the push rods with the ball ends of the tappet adjusting screws. The crankshaft will require turning slightly to allow all the push rods to be entered in this manner.

Effective with Engine No. 1425097 *the push rods were reduced in length from approximately 11.9 ins.* (302.3 *mm.) to* 11.8 *ins.* (299.7 *mm.). The longer rods are still serviced for engines built prior to the change.*

51. Check the valve clearances by turning the crankshaft to bring each valve to the fully closed position, and then inserting feeler blades between the valve stem or rotator cap and the end of the rocker lever. Adjust the clearances to approximately 0.012 in. (0.305 mm.) for exhaust valve and 0.015 in. (0.381 mm.) for inlet valve.

NOTE— Early Mk. I engine exhaust valves were not fitted with rotator caps in which case the gaps should be set at 0.015 *in.* (0.381 *mm.).*

After final assembly it is important that the engine is run up to normal operating temperature and the cylinder head bolts re-tightened to the correct torque and the valve clearances readjusted.

52. Fit the copper sealing washers to the injector bores in the cylinder head, place the rubber seal on the inlet adaptors of the injectors and assemble the injectors to the head locating the seals in the recesses in the side of the cylinder head.

Injectors used on Mk. I and Mark 111 Engines are identical but a different injector was used on Mk. II Engines (i.e. between Engine Nos. 1425097 *and* 1481090) *see " Fuel Injection System."*

Where service replacements are required, similar type injectors to those originally fitted should be installed but in an emergency it is possible to use either type, preferably in sets of four.

53. Insert the retaining bolts and tighten them to a torque of 15 lb. ft. (2.073 kg.m.). Note that these bolts are marked " H T " on the head end are fitted without lockwashers.

54. Remove the protective covering from the injector cap nuts and assemble the injector leak-off pipe securing the banjo connections with the appropriate screws which are of a special slotted type.

55. Fit a new gasket to the valve rocker cover, locate the cover and gasket on the cylinder head and secure in position with six bolts around the flange.

On Mk. I engines the valve rocker cover was secured with two screws through the centre of the cover.

56. Assemble the push rod side cover using a new gasket between the cover and cylinder block and copper washers between the heads of the fixing screws and the cover.

Prior to Engine No. 1481091 the two outer jixing screws were of a special type having an extended thread portion on the outside of the head to provide fixing points for the main wiring loom clips. Subsequent to this Engine No. the wiring loom was re-routed on the opposite side of the engine and the special screws were no longer required.

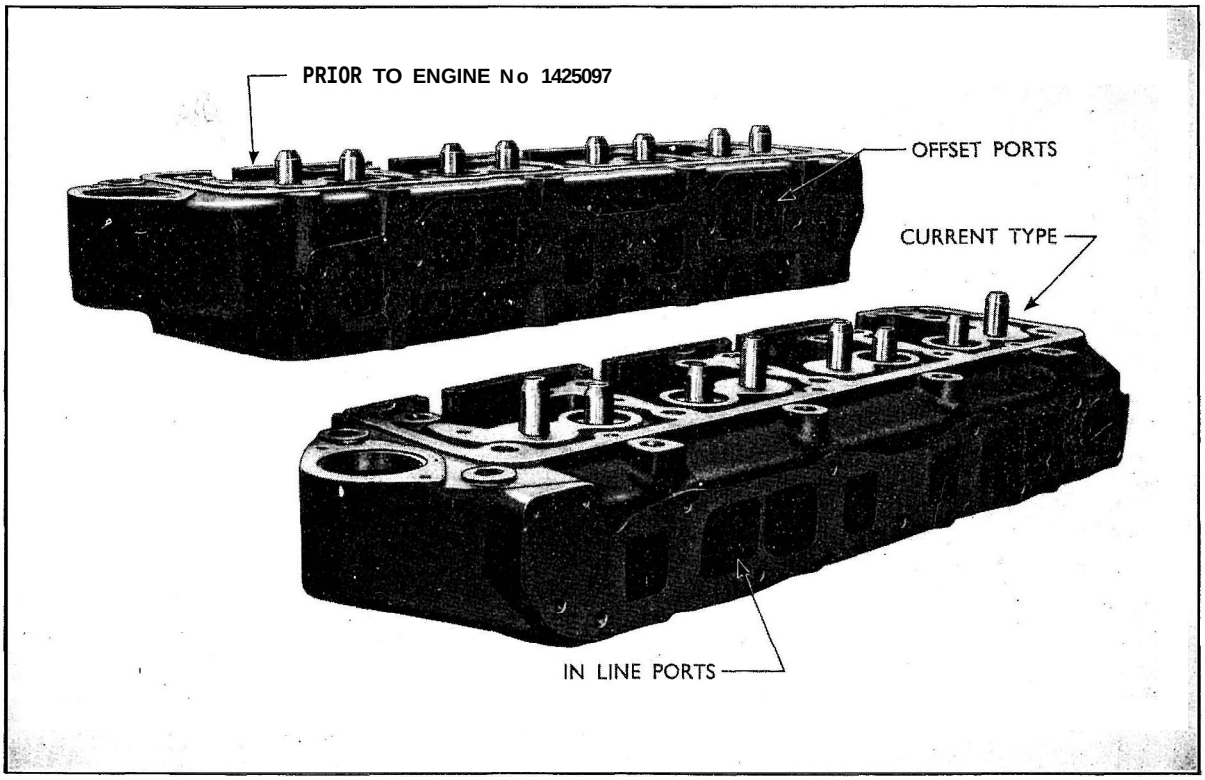

Fig. 50
Cylinder Head Comparison

57. Fit the coupling flange on to the rear end of the auxiliary drive shaft, the flange is keyed and secured by a bolt which clamps it to the shaft.

When the changes made to the auxiliary drive shaft, described after item No. 28, came into effect a new engine half of the fuel injection pump coupling was introduced. This type of coupling, fitted after approximate Engine No. 1599502 may be identified by the pinch slot which is at an angle to the Allen screw used to pinch the coupling on the shaft.

Further changes were later made whereby the pinch slot reverted to its original position at right angles to the bolt and a hexagon-headed screw used in place of the Allen screw. These two types are interchangeable but must not be mixed with the type fitted before Engine No. 1599502 due to the difference in internal diameter and corresponding differences to the auxiliary drive shaft diameters.

58. If the fuel injection pump mounting bracket has been removed it should be replaced. Use sealing compound on the lower screw as this breaks through into the crankcase and is a possible source of oil leaks.

Pneumatically governed pumps were supported on a larger bracket secured with four screws and sealing compound should be used on both the lower screws.

59. Swing the plate on the right-hand side of the flywheel bell housing to one side and turn the engine until the appropriate degree marking (B.T.D.C.) on the flywheel is opposite the V notch on the housing with No. 1 piston on the compression stroke.

Mk. I Engines (prior to Engine No. 1425097) *are timed at* 26 *degrees* B.T.D.C.

Mk. II Engines (between Engine Nos. 1425097 *and* 1481090) *were timed at* 19 *degrees* B.T.D.C. *but should be timed at* 23 *degrees* B.T.D.C., *when the latest type copper/asbestos/permanite gasket is fitted.*

Mk. III Engines (after Engine No. 1481091) *are timed at* 23 *degrees* B.T.D.C.

Mk. III Engines with mechanical governor (Minimec) are timed at 21 *degrees* B.T.D.C.

60. Fit the injection pump to the mounting bracket, and cylinder block in the case of Minimec fuel injection pumps, with the pump timing mark on the pump timing plate and the mark on the adjacent coupling in line.

Tightening of the retaining bolts for the fuel pump coupling should be carried out in a definite sequence in order to ensure that all bolts are effectively tightened.

After setting the correct timing tighten the claw plate bolts to finger-tightness only, then tighten the pinch bolt which secures the engine half of the coupling to the auxiliary drive shaft to a torque of 15 to 18 lb./ft. (2.07 to 2.49 kg.m.). Only after this has been done should the claw bolts be fully tightened.

Check that there is a 0.010 in. (0.254 mm.) clearance between the fibre disc and the pump coupling. The correct clearance can be obtained, if necessary, by loosening the pinch bolt on the engine half of the coupling and moving the coupling along the auxiliary drive shaft.

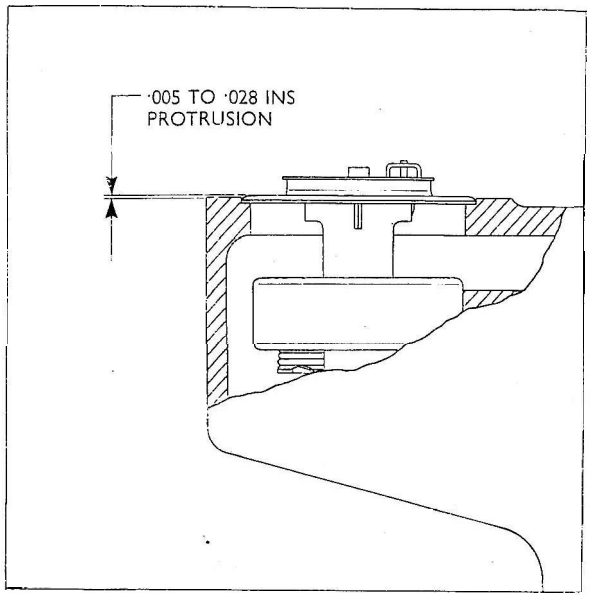

Fig. 51
Thermostat Protrusion

61. Replace the water pump, using a new gasket between the pump body and cylinder block, then fit the water pump pulley and fan. In order to ensure that the correct fan blades are fitted when replacing fan blades refer to "The Cooling System."

62. Fit the thermostat to the cylinder head. The current shrouded by-pass type may be used on all Major engines but the previous type must not be fitted to Mk. II and Mk. III engines. (See "The Cooling System.") Check that the thermostat flange protrudes 0.005 to 0.028 in. (0.13 to 0.71 mm.) above the cylinder head (see Fig. 51).

This protrusion will ensure a satisfactory pinch, and seal, between the recessed seat in the head and the water outlet casting. If this protrusion cannot be obtained, shims of 0.018 to 0.021 in. (0.457 to 0.533 mm.) should be fitted between the thermostat flange and its seat in the cylinder head until this specified limit is obtained.

63. Replace the cylinder head water outlet connection and gasket, securing it in position with two screws and spring washers.

NOTE.—On Mk. II and Mk. III engines with pneumatic governors the governor pipe bracket jts under the head of the right-hand screw.

TO REPLACE THE ENGINE IN THE TRACTOR

1. Lightly pack the recess behind the flywheel spigot bearing with high melting point grease and, if a single clutch is to be fitted, place the clutch disc on the flywheel, longest spline boss to the outside, using locator, Tool No. T.7024, (see Fig. 52). Fit the pressure plate assembly over the clutch disc and retain this in position with six bolts and spring washers.

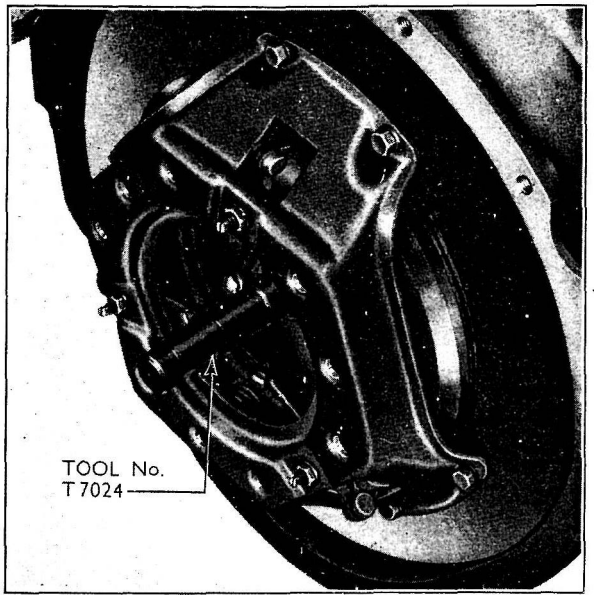

Fig. 52
Clutch Disc Locator

Tighten the bolts evenly to a torque of 12 to 15 lb. ft. (1.658 to 2.073 kg.m.) and remove the clutch disc locating tool.

If a double clutch is to be fitted, locate the clutch assembly on a special flywheel, insert the nine retaining bolts and shake-proof lockwashers and tighten securely.

2. Refit the engine lifting brackets and, using slings and a hoist, remove the engine from the stand and position it in the front axle assembly so that the front mounting plate seats in the right-hand side channel, and the lugs on the sump locate on either side of the radius rod tongue.

3. Fit the radius rod pin.

With the introduction of the Super Major the method of retaining the radius rod pin in position was changed from a split pin to a spring tension pin locating in a cross drilling in the sump.

Effective with Engine No. 1623043 the single tension pin was changed to double tension pins, one inside the other, this was later changed to a solid clevis pin, Part No. 76500–S7/8 and split pin, Part No. 72017–S, and it is recommended that only this method of securing should be used. Under no circumstances should spring tension pins be replaced, if removed from their original position.

4. Fit the left-hand side channel and install the trolley of dismantling stand, Tool No. Tr/NMD 27,

5. Fit the engine and front axle assembly to the front transmission engaging the splines of the gearbox main-shaft, and 'Live' P.T.O. input shaft where fitted, with the clutch disc splines, and install the engine to gearbox, and the side channel retaining bolts.

6. Connect the steering drag link to the spindle steering arm.

7. Remove the front axle wedges, engine lifting brackets and dismantling stand.

8. *Refit the throttle control bracket to the left-hand side of the engine (Mk. II and III engines with* ***pneumatic*** *governors only).*

9. Fit the inlet and exhaust manifolds, using new gaskets as required between manifolds and head.

Effective with Engine No. 1425097 the exhaust manifold was redesigned to suit the new cylinder head which was introduced, and on which the inlet and exhaust ports were brought into line horizontally.

If the exhaust silencer is of the horizontal type, connect the pipe to the exhaust manifold—if vertical, install the adaptor elbow.

10. Refit the generator and fan belt and adjust to give the correct fan belt tension of ½ in. (12.7 mm.) free movement measure midway between the generator and fan pulleys (see Fig. 53).

Effective with Engine No. 1308977 a narrower fan belt was introduced and at the same time the crankshaft pulley diameter was reduced from approximately 9 in. (228.6 mm.) to 7.5 ins. (190.5 mm.) and the water pump and generator pulley diameters from 5.27 ins. (133.85 mm.) to 4.5 ins. (114.3 mm.). The crankshaft pulley hub and front cover oil seal were changed (see operation 35 of assembly instructions) and the timing pointer was deleted in favour of flywheel timing.

The correct combination of pulleys, belt and oil seal must be used with engines before and after the above number.

11. Refit the oil pressure warning light switch (Mk. III) or the oil pressure pipe (Mk. I and II) whichever is required.

When refitting the oil pressure warning light switch it is recommended that a small quantity of approved sealer is smeared around the thread, take care to ensure that no sealer enters the oil passage hole in the end of the switch.

12. Replace the starter motor, connect up the wiring loom to starter motor, generator, oil pressure warning light switch, and headlamps and connect the starter motor actuating rod to the starter switch.

13. Fit the water temperature gauge bulb to the cylinder head and locate the capillary tube in the appropriate clips. Care should be taken to prevent damage to the capillary tube which runs along the right-hand side of the Mk. I and II engines, and on the left-hand side of Mk. III engines.

14. Refit the governor control pipes, (pneumatic governors only), the pipe from the outer governor connection going to the upper manifold union, the remaining pipe fitting in the inner governor connection and the lower manifold union. Both pipes are held in a clip attached to the right-hand water outlet connection bolt.

15. Refit the hose between the inlet manifold and the air cleaner, and the breather pipe between the

valve rocker cover and air cleaner on Mk. II and III engines.

A short pipe was fitted between the inlet manifold and rocker cover on Mk. I engines.

16. Refit the water pump to radiator, and radiator to water outlet connection hoses.

In order to increase the clearance between the lower radiator hose and the front timing cover and to prevent a rubbing condition occurring a new hose was introduced at approximate Engine No. 1589882. Whenever fitting the lower hose care should be taken to ensure that there is ample clearance between the hose and the breather pipe boss in the front timing cover.

Whenever attempting to obtain this clearance the hose should be moved sideways away from the engine rather than further forward on the radiator connection as there will be a danger of the fan blade striking the hose.

17. Secure the radiator tie bar to the clip under the head of the left-hand water outlet connectibn retaining bolt. (Not applicable to current production radiator.)

18. Refit the fuel lift pump, sediment bowl (where fitted), and the high pressure injector pipes. The injector pipes used on the Mk. II and III engines are of equal length and are looped and clipped in pairs.

19. Fit a new element and rubber sealing ring to the fuel filter and assemble the filter to the engine. Install the feed pipe between filter and injection pump and connect the inlet pipe from the lift pump.

20. Connect up the fuel leak-off pipe (to the fuel tank) at the right-hand side rear adaptor in the cylinder head.

21. Replace the batteries and connect up the battery lead.

22. Reconnect the throttle linkage and stop control cable, ensuring that a $\frac{1}{4}$ in. (6.3 mm.) of free movement is allowed at the stop control knob.

23. Fit the oil bath breather to the pipe on the front timing cover (Mk. II and Mk. III engines only) and fill the breather to the correct level with engine oil.

NOTE.—Tractors up to approximate Engine No. 1531000 werefitted with breather, Part No. E15-CG-9 having an 'O' ring fitted between the breather and the tube. It is essential that this 'O' ring is fitted with this type of breather.

Tractors produced after the above Engine No. are fitted with a modified breather having a split tube and secured with a retaining clamp. No 'O' ring is fitted with this type of breather.

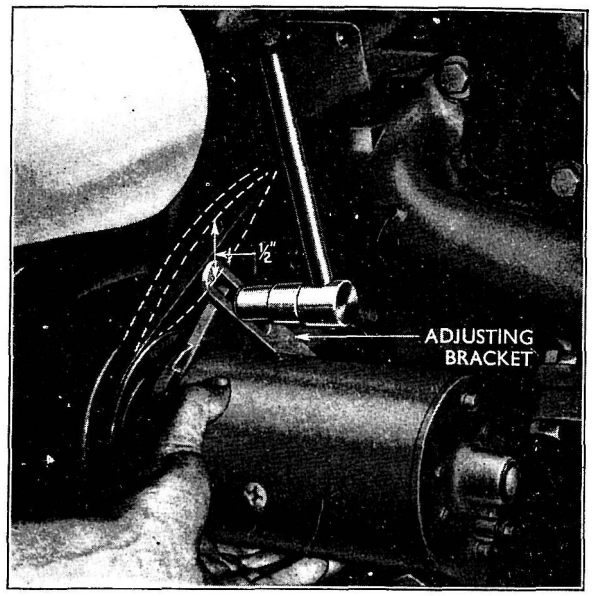

Fig. 53
Adjusting Fan **Belt** Tension

It is essential that the same type of breather as removed is fitted to the engine unless the front timing cover has also been changed.

24. Before refitting the engine oil filter remove and clean the interior of the shell, fit a new element, and a new rubber sealing ring between filter head and shell.

Assemble the filter unit to the engine retaining it with two bolts, the lower one of which should also secure the leak-off pipe from the fuel injection pump cambox.

25. Fill the sump to the correct level with an approved grade of lubricating oil.

26. Fill the radiator with water (fill slowly to avoid an air lock) and run the engine until its normal working temperature is reached.

27. Remove the valve rocker cover, tighten down the cylinder head bolts to the correct torque and readjust the valve clearances.

28. Check for oil and water leaks. Refit the valve rocker cover.

29. Replace the bonnet, primary air cleaner, vertical exhaust silencer if fitted and tool box.

LUBRICATION SYSTEM

The engine lubrication system has received only slight modification since the introduction of the engine, the only major change taking place with Engine No. 1425097 when the oil pressure relief valve previously fitted in the front mounting plate was deleted and a redesigned oil pump cover incorporating a spring loaded plunger type relief valve was introduced.

At the same time the inlet and outlet ports in the pump'body were increased in diameter (current type bodies may be identified by measuring the outlet port diameter which is $\frac{7}{16}$ in. (11.1 mm.) as against $\frac{11}{32}$ in. (8.7 mm.) on the previous type) and a larger diameter pick up pipe was introduced together with a cylindrical type sump filter screen instead of the bowl type screen and separate cover previously used.

A number of changes have been made to the main oil filter and three different makes have been used at one time or another. In order to ensure that replacement elements are of the correct type always compare the replacement element with the one being removed from the engine.

Effective with the introduction of the Power Major an oil pressure indicator switch was fitted on the left-hand side of the cylinder block in a branch passage from the main oil gallery.

Connected to this switch is an oil pressure warning light fitted to the instrument panel which lights up when the engine oil pressure drops below 5 to 7 lb./sq. in. (0.3515 to 0.4921 kg./sq. cm.). The warning light and switch replace the oil pressure gauge and pipe leading from the same location on previous Major tractors.

OIL PUMP

The procedure for carrying out repairs to the oil pump is the same for all engines with the exception that pumps fitted to tractors before Engine No. 1425097 do not incorporate a pressure relief valve in the cover plate. There are, however, variations in certain dimensions and care should be taken, when reassembling, to ascertain which type of pump is fitted and that the correct dimensions are employed.

To Remove the Oil Pump

1. Remove the sump plug and drain off the engine oil.

2. Suitably chock the front wheels to prevent movement and remove the bolts retaining the radius rods to the front axle.

3. Remove the pin retaining the rear end of the radius rod to the sump.

4. Tap the radius rod sideways on the axle beam until the rear end is clear of the sump then remove the radius rod.

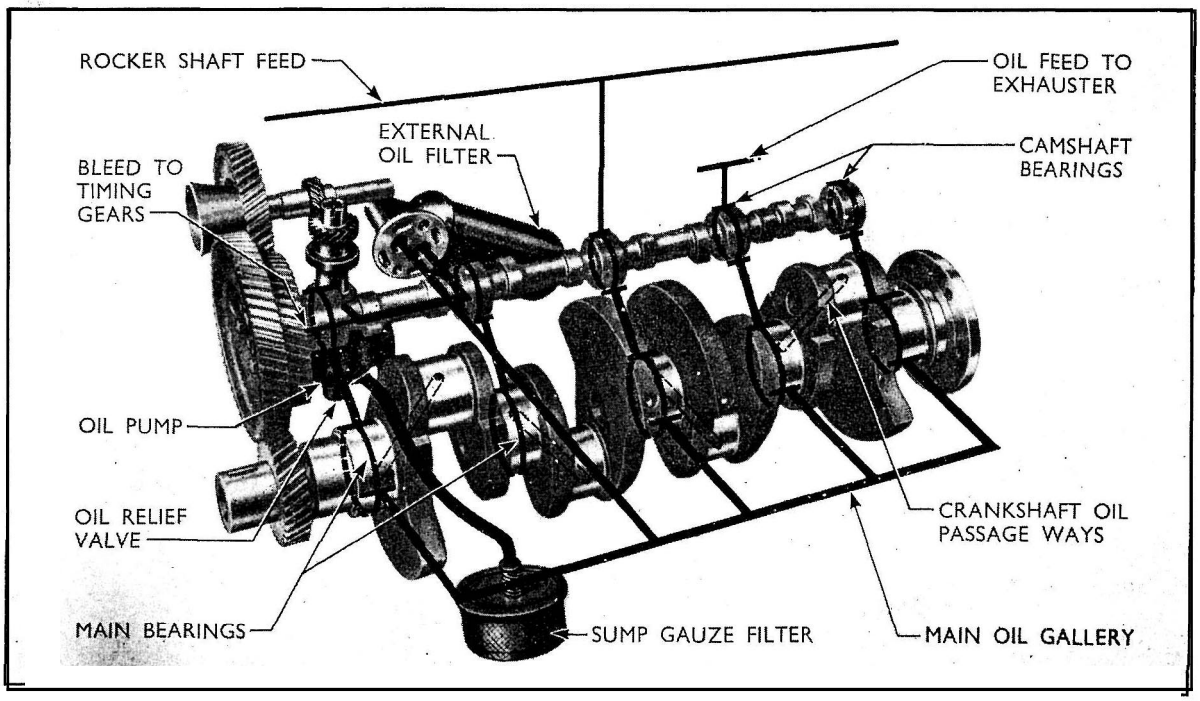

Fig. 54
Oil Flow Diagram

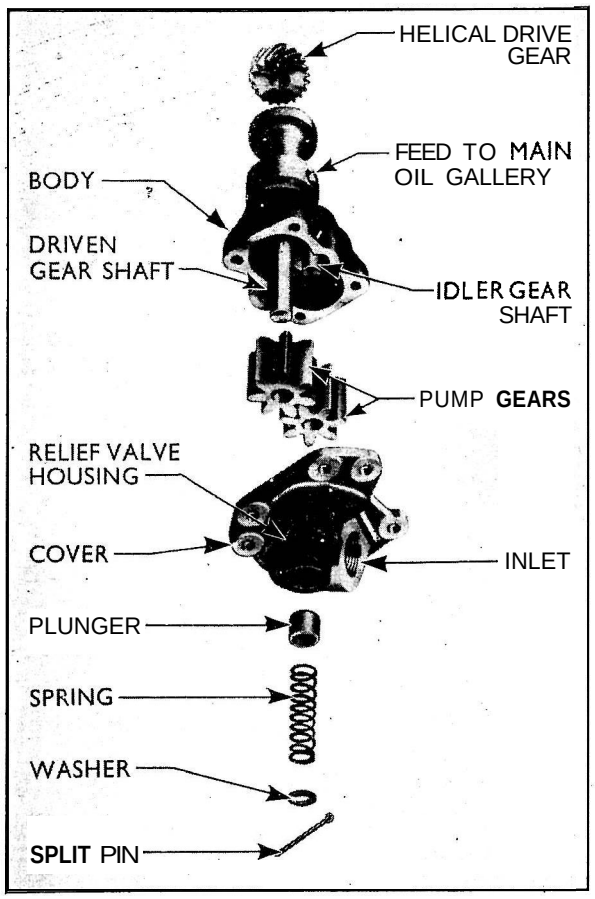

Fig. 55
Oil Pump Shaft and Gears

5. Disconnect the track rod on the left-hand side of the tractor.

6. Suitably support the sump, remove the sump bolts and lower the sump squarely away from the engine.

7. Extract the bolt retaining the oil pump suction pipe to the centre main bearing cap then remove the suction pipe from the pump.

8. Extract the two bolts retaining the pump to the cylinder block and withdraw the pump.

To Dismantle the Oil Pump

1. Remove the four set screws and spring washers securing the pump cover plate to the pump body.

2. Remove the cover plate. If necessary withdraw the split pin retaining the pressure relief valve, and extract the spring seat, spring and plunger (Mk. II and Mk. III engines only).

3. Withdraw the idler gear from its shaft.

4. Press the helical drive gear from its location, and remove the pump driven gear and shaft complete from the pump body.

5. If necessary, press the pump driven gear from its shaft.

To Reassemble the Oil Pump

At the time of going to print an oil pump with a lubricated drive gear is pending introduction. This will shortly be the current production unit and has therefore been referred to as such in the following sections.

NOTE.—Check all parts, especially the two pump gears, shafts, and body to ensure that no excessive wear is present, that no distortion exists on the pump cover face, and that the oil pressure relief valve plunger and spring are in good condition.

1. Press the idler gear shaft (if removed) into the pump body so that there is *0.005* in. *(0.127* mm.) clearance between the end of the shaft and the cover plate face of the pump body, using a straight edge and feeler gauge to check this clearance.

2. Current production tractors are fitted with a drive shaft having a machined scroll to allow oil to pass to the oil pump upper gear for lubrication purposes. The upper gear on these pumps has an annular groove and two holes to feed this oil to the mating faces of the gear and the auxiliary drive shaft gear. These parts are completely interchangeable with previous parts but to obtain full benefit of the oil feed it is recommended that the current parts are used together. The current shaft is approximately $\frac{1}{8}$ in. *(3.18* mm.) longer than the previous shaft to give more engagement with the lower gear. When pressing the drive shaft into the lower gear the following dimensions should be applied.

Previous shafts and gear:—Press the shaft into the gear so that the end of the shaft is 0.20 in. (5.08 mm.) below the face of the gear. A suitable distance piece 0.20 in. (5.08 mm.) thick and approximately 0.40 in. (10.16 mm.) diameter can be used for this purpose.

Current production shafts and gears:—Press the shaft into the gear so that the end of the shaft is *0.080* to *0.090* in. *(2.03* to *2.09* mm.) below the face of the gear. A suitable distance piece *0.080* in. *(2.03* mm.) thick and approximately *0.40* in. *(10.16* mm.) diameter can be used for this purpose.

3. Enter the gear shaft into the pump body and stand the assembly on a flat surface, keeping the same distance piece in the centre of the lower gear to maintain the clearance between the shaft and the top face of the gear.

4. Press the helical gear on to the shaft until the clearance specified below is obtained between the gear hub and the pump body.

Mk. I engines:—
Minimum clearance of 0.010 in. (0.254 mm.). Distance between lower face of helicalgear, not hub, *and bottom of pump body should be 5.200 to 5.202 in. (132.08 to 132.131 mm.). Fig. 56a.*

Mk. 11 and 111 engines:—
Non-lubricated type 0.010 to 0.036 in. (0.254 to 0.914 mm.). Fig. 56b.

Lubricated type *0.007* to *0.012* in. *(0.178* to *0.305* mm.). Fig. 56c.

Effective with Engine No. *1595085* changes were made to the material of the helical drive gear on the

oil pump and to the oil pump drive gear on the auxiliary drive shaft.

The latest type helical drive gear will be marked with a spot of white paint OR will have the Part No. E1ADDN-6652 or 528E-6652 stamped upon it. When replacing this gear or the auxiliary drive shaft and gear assembly it must be remembered that it is not permissible to run a previous type gear with a current type gear, i.e. mating gears must be of the same material, therefore if one gear requires changing the corresponding mating gear must also be changed to the latest type. These instructions also apply to oil pump assemblies in that where it becomes necessary to fit a new oil pump incorporating a current type drive gear it will also be nccessary to change the auxiliary drive shaft assembly to one which incorporates the current type gear.

5. Replace the pump idler gear.

6. Reassemble the relief valve plunger, spring, spring seat and split pin in the pump cover. (Mk. II and Mk. III only.)

Changes have been made to the relief valve plunger and to the relief valve spring retainer in order to prevent the plunger tilting in its bore and so causing loss of oil pressure.

The plunger was increased in length from 0.45 in. (11.43 mm.) to 0.62 in. (15.75 mm.) the current plunger, however, being completely interchangeable with the earlier type.

The relief valve spring retainer was changed from a flat disc to a cylinder incorporating a spigot to positively locate and support the spring (see Fig. 57). The retainer is also provided with a slot to accommodate the split pin which passes through holes in the oil pump bottom cover.

The cover was changed at the same time in that the split pin holes were repositioned radially, however, from a service point of view this cover and the previous type are completely interchangeable.

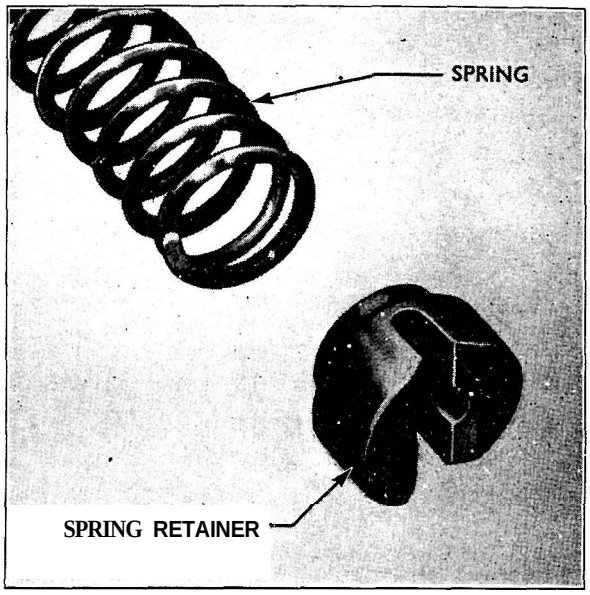

Fig. 57
Current Spring Retainer

It is recommended that when overhauling the oil pump that both the current type plunger and spring retainer are fitted,

7. Replace the cover and secure with four screws and spring washers.

To Replace the Oil Pump

1. Enter the pump assembly into its location in the cylinder block meshing the helical driving gear with the mating gear on the auxiliary drive shaft.

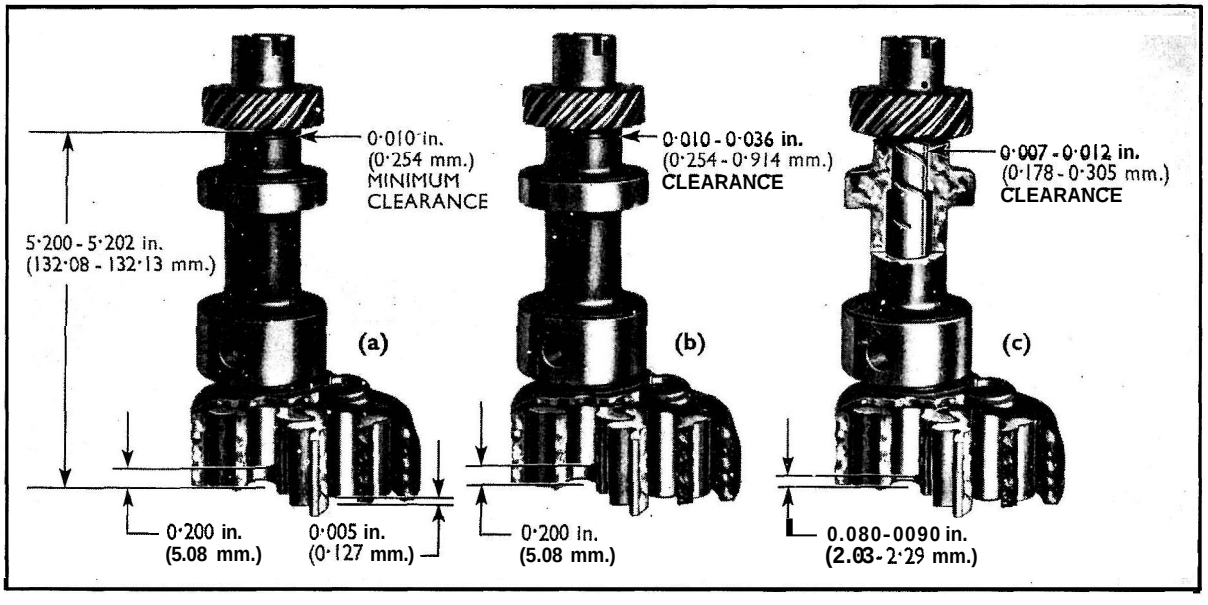

Fig. 56
Oil Pump Assembly Dimensions

2. Insert the two retaining bolts and spring washers and tighten securely.

3. Locate a tab washer on the suction pipe, assemble the pipe to the pump and insert the suction pipe securing bolt through the pipe bracket and into the centre main.,bearing cap.

4. Tighten the suction pipe to pump union nut and turn over the tab washer to secure it in position.

5. Thoroughly wash the sump filter screen in petrol and assemble the screen to the suction pipe, ensuring that the washer and spring are in position on the pipe, above the screen and that they are undamaged. Turn the screen through 90" so that it is retained on the pipe.

6. Using new gaskets between sump and block, assemble the sump and retain with the appropriate bolts and lockwashers. A new cork strip should also be fitted to the front main bearing cap and asbestos seals to the rear oil seal housing in the sump and in the groove in the block if necessary.

7. Replace the front axle radius rod and secure to the front axle with two bolts, castellated nuts and split pins and to the sump with the radius rod pin.

8. Reconnect the track rod to the spindle steering arm.

9. Replace the sump drain plug and refill the engine with the correct type and quantity of H.D. oil.

COOLING SYSTEM

THE COOLING SYSTEM

The water in the cooling system is circulated bp thermosyphon action with water pump assistance. A thermostat fitted in the water outlet connection in the cylinder head assists rapid warming up of the engine to its normal operating temperature. Early tractors were also provided with radiator shutters for this purpose but with current radiator and engines these shutters are considered unnecessary and have therefore been deleted.

Tractors supplied for domestic use have a non-pressurised cooling system but where the tractor is operating in hot climates radiator pressure caps are available which raise the pressure either to 4 lb/sq. in. or 7 lb/sq. in. dependiiig on type. These pressure caps raise the boiling point of the coolant and thus minimise losses through the overflow pipe.

The fan is mounted on the water pump shaft and is driven, together with the generztor, by a 'V' belt from the engine crankshaft pulley.

The water pump bearing is packed with lubricant and sealed at the time of assembly and does not require lubrication in service.

Two drain taps are provided, one in the base of the radiator and the other in the cylinder block just below the generator. The tractor should be standing on level ground when drained to ensure that no water is left in the system which could, in cold weather, freeze and cause damage to the cylinder block. Similarly, when water ceases to flow from a drain tap it should be probed to ensure that all the water has in fact been drained out and that the tap is not blocked with dirt or scale from inside the cylinder block.

During the winter it is recommended that a suitable anti-freeze solution is mixed with the cooling wate: to prevent having to drain the cooling system when the tractor is not in use. Salt solutions and organic compounds such as honey and sugar solutions should not be used. It is preferable to use a solution of inhibited ethylene glycol as not only will this prevent the coolant from freezing but the inhibiting agents will prevent corrosion of the cylinder block and radiator.

Whenever'it is necessary to drain the cooling system it is recommended that as far as possible, the water is retained for re-use. M e frequent use of new water, particularly in hard water districts will tend to cause excessive deposits of fur and scale in the cooling system and should therefore be discouraged.

WATER PUMP

At Engine No. 1425097 changes were made to the water ports in the pump body and it is essential that pump bodies and pump assemblies for tractors prior to the above engine number are not used on later tractors. It is important also that the correct gasket is used as the location of the ports is different on current and previous parts.

To Remove the Water Pump (Tractors less power steering)

I. Drain the cooling system and disconnect the radiator lower hose from the pump.

2. Slacken the generator adjusting bolts, move the generator inwards and detach the fan belt.

3. Remove the fan blades and fan pulley. Unscrew the four bolts securing the water pump and remove the pump and gasket.

The procedure for overhauling a water pump for a tractor without power steering varies from that for a pump from a tractor with power steering, also the special tools used are different and there are therefore two different procedures as detailed below :—

TO DISMANTLE THE WATER PUMP

Tractors less Power Steering

1. Clamp the main tool, CPT.8000, in a vice, pass the hub of the water pump through the base of the tool from the underside and position the split adaptors, CPT.8000–2/a under the hub flange. Attach the centre screw extension, CPT.8000–3/d to the main tool centre screw and wind down the centre screw, applying sufficient pressure to remove the hub from the pump.

2. Lever the bearing retainer clip out of the slot in the housing.

3. Locate the pump mounting flange in the adaptor ring, CPT.8000–2/d and using the hollow thrust block, CPT.8000–3/b press the impeller seal, slinger, shaft and bearing assembly out of the housing.

4. Support the impeller in the adaptor ring, CPT. 8000–2/d with the pump shaft downwards and press the shaft out of its location, using the centre screw extension, CPT.8000–3/d.

5. Remove the pump seal from the shaft, carefully split the slinger bush with a chisel and detach it from the shaft.

Tractors with Power Steering

1. Remove the bolts securing the fan blades and pulley to the hub and locate the pump in the main tool T.7000 with the split adaptors T.7000–17/a under the flange of the pulley and hub assembly.

Using the centre screw extension T.7000–17/b press the pump shaft through the hub as far as possible. Due to the length of the hub boss it will then be necessary to insert a suitable distance piece between the centre screw extension and the end of the shaft to complete the operation. The remainder of the dismantling procedure is as specified above for tractors without power steering.

TO REASSEMBLE THE WATER PUMP

1. Using the ring adaptor, CPT.8000–2 d and thrust block CPT.8000–3 b press the shaft and bearing assembly into the housing (short end of the shaft to the front of the housing) until the groove in the shaft is in line with the groove inside the housing.

2. Refit the bearing retainer clip in the groove of the bearing and housing.

3. Using the split ring adaptor CPT.8000–2, a press the pump pulley hub onto the front end of the shaft until the end of the shaft is flush with the end of the hub bore.

NOTE.—On water pumps from tractors with power steering this operation is carried out with T.7000 main tool and adaptors and it should not be carried out until the remainder of the pump is assembled.

4. Using the driver adaptor CPT.8000–3,a replace the slinger bush, flanged end first, on the rear end of the shaft and refit the pump seal on the slinger bush with the carbon thrust face towards the impeller.

5. Using the ring adaptor, CPT.8000–2 b press the impeller onto the shaft until a clearance of 0.030 in. (0.72 mm.) is obtained between the impeller blades and the housing face.

6. On pumps from tractors with power assisted steering replace the pulley on the hub and, using main Tool No. T.7000 and adaptors T.7000–17/a and b, press the shaft into the pulley hub until the end of the shaft is 1.406 ins. (35.7 mm.) from the machined face of the boss at the front of the hub.

To Replace the Water Pump

1. Clean the front face of the cylinder block and locate a new gasket on the block face, ensuring that the correct type, to suit the pump, is used.

2. Refit the fan pulley to the pulley hub, locate the fan belt around the pulley and secure the fan blades to the hub.

3. Adjust the fan belt tension to give $\frac{1}{2}$ in. (12.7 mm.) free movement midway between the water pump and generator pulleys. Tighten the generator adjusting arm and mounting bolts securely.

4. Reconnect the radiator lower hose to the pump inlet and tighten the hose clamp securely.

5. Refill the cooling system with clean water or anti-freeze solution if required. Run the engine and check all connections and joints for water leaks.

THERMOSTATS

Various changes have been made to the thermostat fitted to the Fordson Major range of tractors. These changes mainly affect the opening temperatures although several different types have been used in production at different times.

The application of these thermostats in service is simplified by the fact that only two types are now supplied—the shrouded type 204E–8575 for engines after No. 1425097 and the non-shrouded type EOTA–8575–B for engines prior to the above number (see Fig. 58).

Although, if required, the shrouded type may be fitted to the earlier range of engines, it is essential that the non-shrouded type is not fitted to Mk. II or Mk. III engines.

The design of the shroud on the current thermostat is such that as the engine reaches its operating temperature the thermostat opens and gradually seals off the by-pass tube located at the front of the cylinder head.

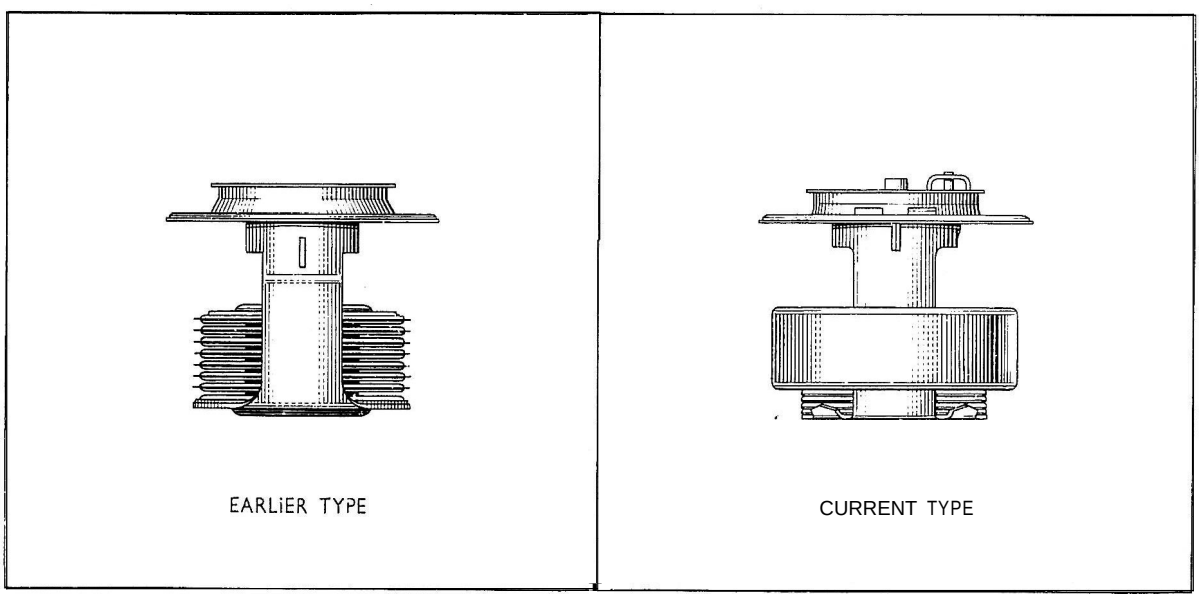

Fig. 58
Thermostat Identification

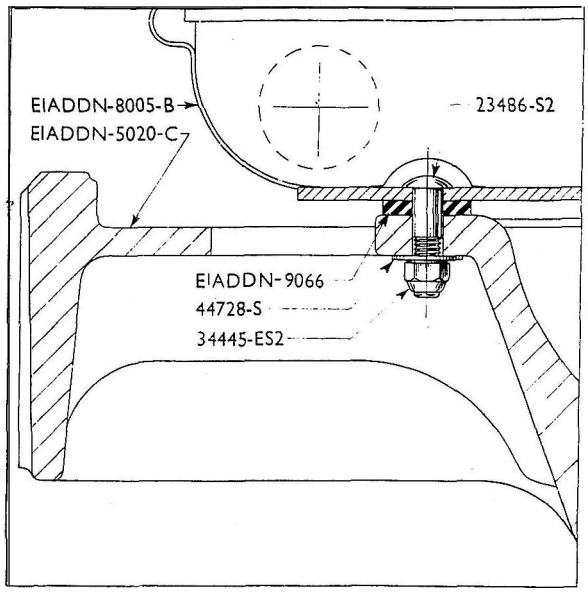

Fig. 59
Current Radiator Mounting

A restricted flow of hot coolant is then circulated through the radiator until,-when the thermostat is fully open, an unrestricted flow is obtained.

Both types of thermostat commence to open at 170° to 179" F. (77" to 82°C.) and are fully open at 199°F. (93°C.).

RADIATOR

Three types of radiator may be encountered in service, i.e.

(L) Radiators fitted before Engine No. 1420356.

(2) Radiators fitted between Engine No. 1420356 and Engine No. 08B767403.

(3) Radiators fitted after Engine No. 08B767403.

The first type of radiator may be identified by the fact that it has ten fins per inch as against the five fins per inch used on later radiators. The later type is completely interchangeable with the previous part.

Current radiators have a modified mounting arrangement designed to make the radiator less subject to leakage consequent upon vibration.

The current radiators are held to the front crossmember by coach-type bolts, the heads of which locate in special shaped holes in the radiator lower plate and pass downwards through the crossmember. The bolt hole centres are $10\frac{1}{4}$ ins. (260.4 mm.) apart as compared to $18\frac{1}{3}$ ins. (460.4 mm.) on the previous radiator.

Rubber mounting pads, which differ from those previously used, are fitted between the radiator and the crossmember (one at each bolt location) and the bolts are secured .beneath the crossmember by the same flat washers and self-locking nuts as were fitted previously. (see Fig. 59).

The radiator drain tap has been changed and re-located in a position at the rear of the lower tank.

The front crossmember has been modified to suit the new radiator and is now carried under a new part number E1ADDN-5020-C. It may, of course, also be identified by the radiator fixing bolt holes which are, as in the radiator, $10\frac{1}{4}$ ins. (260.4 mm.) between centres as compared to $18\frac{1}{8}$ ins. (460.4 mm.) in previous crossmembers.

When stocks of the previous type radiators are exhausted only the current type will be supplied for service on all Major tractors produced since 1952 and since the fixing bolt centres differ from those of the previous radiator it will be necessary to use an adaptor kit to make possible such fitting. The service kits are available from Parts Division, Aveley.

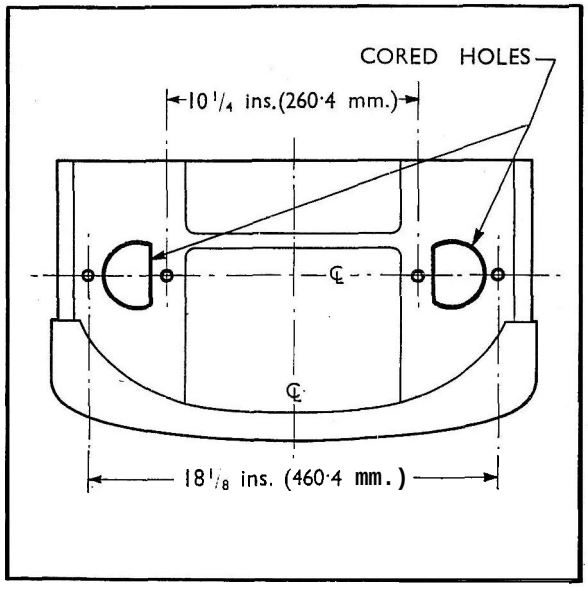

Fig. 60
Front Crossmember Modification

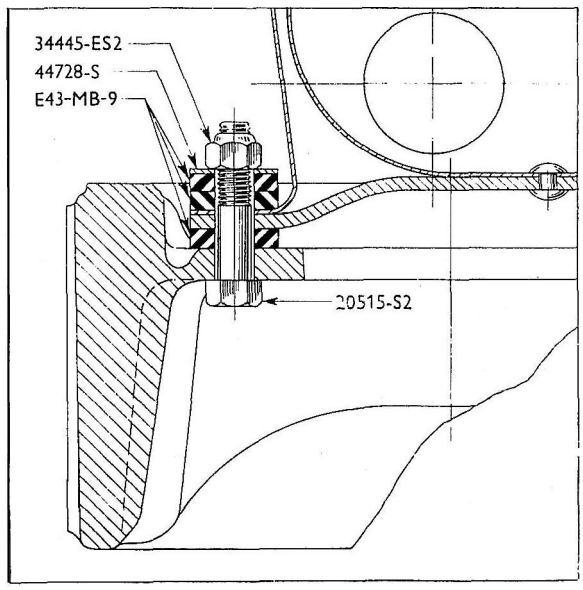

Fig. 61
Previous Radiator Mounting

Similarly, the current type front crossniember will be the only one supplied for Super Major tractors when existing stocks are exhausted. The previous crossmember, Part No. E1ADKN-5020-B, which incorporates the smaller diameter trunnion pin hole, will still be available for previous Major Tractors.

Where it is required to fit a current type crossmember to a previous Super Major and still use the original radiator it will be necessary to drill two $\frac{7}{16}$ in. (11.1 mm.) diameter holes at 18$\frac{1}{8}$ in. (460.4 mm.) centres, equally disposed either side of the centre line and in line with the previous radiator fixing bolt holes (see Fig. 60).

This will enable the old fixing bolt and mounting pad arrangement (see Fig. 61) to be used. A check should, however, be made that the mounting pads provide sufficient clearance to prevent the radiator "bumping" on the crossmember during tractor operation, and if necessary, additional pad thickness should be provided to prevent this happening.

To Remove the Radiator

1. Drain the cooling system.

2. Remove the primary air cleaner and vertical exhaust muffler if fitted. Remove the two screws in the rear bonnet bracket and remove the bonnet assembly.

3. Disconnect the top and bottom radiator hoses and flexible filler neck hose, when fitted, at the radiator end by unscrewing the clips.

4. Remove the two half-sections of the radiator grille and pull out the snap connectors of the headlamp wiring.

5. Remove the two headlamp bracket securing bolts and washers and remove the headlamp assemblies complete (Super Major only).

6. Remove the bolts securing the radiator stays. Current stays fit between the radiator and the cowl whereas previous stays were connected to the cylinder block.

7. Remove the bolts securing the radiator cowl to rhe front crossmember and lift away the cowling.

8. Unscrew the two self-locking nuts from the radiator mounting bolts and li'ft off the radiator.

The positioning of the rubber pads and flat washers varies between current and previous radiator mountings (see Figs. 55 and 57) and note should be taken of the positioning of these parts so that they can be replaced in their correct locations.

To Replace the Radiator

1. Place the radiator in position on the front crossmember, with the rubber pads between the radiator and crossmember. Replace the flat washer and self-locking nuts on the bolts and tighten the nuts until the rubber pads are just compressed. *Previous type radiators have two extra* ***rubber*** *pads fitted between the radiator feet and the flat washers.*

2. Refit the radiator cowl.

3. Reconnect the upper and lower hoses to the radiator and tighten the hose clamps securely.

NOTE.—When the current crankcase breather is fitted (after Engine No. 1425097) always check that sufficient clearance exists between the lower radiator hose and breather pipe boss in the front timing cover, to avoid the hose chafing against the breather pipe boss.

4. Replace the radiator support stays and secure in position.

5. Reconnect the flexible filler cap hose to the radiator.

6. Refit the headlamp and bracket assemblies to the front crossmember (Super Major only), connect up the wiring by pushing in the snap connectors, taking care to match up the colour coding on the wires and replace the two half-sections of the grille.

7. Refit the engine bonnet to the tractor and screw in the two retaining screws. Replace the vertical exhaust muffler where fitted.

8. Close the drain taps on the radiator and cylinder block and fill the cooling system.

9. Run the engine and check for water leaks.

FAN BELT AND PULLEY

Effective with approximate Engine No. 1308977 a narrow fan belt was introduced. At the same time corresponding changes were made to the crankshaft, generator and water pump pulleys resulting in dimensional differences in current and previous parts and it is essential that all the pulleys and the fan belt are of a corresponding type.

For ease of identification the current and previous outside diameters of the pulleys are as follows :—

Part	*Previous Outside Diameter*	*Current Outside Diameter*
Water pump pulley	5.27 ins. (133.9 mm.)	4.5 ins. (113 mm.)
Generator pulley	5.27 ins. (133.9 mm.)	4.5 ins. (113 mm.)
Crankshaft pulley	9.00 ins. (228.6 mm.)	7.52 ins. (189.7 mm.)

Power steering kits, supplied for fitting this option to tractors not so equipped contain a modified water pump pulley. If this kit is to be fitted to tractors prior to Engine No. 1308977 it will also be necessary to change the generator and crankshaft pulleys and to fit a new fan belt of the narrow type to match the narrow pulley supplied for the water pump.

FAN BLADES

During the time that the Fordson Major series of tractors have been in production various types and diameters of fan blades have been used on diesel engine models.

The table at the base of this page shows the correct usage of these parts and will assist identification should it be necessary to fit new parts.

TEMPERATURE GAUGE

The water temperature gauge fitted to Mk. III engines is combined in one instrument with the oil pressure and generator warning lights.

To Remove the Water Temperature Gauge (Mk. III)

1. Disconnect the temperature gauge bulb from its location at the front left-hand side of the cylinder head.

2. Release the capillary tube from the retaining clips.

3. Remove the steering wheel and the throttle operating lever.

4. Remove the three screws retaining the instrument panel and reise the panel sufficient to detach the knurled nuts retaining the gauge. (It will be necessary to remove a grease nipple located on the steering column, to allow the panel to be raised sufficiently).

5. Remove the generator, oil pressure warning and water temperature lighting bulbs complete with holders from the rear of the gauge.

5. Remove the gauge, feeding the capillary tube and bulb carefully up through the steering column bore in the fuel tank.

To Replace the Water Temperature Gauge (Mk. III)

1. Feed the capillary tube and bulb down through the steering column bore in the fuel tank and locate the gauge in the instrument panel.

2. Replace the bulb holders in their correct locations, i.e. holder with violet covered wire to oil side of gauge, holder with yellow and white covered wire to generator side, and holder with yellow and red wire to central, or gauge illumination position.

3. Refit the knurled nuts to retain the gauge in position.

4. Refit the three panel retaining screws, throttle control lever, grease nipple and steering wheel.

5. Refit the temperature gauge bulb in the cylinder head and retain the capillary tube in its appropriate clips.

Model	*Territory*	*15 in. Dia. 2 Blade Inner*	*17 in. Dia. 2 Blade Inner*	*17 in. Dia. 2 Blade Outer*	*18 in. Dia. 2 Blade Inner*	*18 in. Dia. 2 Blade Outer*
PART No.		E1ADDN-8607-A	E1ADDN-8607-B	E1ADDN-8606	508E-8607	508E-8606
Mk. I DIESEL	DOMESTIC	*				
	TROPICAL				*	
Mk. 11 DIESEL	DOMESTIC	*				
	TROPICAL				*	
Mk. III DIESEL	DOMESTIC		*			
	TROPICAL		*	*		
1800 R.P.M. DIESEL	DOMESTIC				*	
	TROPICAL				*	*

Fig. 62
Fan Blade Usage and Identification

	ENGINES FROM Eng. No. 1217101 to Eng. No. 1425095	*ENGINES FROM Eng. No. 1425097 to Eng. No. 1481090*	*ENGINES FROM Eng. No. 1481091 to Eng. No. 1599501*	*FROM Eng. No. 1599502 onwards*
Type of engine	Vertical in line, 4-stroke			
Number of cylinders	Four			
Stroke	4.524 to 4.528 in. (114.91 to 115.011 mm.)			
Bore	3.937 to 3.938 in. (100 to 100.023 mm.)			
Cubic capacity	220.35 c ~in (3,611 c.~.)			
Maximum B.H.P.	40.5 at 1,600 r.p.m. (with accessories less fan)	44 at 1,600 r.p.m. (with accesscries less fan)	51.8 at 1,600 r.p.m. (less ancillaries)	
Maximum torque	140 lb. ft. (19.348kg.m.) at 1,150 r.p.m.	148 lb. ft. (20.45 kg.m.) at 1,150 r.p.m.	171 lb. ft. (23.63 kg.m.) at 1,200 r.p.m.	
Compression ratio	16 : 1			
Firing order	1, 2, 4, 3			
Camshaft				
Cam lift	0.258 in. (6.55 mm.)	0.305 in. (7.75 mm.)	0.258 in. (6.55 mm.)	0.255 in. (6.48 mm.)
Camshaft end-float	0.003 to 0.008 in. (0.076 to 0.203 mm.)			0.005 to 0.021 in. (0.127 to 0.533 mm.)
Cylinder liners	Replaceable wet type retained by pressure of cylinder head through gasket			
Liner protrusion (above top face of block)	0.002 to 0.004 in. (0.051 to 0.102 mm.)			
Pistons	Solid skirt aluminium alloy, 100 mm. dia. Combustion chamber machined in piston crown	Solid skirt aluminium alloy, 100 mm. dia. Combustion chamber machined off-set in piston crown		
	1.250 in. (31.75 mm.) dia. piston pin bore	1.375 in. (34.9 mm.) dia. piston pin bore		
Oversizes	0.0025 in. (0.0635 mm.)			
Piston pin type	From Eng. No. 1362380 Solid pin fully floating retained by end circlips	Hollow pin fully floating retained by end circlips		
Outside diameter	1.2496 to 1.2499 in: (31.74 to 31.8747 mm.)	1.3747 to 1.375 in. (34.917 to 34.925 mm.)		

This replaces Section 1, issued August 1959. Please destroy previous issue.

	ENGINES FROM Eng. No. 1217101 to Eng. Nu. 1425096	*FROM Eng. No. 1425097 to Eng. No. 1481090*	*FROM Eng. No. 1481091 to Eng. No. 1609838*	*FROM Engs. No. 1609839 Onwards*
Piston Rings				
Ring gap—Compression	0.011 to 0.016 in. (0.279 to 0.406 mm.)			
—Oil control	0.011 to 0.016 in. (0.279 to 0.406 mm.)'			
Number of compression rings	3			
Number of oil control rings	2			
Width of piston rings—Compression mean	0.0933 in. (2.370 mm.)			
—Oil control mean	0.187 in. (4.75 mm.)			
Ring to groove clearance—Compression	0.0014 to 0.0034 in. (0.035 to 0.086 mm.)			
—Oil control	0.0015 to 0.0035 in. (0.0381 to 0.0883 mm.)			
Valves				
Valve clearance :				
Inlet hot	0.015 in. (0.381 mm.)			
Exhaust	0.015 in. (0.381 mm.)			
Exhaust with rotator cap	0.012 in. (0.305 mm.)			
Angle of valve head	29° 30'			29° 15' to 29" 30'
Angle of valve seat in head	30"			30" to 30° 30'
Valve Springs				
Number of coils	8.8			7.5
Free length	2.48 in. (62.99 mm.)			2.31 in. (58.67 mm.)
Compressed length and load	1.98 in. at 45 to 50 lb. (50.3 mm. at 20.4 to 22.7 kg.)			1.97 in. at 62 to 68 lb. (50.04 mm. at 28.12 to 30.84 kg.)
Push rod length	11.9 in. (302.26 mm.)	11.8 in. (299.72 mm.)		
Crankshaft				
End-float	0.002 to 0.010 in. (0.051 to 0.254 mm.)			
Maximum run-out at flywheel clutch face	0.005 in. T.I.R. (0.127 mm.)			
Cooling System				
Water pump	Belt drive, vane-type centrifugal pump			
Thermostat	Non-shrouded bellows type	Shrouded by-pass bellows type		
Fan 90" and below	2-blade, 15 in. dia. (38.10 cm.)			2-blade, 17 in. dia. (43.18 cm.)
Fan above 90°F.	2-blade, 18 in. dia. (45.72 cm.)			4-blade, 17 in. dia. (43.18 cm.)
Lubrication System				
Sump capacity	13 Imp. pints	12.5 Imp. pints		
Oil filter *(dry)*	1¼ Imp. pints (approx.)	1 Imp pint (approx.)		
Oil pump type	Spur gear submerged (pressure relief valve in engine mounting plate location)	Spur gear submerged (pressure relief valve in pump cover)		

	ENGINES FROM Eng. No. 1217101 to Eng. No 1425096	*FROM Eng. No. 1425097 to Eng. No. 1481090*	*FROM Eng. No. 1481091 to Eng. No. 08C740000 approx.*	*FROM Eng. No. 08C740000 approx. Onwards*
Relief valve spring free length	(Serviced as a valve assembly)	1.44 in. (36.58 mm.)		1.54 in. (39.12 mm.)
Length under load	0.75 in. at 9.8 to 10.8 lb. (19.05 mm. at 4.45 to 5.39 kg.)			0.75 in. at 11 to 12 lb. (19.05 mm. at 4.99 to 5.44 kg.)
Oil pump pressure	30 to 40 lb./sq. in. (2109 to 2812 gm./sq. cm.)			
Grade of lubricant:				
Temperature Range		*Grade of lubricant*		
From 0° to 20°F. (—18°C. to —7°C.)	S.A.E. 10 H.D. or S.A.E. 10W H.D.			
From 20" to 90°F. (—7° to 32°C.)	S.A.E. 20 H.D. or S.A.E 20W/30 H.D.			
Over 90°F. (over 32°C.)	S.A.E. 30 H.D.			

Torque Tightening Figures

Main bearing cap screws—⅝ in. dia.	95 to 100 lb. ft. (13.13 to 13.82 kg.m)			
— ½ in. dia.	70 to 75 lb. ft. (9.674 to 10.365 kg.m)			
Connecting rod nuts	55 to 60 lb. ft. (7.601 to 8.292 kg.m.)			
Cylinder head screws	85 to 90 lb. ft. (11.747 to 12.438 kg.m.)			
Flywheel to crankshaft screws	80 to 90 lb. ft. (11.056 to 12.438 kg.m.)			
Rocker cover screws	3 to 4 lb. ft. (0.415 to 0.553 kg.m.)			
Auxiliary drive shaft gear retaining nut	60 to 70 lb. ft. (8.292 to 9.674 kg.m.)			
Front mounting plate screws—⅜ in. dia.	22 to 24 lb. ft. (3.040 to 3.316 kg.m.)			
— 5/16 in. dia.	15 to 17 lb. ft. (2.073 to 2.349 kg.m.)			
Camshaft gear screws—3 bolt fixing	18 to 21 lb. ft. (2.487 to 2.902 kg.m.)			
--centre bolt fixing	95 to 100 lb. ft. (13.13 to 13.82 kg.m.)			
Mk. I oil pressure relief valve assy.	20 to 25 lb. ft. (2.764 to 3.455 kg.m.)			