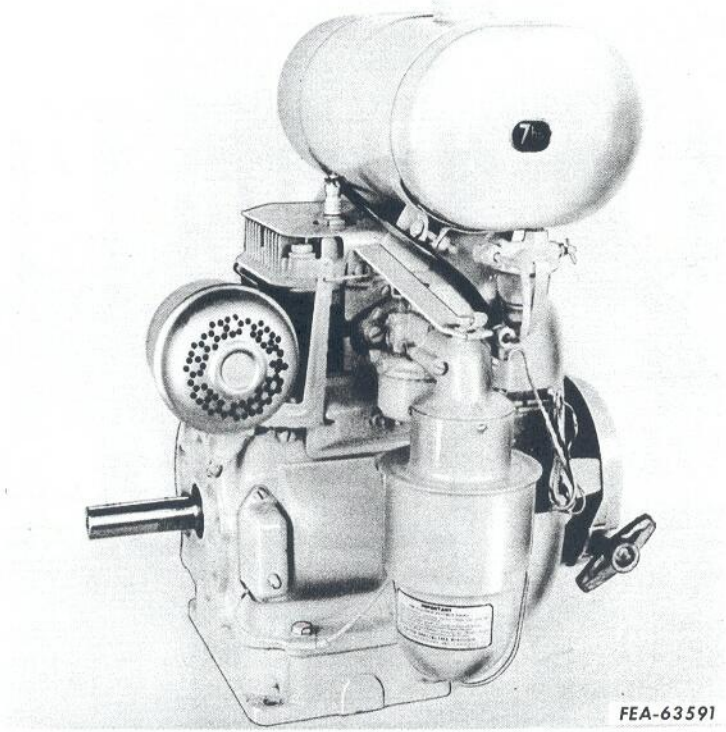
Blue Ribbon Service

Form GSS-1292

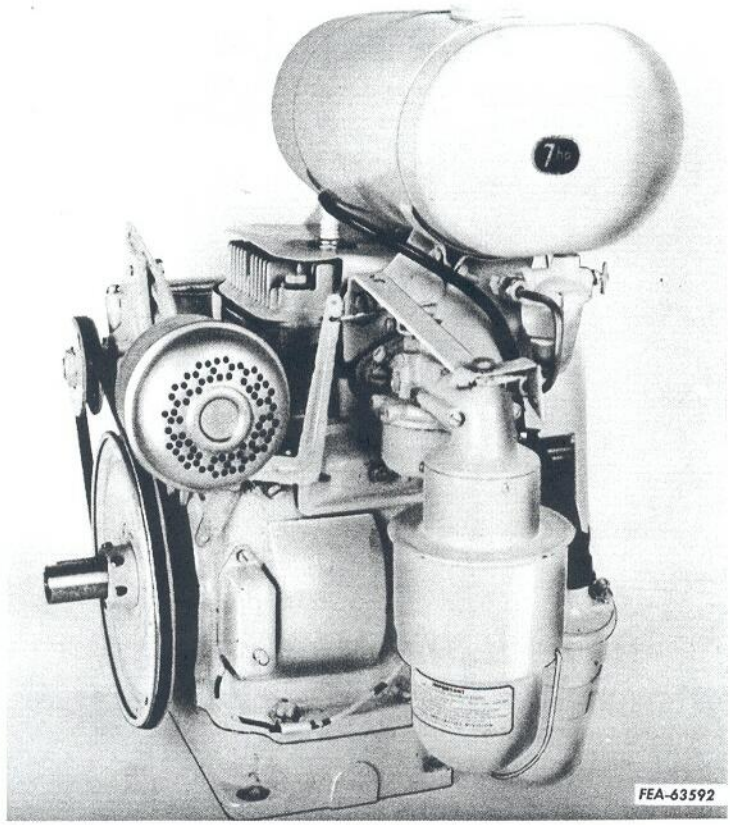
International®
Cub® Cadet Tractor
Engine

File in Tractor Service Manual

INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVE. CHICAGO 1, ILLINOIS



Illust. 1. Left front view of engine with recoil starter.



Illust. 2. Left front view of engine with electric starting.

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SPECIFICATIONS

General

Make and model (with electric starting)	Kohler K 161S
(with retractable starter)	Kohler K 161T
Cylinders	1
Bore	2-7/8 inches
Stroke	2-1/2 inches
Displacement	16-1/4 inches
Compression pressure	110 to 120 psi
Rated horsepower (at 60 degrees F and 29.92 inch Hg barometric pressure)	7.0 at 3600 rpm
Engine speed (governed)	
Minimum speed	1000 rpm
Maximum idle speed (no load)	3780 rpm
Maximum (full load)	3600 rpm
Valve clearance (engine cold)	.006 (intake)
	.017 (exhaust)
Ignition (with electric starting)	Battery
(with retractable starter)	Magneto
Spark plug gap (14 mm plug)	.025 inch
Breaker point gap	.018 to .022 inch
Timing (static)	2 degrees after TDC
(running)	20 degrees before TDC

Engine

Cylinder bore

New	2.8745 to 2.8755 inch
Maximum oversize (before reboring)	2.878 inch
Taper (New)	.0005 inch
Maximum Taper (before reboring)	.0025 inch
Out of round (New)	.0005 inch
Maximum out of round (before reboring)	.0015 inch

Crankshaft

End clearance	.002 to .023 inch
Crank pin diameter (New)	1.1855 to 1.1860 inch
Crank pin, maximum out-of-round before reconditioning	.0015 inch.

Connecting rod

Bore (New)	1.1870 to 1.1874 inch
Maximum bore (before replacing)	1.1890 inch
Crankpin running clearance (New)	.0010 to .0019 inch
Maximum crankpin running clearance (before reconditioning)	.005 inch
Side clearance	.005 to .010 inch

Piston	
New (Measured just below oil ring 90 degrees from piston pin)	2.8690 to 2.8695 inch
Maximum allowable undersize (for wear)	2.867 inch
Piston ring end gap	.007 to .017 inch
Valve stem (diameter)	
Intake (New)	.3105 to .3110 inch
Maximum allowable undersize for wear	.3090 to .3095 inch
Exhaust (New)	.3090 to .3095 inch
Maximum allowable undersize (for wear)	.308 inch
Valve guides (inside diameter)	
Intake and exhaust (New)	.312 to .313 inch
Intake and exhaust maximum (allowable oversize for wear)	.315 inch
Valve Guide Depth from top of block	1-5/16 inch
Tappet clearance in block	.0005 to .002 inch
Camshaft running clearance	.001 to .0025 inch
Camshaft end clearance	.005 to .020 inch
Valve clearance (stem end)	
Intake (Cold)	.006 to .008 inch
Exhaust (Cold)	.016 to .018 inch
Valve seat inserts (service only)	
Intake	Bore 1.4995 to 1.5005 inch Depth .224 to .229 inch
Exhaust	Bore 1.2595 to 1.2605 inch Depth .234 to .239 inch
Current-voltage regulator	
Make and Model	Delco–Remy 1118999
Ground	Negative
Voltage regulator	
air gap	.075 inch
setting range	13.6 to 14.5 volts
adjust to	14 volts
Cut-out Relay	
air gap	.020 inch
point opening	.020 inch
closing voltage	11.8 to 14 volts
adjust to	12.8 volts

Motor-generator

Make and Model	Delco-Remy 1101951
Rotation (viewing drive end)	CC
Brush spring tension	28 oz.
Field current (at 80 degrees F)	
amps	1.5 to 1.6 amps
volts	12 volts

Cold output

amps	15 amps
volts	14 volts
approximate rpm	Low idle

No load test:

volts	11
amps	12 to 18
RPM	1600 to 1900

Carburetor

*Float setting	3/16 ± 1/64 inch
Idle speed adjusting screw setting	3/4 to 2-1/4 turns open
High speed adjusting screw setting	1-1/4 to 2-3/4 turns open

*Measure between top of float (free end) and casting body.

Recoil starter

Preload on rewind spring	4 turns

ENGINE

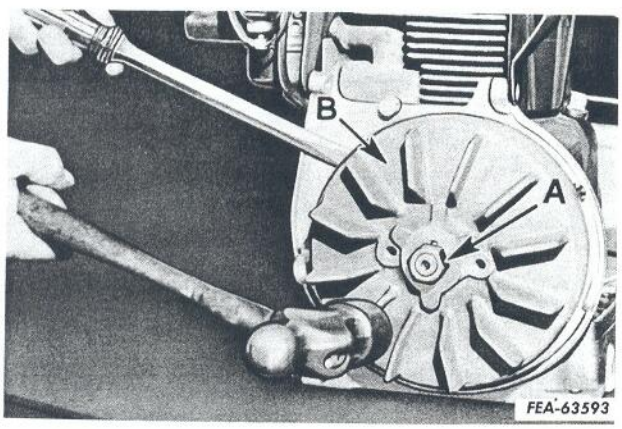
Removal (Electric starting)

1. Disconnect ground cable at battery.
2. Disconnect wire from positive side of coil.
3. Close valve on sediment bowl and remove the fuel line.
4. Remove fuel tank with brackets and sediment bowl attached.
5. Remove air cleaner and carburetor.
6. Remove wires from motor-generator.
7. Remove motor-generator drive belt and mounting bracket.
8. Loosen the bolts through frame and clutch shaft bearing support and remove the drive belt.
9. If crankshaft is to be removed from engine loosen the crankshaft pulley nut.
10. Remove the four cap screws securing the engine to the frame and lift the engine free.

Removal (Manual starting)

Disregard steps 1, 2 & 3 unless the magneto is to be serviced or the crankshaft is to be removed.

1. Remove the four cap screws securing pedestal to tractor frame and remove recoil starter unit.
2. Disconnect yellow wire at ignition switch.
3. Loosen the crankshaft pulley nut.
4. Remove the throttle control from the engine.



Illust. 3. Removing flywheel.

5. Close the fuel shut-off valve.
6. Remove the fuel line.
7. Remove the fuel tank and fuel tank brackets from the engine.
8. Remove the air cleaner and carburetor.
9. Loosen the three bolts securing the clutch shaft bearing support and remove the drive belt.
10. Remove the four cap screws securing the engine to the frame and lift the engine free.

Disassembly

1. Drain engine oil.
2. Disconnect the coil-to-breaker point wire (if so equipped) at the points and remove coil and bracket from engine.
3. Remove breaker point assembly and breaker point push rod.
4. Remove rotating screen and drive pulley assembly.
5. Remove blower housing, cylinder baffle and head baffle.
6. Remove breather plate assembly.
7. Remove the flywheel and (magneto, if equipped).

Note: The flywheel is mounted on a tapered shaft and can be removed without the use of a puller. If flywheel does stick on the shaft, screw flywheel nut flush with end of shaft and rap end of the shaft sharply with a hammer. Illust. 3.

8. On electric starting engines, remove the two Allen set screws in the front pulley hub. Remove the pulley with two long screwdrivers. Place the screwdrivers between the pulley and the crankcase, 180 degrees apart. Pry against the pulley near the crankshaft to prevent bending the pulley.

9. Remove the cylinder head.

10. Compress the valve springs and remove the valve keepers, springs, retainers and valves. Illust. 4.

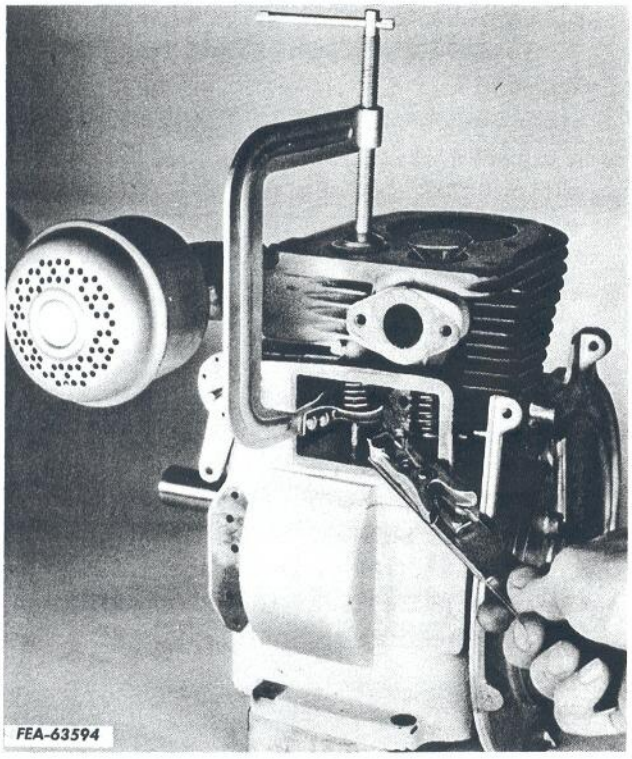
11. Remove the oil base.

12. Remove connecting rod cap. Remove ridge at top of cylinder wall, if present, and slide piston and rod out the top of the cylinder block.

13. Remove crankshaft, oil seals and if necessary press out the crankshaft main ball bearings.

Note: It may be necessary to press the crankshaft out of the cylinder block. Bearing plate should be removed first if this is done. The bearing plate can be removed with a bridge type puller, using the two tapped holes in the bearing plate.

14. Turn the cylinder block upside down and using a small punch, drive out camshaft pin from front side of engine. The pin will slide out easily after it is driven free of front side of cylinder block.



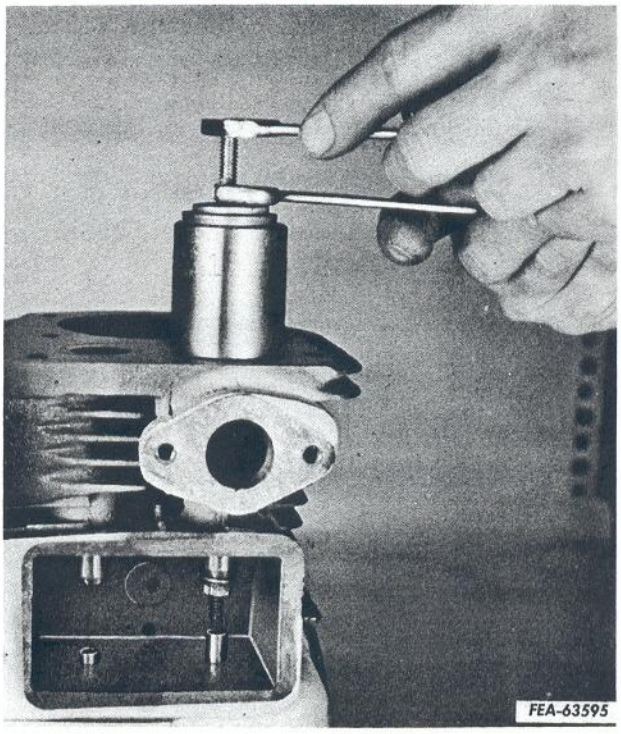
Illust. 4. Valve spring compressed to remove or install keepers.

15. Remove the camshaft and valve tappets. Save the washer type shim or shims located between the end of the camshaft (opposite camshaft gear), and the cylinder block. These shims will be reused in reassembly.

16. Unscrew the governor bushing nut and remove the throttle bracket and speed control disc. The governor cross shaft can now be removed by sliding the pilot end from its bearing, then inward and downward from inside the crankcase.

17. Loosen the screw (located to lower right of governor bushing nut) until governor gear is free to slide up, off the stub shaft. Do not remove the screw.

18. The valve guides can be removed using a 1-4 inch cap screw threaded the entire length, approximately six inches long. Use two nuts one at the top of the cap screw and one at the bottom as shown in Illust. 5. Make sure cap screw is centered in guide and nut is smaller than O.D. of valve guide.



Illust. 5. Removing valve guides.

Inspection and Repair

Clean all parts and inspect them to determine which parts are reusable.

Reboring Cylinder Block

1. The cylinder should be rebored if badly scored, tapered, or out of round more than .005.

2. Always hone or rebore to exactly .010, .020, or .030 over standard bore size of 2.875.

3. Use an inside micrometer or dial gauge to determine cylinder size and condition before and during honing.

4. If honed to nearest available oversize mentioned in step 2 above, oversize piston and ring assemblies can be used without additional fitting.

5. Any commercial cylinder hone can be used with either a drill press or a portable electric drill. The drill press is preferred, for it is important to keep bore in alignment with crankshaft crossbore.

6. Finish by washing cylinder walls with SAE-10 oil and a clean cloth.

Crankshaft

1. Check for score marks and metallic pick-up. Superficial score marks can be cleared up with crocus cloth soaked in oil.

2. With a micrometer, check journal for out of round. Correct crankpin size is 1.1855 to 1.1860. If out of round, replace shaft or regrind to .010 undersize.

3. Check gear, keyway and tapered part of shaft for wear. If worn, replace shaft.

Connecting Rod

1. Check rod for wear, score marks, running clearances, and side clearance. Replace rod if worn beyond high limit of clearances shown in specifications.

2. Connecting rod bearings are an integral part of the rod and not separately replaceable.

3. Connecting rods .010 undersize are available for reground crankshafts.

Piston

1. If cylinder block does not require reboring and old piston is free of score and scuff marks, check piston ring grooves and lands.

2. Clean grooves and fit <u>new</u> rings.

3. With rings in place, check clearance with a feeler gauge. Replace piston if a .005 feeler can be inserted between ring and land.

4. When inserted in cylinder, piston ring end clearance should be between .007 and .017.

5. NEVER RE-USE OLD RINGS.

Piston Pin

1. Very little wear takes place on piston pin or in piston bosses.

2. If it is necessary to replace connecting rod because of wear at large end of rod, it is advisable to install a new piston pin.

3. Oversize pins are available.

4. Assemble piston to connecting rod. Use a commercial rod aligner. Piston must be square with cylinder bore and crankshaft.

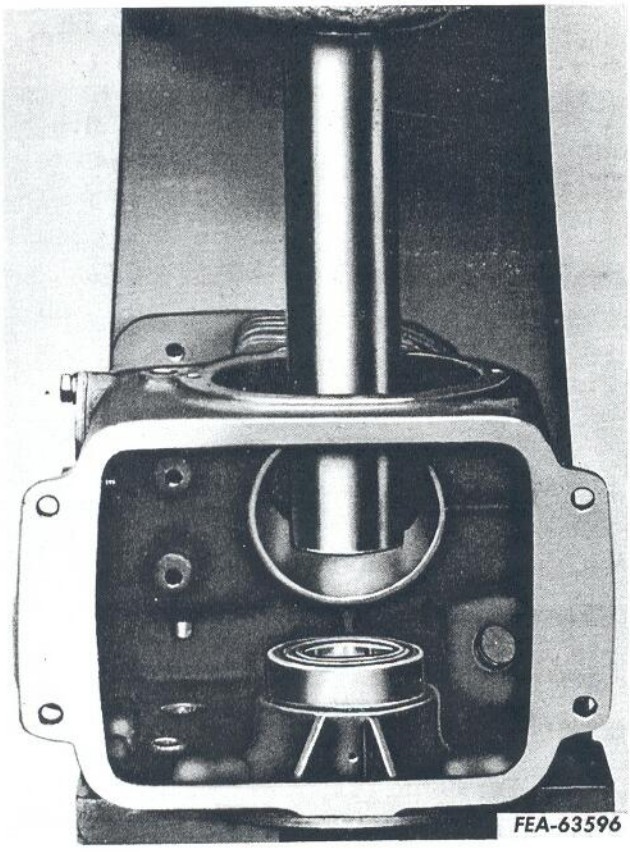
Valves, Seats and Guides

1. Check clearance of valve stems in guides.

2. If worn, replace valve guides. Press new guide into a depth of 1-5/16 inch below top surface of cyl. block. It will be necessary to ream guides to gain correct fit. Refer to Specifications for proper clearance.

3. Intake valve seat is machined into block. An insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

4. The exhaust valve seat is a Stellite insert. An oversize insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.



Illust. 6. Installing rear main bearing.

5. The seating surfaces should be held as nearly as possible to 1/32 inch in width. Seats with more than 1/16 inch seating surface should be reconditioned with 45 degree or 15 degree cutters and ground to form proper seat.

6. Check the governor stub shaft for wear. Do not remove the shaft unless it needs to be replaced. To remove the shaft, remove the expansion plug and drive the shaft into the inside of breather, or or valve spring compartment.

Reassembly

Install rear main bearing by pressing it into cylinder block with shielded side facing to inside of block. Illust. 6.

Governor

1. Install the governor stub shaft and expansion plug, if they were removed. See Illust. 7.

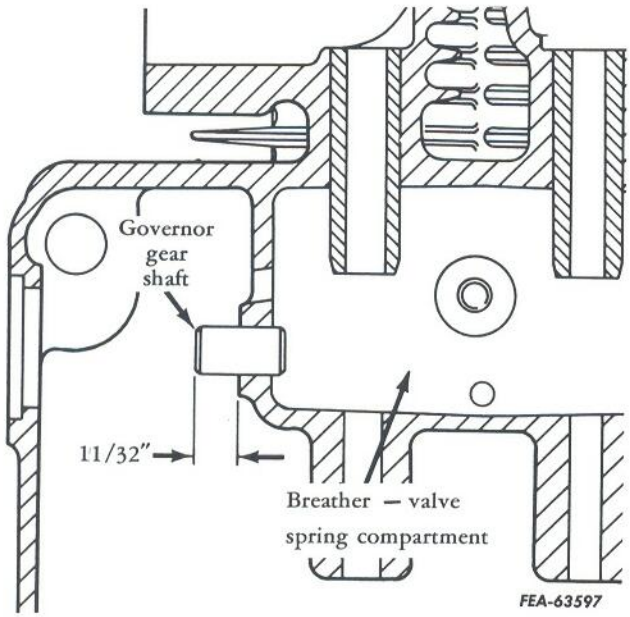
2. Place spacer washer on stub shaft and slide governor gear assembly into place.

3. Place cylinder block on its side. Slide governor cross shaft into place from inside of block. Make sure tab on governor shaft is against pin in end of governor gear.

4. Place speed control disc on governor bushing nut and thread bushing nut into block, clamping throttle bracket into place.

5. Governor shaft can be adjusted for end clearance by moving needle bearing in block. Set bearing to allow a slight back-and-forth movement of the shaft.

6. Tighten holding screw from outside of cylinder block. This screw prevents governor gear from sliding off stub shaft during assembly.



Illust. 7. Height of governor gear shaft.

7. Rotate governor gear assembly to be sure holding screw does not contact weight section of gear.

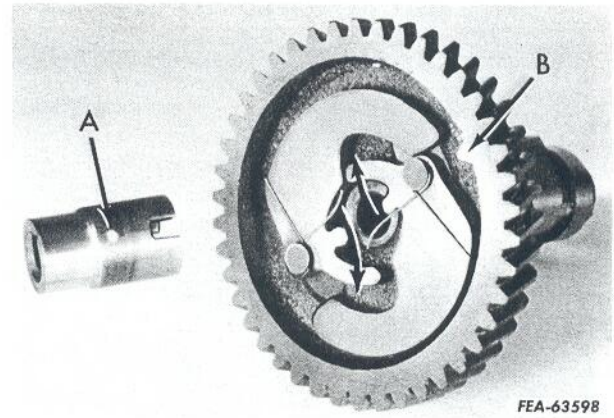
Valve Tappets and Camshaft

1. Turn cylinder block upside down and place valve tappets in tappet guides.

2. Before installing camshaft assembly in block, breaker cam must be correctly inserted between springs of spark advance systems to insure proper spark timing. Spark timing marks (A and B, Illust. 8) on cam and spark-advance side of camshaft gear must coincide. Spread springs in direction indicated by arrows on flyweight and insert cam.

3. Position the camshaft in the block with washer type shims (that were removed during disassembly) between the end of the camshaft and the bearing plate side of the block. Slide the camshaft pin through the shims and camshaft from the bearing plate side (Illust. 9), and press into front side of block.

4. Check camshaft end clearance. End clearance should be from .005 to .020. Clearance can be changed by adding or removing shims as required.

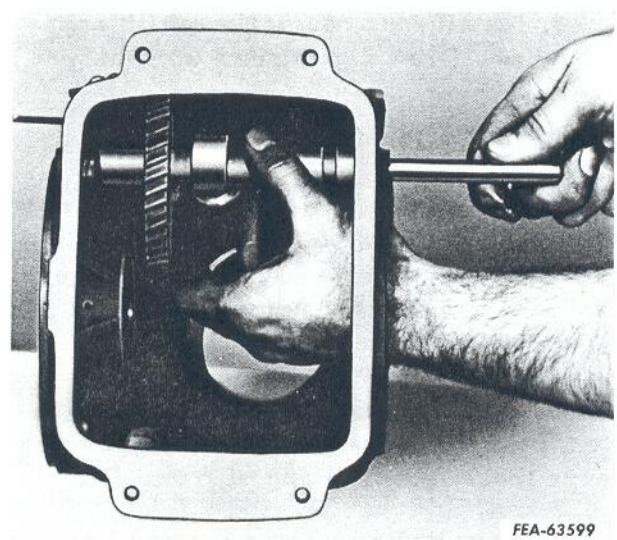


Illust. 8. Camshaft and breaker cam, A and B are timing marks.

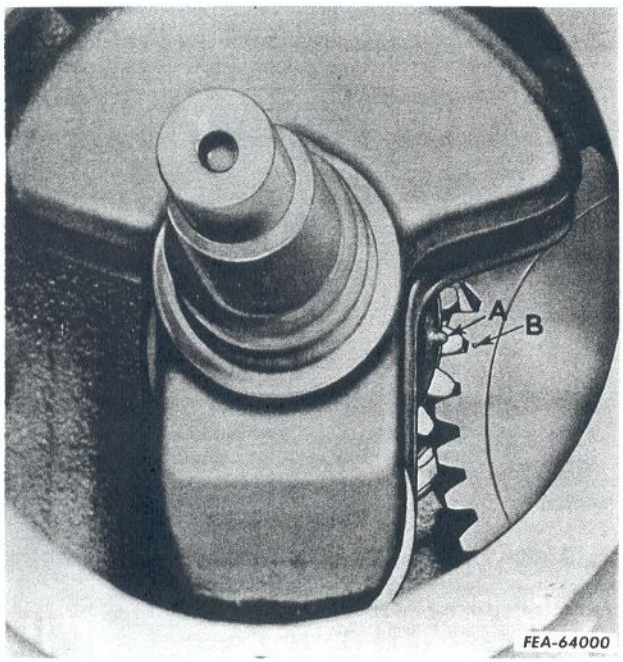
Installation of Crankshaft

1. The installation of crankshaft in cylinder block is shown in Illust. 10.

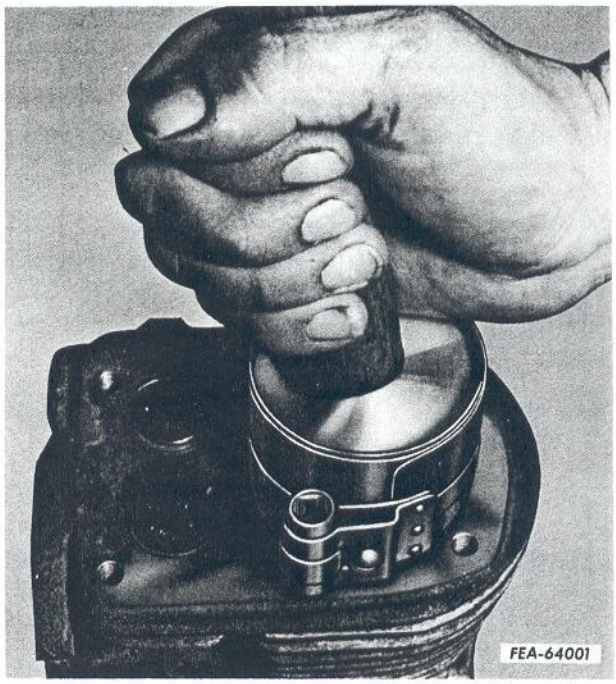
2. Timing marks are provided crankshaft and camshaft gears for correct timing of engine. When in place, mark between teeth of camshaft (B, Illust. 10) must line up with mark on shoulder of crankshaft (A, Illust. 10). Chalk timing mark positions for ease of viewing during assembly.



Illust. 9. Installing camshaft.



Illust. 10. Crankshaft installation A and B are timing marks.



Illust. 11. Installing piston assembly.

Bearing Plate

1. Press front main bearing, shielded side up, into bearing plate.

2. Place bearing plate and gasket on crankshaft.

3. Carefully press bearing plate assembly onto crankshaft and into block.

4. Install four cap screws with copper washers. Draw cap screws up evenly.

Piston and Rod Assembly

1. Assemble piston to connecting rod and secure piston pin with retainer rings. Always use new retainer rings. Be sure retainer rings are fully engaged in grooves in piston bosses.

2. Before placing piston rings on piston, position rings in cylinder bore to be sure there is a ring gap of from .007 to .017.

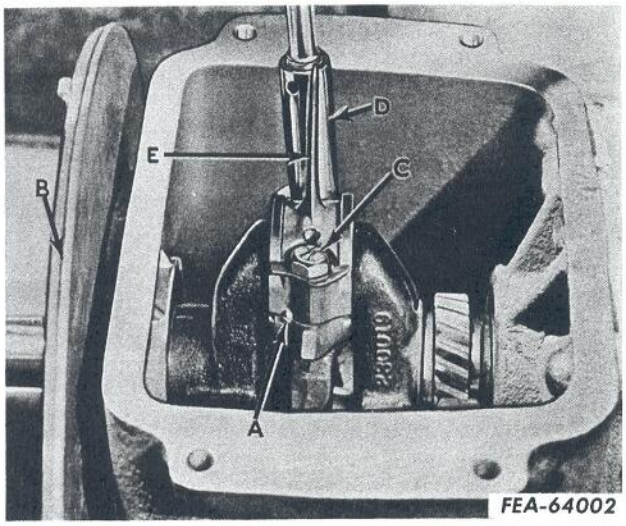
3. Piston rings must be installed according to their markings. Install compression ring with groove or bevel up. Oil control rings can be installed either way. Install rings properly to gain correct ring function.

4. After rings are in proper position in correct grooves, oil complete assembly, stagger ring gaps so they are not in line and insert complete assembly into cylinder bore. Be sure connecting rod marking (A, Illust. 12) is toward flywheel side of engine. Use a ring compressor to prevent ring breakage during installation. Illust. 11.

Attaching Rod to Crankshaft

1. After Piston Assembly is installed, place block on end and oil connecting rod and crank pin.

2. It is important that marks on connecting rod and cap (A, Illust. 12) line up and face flywheel end of engine. (B, Illust. 12.)



Illust. 12. Tightening connecting rod cap screws.

A - Connecting Rod Marks
B - Bearing Plate
C - Cap Screw
D - Socket Wrench
E - Oil Slinger

3. Install connecting rod cap, lock and cap screws to connecting rod. Illust. 12.

4. Use a torque wrench to tighten cap screws to 200 inch pounds. Back off screws and tighten cap screws to 180 inch pounds. This two-step procedure will assure a tight fit of rod to crankshaft and avoids possibility of screws tightening in threads while rod remains loose on shaft.

Note: Be careful not to bend oil slinger (E, Illust. 12).

Installation of Oil Seals on Crankshaft

IMPORTANT: The oil seal at the front of the engine is countersunk 1/8 inch in factory production. This is not necessary for service. The service oil seal is to be installed flush with the crankcase. Since the seal will be seating on a new portion of the crankshaft, it is extremely important that all paint and any foreign material be removed from the sealing surface before the new seal is installed.

1. Place seal protector tool FES-54-5 over the crankshaft at the front of the engine and protector tool FES-54-4 over the crankshaft at the flywheel end of the engine.

2. Lubricate the seals and slide them onto the protector tools. Drive the front seal in flush with the cylinder block and the rear seal flush with the bearing plate with seal driver FES-54-6. (Illust. 13.)

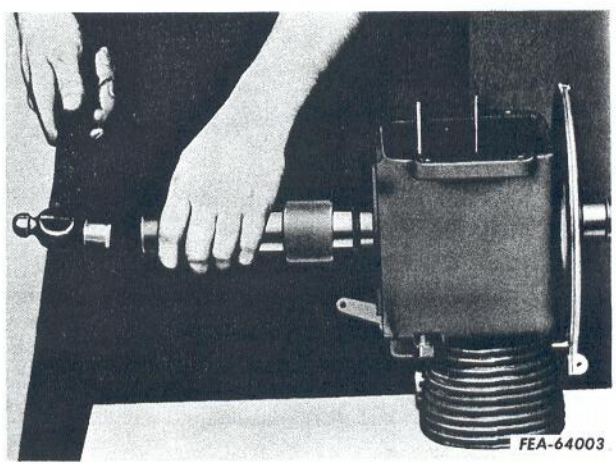
Note: The two seal protector tools and the driver can be ordered from:
Service Tools Inc.,
1901 S. Indiana Ave.
Chicago 16, Illinois

Oil Base

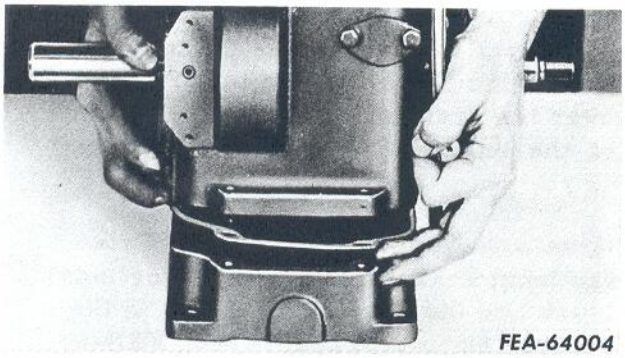
1. Assemble oil base to block with four screws. Illust. 14.

2. It is important that a new gasket be used to prevent oil leakage.

3. Use 5/16 inch pilot studs to align cylinder block, gasket and oil base.



Illust. 13. Installing oil seal on front side of engine.

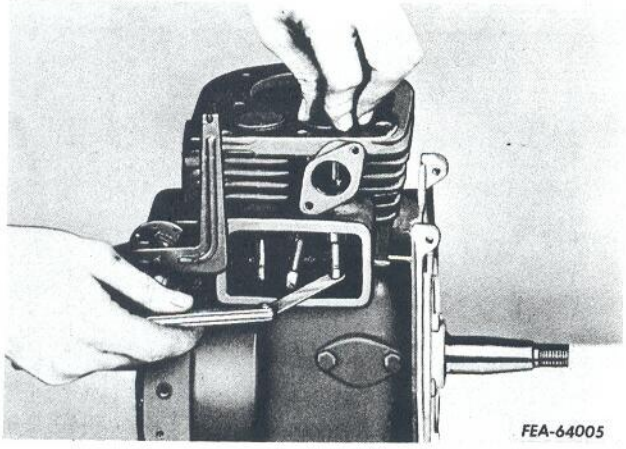


Illust. 14. Installing oil base.

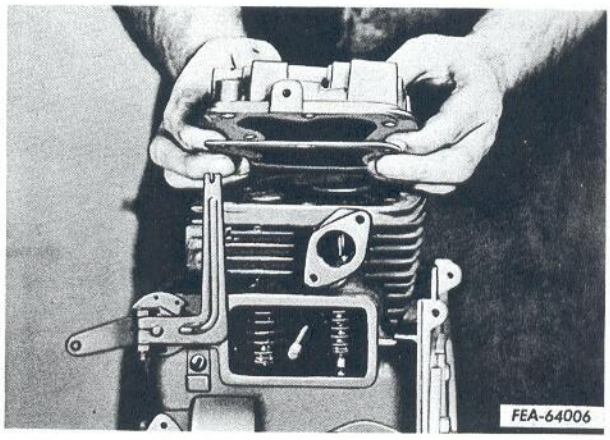
Installing and Setting Valves

1. Valves, valve seats and ports should be thoroughly cleaned. Valves and seats should be ground and lapped-in to obtain a good valve seal. Keep valve seat from 1/32 inch to 1/16 inch in width.

2. Illust. 15 illustrates checking valve clearance. Intake valve clearance should be .006/.008 cold. Exhaust valve clearance should be .016/.018 cold. Valves that do not have sufficient clearance must be removed and ends ground until desired clearance is obtained. ENDS MUST BE GROUND SQUARE AND ALL BURRS MUST BE REMOVED. If clearance is excessive install new valves.



Illust. 15. Checking valve clearance.



Illust. 16. Cylinder head assembly.

3. After correct clearance is obtained, remove valves and install valve springs and retainers. Replace valves, compress springs (using a spring compressor) (Illust. 2) and place locking key in grooves of valve stems.

Cylinder Head

1. Always use a new gasket when head has been removed for service work. Illust. 16. It is recommended that head gaskets be soaked in water before assembly.

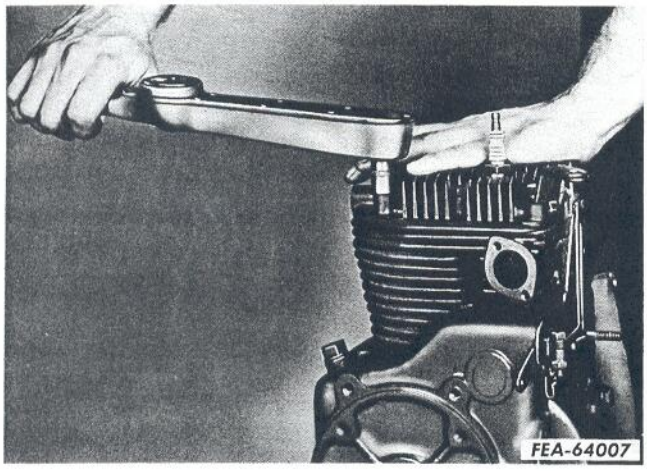
2. Check cylinder head on face plate to be sure gasket surfaces make good contact at all points.

3. It is important that head cap screws be tightened evenly and in steps until 200 inch pounds torque is reached. Illust. 17.

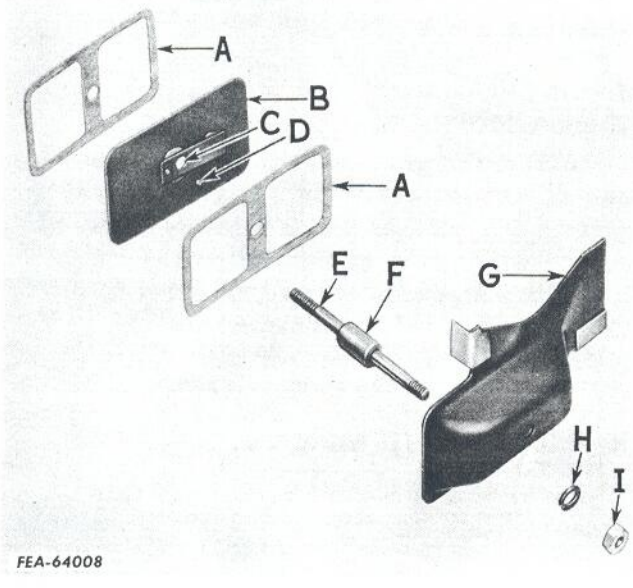
4. Install new spark plug and gasket and tighten to 27 foot pounds torque. Spark plug gap should be .025.

Breather Assembly

1. The reed type breather valve maintains a slight vacuum in engine crankcase. All parts must be clean and in good condition. Parts can be replaced as necessary.



Illust. 17. Tightening cylinder head cap screws.



Illust. 18. Exploded view of breather and vent assembly.

A - Gaskets	D - Hole	G - Cover
B - Plate	E - Stud	H - Washer
C - Reed	F - Spacer	I - Nut

2. The correct order for assembly of breather is as follows: (Illust. 18) A-Gasket, B-Plate and C-Reed, (D-small drilled hole must be at bottom of plate), A-Gasket, E- Stud, F-Rubber spacer, G-Cover, H-Lock washer and I-Nut.

3. Cover must be tight to prevent oil leaks.

Magneto (If equipped)

1. Install square key in slot of crankshaft.

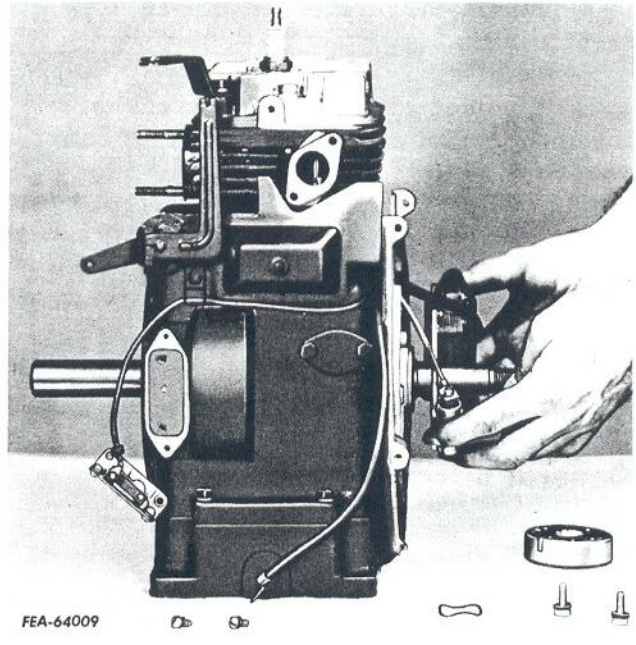
2. Illust. 19 shows magneto in position. Note how breaker lead and high tension spark plug cable are pulled through plate opening.

3. After magneto assembly has been fastened to bearing plate, rotating magnet is pressed onto crankshaft. Magnet is marked "ENGINE SIDE" for correct assembly.

Flywheel

1. Place wave washer on crankshaft and place flywheel in position.

2. Install blower housing, starter pulley, lock washer, and flywheel nut. Torque the nut to 75 ft. lbs., place the engine on the tractor and secure the engine to the tractor frame with four mounting cap screws.



Illust. 19. Assembly of magneto.

1. Install push rod.

2. Fasten breaker in place with two screws.

3. Place cover gasket in position and attach magneto lead or coil lead.

4. Set breaker gap at .020. For precision ignition setting refer to Ignition Timing, page 25.

5. Make final adjustments before installing breaker point cover. Be sure breaker lead grommet is in place.

6. Fasten coil (if equipped) to blower housing.

Carburetor

1. Insert a new gasket and assemble carburetor to intake port with two screws.

2. Refer to FUEL SYSTEM, page 17 for carburetor adjustment procedure

Governor Arm and Linkage

1. Insert carburetor linkage in throttle arm.

2. Connect governor arm to carburetor linkage and slide governor arm onto governor shaft.

3. Position governor spring in speed control disc.

4. Before tightening clamp bolt, turn shaft counterclockwise as far as possible with a pair of pliers, pull governor arm (I, Illust. 23) as far as possible to left (away from carburetor), tighten nut and check for freedom of movement.

Cylinder Baffles and Fuel Tank

1. Install the cylinder baffles and the head baffle.

2. Gasoline fuel tank and brackets are installed at the same time as the baffles.

3. Connect fuel line between filter and carburetor.

Motor-Generator (If equipped)

Install the generator-cranking motor and adjust the drive belt to give approximately 1/4 inch of slack midway between the driven pulley and drive pulley. Refer to wiring diagram (page 21) under Electrical System of this manual for the proper electrical connections.

Recoil Starter (If equipped)

Refer to the Recoil Starter of this manual, page 26.

Continue reassembly in the reverse order of disassembly.

FUEL SYSTEM

General Information

The fuel system consists of a gasoline storage tank, shut-off valve, sediment bowl, fuel line with connections, and carburetor.

Service difficulties with fuel systems usually originate from improper carburetor adjustments or dirt in one of the components. If gum forms in the components it will be necessary to completely disassemble and thoroughly clean the carburetor.