



Blue Ribbon Service

GSS-1350

**International[®]
Cub[®] Cadet Tractor
ENGINE
Model 70 and 100**

Price 75¢

File in Tractor Service Manual

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

FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester Dealers and their factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, dealers are periodically issued service bulletins to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service I.H. equipment.

LIBRARY FILING INFORMATION

1. File this Manual in Book 12 after Divider Tab GSS-1350.
2. Enter the following information in the Service Manual Index.

Print, or preferably type in, the Manual Description, Form Number, and the Book Filed in, on the following pages:

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SPECIFICATIONS

General	Model 70	Model 100
Make and model (with electric starting) . . .	Kohler K 161S	Kohler K 241AS
(with retractable starter) .	Kohler K 161T	
Cylinders	1	1
Bore	2-7/8 inches	3-1/4 inches
Stroke	2-1/2 inches	2-7/8 inches
Displacement	16.25 cu. inches	23.9 cu. inch
Compression pressure	110 to 120 psi	110 to 120 psi
Rated horsepower (at 60 deg. F and 29.92 inch Hg barometric pressure)	7.0 at 3600 rpm	10 at 3600 rpm
Engine speed (governed)		
Minimum speed	1000 rpm	1000 rpm
Maximum idle speed (no load)	3780 rpm	3800 rpm
Maximum (full load)	3600 rpm	3600 rpm
Valve clearance (engine cold) . . . . .	.006 (intake) .017 (exhaust)	.010 (intake) .020 (exhaust)
Ignition (with electric starting)	Battery	Battery
(with retractable starter)	Magneto	
Spark plug gap (14 mm plug) . . . . .	.025 inch	.025 inch
Breaker point gap . . . . .	.018 to .022 inch	.018 to .022 inch
Timing (static)	2 deg. after TDC	3 deg. after TDC
(running)	20 deg. before TDC	20 deg. before TDC
Engine		
Cylinder bore		
New	2.8745 to 2.8755 in.	3.2505 to 3.2515 in.
Maximum oversize (before reborng) . . .	2.878 inch	3.2545 inch
Taper (new) . . . . .	.0005 inch	.0005 inch
Maximum Taper (before reborng) . . . .	.0025 inch	.0015 inch
Out of round (new) . . . . .	.0005 inch	.0005 inch
Maximum out-of-round (before reborng) .	.0015 inch	.0015 inch
Crankshaft		
End clearance . . . . .	.002 to .023 inch	.005 to .010 inch
Crankpin diameter (new)	1.1855 to 1.1860 in.	1.5000 to 1.4995 in.
Crankpin, maximum out-of-round before reconditioning . . . . .	.0015 inch	.0015 inch

Model 70

Model 100

	Model 70	Model 100
Connecting rod		
Bore (new)	1.1870 to 1.1874 in.	1.5010 to 1.5015 in.
Maximum bore (before replacing) .	1.1890 inch	1.5030 inch
Crankpin running clearance (new) .	.0010 to .0019 inch	.001 to .002 inch
Maximum crankpin running clearance (before reconditioning) . . . . .	.005 inch	.005 inch
Side clearance . . . . .	.005 to .010 inch	.007 to .016 inch
Piston		
New (measured just below oil ring 90 deg. from piston pin)	2.8690 to 2.8695 in.	3.2425 to 2.435 in.
Maximum allowable undersize (for wear)	2.867 inch	3.2410 inch
Piston ring end gap . . . . .	.007 to .017 inch	.010 to .020 inch
Valves		
Valve stem (diameter)		
Intake (new) . . . . .	.3105 to .3110 inch	.3105 to .3110 inch
Maximum allowable undersize (for wear) . . . . .	.3090 to .3095 inch	.3090 inch
Exhaust (new) . . . . .	.3090 to .3095 inch	.3090 to .3095 inch
Maximum allowable undersize (for wear) . . . . .	.308 inch	.308 inch
Valve guides (inside diameter)		
Intake and exhaust (new) . . . . .	.312 to .313 inch	.312 to .313 inch
Intake and exhaust maximum (allowable oversize for wear) . . . . .	.315 inch	.315 inch
Valve guide depth from top of block .	1-5/16 inch	1-15/32 inch
Tappet clearance in block . . . . .	.0005 to .002 inch	.0008 to .0023 inch
Camshaft running clearance . . . . .	.001 to .0025 inch	.001 to .0025 inch
Camshaft end clearance . . . . .	.005 to .020 inch	.005 to .010 inch
Valve clearance (stem end)		
Intake (cold) . . . . .	.006 to .008 inch	.008 to .010 inch
Exhaust (cold) . . . . .	.016 to .018 inch	.017 to .020 inch
Valve face angle	45 degrees	45 degrees
Valve seat inserts (service only)		
Intake	Bore 1.4995 to 1.5005 in. Depth .224 to .229 inch	1.4995 to 1.5005 in. .224 to .229 inch
Exhaust	Bore 1.2595 to 1.2605 in. Depth .234 to .239 inch	1.2595 to 1.2605 .234 to .239 inch
Seat angle	45 degrees	45 degrees

Model 70

Model 100

Current-voltage regulator

Make and Model Delco-Remy 1118999

Ground Negative

Voltage regulator

Air gap075 inch

Setting range 13.6 to 14.5 volts

Adjust to 14 volts

Delco-Remy 1118999

Negative

.075 inch

13.6 to 14.5 volts

14 volts

Cut-out relay

Air gap020 inch

Point opening020 inch

Closing voltage 11.8 to 14 volts

Adjust to 12.8 volts

.020 inch

.020 inch

11.8 to 14 volts

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 deg. F) .

Amps 1.5 to 1.6 amps

Volts 12 volts

Delco-Remy 1101967

CC

28 oz.

1.5 to 1.6 amps

12 volts

Cold output

Amps 15 amps

Volts 14 volts

Approximate rpm Low idle

15 amps

14 volts

Low idle

No load test:

Volts 11

Amps 12 to 18

RPM 1600 to 1900

11

12 to 18

1600 to 1900

Carburetor

*Float setting $3/16 \pm 1/64$ 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

$11/64 \pm 1/32$ inch

$3/4$ to 2- $1/4$ turns open

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

4 turns

ENGINE

Removal (Manual Starting)

1. Remove the grille and hood.

NOTE: Four capscrews (2 on each side) hold the grille to the tractor main frame.

2. Remove the clutch shield. Refer to Illust. 1.
3. Disconnect the throttle wire from the governor speed control disc.
4. Disconnect the choke wire from the carburetor.
5. Disconnect the engine from the main frame.

NOTE: Four cap screws (two on each side) go through the frame into tapped holes in the engine oil pan base. Refer to Illust. 2.

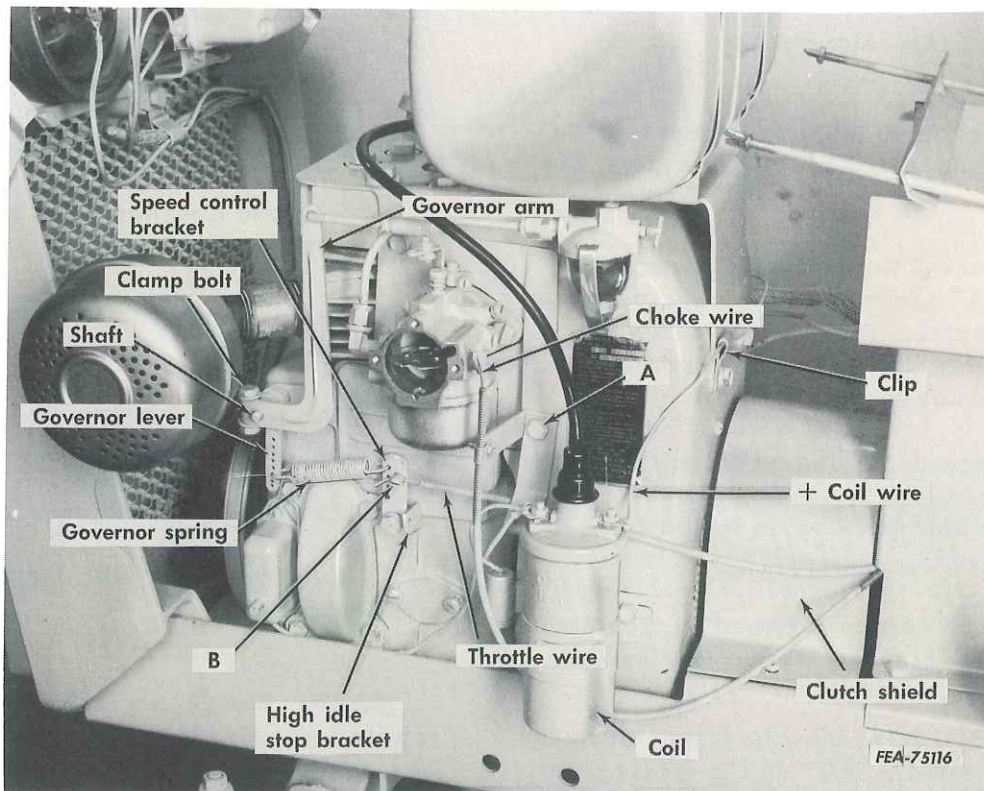
6. Slide the engine forward in the frame to disengage the clutch drive plate pins from the driven disc and disengage the clutch shaft from its pilot bushing. Refer to Illust. 3.

7. The engine can now be lifted from the tractor frame and chassis.

NOTE: One cylinder head cap screw can be removed and a 3/8" N.C. eyebolt installed to lift the engine if desired. Refer to Illust. 3.

Removal (Electric Starting)

1. Disconnect the battery cables and remove the battery.
2. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor. Refer to Illust. 3.
3. Remove the clutch shield (Illust. 1).

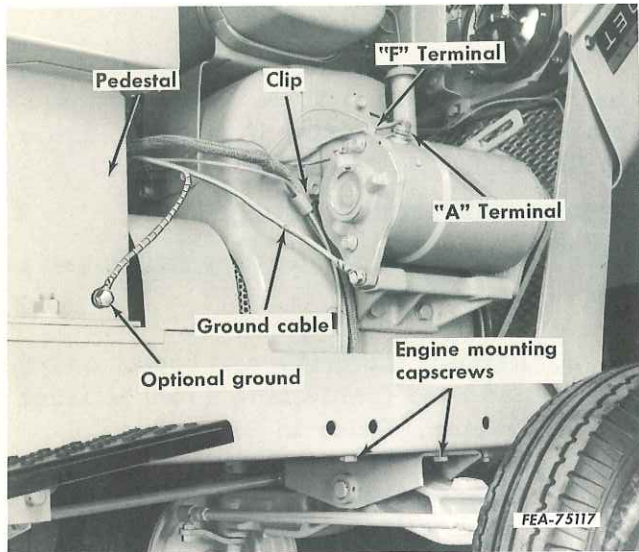


Illust. 1. Left side view Model 100 with air cleaner removed.

4. Remove the air cleaner.

5. Remove cap screw "A" and loosen screw "B" (Illust. 1). Remove the choke wire from the carburetor, and the throttle wire from the speed control bracket.

6. Disconnect the positive (+) coil wire from the coil. Spread the wire clip.



Illust. 2. Right side view Model 100.

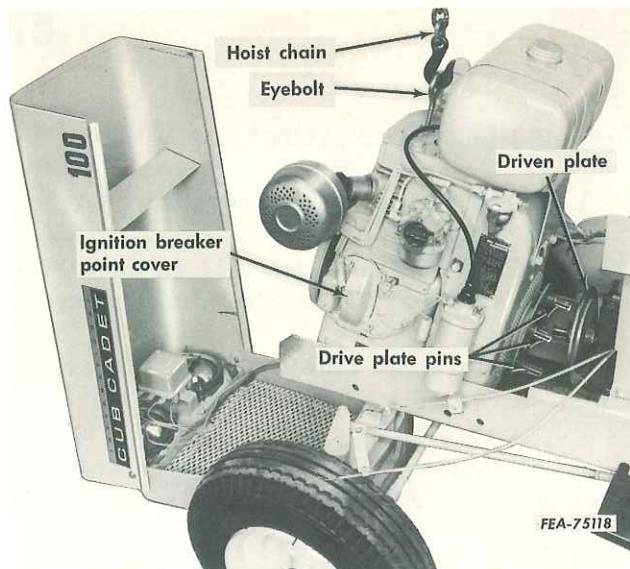
7. If the ground cable is connected to the starter-generator pivot cap screw, disconnect it.

8. Disconnect the two wires from the Generator "A" terminal and one wire from the "F" terminal. Tie the two wires removed from the "A" terminal together and identify them for reassembly.

9. Disconnect the engine from the main frame. Two engine mounting cap screws on each side hold the engine to the frame. Refer to Illust. 2.

10. Slide the engine forward to disengage the drive pins from the clutch driven disc.

11. The engine can now be lifted from the frame. An eyebolt (3/8" N.C.) can be installed in place of one cylinder head bolt. Refer to Illust. 3.

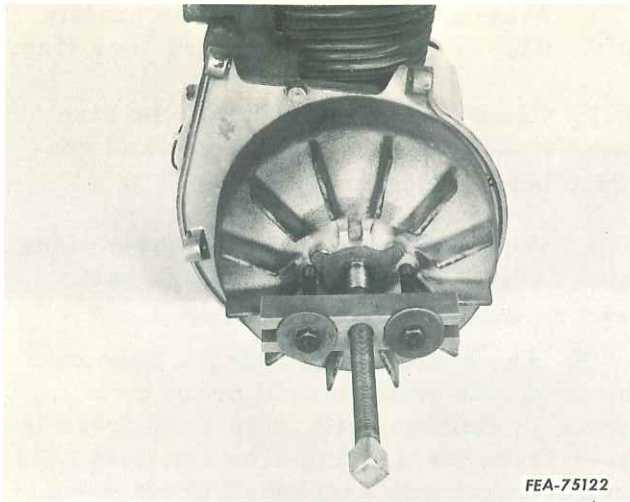


Illust. 3. Lifting the engine from the frame.

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 so equipped).

NOTE: The flywheel is mounted on a tapered shaft and can be removed with the use of a puller. If flywheel seizes to the shaft, screw the puller tight and rap end of the puller sharply with a hammer (Illust. 4).



Illust. 4. Removing flywheel.

8. 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. On manual starting engines, remove the retractable starter assembly and its mounting plate.

10. Remove the cylinder head.

11. Compress the valve springs and remove the valve keepers, springs, retainers and valves (Illust. 5).

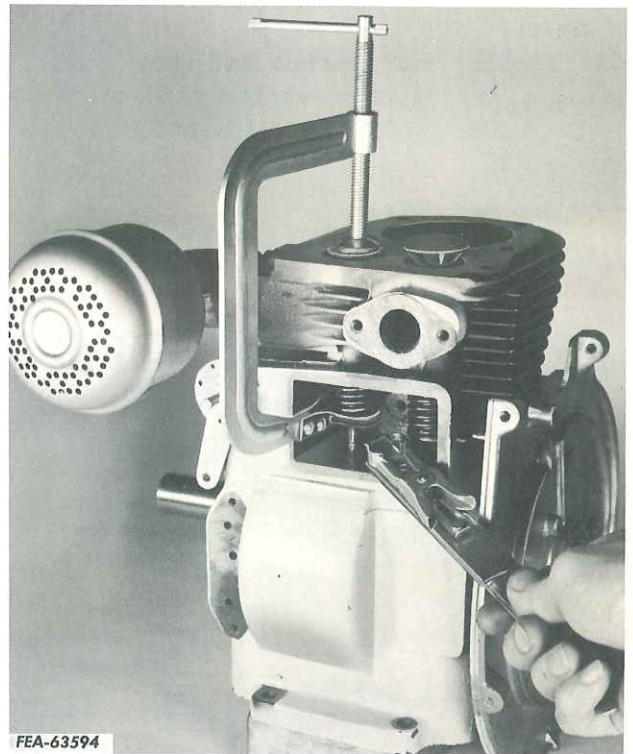
12. Remove the oil base.

13. 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.

14. 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.

15. 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. 5. Valve spring compressed to remove or install keepers.

16. 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 re-assembly.

17. 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.

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

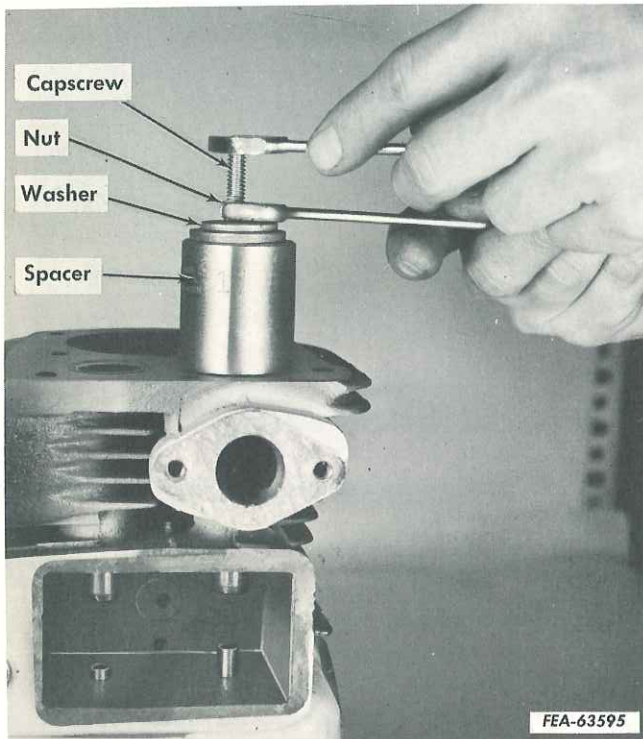
19. To remove the valve guides:

Tap the valve guide its full length using a 3/8 inch N.C. tap.

Thread a 3/8 N.C. x 6 inch cap screw its full length.

Install a nut, washer and spacer on the cap screw, then screw the cap screw into the valve guide, the full length of the valve guide.

Hold the cap screw and turn the nut, as shown in Illust. 6.



Illust. 6. 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, or worn in excess of taper or out-of-round limits.

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

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

4. Oversize piston and ring assemblies must be used in crankcases which have been re-bored.

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 cross-bore.

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 polished out with crocus cloth soaked in oil.

2. With a micrometer, check connecting rod journal for out-of-round. Correct size is 1.1855 to 1.1860 on K-161 and 1.4995 to 1.5000 on K-241. 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 re-boring and old piston is free of score and scuff marks, check piston ring grooves and lands.
2. NEVER RE-USE OLD RINGS.
3. When inserted in cylinder, piston ring end clearance should be between .007 and .017 on K-161 and .010 to .020 on K-241.
4. Clean grooves and fit new rings.
5. With rings in place, check clearance with a feeler gauge. Replace piston if a .005 feeler can be inserted between ring and land.

Piston Pin

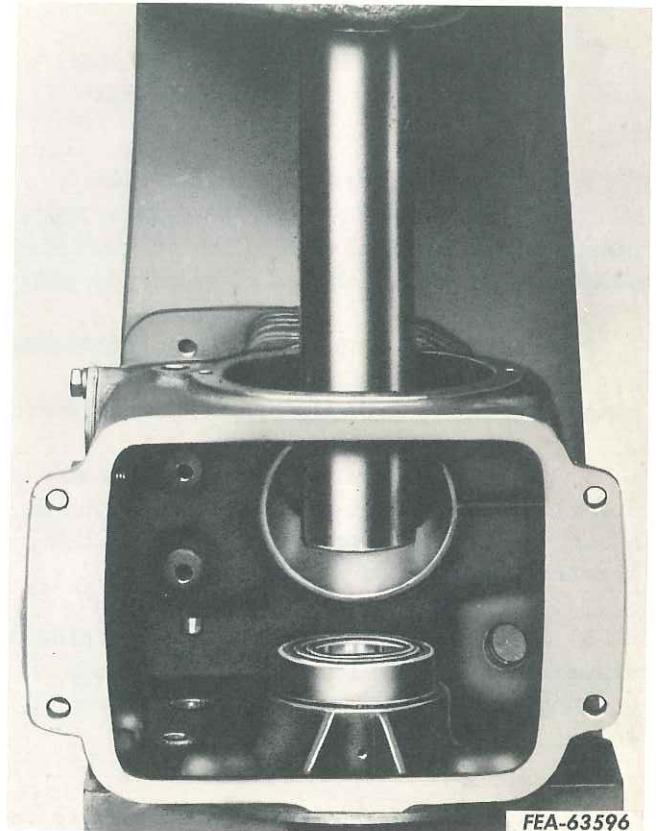
1. Very little wear takes place on piston pin or in piston bosses.
2. If it is necessary to replace connecting rod because of wear at large end of rod, it is advisable to install a new piston pin.
3. Oversize pins are available.
4. Assemble piston to connecting rod. Use a commercial rod aligner. Piston 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 the crankcase a depth of 1-5/16 inch (on K-161 and 1-15/32 on K-241) below top surface of cylinder 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 Moly Nickel Chrome or Stellite insert. An over-size insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.



Illust. 7. Installing rear main bearing.

5. The valve seat should be held as nearly as possible to 1/32 inch in width. Seats with more than 1/16 inch width 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 valve spring compartment.

Reassembly

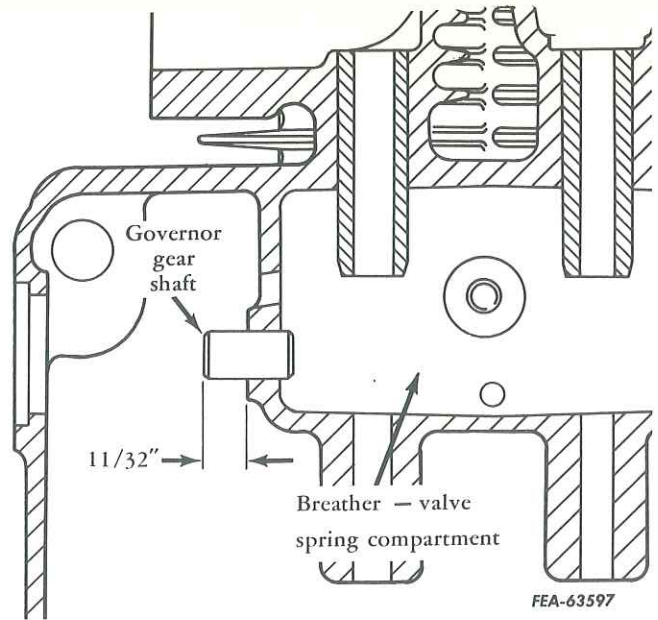
Install rear main bearing by pressing it into cylinder block with shielded side facing to inside of block (Illust. 7).

Governor

1. Install the governor stub shaft and expansion plug, if they were removed. See Illust. 8.
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.
7. Rotate governor gear assembly to be sure the holding screw does not contact the weight section of the gear.

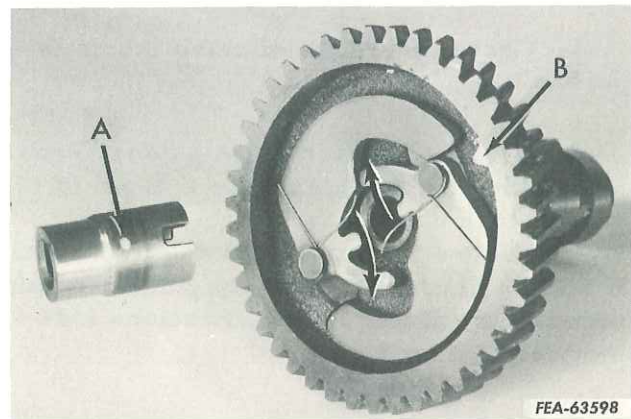
Valve Tappets and Camshaft

1. Turn the cylinder block upside down and place valve tappets in tappet guides.
2. Before installing the camshaft assembly in the block, the breaker cam must be correctly inserted between springs of spark advance systems to insure proper spark timing. Spark timing marks (A and B, Illust. 9) on the cam and spark-advance side of the camshaft gear must coincide. Spread springs in the direction indicated by arrows on the flyweight and insert cam.



Illust. 8. Height of governor gear shaft.

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. 10), and press into the front side of the block.
4. Check camshaft end clearance. End clearance should be from .005 to .020 on K-161 and .005 to .010 on K-241. Clearance can be changed by adding or removing shims as required.

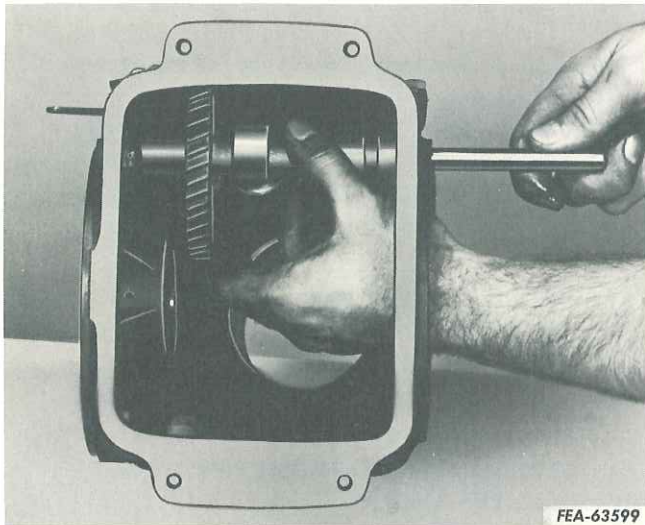


Illust. 9. Camshaft and breaker cam, A and B are timing marks.

Installation of Crankshaft

1. The installation of the crankshaft in the cylinder block is shown in Illust. 11.

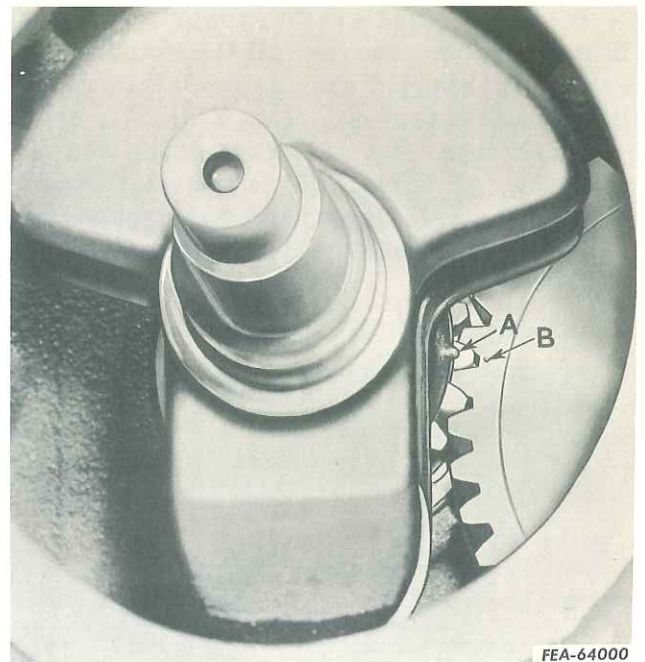
2. Timing marks are provided on the crankshaft and camshaft gears for correct timing of engine. When in place, the mark between teeth of camshaft "B" (Illust. 11) must line up with the mark on shoulder of crankshaft "A" (Illust. 11). Chalk timing mark positions for ease of viewing during assembly.



Illust. 10. Installing camshaft.

Bearing Plate

1. Press front main bearing, shielded side up, into bearing plate.
2. Place bearing plate and gasket on crankshaft.
3. Carefully press the bearing plate assembly onto the crankshaft and into the block.
4. Install four cap screws with copper washers. Draw cap screws up evenly.



Illust. 11. Crankshaft installation, A and B are timing marks.

Piston and Rod Assembly

1. Assemble piston to connecting rod and secure piston pin with retainer rings. Always use new retainer rings. Be sure the retainer rings are fully engaged in the 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 on K-161 and .010 to .020 inch on K-241.
3. Piston rings must be installed according to their markings. Install compression ring with groove or bevel up when it is located on the inside of the ring. The groove or bevel goes down when located on the outside of ring.

4. After rings are in proper position and in the correct grooves, oil the 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. 13) is toward flywheel side of engine. Use a ring compressor to prevent ring breakage during installation (Illust. 12).



Illust. 12. Installing piston assembly.

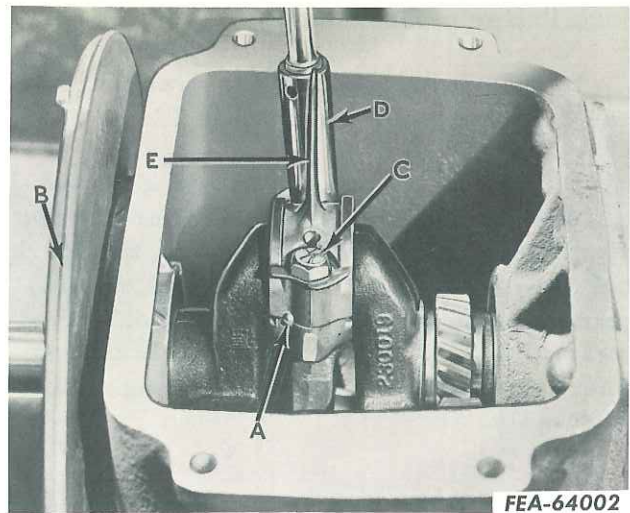
Attaching Rod to Crankshaft

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

2. It is important that marks on the connecting rod and cap "A" (Illust. 13) line up and face flywheel end of engine "B" (Illust. 13).

3. Install connecting rod cap, lock and cap screws to connecting rod (Illust. 13).

4. Use the torque wrench to tighten cap screws to 200 inch pounds on the K-161, and 300 inch pounds on the K-241. Back off the



Illust. 13. Tightening connecting rod cap screws.

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

screws and tighten cap screws to 180 inch pounds on the K-161, and 280 inch pounds on the K-241. This two-step procedure will assure a tight fit of rod to crankshaft and avoids the possibility of screws tightening in threads while the rod remains loose on the shaft.

NOTE: Be careful not to bend the oil slinger "E" (Illust. 13).

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 the 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. 14).

NOTE: The two seal protector tools and the driver can be ordered from:

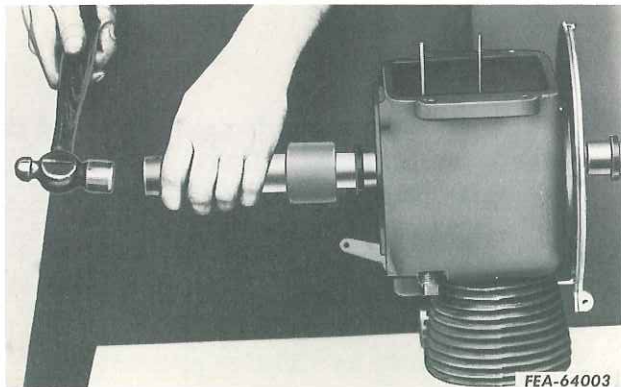
Service Tools Inc.,
1901 S. Indiana Ave.
Chicago 16, Illinois

Oil Base

1. Assemble oil base to the block with four screws (Illust. 15).

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

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

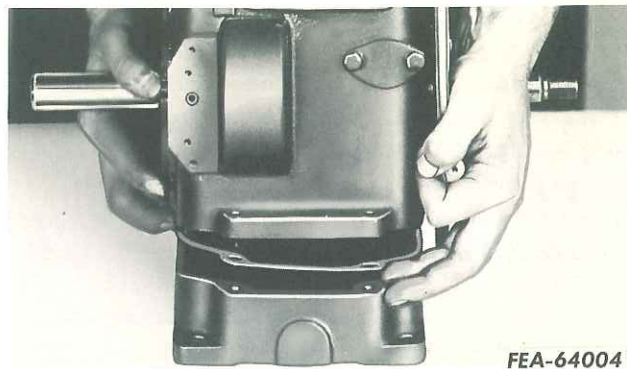


Illust. 14. Installing oil seal on front side of engine.

Installing and Setting Valves

1. Valves, valve seats and ports should be thoroughly cleaned. Valves and seats should be ground to obtain a good valve seal. Keep valve seat from 1/32 inch to 1/16 inch in width. Valve face and seat angle is 45 degrees.

2. Illust. 16 illustrates checking valve clearance. Intake valve clearance should be .006/.008 cold on K-161 and .008/.010 on K-241. Exhaust valve clearance should be

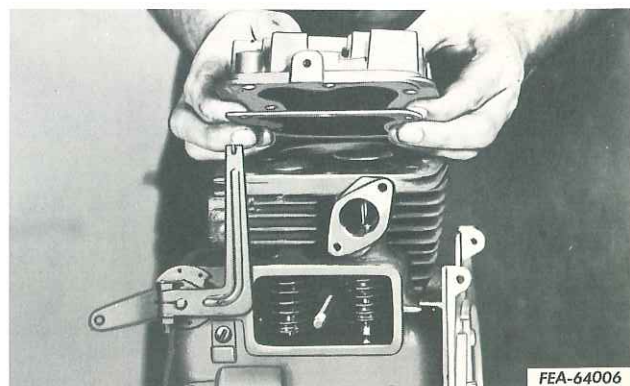


Illust. 15. Installing oil base.

.016/.018 cold on K-161 and .017/.020 on K-241. Valves that do not have sufficient clearance must be removed and stem 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. 16. Checking valve clearance.



Illust. 17. Cylinder head assembly.

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

Cylinder Head

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

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

3. It is important that cylinder head cap screws be tightened evenly and in steps until 200 inch pounds torque is reached on the K-161 and 300 inch pounds on the K-241 (Illust. 18).

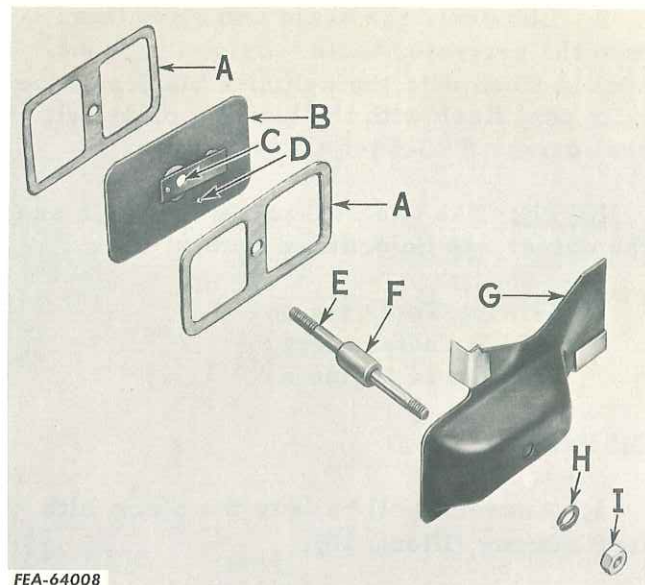
4. Install a new spark plug and gasket and tighten to 27 foot pounds torque. Spark plug gap should be .025.

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. 18. Tightening cylinder head cap screws.



Illust. 19. 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 the breather is as follows: (Illust. 19)

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. 20 shows the magneto in position. Note how breaker lead and high tension spark plug cables are pulled through plate opening.

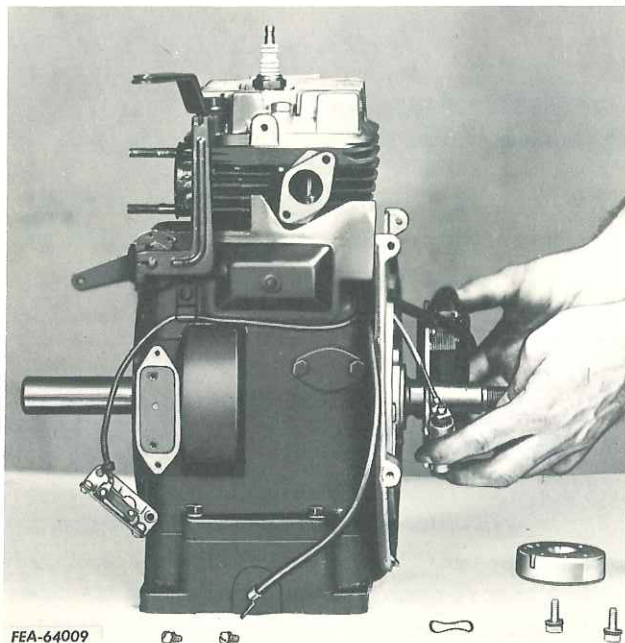
3. After the magneto assembly has been fastened to the bearing plate, the rotating magnet is pressed onto the crankshaft. Magnet is marked "ENGINE SIDE" for correct assembly.

Flywheel

1. Place tension washer on crankshaft and place flywheel in position. (The square key holds flywheel on shaft.)

2. Install blower housing, screen, "V" pulley, lock washer, and flywheel nut. Torque the nut to 75 ft. lbs.

3. Install the clutch drive plate to the "V" pulley.



Illust. 20. Assembly of magneto.

4. Install the retractable starting assembly and its mounting plate (if so equipped).

5. Install the starting pulley.

Breaker Points

1. Install push rod.

2. Fasten breaker in place with two screws.

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

4. Set breaker gap at .020. For precision ignition setting refer to Ignition Timing, page 26.

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

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

Carburetor

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

2. Refer to FUEL SYSTEM, page 18 for carburetor adjustment procedure.

Governor Arm and Linkage

1. Insert carburetor linkage in throttle arm.

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

3. On the Model 70, position the governor spring in the speed control disc. On the Model 100, install the governor spring, as shown in Illust. 1.

4. Before tightening clamp bolt, turn the shaft counterclockwise as far as possible with a pair of pliers, move the governor arm as far as possible (away from carburetor on the 70 and toward the carburetor on the 100). Tighten the 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 the fuel line between the sediment bowl 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

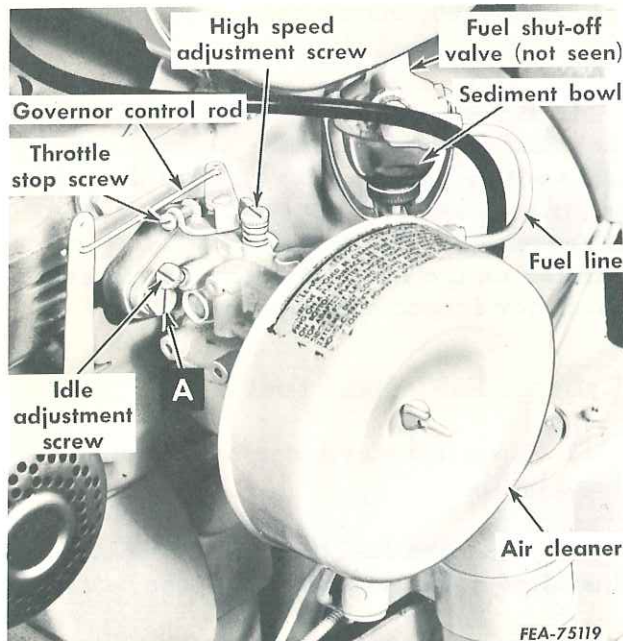
the driven pulley and the drive pulley. Refer to wiring diagrams (pages 23 and 24) under Electrical System of this manual for the proper electrical connections.

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.

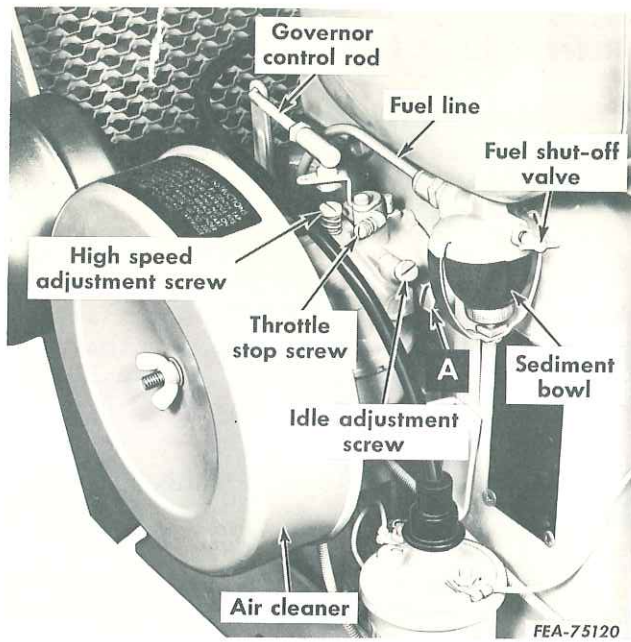


Illust. 21. Carburetor for Model 70.

Carburetor Adjustments (Refer to Illust. 23)

The carburetor is adjusted at the factory and under normal operating conditions will not require readjusting. If readjustment is necessary because of fuel values and oil conditions, the following procedure is recommended:

1. Turn the high speed adjustment screw counter-clockwise two turns from closed position and start the engine.
2. After the engine has reached normal operating temperature, accelerate and check the response. Place the engine under full load and adjust the high speed adjustment screw for leanest mixture that will still allow satisfactory acceleration and steady governor operation.
3. If the engine misses and backfires under full load, the high speed mixture is too lean. The high speed adjustment screw must be turned counter-clockwise 1/4 turn at a time until the condition is corrected.
4. If engine shows sooty exhaust and is sluggish under full load, the high speed mixture is too rich. The high speed adjustment screw must be turned clockwise 1/4 turn at a time until the condition is corrected.
5. Final check of high speed adjustment; operate the engine under full load and make any corrections necessary for smooth operation.



Illust. 22. Carburetor for Model 100.

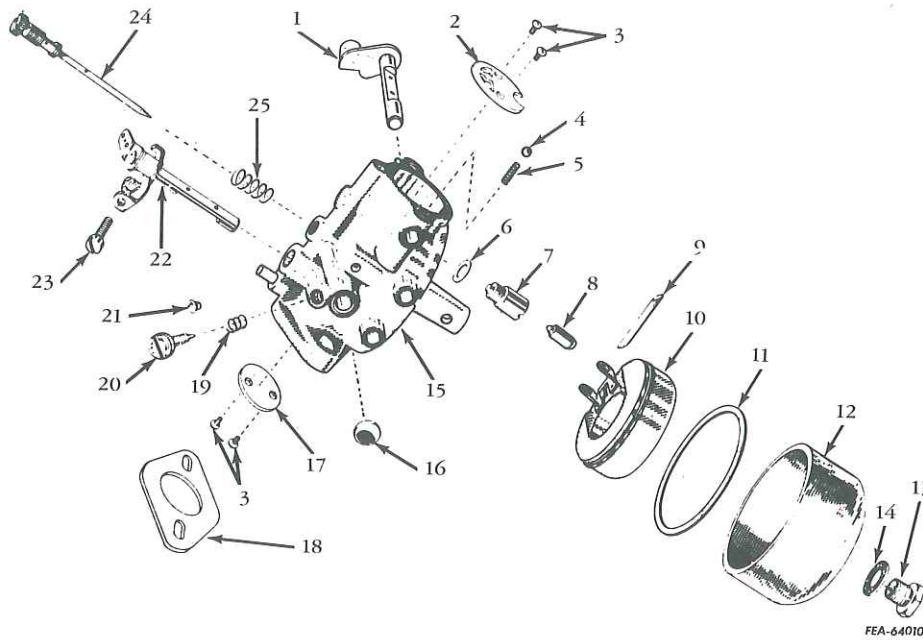
6. Idle screw adjustment should be made at the same time as high speed screw adjustment, as each effects the other.

7. The final idle adjustment should be made at an engine speed of not less than 1000 rpm. Adjust until smoothest idle is obtained.

CAUTION: Do not use force on high speed adjustment screw or idle speed screw -- they will be damaged.

Disassembly of Carburetor (Refer to Illust. 23)

1. Remove the carburetor from engine.
2. Remove the bowl nut, gasket, and bowl.



Illust. 23. Exploded view of carburetor.

- | | | | |
|-----------------------------------|----------------------|---------------------------|---------------------------------|
| 1. Choke shaft and lever assembly | 7. Float needle seat | 14. Gasket | 21. Rivet plug |
| 2. Choke valve | 8. Float needle | 15. Body | 22. Throttle shaft |
| 3. Screws | 9. Float pin | 16. Expansion plug | 23. Low idle stop screw |
| 4. Choke shaft ball | 10. Float | 17. Throttle plate | 24. High speed adjusting needle |
| 5. Choke shaft spring | 11. Gasket | 18. Gasket | 25. Spring |
| 6. Gasket | 12. Bowl | 19. Spring | |
| | 13. Cap screw | 20. Idle adjustment screw | |

3. Remove the float pin, float, needle and needle seat. Check the float for dents or leaks on the float lip. Check float pin holes for wear.

4. Remove the bowl ring gasket.

5. Remove the idle speed screw and high speed adjustment screw and spring.

6. Remove throttle valve screws, valve, shaft and lever assembly.

7. Do not remove the choke valve and shaft unless replacement of these parts is necessary.

8. A spring loaded ball retains the choke in wide-open position.

CAUTION: Hold a screwdriver handle or small piece of wood over the threaded hole in air horn (side opposite choke lever) to prevent the ball from flying out when shaft is removed.

Cleaning Carburetor Parts

1. Clean all parts in solvent. Gum is easily removed with an alcohol or acetone solvent.

2. Be sure all carbon deposits are removed from bore, especially where the throttle valve seats in the casting.

3. Blow out all passages with compressed air.

4. Replace all worn and damaged parts. ALWAYS USE NEW GASKETS.

Reassembly of Carburetor (Refer to Illust. 23)

1. Install throttle, shaft and valve. Valve must be installed with trademark "C" on side towards idle port when viewing from flange side.

2. With valve screws loose and the throttle lever set screw backed out, seat the valve by tapping lightly with a small screwdriver. Hold in place while tightening screws.

3. Install needle seat, needle, float and float pin.

4. Set float level. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be 13/64 inch clearance between machined surface of casting and free end of float (side opposite needle seat).

5. Adjust by bending lip of float with a small screwdriver.

6. Install new bowl ring gasket, new bowl nut gasket and bowl nut. Tighten securely after making sure bowl is centered on gasket.

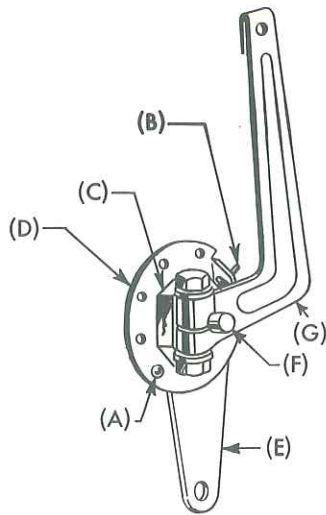
7. Install high speed adjustment screw assembly. Turn in until the screw seats in nozzle and back out two turns.

8. Install idle adjusting screw assembly. Back out approximately 1-1/2 turns after seating lightly against jet.

CAUTION: Do not jam the adjusting screw into the seat as this will damage idle adjustment screw.

GOVERNOR

Model 70



FEA-64011

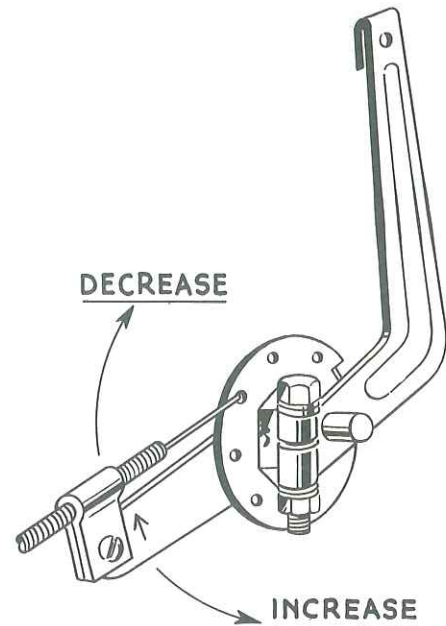
Illust. 24. Governor linkage.

- | | |
|---------------------|------------------------|
| A - Drive Pin | D - Speed Control Disc |
| B - Governor Spring | E - Throttle Bracket |
| C - Bushing Nut | F - Governor Shaft |
| G - Governor Arm | |

The engine is equipped with a centrifugal governor and operating speed is determined by throttle control setting. The governor maintains engine speed under varying loads and serves as a top speed limiting device.

To change high speed setting:

1. Loosen bushing nut (C, Illust. 24) slightly.
2. Moving the throttle bracket "E" (Illust. 24) counter-clockwise will rotate the speed control disc, increasing the tension on the governor spring "B" (Illust. 24), resulting in increased engine speed.
3. To decrease the engine speed, move the throttle bracket clockwise.



FEA-64012

Illust. 25. Speed range adjustments.

4. Tighten governor bushing nut "C" (Illust. 24) to lock throttle bracket "E", (Illust. 24) in desired position.

CAUTION: Do not apply excessive pressure on bushing nut.

Throttle Control

Installation and Adjustment:

1. With the control handle in an open position, insert throttle wire into speed control disc in the first hole clockwise from drive pin.
2. Install cable clamp and bolt to throttle bracket.
3. Operate control handle, rotating the disc from idle to full speed.

NOTE: Throttle wire should be adjusted so that when the throttle is in full speed position, stop "A" is just touching the throttle control bracket "E" (Illust. 24).

4. Operating speed range can be changed by moving the throttle bracket as shown in Illust. 25.

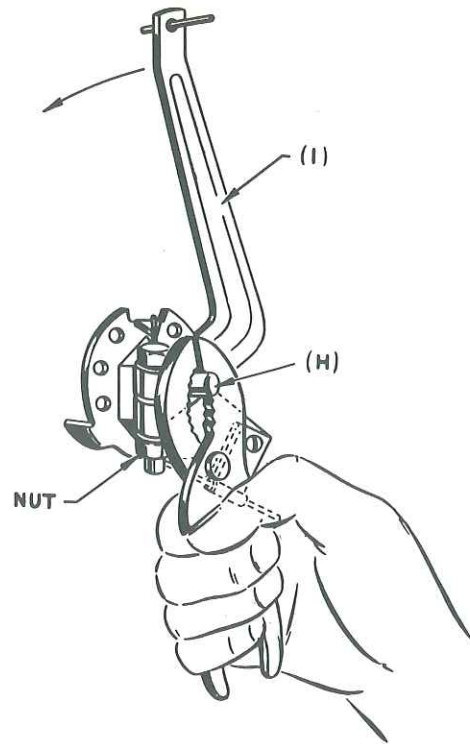
Governor Adjustment

Governors are set when the engines are assembled and should not require readjustment unless the governor arm is loosened or removed from the governor shaft.

1. To reset the governor (Illust. 26), loosen the nut which holds the governor arm (I) to shaft (H).

2. Turn shaft counter-clockwise as far as possible with a pair of pliers.

3. Pull arm (I) all the way to the left (away from carburetor). Tighten nut. Check for freedom of movement.



Illust. 26. Resetting governor.

Model 100

K241 Engines are equipped with internal mechanical governors and operating speed is determined by speed control lever setting. The Governor maintains engine speed under varying loads and also serves as a top speed limiting device.

Governor sensitivity may be adjusted by means of changing the setting of the Governor spring in the governor lever (Illust. 1) If too sensitive, speed surging may occur on change of load. A big drop in speed when load is applied indicates governor should be set for greater sensitivity.

Increasing the tension of the governor spring will give greater sensitivity; conversely decreasing spring tension will allow broader governor action.

Throttle Control

Install throttle wire into clamp and tighten screw "B". Refer to Illust. 1.

Governor Adjustment

Governors are set when the engines are assembled and should not require readjustment unless governor arm is loosened or removed from governor shaft.

1. To reset governor loosen clamp bolt which holds governor arm, to shaft, (Illust. 1).

2. Turn shaft counter-clockwise as far as possible with a pair of pliers.

3. Push governor arm all the way towards the carburetor. Tighten nut. Check for freedom of movement.

ELECTRICAL SYSTEM

Magneto Ignition

On tractors equipped with Recoil Starter, the ignition system is equipped with a magneto to furnish the electrical impulse at the spark plug. See Illust. 27.

Testing Magneto

1. Check magneto output by placing the end of the spark plug cable about 1/8 inch from the crankcase and the engine. Remove the spark plug to make cranking easier.

2. If there is no spark, check the breaker points.

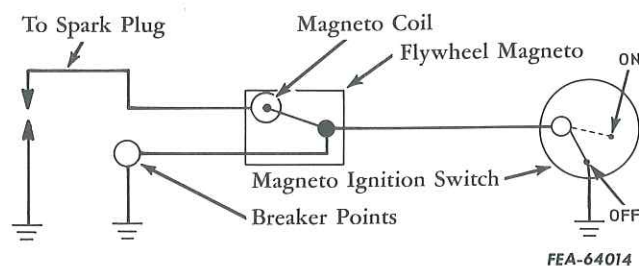
3. After the breaker points have been cleaned or replaced and there is still no spark, the magneto is at fault.

4. If a good commercial tester is available, components of the magneto can be checked. Refer to tester manufactures instructions for acceptance limit of coils.

Battery Ignition

On tractors equipped with an electric starter, the electrical system consists of a motor-generator, voltage regulator, ignition switch, starting switch, battery, ignition coil and breaker point assembly.

The motor-generator acts as a cranking motor when the starter switch is closed



Illust. 27. Schematic wiring diagram of magneto ignition.

and a generator when the switch is open. The voltage regulator controls current and voltage to the battery at all engine speeds. See Illust. 28.

Motor-Generator

1. The brushes should be inspected for wear approximately every 200 hours. If brushes are worn to less than half their original length, they should be replaced. Compare the old brushes with new to determine the amount of wear.

2. Brushes can be inspected or replaced by removing the two through bolts and the commutator end frame.

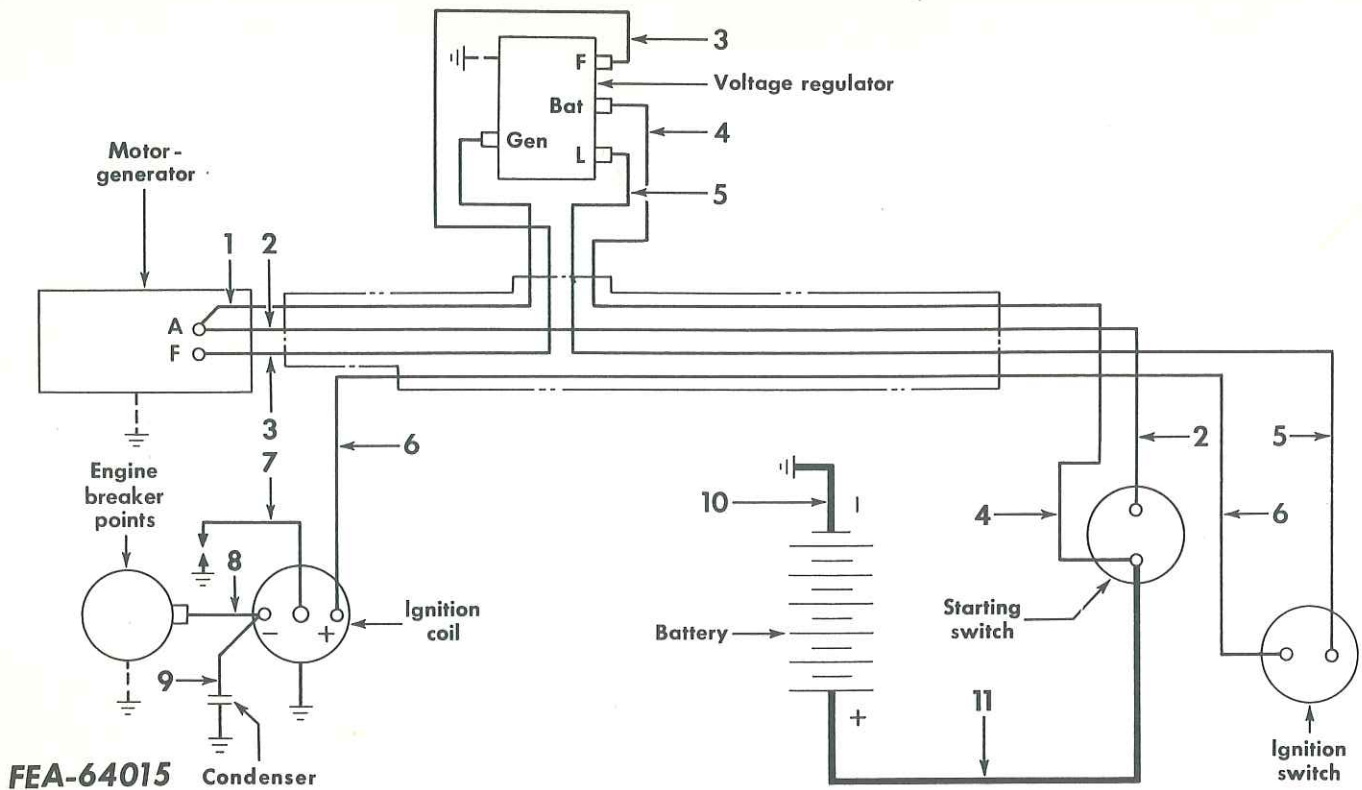
3. After checking or replacing brushes, if the motor-generator still fails to operate satisfactorily the unit will have to be checked further with special testing equipment. Instructions for performing the test can be found in literature furnished with the test equipment.

Current-Voltage Regulator

CONTACT POINTS

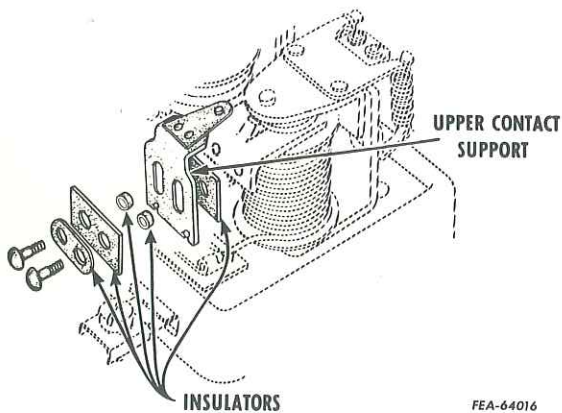
The contact points of a regulator will not operate indefinitely without some attention. A great majority of regulator troubles can be eliminated by a simple cleaning of the contact points and slight adjustments. See Illust. 29. The flat point always develops a slight cavity and is the point that requires the most attention. It is not necessary to have a perfectly flat surface on this point, but cleaning the surface down to pure metal with a fine-cut point file will insure long periods of service without difficulty. The file should not be allowed to become greasy and should not be used to file other metals. After filing, wipe points with lintless cloth saturated in carbon tetrachloride to insure clean surfaces.

CAUTION: Avoid excessive removal of contact point metal. Never use sandpaper or emery cloth to clean points.



Illust. 28. Schematic wiring diagram of battery ignition.

1. Cable-regulator "GEN" terminal to generator "A" terminal (light blue).
2. Cable-generator "A" terminal to starter button (red).
3. Cable-regulator "F" terminal to generator "F" terminal (yellow).
4. Cable-regulator "BAT" terminal to starter button (gray).
5. Cable-regulator "L" terminal to ignition switch (light green).
6. Cable-ignition coil positive (+) terminal to ignition switch (black).
7. Cable-spark plug to coil (secondary).
8. Cable-breaker points to coil negative (-) terminal.
9. Cable-condenser to coil negative (-) terminal.
10. Cable-battery to ground.
11. Cable-battery to starter button.



Illust. 29. Disassembly of upper contact support for cleaning. Use new insulator bushings upon reassembly.

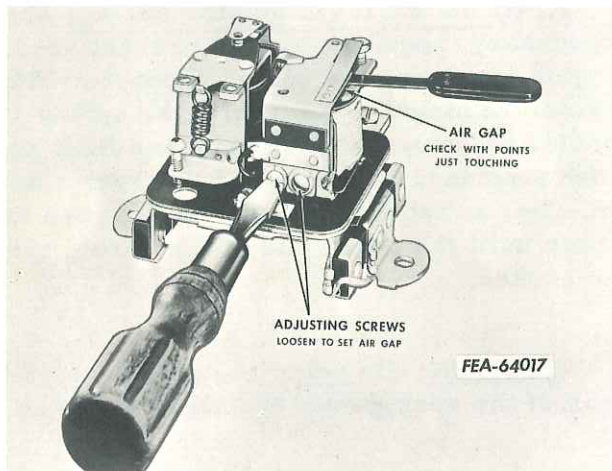
On (-) negative grounded system regulators the flat point is in the armature. Clean them by loosening the upper contact support and moving it to one side.

NOTE: Regulators are designed for use with a system having a given battery ground polarity. Using the wrong polarity regulator on an installation will shorten the life of the regulator contact points. Be careful to avoid interchanging the two types of regulators in service. Check the parts catalog for the regulator part number when a replacement is necessary.

CUT-OUT RELAY ADJUSTMENTS

There are three adjustments of the cut-out relay: Armature to core air gap, contact point opening, and voltage required to close points. The air gap and point opening adjustments must be made with the battery disconnected.

1. Air gap. Place your fingers on the armature directly above the core and press the armature down until the points just close. Then measure the air gap between the armature and the center of the core. See Illust. 30. The air gap should be .020 inch. Adjust by raising or lowering the armature at its hinge mounting. Retighten screws after adjustment.



Illust. 30. Cut-out relay air gap inspection and adjustment.

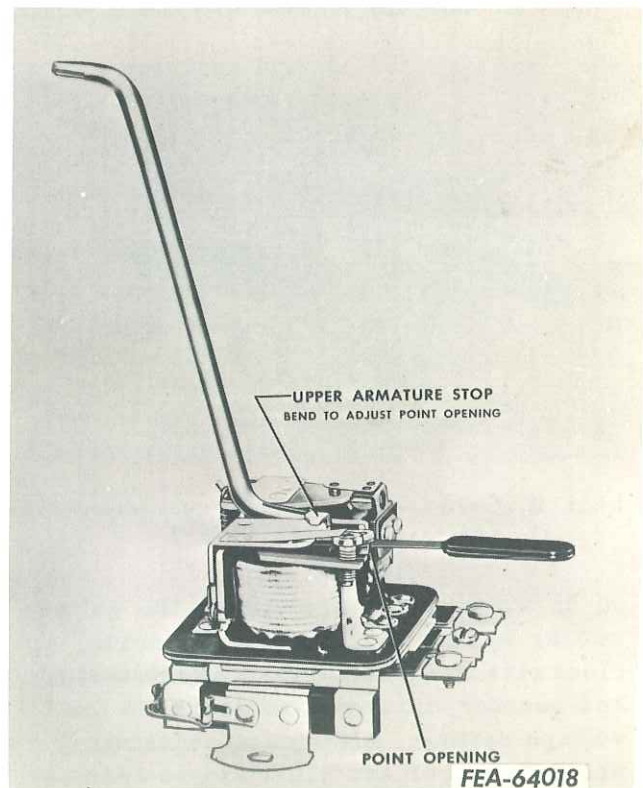
2. Point opening. Adjust the point opening by bending the armature stop as shown in Illust. 31. The opening should be .020 inch.

3. Closing voltage. Adjust the closing voltage by turning the screw clockwise to increase spring tension and voltage, counterclockwise to decrease spring tension and closing voltage. Be sure that closing voltage adjustment is at least 0.5 volt less than the current-voltage regulator unit setting. Refer to the specifications table for range and adjustment. See Illust. 32.

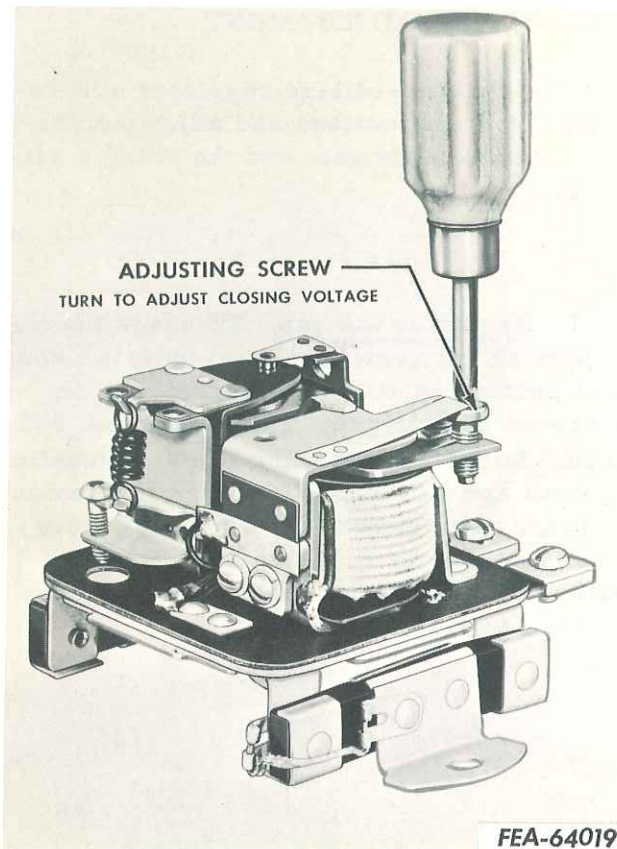
REGULATOR ADJUSTMENT

The current-voltage regulator unit requires two inspections and adjustments: the armature air gap, and the voltage setting.

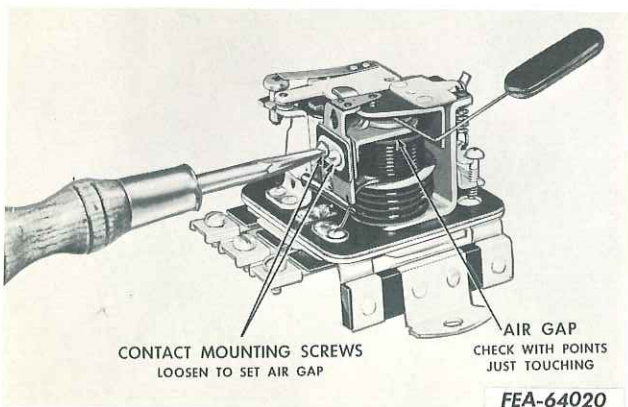
1. Regulator air gap. To check the air gap, push the armature down until the contact points are still just touching; then measure the air gap. This should be .075 inch. Adjust by loosening contact mounting screws and raising or lowering the contact bracket as required. Be sure the points are lined up and screws are retightened after adjustment and before retesting the voltage setting. See Illust. 33.



Illust. 31. Cut-out relay point opening inspection and adjustment.



FEA-64019
 Illust. 32. Adjustment of cut-out relay closing voltage.



FEA-64020
 Illust. 33. Current-voltage regulator air gap inspection and adjustment.

2. Voltage setting. Adjust the voltage setting by turning the adjusting screw — clockwise to increase the voltage setting and counter-clockwise to decrease the voltage setting. After each adjustment, replace the cover and allow ample running time to again stabilize voltage and temperature before rechecking the voltage setting. See Illust. 34.

CAUTION: If the adjusting screw is turned down (clockwise) beyond the normal range required for adjustment, the spring support may fail to return when the pressure is relieved. If this happens, turn the screw counter-clockwise until enough clearance develops between the screw head and the spring support. Then bend the spring support upward carefully with small pliers until contact is made with the screw head. The final setting should always be approached by increasing the spring tension. In other words, if the setting is too high, the unit should be adjusted below the required value and then raised to the exact setting by increasing the spring tension. Be sure the screw is exerting force on the hanger.

3. Replacing the regulator spring, when necessary, requires care to prevent bending or distorting the spring support or the armature hinge. Preferably, the spring should be hooked at the lower end first and then stretched up with a screwdriver blade, or other suitable tool, inserted between the turns until the upper end of the spring can be hooked.

CAUTION: Do not try to pry the upper end of the spring over the armature hook.

4. The resistor, "F" terminal to ground, when open circuited will cause rapid pitting and burning of regulator unit points. The original resistor unit can be removed by use of pliers, and a new unit can be soldered firmly in its place.

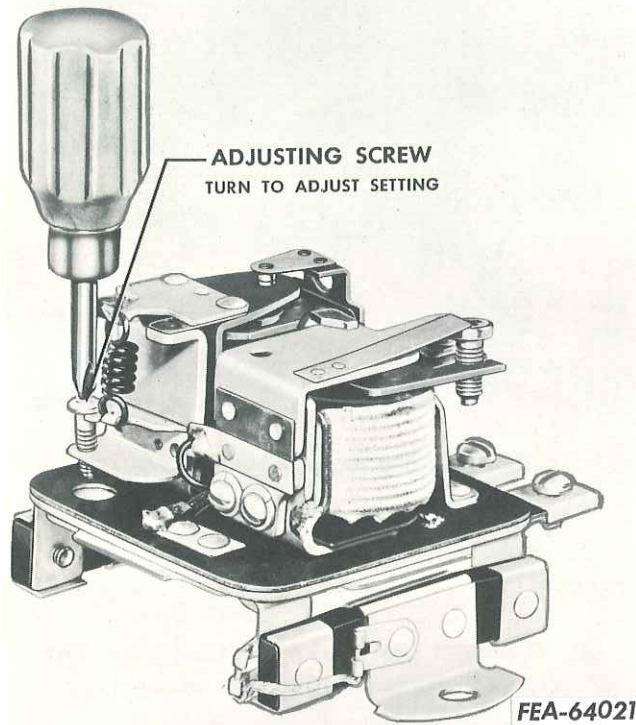
5. Ground lead assembly may also be replaced when necessary by soldering a new assembly into place between the regulator base plate and mounting bracket on the rubber shock mounting.

Ignition Timing

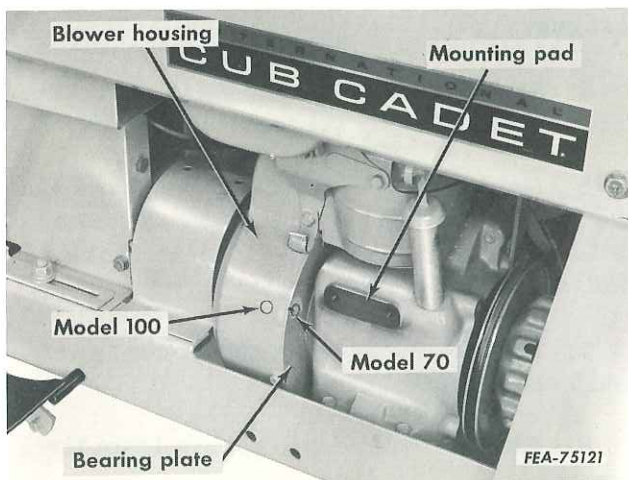
1. For static ignition timing, remove the ignition breaker point cover (Illust. 3). Rotate the engine flywheel until breaker

point cam has opened the points to their maximum. Adjust the points to .020 inch gap.

2. The engine is equipped with a timing sight hole in the right side of the engine bearing plate on the Model 70 and in the right side of the blower housing on the Model 100 (Illust. 35).



Illust. 34. Adjusting voltage setting, current-voltage regulator unit.



Illust. 35. Location of timing sight hole. (Starter - generator has been removed to better illustrate location.)

3. If timing light is available, adjust breaker point gap while the engine is running until "SP" mark on flywheel is centered in sight hole (Illust. 35).

NOTE: The "SP" mark will appear 20 degrees before top dead center. Top dead center is stamped with "DC" below its mark.

Breaker Assembly

1. Breaker points are operated by a cam on engine camshaft.

2. Dirty contact points can be cleaned with gasoline. Wipe dry and make sure that no lint or oil film is left between breaker point surfaces.

3. Pitted or burned points should be replaced. See ignition timing for proper setting.

Spark Plug

1. Service periodically to reduce fouling. The deposits are hard to remove if allowed to remain longer than 100 operating hours.

2. Degrease wet or oily plug and dry thoroughly.

CAUTION: If spark plug is sand blasted, make sure all sand is removed by washing in a cleaning solvent and dry with compressed air.

3. File electrode sparking area to obtain bright, flat surfaces.

4. Set gap at .025 inch.

5. Use new gasket when installing new or serviced spark plug. Torque to 27 ft. lbs.

Testing Condenser

Check condenser with a reliable commercial condenser tester. Replace as necessary.

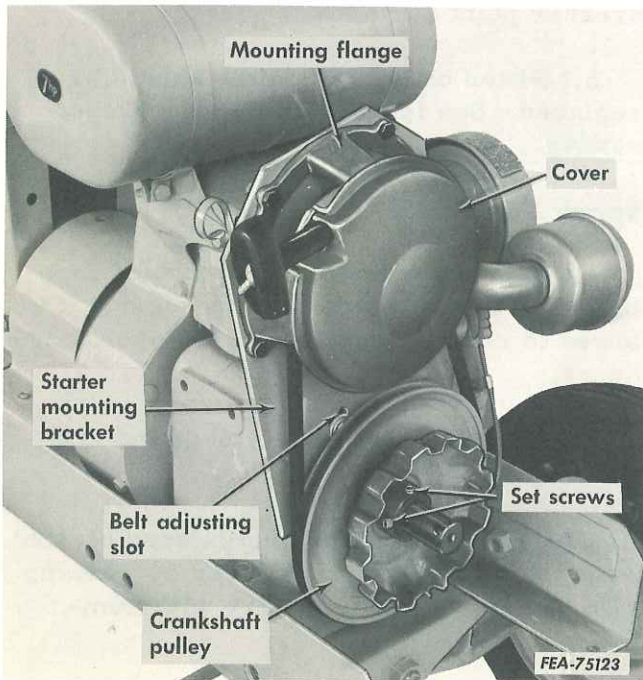
RECOIL STARTER

This unit is made by Fairbanks-Morse and has a cast aluminum housing, rotor, and mounting flange.

A steel bracket bolted to the front of the engine supports the starter unit and the starter pulley and bearing assembly.

Twin friction shoes, of the starter unit, are activated to engage the drive cup of the starter pulley.

A "V" belt connects the starter pulley to a "V" pulley on the engine crankshaft.



Illust. 36. Model 70. Recoil starter and mounting bracket.

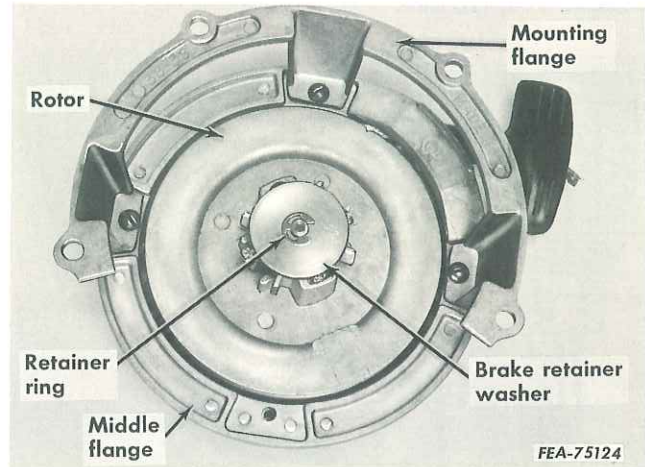
Removal

1. Remove the four bolts which secure the starter assembly to its mounting bracket.

2. Move the starter unit forward and upward from the pulley assembly.

Disassembly

1. Place the starter assembly rear side upward as shown on a work bench.



Illust. 37. Starter assembly rear view.

2. Hold down on the brake retainer washer and remove the retainer ring.

3. Remove the brake retainer washer and the coil spring under the washer.

4. Remove the three slotted head screws which hold the mounting flange and middle flange to the cover. Remove the flanges.

5. Slide the friction shoe assembly and friction washers up off the cover shaft.

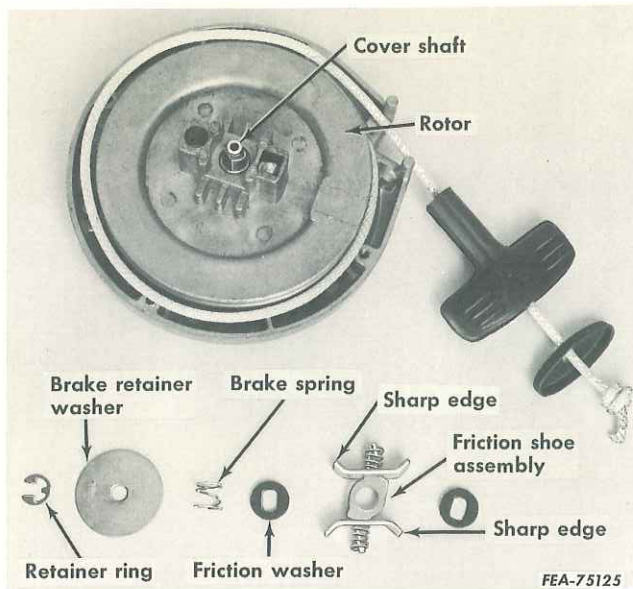
6. Hold the rope handle in one hand and the cover in the other and allow the rotor to turn counter-clockwise to unwind the recoil spring pre-load.

7. Lift the rotor from the cover, shaft and recoil spring.

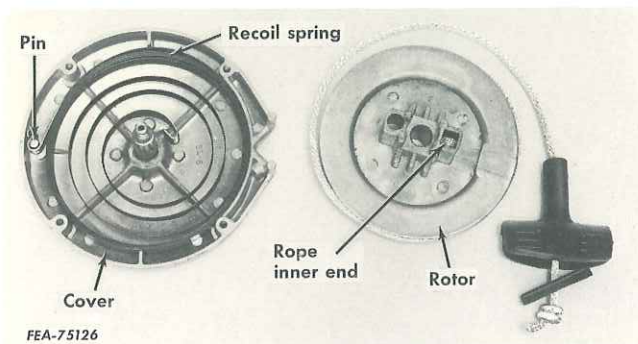
8. Remove the recoil spring from the cover.



CAUTION: Allow the spring to uncoil slowly to avoid personal injury.



Illust. 38. Friction shoe assembly removed.



Illust. 39. Rotor removed to show recoil spring in cover.

9. Unwind the rope from the rotor, push the inner end through the rotor to permit the "end-double-back" to straighten then the rope can be removed.

Inspection and Reassembly

1. Clean the recoil spring in solvent, inspect the hook ends, lubricate spring with light oil then install the spring in the cover. Spring must spiral in a clockwise direction as you follow the spring from the outside end to the inside. Refer to Illust. 39.

2. Inspect the rope and the clip on its inner end. Rope must be free of cuts and frayed or worn spots. Clip must be tight on the end.

3. Install the rope (clip end) through the rotor then double the clip end back and retrieve the rope to "lock-in" the clip end. Wrap the rope around the rotor in the direction shown in Illusts. 38 and 39.

4. Lubricate the shaft and its bore in the rotor with chassis lube or lubriplate then install the rotor to the shaft and engage the recoil spring inner end hook.

5. Pre-load the spring four turns and install the middle flange and the mounting flange. Secure with screws.

6. Install one friction washer to the shaft and push down against the rotor.

7. Check the friction shoe sharp ends, replace if worn then install the shoe assembly to the shaft and rotor. Be sure the shoe assembly is right-side-up as shown in Illust. 38.

8. Install the second friction washer.

9. Install the spring, retainer washer and retainer ring.

10. Pull the rope. The sharp ends of the friction shoe plates should extend.

NOTE: Some starter assemblies available from parts depots have a long rolled pin in the end of the cover shaft. Pull this pin from the shaft. It is not used on the Model 70 cadet tractor.

11. Replace the starter to the support bracket. Check starter belt tension and adjust if necessary.

NOTE: The starter pulley is a press fit on its bearing shaft. A wire clip holds the sealed bearing assembly in the bracket. If replacement of the support bracket is necessary, both set screws in the crankshaft pulley hub must be loosened to move pulley forward then bracket capscrews can be removed.

SERVICE BULLETIN RECORD

Important: Information in this manual section is subject to change or supplementing from time to time as a result of field experience and engineering modifications. As Service Bulletins are received, record them on this page for handy reference whenever this manual is to be used. . . Print entries in ink.

Bulletin No.	Date Issued	Book No.	Topic or part of machine involved.



1st in service