SECTION D
COOLING SYSTEM

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COOLING SYSTEM

COOLANT - ENGINE THERMOSTAT - COOLANT PUMP SERVICING - RADIATOR FAN - FAN BELT ADJUSTMENT - OVERHEATING - RADIATOR - RADIATOR CALORSTAT - RADIATOR SHUTTERS - RADIATOR STEAM VALVE - CAR HEATERS.

SECTION D.

COOLING SYSTEM

List of Illustrations:-

COOLING SYSTEM

Capacity	- 4 gallons, (Silver Wraith, Silver Dawn, Bentley)
	- 5½ gallons, (Phantom IV)
Type	- Pressure
Pump	- Centrifugal
Pump drive	- "Vee" belt, 45.62" x .920"
Fan	- 5 blade
Radiator	- Thermostatically controlled shutters and by-pass thermostat (Silver Wraith, Phantom IV). Fixed shutters and by-pass thermostat (Silver Dawn and Bentley)

COOLANT:

The cooling system is filled with a 25% mixture of inhibited ethylene glycol and water on leaving the factory. This, or a similar solution of "Bluecol" should be used all the year round, the amount of anti-freeze being adjusted to suit more severe winter conditions as under.

INHIBITED ETHYLENE GLYCOL OR BLUECOL

PERCENTAGE CONCENTRATION	25%	30%	35%	40%
Freezing point Fahrenheit	10°	4°	-3°	-9°
Degrees of frost Fahrenheit	22°	28°	35°	41°
Degrees of frost Centigrade	12°	16°	19°	23°
Silver Wraith, Silver Dawn, Bentley	8 pts.	9½ pts.	11 pts.	12½ pts.
Phantom IV	11 pts.	13 pts.	15½ pts.	17½ pts.

A similar solution must be used for topping-up.

If a suitable hydrometer is available it is possible to check the percentage of anti-freeze in the coolant, so that topping-up may be done with more anti-freeze or water to maintain the correct ratio required.

To check, note temperature of coolant with thermometer, take specific gravity reading with hydrometer, refer to Fig. D1, and read off degree of concentration.

Example:- A specific gravity reading of 1.05 at a temperature of 35°C indicates that 40% of the coolant is anti-freeze.

ENGINE THERMOSTAT:

The purpose of the thermostat is to ensure rapid warming-up of the engine and the maintainance of the correct coolant temperature.

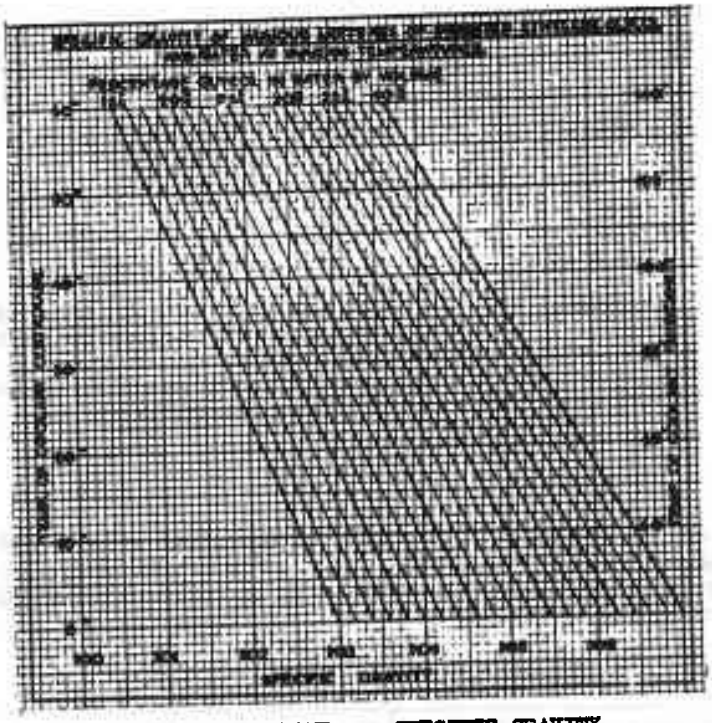


FIG. D1. COOLANT - SPECIFIC GRAVITY.

Fig. D2, shows thermostat exploded from housing.

1. Outlet cover
2. Joint
3. Thermostat unit
4. Casing
A. Locating slot
B. Locating screw (Air release hole)

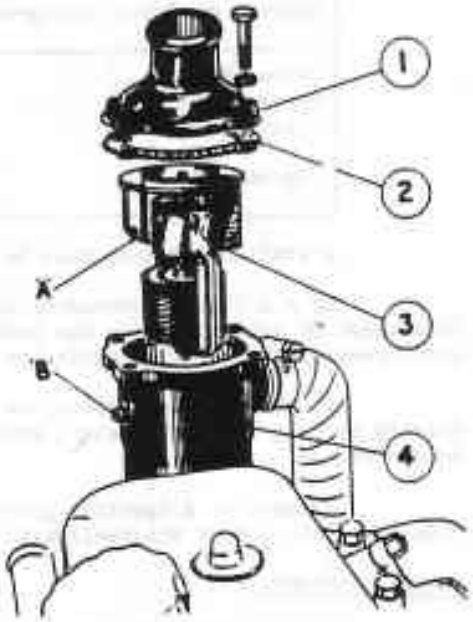


FIG. D2. THERMOSTAT.

The thermostat valve should start to open at 79° ± 1°C and should be fully open at 95°C.

If a faulty thermostat is suspected, remove from housing and place in a suitable container with water and an accurate thermometer. On heating the water note the temperature at which the valve begins to open. Renew thermostat if not functioning correctly.

NOTE:- The thermostat may be found to be stuck in its housing. Do not try to get a screw-driver under the valve and prise it out, but screw two 3 BA setscrews into the tapped holes provided on the top of the unit body and prise unit from housing with screw-driver under setscrew heads.

When replacing thermostat unit ensure that the slot 'A' in the body locates with the screw 'B' on the side of the thermostat housing. See Fig. D2.

When refilling the system after complete drainage, it is as well to temporarily remove the locating screw 'B', this will act as an air release hole; replace screw as soon as coolant spills freely.

COOLANT PUMP:

The coolant pump is of the centrifugal type, and is combined with the radiator fan to form one belt-driven unit mounted on a common spindle. The spindle and the double-row ball bearing are integral, the bearing being packed with a special high-melting point grease at the time of manufacture, and requires no further lubrication.

Pressed on the front end of the spindle is the fan and pulley unit, whilst the pump impeller is pressed on the rear end, an interference fit between the spindle and bore being the only means of retention.

The seal against seepage of coolant along the spindle consists of a packless gland assembled between the front end of the impeller and the casing. In the event of leakage it should be replaced.

1. Fan
4. Fan retaining screws
5. Spring ring
6. Grease retainer
7. Bearing and spindle
10. Pulley
11. Belt
14. Spring ring
15. Gland ring
16. Seal
17. Housing, seal
20. Spring
21. Flinger
23. Rotor

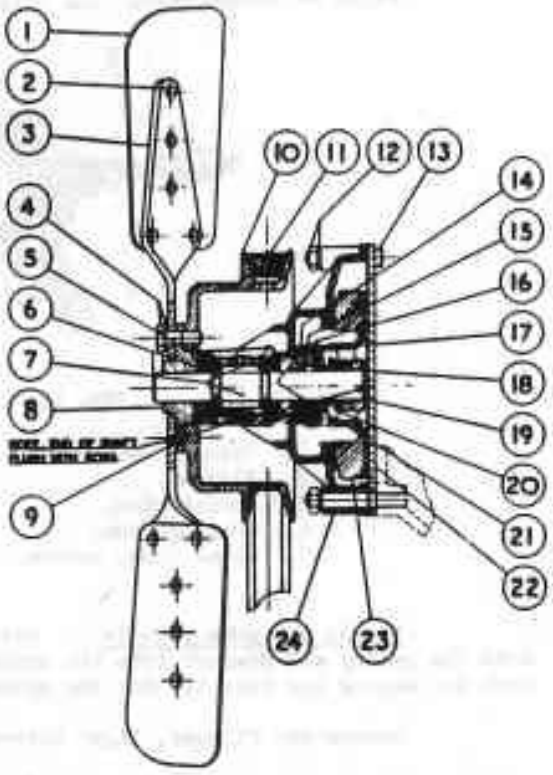


FIG. D3. COOLANT PUMP.

COOLANT PUMP SERVICING:

To dismantle coolant pump - remove backing plate and with the aid of extractor RF-6025, withdraw the rotor from the spindle. Fig. D4.

Remove the circlip from the rotor, and then remove the gland ring and spring etc.

Examine the face of the carbon gland ring for wear and its projections for chatter marks, a new gland ring should be fitted if this is not in good condition.

Examine the carbon gland bearing facing on the pump casing, this should be refaced if scored. Squeaks and groans from the coolant pump usually emanate from wear on these two surfaces.

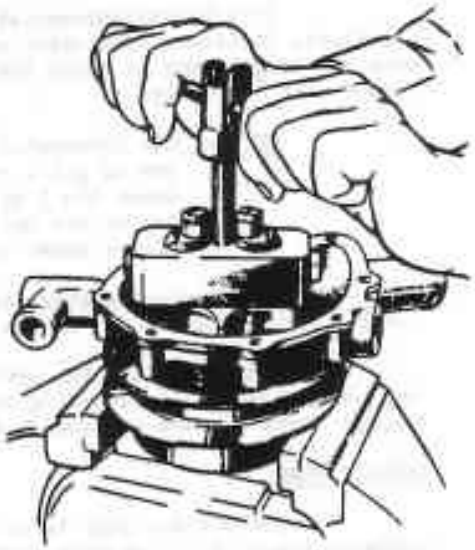


FIG. D4. REMOVING ROTOR FROM SPINDLE.

Thickness of carbon gland ring - .185" to .177" Max.
Width of carbon gland ring splines - .432" to .428" Max.

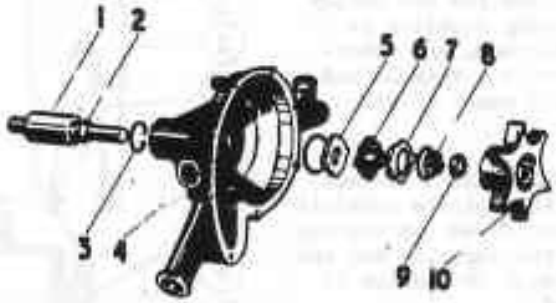


FIG. D5. COOLANT PUMP.

1. Spindle and bearing.
2. Flinger.
3. Spring ring.
4. Bearing face.
5. Gland ring, carbon.
6. Seal, rubber.
7. Housing, seal.
8. Spring.
9. Retaining ring, seal.
10. Rotor.

To fit new pump spindle - with the aid of the extractor RF-6025 withdraw the pulley and adaptor from the spindle. Remove the retaining spring ring from the casing and then tap out the spindle and bearing assembly.

Remove the flinger, light interference fit, and re-use on new spindle.

Remove the adaptor from the fan pulley, this and the spindle bearing assembly should be discarded as scrap. The old adaptor must not be used on the new spindle as some inevitable loss of interference may result in the fan and pulley working loose at a later date.

Press flinger on to longer end of new spindle, .300" ± .015" from the outer end of the bearing.

Lubricate outer race of bearing and press spindle and flinger assembly into pump casing. Check flinger is not fouling. Fit retaining spring ring.

Fit new adaptor to fan pulley and secure.

Press the pulley and adaptor assembly onto spindle. Press on until .125" ± .005" of the spindle protrudes through the boss of the adaptor.

Using new gland ring and seal, complete the re-assembly.

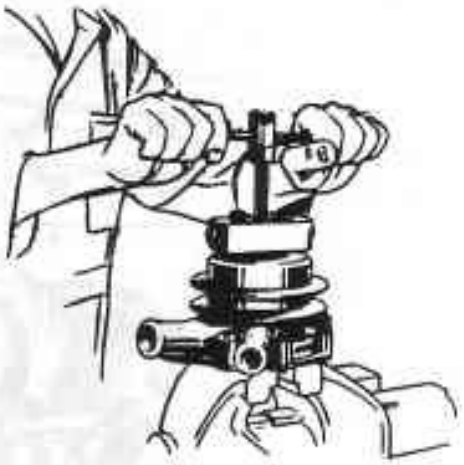


FIG. D6. REMOVING PULLEY FROM SPINDLE.

RADIATOR FAN:

As previously mentioned, the fan is attached to a pulley on the coolant pump spindle, and is driven by the same belt which drives the dynamo.

If the engine has to be run with the fan removed, it is essential that the fan retaining setscrews and washers with distance pieces .016" thick, to allow for the thickness of the fan, are fitted to retain the pulley.

The original fan fitted to the Silver Wraith, Silver Dawn and Bentley MK. VI engine was 16.00" dia., and revolved at 1.1 times engine speed. This has now been superseded by a larger diameter fan 17.750" running at .850" times engine speed. These two fans are not interchangeable.

The fan fitted to the Phantom IV, is 16.00" dia., and runs at 1.1 times engine speed.

FAN BELT ADJUSTMENT:

This is effected by releasing the dynamo retaining nuts and moving the dynamo outwards or inwards to suit.

If the belt is too loose, it will slip and wear excessively - if too tight it will cause premature wear to the pump spindle and dynamo bearings.

The tension should be such, that the fan belt can be moved 1" transversely, with finger, (i.e. half an inch either way) when checked at a point equidistant from the crankshaft pulley and the fan pulley.

To change a belt - do not strain over pulleys, slack off nuts and move dynamo fully inwards.

OVERHEATING:

Overheating may be due to one or more of the following causes:-

(a) Radiator calorstat may have failed (if fitted)
(b) Shutter mechanism may have jammed (if fitted)

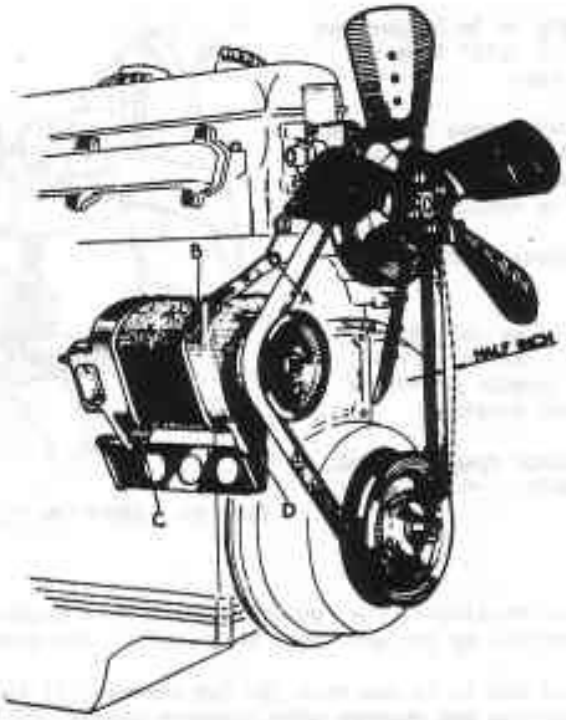


FIG. D7. ADJUSTMENT OF FAN BELT.

(c) Fan belt may need adjustment.
(d) Shortage of coolant in system.
(e) Detonation and poor grade of fuel.
(f) Radiator matrix blocked either externally or internally.

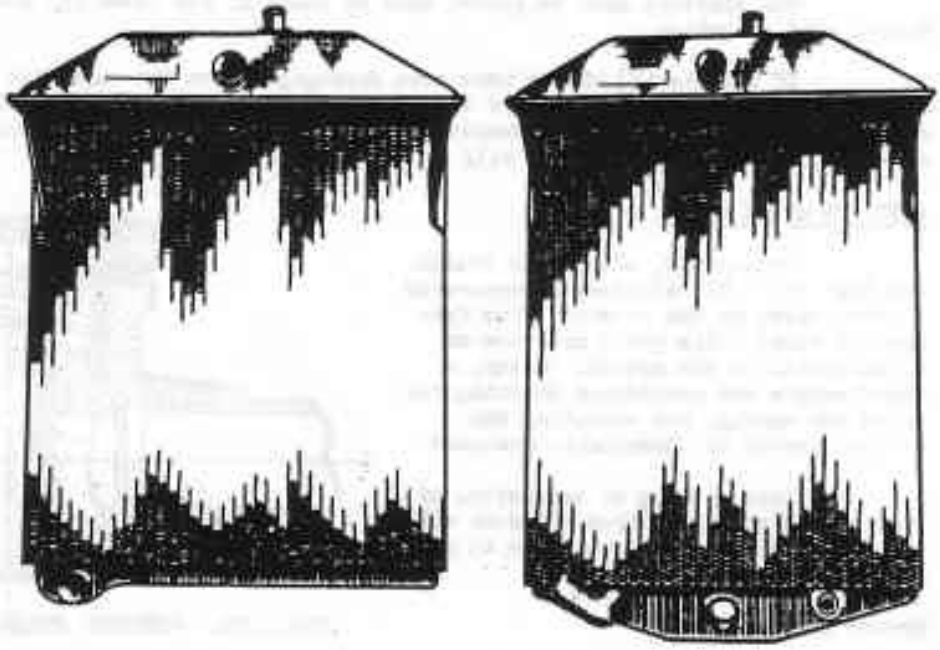
RADIATOR:

The radiator comprises two units, the outer shell, carrying the radiator shutters, and the matrix itself, the complete assembly mounted on a central rubber support.

The shell, diagonally braced, is connected to the wings and valances, with the matrix secured in the shell at three points.

Early models were fitted with the Mk.VI type matrix, later superseded by the Mk.VII type as below:-

Silver Wraith	-	WTA-1 to WVH-116 ALW-1 to ELW- 41	Mk.VI type matrix.
		ELW-43 and onwards	Mk.VII type matrix.
Silver Dawn	-	All series,	Mk.VII type matrix.
Bentley	-	B-2-AK to B-270-DA,	Mk.VI type matrix.
		B-272-DA and onwards,	Mk.VII type matrix.
Phantom IV	-	All series,	Mk.VII type matrix.



RADIATOR RECOGNITION.

FIG. D8. MK.VI TYPE MATRIX. FIG. D9. MK.VII TYPE MATRIX.

RADIATOR CALORSTAT:

Fitted to the Silver Wraith and Phantom IV models, to operate the shutters in front of the radiator.

The calorstat stem should start to move when the temperature of the coolant in the radiator header tank reaches 75°C and give the full .425" travel at 90°C. Also, from the inner stop when a temperature of 90°C is reached, the stem should move a load of 27½ lbs. + or - 2.

Reference to the instrument board thermometer will indicate if the calorstat is operating correctly.

RADIATOR SHUTTERS:

Movable shutters are fitted to the Silver Wraith and Phantom IV models whilst fixed shutters are fitted to Silver Dawn and Bentley.

In the event of faulty operation of the radiator calorstat with consequent failure to open the shutters, disconnect the calorstat by raising the spring loaded pin (2) and disengaging the end of the lever (3) from the calorstat rod. A knob (4) is provided to ease re-engagement.

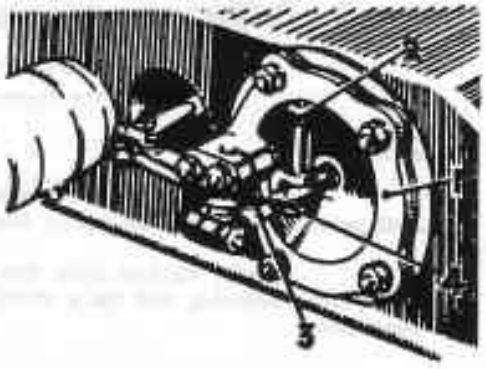


FIG. D11. RADIATOR SHUTTER CALORSTAT.

The shutters must be pushed open by means of the lever (3) and not by direct hand operation.

If the pin (2) should have been disengaged when the calorstat is in working order it will be difficult to re-engage with the system cold. If the engine is first warmed up to a temperature at which the shutters would normally commence to open, re-engagement will be found to be easy.

RADIATOR STEAM VALVE:

Originally, all Silver Wraith and Bentley Mk.VI radiators incorporated a steam valve in the overflow pipe from the top tank; this put a pressure of 4 lbs/sq.in. on the system. Later, a modification was introduced deleting the valve and spring, and operating the coolant system at atmospheric pressure.

Later, owing to complaints of loss of coolant, a reduced pressure valve was introduced and is now fitted to all models. See Fig. D12.

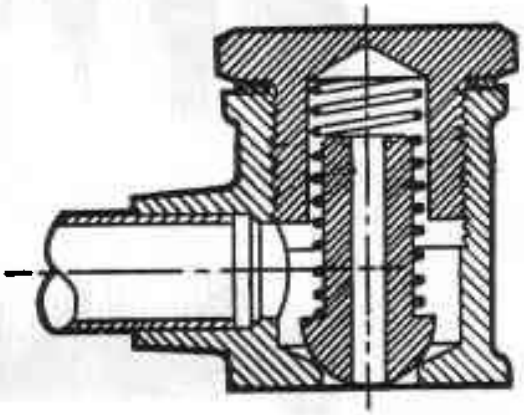


FIG. D12. RADIATOR STEAM VALVE.

Spring particulars:-

Free length - .900"
Compressed to .600" - 3 ozs.

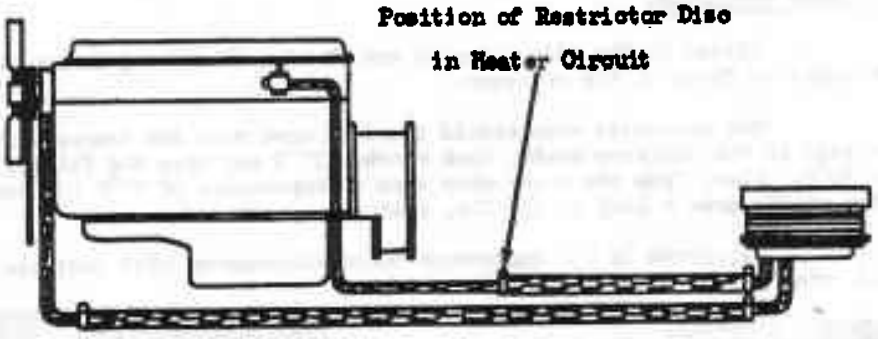


FIG. D13. HEATER CIRCUIT.

CAR HEATERS:

An electrically operated hot water heater is fitted as standard equipment on all models under the front passenger's seat.

A tap, fitted into the cylinder head, supplies the hot coolant for the heater matrix, and this should be used to isolate the system when not required.

To obviate building up too high a pressure in the system, a restrictor is fitted, see Fig. D13. When customer requirements call for the fitting of an extra heater under the dash, the position of the restrictor should be removed as shown in Fig. D14.

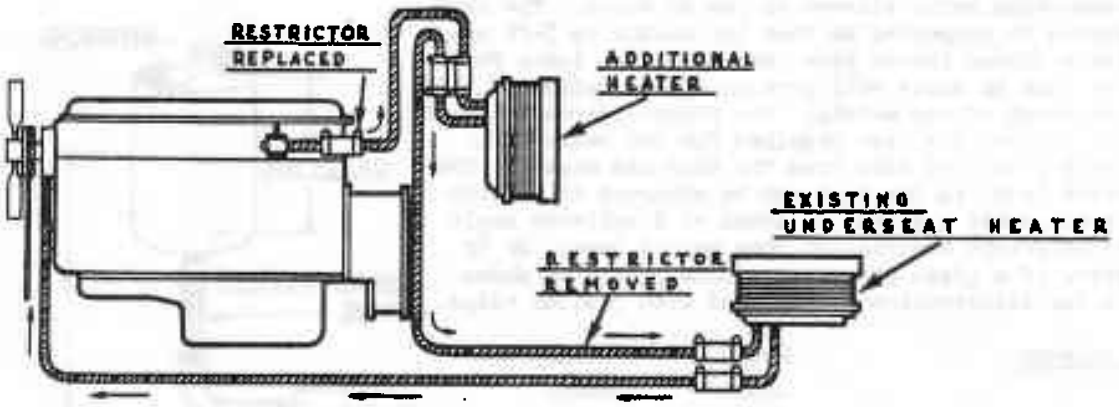
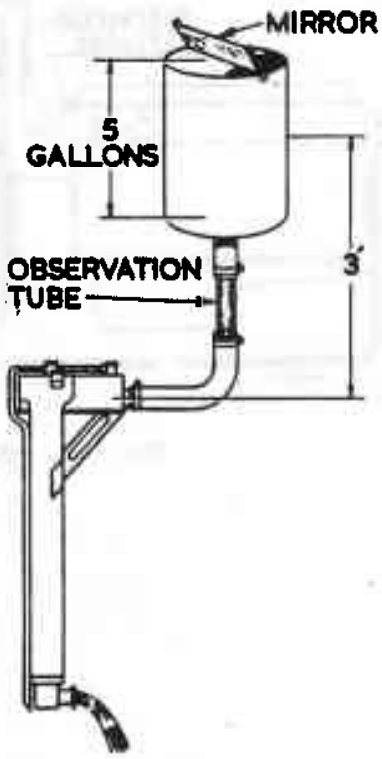


FIG. D14. HEATER CIRCUIT - UNDERDASH HEATER.

RADIATOR FLOW TESTING.

The radiator may be checked by means of a water flow test. A container with a 1" bore pipe let into the bottom should be hung above the radiator and connected to the header tank intake pipe, the radiator lower connection being allowed to run to waste. The tank should be suspended so that the centre is 3-ft above the radiator intake pipe, when the time taken for the tank to empty will give an approximation of the condition of the matrix. The figures given below do not include the time required for the radiator to empty after the flow from the tank has ceased. The water level in the tank may be observed if the top is cut open; a mirror attached at a suitable angle would permit observation from ground level, or by means of a glass observation tube fitted as shown in the illustration and secured with jubilee clips.



FLOW TEST RIG.

Container.	Mk.VI Rad.	Mk.VIII Rad.
5 Gall. (Oil Drum)	14 secs.	22 secs.
10 Gall. (Tank)	28 "	44 "
18 Gall. (Petrol Tank)	50 "	80 "

These flow times are for a radiator in new condition.

NOTE: (BENTLEY ONLY) The Mk.VII radiator which was fitted on Chassis No. B-270-BA and onwards, incorporates a drain tap and a starting handle tunnel in the bottom tank, neither of which is featured on the earlier type.

Should the flow time exceed those quoted by over 25% it is probable that the radiator is the cause of overheating, and should be replaced.

When fitting a replacement radiator, it is essential to flush out the engine thoroughly. The thermometer and thermostat should be carefully checked, as these may be damaged by severe overheating.

A radiator with a flow figure of less than 25% above the nominal should be given a Cooling System Service as a preventive measure, but it is not likely to be the cause of overheating in this condition.

Annual Routine Servicing.

Drain the system and flush out as follows :-

1. Remove the top and bottom radiator hoses and reverse flush the radiator with mains pressure for ½ hour.

2. Remove the cylinder block drain tap and thermostat or thermostat housing and flush from both ends for about ¼ hour each.

3. Refill the system.

3a. Smith's "Bluecol" anti-freeze and the Ethylene Glycol used at the Factory now both contain a new inhibitor, but before using either in a car which has been filled with the earlier anti-freeze, the following action is necessary to conserve the new inhibitor which will otherwise be consumed within a few hours.

a) Start the engine and run for a few minutes.

b) Remove cylinder drain cock and insert a hose into the radiator, run the engine, occasionally opening the throttle slightly until the water runs clear; this usually takes about 20 minutes.

c) Replace the drain cock, add ½ pint of Stergene to the full system and run for 5 minutes at normal engine temperature.

d) Repeat (b) and run until cool, then switch off and leave until engine is cold. Start up and run until the water ceases frothing.

e) Drain and refill with anti-freeze.

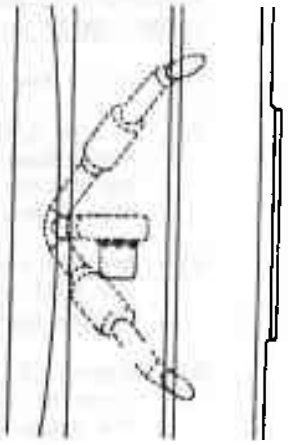
This operation need only be done once on any car, provided that the owner continues to use the recommended anti-freeze. A distinct fluorescent effect can be observed in the new type proprietary anti-freeze; the Ethylene Glycol equivalent is yellowish-green.

THE HEATER AND DEMISTING SYSTEMS.

As a result of investigation and development the Demister system has been modified from time to time.The various schemes employed are given hereunder. These will be helpful in identifying the types that may be expected with certain chassis numbers. But, it should be noted that in some cases the earlier types have been removed and replaced with later types.

(i) "Bentley Mk.VI B2AK - B191LZ
Silver Wraith WTA1 - WDC99
Not fitted to LH drive cars."

Demister motor and air intake situated under scuttle. Defroster heater element in RH side of outlet duct. Controlled by switches on facia. Switch marked "M" to operate motor and switch marked "F" to operate Defroster.



ORIGINAL SYSTEM.

(ii) "Bentley Mk.VI B193DZ - B271EW
Silver Wraith WDC100 - WGC49."

Demister motor situated under scuttle. Radiator heated air intake with tubing connections between air intake and Demister motor. Controlled by means of "Eyelids" on windscreen capping rail, with the switch "M" operating the motor. In this scheme the heater element is deleted.

(iii) "Bentley Mk.VI B273EW - B149HP
Silver Dawn LSBA2 - LSCA51
Silver Wraith WGC50 - WLE25."

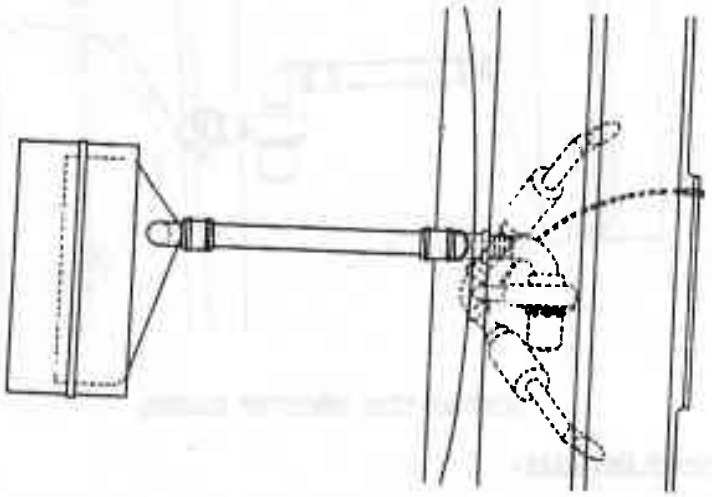
Radiator heated air intake, Demister motor on engine side of dash. Duct connecting air intake to Demister motor. Controlled by "Eyelids" and switch "M" to operate the motor.

(iv) "Bentley Mk.VI B151HP - B251JN
Silver Wraith WLE26 - WSG101
Silver Dawn LSCA53 - LSDB4."

Radiator heated air intake. High speed Demister motor and modified transfer ducting to give improved air flow. The Demister motor bracket is deleted and the motor is suspended in the transfer ducting. The air intake is fitted with a deflector designed for use with the later type triple pass system (Scheme vii). Controlled by "Eyelids" and switch "M" for the Demister motor. This is a intermediate scheme prior to the introduction of the triple pass system.

(v) "Bentley Mk.VI B2KM - B51PU
Silver Dawn LSDB6- SHD60."

Radiator heated air intake designed to pass air three times through the radiator matrix thereby ensuring a higher air temperature. Ducting and Demisting motor as in scheme iv.



RADIATOR HEATED SYSTEM (INTERMEDIATE TYPE).

(vi) "Bentley B53PU - B401TO
Silver Wraith WVH1 - WVH98 (Long wheelbase ALW27 - ELW42)
Silver Dawn SKE2 - SMF76."

Similar to scheme v, but with hot and cold demisting controlled by an under bonnet hand lever operating two spring loaded butterfly valves, one of which opens when the other closes. The cold air being drawn through the RH dummy horn grill.

(vii) "Bentley B2TN - B244YD
Silver Wraith ELW43- DLW79 (Long wheelbase)
Silver Dawn SNF1 - SUJ12."

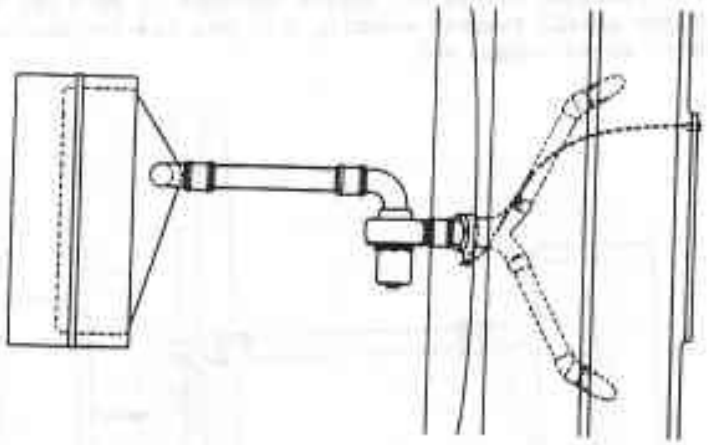
Similar to scheme v but with a wire cable control from the instrument board operating the valve lever.

(viii) "Bentley B246YD - onwards
Silver Wraith DLW80 - onwards
Silver Dawn SUJ14 - onwards

Continental Bentley Only.

A flexible rubber and wire duct from a grill in the front wing to a manually operated trap to the drivers compartment provides fresh air ventilation.

For the windscreen, a separate air tube is tapped into this ducting and taken through a heater fed from the engine cooling system, to the motor mounted on the front of the dashboard, then through ducts to vents in the capping rail (These vents are fitted with "Eyelids").



IMPROVED TYPE DEMISTER SYSTEM.

The Rear Window Demister.

The rear window demister was introduced with the following chassis numbers :

Bentley B311NY
Silver Dawn SPC94

and consists of an electrically heated glass pane, with a series of wires moulded into the glass. It is controlled from the facia board by the switch "RW".

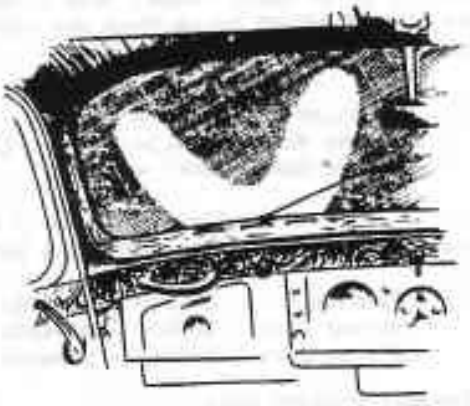
Test Procedure.

Create artificial misting by means of an electric kettle, with all windows closed, keeping the exterior of the windscreen cool with an air blast or sprinkler hose. Warm the engine to normal running temperature, remove the kettle and operate demister.

If the ducts are free the screen will clear except for a narrow "V" which will clear gradually.

If the vents or ducts are obstructed, the "V" pattern will be broad, as shown.

The source of obstruction can then be traced by starting from the "Eyelids" and working downwards.



UNSATISFACTORY PATTERN

Servicing.

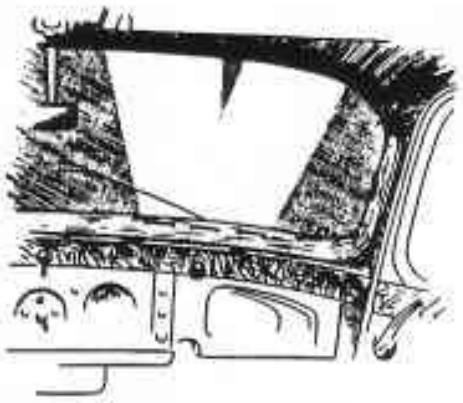
In complaints of inefficiency of the demisting system, the following items should be checked:-

Demister Motor.

Clean brushes, check the spring tension and also free movement. Clean commutator with petrol moistened cloth.

Air Leaks.

Check for leaking at joints or piping out of alignment.



SATISFACTORY PATTERN

Air Flow Restriction.

The slot in the capping rail must be in alignment with the Duct delivery aperture, and give an unobstructed passage to the air flow. Dirt frequently obstructs the flow.

CAPPING RAIL DUCT AND EYELIDS.

"Eyelids."

The "Eyelids" must open sufficiently, check that they are not bent. It may be found necessary to cut the woodwork beneath the capping rail to correct these faults.

Delivery Pattern on Windscreen.

An unsatisfactory cleared pattern on the windscreen is usually due to one of the above, but quite often it is caused by incorrect shaping of the duct at its delivery point.

The ideal shape is a 1/16 slot, with the duct main body left as full as possible, especially round the windscreen wiper.