A supplement to be used in conjunction with the Hunter Technical Service Manual

The SM 1500

SM.1500 CHASSIS NUMBER SERIES

D.101.S	... ...	D.530.S
D.531.T	... ...	D.5410.T
D.5411.U	...	D.9999.U
D.1.U	... ...	D.1774.U
D.1775.V	... ...	D.6108.V
D.6109.W	...	D.7666.W
D.7667.X	...	Onwards

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MODIFICATIONS

UNIT	COMMENCING	NATURE OF MODIFICATION
Engine	Engine No. D.730.S ...	Timing mark scribed on Camshaft See Page O1. Valve clearances increased to .020" See Page O1.
Camshaft Chain Tensioner	Hunter Saloon	Spring loaded tensioner replaced by spring loaded jockey wheel. See Page O1.
By-pass oil filter	Hunter Saloon	Type M.1. replaced by Type L.4. See Page P2.
Oil sump filter	Engine No. D.122.U ...	B.W.P. floating filter is replaced by a fixed basket type. See Page P3.
Oil pressure release valve	Hunter Saloon	Ball valve replaced by plunger. See Page P3.
Fuel pump	Hunter Saloon	S.U. electrical pump replaced be A.C. mechanical pump. See Page Q1.
Carburettor	Hunter Saloon	Type FAI.30 Solex replaced by FAIO.30 Solex with progressive starter. See Page R2.
Camber Adjustment ...	—	Full camber adjustment provided for by shims. See Page S.1.
Steering gear	RHD Chassis No. D.7128.W LHD Chassis No. D.7183.W	Type L.3 and L.3A are replaced by recirculatory ball steering gear. See Page T1.
Body	Hunter Saloon	Grille and bonnet restyled. See Pages U1 and U2.
Door lock	Body No. D.5373.W ...	Replaced by push button type See Page U2.
Doors	Chassis No. D.701.S ...	Wooden frames replaced by metal pressings. See Page U2.
Trafficators	Hunter Saloon	Replaced by flashing indicators. See Page V1.
Pilot lamps	Chassis No. D.301.S ...	Replaced by side lamps. See Page V2 and V7.
Control-box	Chassis No. D.101.U ...	Type RF952 replaced by type RB106-1. See Page V4.

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SECTION O — ENGINE

VALVE CLEARANCES.

A modified form of camshaft, Part No. C.11714, as fitted to the Hunter from Engine No. H.1501.Y, is now supplied for all SM.1500 Service requirements and with this type the valve clearances must be set to **.020" (.51 mm). (cold) Inlet and Exhaust.**

A metal plate showing these clearance figures is supplied with the modified camshaft in cases where replacement of the original pattern is involved and this plate should be permanently attached to the valve cover.

This modified camshaft can be identified by a groove which is machined around the outside diameter of the driving flange—*See page* B14.

VALVE TIMING.

From Engine No. D.730.S a mark is scribed on the rim of the driving flange of the camshaft which, when in line with the machined face of the pad at the butt face of No. 1 bearing cap of the camshaft, and with the mark 1/4 on the flywheel set at top centre, indicates the inlet valves are opening at 10° B.T.D.C.

With engines bearing numbers prior to D.730.S to position the camshaft with the inlet valve just opening at 10° B.T.D.C.

Proceed as follows :—

Check and, if necessary, set the rocker clearances to .004" (.1 mm.) for the inlet valves and .006" (.15 mm.) for the exhaust valves.

Rotate the engine slowly by means of the starting handle, and while doing so, endeavour to oscillate, with the forefinger and thumb, the collar of the inlet valve for No.1 Cylinder. As long as the valve is on its seat oscillation will be difficult, but immediately the valve commences to leave its seat oscillation will be comparatively easy.

Where this condition occurs is the exact opening position of the valve and for the timing to be correct, the mark 1/4 on the flywheel should at that point, be 10° or $\frac{15}{16}$" (23.812 mm.) measured on the rim of the flywheel, before top centre.

These instructions should be followed when positioning the camshaft prior to replacing the cylinder head or removing the primary chain and timing wheels as described on *pages B9 and B21*.

Any correction to the valve timing should be carried out as described under Method 2 on *page B.16*.

NOTE. When positioning the camshaft always ensure that the electrode of the distributor rotor points to the segment in the cap connected to No. 4 Sparking Plug.

CAMSHAFT CHAIN TENSIONER ADJUSTMENT.

Secure from turning, with a fairly thin $\frac{7}{16}$" spanner, the lock nut of the chain tensioner, and with the aid of a second $\frac{7}{16}$" spanner, remove the cover of the tensioner—the lock nut is the one nearest the cylinder head.

Release the lock nut and, with a $\frac{3}{16}$" spanner, screw "in" or "out" the threaded plug of the tensioner until the distance between the end of the cottered plunger and the end face of the threaded plug is $\frac{15}{32}$". It is important that this dimension is not exceeded or reduced, as any such action will cause the chain to wear abnormally.

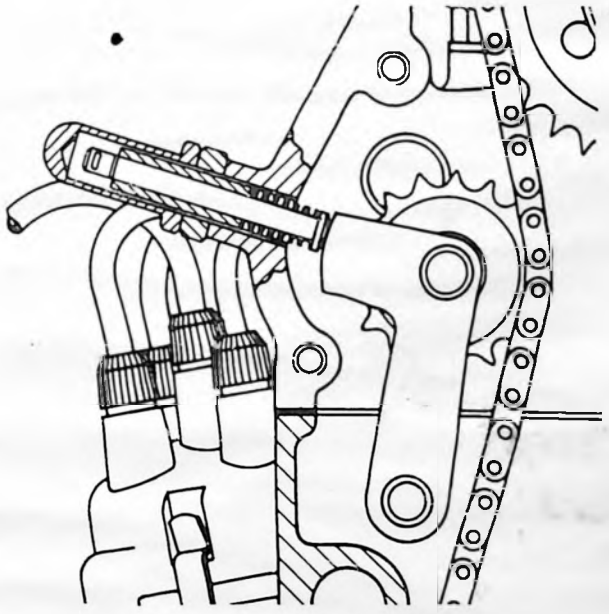

Fig. 1. Camshaft Chain Adjuster.

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SECTION P — LUBRICATION

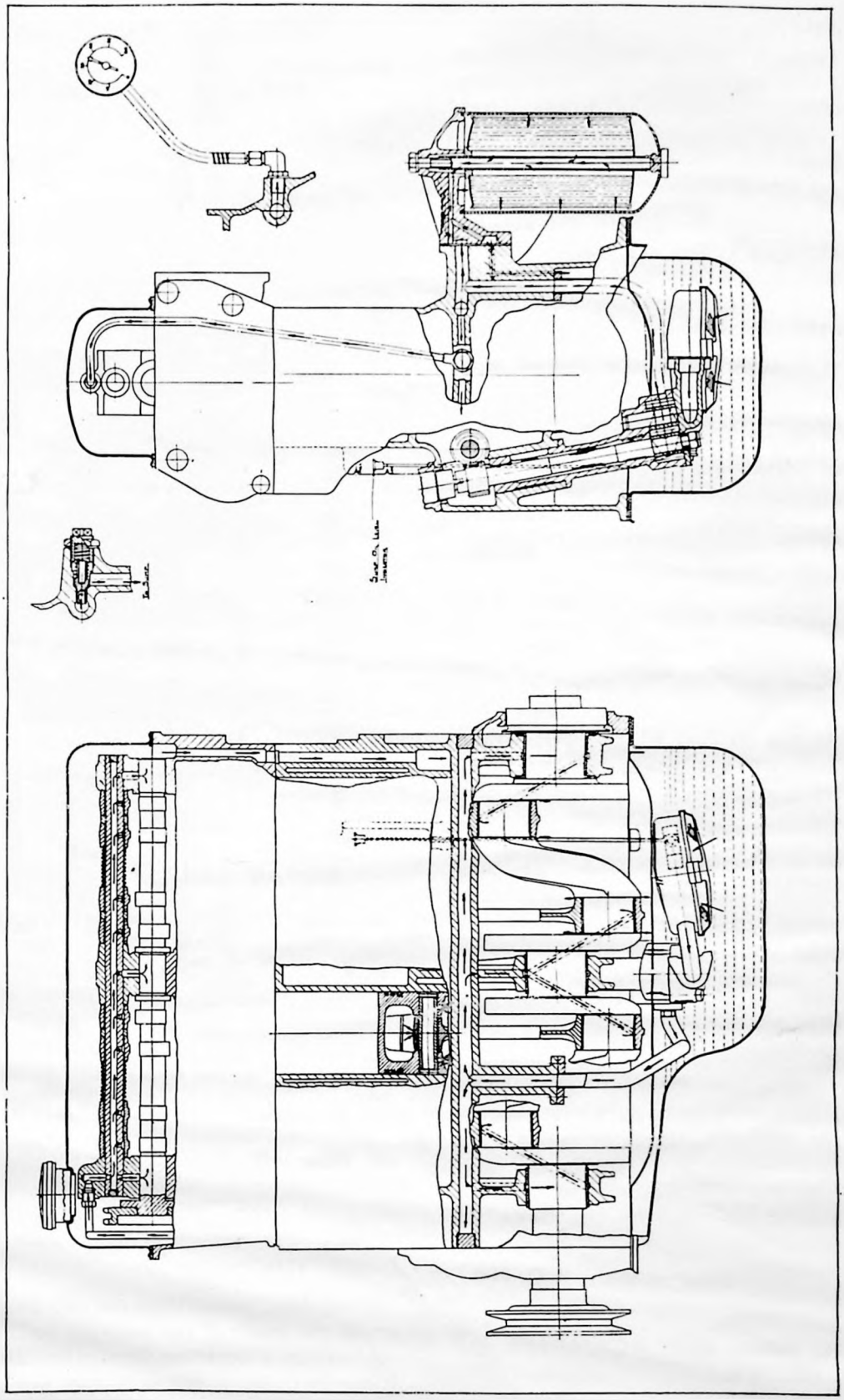

Fig. 1. Engine Oil Circulation Diagram.

A.C. OIL FILTER.

Description.

The Oil Filter serves the important function of keeping the engine oil free from foreign matter, and its efficiency is such that, during the useful life of the filter element, the oil remains almost equal in colour to new when judged by its appearance.

To maintain these conditions, the element must be changed when its useful life has ended, which is approximately 10,000 miles (16,093 Kms.). The Engine Oil must also be changed at the same time.

The filter is inserted in the engine lubricating system on the by-pass principle, and reference to the oil flow diagram on *page P1* will give a clear idea of the passage of oil through the engine and oil filter.

TO CHANGE THE ELEMENT.

Remove completely the hexagon-headed stud in the aluminium support bracket, when the filter casing complete with element will come away.

The element can now be lifted out and should be discarded, the casing cleaned and care taken to ensure that all traces of paraffin or any other solvent used, are removed. the new element inserted and the small fibre washer, supplied with each genuine A.C. replacement element, fitted around the centre tube and on top of the element. The new neoprene joint, supplied with the new element, should replace the old joint in the groove on the under face of the aluminium support bracket. The casing can now be placed in position and the hexagon headed centre stud, with its joint washer replaced and tightened.

As a precautionary measure, the engine should then be run to make sure that there is no oil leakage, and since the filter casing holds an appreciable amount of oil, the level should be checked by the indicator rod or dipstick, and, if necessary, the required quantity of oil added.

The type of filter element is the A.C. M.11.

REMOVAL AND REPLACEMENT OF THE OIL FILTER.

Remove the two bolts securing the aluminium support bracket to the crankcase, when the filter will come away as a complete unit. If the casing is removed while the unit is detached from the engine, remember to replace the securing bolts into position, before replacing the bowl.

On later productions the two plain washers under the heads of the securing bolts have been replaced by a lockplate, Service Part No. C10028. If the lockplate is not available, two shakeproof washers should be used in addition to the plain washers.

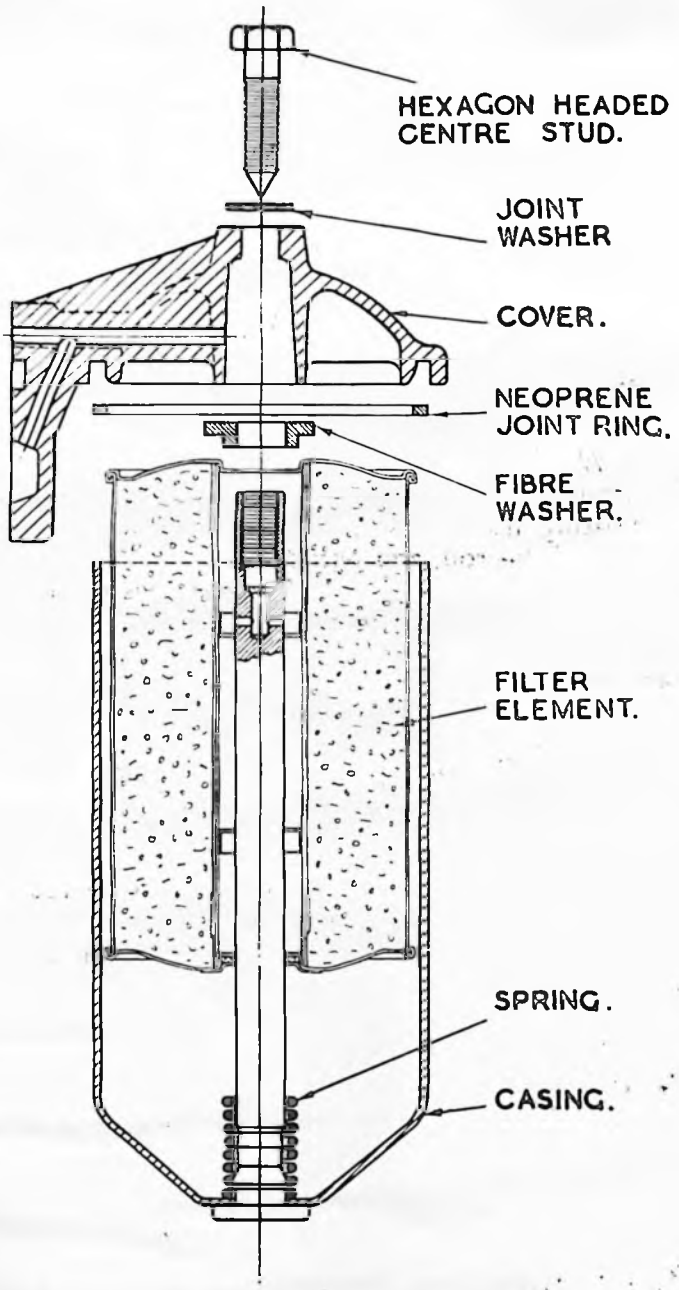

Fig. 2. Section through A.C. Oil Filter.

B.W.P. FLOATING FILTER.

Description.

This filter is situated in the engine sump and, as its name implies, is free to float on the surface of the oil, thus keeping the filter element clear of any sediment which may collect in the sump. From Engine No. D.122.U the floating filter is replaced by a fixed basket type.

To obtain access to the filter the engine sump must be removed. For details of the operation see *page B24.*

With the sump removed withdraw the cotter securing the indicator rod to the floating filter, unscrew the button on the top end of the rod, and withdraw the rod downwards out of position. Remove the cotter securing the floating filter to the oil pump and detach the filter from the pump.

As advised in the "Summary of Regluar Attentions", the filter should be removed every 5,000 miles (8,046 Kms.) and cleaned in petrol with a stiff bristle brush.

Before reassembling the sump to the engine, make sure that the filter unit, when connected to the suction pipe and indicator rod and secured by a cotter, is free to rise and fall under its own weight.

OIL PRESSURE RELEASE VALVE.

Dirt or foreign matter may prevent the pressure release valve, situated in the main gallery from working correctly. To clean, release the locknut just sufficiently to allow the central plug to be unscrewed. Avoid altering the position on the nut unnecessarily, for the position of the nut on the plug is an indication of how far the plug must be screwed in for the pressure to be approximately correct. Completely detach the plug from the cylinder block, remove the spring, and plunger. Clean all parts including the bore in the cylinder block and the seat with petrol, and reassemble, first the plunger, then the spring, and lastly the plug which should be screwed up to the locknut which should now be tightened. If the pressure is low, release the lock nut, and screw the plug "in" until the correct pressure of 30/35 lbs. per square inch at 30/35 miles per hour is registered. To lower the pressure screw "out" the plug appropriately. Do not forget to tighten the locknut after each adjustment.

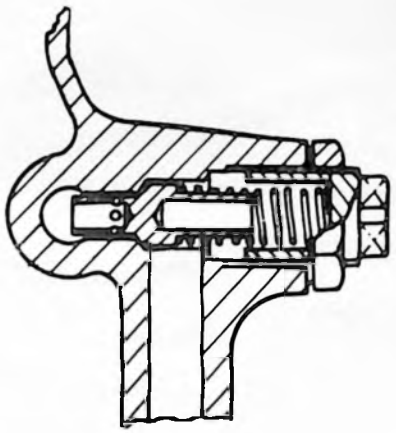

Fig. 3. Sectional View of Oil Pressure Release Valve.

For other possible sources of low oil pressure see *page B25.*

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SECTION Q — FUEL PUMP

SECTION Q

FUEL PUMP

THE SU. FUEL PUMP.

Description.

The pump is capable of delivering eight gallons of fuel per hour through a suction lift of four feet, with no general maintenance other than an occasional cleaning of the filter.

The unit consists of three main assemblies (see *Fig.* 1, *page* Q2) : the body, the magnet assembly and the contact breaker.

The body is composed of two aluminium die castings (A) and (B), the larger of which (B) has the filter (X) screwed into the bottom, the inlet union (C) into the side, and the outlet (D) into the top.

The outlet union tightens down on to the delivery valve cage (E) which is clamped between two fibre washers (F) and (G), In the top of the cage is the delivery valve, (H) a thin brass disc, held in position by a spring clip (I), while the suction valve (K) a similar disc, rests on a seating machined in the body. Holes connect the space between the valves to the pumping chamber which is a hollow depression on the forward face of the small body casting. The space is enclosed by a diaphragm (L) clamped between the magnet housing (M) and the smaller of the two bodies (A). A bronze rod (P) is screwed through the centre of the armature to which the diaphragm is attached, and passes through the magnet core to the contact breaker located at the far end. A spring (SL) is interposed between the armature and the end plate of the coil. There is a fabric joint washer (Z) between the large and small body castings.

The magnet consists of a cast iron pot (M) having an iron core wound with a coil of copper wire which energises the magnet.

Between the magnet housing and the armature are fitted eleven spherical edged brass rollers (S) which locate the armature centrally within the magnet and allow absolute freedom of movement in a longitudinal direction.

The contact breaker consists of a small bakelite moulding which carries two rockers (U) and (UI) both hinged at one end to the moulding and connected together at their top ends by two small springs arranged to give a throw-over action. A trunnion is fitted into the centre of the inner rocker and the bronze rod (P) connected to the armature is screwed into this trunnion. The outer rocker (U) is fitted with a tungsten point which makes contact with another tungsten point on the spring blade (V). This blade is connected to one end of the coil, the other end of which is connected to the terminal (W).

To ensure a good earth connection, a short length of flexible wire connects the outer rocker (U) to one of the screws holding the bakelite moulding to the magnet housing.

THE ACTION OF THE PUMP IS AS FOLLOWS :—

When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal, through the coil, back to the blade, through the points and to earth, thus energising the magnet and attracting the armature. This comes forward bringing the diaphragm with it and sucking petrol through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the "throw-over" mechanism operates and the outer rocker flies back, separating the points and breaking the circuit. The spring (SL) then pushes the armature back forcing petrol through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the "throw-over" mechanism again operates, the points make contact and the cycle operation is repeated.

FAILURE TO DELIVER FUEL.

Should the pump fail to deliver fuel, disconnect the petrol delivery pipe from the pump. If the pump then works the most likely cause of the trouble is a sticking needle in the float chamber of the carburettor. Should the pump not work disconnect the lead from the terminal and strike it against the body of the pump. If it sparks, current is available in the wire. Then remove the

bakelite cover and touch the terminal with the lead. If the pump does not operate and the points are in contact but a spark cannot be struck off the terminal it is probable that the points are dirty. These can be cleaned by inserting a piece of card between them, pinching them together and sliding the card backwards and forwards. If when the wire is connected to the terminal and the tickler of the carburettor is depressed the points fail to break it is possible that there is either an obstruction in the suction pipe, which should be cleaned by blowing down it with a tyre pump, or there is something in the pump itself preventing correct movement. This latter condition may be due to either the diaphragm having stiffened or to foreign matter in the roller assembly which supports the diaphragm. The diaphragm should be removed, the whole assembly cleaned and reassembled in accordance with the instructions given below.

If the pump keeps on beating without delivering any petrol it is possible that a piece of dirt is lodged under one of the valves. These can be removed by unscrewing the top union and lifting the valve cage out. When replacing it see that the thin hard red fibre washer is below the valve cage and the thick coloured one above. A choked filter or an obstruction on the suction side will cause the pump to get very hot and eventually cause failure.

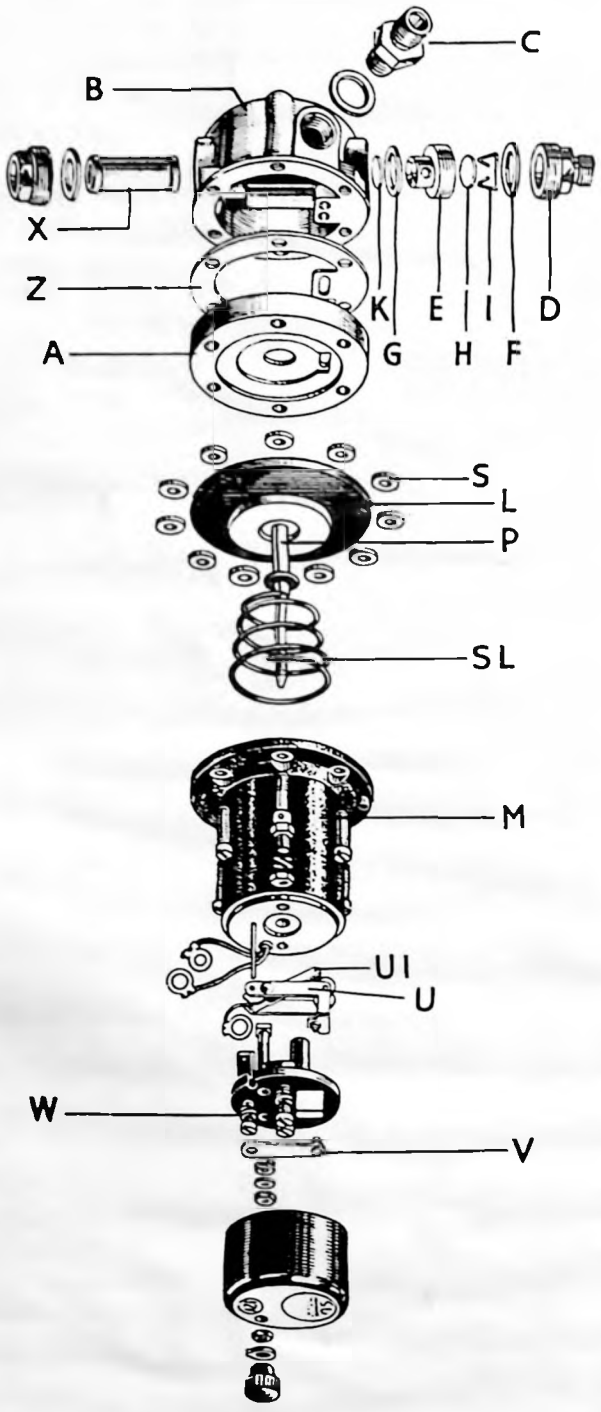

Fig. 1. Exploded View of Fuel Pump.

FUEL FILTER. Cleaning.

Detach the pump from the car by disconnecting the lead attached to the terminal on the pump, removing the feed and delivery pipes, and the two nuts and washers which secure the unit to the side of the bonnet platform. Hold the pump securely in a vice fitted with lead clamps and remove the filter which forms part of the hexagon nut in the bottom of the pump body.

Clean the element of the pump filter in petrol with a stiff brush. Do not under any circumstances use rag. Replacement is the reversal of removal.

PUMP NOISY.

If the pump becomes noisy look for an air leak on the suction side. The simplest way to check is to disconnect the petrol pipe from the carburettor and allow the pump to pump petrol into a pint can. If the end of the pipe is then submerged in the petrol and bubbles come through there is an air leak, which must be found and cured. Probable causes, loose union connections or punctured pipes.

ADJUSTMENTS.

The Contact Breaker.

The contact breaker should be assembled on to the pedestal in such a way that the

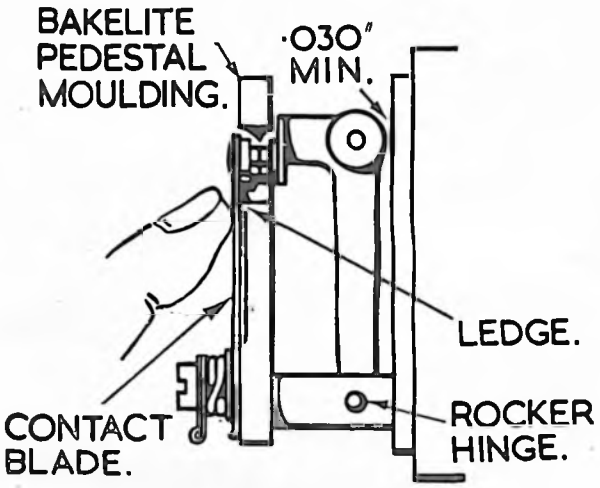

Fig. 2. Rocker Assembly.

rockers are a free fit but without side play. Excessive side play on the outer rocker will allow the points to get out of line, while excessive tightness will make the contact breaker sluggish in action. To obtain the required freedom, square up the outer rocker with the aid of a pair of thin nosed pliers. The hinge pin is case-hardened and under no circumstances must pieces of ordinary wire be used. In all instances a standard pin must be fitted.

The spring contact blade must be fitted directly against the bakelite pedestal and under the tag to which the lead is attached. The blade should rest against the ledge on the pedestal when the points are apart and should not be so stiff as to prevent the outer rocker from coming right forward when the points are in contact. The points should just make contact when the rocker is in the midway position.

The simplest way to check this condition is to hold the blade in contact with the pedestal, taking care not to press on the overhanging portion, and see whether a .030 in. (.8 mm.) feeler gauge will pass between the white rollers and the cast iron body of the magnet. If necessary set the tip of the blade to obtain the correct gap of .030 in. (.8 mm.).

The spring washer on the 2 BA screw to which the earthing connection is taken must be fitted below the tag, that is next to the pedestal. The reason is that the spring washer cannot be relied on as a conductor, and the brass tag must therefore be next to the head of the screw.

All four connections, that is the ends of the earthing tag and those of the coil, must be soldered. The coil end going to the terminal must be soldered to the tag and not to the nut.

The correct order for the assembly on the terminal is the spring washer next to the bakelite pedestal, then the tag, the lead washer and the countersunk nut.

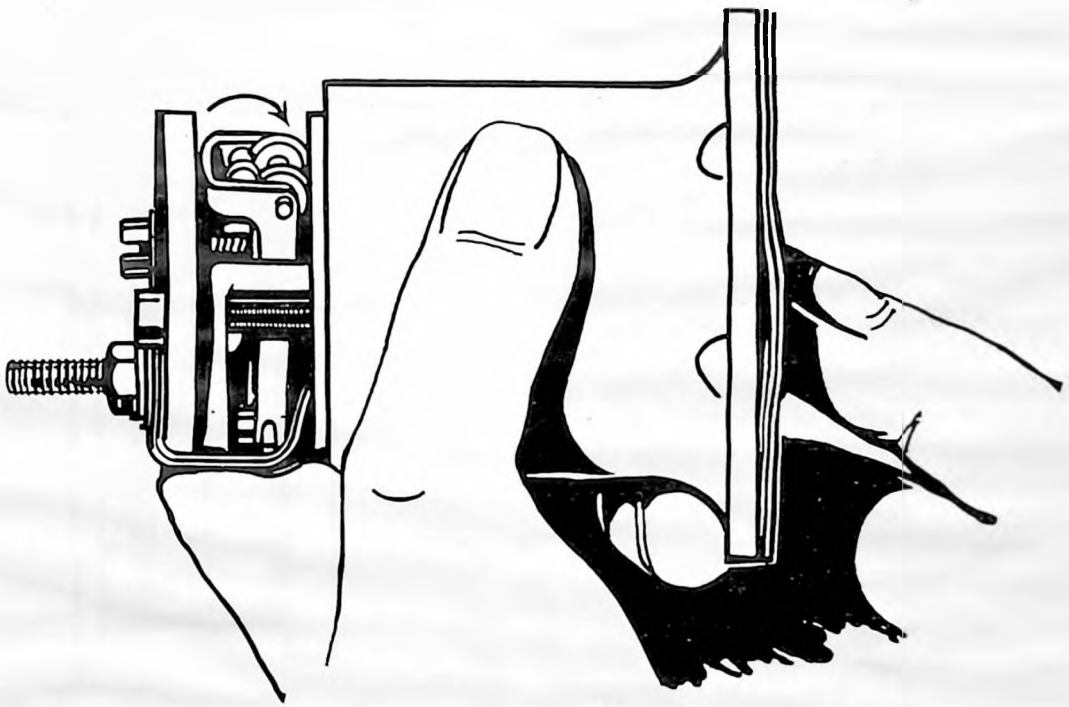

Fig. 3. Adjusting Armature.

A lead washer is necessary at this point to ensure a good connection. Under no circumstances should this assembly be shortened either by leaving out the spring washers or in any other way, as any such action will cause the pedestal to break when the nut, holding the cover in position, is tightened.

ADJUSTING THE MAGNET ASSEMBLY.

Under no circumstances should an attempt be made to remove the core of the magnet, since to assemble and locate it correctly special press tools are needed.

The armature spring should be fitted with the large diameter in the mouth of the pot and the small diameter resting against the armature. Do not stretch the armature spring since this will disturb the action of the pump.

Adjust the Armature as Follows.

The contact blade on the pump must be swung to one side while the adjustment is being made. Take care to fit the impact washer into the recess of the armature, which should then be screwed in and the eleven rollers placed into position. Do not dope the diaphragm.

The magnet assembly should be held in the left hand in an approximately horizontal position and the armature pushed in with the thumb of the right hand pressing firmly but steadily. If the contact breaker throws over, the armature should be screwed in until this throw over action does not occur and then unscrewed one-sixth of a turn at a time until a position is found at which the contact breaker just throws over. Take care that the armature is not jerked in but pressed in with a steady pressure. The armature should then be unscrewed two-thirds of a turn, that is four holes, at which position the setting should be correct. Do not forget that this is done with the points out of contact. When a new diaphragm is fitted it is possible that considerable pressure will be required to push it right home. If there is doubt about the point at which the contact breaker throws over, come back one-sixth of a turn.

The cast iron body should then be placed into position on the pump body with the drain hole in the former in line with the filter plug on the brass body, that is, at the bottom.

Take care to see that the cast iron body sits down on the pump body before the screws which hold it in place are inserted. If one of the rollers falls out of position it will be trapped between the two parts and cut a hole in the diaphragm. Five screws and an earthing terminal should then be fitted to hold the two parts together. These should not be screwed right home, for it is necessary that the diaphragm is stretched to its outermost position before tightening the screws down, To stretch the diaphragm a special forked wedge can be obtained from the S.U. Pump Distributors. *See Fig.* 4.

This fork is inserted between the white roller on the outer rocker and the body of the pump and pressed in under the tips of the inner rocker until it lifts the trunnion in the centre of the inner rocker as far as it will go. If a fork is not available the diaphragm may be stretched by holding the points in contact,

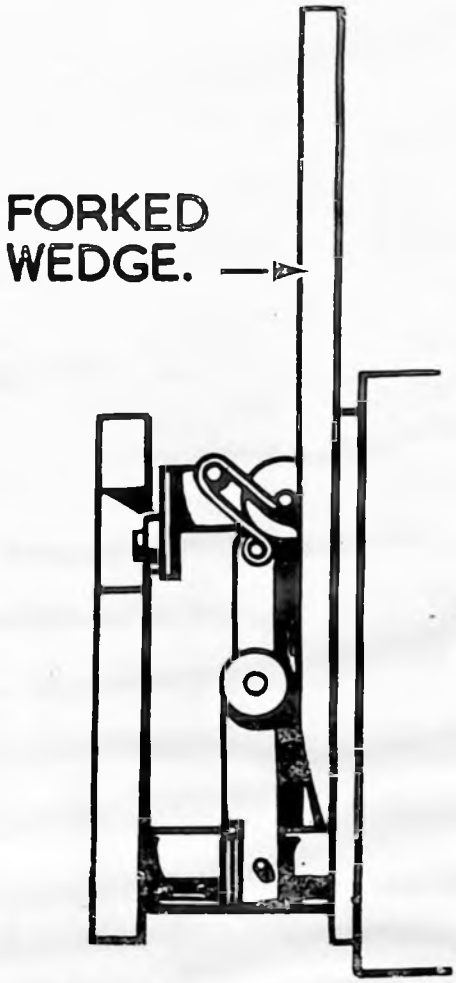

Fig. 4. Fork for Diaphragm Stretching.

inserting a match stick under one of the white fibre rollers and passing a current through the pump. While the diaphragm is held in this position the five screws and the earthing terminal should be tightened down fully.

The pump should then be put on test. The use of a cut away cover while testing prevents the hinge pin from falling out and also makes it possible to observe the action of the contact breaker.

The pump should be mounted suitably three feet above the tank from which the testing fuel, either petrol or paraffin, is to be drawn. When switched on the pump should prime promptly and deliver a continuous stream of fuel from the outlet pipe.

NOTE. There are three important instructions which repairers are apt to overlook, and when not observed the working of the pump can be seriously affected, they are :—

(1) To keep the blade out of contact while adjusting the correct diaphragm setting.

(2) To press steadily and firmly on the armature while obtaining the setting. A jerky or bumpy action must be avoided.

(3) Failure to stretch the diaphragm to the limit of its stroke while tightening up the body screws.

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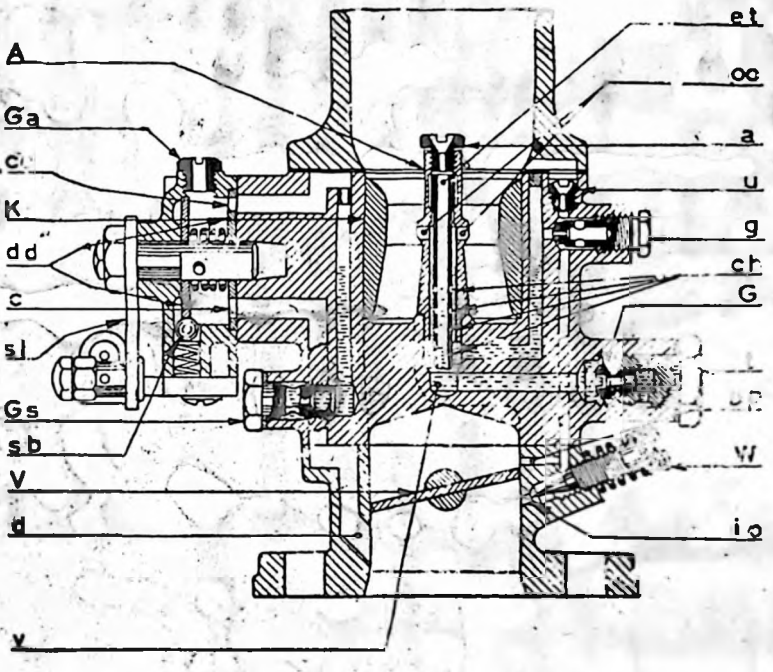
SECTION R — CARBURETTOR

SOLEX CARBURETTER TYPES FAI. and AIC.

DIAGRAMMATIC SECTION



BI-STARTER

Ga	Starter air jet.
cc	Starter valve duct.
dd	Spring loaded [illegible] valve
c	Starter mixture exit duct
sl	Starter lever
Gs	Starter petrol jet
sb	Spring ball (bi-starter position)
d	Starter mixture delivery duct

MAIN CARBURETTER

A	Spraying well
a	Air correction jet
et	Emulsion tube
oo	Spraying orifices
u	Pilot jet air bleed
g	Pilot jet
ch	Emulsion holes
G	Main jet
t	Main jet holder
K	Choke tube
bp	By-pass
W	Volume control screw
io	Idling mixture orifice
V	Throttle butterfly
v	Reserve well

CARBURETTOR.

Description.

The model FAI, Solex carburettor incorporates the Bi-starter principle in which the hand-operated mixture control on the dash for starting from cold has two positions—rich for cold starting, and the intermediate in which the petrol proportion is considerably reduced. In the intermediate position the car can be immediately driven away without the possibility of "overdosing".

It is difficult to show in one diagram all the parts simultaneously, so the float chamber, which is of standard design, has been omitted in the diagram on *page R1*.

Describing the main carburettor and referring to the diagram.

(t) is the main jet holder, 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 is the emulsion tube (et) which is located on a conical seating and held by the air 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 correction 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 the 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.

Idling is effected by petrol drawn from the main jet well via a small channel which will be seen emerging immediately 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 mixture orifice (io) controlled by the spring-loaded and knurled-headed taper screw (W).

The orifice (io) is on the engine and therefore on the suction 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, this branch lead which is termed the "by-pass", acts as an air bleed upon the idling petrol supply and prevents over-richness when idling. Directly the throttle opens, however, the vane passes to the atmospheric side of the orifice, so that both "bp" and "io" function as delivery orifices, thereby proportionately enriching the output at the transfer position between the pilot and main supplies and preventing a lean flat spot which might otherwise take place.

Adjustment.

The adjustment of the carburettor 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).

The Bi-Starter.

The diagram shows the Bi-starter as a disc valve controlled chamber, fed via the starter petrol jet (Gs) and the starter air jet (Ga), and put into operation by the lever (sl) which rotates the spring-loaded discs (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).

It differs from the original Solex starter in that, instead of having two positions, "shut" and "open", there is now an intermediate one, so that it is possible, when the lever is operated along the full length of its travel, to have a very rich mixture which will ensure

easy starting under the coldest conditions. Then, by pushing the lever back a short distance, another very much smaller drilling in the inner disc comes into operation. The effective position of the lever 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 prolonged "semi-idling" for warming-up purposes, or the car being driven straight away under load without 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 control on the dash should be pushed fully home so that the holes in the right-hand disc will no longer 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 selection of a suitable air jet (Ga) and petrol jet (Gs). This adjustment is done at the works and no alteration under normal circumstances is necessary from the standard selection. *See page R4 for Jet Sizes.*

NOTES ON STARTING.

During cold weather, when the engine has remained at rest for a long period, it is advisable, before switching on the ignition and pulling out the dashboard mixture control of the starting device or Bi-starter, to give the engine a few turns by hand to break the normal inertia of the oil.

If the car has been standing for some time the petrol in the fuel chamber may be stale and difficult starting may be experienced during cold weather. It is therefore advisable to pump into the fuel chamber a fresh supply of petrol before attempting to start the engine.

The auxiliary carburettor forming the starting device of Bi-starter, as explained, gives :

(1) A mixture which is enriched proportionately as the temperature falls and so ensures instantaneous starting from cold.

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

To start the engine switch the ignition "ON", pull out the dashboard control to the full extent and operate the starter switch. Immediately the engine fires, release the starter switch and push the dashboard control to the halfway or "Bi-starter" position. The car can now be driven away and the mixture control pushed right home immediately the engine will work without hesitation on the main carburettor. This can usually be done within half a mile (.8 Kms.) of starting.

There are three stages in the use of the starting device or Bi-starter :—

(1) Dashboard mixture control pulled fully out to start.

(2) Dashboard mixture control pushed in half-way as soon as possible. This stage is for driving away.

(3) Dashboard mixture control pushed fully "home" after driving a few hundred yards.

Under no circumstances should the dashboard mixture control be used for starting the engine, when hot.

Careful attention to these details will ensure permanent satisfaction at minimum cost in petrol and engine wear and tear.

DISMANTLING THE CARBURETTOR.

When designing the FAI model the principles of Solex simplicity and accessibility have been faithfully followed.

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, after the air cleaner, if fitted, is removed.

Two slotted square headed bolts secure the top casting to the body of the carburettor, and the removal of these allow the top to be detached from the main body of the carburettor, thus exposing the float chamber, air correction jet (a) and pilot jet air bleed (u). These two jets can now be removed with a small screwdriver.

ADJUSTMENT OF THE CARBURETTOR.

The sizes of the choke tube and those of the various jets for the Bi-starter device, idling and general running have been chosen by careful experiment and there should be no reason to replace them with others of different dimensions. If the results being obtained are not satisfactory, the sizes stamped on the choke tube and the various jets should be checked against the table given below, and replacements fitted as necessary :—

	Single Carb.	*Twin Carb.*
Choke Tube	... 24	22
Main Jet ..	... 125	110
Correction Jet	.. 230	220
Pilot Jet ...	... 45	45
Starting Petrol Jet	... 115	115
Starting Air Jet	... 4	4
Emulsion Tube	... L4	L5

The only adjustment which may at times be needed is that for the slow running and is as follows :—

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 fixes the idling speed of the engine. By screwing in this screw the engine idling speed will be increased 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 ; 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.

Normal adjustment is carried out as follows:

(1) Wait until the engine is hot.

(2) Set the slow running screw until the idling is on the high side.

(3) Slacken the volume screw (W) until the engine begins to "hunt".

(4) Screw it in very gradually until the "hunting" just disappears.

(5) If the engine speed is too high reset the slow running screw to slow it down to idling speed of about 500 r.p.m.

(6) This may cause a resumption of slight "hunting". If so, turn the volume control screw gently in a clockwise direction until the idling is perfect.

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

The substantial valve overlap and rubber frame-block mountings of modern engines do not permit the clock-like tickover of earlier days. About 400 to 500 r.p.m. is the normal idling speed for present day engines.

NOTE. Under local conditions and such as those met with in some countries overseas or at high altitudes, it may be necessary to alter slightly the jet selection already given. Should such a need arise, before any readjustment is attempted, the local representative of Messrs. Solex Limited should be consulted. (A list of Solex Agents overseas will be supplied on application).

Messrs. Solex Limited London's address is : "SOLEX WORKS," 223/231 Marylebone Road, London, N.W.1.

METHOD OF SYNCHRONISING THE TWIN CARBURETTORS.

Throttle adjustment. (*IMPORTANT. This adjustment must be made when the engine is at normal running temperature*).

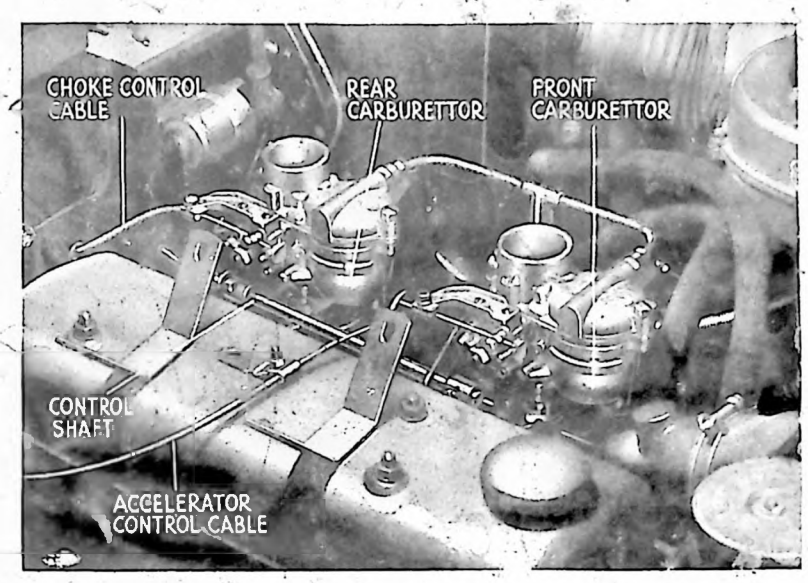
(1) Detach from the control shaft lever, the throttle control link connecting this lever to the throttle lever of the Front Carburettor (nearest the Radiator), thus retaining the spring on the throttle lever.

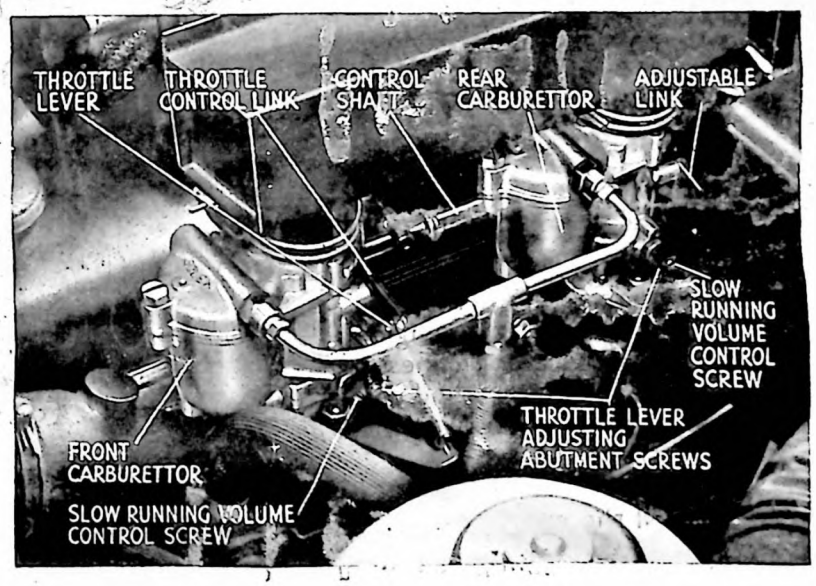
(2) With the Air Filters and their fittings removed from both Carburettors, screw in the throttle lever adjusting abutment screw on the Front Carburettor, thus opening the throttle, until fuel is seen to issue from the spraying orifices towards the choke tube.

(3) Adjust the throttle lever adjusting abutment screw on the Rear Carburettor until the foregoing conditions exist on this carburettor also.

(4) The engine will now be running at more than idling speed. Screw back the throttle lever adjustment abutment screws on the carburettors half a turn, each screw, at a time, until the engine idles without stalling. The engine may not now be running evenly. It is important that the adjusting abutment screws on both carburettors be moved exactly the same amount at each adjustment.

(5) Release the lock nut locking the adjustable link between the Rear Carburettor and the control shaft lever and move the screw until the fixed link between the Front Carburettor and the control shaft lever mentioned in Instruction 1, can be replaced, together with the Air Filters.





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SECTION S — FRONT SUSPENSION

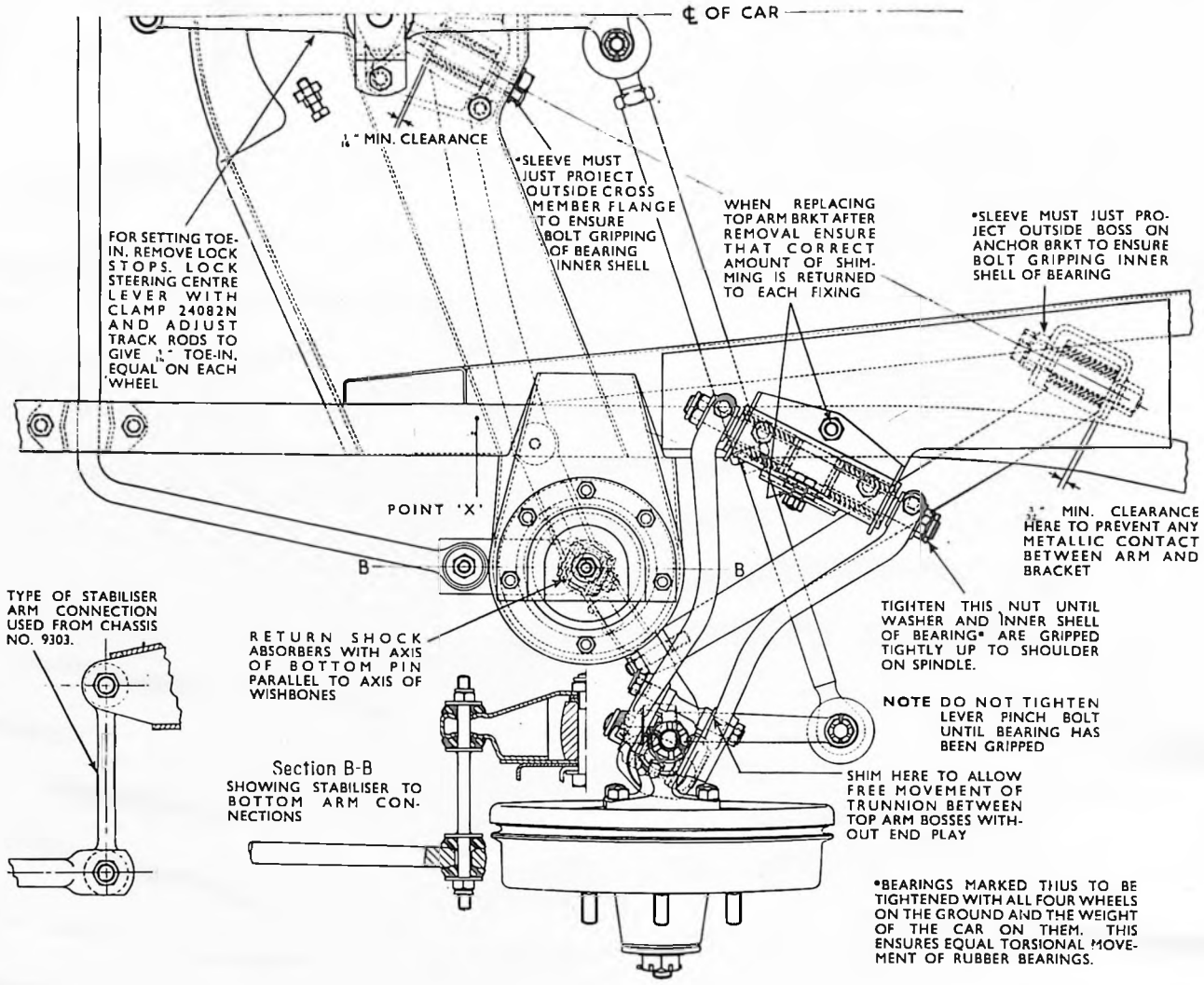

Fig. 1. Plan View of Front Suspension.

DESCRIPTION.

The front suspension is a fully independent coil and special wishbone system, controlled by Girling Telescopic D.A.5 Type Dampers and an Anti-Roll Bar device. Moulded rubbers are used at all anchorage points to help damp out road noises and to reduce the number of lubrication points. Where lubrication is necessary, *i.e.*, at all swivel pins and trunnion bushes, rubber sealing glands are provided for retaining grease and excluding dirt and moisture.

The lower suspension arms have very wide supporting bases and the junctions of the arms are close up to the wheel swivel to ensure maximum rigidity. The front wheels run on taper roller bearings. Steering is effected by a Burman "L" Type High Efficiency Worm and Ball Gear. The linkage is by Lockheed Thompson joints moved from a central lever mounted on needle bearings and controlled by a 17 in. two-spoked Steering Wheel, in the centre of which are fitted the trafficator and horn switches.

All Steering connections are in protected positions.

With the exception of a few minor differences, the method of servicing the front suspension is the same as described on *pages D1 to D13*. Where differences exist they are illustrated on the following pages.

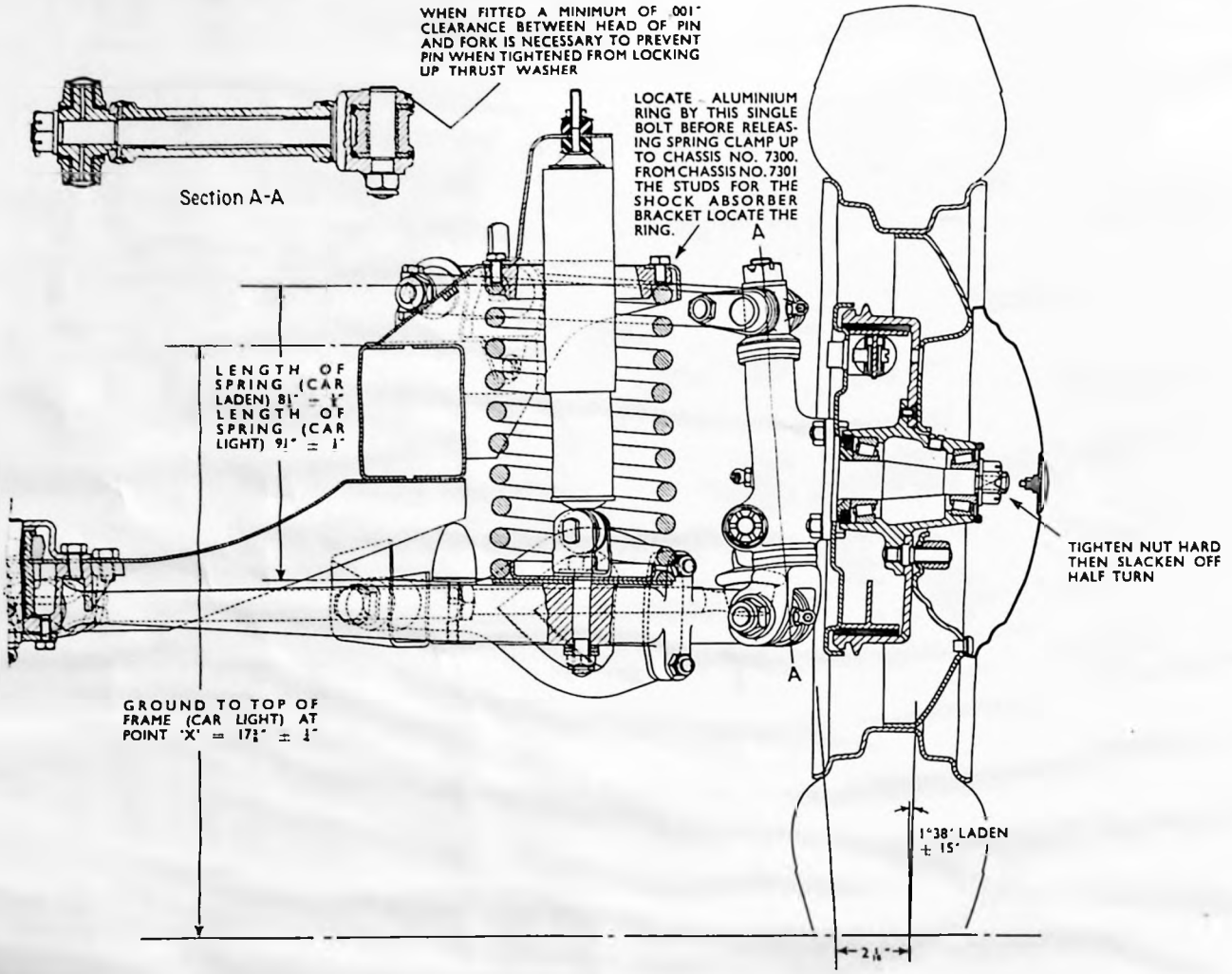

Fig. 2. Front View of Front Suspension.

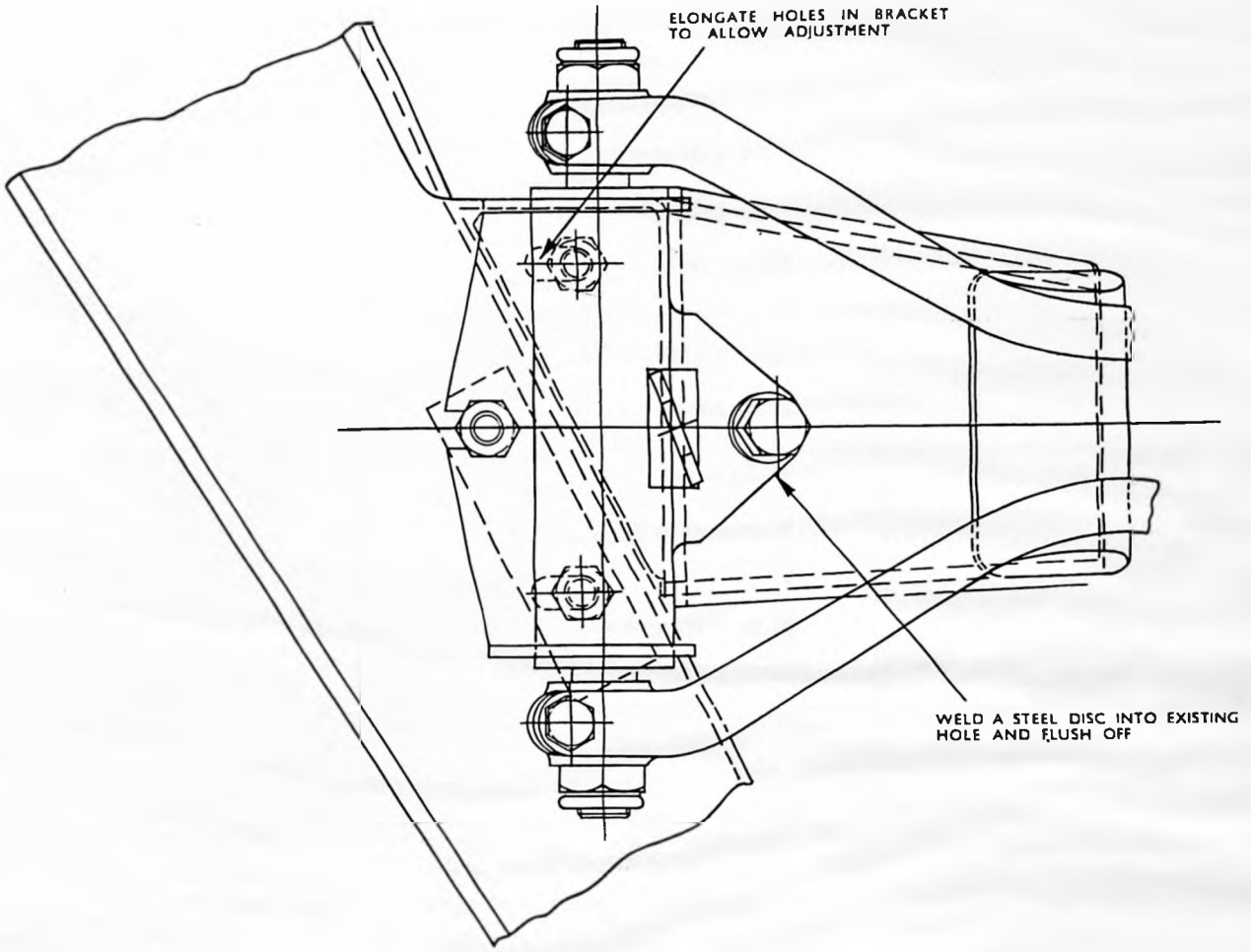

Fig. 3. Plan View of Top Arm Front Suspension Chassis Bracket.

TO RESET CAMBER ANGLE OF FRONT WHEELS ON CARS FITTED WITH REBOUND STOPS TO TOP SUSPENSION ARMS.

The wheel camber is the angle at which the topmost point of each front wheel leans away from the centre line of the car and from the vertical. Under normal conditions of operation the camber angle should not alter, but if as the result of an accident or some other abnormal circumstance a suspected alteration has occurred, an adjustment can be made in the manner described in the above diagram and that on *page* S4. To reset the camber angle on later models see *page* D1.

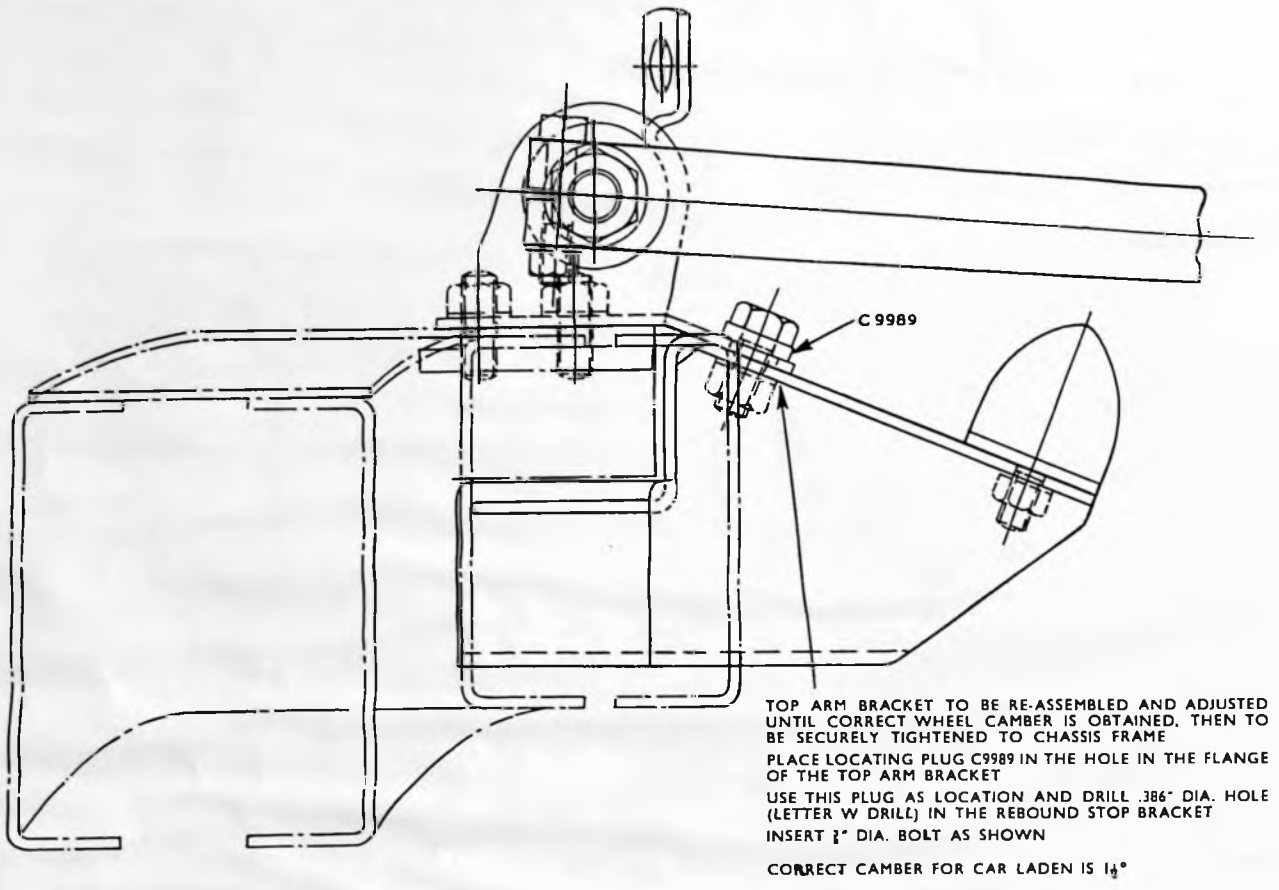

Fig. 4. Section through Fig. 3, Page S3.

Type of springing	Coil Springs
Camber	Laden 4 up 1°—38′
King Pin inclination	Laden 4 up 4°—22′
Castor	Laden 4 up 2°—45′
Toe-in Car unladen, measured at wheel centre height and at centre of tyre tread	$\frac{3}{16}$″ (4.762 mm.)
Inner Wheel Max. L.H. Lock	38½°
Outer Wheel Max. L.H. Lock	31°
Turning Circle	33 ft. (10 metres)

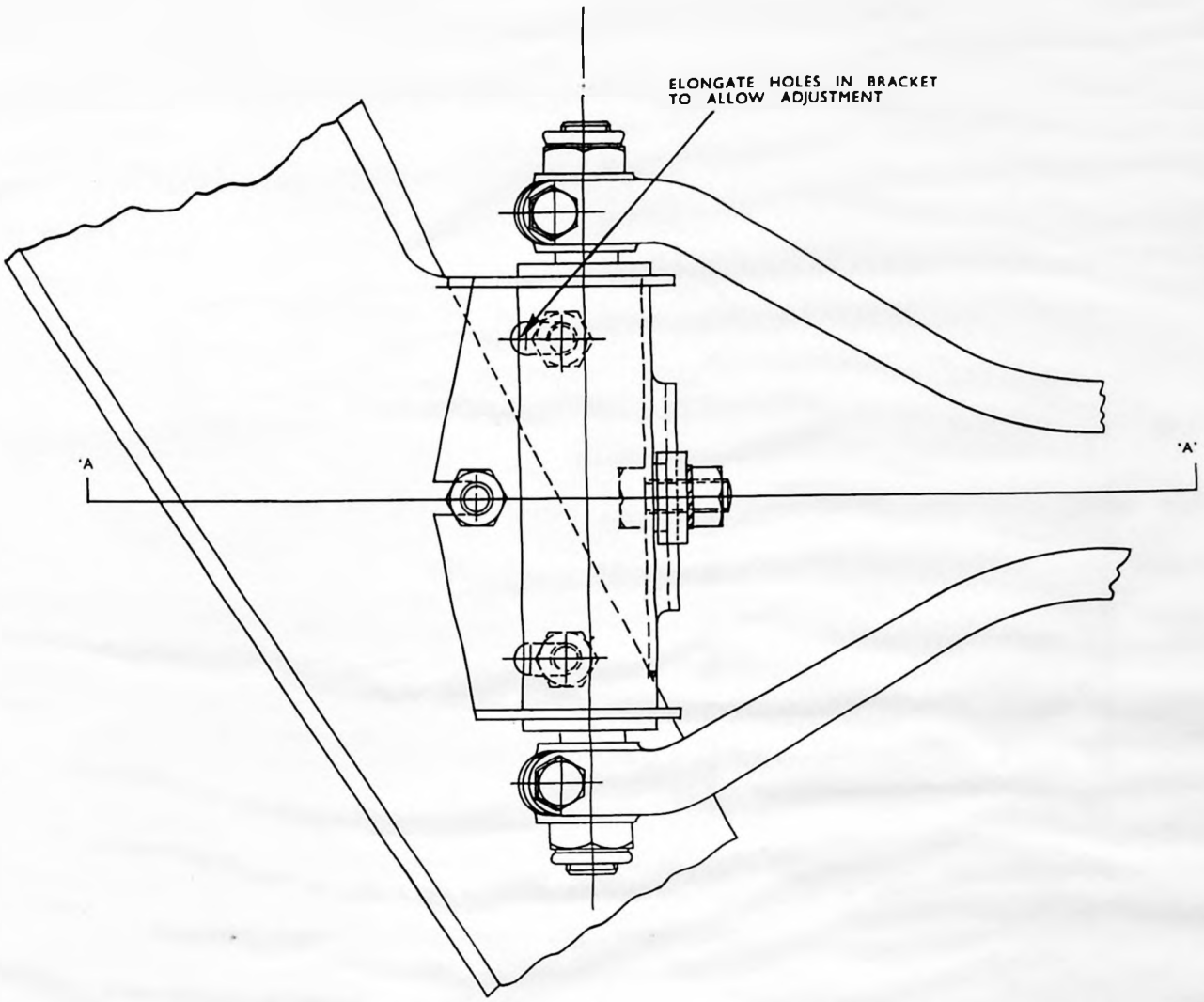

Fig. 5. Plan View of Top Arm Front Suspension Chassis Bracket.

TO RESET CAMBER ANGLE OF FRONT WHEELS ON CARS NOT FITTED WITH REBOUND STOPS TO TOP SUSPENSION ARMS.

The wheel camber is the angle at which the topmost point of each front wheel leans away from the centre line of the car and from the vertical. Under normal conditions of operation the camber angle should not alter, but if as the result of an accident or some other abnormal circumstance a suspected alteration has occurred, an adjustment can be made in the manner described in the above diagram and that on *page* S6. To reset the camber angle on later models *see page* D1.

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SECTION T — STEERING GEAR ASSEMBLY

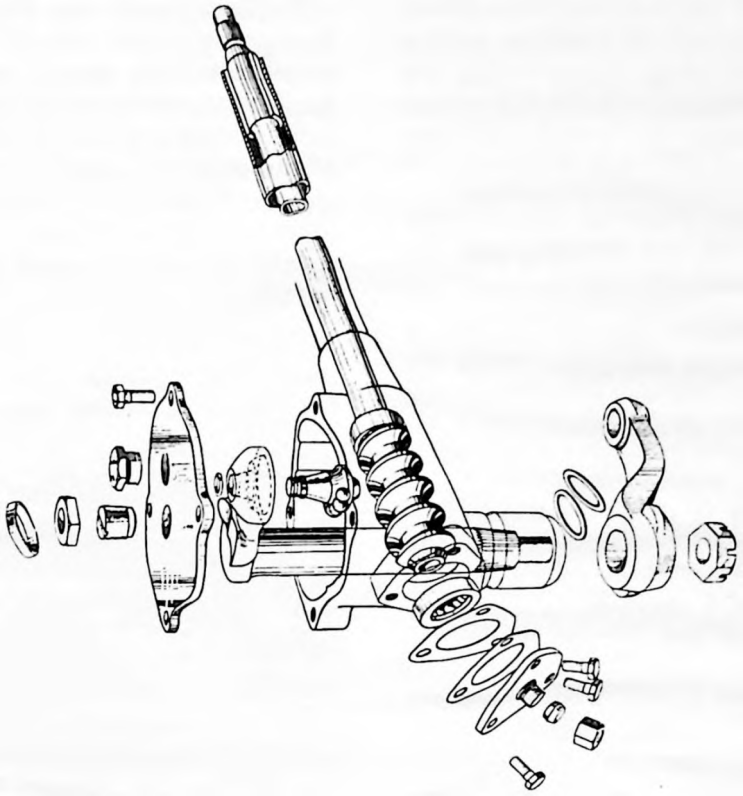


Fig. 1. Exploded View of Steering Gear Assembly.

DESCRIPTION.

The Burman steering gear assembly, type L3, consists of a single start worm fitted to the lower end of the steering column. Two ball races in the housing, fitted immediately above and below the worm, support the column at its lower end and an oil impregnated felt bush at its upper end. Engaging the worm is a spherically ended ball peg, also mounted on ball bearings in the rocker shaft. In action, revolving the steering column produces rotation of the ball peg and an accurate movement of the rocker shaft. As the ball peg moves out of the plane of the worm the rocker shaft is moved in by means of a cam controlled by an adjuster screw in the cover plate, and by this means the ball peg is kept in contact with the worm. Should wear take place in the peg or worm, it can be taken up by adjustment of the adjuster screw.

TO REMOVE AND REPLACE THE STEERING GEAR—LEFT-HAND DRIVE.

(1) Lift the bonnet.
(2) Drain the cooling system.
(3) Remove the air cleaner.
(4) Remove the radiator.
(5) Detach the left-hand support plate for the radiator and disconnect the hose from the Heater pipe. Three nuts and bolts secure the plate to the grille, the centre one secures the clip for the horn and trafficator wires.
(6) Disconnect the drag link from the steering box drop arm by removing the cotter and $\frac{3}{8}$ in. nut securing the ball pin of the joint to the drop arm.
(7) Bend back the tabs locking the heads of the bolts securing the steering box support bar to the chassis frame, one each side of the car ; access to these being obtained from beneath the front wings.
(8) Release the two nuts and bolts securing the trunnion support bracket to the steering box.
(9) Disconnect the horn and trafficator wires at their pull-push joints. Mark the wires to help reassembly. If in doubt about any connection consult the wiring diagram on *page V9*.
(10) Remove the nut securing the stator tube of the trafficator and horn switch to the

bottom cover of the steering box. Drive the sealing olive out of position with a sharp chisel and when reassembling use a new olive. The stator tube and switch assembly can now be withdrawn into the car.

(11) Release the clips securing the Heater element hoses to the engine and the element and detach the hoses.

(12) Remove the Heater element which is held by three bolts and nuts. *Note the distance pieces on the horizontal bolts and the rubber buffers, one on each side of the support bracket of the vertical bolt.*

(13) Remove the two $\frac{5}{16}$ in. nuts on the "U" clip securing the lower bracket of the change speed gear mechanism to the column and the $\frac{3}{8}$ in. bolt holding the support strip to the Master Cylinder.

(14) Remove the nut securing the steering wheel to the steering mast and withdraw the wheel.

(15) Release the $\frac{3}{8}$ in. bolt securing the top bracket of the change speed lever to the column and remove the two $\frac{5}{16}$ in. bolts and nuts securing the column to the support brackets under the facia board. Depress the column and remove the halves of the clamp block.

(16) Remove the clips holding the head lamp wires to the support bar. Then with an assistant supporting the box and bar, remove completely the bolts holding the bar to the chassis frame. Lock tabs released in operation 7. *Note the distance pieces between the bar and frame, these must be replaced as removed.*

(17) The steering box with support should now be raised, while the helper steadies the column inside the car. As soon as possible rotate the box and extract the support bar, then continue to raise until sufficiently high to withdraw the box and column away from the car.

(18) Support the change speed lever and bracket conveniently and avoid altering the relative positions of the lever and bracket by preventing the latter from revolving. There must be about $\frac{1}{8}$ in. (3.2 mm.) clearance between the face of the bracket and the boss of the lever.

Replacement is the reverse of the foregoing, but there are one or two points which must receive attention. Replace the steering wheel so that with the front wheels in a line ahead position the spokes of the steering wheel are horizontal, and that the Trafficator trip plate in the hub of the steering wheel is in correct setting in relation to the mechanism in the central Trafficator switch.

Position the hoses of the Heater element so that they do not foul the nuts of the "U" clip securing the change speed lever mechanism bracket. Check the lever mechanism as directed on *page* C12. Do not omit to fill the steering box with lubricant as directed in the lubricating chart, *page* M7.

TO REMOVE AND REPLACE THE STEERING BOX — RIGHT-HAND DRIVE.

The operations are identical to those given for a Left-hand Drive Car, except that there is no necessity to remove the Air Cleaner or detach the Heater pipe hoses.

TO DISMANTLE THE STEERING GEAR ASSEMBLY.

(1) Remove, by means of an extractor, the drop arm held up by a castellated nut and split pin on the tapered splines on the rocker shaft.

Under no circumstances should the drop arm be hammered off as this will damage either the worm or the ball bearing on the follower peg or both.

If no extractor is available remove the cover plate, support the housing on the cover plate face leaving the rocker shaft free and use a soft metal hammer to drive the rocker shaft through the drop arm.

(2) Remove the split ring securing the ball peg to the rockershaft when the peg complete with ball race can be dismantled.

(3) Release the gland nut in the centre of the bottom end plate and draw out the stator tube.

(4) Remove the three set screws holding the end plate to the housing and detach the

plate. Note the shims between the plate and box for adjusting purposes. The column, complete with balls and inner and outer races, can now be withdrawn through the bottom of the housing.

Assembly is the reverse of the foregoing but the following precautions should be observed.

(1) Lightly smear the top felt bush with grease before assembling.

(2) To assist assembling the bearings of the column smear their balls with thick grease to hold them in their races.

(3) Adjusting shims should be fitted between the end plate and housing so that while there is no end play in the column stiffness is also not present. Any stiffness would suggest that the bearings are being pre-loaded, a condition which would result in damage to the balls and races.

(4) Hold, with thick grease, the balls in the race of the ball peg, insert the peg in the rocker arm and secure it with the split ring, check that the peg revolves freely.

(5) Drop the rocker shaft complete with ball peg into position and check that the shaft is a good fit in its housing and making good contact with the seal in the lower end of the trunnion. Should there be excessive play between the shaft and housing fit a new rocker shaft ; if still present replace the housing. Any doubt about the condition of the seal should be removed by fitting a replacement.

(6) Remove the steel cap over the adjuster in the cover plate, release the locknut and slack off the adjuster. On later productions a lock plate is fitted to the adjuster lock nut and held in position by one of the nuts securing the cover plate. On completion of the adjustment see that the plate is correctly positioned over the lock nut. On still later productions the adjuster and plate have been deleted and shims fitted between the box and cover plate. For methods of adjustment see *page T4*.

Adjustment 2.

(7) Bolt the cover plate into position and when doing so make sure that an oil-tight joint is formed.

(8) Position the peg in the centre of the worm and screw down the adjuster until there is no free movement between the ball peg and worm.
Normal wear, which takes place in use occurs to a greater degree in the straight ahead position than on locks. The design of the worm makes provision for this by allowing slightly greater free movement towards each lock. It is essential, therefore, that the adjustment of the ball peg be made in the straight ahead position. When the adjustment is complete tighten the lock nut and replace the steel cap.

(9) Fit the drop arm with the locating line on it coinciding with a similar line on the end of the rocker shaft.

(10) Replace the stator tube and fill the steering gear with the **Hypoid** oil recommended on the chart. See *page M7*.

(11) Check that the gear can be moved freely from lock to lock before assembly to the car.

TO ADJUST THE STEERING GEAR ASSEMBLY.

There are Two Adjustments.

(1) The elimination of excessive "up" and "down" movement in the inner column or steering mast.

(2) The removal of excessive backlash between the steering worm and the rocker shaft ball peg. This adjustment sets also the end play, or "in" and "out" movement of the rocker shaft.

Adjustment 1.

Shims are fitted between the end plate of the steering column assembly and the box itself to control the "up" and "down" movement of the inner column.

Should there be too much movement, proceed as follows :—

(*a*) Disconnect the horn and trafficator wires at their push-pull connections, remove

the nut in the centre of the end plate, drive out the sealing olive and remove the plate. The required number of shims should now be removed, to obtain a condition where, without stiffness being present, there is no "up" or "down" movement in the column. Any stiffness would suggest that the bearings are being pre-loaded ; a condition which would result in damage to the balls and races. The stiffness must be removed by adding shims of the required thickness to restore freedom without play.

Adjustment 2.

Normal wear which may take place between the peg and worm does so to a greater extent in the straight ahead position than on the locks. The design of the worm makes provision for this by allowing slightly greater degree of backlash towards each lock than at the centre. It is imperative, therefore, that the adjustment of the ball peg must be made with it in the central position.

(*a*) Check that the lines on the drop arm and on the end of the rocker shaft coincide with each other.

(*b*) Place the front wheels in a line ahead position.

(*c*) Remove the steel cap over the adjuster in the cover plate, release the locknut and position the adjuster screw until there is the minimum of backlash between the ball peg and worm with no stiffness present.

NOTE. Do not neglect to retighten the locknut securely. It is advisable to hold the adjusting screw while the nut is being tightened and to check that the adjustment is correct after the nut has been tightened. Replace cap or locking plate where fitted.

STEERAGE LINKAGE.

Description.

The linkage between the drop arm of the steering gear assembly and the swivel levers, consists of a central lever assembly, a drag link from the steering gear assembly and two track rod assemblies.

The joints or sockets of the drag link and track rods are of the Lockheed Thompson type, and the central lever is mounted on needle roller bearings. Rubber boots protect the joints or sockets and sealing washers the bearings of the lever from water and road dirt.

Maintenance.

No adjustment is possible either to the joints or to the bearings of the central lever and provided the lubrication instructions given in the "Summary of Regular Attentions", *page M8*, are strictly observed, there is no reason to believe that wear, other than normal, will occur. In addition to these routine lubrication attentions, the rubber boots of the joints and the sealing washers of the central lever should be examined occasionally and if in a perished condition replaced.

When setting the "toe in" of the front wheel, particular attention should be paid to the following :—

(1) Both track rods must be maintained at the same length—the central tube is screwed with right and left-hand threads to help make this and the "toe in" adjustment readily.

(2) The end faces of the joints or sockets of each rod must be set parallel to each other before the locknuts are tightened.

(3) The locknuts must be tightened securely. It is advisable to hold the central tube with a pair of "Footprints" or pipe pliers when tightening the nuts.

TO REPLACE THE FELT BUSH AT THE TOP OF THE COLUMN OF THE STEERING ASSEMBLY.

(1) Disconnect the horn and trafficator wires at their pull-push joints. Mark the wires to help reconnecting. If in doubt consult the wiring diagram on *page V9*.

(2) Remove the nut securing the stator tube of the trafficator and horn switch to the bottom cover of the steering box. The sealing olive gripping the tube will now be exposed. Drive out the olive with a sharp chisel and when reassembling use a new olive. The stator tube and switch assembly can now be withdrawn upwards out of the steering column into the car.

(3) Remove the nut securing the steering wheel to the mast and draw off the wheel. The felt bearing will now be

observed in the top of the column and can be extracted with an instrument similar to a button hook with a sharp point.

(4) Before fitting the new bush smear it liberally with some form of heavy lubricant such as tallow, and replace the dismantled parts in the reverse order of removal. When fitting the steering wheel, position it, so that its spokes are horizontal.

L3A STEERING GEAR.

On later productions the L3 steering gear has been replaced by the L3A type steering gear which incorporates a spring loaded ball peg.

All service replacement assemblies supplied are of the L3A type and details of a conversion scheme, together with details of fitting, can be obtained from the Service Department on demand.

ADJUSTMENT.

With the L3A steering gear, it is always necessary to use shims between the cover plate and the cover plate joint washer owing to the fact that a fixed button is now used instead of a Cover Plate Adjuster, which means that adjustment has to be carried out by shims.

In addition to the cover plate joint washer the manufacturers always use a paper cover plate washer which is .005 in. thick ; also, in addition to this paper washer, which must always be used, they usually fit plastic Cover Plate Shims, which are supplied in thicknesses of .002 in. and .005 in.

The average shimming necessary on this particular steering gear is .030 in. so that in addition to the .005 in. paper washer previously referred to, a number of plastic shims are used, usually five .005 in. thick, or in some instances, four .005 in. and one .002 in. thick.

RECIRCULATORY BALL STEERING GEAR.

From RHD Chassis No. D.7128.W and LHD Chassis No. D.7183.W a recirculatory type steering gear is fitted. Servicing instructions for these units will be found on *pages D11 to D13*.

INDEX

SECTION U — BODY

TO REMOVE AND REPLACE THE BONNET.

(1) Lift up and prop open the bonnet.

(2) If the bonnet is to be removed merely to assist the removal of the engine, detach the hinge brackets from the bulkhead by removing the eight securing bolts and shakeproof washers. The bolt holes in the hinge brackets are elongated and reassembly is assisted if lines are scribed around the hinge brackets on the face of the bulkhead.

(3) If the bonnet is to be removed for repairs, or for the fitting of a Service replacement, detach it by removing the bolts and shakeproof washers securing the hinge brackets to the channel welded to the bonnet. The slots for these bolts are also elongated to make adjustments in a fore or aft direction. Replacement of the original bonnet is quite simple if the precaution suggested in the second paragraph is observed ; but it is advisable to check the following.

(4) An air gap of $\frac{3}{16}$ in. (4.76 mm.) must be present between the body and the windscreen edge of the bonnet with the bonnet closed. A correction can be made by releasing the eight bolts securing the hinge brackets to the bulkhead and raising or lowering the bonnet in the required amount before retightening.

(5) There must be approximately $\frac{1}{16}$ in. (1.58 mm.) clearance between the sides of the bonnet and the wings. Any correction necessary can be usually made by releasing the bolts securing the hinge brackets to the bonnet, centralising the bonnet and then retightening the bolts.

(6) The front edge of the bonnet must stand slightly proud of the face of the front grille panel. Usually this condition can be obtained by hinge bracket adjustment, but if this is not possible, release the two bolts securing the front panel to the flitch plates, the four bolts securing the radiator baffle to the front panel and force the panel either in or out, as necessary, before retightening the bolts.

(7) The retaining washer for the bonnet catch spring must be centrally positioned between the ramps of the catch plate bolted to the front panel. If it is not, the bonnet will be thrown out of line with the wings. Set the central stud of the catch over to the right or left, as necessary, and adjust the length of the stud by releasing the locknut and screwing it "in" or "out", so that with the bonnet closed and latched it is possible to press the bonnet down slightly against the spring, and for the bonnet latch control on the instrument panel to work freely.

(8) Lastly, make sure that the hook of the safety catch engages readily and securely beneath the lip of the top surface of the front panel. The bracket of the catch can be set backwards or forwards to obtain the correct position. Smear the ramps of the bonnet catch plate with grease to help the catch to work freely.

TO REMOVE AND REPLACE THE FRONT SEAT.

The bench type of front seat is mounted on runners. The position, relative to the steering wheel, can therefore be altered by winding in the required direction, the handle in the centre of the seat valance.

In order that this adjustment may work freely, the runners and the worm of the winder should be greased periodically. To gain access to the runners and worm, lift the seat cushion.

To remove the seat, lift the cushion out of position, wind the seat back to the full extent and remove the bolts and shakeproof washers securing the forward ends of the runners to the floor. Wind the seat sufficiently forward to uncover the bolts securing the rear end of the runner. Release these bolts.

Raise the front end of the seat and disengage the arms of the adjuster nut from the bracket and slide the seat off the runners in a forward direction.

Replacement is the reversal of the foregoing operation with the following additions :

Grease the runners and rails before fitting the seat ; position the adjuster nut at the forward end of the adjusting screw, and make sure that the arms of the adjuster nut are in engagement with the slots in the bracket before tightening the bolts securing the runners. The nuts for the bolts are captive.

TO REMOVE AND REPLACE THE FRONT GRILLE PANEL.

It is advantageous to remove the panel complete with the front valance attached.

(1) Prop open the bonnet by placing a block of wood between the scuttle and one of the hinge brackets. Remove the four

bolts, nuts and shakeproof washers securing the radiator baffle plate to the front grille panel, also the two bolts, nuts and shakeproof washers securing the panel to the flitch plates.

(2) Disconnect the control cable from the bonnet catch and remove the clip securing the cable to the panel.

(3) Detach the bumpers which are held to the chassis frame and front wing forward support brackets by four nuts and shakeproof washers. Note the rubber spacer bushes.

(4) Remove the head and side lamps and detach the grille panel from the wings by removing the two bolts, nuts and shakeproof washers securing them together. Note the beading between the panel and each wing, also any packing which may be present. This packing is for obtaining a $\frac{1}{16}$ in. (1.58 mm.) clearance between the wings and the bonnet. The packing when necessary is fitted in the curve formed in the wing to accommodate the head lamp.

(5) The panel and valance can now be removed and separated by removing the nine bolts securing them together. The motif and slats are held to the panel by 2 B.A. nuts and washers.

Replacement is the reversal of the foregoing, and when carrying out the work pay particular attention to replace or renew any beadings removed.

TO REMOVE AND REPLACE A FRONT DOOR LOCK—Left or Right.

(1) Press back the spring-loaded collars between the escutcheons and the bosses of the inner handles of the door lock, and window light winder.
Remove the locking pins exposed and draw off the handles and escutcheons.

(2) Remove the four screws, one in each corner of the door trim panel, and a fifth centrally positioned along the bottom edge. The panel can now be prised away from the door against the resistance of the spring clips.

(3) Remove the two screws securing the escutcheon of the door outer handle and drive out the handle complete with shaft.

(4) Wind the window light up to the full extent.

(5) Remove the screws and cupped washers securing the window aperture capping and detach the capping. Lift up a portion of the draught rubber immediately above the lock and wedge, with a suitable piece of wood, the inner panel away from the light. This should provide sufficient room to insert the fingers and to hold the nut of the top screw of the two screws securing the lock to the panel of the door. Remove also the three bolts securing the door inner locking handle bracket and spindle. The lock can now be drawn out of position after the three screws securing the face flange to the edge of the door have been removed. Beware of any sharp edges in the metal surrounding the aperture through which the arm is inserted to hold the bolts.

Replacement is the reversal of the foregoing.

NOTE. Do not neglect to grease freely the lock mechanism before assembling it into position.

TO HANG A FRONT OR REAR DOOR FROM CAR No. D.101S TO D.700S.

In general, the doors fitted to these cars are similar in construction to those used on Cars after D.700S. The main differences being they have wooden frames and the bolt holes in the door hinge arms are enlarged not elongated. To secure each arm in position when once the door is set, two dowel bolts are fitted to each door hinge arm in addition to the four securing bolts.

The bolt holes in the support brackets for the body hinge arms are not, as in the case for Car No. D.701S and onwards, elongated ; the securing bolts are a fit in the holes, consequently these arms cannot be moved as suggested on *page N10*.

Should a door drop for any reason the enlarged holes in the door hinge arms will permit the method suggested on *page N10* for the adjustment of this condition being used after the dowel bolts have been removed. When the door has been positioned correctly a fresh dowel hole should be drilled in the hinge arm and between two of the main support bolt holes, or the existing holes enlarged to take bolts a size larger than the originals.

No attempt should be made to set a door. Any correction necessary should be made by inserting suitable packings between the hinge arms and their support brackets. But as previously suggested, work of this nature should be entrusted to a firm skilled in this class of work and in possession of the necessary tools.

INDEX

SECTION V — ELECTRICAL SERVICES

TRAFFICATORS.

Maintenance.

Oil the Trafficators as in Figs. 1 and 2, every 10,000 miles (16,000 kilometers).

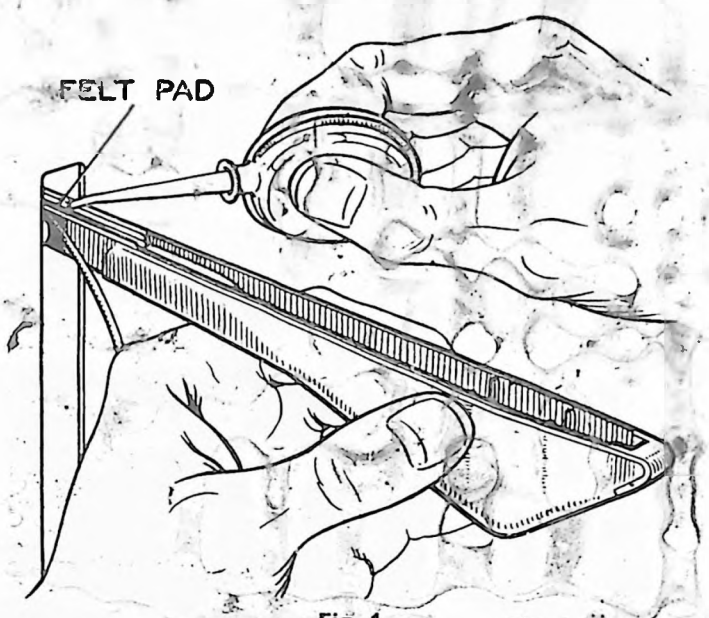


Fig. 1.

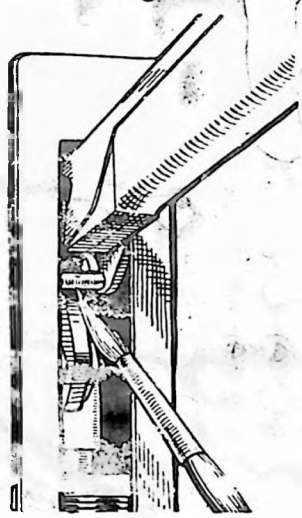


Fig. 2.

TO REMOVE AND REPLACE A TRAFFICATOR.

(1) Ensure that the Trafficator switch is in the **off** position and that it remains in this position while the Trafficator is being removed and replaced.

(2) Remove the three plated screws securing the trim casing to the pillar. Move the front seat backwards or forwards and then to obtain access to the two lower screws, lift the casing upwards towards the roof of the car and outwards to avoid removing it from under the trimming at its top edge.

(3) Detach the weather rolls in the neighbourhood of the Trafficator and the asbestos sheet over the aperture in the pillar, by removing the securing tacks. The Trafficator unit can now be withdrawn from its position by removing the two securing screws and disconnecting the feed wire at its pull-push connection.

Replacement is by reversing the foregoing but before finally tightening the securing bolts, make sure that the arm is central in the aperture in the outer face of the pillar, and that with the bolts securely tightened the arm will work when switched on.

TO REPLACE TRAFFICATOR ARM.

(1) Drill out rivet securing arm to bracket. Remove Trafficator arm cover and withdraw cable and bulb. Open out clip securing cable to arm of Trafficator and remove arm.

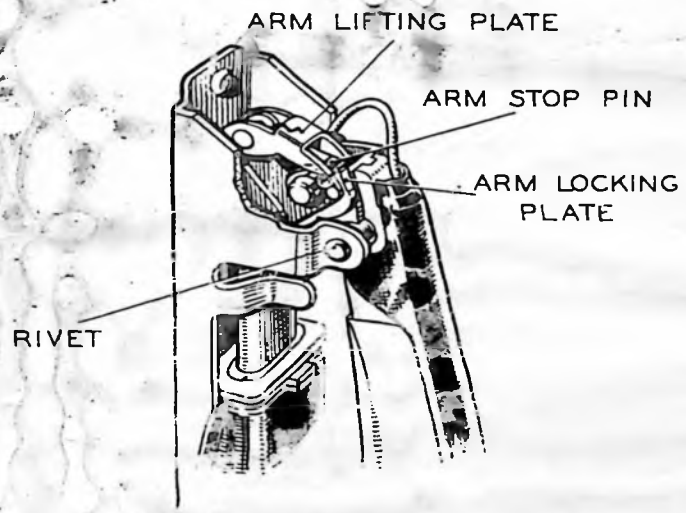


Fig. 3. Trafficator Mechanism.

(2) Replacement of Arm.

Place the new arm in position so that the arm stop pin locates between the arm lifting plate and locking plate. Secure in this position by fitting new rivet. Remove arm cover, replace cable and bulb and refit cover. Finally secure cable to arm by means of the clip, taking care to see that the bending over of the clip does not damage the cable or its insulating covering. Also see that when the Trafficator is operated the cable can move in a wide arc.

TO REMOVE AND REPLACE A SIDE LAMP FROM CAR No. D.301S AND ONWARDS.

(1) Open the bonnet and disconnect the head lamp wires at the snap connections just rear of the rubber sheath of the head and side lamp wires on the bonnet platform. Attach a piece of strong string to the wires and pull the wires through the sheath. The string will help to rethread the wires. Mark the wires to assist reconnecting them. If in doubt, consult the wiring diagram given on *page V9*.

(2) Remove the rim and glass assembly. Detach the lamp from the wing by removing the three brass screws securing it.

Replacement is the reversal of the foregoing.

TO REMOVE AND REPLACE A STOP AND TAIL LAMP FROM CAR No. D.1451S ONWARDS.

(1) Move aside the rubber lip and lever off the front rim ; next move aside the inner rubber lip and remove the glass.

(2) Remove the three 2 B.A. bolts, shakeproof washers and nuts, when the body of the lamp complete with the rubber surround can be withdrawn out of the wing. Separate the body from the surround and detach the earth connection, the red and green tail and the stop light connections. *Note the positions of the red and green wires relative to the lamp body, to help replacement.*

Replacement is the reverse of removal, but before fitting the glass and rim, check that when the brake pedal is depressed the 24 watt stop light is switched on. If the 6 watt light is switched on remove the bulb, revolve it through an angle of 180° and reinsert it. Check again before completing the assembly.

On lamps using the index cap type of bulb No. 361 this precaution is not necessary.

PILOT LAMP BULB REPLACEMENT—UP TO CAR D.300S.

Remove the rim and light unit as for headlamp bulb replacement when the pilot bulb, which is of the bayonet type fitting, can be replaced readily.

SIDELAMPS BULB REPLACEMENT FROM CAR No. D.301S.

Move aside the rubber ring and lever the rim and glass assembly from the bottom of the lamp. When refitting the assembly, move aside the rubber ring, locate the rim at the top of the lamp, press, and finally position the rubber ring so that it fits around the rim.

STOP AND TAIL LAMP BULB REPLACEMENT UP TO CAR No. D.1450S.

Slacken the single securing screw and remove the front glass. To gain access to the bulb move aside the glass fixing stirrup. When replacing the bulb, move it slowly until the locating catch is felt, for if not correctly located the stop lights will not operate properly.

From Car No. D.1451S adopt a method similar to that described for the side lamp bulb replacement. Note, however, that in this lamp the rim and glass are separately located by rubber flanges, and that the bulb, of the "indexed" type, can only be fitted in one position in its holder.

TO REMOVE AND REPLACE THE ILLUMINATED NUMBER PLATE AND REVERSE LAMPS.

The lamp assembly is bolted to the car by two bolts, nuts and washers.

On these being removed and the wire connectors disconnected, the assembly can be detached.

Replacement is the reversal of removal.

GENERAL DESCRIPTION—CONTROL BOX.

The control box houses the dynamo voltage regulator unit and the cut-out ; also two fuses connected in the circuits of the accessories.

Although combined structurally, the regulator and cut-out are electrically separate. Both are accurately adjusted during manu-

facture, after which the cover protecting them is sealed and should not be removed unnecessarily.

The Regulator.

The regulator unit is arranged to work in conjunction with the shunt-wound dynamo described on *page L13*. The regulator is set to maintain a predetermined dynamo voltage at all speeds above the regulating point, the field strength being controlled by the automatic insertion of a resistance in the dynamo field circuit. When the dynamo voltage reaches a predetermined value the magnetic field due to the shunt or voltage winding becomes sufficiently strong to attract the armature. This causes the contacts to open, thereby inserting the resistance in the field circuit.

The consequent reduction in field current lowers the dynamo voltage and this, in turn, weakens the magnetic field due to the voltage coil. The armature is allowed to return to its original position, thus closing the contacts, so that the voltage returns to the predetermined maximum. The cycle is then repeated, and the armature is set into vibration.

As the speed of the dynamo rises above that at which the regulator comes into operation, the amplitude of vibration increases and the periods of interruption increase in length, with the result that the mean value of the dynamo output undergoes practically no increase once the operating speed has been attained.

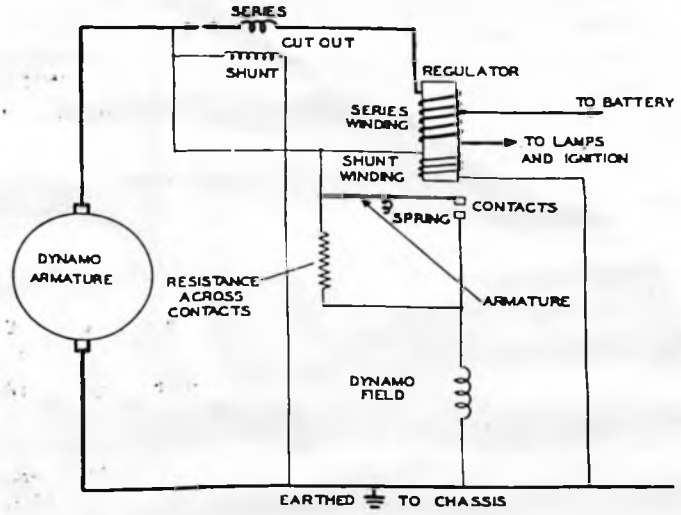


Fig. 1. Diagram of C.V.C. Charging Circuit.

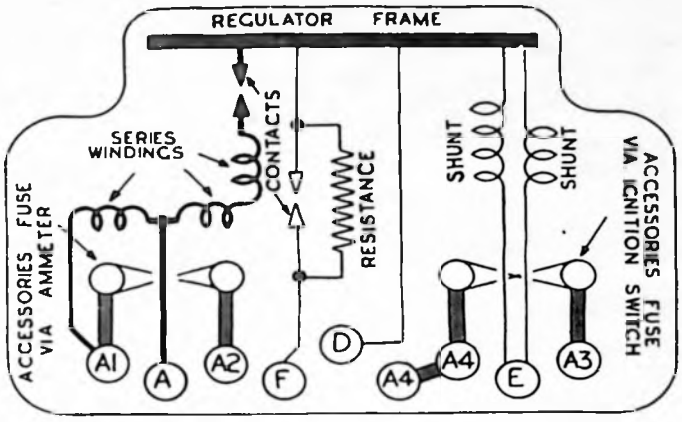


Fig. 2. Internal Connections of Control Box. RF95-2.

The series or current windings provide a compensation on this system of control, for if the control were arranged entirely on the basis of voltage there would be a risk of very seriously overloading the dynamo when the battery was in a low state of charge, particularly if the lamps were simultaneously in use. Under these conditions the dynamo would be forced to give an output to bring the voltage of the system up to the same value as if the battery were in its normal fully charged condition, and this, with a battery of low internal resistance would necessitate an extremely heavy current far beyond the normal capacity of the machine. The series winding assists the voltage coil, so that when the dynamo is delivering a heavy current into a discharged battery the regulator comes into operation at a somewhat reduced voltage, thus limiting the output accordingly.

By means of a temperature compensation device the voltage characteristic of the dynamo is caused to conform more closely to that of the battery under all climatic conditions. In cold weather the voltage required to charge the battery increases, whilst in warm weather the voltage of the battery is lower. The method of compensation takes the form of a bimetallic spring suspension for the armature of the regulator which causes the operating voltage of the regulator to be increased in cold weather and reduced in hot weather, and thereby compensate for the variation in charging current which would otherwise occur due to the changed characteristics of the battery.

The Cut-out.

The cut-out is an automatic switch connected between dynamo and battery. It

consists of a pair of contacts held open by a spring and closed magnetically when the engine is running fast enough to cause the dynamo voltage to exceed that of the battery. The battery will then be charged by the dynamo. On the other hand, when the speed is low or the engine is stationary, the contacts open, thus disconnecting the dynamo from the battery and preventing current flowing from the battery through the windings.

SETTING DATA.

(a) **Cut-out.**

Cut-in voltage ...	12.7—13.3 volts
Drop-off voltage ...	9—10 volts
Reverse current ...	3—4.5 amps.

(b) **Regulator—Setting on open circuit.**

10°C. (50°F.) Cold climate	16.1—16.7 v.
20°C. (68°F.) Normal temperature ...	15.8—16.4 v.
30°C. (86°F.) Hot climate	15.6—16.2 v.
40°C. (104°F.) Very hot	15.3—15.9 v.

TESTING REGULATOR IN POSITION TO LOCATE FAULT IN CHARGING CIRCUIT.

If the procedure given in *Section L, page L13*, the dynamo section shows the dynamo to be in order, proceed to check further as follows :—

(1) First ensure that the wiring between battery and regulator is in order. To do this disconnect the wire from the A terminal of the control box and connect the end of the wire removed to the negative terminal of a voltmeter.

Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.

If there is no reading, examine the wiring between battery and control box for broken wires or loose connections.

(3) Reconnect the wire to terminal A.

REGULATOR ADJUSTMENT.

The regulator is carefully set during manufacture to suit the normal requirements of the standard equipment and in general it should not be necessary to make further adjustments. However, if the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged it may be advisable to check the setting and readjust if necessary.

It is important before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the dynamo belt slipping.

(1) **Electrical Setting.** It is important that a good quality **Moving Coil Voltmeter** (0—20 volts) be available before attempting to adjust the regulator.

The electrical setting can be checked without removing the cover from the control box.

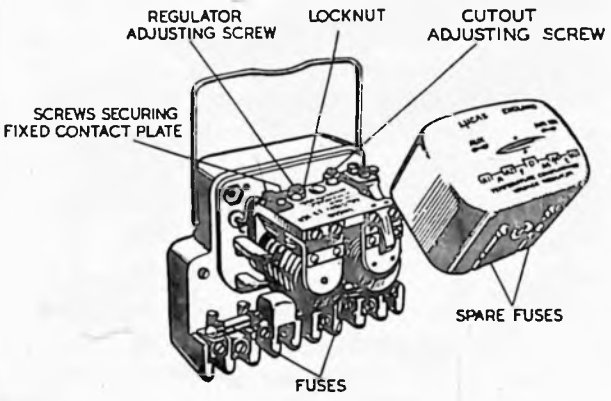


Fig. 3. Control Box with Cover Removed.

Withdraw the cables from the terminals marked A and A1 at the control box and join the wires together.

Connect the negative lead of the moving coil voltmeter to the D terminal of the dynamo, and connect the other lead from the meter to a convenient chassis earth. Slowly increase the speed of the engine until the voltmeter needle "flicks" and then steadies ; this should occur at a voltmeter reading between the limits given in Setting Data (b) on *page V4* for the appropriate temperature of the regulator.

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted. Shut off the engine and remove the control box cover.

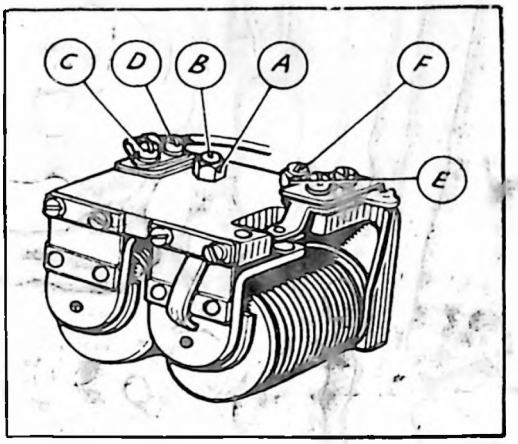


Fig. 4. Cut-out and Regulator Assembly.

Release the locknut (A) holding the adjusting screw (B) and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the screw a fraction of a turn only at a time and then tighten the locknut. Repeat as above until the correct setting is obtained. Remake the original connections.

When the dynamo is run at a high speed on open circuit, it builds up a high voltage. Therefore, when adjusting the regulator, do not run the engine up to more than half-throttle or a false voltmeter reading will be obtained.

(2) **Mechanical Setting.** The mechanical setting of the regulator is accurately adjusted before leaving the works and provided that the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If however, the armature has been removed from the regulator for any reason, the contacts will have to be reset. To do this proceed as follows :— Slacken the two armature fixing screws (*Fig.* 5 *page V5*). Insert a .018 in. (.457 mm.) feeler gauge between the back of the armature and the regulator frame.

Press back the armature against the regulator frame and down on to the top of the bobbin core with gauge in position and lock the armature by tightening the two fixing screws.

Check the gap between the underside of the arm and the top of the bobbin core. The gap should be .012 in.—.020 in. (.305 —.508 mm.). If the gap is outside these limits, correct by adding or removing shims at the back of the fixed contact. Remove the gauge and press the armature down, when the gap between the fixed contacts should be .006 in.—.017 in. (.152—.432 mm.).

(3) **Cleaning Contacts.** After long periods of service it may be found necessary to clean the vibrating contacts of the regulator. These are made accessible by slackening the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C), *Fig.* 4, *page V5*, a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of fine carborundum stone or fine emery cloth. Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

CUT-OUT ADJUSTMENT.

(1) **Setting.** If the regulator setting is within the correct limits, but the battery is still not receiving current from the dynamo, the cut-out may be out of

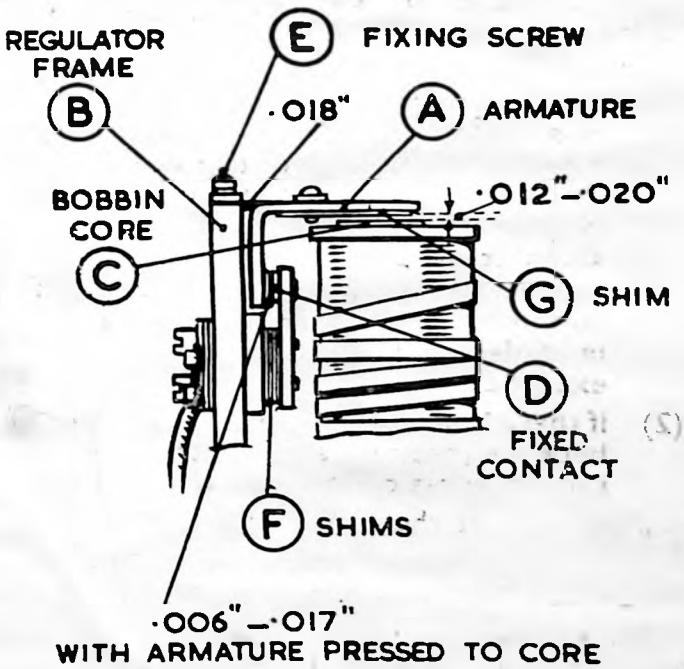


Fig. 5. Mechanical Setting of Regulator.

adjustment, or there may be an open circuit in the wiring of the cut-out and regulator unit.

Remove the cable from the terminal marked A on the control box (ensuring that the bared end does not come into contact with the chassis). Remove the voltmeter lead from the D terminal of the unit and connect it to terminal A. Run the engine as before ; at a fairly low engine speed, the cut-out should operate, when a voltemeter reading should be given of the same value as that when the voltmeter was connected to terminal D.

If there is no reading, the setting of the cut-out may be badly out of adjustment and the contacts not closing. To check the voltage at which the cut-out operates remove the control box cover, and connect the voltmeter between the D terminal and earth. Start the engine and slowly increase its speed until the cut-out contacts are seen to close, noting the voltage at which this occurs. This should be 12.7—13.3 volts.

If operation of the cut-out takes place outside these limits, it will be necessary to adjust. To do this, slacken the locknut on the cut-out adjustment screw and turn the screw in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting, testing after each adjustment by increasing the engine speed until the cut-out is seen to operate, and noting the corresponding voltmeter reading.

Tighten the locknut after making the adjustment.

(2) **Cleaning Contacts.** If the cut-out contacts appears burnt or dirty, place a strip of fine glass paper between the contacts—then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side towards each contact.

LIGHTING EQUIPMENT

THE LIGHTING EQUIPMENT IS GROUPED AS FOLLOWS :—

Up to and including Car No. D301S the parking lights are inside the Head Lamp Bodies, from Car No. D1451S a new type of tail light and a more powerful stop light come into use. A tail and a stop light are fitted to each rear wing. The rear number plate embodies a reversing lamp in addition to being illuminated by a MBC Bulb.

Group A, G and N are for Right Hand Drive	Both Lamps dip Left
Group B, H and O are for Left Hand Drive	Both Lamps dip Right
Group C, J and P are for Left Hand Drive	Both Lamps dip Vertical
Group D is for Left Hand Drive	Both Lamps dip Right : American Specification
Group E, I and R are for Left Hand Drive	Both Lamps dip Vertical (Special Bulbs)
Group F and M are for Right Hand Drive	Right Head Lamp out. Left Head Lamp, dip Left

Bulb Replacements up to Car Number D301S.

Group	*Specification*	*Countries*
A	Headlamps, F.700P. with Bulbs No. 354 Pre-focus, 12V. 42/36W. and Pilot Bulbs No. 989, MBC. 12V. 6W.	For Australia, South Africa, New Zealand, Burma, India, Cyprus, Iceland, Nyasaland, Sudan, Tanganyika, Aden, Bermuda, Jamaica, Malta, Uganda, Hong-Kong, Shanghai, Malay, Straits Settlements.
B	Headlamps, F.700P. with Bulbs No. 301 Pre-focus, 12V. 36/36W. and Pilot Bulbs No. 989, MBC, 12V. 6W.	For Syria, Algeria, Egypt, Iran, Saudi Arabia, Chile, Spain, South America, Eritrea, Ethiopia, Israel, Gibraltar, Canada, Denmark, Greece, Austria, Netherlands, East Indies, Lebanon, Sweden.
C	Headlamps, F700P. Mark II, with Bulbs Hooded Filament, No. 350, C. 12V. 35/35W. and Pilot Bulbs No. 989, MBC. 12V. 6W.	For Finland, Holland, Hungary, Norway, Switzerland, Germany, Belgium, Czechoslavakia, Italy, Portugal.

Group	Specification	Countries
D	Headlamps, F.700, Mark III, with Bulbs No. 301, Pre-focus, 12V. 36/36W.	For U.S.A., Ecuador.
E	Headlamps, F.700P/EF, Mark III less Bulbs, 3-Pin Bulb purchased on Continent.	For France, French Morocco, Tunisia.
F	Headlamp, L.H., F.700P. with Bulbs No. 354 Pre-focus, 12V. 42/36W and Pilot Bulbs No. 989, MBC. 12V. 6W. Headlamp, R.H., F.700P. with Bulbs No. 325, Pre-focus 12V. 38W. and Pilot Bulbs No. 989, MBC 12V. 6W.	For Great Britain and Eire.

From Car No. D301S and up to Cars fitted with Double Dipping System.

G	Headlamp, F.700 Mark III, with Bulbs No. 354 Pre-focus, 12V. 42/36W.	For Australia, South Africa, New Zealand, Burma, India, Cyprus, Iceland, Nyasaland, Sudan, Tanganyika, Aden, Bermuda, Jamaica, Malta, Uganda, Hong-Kong, Shanghai, Malay, Straits Settlements.
H	Headlamps, F.700 Mark III, with Bulbs No. 301 Pre-focus, 12V. 36/36W.	For Syria, Algeria, Egypt, Iran, Saudi Arabia, Chile, Spain, South America, Eritrea, Ethiopia, Israel, Gibraltar, Canada, Denmark, Greece, Austria, Netherlands, East Indies, Lebanon, Sweden.
J	Bulbs, Headlamps F.700 Mark III, with Hooded Filament No. 350, 12V. 35/35W.	For Finland, Holland, Hungary, Norway, Switzerland, Germany, Belgium, Czechoslovakia, Italy, Portugal.
D	Headlamps, F.700 Mark III with Bulb No. 301, Pre-focus 12V. 36/36W.	For U.S.A., Ecuador.
L	Headlamps, F.700/EF. Mark III less Bulbs. 3-Pin Bulb purchased on the Continent.	For France, French Morocco, Tunisia.
M	Headlamp, L.H., F.700, Mark III with Bulb No. 354, Pre-focus, 12V. 42/36W. Headlamp, R.H., F.700, Mark III with Bulb No. 325, Pre-focus, 12V. 38W.	For Great Britain and Eire.

Sidelamps, used with Headlamps D, G. H, J, L, M	Type 489, Bulb No. 989, MBC. 12V. 6 Watt
Tail Lamps, up to Car No. D1450S	Type 482, Bulb No. 189, 12V. 6/24 Watt
Tail Lamps, on Car No. D1451S onwards	Type 488, Bulb No. 189, 12V. 6/24 Watt
Number Plate and Reversing Lamp	Type 469
Number Plate Bulb	Bulb No. 989, 12V. 6 Watt
Reversing Lamp Bulb	Bulb No. 221 MBC. 12V. 18 Watt
Trafficator Bulbs	Bulb No. 256, 12V. 3 Watt (Festoon)
Warning Lights on Instrument Board	Bulb No. 987, 12V. 2.2 Watt
Instrument Panel Lighting	Bulb No. 987, 12V. 2.2 Watt
Roof Lamps	Bulb No. 254, 12V. 6 Watt (Festoon)

DOUBLE DIPPING SYSTEM.

Headlamps using a "block pattern" lens make it possible to revise completely the existing methods of headlighting for vehicles and enables the use of a double-dipping system which, whilst giving double the amount of light for driving in the dipped position, restricts the amount of dazzling light to the level of present dip-and-switch systems. Effective utilisation of all available light from the bulb and reflector has also resulted in a marked increase of usable light for illuminating the road when driving in the non-dipped or normal headlight position.

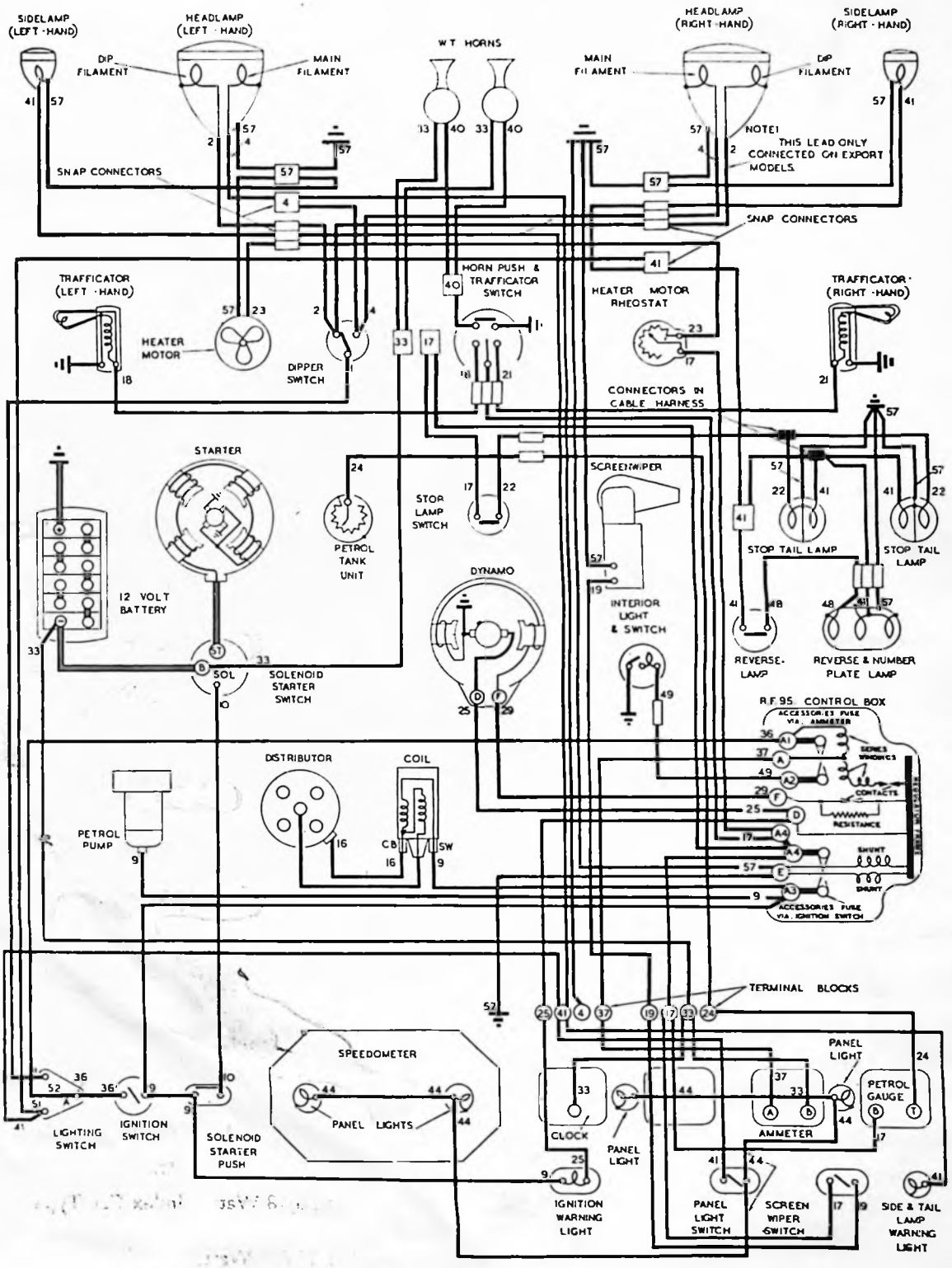
In the new double-dipping system, the "block-pattern" lens is used in conjunction with the well-known Lucas Light Unit, a method of headlamp construction which employs a reflector and front lens permanently fixed to each other and a specially designed bulb fitted into the reflector from the rear. Several important advantages accrue from this method of construction, the chief of them being that tne bulb, by virtue of its design, can be fitted in one position only in the reflector ; once this position has been determined by the Designer to give correct focusing, it cannot be subsequently altered. With the double-filament bulb used to provide dipping facilities, this advantage applies with equal force to both main and dip filaments—both are permanently located in their correct positions with respect to the focal point of the reflector.

Cars fitted with Double Dip System using Block Pattern Lens.

Group	*Specification*	*Countries*
N	Headlamp F.700 Mark III "Block Pattern" Lens with Bulbs. Lucas No. 354 Pre-focus 42/36 Watt.	For Australia, South Africa, New Zealand, Burma, India, Cyprus, Iceland, Nyasaland, Sudan, Tanganyika, Aden, Bermuda, Jamaica, Malta, Uganda, Hong-Kong, Shanghai, Malay, Straits Settlements.
O	Headlamp F.700 Mark III "Block Pattern" Lens with Bulbs, Lucas No. 301, 12 volt 36/36 Watt	For Syria, Algeria, Egypt, Iran, Saudi Arabia, Chile, Spain, South America, Eritrea, Ethiopia, Israel, Gibraltar, Canada, Denmark, Greece, Austria, Netherlands, East Indies, Lebanon, Sweden.
P	Headlamp F.700 Mark III "Block Pattern" Lens with Bulbs, Lucas No. 360 12 volt 45/35 Watt. Duplo hooded filament.	For Finland, Holland, Hungary, Norway, Switzerland, Germany, Belgium, Czechoslovakia, Italy, Portugal.
D	Headlamp F.700 Mark III "Block Pattern" Lens with Bulbs, Lucas No. 301, 12 volt 36/36 Watt.	For U.S.A., Ecuador.
R	Headlamp F.700/EF Mark III "Block Pattern" Lens, less Bulbs 3 Pin Bulb purchased on the Continent.	For France, French Morocco, Tunisia.
S	Headlamp F.700 Mark III "Block Pattern" Lens with Bulbs, Lucas No. 354, 12 Volt 42/36 Watt.	For Great Britain and Eire.

Sidelamps, used with above Headlamps	Type 489, Bulbs No. 989, MBC. 12V. 6 Watt.
Stop Tail Lamp, up to Car No. D1540S	Type 482, Bulbs No. 189, 12V. 6/24 Watt.
Stop Tail Lamps, on Car No. D1541S	Type 488, Bulb 361, 12V. 6/18 Watt. Index Cap Type.
Number Plate and Reversing Lamp.	
Number Plate Bulb.	Type 469 Bulb, No. 989 12V. 6 Watt.
Reversing Lamp Bulb.	Type 469 Bulb, No. 221 MBC. 12V 18 Watt.
Trafficator Bulbs.	Bulb No. 256, 12V. 3 Watt (Festoon).
Warning Lights on Instrument Board.	Bulb No. 987, 12V. 2.2 Watt.
Instrument Panel Lighting	Bulb No. 987, 12V. 2.2 Watt.
Roof Lamps.	Bulb No. 254, 12V. 6 Watt (Festoon).

WIRING DIAGRAM S.M.1500 FOR CARS No. D301S AND UPWARDS



KEY TO CABLE COLOURS

1 BLUE	14 WHITE with PURPLE	27 YELLOW with BLUE	40 BROWN with BLACK	53 PURPLE with WHITE
2 BLUE with RED	15 WHITE with BROWN	28 YELLOW with WHITE	41 RED	54 PURPLE with GREEN
3 BLUE with YELLOW	16 WHITE with BLACK	29 YELLOW with GREEN	42 RED with YELLOW	55 PURPLE with BROWN
4 BLUE with WHITE	17 GREEN	30 YELLOW with PURPLE	43 RED with BLUE	56 PURPLE with BLACK
5 BLUE with GREEN	18 GREEN with RED	31 YELLOW with BROWN	44 RED with WHITE	57 BLACK
6 BLUE with PURPLE	19 GREEN with YELLOW	32 YELLOW with BLACK	45 RED with GREEN	58 BLACK with RED
7 BLUE with BROWN	20 GREEN with BLUE	33 BROWN	46 RED with PURPLE	59 BLACK with YELLOW
8 BLUE with BLACK	21 GREEN with WHITE	34 BROWN with RED	47 RED with BROWN	60 BLACK with BLUE
9 WHITE	22 GREEN with PURPLE	35 BROWN with YELLOW	48 RED with BLACK	61 BLACK with WHITE
10 WHITE with RED	23 GREEN with BROWN	36 BROWN with BLUE	49 PURPLE	62 BLACK with GREEN
11 WHITE with YELLOW	24 GREEN with BLACK	37 BROWN with WHITE	50 PURPLE with RED	63 BLACK with PURPLE
12 WHITE with BLUE	25 YELLOW	38 BROWN with GREEN	51 PURPLE with YELLOW	64 BLACK with BROWN
13 WHITE with GREEN	26 YELLOW with RED	39 BROWN with PURPLE	52 PURPLE with BLUE	