COOLING SYSTEM

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THE COOLING SYSTEM.

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THE COOLING SYSTEM.

THE COOLANT.

GENERAL.

The coolant is drawn by the centrifugal pump from the bottom of the radiator and discharged into the cylinder jacketing through an internally mounted water gallery. Suitably drilled holes in the gallery direct the coolant around the exhaust valve seats.

The coolant then passes upwards through passage-ways into the cylinder head, and after circulating around the combustion chamber jacketing, passes through the outlet connection and the thermostat valve, into the radiator header tank.

Until the coolant reaches its normal working temperature, the thermostat valve is closed, and so causes the coolant to by-pass the radiator through the by-pass pipe connected between the pump and the thermostat casing. This arrangement ensures rapid warming up of the engine.

On no account must any strong alkaline compound be used to clean out the coolant system. Several such compounds are available, but their use must be carefully avoided, owing to the fact that they have a detrimental chemical action on aluminium.

ANTI-FREEZE MIXTURES.

The cooling system (which holds 30 pints) is filled with a 25% solution of inhibited Ethylene Glycol and soft water before the car leaves the factory, this, or a similar anti-freeze mixture such as a solution of "Bluecol" and soft water in the same proportions should be used all the year round, summer and winter. The purpose of this is not only to provide protection against frost during cold weather, but also to prevent corrosion of the coolant passages with consequent deterioration in the standard of cooling.

The following table gives the quantity of inhibited Ethylene Glycol or "Bluecol" required for various percentage solutions:

Percentage concentration.	25%	30%	35%
Freezing point Fahrenheit. Degrees of frost Fahrenheit. Degrees of frost Centigrade.	10° 22° 12°	4° 28° 16°	-3° 35° 19°
Quantity in Pints.	7½	9	10½
Quantity in Litres.	4.3	5.1	6.0

In climates where extremely cold conditions are likely to be encountered the quantity of anti-freeze solution in the coolant may be increased in order to provide additional frost protection but normally the 25% mixture should be used.

The second and third columns of the above table will serve as a guide in case this should be necessary.

The temperatures given in the table are those at which small ice crystals start to form, further reduction of temperature turns the solution into a mush which becomes thicker as the temperature approaches the minimum safe limit.

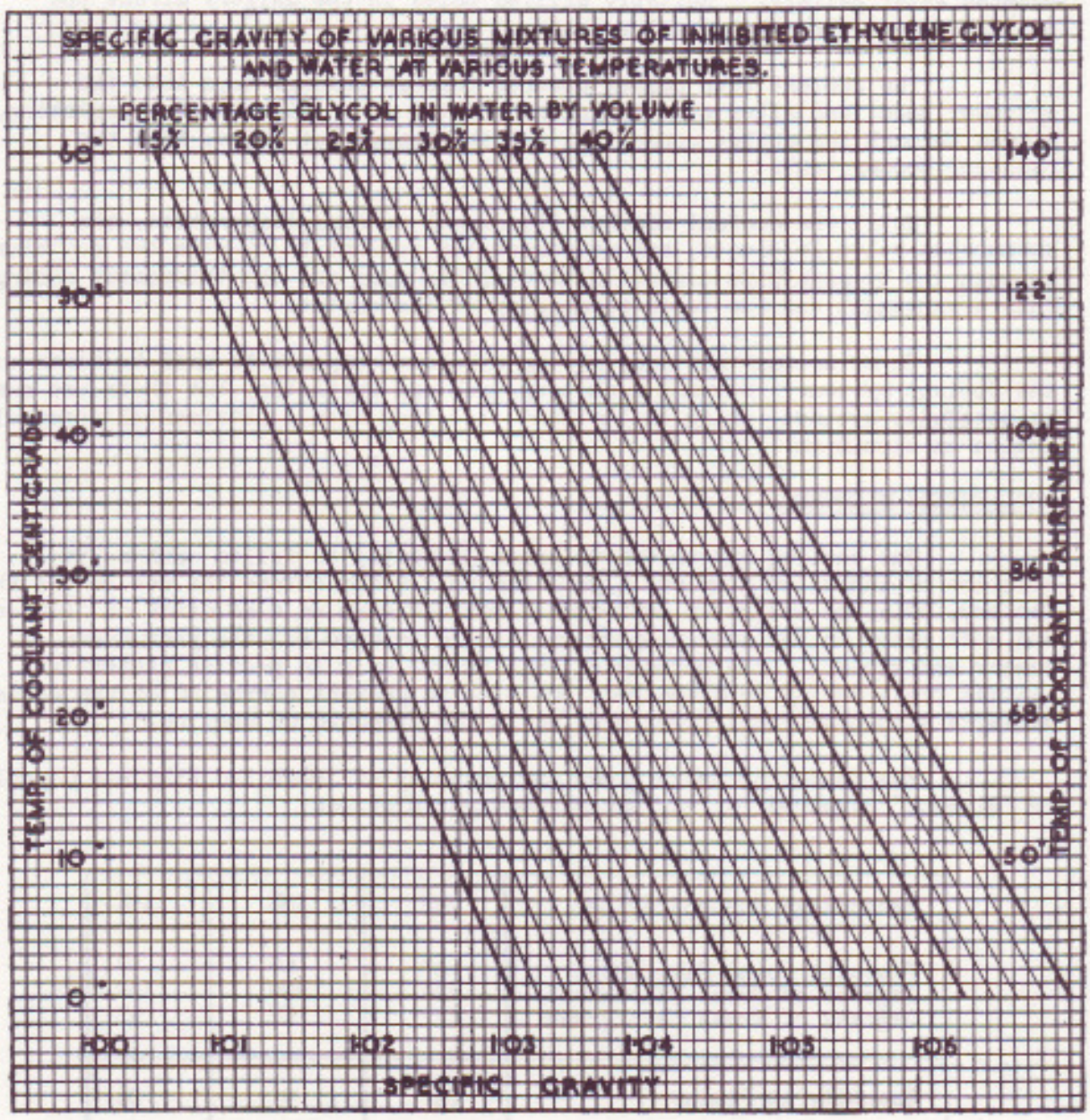

FIG. 1. SPECIFIC GRAVITY OF ETHYLENE GLYCOL (OR "BLUECOL") AND WATER AT VARIOUS TEMPERATURES.

In order to determine the strength of an anti-freeze solution actually in use, the specific gravity of the coolant should be tested with a suitable hydrometer and the temperature of the coolant measured at the same time with a glass thermometer. Reference to the chart Fig.1, will then show the percentage of anti-freeze in use and will indicate whether "topping-up" should be done with plain soft water or with a mixture of the same strength or with neat anti-freeze solution, in order to maintain the correct strength of anti-freeze in the coolant.

For example:- A specific gravity reading of 1.05 at a temperature of 35° Centigrade indicates that 40% of the coolant is anti-freeze, therefore the "topping-up" can be done with plain soft water.

If a hydrometer is not available then it will be necessary to top up with the desired strength of mixture in order to be sure of adequate frost protection.

If there is any abnormal loss of coolant, the cause should be ascertained and rectified and the system "topped-up" as described above.

In the event of inhibited Ethylene Glycol or "Bluecol" being unobtainable, it is permissible to use plain soft water as an emergency measure, but in this case the coolant must be completely drained from the engine, radiator and interior heater, if the car is likely to be left exposed to frost. Also, before attempting to start the engine, hot water should be poured over the coolant pump to thaw any particles of ice which may be present in the casing, as even hand cranking of the engine under these conditions might damage the rotor.

COOLANT LEVEL.

The radiator filler is located under the left-hand side of the bonnet. A warning notice is embossed on the cap to the effect that it must not be removed when the engine is running.

Hot coolant is likely to be forced out in such circumstances.

The correct level is approximately one inch below the bottom of the filling orifice, at which point it will stabilise itself. Filling above this level merely wastes coolant.

It is safe to run as long as the coolant is visible in the top tank when cold.

TO DRAIN THE SYSTEM.

A drain tap is situated on the pipe connecting the pump with the bottom of the radiator. It is in the "off" position when the handle is pointing downwards. A further tap, to drain the cylinder coolant jacket, is situated on the rear R.H. side of the cylinder block. It is in the "off" position when the handle is horizontal.

On chassis No.B2BH and onwards a drain tap is fitted to the bottom of the car heater return pipe, i.e. the pipe attached to the coolant pump on the L.H. side of the engine. It is in the "off" position when the handle is pointing downwards.

First release filler cap to allow air to enter the system. If necessary, a piece of wire may be used to clear the taps.

As an anti-freeze mixture should be in use in the cooling system, run it into clean containers and use again.

To completely drain the system:-

(i) Drain coolant from the cylinder block by means of the tap and pipe provided, then,

(ii) Drain the remainder of the coolant from the system by opening the tap on the pipe connecting the pump to bottom of radiator, then,

(iii) Drain the coolant from the car heater system by opening the tap on the heater return pipe. If a drain tap is not fitted, then disconnect the hose at the forward end of the return pipe leading to the water pump.

Car Heater Taps.

IMPORTANT - It should be noted that although two taps are provided on the engine for isolating the pipes leading to the interior car heater, only the tap in the feed pipe from the cylinder head (the rear tap) should be used for turning off the hot water feed. The tap in the return pipe to the coolant pump should never be closed, and it is accordingly wired back permanently in the open position as shown in Fig.2.

The reason for this is that in the event of this tap being closed, it is possible for excessive pressure to be built up in the supply to the heater with the consequent result of damage to the heater element. Later cars have the tap in the return pipe deleted.

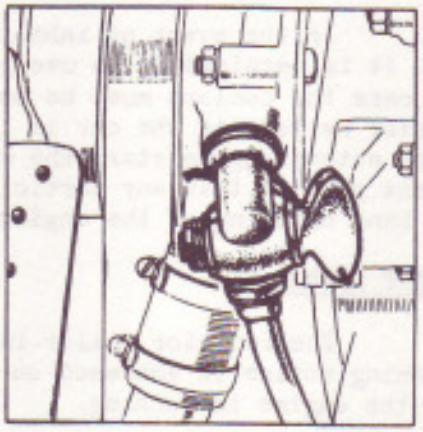

FIG. 2. TAP IN CAR HEATER RETURN PIPE TO COOLANT PUMP WIRED BACK PERMANENTLY IN THE OPEN POSITION. (TAP DELETED ON LATER CARS.)

OVERHEATING.

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

(i) The thermostat may have failed (See Sub-Section BN.2).

(ii) The fan belt may need adjustment (See Sub-Section BN.3).

(iii) If on long ascents which call for full throttle, "boiling" should occur due to abnormal conditions of atmospheric temperature, and/or, following winds, etc., it is preferable to change into a lower gear and reduce the throttle opening.

(iv) There may be a shortage of coolant in the system.

(v) Detonation and low grade fuel.

(vi) Radiator matrix partially blocked with flies, dirt, etc.

HOSE CONNECTIONS.

Anti-freeze mixture, such as Ethylene Glycol and "Bluecol" have a much more searching action than water, therefore it is essential that the rubber hose connections should be examined occasionally and replaced if unsound, as any leakage will necessitate replenishment with anti-freeze mixture. Also make sure that all hose clips are tight.

Rubber hose connections are fitted to:-

(a) Thermostat outlet to radiator header tank, 2 off.
(b) By-pass connection, thermostat to coolant pump, 1 off.
(c) Bottom connection coolant pump to radiator, 2 off.
(d) Car heater to cylinder head feed pipe, 1 off.
(e) Car heater to return pipe (coolant pump), 1 off.

THE THERMOSTAT.

GENERAL.

The thermostat which controls the flow of coolant through the radiator to suit the engine cooling requirements, is contained within a housing attached to the front end of the cylinder head.

The thermostat valve is set so that it commences to open at 78° - 80°C and is fully open at 95°C. Until the valve is fully open, a certain proportion of the coolant by-passes the radiator and returns directly to the engine; so ensuring a rapid warming up, and also maintaining a minimum coolant outlet temperature of 80°C.

Observation of the thermometer on the instrument board when warming up will show whether the thermostat is operating correctly. The engine should warm up to about 79°C quickly even under light load. An unusually and consistently low temperature, after the engine has been warmed up, indicates failure of the thermostat. If the coolant temperature does not behave correctly and a faulty thermostat is suspected, it should be removed from its housing, as described below, and placed in a suitable container with water and an accurate thermometer. On heating the water it will then be possible to note the temperature at which the valve begins to open.

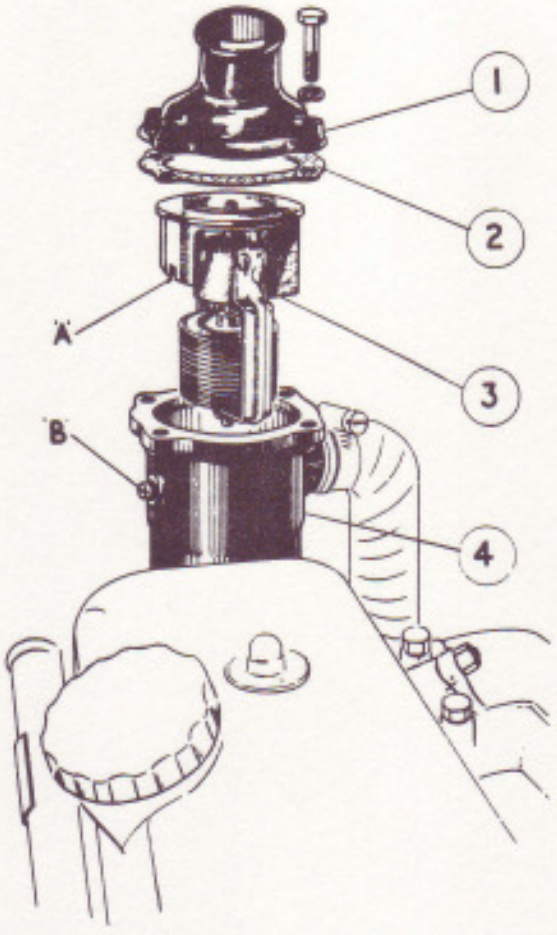

FIG. 3. THERMOSTAT UNIT "EXPLODED" FROM ITS HOUSING.

TO REMOVE THERMOSTAT.

Disconnect the hose from the coolant outlet connection (1) on the top of the housing and remove the four nuts and flat spring washers and then remove the outlet connection (cover) from the top of the thermostat housing (4).

If the thermostat unit is stuck in its housing, do not try to get a screwdriver or other implement under the valve in order to prise the unit out of the housing, but screw two 3 B.A. setscrews into the tapped holes which are provided in the top of the unit body for extraction purposes. Then prise the unit out of the housing by placing the end of a screwdriver under the setscrew heads.

TO REFIT THERMOSTAT.

The instructions for replacing the thermostat are approximately the reverse of those for removal.

It is, however, important to replace the unit so that the slot 'A' in its body fits around the locating screw 'B' in the side of the thermostat housing, (See Fig.3). A new Klingerit joint (2) should be fitted.

THE COOLANT PUMP AND FAN.

GENERAL.

The coolant pump is mounted in tandem with the fan on the front end of the cylinder block and forms one belt driven unit mounted on a common spindle.

Fig.4 shows an "exploded" view of the pump and Fig.5 a section through the pump.

The spindle and double-row ball bearings (7, Figs.4 and 5) form a complete unit which cannot be disassembled. The bearing is packed with a special high-melting point grease at the time of manufacture, and requires no further lubrication during its life.

The fan and pulley unit is pressed on to the front end of the spindle whilst the pump rotor is pressed on the rear end. An interference fit between the spindle and the bore of the adaptor (8) of the fan and pulley unit and the bore of the rotor (23) are the only means of retention.

If for any cause, the engine has to be run with the fan removed, it is essential that the fan retaining setscrews and flat spring washers (4) together with suitable distance pieces, .160" thick, to allow for the thickness of the fan, are refitted in position to retain the pulley.

The seal against seepage of coolant along the spindle consists of a packless gland assembled between the front end of the rotor and the casing. In the event of the gland leaking, which would be evident by coolant coming from between the casing and the fan pulley, it should be replaced as described in the paragraph "Dismantling and Replacing Gland".

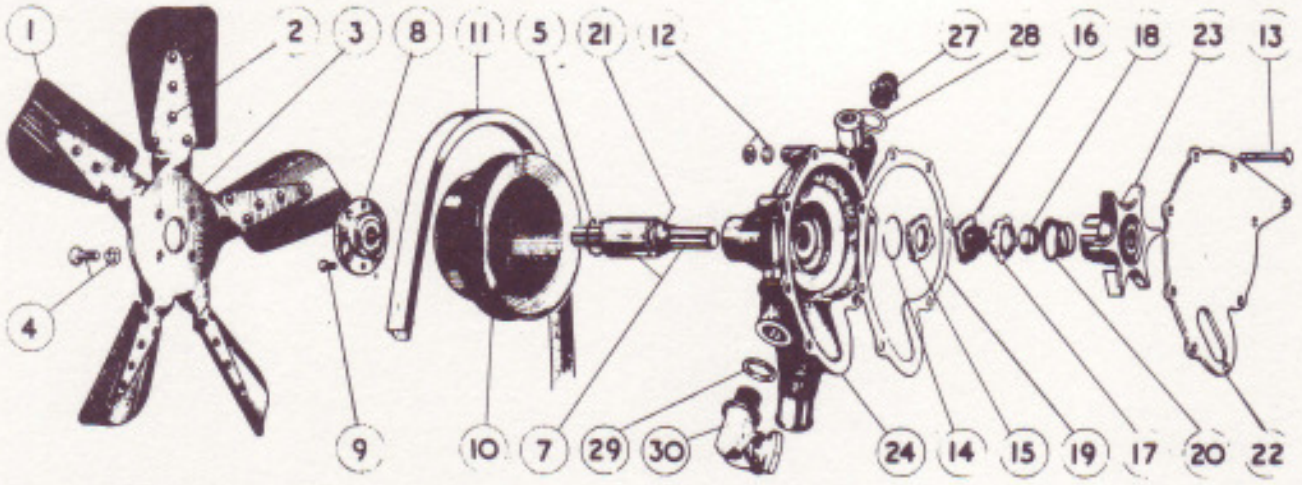

FIG.4. "EXPLODED" VIEW OF COOLANT PUMP. (SEE NOTATION LIST FOR FIG.5.)

1. Fan Blade.
2. Rivet.
3. Fan Flange.
4. Setscrew & F.S. Washer.
5. Spring Ring - bearing.
6. Grease retainer (integral with bearings).
7. Bearing & Spindle assy.
8. Adaptor - Fan Flange to Pulley.
9. Screws (countersunk).
10. Pulley.
11. Driving Belt.
12. Nut & F.S. Washer - Pump Casing.
13. Bolt - Pump Casing.
14. Spring Ring - Rotor.
15. Gland Ring (carbon).
16. Rubber Seal.
17. Housing - Rubber Seal.
18. Retaining Ring - Rubber Seal.
19. Joint - Backing Plate.
20. Spring.
21. Flinger.
22. Backing Plate.
23. Rotor.
24. Coolant Pump Casing.

NOTE: The above numbers appear on Fig.5 and also on Fig.4 with the exception of item 6. The numbers below appear only on Fig.4.

27. Union - Coolant Return Pipe.
28. Plain Washer (alum:) - union.
29. Washer (C & A) - Tap (Only fitted to early cars.
30. Tap.

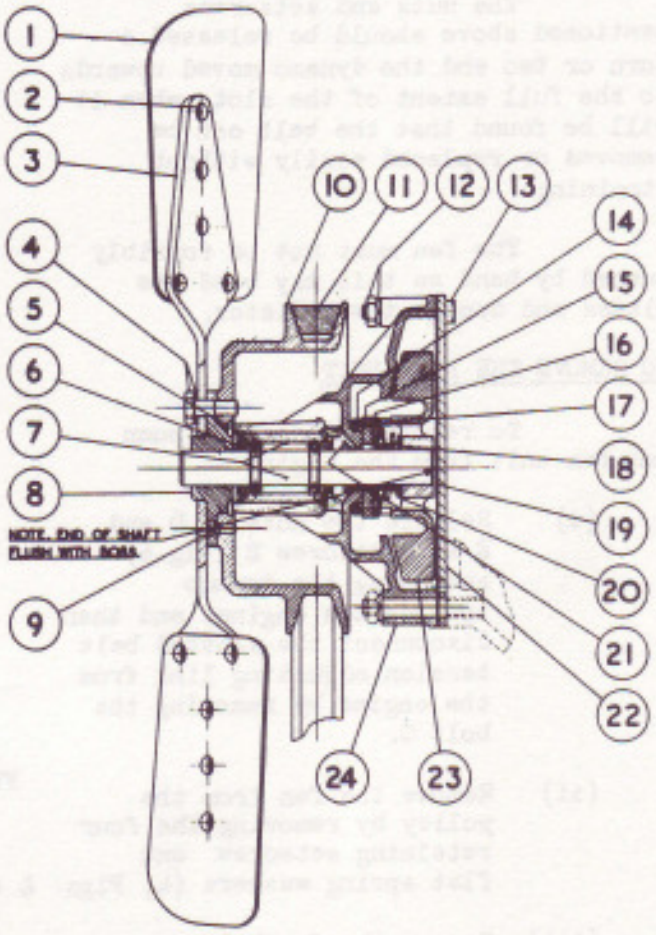

FIG. 5. SECTION THROUGH COOLANT PUMP.

FAN BELT ADJUSTMENT.

Should the belt require adjustment, this is effected by releasing the nut of bolt C a turn or two, the nuts D and E and the setscrew B (See Fig.6) and moving the dynamo outwards on the special slotted link. If a 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 transversely, with the fingers, through a total distance of approximately one inch (i.e. half an inch either way) when checked at a point equidistant from the crankshaft pulley and the fan pulley (See Fig.6).

If it should be necessary to remove the belt for any reason, it must not be strained over the pulleys.

The nuts and setscrews mentioned above should be released a turn or two and the dynamo moved upwards to the full extent of the slot, when it will be found that the belt can be removed or replaced easily without straining.

The fan must not be forcibly turned by hand as this may bend the blades and damage the radiator.

TO REMOVE THE PUMP UNIT.

To remove the coolant pump and fan unit from the engine:-

(i) Release the nuts C, D and E and setscrew B (Fig.6) and swing the dynamo towards the engine, and then disconnect the slotted belt tension adjusting link from the engine by removing the bolt C.

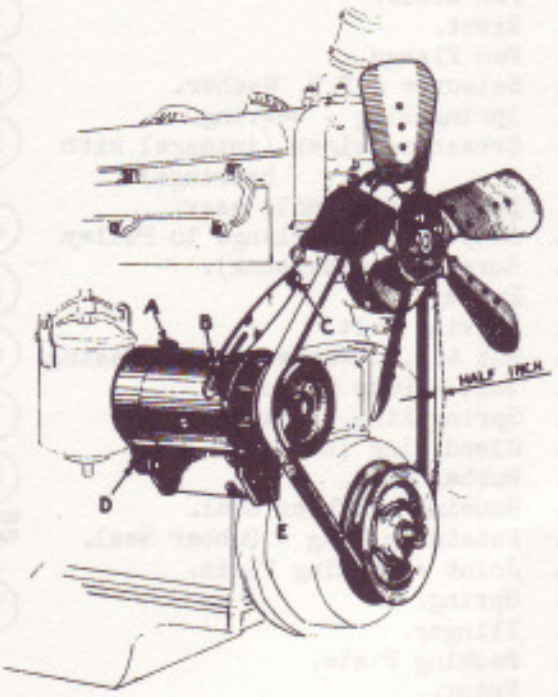

FIG.6. FAN, DYNAMO AND "VEE" BELT DRIVE.

(ii) Remove the fan from the pulley by removing the four retaining setscrew and flat spring washers (4, Figs. 4 and 5).

(iii) Remove the fan belt.

(iv) Remove the rubber by-pass connection from the pump to the thermostat casing.

(v) Disconnect the hot coolant return pipe from the induction manifold at the pump end by holding the union with one spanner and unscrewing the union nut with a second spanner.

(vi) Disconnect the pipe connecting the pump with the bottom of the radiator.

(vii) Disconnect the car heater return pipe at the pump end. On early cars a tap is fitted between the coolant pump and the car heater return pipe (see Fig.2). Remove the pipe from the tap by unscrewing the union nut. Leave the tap in position on the pump and do not remove the wire securing the tap in the permanently open position.

(viii) Remove the four lower nuts and flat spring washers which attach the pump complete with backing plate to the adaptor (support) fitted to the front end of the cylinder block, and then withdraw the pump from the studs.

DISMANTLING AND REPLACING GLAND.

Remove the backing plate (22) from the pump by removing the four nuts, flat spring washers and bolts (12 and 13) thus exposing the rotor. On early cars no tapped holes were provided in the rotor for extraction purposes. On later cars, however, a modified type rotor was fitted in which tapped holes were provided. If it is found upon removing the backing plate that these holes do not exist then mark off and drill two holes diametrically opposite, .265" diameter at 1.250" centres, drill .600" deep in the face of the rotor and then tap .312" diameter, 22 T.P.I. (5/16" B.S.F.) for a depth of .530" fully formed. (See Fig.7.)

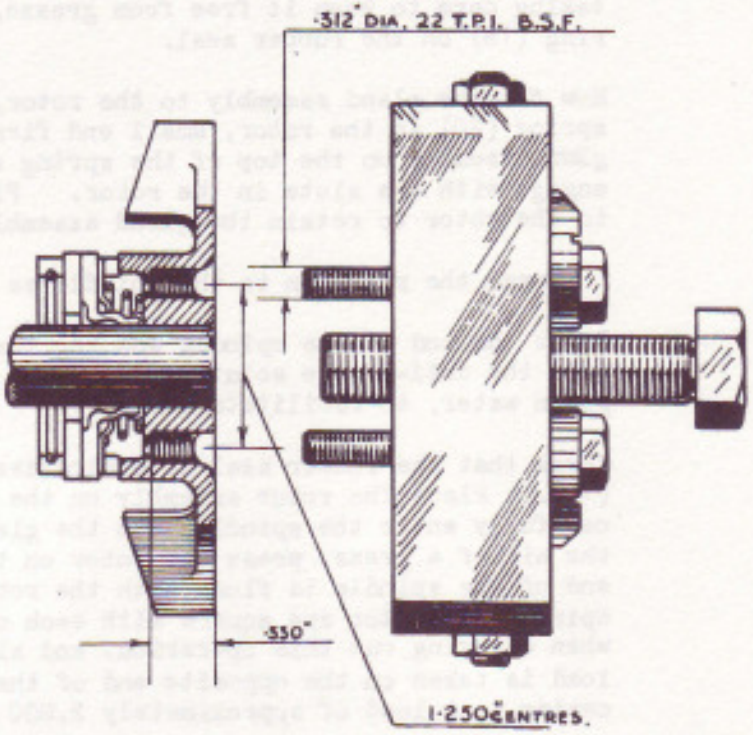

FIG. 7. DIMENSIONS FOR DRILLING AND TAPPING EXTRACTOR HOLES IN EARLY TYPE ROTORS AND ALSO VIEW OF EXTRACTOR STD. 505.

If extraction holes are already provided, then it will only be necessary to use a tap to clean out the threads. Then, using the universal extractor, Tool No.STD.505, remove the rotor from the spindle.

Remove the circlip (14) from the rotor retaining the gland and then separate the gland from the rotor.

Inspect the end of the spindle (7) to ensure it is smoothly radiused with no sharp edges likely to damage the bore of the new rubber seal (16) during re-assembly.

Thoroughly clean all parts and remove all traces of Klingerit jointing from the face of the pump casing and the backing plate.

NOTE: When cleaning, never immerse the shaft and bearing in cleaning fluid as this will dissolve the lubricant in the bearing and make it unfit for further service.

TO RE-ASSEMBLE PUMP UNIT.

Whenever a pump is dismantled a new rubber seal (16) should always be fitted, also the carbon gland ring (15) should be renewed, unless it appears to be in perfect condition with a highly polished surface and with no score or chatter marks. If the carbon gland ring is of the early type with sharp corners at each end of the bore, then it should be replaced, irrespective of condition, by the later type which has a radius at each end of the bore.

Build up the gland assembly as follows:-

Place a new rubber seal in the housing (17). Place the carbon gland ring on next with its smoother side outermost, taking care to keep it free from grease. Place the retaining ring (18) on the rubber seal.

Now fit the gland assembly to the rotor, first placing the spring (20) in the rotor, small end first, then place the gland assembly on the top of the spring so that the projections engage with the slots in the rotor. Fit the spring ring (14) to the rotor to retain the gland assembly in position.

Press the rotor on to the spindle as follows:-

Smear the end of the spindle and the inside of the rubber seal with the anti-freeze solution (Ethylene Glycol), Palmolive or even plain water, to facilitate assembly.

Check that the rubber seal is centralised in the retaining ring (18). Place the rotor assembly on the end of the spindle and carefully enter the spindle into the gland assembly, then with the aid of a press, press the rotor on to the spindle until the end of the spindle is flush with the rotor. Make sure that the spindle and rotor are square with each other and with the press when carrying out this operation, and also make sure that the load is taken on the opposite end of the spindle and not by the casing. A load of approximately 2,000 lbs. will be required.

Fit a new Klingerit joint (19), and then place the backing plate in position and fit the bolts (13) to the uppermost four holes, but do not tighten them until the pump is fitted to the engine. This completes the re-assembling of the coolant pump.

Refitting the pump to the engine is approximately the reversal of the instructions for removing the pump as described previously. Progressively tighten up the nuts securing the pump to the backing plate and pump to engine.

TO FIT NEW PUMP SPINDLE AND BEARING ASSEMBLY.

It is unlikely that the spindle and bearing assembly will ever require replacing. However, the following instructions describe how to do this in case it should prove necessary. Remove and dismantle the pump as previously described. With the aid of the universal extractor STD.505 withdraw the pulley and adaptor (8) from the spindle. Remove the retaining spring ring (5) from the casing and then tap out the spindle and bearing assembly.

It will now be necessary to remove the flinger (21) from the old spindle for refitting to the new spindle. The flinger is only a light interference fit and should therefore be easily removable.

Remove the adaptor from the fan pulley by unscrewing the four countersunk screws (9).

The spindle and bearing assembly together with the adaptor (8) should now be scrapped. No attempt must be made to fit the old adaptor to the new spindle and bearing, as some inevitable loss of interference may result in the fan and pulley assembly working loose at a later date.

Press the flinger on to the longer end of the new spindle and bearing until the flinger is a distance of .300"+ or -.015" from the outer race of the bearing. Reference to Fig.5 will indicate correct way round for flinger.

Lubricate the outer race of the bearing (to facilitate assembly) and then press the spindle and flinger assembly into the casing. Ascertain that the flinger is not fouling the casing by turning the spindle, and then fit the retaining ring (5).

Fit a new adaptor (8) to the fan pulley and secure by means of the four countersunk screws. It is important that this operation is carried out before the adaptor is pressed on to the spindle.

Press the pulley and adaptor assembly on to the spindle. While carrying out this operation make sure that the load is taken on the opposite end of the spindle and not by the casing. Press on until .125" + or - .005" of the spindle protrudes through the boss of the adaptor.

Complete the re-assembly of the pump as previously described.

Refit the pump to the engine, this is approximately the reversal of the instructions for removing the pump. Do not forget to tighten up the four nuts and bolts (12 and 13).

THE CAR HEATER.

An interior heater is fitted under the front passenger's seat, warm air being circulated by an electric fan which is integral with the heater.

Hot coolant is circulated through the heater from the engine cooling system, the coolant being taken from the cylinder head through a tap, the latter being used to isolate the heater when not required.

It is important that the engine is not run with the isolating tap on the heater return pipe closed, and the tap on the cylinder head open, as this may result in damage to the heater element.

The switch for the heater fan incorporates a rheostat, and is mounted on the instrument board, thus giving a variable control of the interior temperature.

TO REMOVE HEATER.

Drain the anti-freeze mixture from the car heater system as described in Sub-Section BN.1.

Turn up the rear cushion and then slide the front passenger seat backwards and off its runners to expose the heater.

With the car heater rheostat switched off and as a further precaution, the master switch on the instrument panel also switched off, disconnect the wires from the two terminals on the underside of the heater. Disconnect the two rubber water pipes from the heater after slackening off the clips.

Remove the six screws securing the heater to the metal floorboard and then remove the heater complete with the adaptor.

TO REFIT.

Replacement is a reversal of the above order of operations, but ensure that the orange coloured wire is connected to the terminal marked SW on the heater and the black coloured wire connected to the E terminal.

The heater circuit fuse is the same as that used for the ignition circuit etc., i.e. the sixth one looking at the fuse box from left to right or the third one looking from right to left.

Replace the anti-freeze mixture removed.

TO REMOVE THE RADIATOR

(STANDARD SALOON BODY)

The radiator comprises two main units, namely, the outer shell and the matrix itself, the complete assembly being mounted on a single central rubber support. The shell is diagonally braced and is bolted to the wings and valance plates. The radiator matrix is secured in the shell at three points which are arranged to provide freedom for expansion under heat.

(i) Remove bonnet - by withdrawing small bolt from hinge-pin bracket on dashboard.

(ii) Drain cooling system - (see Sub-Section EN.1, paragraphs - "To drain the System" & Car Heater Taps").

(iii) Disconnect centre lamp - open front, disconnect and pull wires clear of lamp bracket.

(iv) Undo joint between sides of front apron and wings and remove apron complete with centre lamp.

(v) Remove right-hand and left-hand fairings from bumper (if fitted).

(vi) Remove front wheels and disconnect radiator from valance plates as follows:-

a) It will be observed that there is a line of setscrews on the inside of the front wings which secure wings in position, some of these also secure the radiator shell and matrix. Commencing with the bottom setscrew at the front, and counting this as No. 1, remove first five setscrews from each of the wings and also remove the single setscrew (on either side) which is positioned approximately 2" (50 m/m) to rear of No. 2 setscrew already removed. Remove two screws or bolts (on either side) which retain horn brackets in position, these also secure the two brackets which support the matrix.

NOTE: The horns should be supported and not allowed to hang on their wires as they may become disconnected.

b) Remove bolts (one on either side) which secure radiator shell to the top of valance plates.

(vii) Disconnect top coolant connection (hose), from header tank of radiator.

(viii) Disconnect coolant connection (hose), from bottom of radiator.

(ix) Remove bottom centre screw securing radiator yoke to front cross member and with two operators pulling the wings a little away from the radiator shell, lift and carefully remove radiator from car.