handle from window and inside lock handle, which can be done by inserting a suitable wedge shaped tool between the handle and rosette. This will expose the securing pin which may then be " drifted " out.

(2) Remove window capping frame and door casing.

(3) Raise glass sufficiently for removal of stop block at zero, then wind down glass until lifting arms meet at cut away in lifting channel.

(4) Release front glass channel at bottom (2 screws in recess) the glass may now be tilted forward and lifted out.

To Remove quarter light (All current models.)

Proceed as follows :—

(1) Remove rear seat squab—the fixing bolt and screws are accessible from rear luggage locker, then remove quarter casing and capping frame as for the front door.

(2) Remove winder with metal carrier arm plates (screws at front and rear), slide out lifting arms from glass lifting channel. Next remove front glass channel (screws will be found embedded in felt) the glass and channelling should be withdrawn as an assembly.

To Reglaze Windscreen (8 H.P. models).

Proceed as indicated below :—

(1) Remove the special moulded rubber from the recessed face of the screen with the fingers.

(2) Remove sufficient of the " Dum-Dum " compound, exposed by the withdrawal of the moulded rubber, with a suitable tool, to enable the glass with its rubber surround to be forced out from the interior.

(3) Reglaze using " Dum-Dum " compound only.

To Remove Sliding Roof (8 H.P. Models).

Adopt the following sequence of operations :—

(1) Slide back roof as far as possible.

(2) Remove all screws exposed holding roof runners to roof-framing.

(3) Runners should now be lifted sufficiently to slide roof forward over front header panel.

To Remove Boot Lid (8 H.P. Models).

Proceed as follows :—

(1) Remove four $\frac{1}{4}$" BSF Screws from ends of lid and withdraw.

(2) When refitting and tightening securing screws centralize lid so as to provide equal clearance all round, working on tolerances in caged nuts.

To Remove Window Winding Mechanism (All current Models).

Proceed as directed for " Removal of front door windows," after removal of stop block light glass to disengage window which can then be detached by withdrawal of six fixing bolts.

To Reglaze Windscreen (current 12 H.P. Models).

Proceed as directed below :—

(1) Release screen opener from screen.

(2) Open screen sufficiently to enable the withdrawal of two hinge securing screws on either side of screen.

(3) Remove screen weather rubber and joint securing screws on each side will be exposed for removal.

(4) Having separated screen, glaze with suitable thickness rubber.

To Remove Sliding Roof (current 12 H.P. Models).

Proceed as follows :—

(1) Remove N/S and O/S polished wood cappings.

(2) Withdraw screws from the chromium plated shoes and force these outwards whilst lifting front of roof and withdrawing.

To Remove Boot Lid (current 12 H.P. Models).

Proceed as follows :—

(1) Remove the outside rubber pads on the lid interior to allow access to hinge screws.

(2) Remove the two securing screws at the top through apertures provided by removal of rubber pads.

(3) The bottom two screws can be withdrawn through the spare wheel locker after withdrawal of the spare wheel itself.

Item No.	Defect.	Cause.	Remedy.
1	Doors rattle and squeak.	Loose striking plates „ dove tails (male) „ door hinges. Dry Hinges and Dovetails.	Tighten up all screws with substantial screwdriver. Grease hinges. Remove female portion of dovetail from pillar and pack box with suitable grease (Graphite grease is to be recommended). Set male portion of dovetail inwards as necessary.
2	(a) Door hinges foul centre pillar. (b) Door hinges foul door lapping.	Insufficient clearance due to variation in shape of hinge or position of hinge in relation to pillar.	(a) Chase back metal of recess on centre pillar at point where friction shows. (b) Slightly set hinge flap inwards by hammer and cold chisel until slight clearance is obtained.
3	Rear Door lock rattles.	Usually caused by loose fitting of remote lever.	Remove lock and tighten rivets fixing remote control lever or slightly set levers to shorten centres, and automatically tighten bearings. A small amount of setting only should be required and care taken not to reduce the lock bolt movement. (10 H.P. locks cannot be adjusted).
4	Rear Luggage Tray rattles.	Loose bolts.	Tighten all bolts around the luggage floor.
5	Floorboards squeak.	Loose bolts or metal joints.	(a) Check mounting points and tighten bolts where necessary. (b) Spot weld any loose joints visible between fixed floor and body. Rear corners immediately in front of rear seat should be tested.
6	Front seats loose, rattle or squeak.	Seat too loose on runners or metal to metal friction.	(a) Remove front seats and eliminate sharp edge. (b) Slightly set seat bottom tubes outwards to give tighter fit in runners.
7	Rear locker lid rattles.	Loose fitting probably caused by rubber sealer setting.	Release striker screws and adjust inwards. If all movement has been taken up, remove striker and lengthen slot inwards. With 12 BL models rattle arises as a result of the luggage lid quadrants being loose on their respective hinge pins. These pins should be riveted to reduce unnecessary slackness.
8	Bonnet squeaks and rattles.	Excessive movement on fasteners. Bad fitting of bonnet on 8 H.P. models.	If external knob is at top of slot, adjust clip on wing valance, downwards. If all adjustment has been taken up, remove clip and lengthen slots by filing. Poorly fitting 8 H.P. bonnets can be adjusted by removing rubber buffers from bonnet fastener bracket and refixing this higher up $\frac{3}{8}$" from the platforms and 1" from the front edge. To fix, use No. 10 self-tapping screw. The front screw from the fastener bracket should be refitted, using a spring washer. Vibrations between bonnet side panels and the rod carrying fastener can be eliminated by taking a piece of rubber tubing $1\frac{1}{2}$" in length and of such a section as to completely surround the bar, when slit on one side and applied longitudinally to the fastener rod. The tube will be held in position by pressure of fastener rod against the bonnet side panel.

Item No.	Defect.	Cause.	Remedy.
9	Door rattles (loose windows)	Insufficient felt packing.	Remove trim pads and add further felt layers over the whole of the pocket surface. Check rigidity of glass panels.
10	Check straps rattle.	Loose fixing.	Tighten bolts fixing into sills. If this is not possible, add thin washers. This is necessary as the bolt fitted will only screw down to the shoulder. If rattle persists, slightly set check strap to give binding effect when door is closed. On 12C models, angle plates to which straps are attached on centre pillars are liable to become strained. To deal with such distortion, it will be necessary to re-set angle plates and again weld them into position.
11	Tools rattle in rear cupboard	(a) Jack, working part. (b) Pump, loose shaft. (c) Vibration of tools on to floor.	(a) and (c) Small pieces of felt solutioned to floor under offending part. (b) The use of a rubber band very effectively stops shaft from rattling.
12	Petrol gauge inspection cover in spare wheel floor vibrates.	Defective fitting.	As this cover is very rarely used, it may be securely fixed by the use of a little adhesive tape.
13	Sliding roof rattle.	Wear and tear causing loose fitting.	(a) If roof has too much movement from side to side, remove slide. Side fillets and locking control cover will have to be removed first. Set fixed slides inwards at a point where bolts on slide fit, when sliding roof is closed. A little adjustment by setting outwards may be accomplished with the felted plates on rear of slide. (b) If roof has movement up and down when locked, the slide should be removed and the spring ramp set. (c) With 12C models withdraw roof by:—First removing N/S and O/S polished wood cappings and then remove screws from the chromium plated shoes, force shoes outwards, lift front and withdraw roof. This exposes locking bar which is normally accommodated by a box-housing. Set locking bar so as to permit this to bear on its box at the front end, bolt top and bottom. This contact of the bar with the box will hold the lever and prevent rattle.
14	Rear end of body creaks.	Fouls on bumper support brackets.	Bend bottom flange of body away from bumper brackets.
15	(a) Steering column fouls on dash tray. (b) Steering column squeaks.	(a) Defective fitting. (b) Insecure bracket on dash.	(a) Remove polished fillet from tray and enlarge existing " cut away " to give approximately $\frac{1}{8}$" clearance all round. (b) Tighten bolts visible on dash front.
16	Front wings squeaking.	(a) Metal to metal friction and possibly loose bolts. (b) Radiator cowl fouling wings.	(a) Add felt if not already fitted between wings and body dash. (b) Tighten all fixing bolts in front wheel arch.

COACHWORK Complaints

Item No.	Defect.	Cause.	Remedy.
17	Screen winder chain rattles.	Chain rattles in box container.	Remove winder on some models this will necessitate partial withdrawal of facia panel. Wrap the extreme end of chain with insulation tape so that this presents a moderate resistance to motion. Replace packing washers to securing screws in their original position.
18	Chromium plating tarnished.	Neglect.	Chromium plating should be treated occasionally with a good class chromium polish, in order to remove any stains.
19	Tap or creak in rear bodies of 8 H.P. and 10C models.	Insufficient clearance between petrol filler neck and luggage platform.	Remove petrol filler neck. Cover neck of petrol tank and file angle plate supporting luggage platform.
20	Water leaking into luggage boot (early models 8A and 12C).	Gaps in sorbo rubber packing at bottom corners of lid.	Fit special plates and rubber water excluding strips to the bottom corners of the lid. These brackets and water excluder strips can be obtained from our Service Department. It should also be ensured that lid makes firm contact with sorbo rubber, and packing should be applied to raise the sorbo into contact, where the necessity arises.
21	Creak at rear of boot.	Spare wheel locker lid dropped due to vibration.	Open lid and loosen screw fixing locating link to lid set for correct clearance and tighten up screws.
22	Water leaking through wheel arches.	Gaping of lapped joint occurring.	Remove road wheel and clean between joint. Fill with Dum Dum putty afterwards peaning over both edges of lapped joint to secure Dum Dum in position.
23	Rain leaking through top of doors (1945 12 H.P. models).	Top of door shape failing to conform with cant rail line.	Pack out rubber seal with a suitable piece of rubber tube or strip, sufficiently to seal gap. Chamfer off the extremities of packing used. It is unnecessary to use adhesive to secure in position.
24	Rain leaking through top of windscreen around hinge fittings (1945 12 H.P. models).	Glass panel fails to fill frame properly.	Remove windscreen assembly and withdraw glass panel after separating the screen assembly at sides. Fit six wooden packing pieces of such a thickness as to satisfactorily raise the panel sufficiently to seal off gaps at the top of assembly. Subsequently reglaze in the normal manner.

SPECIALISED TOOLS AND EQUIPMENT

INDEX

NOTE.—There is an illustration for each Tool described in this Section.

SPECIALISED TOOLS AND EQUIPMENT

POLICY

Our organisation for the manufacture and supply of specialised tools is not yet complete, but, in view of the importance of this subject, it is considered desirable to make some temporary provision for the dissemination of information on the subject and the supply of a limited number of tools.

It is proposed therefore, pending the issue of a separate brochure of specialised equipment, to describe a limited number of such tools and where self manufacture is practicable dimensioned sketches are given. If the manufacture of any of these items proves too difficult, and the demand justifies such a course, arrangements will be made at this end for manufacture of such items.

Certain items of proprietary manufacture are also described and illustrated and should be obtained direct from the manufacturers concerned.

It is hoped that these arrangements will bridge the interval which must necessarily elapse before the new organization can function. It is not thought that there should be any serious delay before our more permanent organization for the supply of such items is completed.

The manufacture of specialised tools will be carried out eventually by Messrs V. C. Churchill & Co. Ltd., 27/30, Walnut Tree Walk, Kennington, London, S.E.11.

EQUIPMENT RECOMMENDED FOR USE WITH VEHICLES OF OUR MANUFACTURE

Tool T2. Cutter for Water Pump Gland Seat (Fig. 110).

This cutter by ensuring a proper seating for the rotor driving piece obviates initial leakage, which otherwise might occur after fitting a new packing gland.

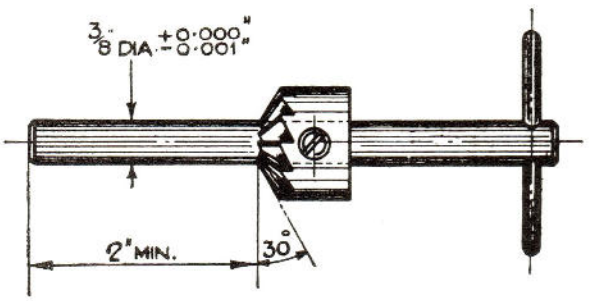


Fig. 110. Cutter.
For Water Pump Gland Seat.

Tool T3. Punch for Water Pump Bushes. (Fig. 111.)

This tool may be used either for fitting or removing these bushes.

Tool T4. Punch for Fan Pulley. (Fig. 112).

This tool is utilized for driving fan pulley off ball bearings and applies to all models having a water pump assembly.

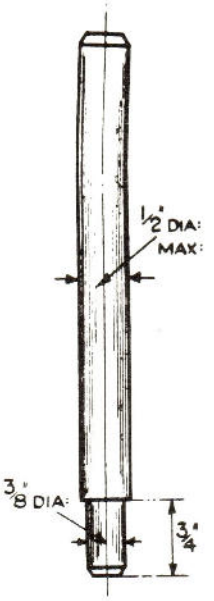


Fig. 111. Punch.
For Water Pump Bushes.

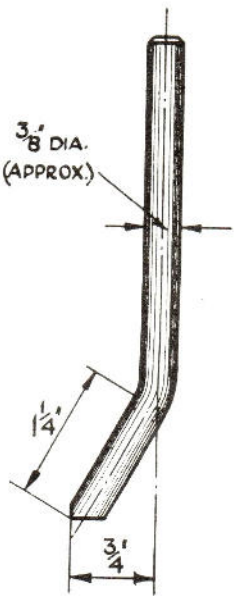


Fig. 112. Punch.
For Fan Pulley.

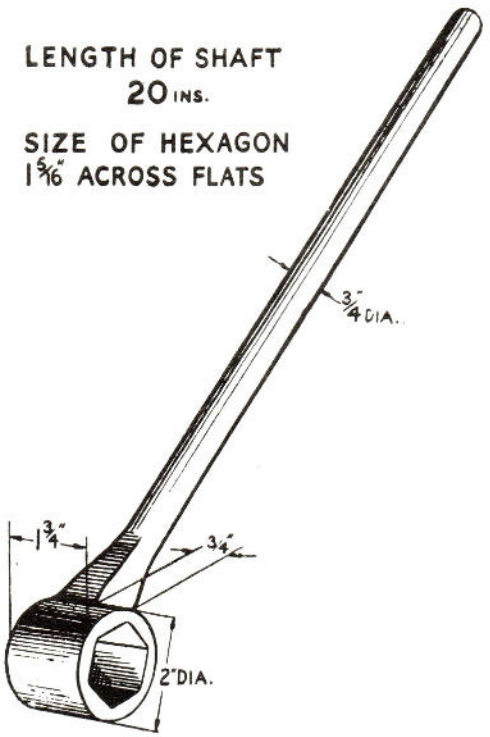


Fig. 113. **Spanner**
For Starter Jaw.

Tool T5. Spanner for Starter Jaw. (Fig. 113).

This tool may be used on the starter jaw nut of all models.

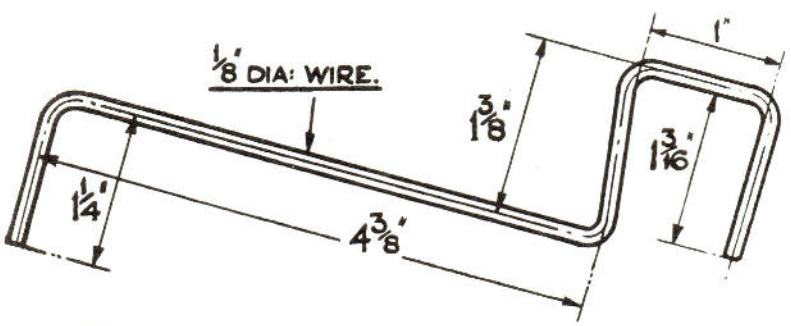


Fig. 114. **Wire Hook.**
For Chain Tensioner.

Tool T6. Wire Hook for Chain Tensioner. (Fig. 114).

This hook is useful for positioning the timing chain tensioner when fitting the timing cover. It may be applied to all current productions.

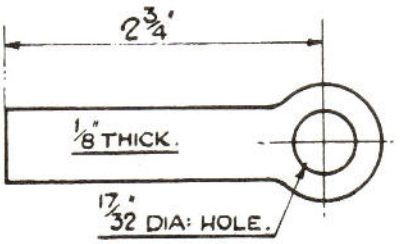


Fig. 115. **Keep Plate.**
For Distributor Shaft.

Tool T7. Keep Plate for Distributor Shaft. (Fig. 115).

This plate is intended for fitting over the distributor shaft when the distributor assembly and cylinder head is removed. Its function is to prevent the distributor shaft becoming disengaged from the oil pump. It may be used with all models.

Tool T8. 45° Valve Seat Cutter. (Fig. 116).

The tool illustrated applies to the 12 H.P. and 14 H.P. engines. With the 8 H.P. models both valve guides are $\frac{1}{4}$" diameter. Limited supplies available in our Spares Department.

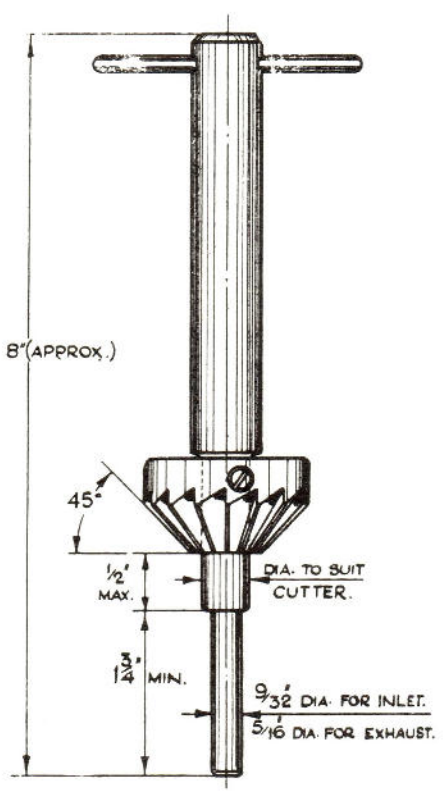


Fig. 116. **45° Cutter.**
For Valve Seats.

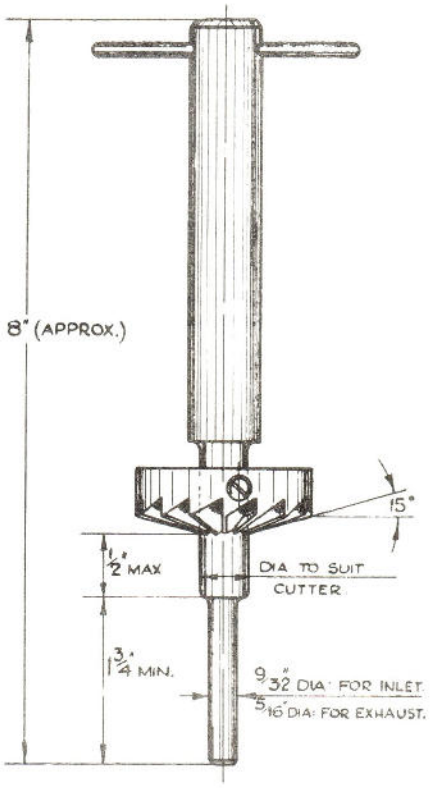


Fig. 117. 15° Cutter.
For Valve Seats.

Tool T9. 15° Valve Seat Cutter. (Fig. 117).

The same remarks apply as for the 45° cutter. This cutter is used before the 45° cutter in cases of embedded valve seats. Limited supplies in our Spares Department.

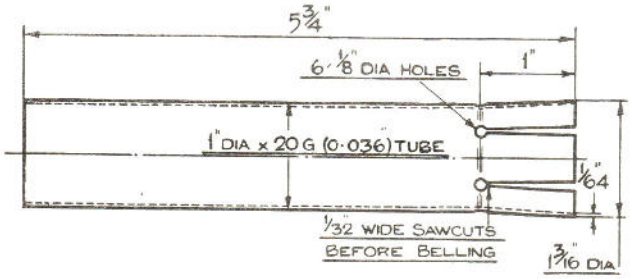


Fig. 118. Sleeve.
For use when fitting Gearbox Front End Cover.

Tool T11. Sleeve for use when fitting Gearbox front end Cover (Fig. 118).

This sleeve protects the oil retaining washer when fitting the front end cover over the constant pinion shaft. This sleeve is applicable on all four-speed gearboxes, and could, by suitable modifications of dimensions, be made to apply to the three-speed units.

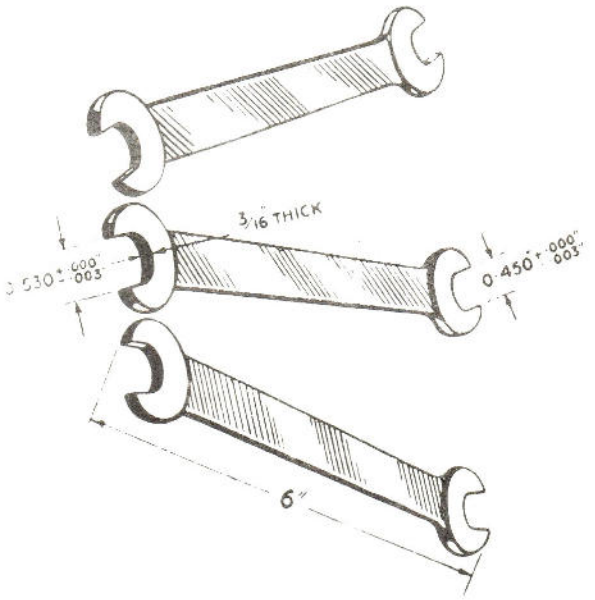


Fig. 119. Tappet Spanners.

Tool T13. Tappet Spanners. (Fig. 119).

These tools may be used with all models. Tappet Spanners of a different pattern may be obtained from our Spares Department.

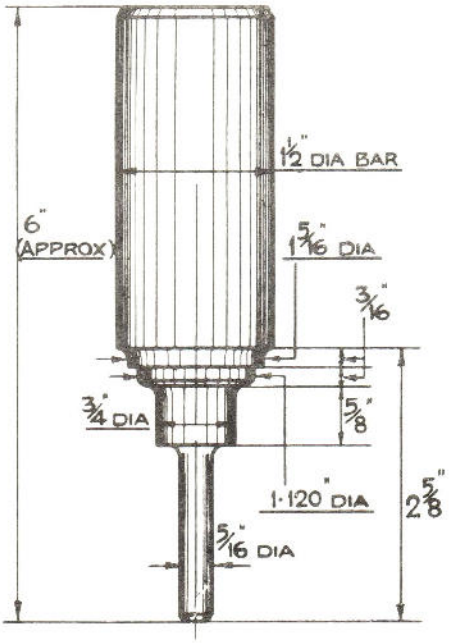


Fig. 120. Spigot Punch.
For Exhaust Valve Insert.

T14 and T15. Spigot Punches for inserting Exhaust and Inlet Valve Inserts into Cylinder Block. (Fig. 120 and 121).

These drifts are useful when fitting valve inserts. Whilst they refer specifically to the

12 H.P. and 14 H.P. models, by suitable modifications of dimensions they may be adapted to any other model.

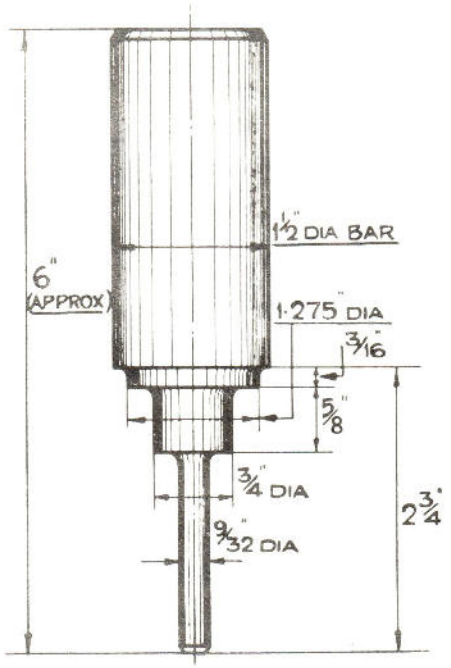


Fig. 121. **Spigot Punch.**
For Inlet Valve Insert.

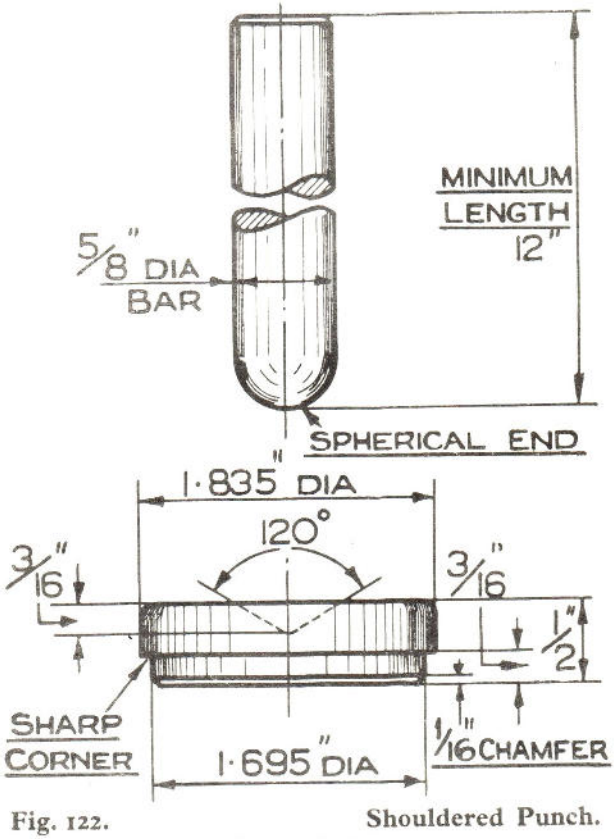


Fig. 122. **Shouldered Punch.**
For Camshaft Bearings.

Tool T16. Shouldered Punch for Removal of Camshaft Bearings. (Fig. 122).

This tool may not be very often required but when, owing to any reason, it is necessary to replace these bearings it will be found of considerable assistance.

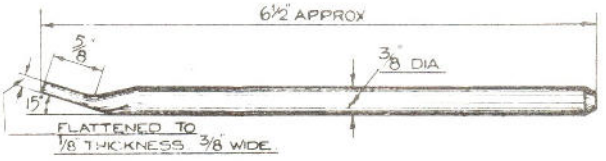


Fig. 123. **Punch.**
For removing Gearbox Front Bearing Outer Race.

Tool T18. Tool for Removal of Gearbox front Bearing Outer Race. (Fig. 123).

This tool is particularly useful when checking and adjusting end float in constant pinion shaft on four-speed models to which it applies.

Fig. 124. **Pilot.**
For use when fitting Gearbox Countershaft.

Tool T19. Pilot for use when fitting counter shaft to four-speed Gearbox. (Fig. 124).

This tool is used for positioning counter shaft gears preparatory to the application of the counter shaft itself.

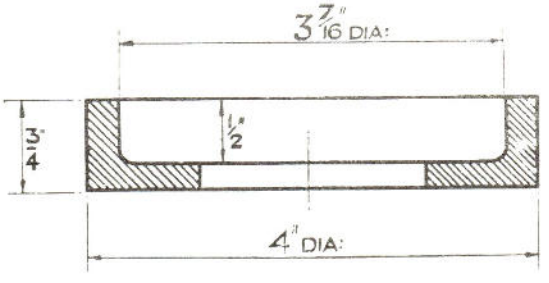
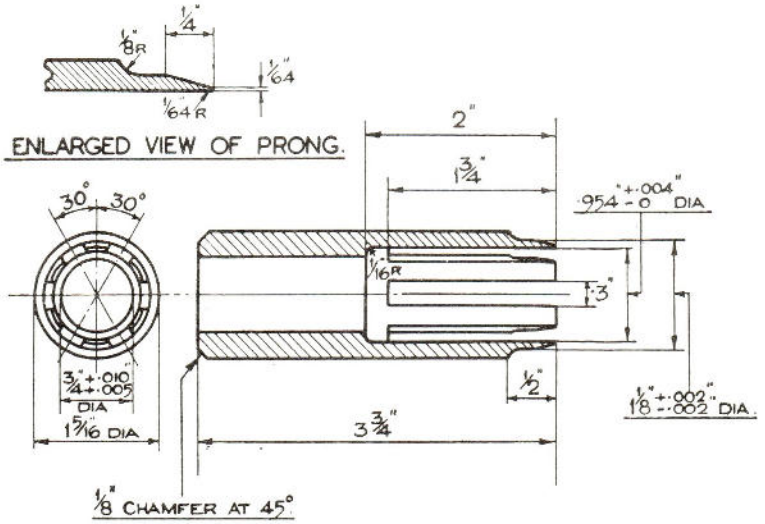


Fig. 125. **Test Ring.**
For "Top and Third" Synchronising Sleeve.

Tool T20. Test Ring for Top and Third Synchro Sleeve. (Fig. 125).

The purpose for which this ring is intended is to assist in measuring the axial load required to release the operating sleeve applying to the "Top" and "Third" gears on the Four-speed Gearboxes. With this operating sleeve the spring balance reading (see page 79) should be between 42-45 lbs.



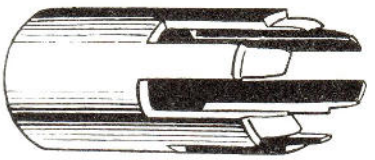


Fig. 126. **Expander.**

For removal of Gearbox Mainshaft Circlip. Pictorial view above, dimensioned detail drawing at side.

Tool T21. Expander for removal of Gearbox Mainshaft Circlip. (Fig. 126).

The removal of this circlip is made very much easier by the employment of this tool. It applies to all our four-speed models. There is no tool which applies to the 8 H.P. three-speed box for *removal* of circlips, it being necessary to either chisel the circlips off or use a pair of pliers for the purpose. This expander may be obtained by special order from our Spares Department.

Tool T22. Expander for fitting Gearbox Mainshaft Circlip. (Fig. 127).

A tool of this description is essential to the proper installation of this circlip to the mainshaft of the four-speed Gearbox. A similar tool may be obtained for our 8 H.P. models. These items may be obtained from our Spares Department.

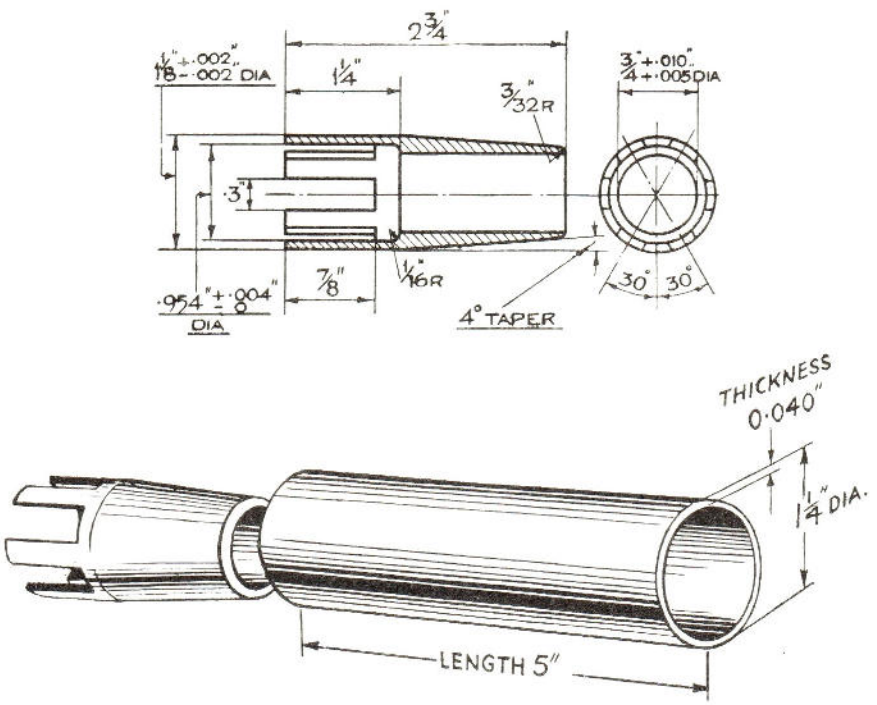


Fig. 127. **Expander.**

For fitting Gearbox Mainshaft Circlip. Dimensioned detail drawing of pronged portion shown above.

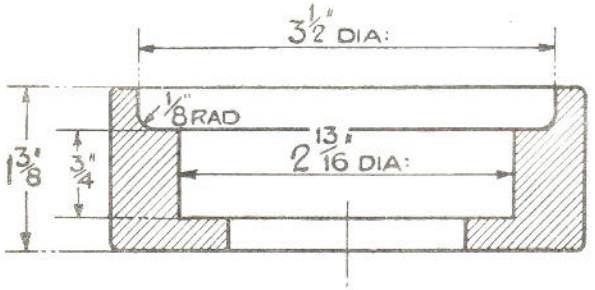


Fig. 128. **Test Ring.**
For Second speed Synchronising Sleeve.

Tool T23. Test Ring for Second Speed Operating Sleeve. (Fig. 128).

This Test Ring is necessary if an accurate test is to be made of the axial load required to release operating sleeve. Utilizing a spring balance the reading for the four-speed box to which the dimensions refer should be 54-57 lbs.

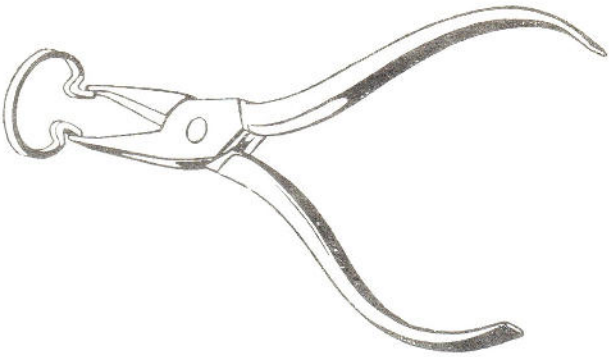


Fig. 129. **Special Pliers.**
For Snap Ring Circlips.

Tool T24. Pliers for fitting and removing Snap Ring Circlips. (Fig. 129).

This tool is used for the removal and fitting of circlips used on the universal joints of Propeller Shafts. May be obtained locally or through our Spares Department.

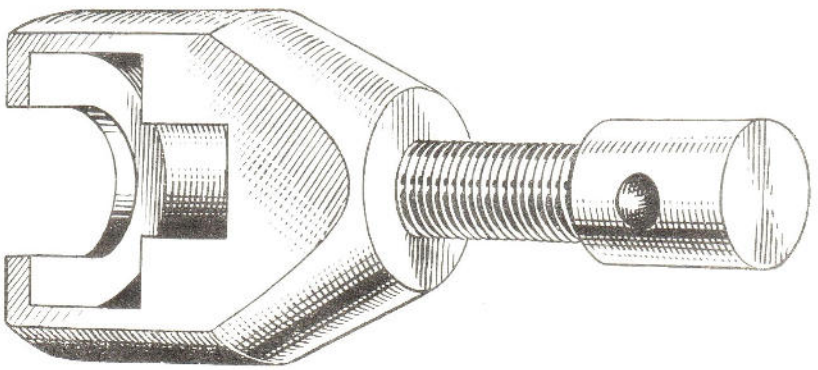


Fig. 130. **Puller.**
For Withdrawing Steering Drop Arm.

Tool T30. Puller for withdrawal of Steering Drop Arm. (Fig. 130).

This tool applies to the steering box fitted to the 12 H.P. models.

Tool T31. Tool for removing and fitting Stub Axle Bushes. (Fig. 131).

The dimensions given are for a 14 H.P. model but by suitable modifications to these measurements may be manufactured to suit other models.

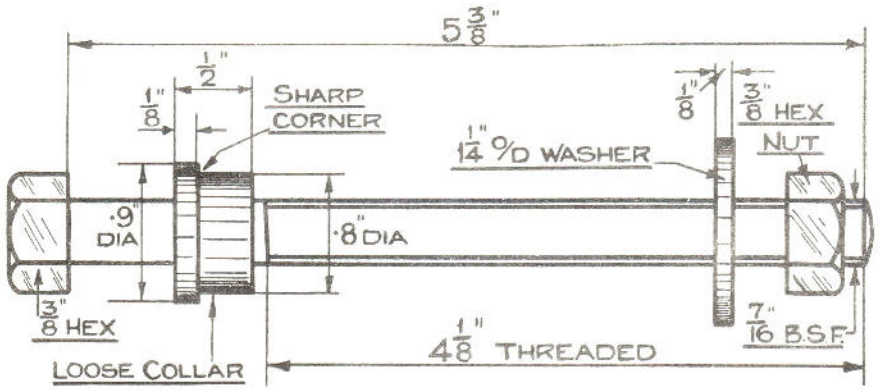


Fig. 131. **Tools for Removing and Fitting Stub Axle Bushes.**

Fig. 132. Spring Hook.

Tool T32. Spring Hook for removal of Brake Springs. (Fig. 132).

The removal of brake shoe springs and the refitting of these will be facilitated by the employment of this tool.

Tool T34. Tool for replacing Ignition Distributor Bearing. (Fig. 133).

Although this tool may be required very rarely its advantages are obvious where the necessity does arise.

Tool T35. Fixtures for Locating Transverse Road Springs. (Fig. 78).

With the independant front suspension the correct alignment of the road springs is of considerable importance to the question of steering geometry. When fitting a front road spring the fixtures under consideration, replace the shackles and " H " pieces, being hinged to the Top Inner Shackle Pin Bushings on the chassis frame. The front springs position is then adjusted with the securing bolts partially tightened, until the spring eyes are located between the jaws of the respective fixtures. The spring securing bolts are then finally secured and re-checked and ultimately the shackles and " H " pieces are fitted together with the shackle pins and thrust washers. These items may be obtained by special order from our Spares Department.

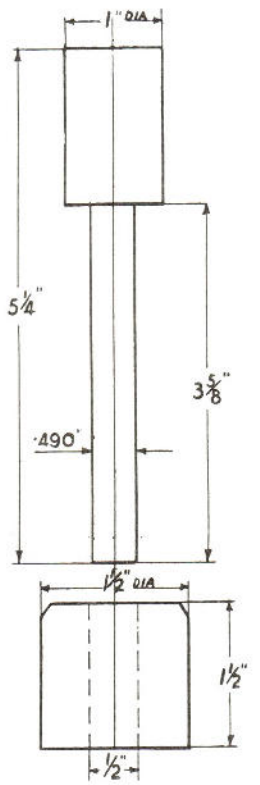


Fig. 133. Tools for Replacing Ignition Distributor Bearings.

EQUIPMENT OF PROPRIETARY MANUFACTURE

Road Wheel Camber Gauge—*Manufactured by Messrs. Dunlop Ltd., Fort Dunlop.* (Fig. 74).

A gauge of this kind is frequently required to check wheel camber after accidental damage has occurred and can be used in conjunction with a wheel turning measure to obtain the Castor Angle of front swivel pins (see page 128).

Front Wheel Optical Alignment Gauge. *Manufactured by Messrs. Dunlop Ltd., Fort Dunlop.* (Fig. 134).

The accurate tracking of the front wheels is of great importance to good steering and to ensure the maximum possible life of front wheel tyres. This gauge is particularly accurate and easy to manipulate.

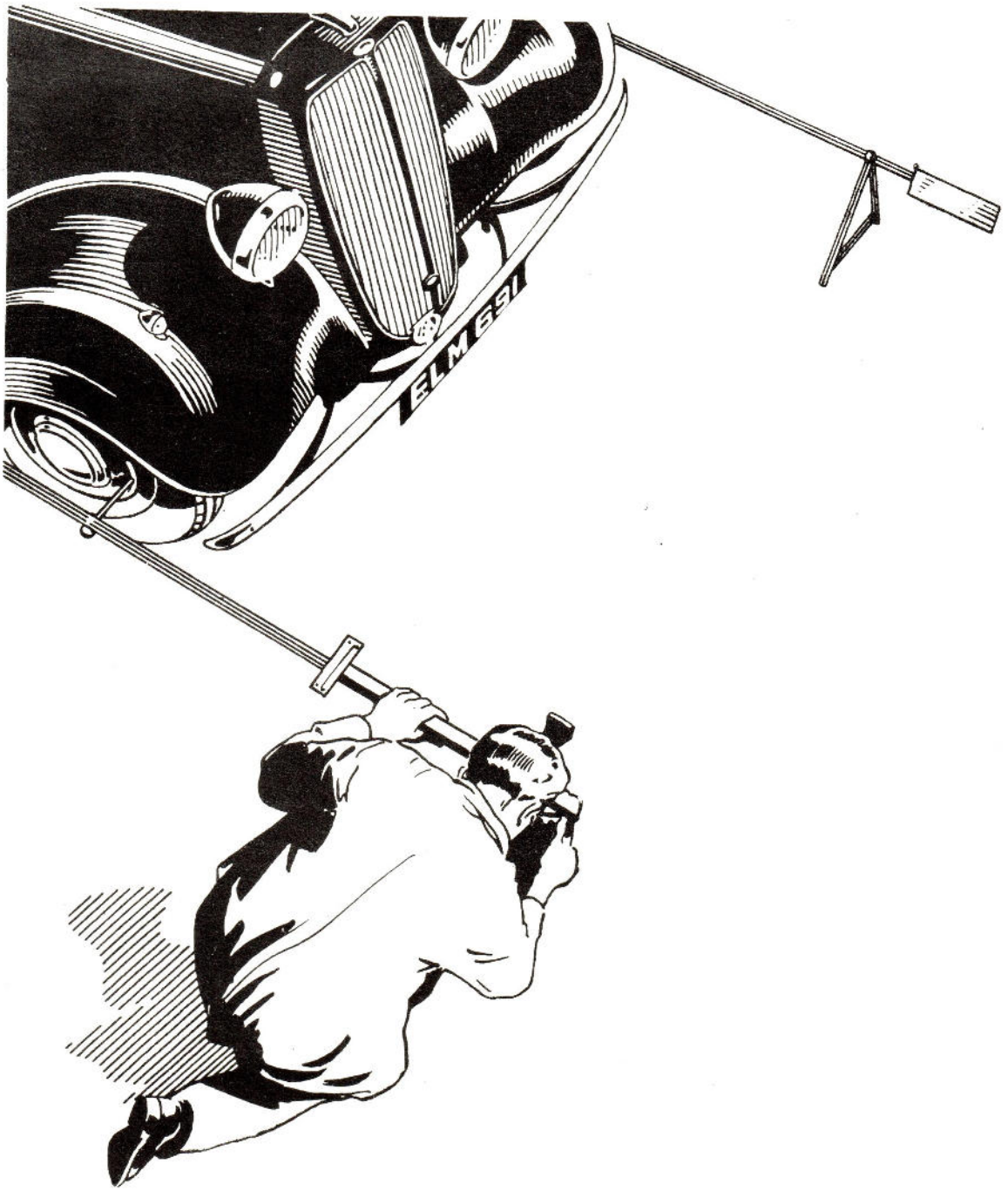


Fig. 134.

Borg & Beck Lever Adjustment Gauge. *Manufactured by Messrs. Borg & Beck Co., Ltd., Tachbrook Road, Leamington.* (Fig. 32).

This gauge is essential to the proper setting of the clutch release levers where this becomes necessary after fitting replacement parts to the pressure plate assembly. The gauge is supplied in sizes to suit the diameter of driven plates. For the clutches under consideration these sizes of gauges are required, namely :—

$6\frac{1}{4}$" for 8 H.P. Models.
$7\frac{1}{4}$" for 10 H.P. Models.
8" for 12 H.P. and 14/12 CD Models.

V.L.C. Swivel Pin Bush Reamers. *Manufactured by Messrs. V. L. Churchill Co., Ltd., 27/34, Walnut Tree Walk, Kennington, London, S.E.11.* (Fig. 135).

When ordering these, please specify model for which required with Commission Number.

Fig. 135. Swivel pin bush reamer.

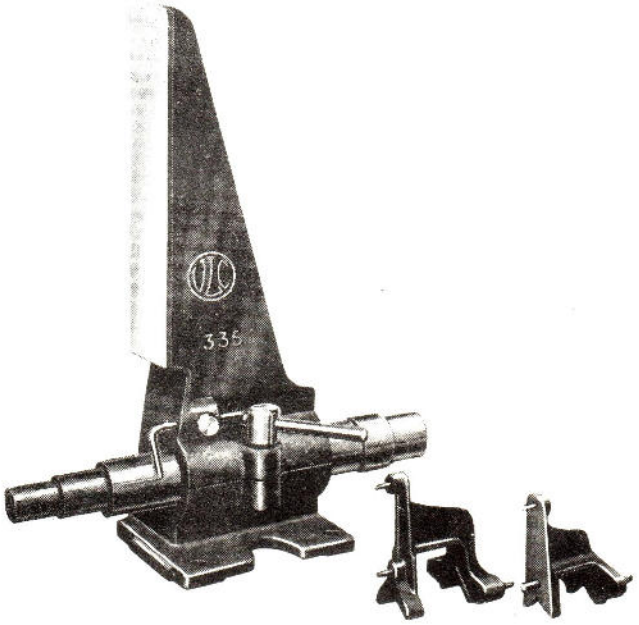


Fig. 136. Connecting rod alignment jig.

V.L.C. 335 Connecting Rod Aligning Jig. *Manufactured by Messrs. V. L. Churchill Co., Ltd., 27/34, Walnut Tree Walk, Keninngton, London, S.E.11* (see Fig. 136).

When ordering these jigs please specify models for which required.

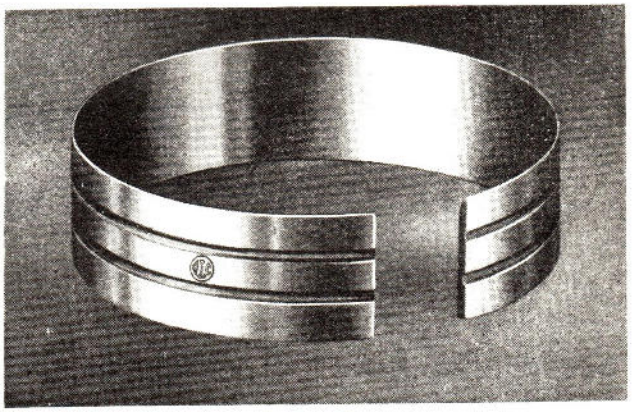


Fig. 137. Piston ring clamp.

V.L.C. Piston Ring Clamps. *Manufactured by V. L. Churchill Co., Ltd., 27/34, Walnut Tree Walk, Kennington, London, S.E.11.* (Fig. 137).

When ordering specify models for which required with dimensions of bore.

PART II

TRIUMPH MODELS
TYPE 18T and 18TR

CONTENTS

ENGINE

INDEX

ILLUSTRATIONS

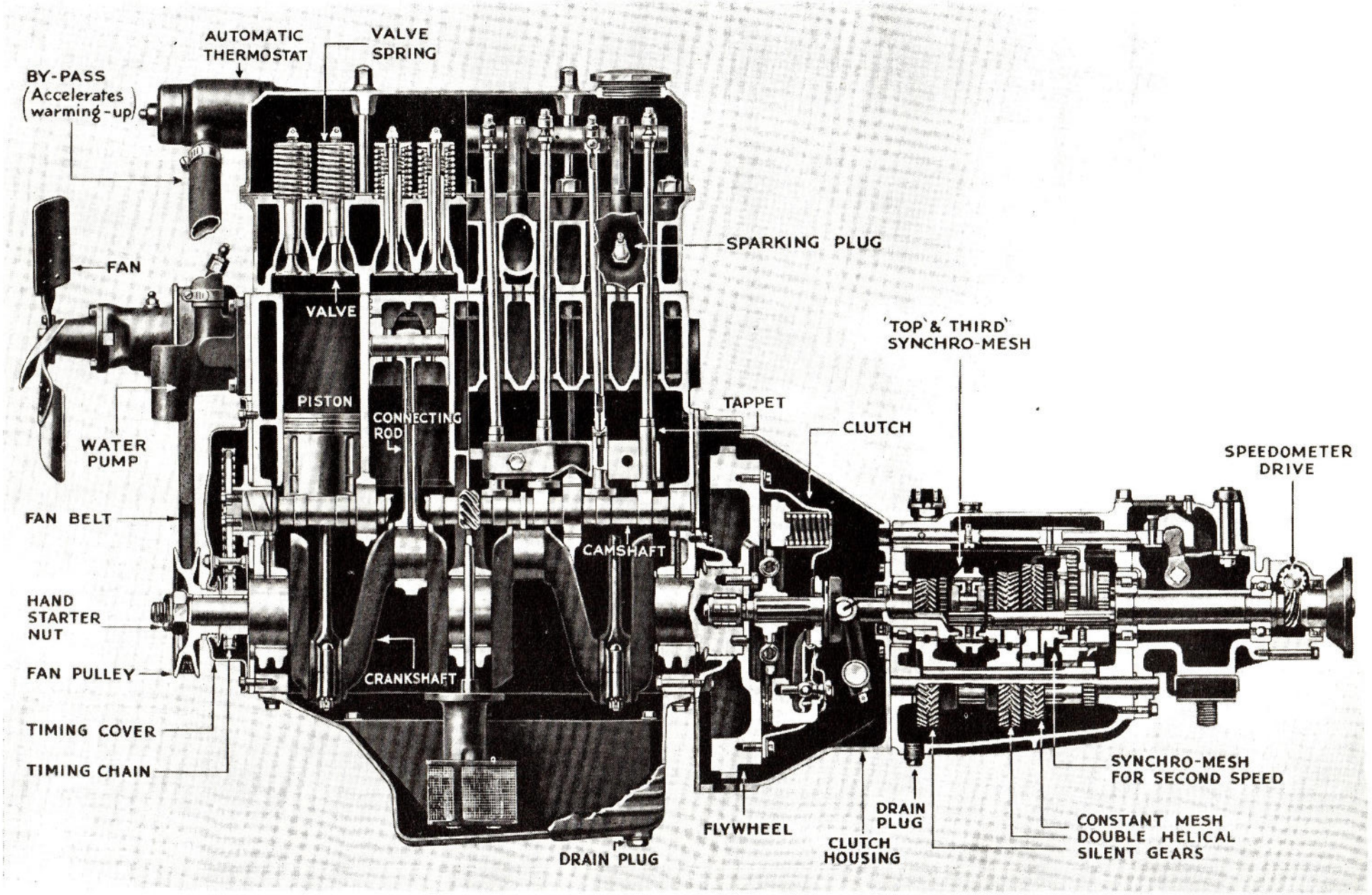


Fig. 138. **Sectional view of Triumph engine and gearbox.**

ENGINE

DESCRIPTION

The crankcase and cylinders are an integral casting being manufactured of chromium cast iron, which metal offers considerable resistance to corrosion, enhancing its wearing properties.

As with the Standard models, pistons are of aluminium alloy, specially heat treated to prevent distortion, and tin coated to obviate damage due to partial seizure during the initial running in period.

The connecting rods are of I section, being manufactured of special steel and are of the same type, but not interchangeable with those used on the Standard models. A modification in the connecting rods used with these cars, as compared with the 14 H.P. and 12 H.P. Standards, consists of a small hole drilled in the side of the connecting rod so as to break into the oil way from the big end bearing thus ensuring adequate lubrication of the cylinder walls.

The crankshaft is of Molybdenum Manganese steel being interchangeable with the assembly used on the 12 H.P. and 14 H.P. Standard engines. The big end bearings and the main bearings are interchangeable with those used on the quoted Standard models.

The **Crankshaft thrust** is taken, as with the Standard models, by thrust washers fitted on either side of the rear main bearings.

The rocker shaft assembly is lubricated under pressure from the main oil supply. An adaptor screwed into the cylinder block taps the supply of oil fed through the oil gallery and this adaptor is connected by an external oil pipe to another at the rear end of the combustion head. Oil is fed through this latter adaptor to an oil way which leads to a vertical drilling connecting the oil way with another in the rear rocker shaft bracket. The rocker shaft is hollow and filled with wick and communicates by radial drillings with each rocker, these in turn being drilled horizontally to allow oil to pass to the ball pins and push rod cups and also to the valve stems. Surplus oil is returned to the sump via the push rods providing lubrication for the ball and cup junctions between the tappets and these rods.

As with the Standard 12 H.P. and 14 H.P. models, an external filter is fitted which is similar although not interchangeable with that employed on the quoted models. The operations of this filter is identical to that one described on Page 32.

As already stated above, connecting rods are drilled so that a small jet of oil is sprayed out from each rod to give additional lubrication to the cylinder walls.

The **camshaft** used is identical with that employed on the 12 H.P. and 14 H.P. model Standards. As with the latter models the tappets are accommodated in detachable guides, but these items are not interchangeable between the two ranges of models.

The **tappets** are provided, at their upper extremities with case hardened cups, which accommodate the case hardened spherical ends fitted to the hollow push rods. At the upper end of the **push rods** case hardened cups are fitted which operate on ball pins screwed into the extremities of **case hardened steel rockers.** These rockers are mounted on a rocker shaft which is carried by four brackets secured to the combustion head. The inner end of each case hardened rocker operate on each valve stem. The valves being provided with two springs each of which are coated with chromium to inhibit the effects of corrosion.

Each push rod is provided with a spring, at its lower end which fits between a collar, shaped to grip round the " necked " portion of the push rod ball ended extremity, and in a recess in the cylinder block itself. These springs quieten the tappet gear.

The tappets are lubricated under pressure as described under " Engine Lubrication " on Page 31.

As with the Standard models the camshaft embodies a helical gear. This gear drives two shafts through a spiral gear on each, one of the two shafts drives the oil pump, which is the same gear type as used with the Standard models, and the other operates the distributor which is mounted on an adaptor on the tappet cover.

The oil pump is driven by a shaft set at right angles to the camshaft, the spiral gear keyed to the upper end of the shaft, which is accommodated in a flanged bearing pressed into the cylinder block as with the Standard models, the assembly being located endwise by means of an abutment bracket, secured by the two inner tappet block securing set screws. The shaft is provided with a projecting tongue at its lower extremity which engages the oil pump.

The **Distributor Shaft** is accommodated in a blind bearing pressed into the Cylinder block. The shaft is set at an angle of 50 degrees to the camshaft, the spiral gear taking its drive from above and on the opposite side of the helical gear supplying the drive for the oil pump. As with the oil pump drive the spiral gear is keyed to the shaft and is similarly provided at its upper extremity with a projecting tongue, which engages with the distributor dog. Packing shims are fitted between the distributor adaptor and tappet cover to provide the requisite end float of 0.006".

An oil breather pipe is attached to an adaptor on the tappet cover and the pipe is extended downwards to carry the fumes clear of the body level, thus preventing their entry into this.

LUBRICATION

The lubrication of the engine is practically identical with that employed on the Standard models and described on Page 31. The point of variance between the two ranges of cars is the necessity to lubricate the overhead rocker gear with the models under consideration in this portion of the manual.

TO REMOVE ENGINE FROM CHASSIS

The procedure for the removal of the engine is similar in many respects to that adopted with the Standard 12 H.P. model, and may be summarized as follows :—

1. Remove Bonnet, radiator and tie rods.
2. Disconnect terminals from accumulator.
3. Remove wing support stay.
4. Remove exhaust downtake pipe from exhaust.
5. Detach oil pressure gauge pipe and that leading to the petrol pump from the tank.
6. Disconnect high and low tension leads from the coil and leads from terminal block on dynamo.
7. Remove starter motor and place aside carefully.
8. Remove choke and throttle controls from carburettor.
9. Remove air silencer and adaptor from its attachment to rocker cover and carburettor by removal of four $\frac{5}{16}$" B.S.F. nuts (2 domed) from Water Cover and nuts securing adaptor to carburettor.
10. Remove heel and toe boards.
11. Disconnect the clutch operating rods from the clutch housing end.
12. Detach the two gear actuating rods from their respective levers on the gearbox. **To do this** remove the ball pins from the levers. Do not interfere with the ball joints or alter the rod lengths (see Page 195).
13. Remove the bolts which secure driving flange on gearbox to that on the propeller shaft.
14. Detach the two leads from the reverse gear indicating light switch on the gearbox top cover.
15. Remove the two nuts which secure the gearbox rear mounting to the chassis cross frame and the two nuts on either side of the engine securing the front bearer plate to the rubber mounting. The earthing wire on the N/S of bearer plate will have to be detached to carry out the operation.
16. Lift engine assembly out of chassis applying the sling to the fan pulley on the crankshaft after removal of fan belt, and between the clutch housing and engine sump. A similar application as that made with the Standard engine in Fig. 8 may be used.

TO DISMANTLE ENGINE

Having removed engine from chassis as directed on Page 187 dismantling procedure is in many respects the same as that set out on Page 36 for the Standard 12 H.P. model apart from the alterations necessitated by the employment of the overhead valve gear. When carrying out this work the following sequence of operations should be adopted :—

1. Disconnect the gearbox and bell housing from engine by removal of nuts and bolts.
2. Remove the aluminium rocker cover.
3. Remove the exhaust and induction manifold complete with the carburettor and induction manifold drain pipe.
4. Remove water expellor and fan assembly from engine.
5. Remove dynamo.
6. Remove starting handle dog nut, noting the number of shims fitted to give correct position of starting dog nut in relation to compressions.
7. Remove fan pulley and driving key.
8. Remove timing cover.
9. Place No. 1 piston on T.D.C. (that nearest the driver) and proceed as directed in operation 9 on Page 37. This will give the open position of No. 4 (the cylinder most remote from the driver) inlet and exhaust valve, 20 degrees overlap being provided, as with the Standard models, see diagram on Page 41. Mark timing wheels as described on page 37.
10. Remove rocker shaft and brackets by withdrawal of four $\frac{3}{8}$" B.S.F. nuts securing these to the studs on the combustion head. Do not further dismantle the rocker shaft unless it is decided to replace a rocker or to renew the wick in the hollow rocker shaft.
11. Withdraw cylinder head after removal of eight domed and four plain $\frac{1}{2}$" B.S.F. nuts. Dismantle valve and springs.
12. Remove distributor head complete with driving dog and adaptor by withdrawing the two $\frac{5}{16}$" B.S.F. set screws, which secure these parts to the tappet cover. Regard the number of packing shims used to give end float of 0.006".
13. Remove petrol pump after withdrawal of petrol pipe connecting this to the carburettor and removal of two $\frac{5}{16}$" B.S.F. set screws.
14. Remove oil filter after withdrawal of four $\frac{3}{8}$" B.S.F. set screws.
15. Remove tappet cover after withdrawal of 13 set screws. (There are fourteen securing this but a slightly longer one has already been removed when the dynamo was withdrawn.)
16. Remove push rods and springs after detachment of collars locating these springs.
17. Withdraw tappet blocks and oil pump driving shaft abutment, after removal of four $\frac{3}{8}$" B.S.F. set screws. NOTE THAT THE LONGER PAIR OF THESE SECURE THE INNER END OF EACH TAPPET BLOCK AND THE ABUTMENT. FAILURE TO REGARD THIS POSITIONING MAY CAUSE DAMAGE TO PISTONS.
18. Remove distributor shaft with a pair of pliers and twisting it in an anti-clockwise direction thus screwing the gear out of mesh.
19. Grip upper end of oil pump driving shaft and twist this in an anti-clockwise direction to disengage the gear on the shaft from that on the camshaft.
20. Remove timing wheel on camshaft and timing chain.
21. After detachment of camshaft locating plate, withdraw camshaft.
22. Extract chain wheel from crankshaft and remove key.
23. Remove front bearer plate.
24. Remove engine sump after draining off oil.
25. Remove oil pump and primary filter.
26. Remove pistons as indicated in Operation 18 on Page 37.
27. Remove flywheel and roller bearings.
28. Remove the two sealing blocks and bearings as indicated in Operation 20 on Page 37.
29. Proceed as directed in Operation 21-24 inclusive on Page 38.

9.

Operation 9. Page 37

Place No.1 piston on T.D.C. with both valves closed and on the assumption that the valve timing is correct (if this is not the case, timing will be reset as directed on Page 41 under Valve Timing when re-assembling) proceed to mark the timing gear as follows:-

"Scribe a line across the surface of the two chain wheels, which, if produced in both directions would pass through the respective centres. In addition, take a centre punch and mark a dot on the end of the camshaft through a set screw hole and similarly mark the face of the camshaft wheel adjacently".

It may be found that these markings have already been made, in which case, fresh markings will only be required if the existing ones are indistinct. See Figure 9 which illustrates the method of marking these.

26.

Operation 18. Page 37

Remove pistons, and connecting rods after removal of split pins and nuts securing big end caps. To draw out pistons, place crank-pin towards camshaft and then by turning the engine slowly anti-clockwise, as the piston concerned comes against the balance weight on the crabkshaft, the assembly can be moved down clear of the shaft. (See Figure 10.) Replace bearing cap and the slotted nuts on their respective bolts. Each bearing housing should already be numbered on its offside face.

28.

Operation 20. Page 37

Remove the two securing blocks and four filling pieces from over the front and rear main bearings. The front sealing block is secured by two vertical set screws, but in the case of that fitted over the rear main bearing, there are, in addition, two horizontal set screws which also assist to secure the rear oil retainer.

29.

Operations 21 - 24. Page 38

21. Remove rear oil retainer.

22. Remove rear engine bearer plate.

23. Remove main bearing caps and lower halves of thrust washers.

24. Lift crankshaft from the engine.

PRECAUTIONS TO BE OBSERVED WHEN RE-ASSEMBLING ENGINE

All the points mentioned on Pages 38 and 39 apply with the exception of Operation No. 10. In addition to the precautions set out on the quoted pages the following apply with this model :—

1. Ensure that oil is circulating through the rocker shaft and being supplied to the respective rocker ball pins, and push rod cups fitting new wick and cleaning out oil ways as necessary to ensure proper lubrication.

2. Ensure that the same number of shims are fitted between the distributor adaptor and tappet cover thus safeguarding the provision of 0.006" end float in driving shaft.

CLUTCH

INDEX

CLUTCH

BORG & BECK TYPE 9A—6G

This clutch is similar in construction to that employed on the Standard model.

NINE orange thrust springs are used with a 9″ floating plate having SIX white radial springs and 1″ splines in the hub centre.

Running Adjustments.

These are the same as those indicated for the Standard models on Page 58.

To Remove Clutch.

1. Remove Gearbox and Clutch housing as instructed on Page 195. Do not allow the gearbox to hang on the constant pinion shaft during this attention.

2. Proceed thenceforward as directed on Page 59 for the same work on the Standard $7\frac{1}{4}$″ and 8″ clutches.

To Dismantle Clutch.

Proceed to dismantle as directed on Page 59 for Standard 12 H.P. Model.

To Assemble Clutch.

The same procedure as that indicated for the 12 H.P. Standard on Page 60 should be employed.

To adjust Release Levers.

This work is identical with that set out for the Standard 12 H.P. model on Page 61.

To Refit Clutch.

Proceed as indicated for Standard 12 H.P. models on Page 61. Re-installation of clutch and gearbox assembly should be carried out in the opposite order to that indicated for removal on Page 195.

GEARBOX

INDEX

ILLUSTRATION

GEARBOX

DESCRIPTION (See Fig. 138)

The four-speed synchro-mesh gearbox fitted to the Triumph models, apart from the use of a remote control for gear operation and the consequent changes to the selector mechanism, agrees largely with that fitted to the 1945 12 H.P. and 14 H.P. Standard models already described earlier in the manual on Pages 74 and 75.

All the gears, synchro units, shafts, gearbox casing, and its mounting on the chassis frame, are interchangeable with those used on the Standard 12 H.P. cars.

A slightly different reverse operating lever is used, in conjunction with the same type of slipper as that employed with the Standard models.

An entirely different design of selector mechanism is necessitated by the mounting of the change-speed lever, on the steering column, just below the steering wheel.

The **selector mechanism** is still contained in the gearbox top cover, as is the case with the 12 H.P. and 1945 8 H.P. Standard cars, but this has been re-designed to dispense with the change-speed lever turret and to suit the different method of gear operation.

The **Gearbox Top Cover** is of aluminium alloy and accommodates the selector rods and mechanism, selector rod locking plungers and springs and also the interlocking device for preventing the engagement of two gears at once.

The **Selector Mechanism** consists of three selector rods, each carrying an operating fork and being provided, at its rear extremity, with a sleeve having a recess cut to accommodate the striking lever.

Actual selection of gears is carried out by lateral movements of a sleeve, on which the striking lever is mounted. This sleeve is fitted to a splined shaft which is accommodated in the gearbox extension. The lateral movements are imparted to the sleeve by a lever engaging in a slot cut in the sleeve, being operated through a spindle in the top cover by an arm, external to the gearbox which is inter-connected with the remote control on the steering column.

The operation of the selector rods is carried out, after selection of gears, by rotary movements of the collar which carries the striking lever. The splined shaft, on which the operating sleeve is mounted, has attached to it a lever, external to the gearbox, which is connected by links and levers to the remote control. (The operation of the change-speed control is described below.)

An **interlocking device** is supplied to prevent more than one gear being engaged at one time. This consists in the provision of a steel roller accommodated in a diametrical recessed " drilling " at the forward end of the middle (" second " and " first ") selector rod, abuting at each extremity against a $\frac{3}{8}$" steel ball. These two steel balls fit lightly into recesses cut in the outer selector rods when no gear is engaged. The length of the silver steel roller falls short of the external diameter dimension of the accommodating selector rod and just sufficient end float in this plunger and the two balls is provided to allow the movement of one selector rod at a time.

The movement of either of the outside selector rods locking the other two by means of the roller and two steel balls, whilst the movement of the middle rod with the roller, causes the two balls to be forced into their respective recesses in the outer selector rods and thus preventing their movement.

The **change-speed lever** is fitted just below the steering wheel, being hinged at its attachment to the control shaft, the fulcrum point being provided by a double extension of a screwed collar, which is accommodated in a bracket on the steering column. The control shaft passes through this screwed collar and takes its bearing in it, a second bearing point being provided towards its lower end in a bracket clamped to the steering column.

Selection of gears is carried out by up and down movements of the control shaft operated lever-wise by the change-speed lever about its fulcrum point. The normal and horizontal position of the change-speed lever provides the **" Second " and " First "** gears being maintained in this location by means of

a spring between the steering column and the lever arm towards the lower extremity of the control shaft.

To obtain the position for the selection of either **"Top" or "Third"** gears it is necessary to raise the control lever's outer extremity as far as possible, thus forcing the control shaft to its limit in a downwards direction.

To obtain **"Reverse"** gear it is first necessary to release a catch pin on the control lever from a stop. This is done by pulling the control lever outwards, at right angles to the steering column, against spring pressure. This movement, which is permitted by slots in the fulcrum bracket, allows the gear lever outer extremity to be further depressed and thus raising the control shaft to its limit.

The movements described above are transmitted, by a collar pegged to the control shaft, to a lever having its fulcrum point on a pillar, which is integral with the bracket carrying the lower bearing for the control shaft. This latter lever arm is attached by a socket assembly to a rod which is, in turn, similarly attached to the external lever mounted on the spindle in the gearbox top cover. Thus up and down movements of the control shaft are communicated to the gearbox and cause lateral actuations of the striking lever assembly on the splined shaft carried in the gearbox extension.

The gear engagement is effected, after selection of the gear required in the manner described in the preceding paragraph, by rotary movements of the gear lever extremity in three different planes.

"First" and "Second" gears are obtained in the control lever's normal position, parallel to the steering wheel, by moving this lever as far as possible anti-clockwise and clockwise (viewed from above) respectively (see Fig. 139).

By raising the control lever's extremity as far as possible and moving anti-clockwise or clockwise (viewing from above) in this plane, the **"Third"** and **"Top"** gears respectively are engaged.

"Reverse" gear is obtained, after releasing reverse stop, by pressing down the lever extremity as far as possible and then moving the latter, in this plane, anti-clockwise until resistance stops further movement.

These rotary movements of the change speed lever extremity and control shaft are conveyed by a lever arm fitted towards the lower extremity of the shaft, through a short rod to a bell crank lever mounted on a chassis side member. The other end of this cranked lever is connected by a rod to the external lever mounted on the splined shaft in the gearbox extension, which shaft carries the striking lever assembly. Thus rotary movements of the change-speed lever by operating the arm on the gearbox cause similar motion of the striking lever assembly, operating the gears selected, the gears being maintained in position by engagement of the locking plungers in their respective recesses in the selector rods.

The effects of relative movements between the engine assembly and chassis frame, permitted by flexible mounting, have been rendered innocuous by careful lay out of control details.

Gear Ratios.

The following gear ratios are provided :—

	Saloon	Roadster
Top	4.86	4.57
Third	7.06	6.64
Second	11.80	11.1
First & Reverse	19.18	18.04

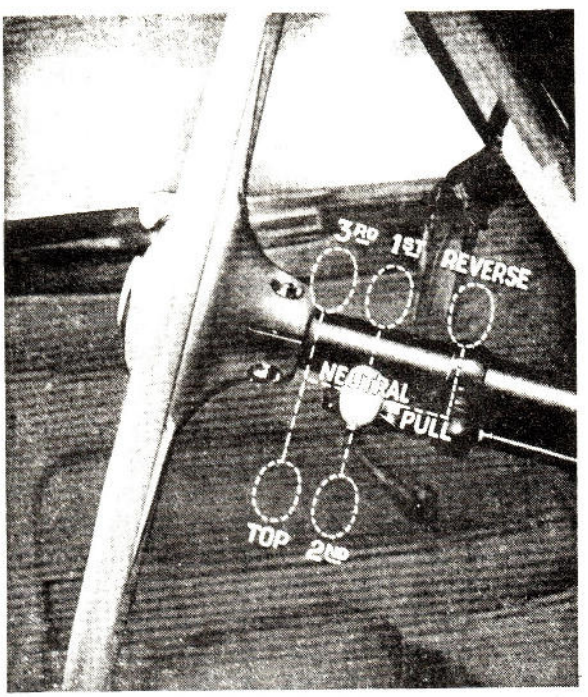


Fig. 139. Showing gear engagement positions of change speed lever.

TO REMOVE GEARBOX FROM CHASSIS

The removal of this unit from the chassis necessitates practically the same work as that involved by the withdrawal of the gearbox from the 12 H.P. Standard which is set out on Page 75.

In addition to the schedule of operations given on the quoted page it is necessary to detach the respective rods from the selecting and operating levers on the gearbox. **This detachment should be effected by removal of the ball pins from the levers and without disturbing the socket assembly junctions or interfering with the coupling rod lengths.**

TO DISMANTLE GEARBOX

The procedure for dismantling this gearbox is the same as that set out on Page 76 for the unit fitted to the current range of Standard cars, with the exception of the top cover and selector mechanism.

Instead of the removal of the change-speed lever and gearbox lid as direct in Operation 1 on Page 76, the gearbox cover will be withdrawn with the selector rods and levers.

The removal of the operating lever and splined shaft from the gearbox is not recommended unless a proper tool for fitting the securing circlip is available. (Such a tool will become available in due course through our Spares Department.)

Operations 19—23 described on Page 77 do not apply to the gearbox, the dismantling of the Top Cover, used with the unit under consideration, is explained below.

To Dismantle Top Cover and Selector Rod Assemblies.

Having removed the Top Cover proceed as follows :—

1. Remove the three screwed plugs, situated at the forward end of the Top Cover over the selector locking plungers and springs. Withdraw the locking plungers and springs.
2. Remove the set screws securing the selector forks and the collars, after withdrawing the locking wires.
3. Draw out the selector rods from the front of the cover taking special care to avoid loss of the interlocking details, *i.e.*, the steel roller from the middle selector rod and the two locking balls. The withdrawal of the selector rods will release the forks and collars from each selector.
4. The selector lever assembly, which remains in the top cover, should not be dismantled and if necessity ever arises for its replacement it is advisable to obtain an exchange top cover assembly from our Service Department, returning the existing one for re-conditioning. The assembly of a new lever requires careful fitting and the possession of the necessary drawing giving precise relation of the two levers.

Precautions to be observed when re-assembling Gearbox.

The precautions to be regarded when re-assembling gearbox will be the same as those set out on Page 78 for the assembly of the Standard gearbox, apart from the information concerning the Top Cover. Points to be remembered when re-assembling the top cover are set out below.

TO RE-ASSEMBLE GEARBOX

To Re-assemble Top Cover of Gearbox.

Re-assembly of this cover is the reverse procedure to that given above for dismantling observing the following points :—

1. Do not attempt to fit a new selector lever assembly to the Top Cover (see remarks above).

   Fit the outer selector rods first, next introduce the two locking balls utilizing a loop of wire to position these in their

respective recesses in the top cover. The centre selector rod should be fitted last not forgetting to do this with the steel roller in position. Whilst fitting the three selector rods to the top cover, the selector forks and collars will have to be aligned for entry.

3. After fitting a new selector rod a small amount of circumferential movement on the rod should be ensured to prevent "Binding" between the selector rod ends accommodating the striking rod. If it is necessary to provide circumferential movement on this selector rod, it may be arranged by increasing the recessing, at the top and bottom (in its normal position) only of the holes accommodating the locking balls. These recesses can be suitably dealt with by the employment of a small diameter grinding tool or by using a suitably shaped piece of carborundum stone. This increase at the top and bottom of the recesses need only be carried out if there is no circumferential movement possible in this selector rod—10 degrees of rotary movement is sufficient provision to allow for any small discrepancies likely to cause binding between the striking lever collars.

4. If, in spite of recommendations on Page 195 it has been found necessary to interfere with the change-speed control rods for any reason, the dimensions and instructions given below will prove of assistance in restoring correct gear operation.

TO ADJUST POSITION OF CHANGE SPEED CONTROLS

1. Adjust the length of the rod attaching the lever, hinged on the steering column steady bracket, to that attached to the spindle in the gearbox top cover, until the distance between this steady bracket and the lower face of the collar fixture on the control shaft is at least $\frac{5}{8}$".

2. The length of the operating rod between the cranked lever on the side member and the operating lever on the gearbox, should provide centres of $14\frac{3}{4}$" with the Roadster models and 18" with the Saloon, where forward mounting of the engine is used.

3. As previously indicated certain further adjustments may be required, and in the case of the operating linkage these should be made to the short rod connecting the cranked lever to the one attached to the control shaft. This will leave a fixed dimension for the longer rod for possible future reference. The dimensions given will be found to approximate very nearly to the average setting.

RE-INSTALLATION OF GEARBOX

This work entails the reverse procedure to that employed for removal and is perfectly straightforward if the precautions with regard to the remote control linkage, described above, are regarded.

VARIOUS SECTION

INDEX

PROPELLER SHAFT

A Hardy Spicer propeller shaft and universal joints are used with the Triumph. There are two different lengths of propeller shafts used owing to the longer wheel base used with the Saloon type of bodywork. The types used are :—

For the roadster	Type 1300—4
For the saloon	Type 1300—12

LUBRICATION

The same provisions are made for the lubrication of these propeller shafts as with those fitted to the 1945 model Standard. These are enumerated on Page 89.

MAINTENANCE, REPAIR AND ASSEMBLY

The instructions already given for "Standard" models on Page 89 will apply equally to the propeller shaft used with the Triumph.

The precautions set out on Page 91 with regard to replacing sliding joint on shaft are particularly stressed for attention when re-assembling shaft.

FUEL SYSTEM

PETROL PUMP

An A.C. Sphinx Fuel Pump Type T, No. 1524482 is employed with these models. This pump is mounted and operated as with the Standard models which is described in detail in Part I of this manual.

CARBURETTOR

The carburettor used with these cars is the Solex Type F.A.I.E. which is also fitted to the 14 H.P. engine employed in the 14/12CD model Standard. This carburettor is dealt with in that portion of the manual dealing with the quoted model on Page 120.

REAR AXLE

DESCRIPTION

The rear axle assembly is similar to that used with our 12 H.P. Standard models but is not interchangeable owing to the different chassis and wheel track employed.

LUBRICATION

The same attentions for this assembly are required as those indicated for the Standard models.

TO REMOVE REAR AXLE COMPLETE FROM CHASSIS

The same procedure may be adopted as with the Standard models. This is indicated on Page 96.

When withdrawing the axle shafts and bearing housings **observe that the packing shims are fitted between these latter housings and backing plates as well as against the axle sleeves and not as with the 12 H.P. Standard, between the back plate and the axle casing only.**

This change in position of the shims is made to provide the correct clearance between the brake drums and the back plates.

TO DISMANTLE AND RE-ASSEMBLE NOSEPIECE ASSEMBLY

The same procedure may be employed for this work as that set out for the Standard 12 H.P. model on Pages 96 and 97.

NOISY REAR AXLE

The same adjustments as those suggested for the Standard on Page 96 should be employed.

There are the same facilities existing for the supply of a reconditioned nosepiece assembly as with the Standard models, should the suggested adjustments prove abortive.

TO REMOVE AND REFIT OIL SEALS IN AXLE SLEEVES AND THOSE ON AXLE SHAFTS

Proceed as directed for the Standard 12 H.P. model on Page 100. Do not forget the precaution with regard to the different positioning of the packing shims between the axle sleeves and bearing housings indicated on Page 98.

TO REMOVE AND FIT NEW OIL SEAL IN BEVEL PINION HOUSING

The procedure for this attention is the same as that indicated on Page 99 for the Standard 12 H.P. model.

ELECTRICAL EQUIPMENT

The instructions given in Part 1 with reference to the Electrical Equipment and its maintenance, also apply to that used on the Triumph Models.

Different components are employed in many instances, but as these are of a similar type the same instructions still hold good.

WHEELS AND TYRES

The contents of this Section in Part 1 apply to the Triumph range of cars with the exception of the details given for "track setting" under Misalignment on Page 146.

The correct front wheel setting should be from **Parallel** to **"Toe-In"** $\frac{1}{16}$" the difference being explained by the different position of the Steering Levers, these being behind the stub axle with these models.

COACHWORK

Description.

Two styles of bodywork are supplied on two different lengths of chassis frames. A saloon body on a chassis having a 9' wheel base with a forward mounting of the engine and a Roadster with an 8' 4" wheel base.

Roadster.

The body is built of light alloy panelling on a strong ash framework, being securely fastened to the rigid tubular chassis.

The front seat is of the bench type providing accommodation for three passengers. The

remote gear control fitted on the steering column, just below the steering wheel provides a floor clear of obstructions and allows particularly comfortable seating for two passengers and the driver.

There are two tip up seats in the boot for occasional passengers, such passengers being shielded by a hinged glass panelled lid which can be adjusted to suit the height of the individuals concerned. This glass panelled lid forms the first half of the covering for the rear compartment, the rear portion being opened to allow access for the passengers. This portion of the divided lid also accommodates the spare wheel, the tools with this type of bodywork being located in the scuttle.

Saloon.

A six light saloon body with knife edge coachwork is fitted. Blind spots from within the car are reduced to a minimum by the employment of narrow chrome windscreen and window pillars.

The body itself is built of light alloy panelling on an ash framework. The sharp edges of the bodywork are provided with a slight radius to remove the possibility of the cellulose being rubbed off by constant polishing.

The front seat is of the bench type and can, if desired, accommodate 3 passengers comfortably owing to the clear floor line made possible by the adoption of the remote gear control which is employed. Folding centre arm seats are provided and adjustable side arm seats in the front compartment.

The spare wheel and tools are carried in the boot lid which when lowered forms a platform for luggage.

The locker lid when closed is protected from the ingress of water by a special section rubber water seal.

STEERING AND FRONT SUSPENSION

INDEX

STEERING AND FRONT SUSPENSION

STEERING

DESCRIPTION

As with the 12 H.P. Standard, the steering gear used with the Triumph is the " Marles " cam and double roller type. The mounting on the chassis frame, with the models under consideration is different to methods employed on the Standard. A clamping bracket is secured to a boss extension of the steering box by two $\frac{5}{16}$" B.S.F. nuts and bolts, provision being made in this bracket to accommodate the $\frac{1}{2}$" B.S.F. fixing bolt. The assembly is secured to the O/S chassis member by a $\frac{1}{2}$" B.S.F. bolt accommodated in a tube passing laterally through the O/S tubular chassis member, being welded into position.

Steering levers and Connecting Rods.

A different drop arm is used as compared with the Standard 12 H.P. model, this being attached to the ball pin of a socket assembly of a special type. This assembly is provided at one extremity, with the normal threaded portion which screws into a steering rod, being secured in the rod by a clamp. The other extremity of this special assembly is formed by a lever extension provided with a hole for the accommodation of a ball pin forming the central portion of a normal socket assembly, mounted at the inner end of the other steering rod.

The axis of the two ball pins are at right angles to one another, the one attached to the drop arm assuming a vertical position whilst the other is horizontally disposed.

The two steering rods, which are attached by their inner ends as described above, are connected at their other extremities to a socket assembly mounted on a steering lever fixed at the rear of each stub axle assembly. The steering levers and connecting rods are mounted at the rear of the front spring and not in front as with the Standard models.

MAINTENANCE

LUBRICATION

The steering box is replenished with oil by the application of a gun, filled with a recommended grade of oil, to a grease nipple on the box lid as with the Standard 12 H.P. model. A grease nipple is fitted to the ball joint at either end of each rod, attentions being given to these lubricating points as recommended for the Standard models on Page 23.

ADJUSTMENTS FOR WEAR

The same provisions are made for the elimination of wear as with the assembly used on the Standard 12 H.P. model and the same precautions should be exercised when making these adjustments.

FRONT WHEEL ALIGNMENT

The correct front wheel alignment should provide a parallel setting of the front wheels, this being adjusted by alterations to the length of the **longer** of the two steering connecting rods.

FRONT SUSPENSION

DESCRIPTION

The system used with these cars is somewhat similar to that employed with the Standard range of models and is described on Page 133.

Front Spring.

A different front spring is used for each of the two models. The data for these being as follows :—

Roadster.

Number of blades	17
Static load	1120 lbs.
Laden spring camber	1¾" Negative
Loaded Camber	39½"

Saloon.

Number of blades	18
Static Load	1230 lbs.
Laden spring centre	1" Negative
Loaded Camber	39½"

MAINTENANCE

The **anchorage of the front spring** on the chassis cross member is of considerable importance to the correct steering geometry. The six securing bolts should be periodically checked for tightness, and, if at any time, these bolts are removed, any nuts about which doubt exists, should be replaced and all those considered suitable for continued use should be soaked in water. If the front spring is allowed to work loose on its mounting, it is possible for the wheel camber on each side to vary and when such a variation is noted a check of the securing bolts' tightness should be carried out.

Steering levers should be checked periodically for looseness or damage. As already indicated on Page 134 no attempt should be made to apply heat to these levers although slight damage may be rectified by judicious cold " sets." The best course to adopt with a damaged steering lever however, is to replace this.

DAMPERS

Luvax Girling Hydraulic Dampers Type PR 6 are used with the front suspension of these models. The dampers used are of the differential type offering greater resistance to compression than to recoil. Pressure Recuperation is provided and the description given for the dampers fitted to the rear axle of the current Standard models applies equally to the dampers used on these models. The dampers are attached to the " H " piece assemblies in the same way as that used with the Standard models.

CASTOR ANGLE AND WHEEL CAMBER

The **Castor Angle** is fixed by design and is non-adjustable this being 6½° positive for the saloon and 6° positive on the roadster. The same methods of calculating this by the employment of a Camber gauge and a wheel turning measure as described on Page 128 may be employed.

Wheel Camber is fixed by design and should, with the car laden, fall between 1° and 2° positive.

TO REMOVE AND REFIT FRONT AXLE ASSEMBLIES

The same procedure may be adopted for this work as that recommended on Page 134 for the Standard models.

BRAKES

INDEX

ILLUSTRATIONS

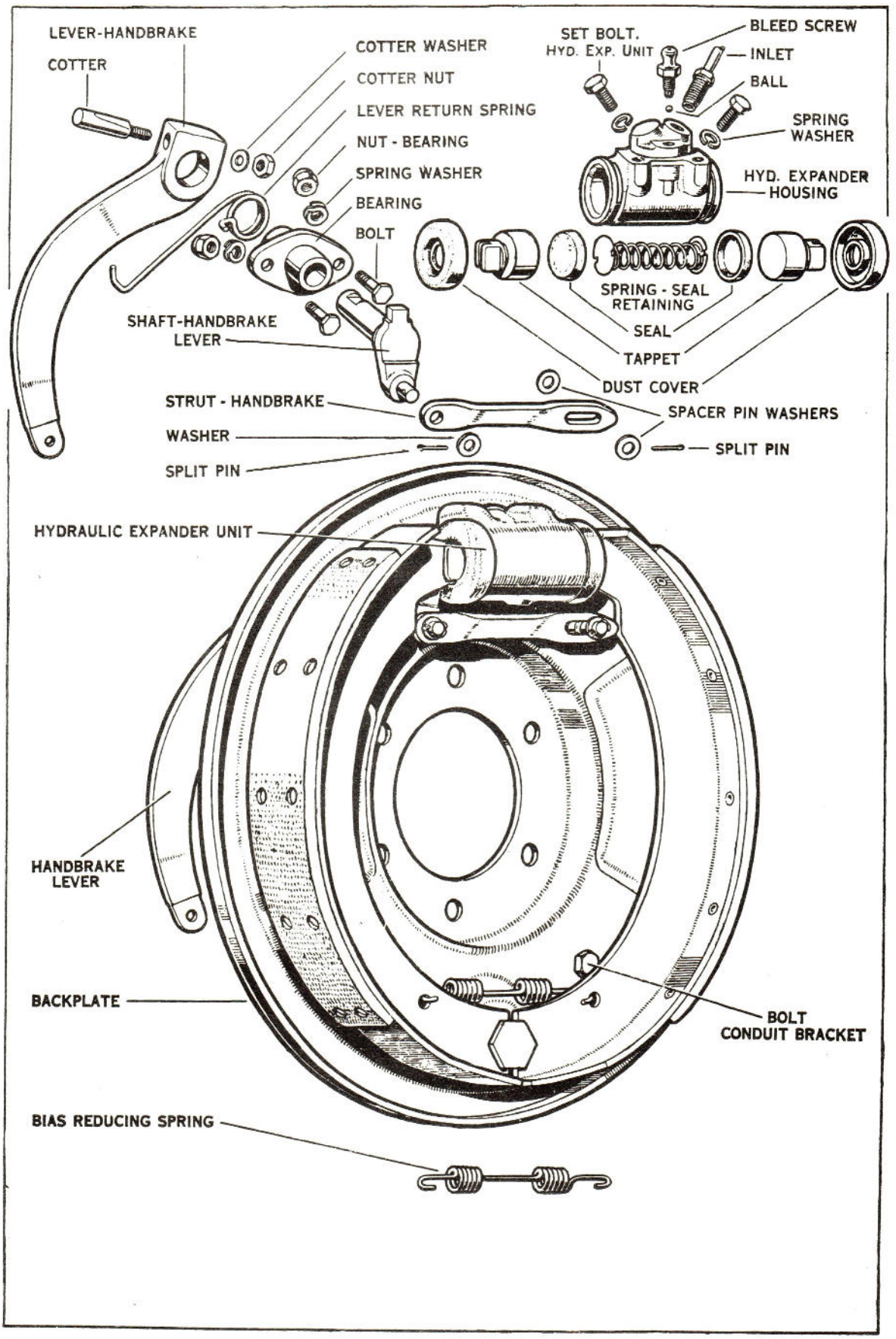


Fig. 140. **Rear brake assembly showing hand brake details.**

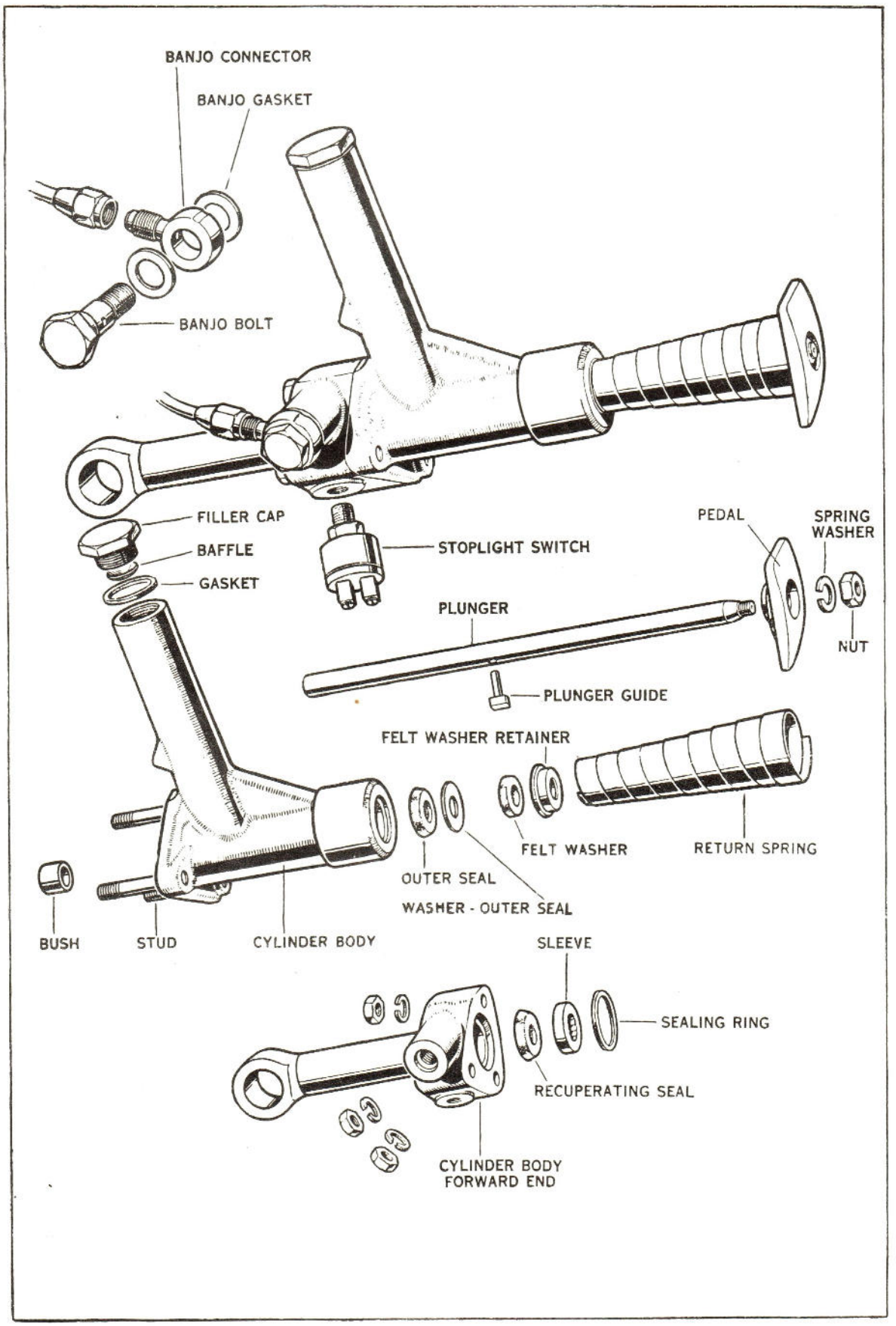


Fig. 141. **Master cylinder details.**

BRAKES

DESCRIPTION

Girling "Hydrostatic" brakes are used with both the Triumph models, this system of braking provides hydraulic operation of the four pairs of shoes employed, by a foot pad, and the handbrake lever actuates the rear pair of shoes by mechanical and independent means.

The **Brake Drums** are 1½" wide and 10" in diameter and each is provided with a circumferential rib whilst immediately abutting the flange, adjacent to the lip on the back plate, is a groove with a sharp edge remote to the rib. The combined purpose of the rib and the sharp edge of the recess is to throw off water and dirt thus preventing their entry under the lip of the back plate, and jeopardising the efficiency of the system.

The single pairs of **Brake Shoes** are operated by cylinder assemblies containing opposed pistons. These pistons are larger for the front brake than for the rear, being proportioned to give a 60% to 40% ratio of braking. The outer end of each piston has a slotted projection, which engages the tip of the adjacent brake shoe. At the back of each piston is a special form of cup washer and the pistons are kept separated by a light spring. At the base of the shoes, which are located laterally, close to the fulcrum point is a light tension spring. This spring is known as the "bias" spring and its function is to counterbalance the springs fitted between the pistons and to hold the shoes together sufficiently to prevent any inclination of the tip of the leading shoe to "grab." There is no form of adjustment provided for the shoes, apart from normal lubrication of parts and topping up Master Cylinder, maintenance being limited to "bleeding" the system as and when this becomes necessary using the bleeder nipples provided for this purpose on the back plates. These nipples are protected by rubber covers to exclude grit and dirt.

The drums and shoes are manufactured to very fine limits and are always in contact with one another. When not in operation this contact is so light as not to cause any "drag" or generation of heat. This perpetual contact is only rendered possible by the reduction of lost movement between the pedal pad and the brake shoes and the adoption of close limits in the manufacture of the drums and shoes.

The **normal foot brake pedal action, on other systems of braking,** which occurs leverwise about an axis, calls for a considerable amount of lost movement to ensure its proper operation.

The **Master Cylinder Assembly** is operated directly by a rim with a toe pad at its upper extremity, this taking the place of normal foot brake pedal. The ram moves in a fixed angular plane and is retained in its position when not in use, by a light volute spring. It passes into a cylinder casing through a rubber grommet and a rubber sealing cup, into a guide bearing. Beyond the guide bearing is a hollow cylindrical chamber which is filled with the hydraulic fluid. This chamber is kept full from a recuperating chamber which extends upwards in the form of a cylindrical reservoir and is integral with the master cylinder casting being provided with a filler plug and atmospheric air vent. The ram passes through the cylinder to the opposite end, where it is received by a guide bearing. Abuting the guide bearing on the far side is a double cup washer, the inner lip of which contacts the ram whilst the outer lip seals the guides.

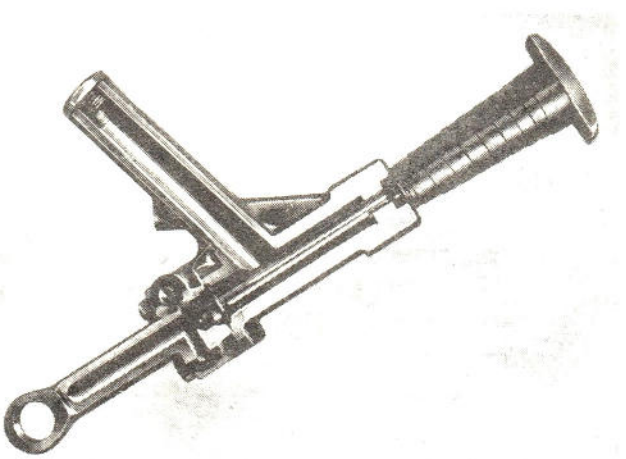


Fig. 142. **Master cylinder assembly.**

This cup washer does not move, and its area of rubbing contact is confined to the ram surface, hence the total fluid pressure upon this is as low as possible. When the ram is pressed inwards it enters into a **pressure chamber** which it does not touch, so that it does not act as a piston in the normally accepted manner, but rather acts as a fluid displacement plunger.

The pressure chamber is kept replenished with fluid by the provision of internal splines cut in the far guide bearing through which the ram passes. The extreme end of the ram is recessed and two small ports are provided behind the base of the cup washer to register with the channels of the guide when the ram is in the off position. As soon as the ram is moved inwards by foot pressure these ports pass to the far side of the cup washer before hydraulic pressure is generated. Pipe lines from distributor ports in the pressure chamber are led to the four brakes and a brake light switch, operated hydraulically from the pressure of the ram, is incorporated in the body of the master cylinder assembly. (See Fig. 142).

The **hand brake lever** by law must operate the rear brakes by a second and independent means. In this system of braking under consideration this is achieved by a hand-brake lever attached by a short rod to a counter shaft which is connected by a cable from a lever at each side to a lever arm carried by a short swinging compensator plate hinged to each brake back plate. The spindle of the lever arm carries a cam which bears against one shoe and also operates a rod which actuates the opposite shoe, the spring on the fulcrum point providing the necessary equalisation and balance of application between the two shoes. When the hand brake is off the shoes are entirely free from interference and are therefore free for unassisted hydraulic operation.

MAINTENANCE

Bleeding the Brake System.

Except for periodical inspection of the reservoir chamber in the **Master Cylinder** no attention should be necessary. If however, a joint is uncoupled at any time, or the cylinder pressure seals have to be interfered with in any way, the system must be **bled** in order to expel any air which may then be allowed to enter. Air may be compressed and thus its presence in the fluid will impair the efficiency of the system. The operation of bleeding the system is no way complicated if the following sequence of operations are observed :—

1. Fill fluid reservoir and do not allow to more than half empty during the operation.
2. Remove the rubber cover from dust-cover, having first wiped away all surrounding dirt.
3. Fit bleeder pipe allowing this to hang in a clean container.
4. Unscrew the bleeder nipple about three quarters of a turn employing a suitable spanner.
5. Work brake pad up and down a few times. One or two strokes should cause the fluid to commence to flow, but this should be continued until the fluid is entirely free from air bubbles.
6. It is **important** that the reservoir is kept replenished as necessary, to prevent the reservoir being more than half emptied, whilst the " bleeding " operation is being carried out. If the level of the fluid is allowed to sink to the bottom, more air will be drawn into the system and the whole operation will have to be repeated.
7. Having expelled all air from the system, tighten up the bleeding nipple and replace the dust cover. After completion of the " bleeding " operation there should be approximately $\frac{1}{8}$" free movement on the pedal pad. If lost movement in excess of this exists air is still present and the operation of " bleeding " must be repeated.
8. Carry out the foregoing procedure for each piston assembly in turn.

Replenishment of Reservoir.

It is important that only genuine **GIRLING HYDRAULIC FLUID** is used in this system and that before replenishing the reservoir all dust and grit are wiped clean from around the filling orifice before removing the filler plug.

ADJUSTMENT OF HAND BRAKES

After a fairly large mileage, depending on how the brake has been employed, it will become necessary to adjust the cables to take up lost movement. The linkage is so arranged that shoes are free to move to compensate for lining wear, but it will be necessary to shorten the cables to restore the original effective travel of the hand brake lever.

The nuts on the end of the cables should be tightened up evenly, a turn or two at a time, until the brakes are just commencing to rub when the hand control engages the first tooth on the ratchet. **Initially in production, or when fitting new liners, to allow for a tendency for initial "growth" of liners, the cables are adjusted so that shoes do not commence to rub until engagement of the second notch, subsequent adjustments being made as directed at the commencement of this paragraph.**

Note :—When the brakes just commence to rub it should be possible to turn the brake drums by hand with the road wheels removed.

FITTING RE-LINED BRAKE SHOES

When linings are worn to the rivets or the liners have become soaked with oil or grease, the shoes should be replaced with genuine GIRLING REPLACEMENT SHOES and no attempt should be made to re-line these. Girling replacement shoes have the correct type of lining and are ground to the correct radius. The necessary replacement shoes can be obtained through our Spares Department or from any Girling Service Agent or Stockist, or direct from Messrs. Girling Ltd., if so desired.

SERVICE INSTRUCTIONS FOR BRAKES FITTED TO TRIUMPH 18T & 18TR

Description.

Brakes are 10″ x 1½″ Hydro-Static.

The shoes are free to float at the top of the Backplate, *i.e.*, **Hyd. Cyl.** and are anchored at the bottom, no shoe return springs being fitted. It will therefore be realised that all lining wear is thus taken up by the **Hyd. Cyl.** action. A Bias Spring is fitted across the shoes at the bottom of the brake by the pivot pin, this to compensate the spring between the pistons in the **Hyd. Cyl.** It will be obvious that no brake adjustment should be necessary during the life of the brake linings.

Hand Brake.

This is mechanically operated by two cables on the rear only, linkage so arranged that shoes are free to move to compensate for lining wear, lost action being taken up on the cables.

It is important that when fitting the hand brake operating shaft bearing to allow for a certain amount of relative movement between this part and the brake back plate to which it is secured. This is necessary to enable the bearing to centralise itself in relation to the two shoe tips. To allow for this movement, it will be found sufficient to tighten up the two securing Simmonds nuts fully, and then to slacken back one third of a turn each.

Master Cylinder.

This is the Girling **Direct Action** Type of Cylinder. A striking feature of this cylinder is its position and form, the plunger directly carries the **pad** which is pressed by the driver's foot, when applying brake. The stroke and bore are so arranged that ample leverage is available.

Wheel Cylinders.

These are of simple construction, they consist of two pistons on which shoes locate, separated by a spring and two pressure seals. A Bleeder Valve is incorporated on the top of each cylinder, rubber covers being fitted to exclude foreign matter.

Bleeding the System.

Except for periodical inspection of reservoir chamber in the **Master Cylinder** no attention should be necessary, if however, a joint is uncoupled at any time or the cylinder pressure seals are inspected or replaced, the system must be **bled** in order to rid it of any air admitted.

Air is compressable and its presence in the system will affect the working of the brakes. The operation of bleeding the system is easy if the following sequence is carried out.

The rubber dust cover on bleeder nipple of the brake cylinder concerned should be removed the bleeder pipe should be fitted in its place and allowed to hang in a clean container. The bleeder nipple should now be unscrewed about three quarters of a turn with a suitable spanner and the brake pedal should be worked up and down a few times. One or two strokes will cause the fluid to commence flowing but the pumping must be continued until the fluid appears entirely free from air bubbles.

Important.

The fluid reservoir should be filled before commencing this operation and must be replenished sufficiently after to prevent the fluid sinking more than halfway down the reservoir, **i.e. approx. seven to eight strokes.** If the level of the fluid in the reservoir sinks to the bottom, more air will be drawn into the system and the whole operation will have to be performed again until the air thus admitted is expelled. As soon as all air has been pumped out of the system, the bleeder nipple should be tightened up, the bleeder pipe removed and rubber dust cover refitted. After completion of bleeding there should be approx. $\frac{1}{8}$" free movement at pedal pad. If movement is excessive, it still denotes that air is present in the system.

NOTE

It is important that only genuine **GIRLING HYDRAULIC FLUID** is used.

When Linings are worn to rivets new relined shoes should be fitted. Oil or grease soaked shoes should invariably be replaced. Do not reline Girling Shoes, but fit genuine **GIRLING REPLACEMENT SHOES.** These shoes have the right type of Lining and are ground to correct radius. Girling replacement shoes can be obtained from all Girling Service Agents or Stockists, or direct from Girling Limited.

GENERAL DATA

INDEX

GENERAL DATA

A number of features, incorporated in the design of this range of cars, are similar to those employed with the Standard models and such being the case, there is possible a certain amount of interchangeability of parts between the two types of vehicles.

As the Triumph models are to be handled by Standard dealers, it is considered advisable to summarize some of the interchangeable items, to assist our agents when provisioning for spares.

SOME PARTS WHICH ARE INTERCHANGEABLE BETWEEN THE TWO RANGES OF MODELS

ENGINE

Triumph Items,	Models	Standard models on which employed.		
Crankshaft	(18TR & 18T)	12CD & 14/12 CD		
Main Bearings	,,	,,	,,	,,
Thrust Washers	,,	,,	,,	,,
Big End Bearings	,,	,,	,,	,,
Camshaft Details	,,	,,	,,	,,
Timing Chain	,,	,,	,,	,,
Timing Chain and Wheels	,,	,,	,,	,,
Timing Cover	,,	,,	,,	,,
Dynamo (Different mounting)	,,	,,	,,	,,
Oil Pump Details	,,	,,	,,	,,
Crankshaft Fan Pulley	,,	,,	,,	,,
Oil Retaining Cover	,,	,,	,,	,,
Rear Engine Plate	,,	,,	,,	,,
Sealing Blocks and Filling Pieces	,,	,,	,,	,,

CLUTCH

The clutch housing is interchangeable as between the Triumph and Standard 12 and 14 H.P. models.

Whilst a similar type of Borg and Beck clutch is employed on both Triumph and the 12 and 14 H.P. models Standards there are differences in detail and size which makes interchangeability impossible.

A similar linkage for operating the clutch is used on both ranges of cars but the two systems are not interchangeable.

GEARBOX

Triumph Model & Item	Employed on Standard Model.			
Mainshaft	(18TR & 18T4)/8A,		12CD & 14/12CD	
Countershaft Details	,,	,, ,, ,,		,,
Gearbox Casings	,,	,, ,, ,,		,,

Triumph Model & Item.	Employed on Standard Model.			
Constant Pinion	(18TR & 18T)		12CD & 14/12CD	
Constant Wheel	,,	,,	,,	,,
Reverse Wheel	,,	,,	,,	,,
Reverse Spindle	,,	,,	,,	,,
1st Speed Gear M/Shaft	,,	,,	,,	,,
1st Speed Gear C/Shaft	,,	,,	,,	,,
Synchro Mesh Detail	,,	,,	,,	,,
Roller Bearings (Mainshaft)	,,	,,	,,	,,
Roller Bearing (Constant Pinion Shaft)	,,	,,	,,	,,
Ball Bearing (Rear End Cover)	,,	,,	,,	,,
Oil Thrower	,,	,,	,,	,,
Thrust Button	,,	,,	,,	,,
Front End Cover	,,	,,	,,	,,
Speedometer Gear and Details	,,	,,	,,	,,
Rear End Cover	,,	,,	,,	,,
Distance Piece	,,	,,	,,	,,
Constant Pinion Shaft	,,	,,	,,	,,
3rd Speed Wheel M/Shaft	,,	,,	,,	,,
3rd Speed Wheel C/Shaft	,,	,,	,,	,,
2nd Speed Wheel M/Shaft	,,	,,	,,	,,
2nd Speed Wheel C/Shaft	,,	,,	,,	,,

FRONT SUSPENSION UNIT

Triumph Model & Item.	Standard Model on which Employed.			
Stub Axle Bush Bottom	(18TR & 18T)		12CD & 14/12CD	
Stub Axle Bush, Top	,,	,,	,,	,,
Swivel Pin and Details	,,	,,	,,	,,

Front Suspension Unit—continued

Triumph Model & Item.		Standard Model on which Employed.
Front Hubs and Bearings	(18TR & 18T)	12CD & 14/12CD

REAR AXLE UNIT

Triumph Model & Item.		Standard Model on which Employed.
Pinion Housing	(18TR & 18T)	1939 14 H.P.
Bearings Adjuster Front	,, ,,	1939 14 H.P.
Ball Bearing Front for Bevel Pinion	(18TR & 18T)	12CD & 14/12CD
Adjusting Collar Rear	,, ,,	1939 14 H.P.
Roller Bearings for Bevel Pinion	,, ,,	12CD & 14/12CD
Diff. Box Assembly	,, ,,	1939 14 H.P.
Differential Star Piece	,, ,,	,, ,,
Oil Retaining Washer on Rear Hub	,, ,,	,, ,,
Bearing Housing	,, ,,	,, ,,
Rear Hub	,, ,,	,, ,,

TRIUMPH DATA

ITEM.	18T (Saloon)	18TR (Roadster).
Bore and Stroke	73 x 106 m/m.	73 x 106 m/m.
Cubic Capacity	1776 c.c.	1776 c.c.
R.A.C. Rating	13.23	13.23
Carburettor Setting.		
Choke Tube	25	25
Main Jet	125	125
Air Correction	230	250
Pilot Jet	50	50
Needle Valve	1·5 m/m	1·5 m/m
Air Bleed to Pilot	1·5	1·5
Starter Setting	GS 1·25 GA 5 m/m	GS 1·25 GA 5 m/m
Speed Jet	50	50
Compression Ratios	7·5	7·5
Ignition Setting (Full retard)	8° B.T.D.C.	8° B.T.D.C.
Sparking Plug Gap	0·020″	0·020″
Distributor make and break gap	0·010″—0·012″	0·010″—0·012″
Tappet clearances Inlet (cold)	0·012″	0·012″
Tappet clearances Exhaust (cold)	0·012″	0·012″
Tyre Pressures Front	22 lbs. per sq. in.	22 lbs. per sq. in.
Tyre Pressures Rear	26 lbs. per sq. in.	24 lbs. per sq. in.
Tyre Size	5·75. 16	5·75. 16
Front Wheel Alignment	Parallel	Parallel
Clutch Pedal lost movement (at pad)	$\frac{5}{8}$″	$\frac{5}{8}$″
Between toggle levers and throw out	$\frac{1}{16}$″	$\frac{1}{16}$″
Oil Capacities.		
Engine	14 pints	14 pints
Gearbox	2 pints	2 pints
Rear Axle	3½ pints	3½ pints
Radiator Capacity	19 pints	19 pints
Full Capacity	10 Gallons	10 Gallons
Battery Capacity	63 amp. hr. at 10 hr. rate	63 amp. hr. at 10 hr. rate
Steering Gear	Marles Cam and Twin Roller	Marles Cam and Twin Roller
Track	4 ft. 1¾ ins.	4 ft. 1¾ ins.
Overall length	14 ft. 8 ins.	14 ft. 8 ins.
Overall width	5 ft. 3½ ins.	5 ft. 3½ ins.
Overall height	5 ft. 3½ ins.	4 ft. 8 ins. (hood up)
Ground clearance	7 ins.	6½ ins.
Turning circle	40 ft.	39 ft.
Weight—dry	24 cwt. 14 lbs.	22½ cwts.
Wheel Base	9 ft.	8 ft. 4 ins.

DIMENSIONS AND TOLERANCES (Both Models)

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearances, new.	Permissible worn Clearances.	Remarks.
Pistons and Rings.					
Compression Ring Width.	0·092¾″ / 0·093¾″	0·091″	0·001″ to 0·003″	0·005″	Allow increase in side clearance of 0·003″ Mean.
Groove Width.	0·0937″ +0.001″ +0.002″	0·098″			
Scraper Ring Width.	·186″ / ·187″	0·184″	0·001″ to 0·003″	0·005″	
Groove Width.	·187″ +0.001″ +0.002″	0·191″			
Ring Gap in Cylinder.	—	—	0·003″ to 0·007″	0·020″	

Pistons and Cylinders.	F	G	H			
Dia. of Cylinder.	Min. 2.8746″ 2.8749″	Min. 2.8750″ 2.8753″	Min. 2.8754″ 2.8757″	—	At Top 0·007″	
Top of Skirt (Pressure Face)	2.8715″ 2.8718″	Over 2.8718″ 2.8722″	Over 2.8722″ 2.8726″	0·002¾″		
Bottom of Skirt (Pressure Face)	2.8730″ 2.8733″	Over 2.8733″ 2.8737″	Over 2.8737″ 2.8741″	0·001″ to 0·002½″	0·005″	
Top Land Dia.	2·859″ / 2·857″			0·015¾″ to 0·018½″		
Gudgeon Pin Hole	·750″ +0.003″ +0.0005″		0·751″	See Note	0·002″	Pins to be selected to have 0·000¼″ clearance at 68° F. when new.
Oversize Piston	Rebore sizes +0·020″, +0·030″ and +0·040″ within the limits +0.000¼″ −0.000¼″					

Oil Pump.

See details for Standard 12 H.P. Model on Page 16.

Camshaft.

See details for Standard 12 H.P. Model on Page 16.

GENERAL DATA—TRIUMPH—Dimensions and Tolerances (Both Models)

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearances, new.	Permissible worn Clearances.	Remarks.
Valves and Valve Guides.					
Inlet Stem Diameter.	$\frac{5}{16}$″ $^{-0.0025}_{-0.0035}$″	—	0·002″ to 0·004″	—	The clearance between valve stem and guide, new, is 0·002″ to 0·004″ corresponding to a sideways movement of the valve head when just clear of its seat of 0·008″ This is obtainable by rocking the valve in its guide completely from one side to the other. The maximum rock allowable is 0·020″ If this is exceeded it is necessary to fit a new guide and possibly a new valve. When refacing a bad seat, first clean up with 15° cutter and finish with 45° cutter.
Guide Diameter (Int.)	$\frac{5}{16}$″ $^{+0.0005}_{-0.0005}$″	—		—	
Exhaust Stem Dia.	$\frac{5}{16}$″ $^{-0.0045}_{-0.00035}$″	—	0·003″ to 0·005″	—	
Guide Diameter (Int.)	$\frac{5}{16}$″ $\pm$0.005″	—		—	
Diameter of Seatings.	EXHAUST $1\frac{11}{32}$″ x $\frac{1}{16}$″ at 30°				
Width and angle of Seatings.	INLET $1\frac{15}{32}$″ x $\frac{1}{16}$″ at 30°	—	—	—	
Valve Springs.					
Fitted length.	INNER $1\frac{13}{16}$″	OUTER $1\frac{7}{8}$″	—	—	—	
Fitted Load.	INNER 26 lbs. $^{+2}_{-1}$	OUTER 40 lbs. $^{+2}_{-1}$	INNER Min. 22 lbs.	OUTER Min. 32 lbs.	
Flywheel.	See details for Standard 12 H.P. Model on Page 17.				
Clutch.					
Operating Shaft Dia.	$\frac{3}{4}$″ $^{-.002}_{-.003}$″		0·002″ to 0·004″		Allow max "Lift" of shaft in bearing (worn) of 0.010″.
Bush Bore Dia.	·7500″ ·7507″				
Gearbox.					
Change Speed Mechanism.					
Selector Rod Dia.	$\frac{9}{16}$″ $^{-0.0015}_{-0.0025}$″		0·001″ to 0·003″		Allow 10° circumferential movement on selector rods to prevent binding between striking rod lugs.
Selector rod Bore in top cover.	$\frac{9}{16}$″ $^{+0.0007}_{-0.0005}$″				
Plunger axial load	35 lbs.				
Change Speed Fork sides.	See details for 12 H.P. Standard on Page 17.				
Gearbox.					
Main Line.	See details for 12 H.P. Standard on Page 17.				

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearances, new.	Permissible worn Clearances.	Remarks.
Countershaft.					
See details for 12 H.P. Standard on Page 18.					
Front Suspension.					
Swivel Pin Angle	$9\frac{1}{2}''$				
Stub Axle Camber Angle					1°—2° Positive when laden.
Castor Angle—Saloon	$6\frac{1}{2}°$ Positive				
Roadster	6° Positive				
Shackles and Shackle Pins.					
Front Suspension.					
Swivel Pin Bushes (Int.)	$\frac{11}{16}''^{+0.000''}_{-0.0005''}$		0·0001″ to 0·0010″	—	Allow 0·008″ wear on assembly.
Top and Bottom	·8165 Notgo				
(Ext.)	·8175 Go	—		—	
Swivel Pin Diameter.	$\frac{11}{16}''^{-0.0006''}_{-0.0010''}$	—			
Shackle Pin Top Inner Dia.	$\frac{9}{16}''^{-0.0005''}_{-0.0012''}$	—	0·0003″ to 0·0014″	—	Allow 0·0010″ wear on assembly.
Int. Dia. of Bush for Top Inner Pin.	$\frac{9}{16}''^{+}_{-0.0002''}$	—		—	
Ext. Dia. of Bush for Top Inner Pin. (Int.)	Press Fit $\frac{11}{16}''^{-0.0000''}_{+0.0015''}$	—	—	—	
Shackle Pin Top Outer Diameter.	$\frac{5}{8}''^{0.0007''}_{0.0011''}$	—	0·0002″ to 0·0016″	—	Allow 0·0010″ wear on assembly.
Int. Dia. of bush for Top Outer Pin.	$\frac{5}{8}''^{+}_{-0.0005''}$	—		—	
Ext. Dia. of Bush for Top Outer Pin	·754″ Go ·755″ Notgo	—	—	—	
Front Spring Shackle Pin.	$\frac{5}{8}''^{-0.0005''}_{-0.0012''}$	—	0·0006″ to 0·0017″	—	Allow 0·010″ wear on assembly.
Bush Int. Diameter.	$\frac{5}{8}''^{+0.0005''}_{+0.00015''}$	—		—	
Rear Axle.					
See details for Standard 12 H.P. on Page 18.					
Front Road Springs (19T).					
Test Data.					
Eye Centres (Loaded).	$39\frac{1}{2}''$	—	—	—	
Static Load.	1,230 lb.	—	—	—	
Camber (Free).	Not Specified.				
Camber (Loaded)	$1'' \pm\frac{1}{8}''$ Neg. $1\frac{1}{2}''$		—	—	
Rear Road Springs (18T).					
Eye Centres(Loaded).	$41'' \pm\frac{1}{8}''$				
Static Load.	900 lb.	—	—	—	
Camber (Free).	Not Specified.				
Camber (Loaded).	$1\frac{3}{8}'' \pm\frac{1}{8}''$ Neg. $1\frac{5}{8}''$		—	—	

GENERAL DATA—TRIUMPH—Dimensions and Tolerances (Both Models)

Parts and Description.	Dimensions, new.	Permissible worn Dimensions.	Clearances, new.	Permissible worn Clearances.	Remarks.
Front Road Springs (18TR).					
Eye Centres (Loaded).	$39\frac{1}{2}''$	—	—	—	
Static Load.	1120 lb.	—	—	—	
Camber (Free).	Not Specified.				
Camber (Laden).	$1\frac{3}{4}''$ $\frac{+\frac{1}{8}''}{-}$ Neg.	$2\frac{1}{4}''$	—	—	
Rear Road Springs (18TR).					
Eye Centres (Loaded)	$41''$ $\frac{+\frac{1}{8}''}{-}$	—	—	—	
Static Load.	725 lb.	—	—	—	
Camber (Free).	Not Specified.				
Camber (Laden).	$\frac{15}{16}''$ $\frac{+\frac{1}{8}''}{-}$ Neg.	$1\frac{7}{16}''$	—	—	
Crankshaft.					
See details for Standard 12 H.P. on Page 15.					
Crankshaft End Float.					
See details for Standard 12 H.P. on Page 15.					
Big End.					
See details for Standard 12 H.P. on Page 15.					
Big End Float.					
See details for Standard 12 H.P. on Page 15.					
Ovality.					
See details for Standard 12 H.P. on Page 15.					
Little End.					
See details for Standard 12 H.P. on Page 15.					

NOTATION FOR FIG. 61 (See page 103)

Ref. No.	Description.
1	Brake Assembly, R.H.
2	Adjuster Pinion and Screw.
3	Adjusting Spindle
4	Anchor Pin.
5	Nut.
6	Washer.
7	Lock Washer.
8	Back Plate, L.H.
9	Conduit Bracket Set Screw.
10	Brake Shoe and Lining.
11	Cam, R.H.
12	Cam Lever.
13	Spring (Anchor-to-Shoe), primary.
14	Red Spring (Anchor-to-Shoe) secondary.
15	Spring (Shoe Adjuster).
16	Shoe Hold-down Spring.
16A	Spring, Lever to Shoe.
17	Steady Rest Cup, Top.
17A	Steady Rest Cup, Bottom.
18	Steady Rest Pin.
19	Crown Wheel.
20	Eccentric Adjuster.
21	Lock Nut.
	BRAKE CABLES.
22	Brake Cable, Front, L.H.
23	Brake Cable, Front, R.H.
24	Brake Cable, Rear, L.H.
25	Brake Cable, Rear, R.H.
25A	Abutment Bracket Back Plate.
25B	Clip.

Ref. No.	Description.
	HANDBRAKE.
26	Hand Brake Lever.
27	Locking Rod.
28	Pawl for Handbrake, with Stop.
29	Spring for Pawl.
30	Trigger.
31	Bolt.
32	Fulcrum Pin.
33	Brake Ratchet.
34	Spring for Ratchet.
35	Handbrake Operating Fork, Male.
36	Pin for Lever (Flat on Head).
36A	Clevis Pin for Fork End Offside Rear (Flat on Head).
37	Handbrake Operating Fork, Female.
38	Roller Pin for Handbrake, Operating Lever.
	BRAKE CROSS SHAFT.
39	Brake Cross Shaft.
40	Pull-off Spring.
41	Tab Washer to Cross Shaft.
42	Tab Washer.
43	Fork End.
44	Clevis Pin for Fork End.
45	Abutment Bracket, Front.
46	Abutment Bracket, Rear.
47	Tab Washer, Brake Lever Return.

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,,	HOLLINGDRAKE AUTO CO LTD., Town Hall Square. Tel. 4464.

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	F. PILMORE-BEDFORD & SONS, 102/110, Bromley Road, Catford, S.E.6. Tel. Hither Green 1001-2.
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BOLIVIA.

CHILE. Messrs. Javier Echeverria Y Cia Ltda., Agustinas 1111—Of. 514, Santiago.

COLUMBIA.

DUTCH GUIANA.

ECUADOR. B. Aviles Alfaro y Cia, Casilla 354, Guayaquil.

FRENCH GUIANA.

PARAGUAY. J. & F. Perez, 14, de Mayo y Pte, Franco, Asuncion.

PERU. Buchanan International S.A. Ltd., Av Grau 370-372, Box 96, Lima.

URUGUAY. Pike & Company, Rondeau 2166/70, Montevideo.

VENEZUELA. Sr. Gregorio Martinez M., Apartado 1803, Caracas.

WEST INDIES.

BAHAMAS. Kelly's Hardware Company, P.O. Box 351, Nassau N.P.

BARBADOS. The Chelsea Garage Ltd., Chelsea Road, Barbados.

CUBA.

DOMINICA. J. R. H. Bridgewater & Company, Corner Queen & Church Streets, Dominica.

GRENADA. W. E. Julien & Company, Young Street, St. Georges.

OVERSEAS DISTRIBUTORS

JAMAICA. Motta's Garage, P.O. Box 168, Kingston.

ST. VINCENT. Mr. Fred J. Dare, Kingstown.

TRINIDAD. The Caribbean Auto & Transport Agencies Ltd., 18/20, Wrightson Road, Woodbrook, Port-of-Spain.

BERMUDA. J. B. Astwood & Son, Hamilton, Bermuda.

ASIA.

ARABIA. Messrs. Abdul Kader Ali Mohamed, Omer Bazara, Crater, Aden.

BURMA. Ensign Motors Ltd., 183/187, Phayre Street, Rangoon.

CEYLON. Brown & Company, P.O. Box 200, Colombo.

CHINA.

HONG KONG. Far East Motors, 26, Nathan Road, Kowloon.

SHANGHAI. New China Motors, 336 Avenue du Roi Albert.

INDIA. Messrs. C. C. Xavier Jorge & Cia Ltda., Novo Gova.
The French Motor Car Co. Ltd., 23-4, Lower Circular Road, Calcutta.
Munjee Nathoobhoy & Company, Amar Building, Sir Pherozshah Mehta Road, Fort, Bombay.
The Rajputana Motor Car Company, Nasirabad Road, Ajmer.
The Union Company, P.O Box 331, Madras.
Girdharilal & Company, Garden Road, Karachi.
Maira Bros., P.O. Box 234, Lahore.
Sikand & Co., 50 Queensway, New Delhi.

IRAN. Ibrahim J. Saad & Fils, Saadi Avenue, Teheran.

IRAQ. Messrs. W. J. Coker, P.O. Box 93, Al Rashid Street, Baghdad.

MALAYA. Federated Motors Ltd., 48, Orchard St., Singapore.

NETHERLANDS EAST INDIES. N. V. Velodrome, Noordwijk, Batavia.

PALESTINE. Mr. A. Sperling, Messrs. Palestine Motors, P.O. Box 439, Haifa.

PERSIAN GULF. Mahmood Bin Abduljabber, Kooheji & Sons, Bahrein.

SARAWAK. Mr. Lim Bah Too, 92 Padungan Rd., Kuching.

SAUDI ARABIA. Messrs. S. M. Ahmad Aziz Ahmad, P.O. Box No. 10, Mecca.

SYRIA. Joseph D. Badaro & Company, P.O. Box 423, Beyrouth.

THAILAND. Butler & Webster, Bangkok.

AUSTRALASIA.

AUSTRALIA.

NEW SOUTH WALES. Standard Cars Ltd., 91-97, Flinders Street, Sydney.

QUEENSLAND. Austral Motors Pty Ltd., Brisbane.

SOUTH AUSTRALIA. Waymouth Motor Co. Ltd., 42, Waymouth Street, Adelaide.

VICTORIA. Standard Cars Ltd., P.O. Box 858K, Elizabeth Street, Melbourne.

WESTERN AUSTRALIA. Mortlock Brothers Ltd., 914, Hay Street, Perth.

FIJI ISLANDS. Burns, Philp (South Sea) Co Ltd., Suva.

NEW GUINEA. J. L. Peadon Ltd., P.O. Box 8, Rabaul.

NEW ZEALAND. The Northern Automobiles Ltd. 152-156, Albert Street, Auckland.
T. R. Taylor Ltd., P.O. Box 318, Invercargill.
Amuri Motors Ltd., Durham Street, Christchurch.
Newton King Ltd., P.O. Box 100, New Plymouth.
Amuri Motors Ltd., 28-32, Vivian Street, Wellington.

PAPUA. Messrs. G. G. Smith & Co., P.O. Box 44, Port Moresby.

TASMANIA. The Co-operative Motors Ltd., Hobart.

EUROPE.

BELGIUM. Automobiles "Imperia" Nessonvaux-lez-Liege.

BULGARIA.

CHANNEL ISLANDS.

Jersey. St. Aubins Motor Coach & Car Company Ltd., St. Helier Garage, Bath Street, Jersey.

Guernsey. St. Peter Port Garage, Rue du Pre, Guernsey.

CZECHOSLOVAKIA.

CYPRUS. Mr. D. J. Demades, P.O. Box 104, Nicosia.

DENMARK. Nordisk Dieselauto, Fredericksholms Havnevej 14, Copenhagen SV.

DODECANESE ISLANDS. Mr. P. C. H. Paraskevas, Rhodes.

EIRE. McEntagart Brothers Ltd., Percy Place, Dublin.

ESTONIA.

FAROE ISLANDS. Norrona Forlagid, Torshavn, Foroyar.

FINLAND. Korpivaara & Halla Oy, Mannerheimintie 5, Helsinki.

FRANCE. Societe Commerciale et Industrielle, Franco-Brittanique, 1, Rue de Clichy 1, Paris, France.
Monsieur M. See, 54, Brook Street, London, W.1.

GERMANY.

GIBRALTA. Mr. A. Bassadone, 51, Irish Town, Gibralta.

GREECE. The "Achille" Motor Car Co. S.A., Syngrou 14, Athens.

HOLLAND. Mr. J. H. Eggelmeijer, Costzeedijk 278, Rotterdam.

HUNGARY. Bolgar Motors Ltd., Budapest.

ICELAND. H. Olafsson & Bernhoeft, Reykjavik.

ITALY.

LATVIA.

LITHUANIA.

MALTA. Messrs. Godwin E. Muscat, Rue d' Argens, Czira.

NORWAY. Den Norske Automobilfabrikk, Pilestredet 56C, Oslo.

POLAND.

PORTUGAL. Messrs. C. Santos Lda., 29-41, Avenida da Liberdade, Lisbon.

ROUMANIA.

SPAIN. Sr. Carlos de Salamanca, Avda. de Jose Antonio 61, Madrid.

SWEDEN. A/B Nykopings Automobilfabrik, Folkungavagen 1, Nykoping.

SWITZERLAND. Neue Amag A/G., Utoquai, Zurich.

TURKEY. Messrs. Mecdettin Serbetci, B.P. No. 529, Istambul.

YUGOSLAVIA.

LIST OF MESSRS. BRICOVMO'S STOCKISTS (Overseas)

CANADA.	British Motor Products Ltd., P.O. Box 424, Vancouver B.C.
DENMARK.	Vilh. Nellemann & Co., Vodroffavej 55-57, Copenhagen.
EGYPT.	Tamraz Freres, 42, Soliman Pacha Street, Cairo.
IRAQ.	Stanley Shashoua, P.O. Box 67, Baghdad.
MALTA.	Michael Attard, E.F.G. Marsa Cross Road, Marsa.
SOUTH AFRICA.	Williams, Hunt and Johnson, 77, Strand Street, Capetown. Herbert and Babbage, P.O. Box 3607, Johannesburg. Stansfield Ratcliffe, 29, Simmonds Street Extension, Johannesburg.
Also at :—	Durban, Port Elizabeth, Kimberley, Petermaritzburg, East London, Bulawayo.
SPAIN.	Autocesorios Harry Walker, Rosellon 192, Barcelona.
SWEDEN.	Holger Duell, Friggagatan 10, Gothenburg
ZANZIBAR.	Eastern Motor Garage, P.O. Box 67, Zanzibar.
HOLLAND.	Taxameter Centrale, Kevstraat, 445, Amsterdam.
ARGENTINE.	Alberto J. Brass Ltds., Buenos Aires.
BRITISH WEST INDIES.	Robert Thom, P.O. Box 108, Barbados.
ICELAND.	Gardar Gislason, Reykajavik.
NEW ZEALAND.	Skeats and White, Auckland.
PALESTINE.	N. & M. Mizrahi, 4, Palmers Gate, Haifa.
SYRIA.	Ets. N. Jaenbart, B.P.254, Rue du Musee, Aleppo.
URUGUAY.	Co-operative Uruguaya Transportes, Collectivos, Montevideo.

LIST OF MESSRS. DUNLOP RUBBER COMPANY'S OVERSEAS AGENTS

INDIA.	The Dunlop Rubber Co. (India) Ltd., 57-B, Free School Street, P.O. Box 391. Calcutta, India. *Managing Director* : F. F. M. Ferguson. *Act. Sales Director* : C. Stack.
SOUTH AFRICA.	Dunlop South Africa Ltd., 265, Sydney Road, P.O. Box 925, Durban, South Africa. *Managing Director* : T. E. Peppercorn. *Sales Manager* : Tyres : R. S. Faulder.
NEW ZEALAND.	Dunlop Rubber Co. (N.Z.) Ltd., 38, Taranaki Street, Wellington, New Zealand. *Manager* : V.A. Hopkirk (new organisation being formed during 1946).
ARGENTINE.	Dunlop Pneumatic Tyre Co. (S.A.) Ltd., Avenida Ingeniero Huergo, 1433, Buenos Aires, Argentine. *General Manager* : A. E. Morton. *Sales Manager* : J. G. Macksey.
BRAZIL.	Dunlop Pnuematic Tyre Co. (S.A.) Ltd., Rua 7 de Abril No. 125, Sao Paulo, Brazil. *General Manager* : J. F. Rose. *Sales Manager* : G. E. Cleaver.
PERU.	Neumaticos Dunlop S.A., Apartado 1352, Lima, Peru. *Manager* : D. Cary-Barnard.
SWEDEN.	Dunlop Rubber Co. A/B, Stockholmsvagen 16, Norrkoping, Sweden. *General Manager* : E. F. Hingeley (*On loan to H.M.G.*) *Sales Manager* : T. Dahlgren.
URUGUAY.	Dunlop Rubber Co. (Uruguay) Ltd., Calle Uruguay 774, Montevideo, Uruguay. *Manager* : R. L. H. James.
HOLLAND.	N. V. Nederlandsche—Dunlop Rubber en Baden Mij, Nicholas Witzenkade 14, Amsterdam Centrum, Holland. *Manager* : B. G. Wood.
BELGIUM.	Dunlop Rubber Co. (Continental) Ltd., 13/14, Rue de France, Brussels, Belgium. *Manager* : W. N. Doley.
DENMARK.	Dunlop Rubber Co. A/S., Vennemindevej 30, Copenhagen, Denmark. *Director* : K. V. Tersling.
SWITZERLAND.	Societe Anonima des Pneumatiques Dunlop, 4, Avenue Pictet de Rochemont, Geneva, Switzerland. *Manager* : P. Joyeux.
PORTUGAL.	Wm. Graham Jun. & Co., Caiza do Correio 49, Lisbon, Portugal. *Resident Representative* : J. A. Goldie (c/o above address).
EGYPT.	*Resident Representative* : C. H. Tancred, (c/o The Turf Club, Cairo, Egypt.
BRIT. EAST AFRICA.	*Resident Representative* : P. W. Vaughan, P.O. Box 718, Nairobi, Kenya, British East Africa.
FRANCE.	Societe Anonyme des Pnuematiques Dunlop, 64, Rue de Lisbonne, Paris, France. *Liaison Officer* : L. Gauchet.
CANADA.	Dunlop Tire and Rubber Goods Co., Ltd., 870, Queen Street East, Toronto, Canada. *Commercial Liaison Officer* : H. J. Clark.
U.S.A.	Dunlop Tire & Rubber Corporation, Buffalo N.Y., U.S.A. *Liaison Officer* : M. J. Buschman.
AUSTRALIA.	Dunlop Rubber Australia Ltd., 108, Flinders Street, Melbourne, Australia. *Commercial Liasion Officer* : E. E. Dunshea.

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