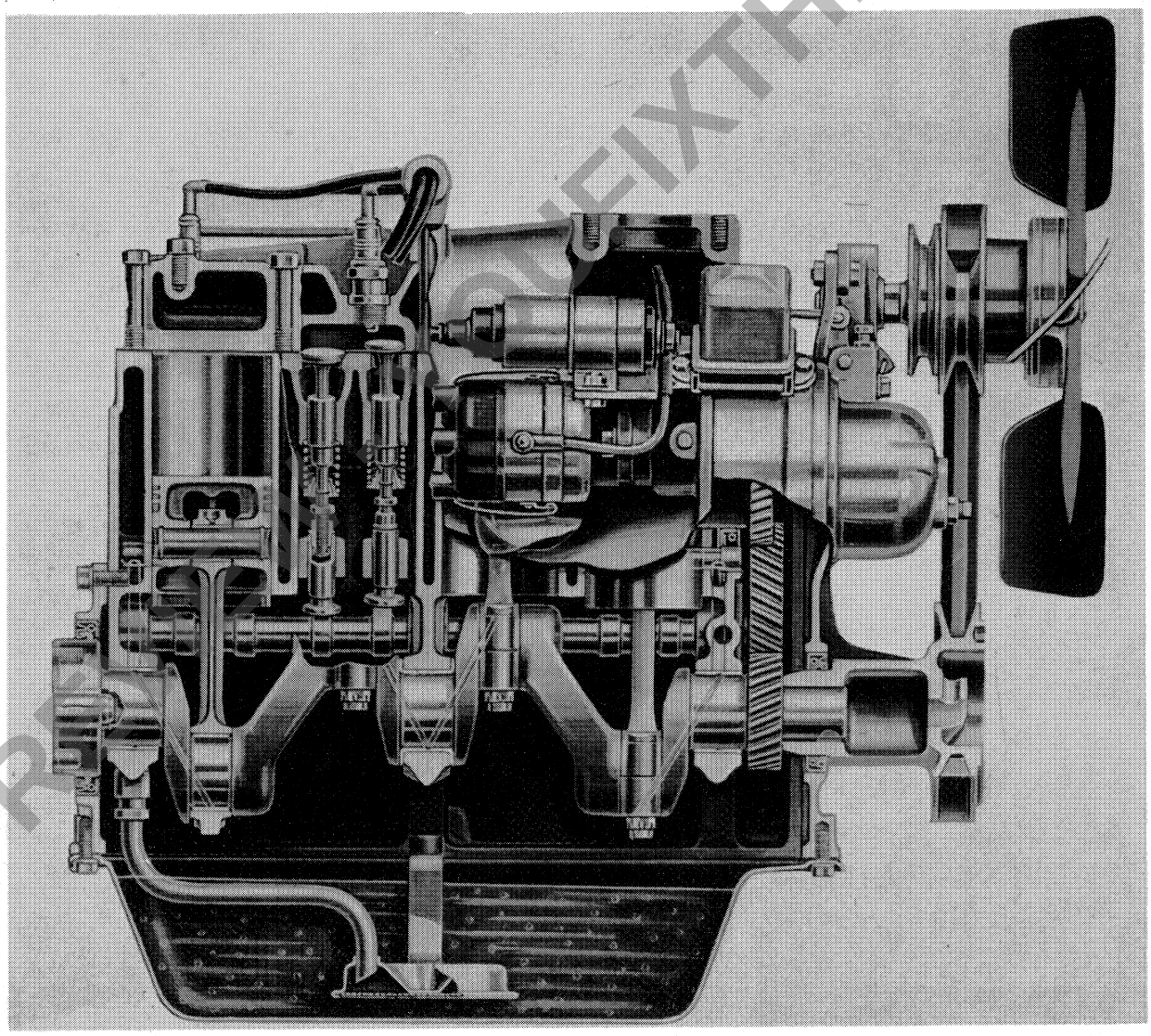
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Illust. 1 -- Cross section of Farmall Cub engine, side view.

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CYLINDER HEAD

SPECIFICATIONS

Material	Gray iron
Cylinder head capscrews:	
Number	15
Diameter	3/8-in.
Tension	40-50 ft. lb.

The cylinder head is a relatively simple casting into which the spark plugs and cooling water outlet are assembled. The 3/8-in. cylinder head capscrews should be turned down evenly a small amount at a time, starting in the center of the head and working toward each end. Use an accurate torque wrench and follow the sequence in Illust. 47 for final tightening of head to prevent distortion of the head or block. Use a new gasket each time the head is replaced. Reuse of an old gasket may result in compression or water leaks.

When this engine is used in high altitudes the compression ratio is raised by the use of a high-altitude cylinder head having smaller combustion chamber cavities. This ratio change is necessary to insure a normal compression pressure in the less dense air at high altitude. The use of this high altitude head at low or normal altitude will result in rough engine operation and compression knocks under load because compression pressure is increased above normal.

Removing Cylinder Head

In order to service connection rods, piston assembly, camshaft, valve tappets or valves, the cylinder head must be removed. To remove the cylinder head only, cooling water must be drained.

1. Remove the hood, the fuel tank, generator, and the water outlet elbow.

2. Remove spark plugs.

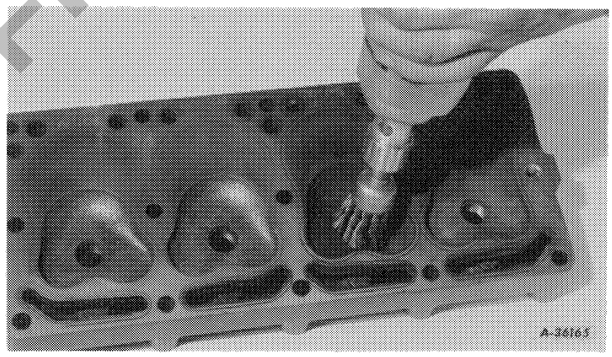
3. Remove the 15 cylinder head capscrews, and lift off cylinder head and gasket.

Inspection and Service

After the cylinder head is removed it should be inspected as follows:

1. Check head and gasket for "blow-by" or compression leaks.

2. Remove carbon from combustion chamber cavities with wire brush. See Illust. 5.



Illust. 5 -- Cleaning carbon from cylinder head.

3. Clean cylinder head combustion cavities with cleaning solution.

4. Carefully inspect head for cracks.

5. Use a straight edge and inspect for warped head, particularly in any area which shows "blow-by."

6. Inspect water jacket in head for an accumulation of rust or lime deposit which would affect circulation of cooling water and cause hot spots. Clean if necessary.

7. Discard old gasket.

8. If cylinder head is satisfactory for further service, set aside and cover to keep clean.

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Utmost cleanliness is necessary when performing service operations because of the precision parts incorporated in the construction of modern tractors. Service work on the tractor engine should always be performed in the dealer's shop, where parts and surroundings can be kept clean and where service equipment is adequate. Before starting any major service work, the tractor should be steam cleaned and each individual part should be cleaned as soon as removed. Be sure you have all necessary tools and equipment. Proceed as follows to remove the engine:

1. Drain water, crankcase, oil and Touch-Control reservoir.

2. Disconnect battery cables (at battery) and headlight wires.

3. Remove air intake cap and radiator grill. (On old model Cub tractors the vertical muffler will also have to be removed at this time.)

4. Shut off fuel at fuel strainer and remove fuel pipe, hood and fuel tank.

5. Remove water outlet and inlet elbows.

6. Disconnect or remove all control rods and wires extending forward of the clutch housing.

7. Remove muffler and exhaust pipe, Touch-Control manifold and hydraulic pump. Cover openings in manifold, reservoir and hydraulic pump to prevent the entrance of dirt.

8. Remove governor connecting rod, air cleaner, exhaust and intake manifold with carburetor, and oil level gage with breather cap.

9. Remove generator, voltage regulator, fan assembly with belts, magneto or distributor assembly with spark plug wires, and cranking motor.

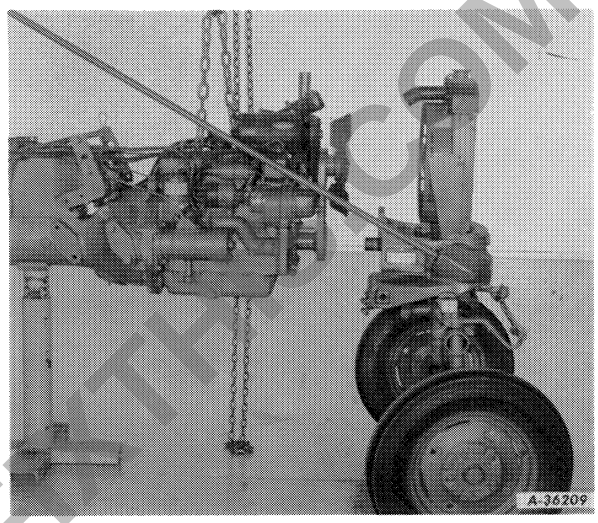
10. Disconnect steering shaft support arm bracket from steering shaft support arm.

11. Remove clutch housing cover immediately below the rear flange of the crankcase oil pan.

12. Attach chain hoist to the engine and adjust to eliminate slack.

13. Use wood blocks between the steering gear assembly housing and the front axle on both sides to eliminate movement on the front axle pivot shaft.

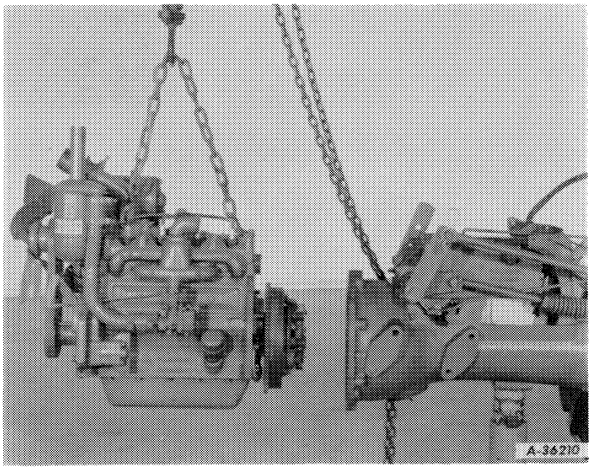
14. Remove the two bolts and two capscrews between the crankcase and steering gear housing. Roll front axle and radiator assembly away from the tractor. See Illust. 3



Illust. 3 -- Front axle and radiator assemblies being removed from tractor.

15. Adequately support the clutch housing and remove the four bolts and two capscrews between the clutch housing and the rear of the crankcase.

16. Separate the engine from the rear section of the tractor at the clutch housing.



Illust. 4 -- Removing engine from rear section of tractor.

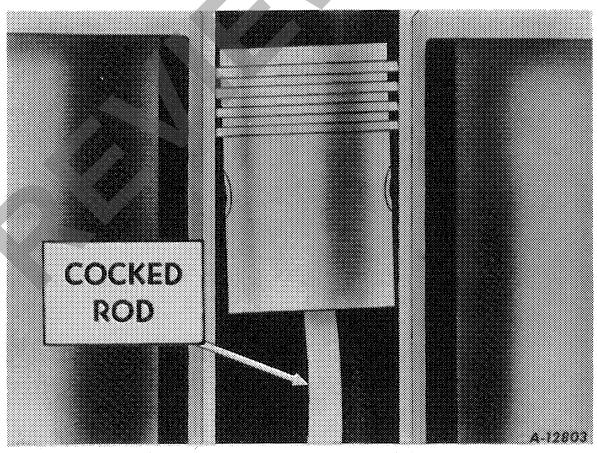
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New bearings furnished through service parts are available in standard size and .002-in. and .003-in. undersize for use with slightly worn standard crankshafts. Also, .030-in. and .032-in. undersize are available for reground crankshafts.

When installing connecting rod bearings be sure the bearing backs and rod surfaces are absolutely clean, smooth, and free from oil. Any foreign material lodged between the bearing back and the rod or cap not only interferes with the dissipation of heat from the bearing but also distorts the bearing and reduces the running clearance between the bearing and shaft. Bearings have a nib or projection which prevents the bearing from turning in the rod, and must be assembled with the nib engaging the milled notch in the rod.

Proper alignment of the connecting rod bearing in relation to the piston pin and piston skirt is most important. Cocked or twisted rods will prevent the piston and rings from contacting the cylinder wall squarely, which will result in oil being pumped up past the rings (see Illust. 7). When rods are badly misaligned a knock may develop, caused by the rod striking the piston boss. This indicates the rod is offset toward the front or rear. The use of a connecting rod aligner is strongly recommended for all engine overhauls to assure a Blue Ribbon quality service job. Always use genuine IH service parts to restore the tractor to "Like new" performance.



Illust. 7 -- Bent connecting rods prevent rings from making proper contact with cylinder walls.

Misalignment of connecting rods may be caused by engine overloads or premature firing. It may also occur during replacement of a piston pin if the bushing is reamed out of parallel with the rod bearing.

Use a good torque wrench when tightening connecting rod nuts. This will prevent distortion of the bearings and also prevent placing undue strain on the bolts. Tighten nuts down evenly from side to side to prevent pinching the bearing insert and to secure proper seating of the bearing cap. These nuts are of the self-locking type.

Piston pin bushings may be replaced in the rod and must be reamed or honed after assembly to obtain a running clearance of .0005-in. on the pin diameter. This is a light push fit with bushing and pin clean and dry (see Illust. 8). Notice that this is a slightly larger clearance than specified for the bore in the piston; thus, after assembling the piston on the rod, the movement will be between the rod bushing and pin only.

Removing Connecting Rods and Bearings

In order to completely service the connecting rods, the crankcase oil and cooling system must be drained; the hood, fuel tank, cylinder head, and crankcase oil pan must be off; and the rods and pistons must be removed from the crankcase. Proceed as follows:

1. Remove crankcase oil pan, oil pump screen and oil screen tube.

2. Check cylinders for ridges at the top of piston ring travel. Ridges must be removed with a ridge reamer before piston and rod assemblies are removed. (See main heading Piston Assembly under Removing and Disassembling Piston Assembly).

3. Remove connecting rod bearing nuts and caps. Be sure to keep bearings and caps with the rods from which they were removed.

Note: It may be desirable to check bearing clearances at this time (see Inspection and Service below).

4. Remove the connecting rod and piston assemblies from the top of the cylinder.

Note: Before removing piston, mark top

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PISTON ASSEMBLY

SPECIFICATIONS

Pistons:	
Material	Gray iron
Length	2-7/8-in.
Clearance in cylinder bore	.0016 to .0024 in.
Use a .001-in. gage 1/2-in. wide as a "go" gage with a light pull of 4 to 6 lb. tension.	
Use a .002-in gage ribbon as a "no go" gauge with a tight pull of 11 to 14 lb. tension.	
Compression rings, 3/32-in. wide, per piston:	
Number	2
Clearance in groove	.0035 in.
Gap	.007 to .017 in.
Oil control rings, 3/16-in. wide, per piston:	
Number	1
Gap	.007 to .017 in.
Clearance in groove	.003 in.
Piston pin (full floating):	
Diameter	.6875 to .6878 in.
Clearance in piston	.0001 to .0003 in.
Clearance in rod bushing	.0003 to .0005 in.
Pin length	2-3/16-in.
Retainers	Snap rings in piston

Piston rings. The two compression rings are the same width but differ in the shape of their cross section. The top ring has a groove cut in the upper inner corner. Always be sure this ring is assembled with the groove up. The lower compression ring has a groove cut in the lower outer corner. This ring must be assembled with the groove down. The oil control ring is mounted in the bottom position on the piston. See Illust. 12.

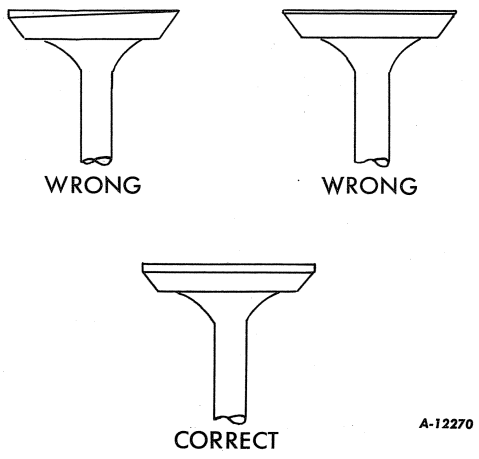
In addition to the regular production rings, there are available replacement piston ring kits which will compensate for a certain amount of piston and cylinder wall wear. If the cylinder bores are not worn more than 0.0105-in. taper from top to bottom of ring travel area (see Illust. 41) or not more than 0.0026-in. out of round (egg-shaped), and the piston ring grooves in the piston are not worn to give more than 0.006-in. ring clearance, additional useful life of these pistons and cylinder bores may be had by installing the compensating ring kits. These replacement ring kits are furnished for both standard pistons and the .020 and .040-in. oversize pistons. If cylinder wall wear exceeds these limits, the cylinder must be bored to take oversize pistons for satisfactory operation and oil control. (See also main heading, Cylinder Block.)

Piston pins. Piston pins are of full floating type, retained in the piston by a snap ring at each end of the bore. The pins are a hand press-fit in the piston and a light pressure

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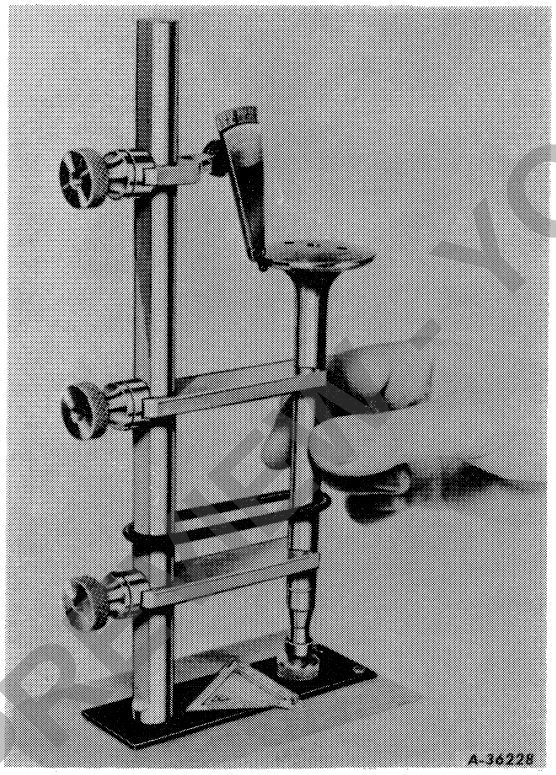
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Carefully check each valve margin after refacing. See Illust. 27.



Illust. 27 -- Valve margins.

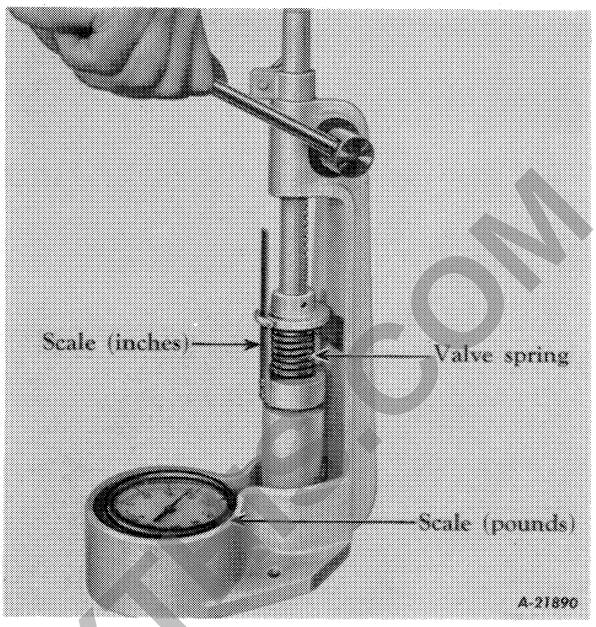
5. Check valve for face and stem "run-out". See Illust. 28.



Illust. 28 -- Checking valve for runout.

6. Check for worn or damaged spring seats and spring seat retainer keys.

7. Check valve springs for proper tension, rust pits and distortion. See Illust. 29.



Illust. 29 -- Checking valve spring tension.

8. Check valve tappet screws for wear and square up as required. Accurate tappet clearance adjustment cannot be accomplished if tappet screws and ends of valve stems are worn or grooved.

9. Clean and visually inspect for broken, cracked or worn valve guides.

10. Press out excessively worn or damaged guides, using care not to damage guide bore in crankcase.

11. Press new guides into crankcase to a measured distance of 1 in. from the top surface of the crankcase to the top center of the guide (see Illust. 42) and ream to .0015 - .0025-in. clearance between valve stem and guide (see Illust. 30).

12. Having cleaned and checked valve seats, use a good valve seat grinder and closely follow manufacturer's instructions for grinding valve seats.

The valve seat angle is 45° and the normal seat width 3/16-in. for both intake and exhaust ports.

Note: Always service valve guides before grinding valve seats. A true valve seat

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CAMSHAFT AND BEARINGS

SPECIFICATIONS

Camshaft:	
Material	Cast iron alloy
Cam surfaces	Flame hardened
Length over-all	15-25/32-in.
Minimum diameter	13/16-in.
Type of drive	Helical gear
Gear tooth face width	3/4-in.
Bearings (bored in crankcase):	
Material	Gray iron
Diameter and length:	
Front	1.8755 x 13/16-in.
Center	1.7505 x 3/4-in.
Rear	0.8755 x 1-in.
Running clearance:	
Front and center	.002 to .0045 in.
Rear	.001 to .0035 in.
End clearance	.003 to .012 in.

The camshaft is mounted in the crankcase without bushings; the bore in the gray iron case forms the three bearing surfaces. End clearance is limited by a retaining thrust plate between the crankcase and the drive gear.

The camshaft extends through the rear bearing bore into the oil pump body. This extended portion of the shaft is smaller in diameter than the rear bearing journal and carries a Woodruff key to drive the oil pump drive gear.

Removal of the camshaft only requires the removal of the engine from the tractor and removal of head, valves, oil pan, flywheel, oil pump, and crankcase front cover from the engine.

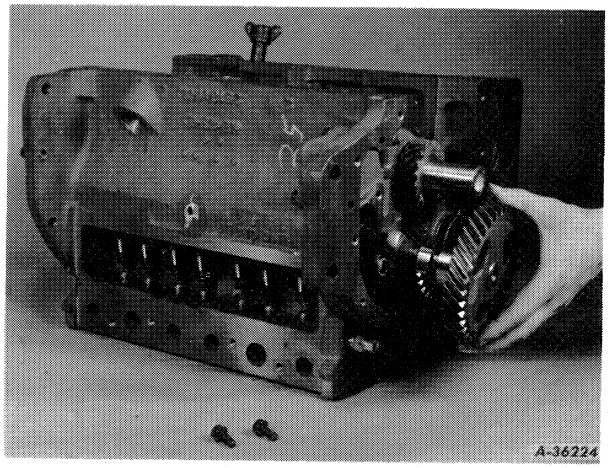
Removing Camshaft

1. Remove oil pump body and gears at rear of camshaft.

2. Remove two 5/16-in. capscrews in the camshaft retainer plate through openings in the cam drive gear.

3. Turn crankcase upside down so tappets will fall away from camshaft to provide clearance for removal.

4. Withdraw camshaft from the front



Illust. 39 -- Removing camshaft from crankcase.

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