David Brown®

Service Repair Manual

CROPMASTER, 30C, 30D, 25, 25D and 900 TRACTORS

Pub. 9-38108 (DBT 475) December 1960 reprinted June 1983

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A Tenneco Commpany
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DIESEL ENGINE

Series CAD4/30 AD4/30H AD4/25 and AD4/25H

AD4/25

The construction of the David Brown AD4/25 diesel engine is basically similar to the earlier David Brown diesel engine, except that a direct mounted fuel injector pump is fitted.

CAD4/30

The construction of the David Brown CAD4/30 diesel engine is basically the same as the AD4/25 diesel engine with the exception of the larger bore cylinder liners, increased diameter piston assemblies, cylinder head gasket and the fuel injection pump.

AD4/25H and CAD4/30H

These engines are of similar construction as the previous series except that a DPA rotary type fuel injection pump is fitted.

To Adjust the Valve Clearances

IMPORTANT.—The valve clearances of all diesel engines are 0·015 in. hot, for both the inlet and the exhaust valves. It is important to adjust the clearances accurately and in the following sequence or damage to the pistons or valves may result.

1. Start the engine and run at a steady speed until the normal working temperature of 180°F. is reached, and then stop the engine and remove the bonnet sides and top.
2. Remove the two nuts securing the rocker box cover. Remove the cover taking care not to damage the gasket.
3. Raise the decompressor lever and turn the engine with the handle until the 1/4 T.D.C. marking on the flywheel is opposite the pointer on the clutch housing. Lower the decompressor lever and check that number one cylinder inlet and exhaust valves are fully closed, if they are open, turn the engine a further complete revolution until the flywheel marks 1/4 are again opposite the pointer.
4. Ensure that number one exhaust valve is clear of the decompressor cam and adjust the number one inlet and exhaust valves to 0·015 in. by means of the ball ended adjusting screws "B" Fig. 1. When the correct clearance is obtained tighten the locknut "A", Fig. 1.
5. Turn the engine exactly half a revolution and adjust number two cylinder inlet and exhaust valve clearance. Turn the engine a further half revolution (this brings the flywheel again to the 1/4 T.D.C. position), and adjust the clearance of number four cylinder inlet and exhaust valves. Turn the engine a further half revolution and adjust the valve clearances of number three cylinder.

Always finally recheck the clearances when the engine has started and normal working temperature is reached. Whenever the cylinder head bolts are tightened the valve clearances must be rechecked.

NOTE.—In no circumstances must the engine be operated with incorrect valve timing or valve clearances.

N.B.—Should difficulty arise when adjusting the valve clearances after re-seating the valves, this may be caused by the lever on the rocker arm making contact with the flat of the decompressor shaft. In this instance the rocker arm should be removed and metal removed from the rocker arm lever.

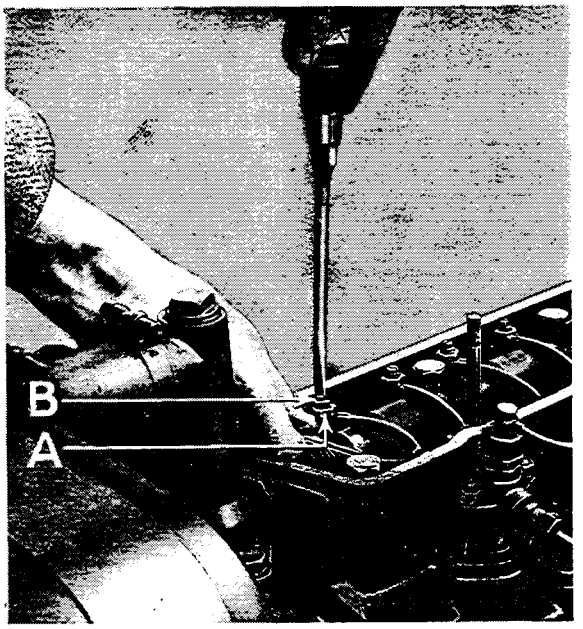


Fig. 1. VALVE CLEARANCE ADJUSTMENT
A. Locknut B. Adjusting Screw

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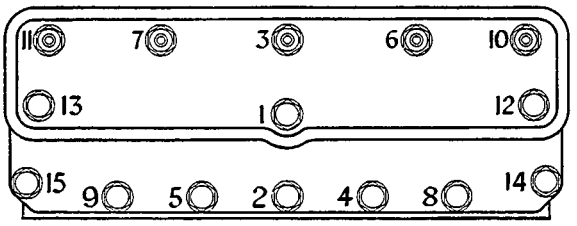


Fig. 2. CYLINDER HEAD TIGHTENING SEQUENCE

Cylinder Head Bolts Tightening Sequences

It is important that the cylinder head bolts are tightened *progressively* in the tightening sequence shown in Fig. 2 and the torque wrench set to 90 lb. ft.

The cylinder head bolts should be progressively retightened after the first 25 operational hours of a new engine and each time the valve clearances are subsequently readjusted whilst the engine is hot.

To Remove and Clean the Engine Breather

The combined crankcase and valve cover breather is easily detachable for inspection and cleaning, being a push fit on an extension sleeve in the valve cover. The breather should be cleaned with petrol and allowed to dry.

If the breather is choked or broken it should be renewed, when the element is in good condition apply a few drops of engine oil before replacing.

Removal of the breather provides access for fitting the eye lifting bolt when removing the engine from the frame.

To Remove, Clean and Replace the Air Cleaner

1. Remove the air cleaner base and clean the oil container. Disconnect the hose clips securing the intake connection to the manifold. Remove the two $\frac{5}{16}$ in. B.S.F. bolts securing the bracket to the main frame. Remove the air cleaner complete with bracket.

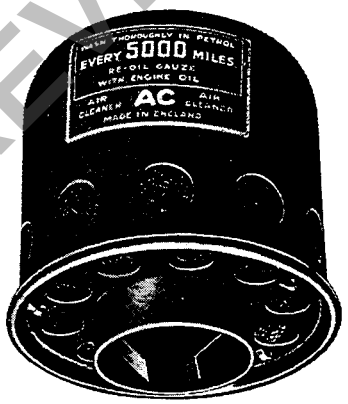


Fig. 3. ENGINE BREATHER

NOTE.—If the air cleaner is removed with the base attached it should be maintained in an upright position to avoid any loss of oil.

2. To clean the element invert the air cleaner, after removing the pre-cleaner and the base, and flush the element with clean paraffin. Clean the tubes and the air pre-cleaner and allow the element to dry. Apply new engine oil to the element and allow it to penetrate the element by leaving the cleaner inverted for several minutes. Thoroughly clean the exterior of the cleaner.

3. Refitting the air cleaner is in the reverse order to the removal instructions in paragraph 1. Ensure that the hose joints are secure and refill the container to the correct level with new engine oil.

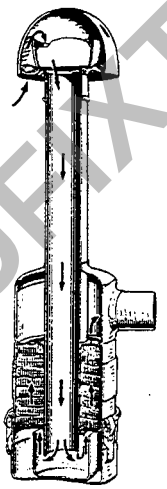


Fig. 4.
AIR CLEANER AND PRE-CLEANER

The directional arrows indicate the direction of air flow. It is important that the oil bowl is maintained at the correct level as indicated by the bead. Use only new engine oil.

N.B.—The centrifuge type pre-cleaners are selectively fitted to individual engine units and must not be interchanged. Ensure the deflector vanes are at the correct angle and are not obstructed or damaged.

To Remove and Replace the Manifolds

1. Remove the air cleaner and disconnect the throttle control rod at the actuating lever ball joint. Disconnect the vacuum pressure pipe from the venturi union. Remove the high pressure fuel pipe lines from the fuel pump and injectors.

2. To remove the air intake manifold, remove the four special brass nuts securing the manifold to the cylinder head. Remove the special washers and remove the air intake manifold complete with venturi unit.

3. To remove the exhaust manifold, disconnect the vertical pipe and silencer by releasing the locknut and locating screw in the support sleeve. Remove the special brass nuts and washers securing the exhaust manifold to the cylinder head and remove the manifold.

   Remove the manifold gasket.

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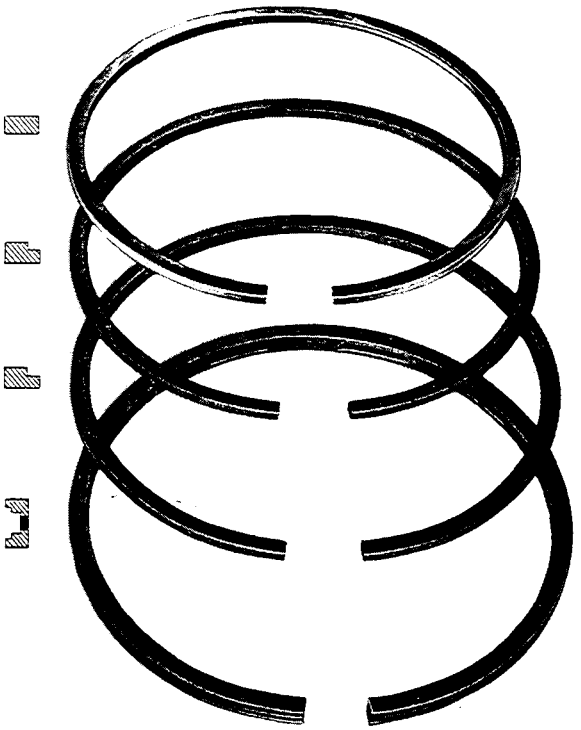


Fig. 16. PISTON RINGS AND CROSS SECTIONS

3. Carefully push the piston out of the cylinder until the piston rings are clear of the bore. Remove the piston and connecting rod completely.

4. The piston and connecting rod is installed in the reverse manner to that of removal. A piston ring compressor tool is required to enter the piston rings in the cylinder bore and care should be taken to ensure that the piston ring gaps are equidistantly spaced.

   Note that the piston is positioned correctly with the toroidal cavity directly below the injector port.

   New connecting rod bolts, nuts, and locking washers should also be fitted.

   The connecting rod bearing bolts are tightened to 40 lb. ft.

5. The big end shell bearings may be removed and inspected after removing the bearing caps (2), this does not necessitate the removal of the pistons but when the pistons and connecting rods are removed the crank pin journals and the bearings should always be examined.

   Caution. **When the connecting rods are detached from the crankshaft do not allow the piston to drop farther down the bore and release the oil control ring.** If this occurs the piston rings cannot be re-entered in the cylinder and damage to the piston or piston rings may result. In these circumstances the oil control ring should be removed and the piston withdrawn from the top of the bore before refitting.

6. The bearing liners (copper-lead steel backed shells) should be renewed if the bearing surface is pitted, scored, worn or discoloured. Ensure that the correct size liners are replaced by comparing the identification numbers stamped on the back. When refitting liners always ensure that the locating lugs are correctly located and the oil ways are clear, tighten the bearing bolts securely.

   Precaution. Each piston, connecting rod and bearing cap should be retained as one unit and regarded as non-interchangeable. They should be marked with the cylinder number and always replaced in the same order.

To Examine the Connecting Rod Big End Bearings without Removing Pistons.

NOTE.—The individual big end bearing shells may be examined after removing only the sump. By turning the engine until the particular bearing is at its bottom dead centre position, the bearing is accessible.

1. After removing the sump, turn engine until bearing is at B.D.C. POSITION. Release cap bolts and remove the bearing cap and lower half bearing.
2. To examine the upper half bearing, push the piston slightly up the bore until the shell can be removed from the connecting rod.
3. The bearings are replaced in the reverse manner to the removal sequence. Tighten cap bolts to 40 lb. ft.

To Detach the Piston from the Connecting Rod

1. Remove the piston and connecting rod.
2. Remove the gudgeon pin retaining clips.
3. Immerse the piston and gudgeon pin in hot oil and push out the gudgeon pin; this is a push fit in the piston at normal working temperature.
4. The piston and connecting rods are reassembled in the reverse order. Care must be taken to position the piston correctly and new circlips should be fitted when the gudgeon pin has been installed.
5. When the connecting rod is removed, the small end bush may be examined and renewed if necessary.
   If new bearings are required the piston and connecting rod alignment checked.

To Remove, Examine and Fit the Piston Rings

1. Remove the pistons and connecting rods.
2. Using a suitable expander tool remove the piston rings from the grooves. Number one is a plain compression ring, the second and third are internally stepped compression rings fitted with

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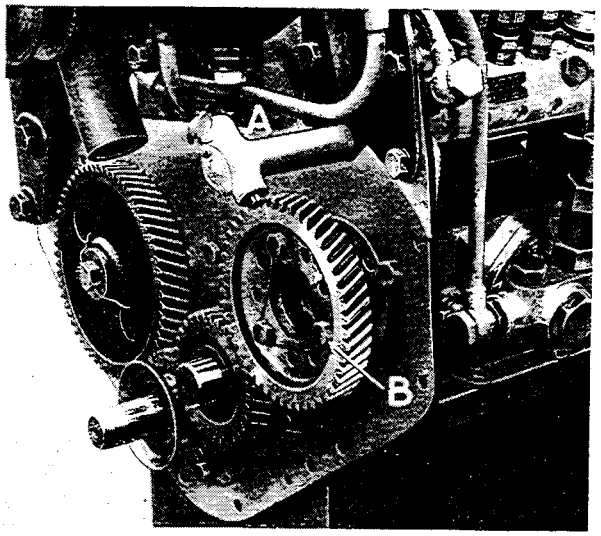


Fig. 72. FUEL PUMP COUPLING

A. Excess Fuel Device B. Timing Adjustment Bolts

4. Position pump drive gear so that one set of the three dowel bolt locating holes are co-incident.

   N.B. There are 48 teeth on the pump drive gear, that is equal to $7\frac{1}{2}°$ variation per tooth. The holes in the gear are grouped at 38° and the holes in the flange coupling at 40°.

1st variation in coincidence..	Nil
2nd variation in coincidence	2°
3rd variation in coincidence	4°

   Minimum error in timing alignment is therefore $1\frac{1}{2}°$ ($7\frac{1}{2}°$-6° total error).

5. Secure drive gear and secure the bolts with locking wire. Tighten the centre flange coupling nut to 30 lb. ft. and replace the timing cover.

6. Reconnect the governor pipe, the fuel pipes and the fuel cut-off control. Refit the air cleaner assembly and reconnect the high pressure fuel lines. Ensure that there is ample fuel in the tanks and prime the system as detailed on page 39. Check the operation of the fuel pump by starting the engine.

   NOTE.—The correct injector pump timing is set with the spill cut-off point 25° B.T.D.C. The moment of actual injection is 20° to 22° B.T.D.C.

To Spill-Time the Fuel Injector Pump

If the pump is mounted on the Hartridge test machine, the fuel is supplied to the fuel gallery or suction chamber of the pump by gravity feed. When the pump is mounted on the engine, slackening the front filter vent plug will ensure that the pressure at the suction chamber is by gravity feed.

1. Set the control rod in any position from half to full travel. The normal full rack position can be used with the pneumatic governed type.

2. Remove No. 1 delivery valve holder after disconnecting the high pressure fuel line (if fitted). Remove the spring and the delivery valve. DO NOT remove the *valve seat*.

3. Replace the valve holder only.

4. Flow fuel through the suction chamber with No. 1 cam at the bottom of its stroke.

5. Turn the pump camshaft in the direction of rotation until fuel ceases to flow from the valve holder orifice. *Immediately* this occurs the camshaft must be held in that position. Where applicable a line should be scribed on the coupling to correspond with the scribed line on the timing indicator or the centre line of the pump driving end plate.

6. The fuel supply should now be turned off and No. 1 delivery valve holder removed. The delivery valve and spring are refitted and the valve holder tightened to 50 lb. ft.
   Ensure that these components are perfectly clean when refitting.

TO PHASE AND CALIBRATE THE INJECTION PUMP

Servicing the Fuel Injector Pump

Operations covering the servicing and repair of the injector pumps must only be carried out by repairers having the necessary special equipment, or by one of the manufacturers' depots or agents. If it is necessary to fit new components to the pump it must be completely checked and readjusted in the following manner before refitting to the engine.

Phasing and Calibration

Before commencing to rephase and calibrate the fuel pump the following points should be noted.

1. Number 1 element of the pump is nearest the front and is timed to number one cylinder of the engine. The remaining pump elements are timed in sequence to number one element.

2. A minimum working clearance of 0·3 mm. (0·012 in.) must always be maintained between the top of the plunger at the top of its stroke, and the face of the delivery valve seat. The desirable working clearance is 0·5 mm. (0·020 in.) and this is used for the initial phase setting.

3. Phasing of the fuel pump is to ensure that the fuel is injected into each cylinder at regular equiangular intervals. In a four-cylinder engine the interval is 90° (rotation of the pump drive shaft) with a tolerance of $\frac{1}{2}°$ maximum rotational error.

4. Adjustments in the phasing of the pump elements are made at the plunger tappet adjustment screw. An adjustment of one "flat" on the tappet adjusting screw equals 1°. One complete turn of the adjusting screw equals 1 mm. Always ensure that the locknut is tightened after each adjustment.

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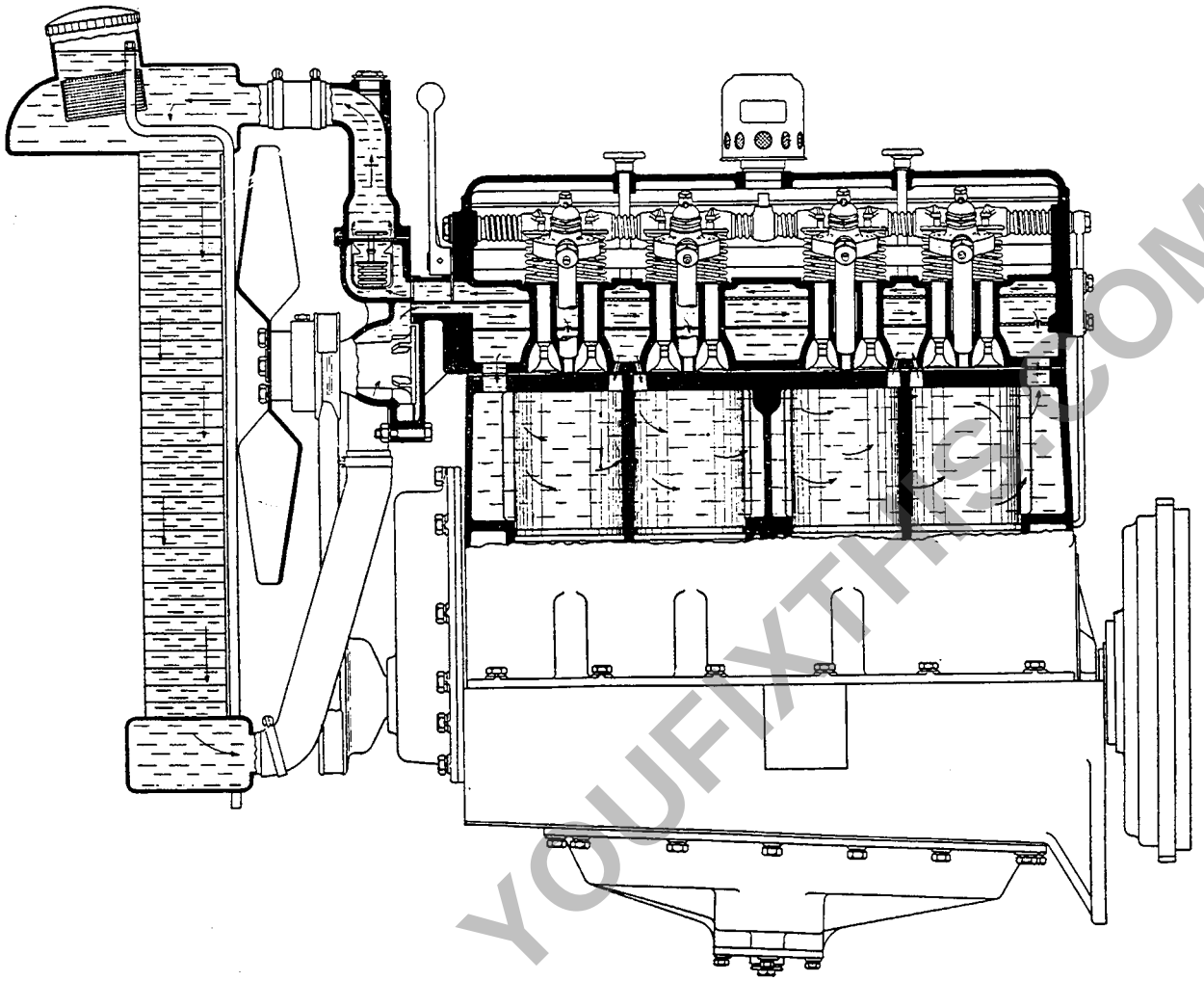


Fig. 47. THE COOLING SYSTEM

2. Prepare 4½ gallons of soft, clean HOT water and add 1¾ lb. of caustic soda. Turn the drain taps off and refill the cooling system with this solution. Start the engine and run at normal working temperature for 15 minutes. Stop the engine and drain the cooling system.
3. Disconnect the hose from the radiator header tank and the water pump stand pipe. Remove the thermostat valve and with a suitable length of hose, entered into the thermostat housing and connected to a supply of clean water, flush out any sediment remaining in the cylinder block. After flushing in this way, enter the hose in the radiator header tank and flush out the radiator block.

   Replace the thermostat valve and refit the water pump stand pipe; renewing the gasket to ensure a watertight joint. Reconnect the hose from the radiator header tank to the water pump stand pipe. Check the tightness of all the hose joints, turn off the drain tap and refill the cooling system with clean soft water.

   After starting the engine, examine all the joints and hose connections for water leaks.

NOTE.—Care should be taken when flushing the cooling system to avoid splashing the caustic soda solution on to the hands or the tractor paint work.

Radiator Blind Adjustment

The radiator blind is adjusted by pre-tensioning the blind roller as described on page 30.

If the operation of the blind is suspect inspect the cord for wear and if any signs of fraying are apparent renew the cordage. The new cord should be the same length as the one removed to ensure the correct operation of the blind.

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KEROSENE AND GASOLINE ENGINES

All series kerosene and gasoline engines are of the same basic construction. The replaceable wet cylinder sleeves being bored to either $3\frac{1}{2}$ in. (88·9 mm.) or $3\frac{5}{8}$ in. (92·1 mm.) diameter according to type and the required compression ratio being obtained by the fitting of alternative types of pistons.

When fitting replacement sleeves or cylinder blocks, reference should be made to the special pages at the rear of this section.

To Remove and Fit the Rocker Cover

1. Remove the two hand screws and fibre washers. Lift the cover vertically to avoid fouling the studs.
2. Remove and clean the breather filter on the top of the cover.
3. Disconnect the H-T and L-T cables on the coil (where coil is mounted on rocker cover).
4. To fit, reverse the removal instructions. If the cork joint is damaged, fit a replacement.

NOTE.—Shellacing the joint to the face of the cylinder head will ensure that the joint is held in position.

To Adjust the Valve Clearances

Specified clearance (Engine Hot) shown on plate attached to valve rocker cover. Inlet ·015″ and exhaust ·022″, or inlet and exhaust ·015″, according to type of camshaft fitted to engine.

1. Remove the Rocker Cover.
2. Turn the engine by hand until No. 1 Inlet Valve opens and closes indicating that No. 1 Cylinder is on compression. Give the engine a further quarter turn.
3. Slacken the locknut A, Fig. 1, on the adjusting screw B. Use a screwdriver to adjust the screw for correct clearance and to hold the screw while re-tightening the locknut. After locking, re-check the clearance.
4. Turn the engine a further half-turn to bring No. 2 Cylinder on compression and deal with as described in paragraph 3.
5. Use the same procedure, paragraphs 2, 3, and 4, for Cylinders 4 and 3.
6. Replace the Rocker Cover.

To Remove and Fit the Rocker Gear

1. Remove the Rocker Cover.
2. Disconnect the Rocker Oil Feed Pipe.
3. Remove the eight nuts from the rocker bracket studs. Lift the shaft and brackets vertically off the studs.
4. To fit the Rocker Gear reverse the removal instructions.

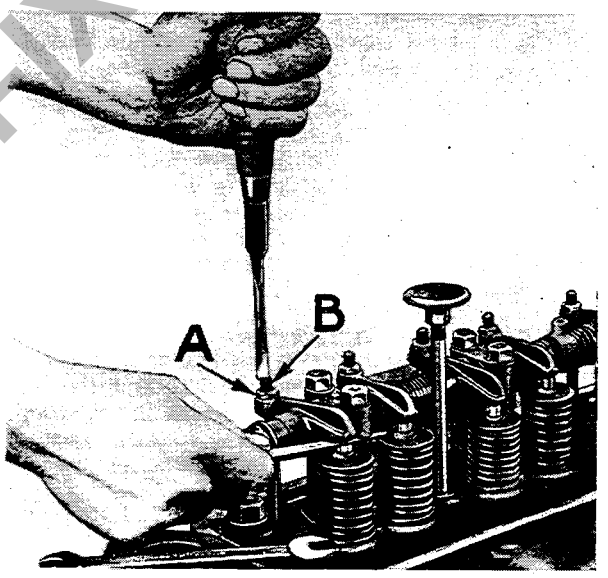


Fig. 1
METHOD OF ADJUSTING VALVE CLEARANCES
A. Locknut B. Adjusting Screw

To Dismantle and Assemble the Rocker Shaft

1. Remove the rocker cover.
2. Remove the rocker gear.

NOTE.—Before dismantling, mark all rockers to prevent interchange when refitting.

If it is not required to completely dismantle the shaft, it may be dealt with in one of two sections, i.e., to left or right of the centre collar "C", Fig. 2.

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FUEL SYSTEM

General Adjustment of the Carburettor

The elements concerned in the adjustment of the carburettor are as follows:—

The choke tube which controls the volume of air supplied at varying velocities to the engine.

The main jet for the normal running range of mixture.

The auxiliary or pilot jet for the idling mixture.

The auxiliary mixture control screw and the slow running screw.

The carburettor is adjusted and set for the best possible performance in a temperate climate at an altitude of less than 3.000 ft. and for normal fuels.

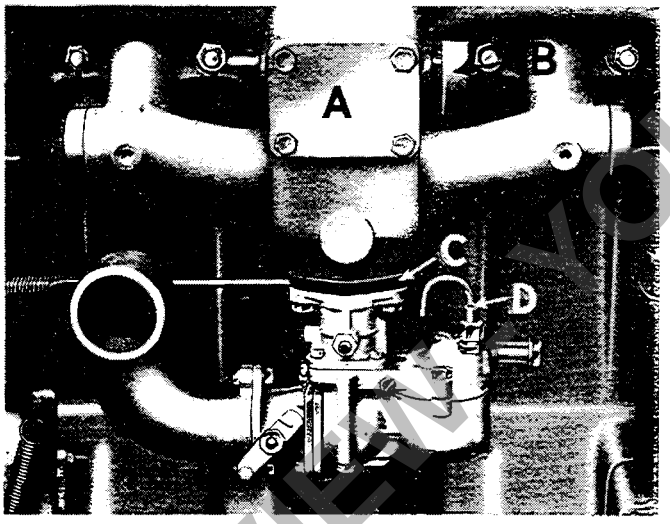


Fig. 48. PETROL CARBURETTOR

A. Hot Spot
B. Flap Control Bop Weight
C. Heat Insulator
D. Vent Pipe

Slow Running Adjustment

The auxiliary jet deals with the idling and its size has been determined with great care.

The slow running adjustment screw is mounted on the abutment plate and limits the closing of the throttle, thus regulating the rate of idling. By rotating the screw clockwise the speed will be increased and *vice versa*. The auxiliary mixture control screw is intended, within certain limits, to regulate the mixture strength. When this is incorrect, the engine tends either to hunt or stall. To carry out this adjustment, commence with the regulating screw fully home and the throttle adjusting screw set to the lowest possible idle, in which circumstance the engine should have a tendency to "hunt". Then rotate the mixture regulating screw anti-clockwise until the engine runs regularly.

CARBURATION

The engine has a specially designed manifold with automatically controlled hot spot.

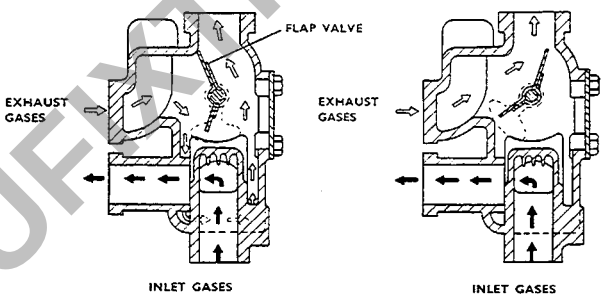


Fig. 49. HOT SPOT FLAP VALVE CONTROL

To Remove and Replace the Float Chamber

1. Disconnect the air cleaner pipe at the air intake elbow.
2. Disconnect the choke control wire.
3. Take out the two square-headed cap screws and the two cap bolts, when the float chamber assembly can be removed leaving the main body of the carburettor attached to the engine.
4. Replace in the reverse order to that of removal.

To Remove and Replace the Choke Tube

1. Remove the float chamber assembly.
2. Take out the dowel screw "U" and remove the choke tube.
3. Replace in the reverse order to that of removal, taking care that the dowel screw registers with the hole in the choke tube.

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6. Detach the check chain from the reduction case inspection cover plate. Remove the plate and allow the oil to drain off.
7. Release the brake and slack off the adjustment.
8. Remove the six remaining cap bolts and nuts securing the reduction casing to the axle casing. Break the joint of the reduction casing by tapping the casing smartly with a copper hammer, and remove the assembly complete, taking care to keep the spur pinion shaft central to avoid damaging the oil seal in the axle casing.

   Caution : Care must be exercised to ensure that the oil seal in the axle casing, Fig. 9, is not damaged when removing and replacing the unit.
9. To install the unit, reverse the instructions for removal.
10. Adjust the brakes.

    Fill the reduction casing to the correct level with a recommended grade of lubricant.

(b) OFFSIDE REDUCTION ASSEMBLY

The same instructions as for the nearside reduction assembly apply to the offside reduction assembly, except that the wiring cable must be disconnected from the rear lamp. It is also important to note that due to the offset axle, more working space is required at the offside of the tractor to ensure that the longer spur reduction shaft may be withdrawn from the axle.

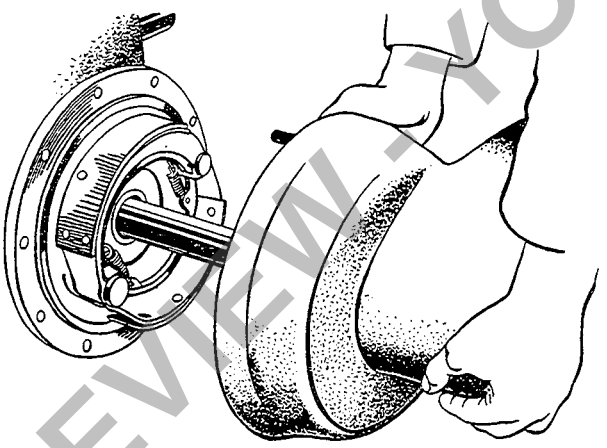


Fig. 6. REMOVING A REDUCTION UNIT

To Remove and Replace Rear Axle Casing

1. Drain the oil from the transmission and the rear axle casings.
2. Remove the top link assembly from the rocking lever.
3. Disconnect the lift arm assemblies from the lift arms, taking care not to lose the floating bush in the lift arm.

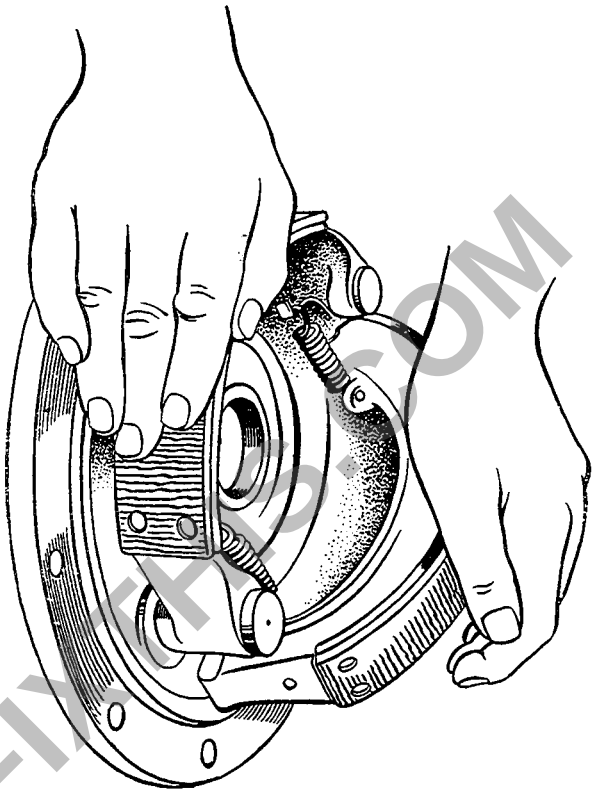


Fig. 7. REPLACING THE BRAKE SHOES

4. Remove the lift arm assemblies and the bottom links.
5. Remove the P.T.O. belt pulley unit and adjustable drawbar hitch.
6. Remove the drawbar and the bottom hitch brackets.
7. Remove the final drive reduction assemblies.
8. Remove the mudguards, the seat assembly and the tool box.
9. Remove the gearbox cover. Disconnect the power lift pressure pipe at the hydraulic cylinder and pump, and release the pipe clips. Disconnect and remove the hydraulic pump valve control rod. Remove the P.T.O. lubricating the pipe.
10. Disconnect the brake rod from the cam levers.
11. Take out the cap bolts and the nuts securing the axle to the main frame.
12. Replace in reverse order to that of removal, taking care to centralise the axle on the four locating lugs machined on the differential carrier caps.
13. Fill the transmission and rear axle casing to level with a recommended grade of oil.
14. Adjust the brakes.

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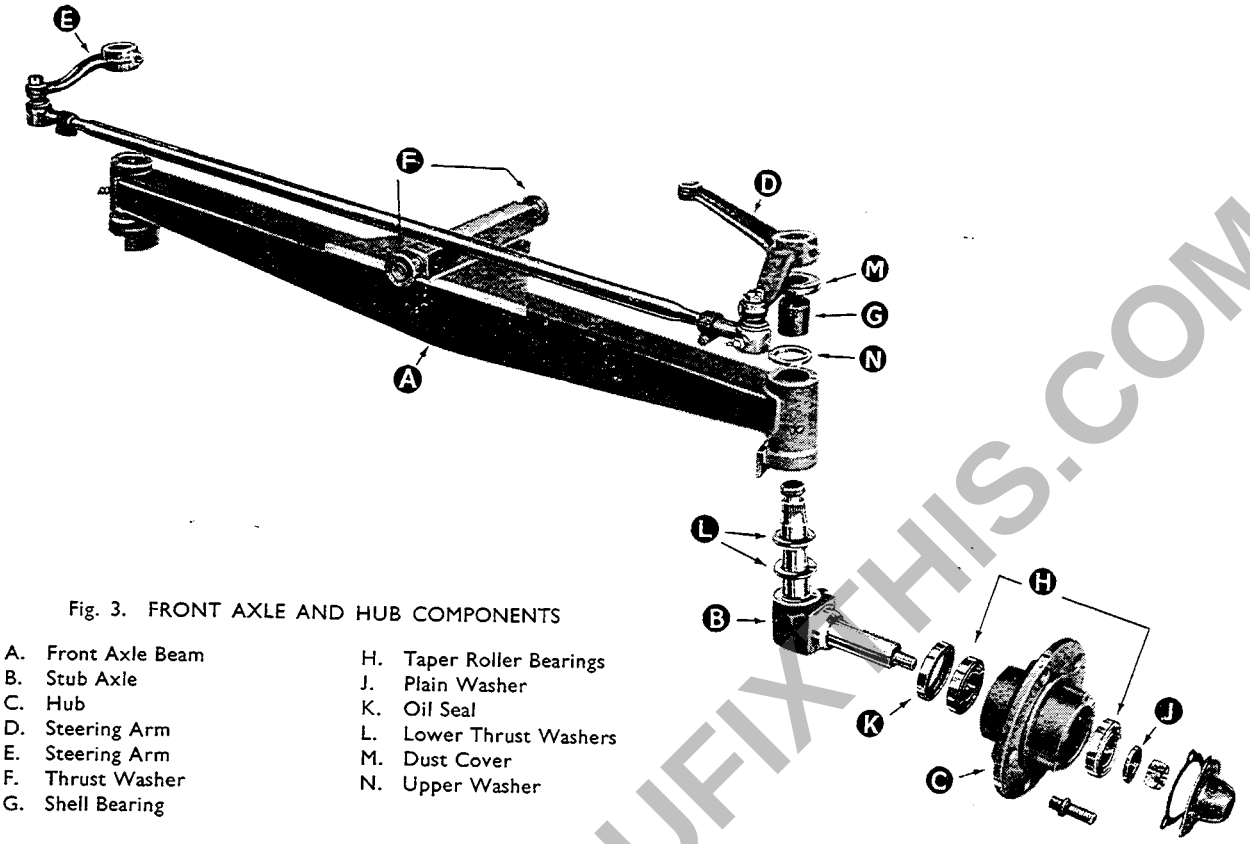


Fig. 3. FRONT AXLE AND HUB COMPONENTS

A. Front Axle Beam
B. Stub Axle
C. Hub
D. Steering Arm
E. Steering Arm
F. Thrust Washer
G. Shell Bearing
H. Taper Roller Bearings
J. Plain Washer
K. Oil Seal
L. Lower Thrust Washers
M. Dust Cover
N. Upper Washer

To Remove and Replace the Front Axle Assembly

1. Place the front wheels in the straight ahead position, place jacks under the engine main frame behind the front axle.

2. Disconnect the side steering rod at the N/S steering lever ball joint ("D", Fig. 3). Lock the front wheels in position by strapping the lever to the axle.

3. Take out six cap bolts securing each trunnion bearing bracket to the underside engine main frame and front extension.

4. Manipulate the jacks so that the load is completely taken off the front axle. Wheel axle complete with trunnion bearing brackets away from under the tractor. Place substantial wood packings under the tractor to support the weight whilst the front axle assembly is removed.

To Renew the Front Axle Trunnion Bushes

5. When the axle assembly is removed the front and rear trunnion bearing brackets may be detached from the trunnion.

6. Press out the worn bushes and examine the trunnion bearing support brackets. Fit new bearing bushes ensuring that the oilway is in line with the lubricator. A press tool should be used for installing the bushes.

7. Examine the trunnions thrust washers "F", Fig. 3. If these show any signs of wear they should be renewed.

8. Examine the trunnion journals and if excessive wear is apparent the front axle should be renewed or returned to the makers for re-conditioning.

9. Replace the components in the reverse order to that of removal. Do not forget to fit the thrust washers at either side of the trunnion.

To Remove the Swivel Pin Bushes

1. Release the front wheel nuts. Raise the wheels off the ground and support the tractor on substantial packings placed under the front axle. Remove the wheel nuts and take off the wheels.

2. Disconnect the drag link at the N/S steering arm "A" Fig. 2, by extracting the split pin and slackening the nut a few turns. Place a pinch bar between the axle and the nut, exert pressure on the bar and at the same time strike the end of the steering arm a smart blow with a heavy hammer. This will cause the taper pin "B", Fig. 2, of the ball joint to "jump" out of the socket. Remove the nut and lift the drag link end up and away from the steering arm, tying it out of the way.

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