SERVICE MANUAL

Uni-Loader

1818

8-66102

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

Uni-Loader

1818

8-66102

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

Uni-Loader

1818

8-66102

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

Uni-Loader

1818

8-66102

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

TORQUE SPECIFICATIONS - STEEL HYDRAULIC FITTINGS

Tube OD Hose ID	Thread Size	Pound-Feet	Newton metres
37 Degree Flare Fittings			
1/4 in 6.4 mm	7/16-20	6-12	8-16
5/16 in 7.9 mm	1/2-20	8-16	11-21
3/8 in 9.5 mm	9/16-18	10-25	14-33
1/2 in 12.7 mm	3/4-16	15-42	20-56
5/8 in 15.9 mm	7/8-14	25-58	34-78
3/4 in 19.0 mm	1-1/16-12	40-80	54-108
7/8 in 22.2 mm	1-3/16-12	60-100	81-135
1.0 in 25.4 mm	1-5/16-12	75-117	102-158
1-1/4 in 31.8 mm	1-5/8-12	125-165	169-223
1-1/2 in 38.1 mm	1-7/8-12	210-250	285-338

Tube OD Hose ID	Thread Size	Pound-Feet	Newton metres
Straight Threads with O-ring			
1/4 in 6.4 mm	7/16-20	12-19	16-25
5/16 in 7.9 mm	1/2-20	16-25	22-23
3/8 in 9.5 mm	9/16-18	25-40	34-54
1/2 in 12.7 mm	3/4-16	42-67	57-90
5/8 in 15.9 mm	7/8-14	58-92	79-124
3/4 in 19.0 mm	1-1/16-12	80-128	108-174
7/8 in 22.2 mm	1-3/16-12	100-160	136-216
1.0 in 25.4 mm	1-5/16-12	117-187	159-253
1-1/4 in 31 8 mm	1-5/8-12	165-264	224-357
1-1/2 in 38.1 mm	1-7/8-12	250-400	339-542

Split Flange Mounting Bolts		
Size	Pound-Feet	Newton metres
5/16-18	15-20	20-27
3/8-16	20-25	26-33
7/16-14	35-45	47-61
1/2-13	55-65	74-88
5/8-11	140-150	190-203

DETAILED SPECIFICATIONS

Low Oil Pressure Switch		
Location	On Oil Filter Adaptor Block	
Operation	Stops Voltage Flow To Ignition When Oil Pressure Is Below 8 PSI	55 kPa
Engine Block Breather		
Location	Above Left Hand Valve Cover	
Cleaning Period	Every 200 Hours	
Oil Pump		
Location	At Front Of Engine Inside Timing Cover	
Drive	Gear In Mesh With Crankshaft Gear	
Gear Backlash	0.001 to 0.008 inch	0.025 to 0.203 mm
Minimum Pressure at 1500 RPM	8 PSI	55 kPa
Shim Gasket Thickness	0.005 inch	0.127 mm
	0.007 inch	0.178 mm
	0.009 inch	0.229 mm
Ignition System		
Type	Electronic Battery Ignition System Using An Ignition Module And Trigger Ring	
Location	Behind Flywheel On Engine Crankshaft And Timing Gear Cover	
Ignition Coil		
Primary Coil Resistance	2.90 to 3.60 Ohms At 70°F	
Secondary Coil Resistance	14.5 to 19.8k Ohms At (21°C)	
Ignition Timing		
Degress Before Top Center	20	
Spark Plug		
Type	RS14YC	
Electrode Gap	0.025 inch	1.64 mm
Carburetor		
Type	Fixed Power Jet With Adjustable Low Idle Needle	
Governor		
Type	Throwout Balls In Cup On End Of Camshaft. Actuates On Throttle Control Lever	
Fuel Pump		
Type	Diaphragm Operated By Vacuum In Engine Block	
Inlet Vacuum (Min)		
Low Idle Speed	2.6 in Hg at 32°F	0.767 kPa at 0°C
Maximum Speed	2.6 in Hg at 32°F	0.767 kPa at 0°C
Outlet Pressure (Min)		
Low Idle Speed	1.7 PSI	11.72 kPa
Maximum Speed	1.7 PSI	11.72 kPa

DETAILED SPECIFICATIONS

Injectors

Injector Assembly	1959384 C1	
Tip Assembly	1959560 C1	
Opening Pressure	1990 to 2133 PSI	13.7 to 14.7 MPa
Change in Shim Thickness/ Opening Pressure	0.039 inch ≈ 142 PSI	0.1 mm ≈ 980 kPa

Glow Plugs

Approximate Resistance	1.0 to 1.6 Ohms

Starter Motor

Case Part Number	1959 380 C1

No Load Test

Temperature	80°F	27°C
Current Draw (Max)	80 Amperes	
Volts	11	
Output Shaft Speed (Min)	3500 RPM	
Test time (Max)	30 secs	

Magnetic Switch Test

Test Time (Max)	5 secs

Armature Run-Out (Max)	0.002 inch	0.05 mm
Commutator Diameter (Min)	1.81 inch	46 mm
Mica Insulation Depth Below Commutator Segments	0.015 to 0.031 inch	0.5 to 0.8 mm
Brush Spring Pull	4 to 9 lb	1.8 to 4.1 kg
Brush Length (Min)	7/16 inch	11 mm

Starter Motor Lubrication

Period	When Starter Motor Is Disassembled Or Each Time The Engine Is Removed For Repair
Molykote-GN	Pinion End Of Output Shaft In Starter Driver
Case Multi Purpose Grease	Bearings, Gears And Springs

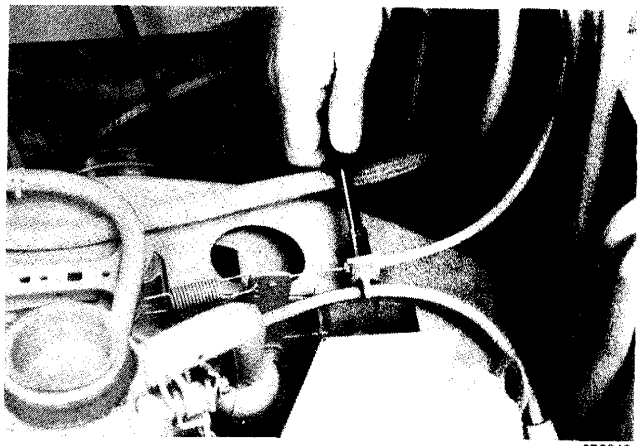
Regulator

Charging Current With Full Load	14 to 15A

Dynamo

No-Load Voltage At 5200 RPM	AC 20V
Stator Resistance (Max)	0.50 Ohms

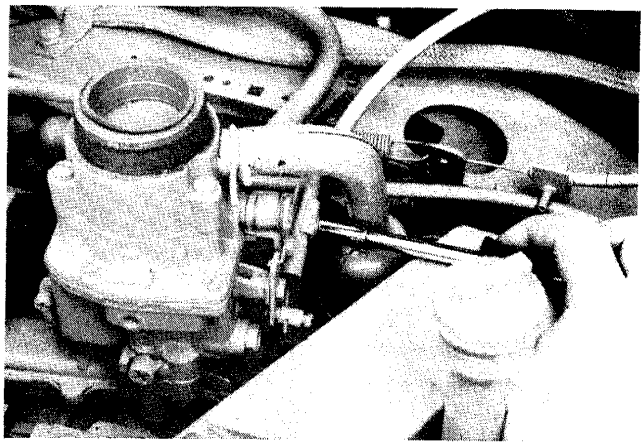
STEP 15



876340

Put the throttle cable in position on the throttle cable mounting bracket. Tighten the screw that fastens the throttle cable to the mounting bracket.

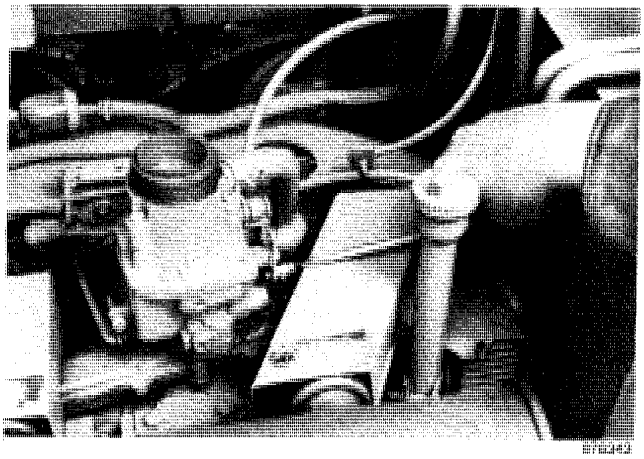
STEP 16



876341

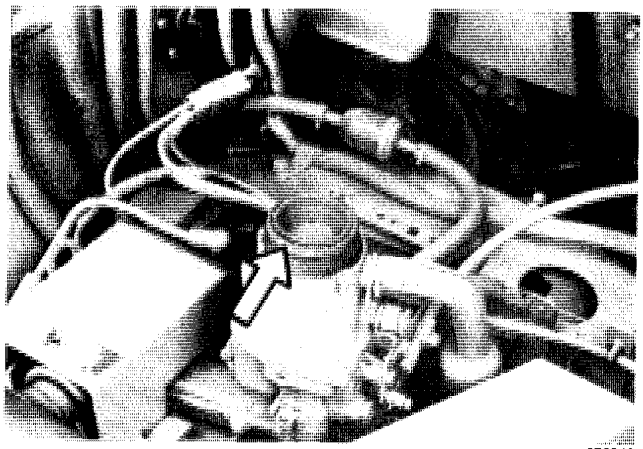
Put the choke cable in position on the carburetor and the choke linkage. Tighten the screw that fastens the choke cable to the carburetor.

STEP 17



Tighten the screw that fastens the choke cable to the choke linkage.

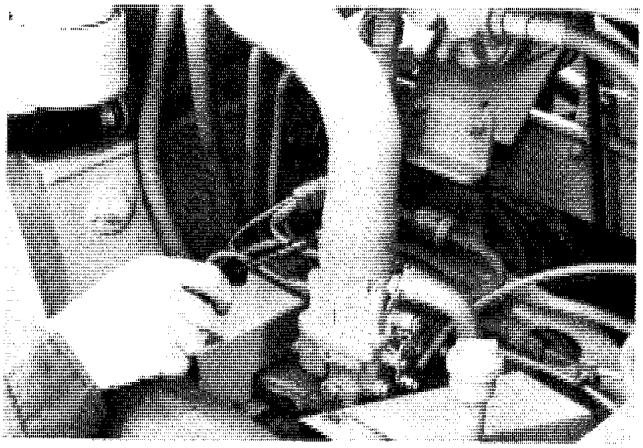
STEP 18



876342

Remove the cover from the carburetor.

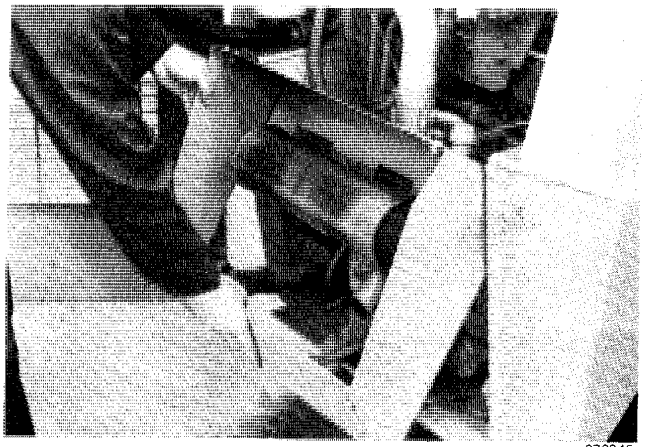
STEP 19



876344

Put the air cleaner hose in position on the air cleaner and the carburetor. Tighten the clamps that fasten the air cleaner hose to the air cleaner and the carburetor.

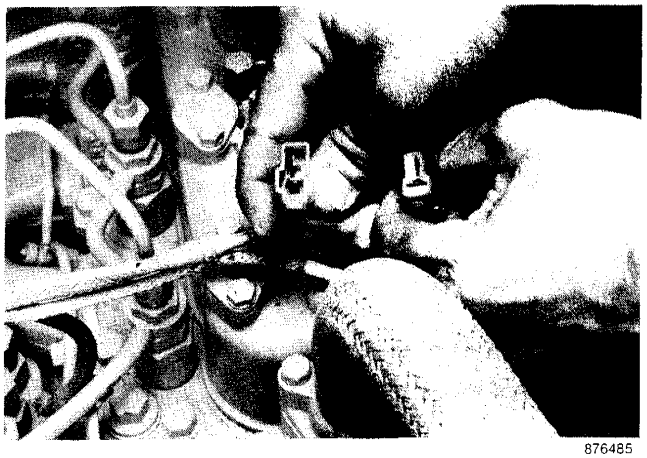
STEP 20



876345

Put the engine shroud in position on the engine.

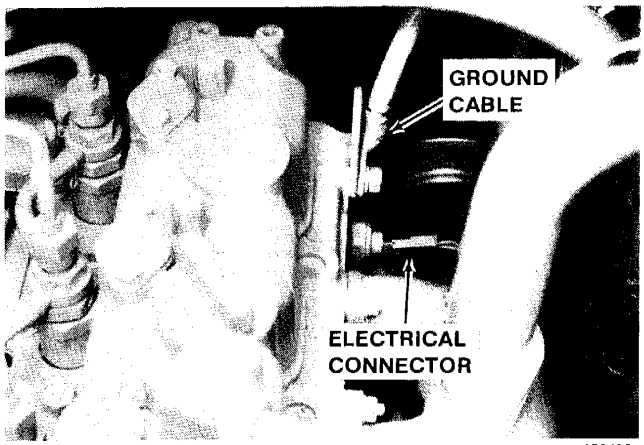
STEP 11



876485

Connect the electrical connector of the alternator to the wiring harness.

STEP 12



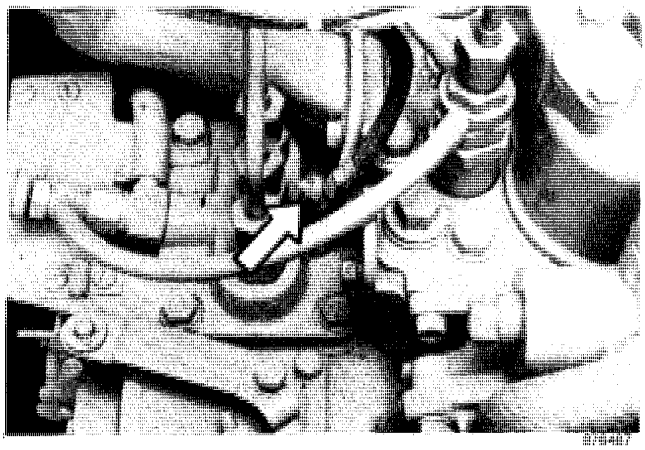
876486

Loosen and remove the cap screw that fastens the lifting eye to the engine. Put the ground cable in position on the cap screw. Install the cap screw, the lifting eye and the ground cable on the engine.

STEP 13

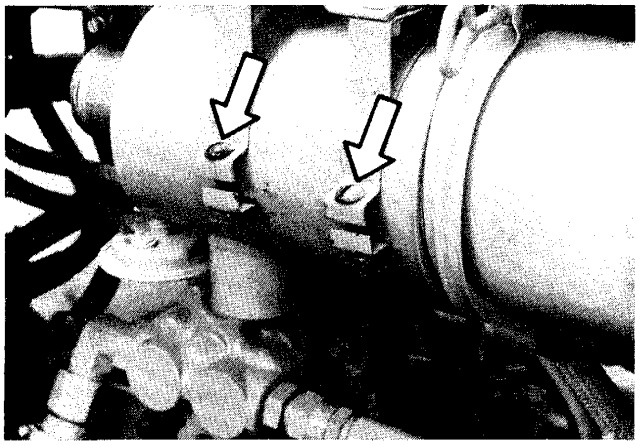
Connect the electrical connector for the oil pressure switch (see photo for step 12).

STEP 14



Connect the wire to the glow plug.

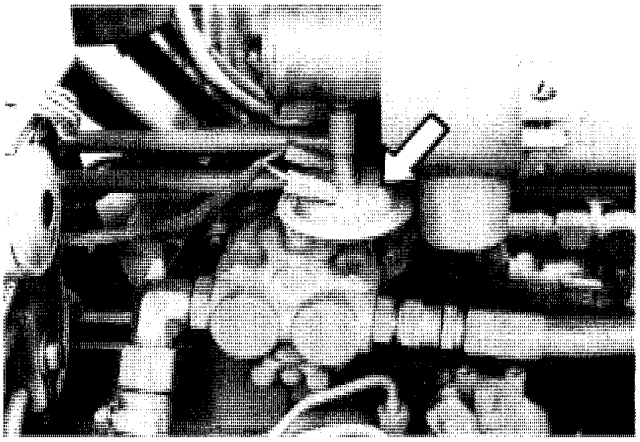
STEP 15



876482

Put the air cleaner in position on the air cleaner mounting bracket. Install the screws and nuts that fasten the air cleaner in the air cleaner mounting bracket.

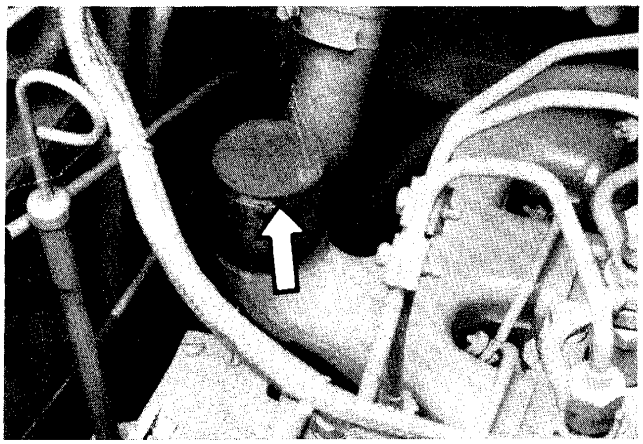
STEP 16



876488

Connect the wire to the air restriction indicator.

STEP 17



876480

Remove the cover from the opening in the intake manifold.

Valve Guide

Intake Inside Diameter - MIN	0.281 inch	7.137 mm
- MAX	0.282 inch	7.163 mm
Exhaust Inside Diameter - MIN	0.2805 inch	7.124 mm
- MAX	0.2815 inch	7.150 mm

Tappet

Body Diameter - MIN	0.7475 inch	18.99 mm
- MAX	0.7480 inch	19.00 mm
Bore Diameter - MIN	0.7500 inch	19.05 mm
- MAX	0.7515 inch	19.09 mm
Clearance In Bore - MIN	0.002 inch	0.051 mm
- MAX	0.004 inch	0.102 mm

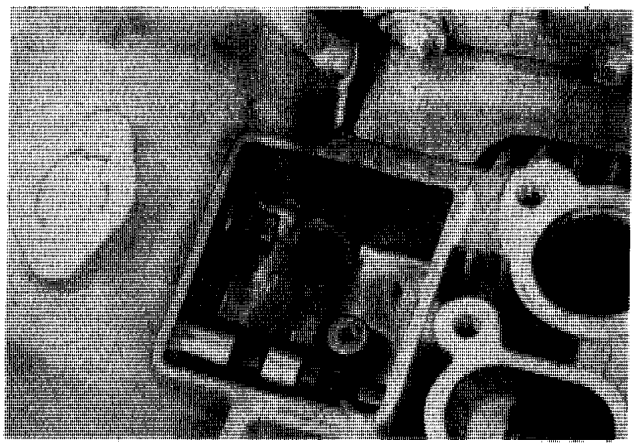
Valve Springs Intake And Exhaust

Valve Spring Free Length (Approx.)	1.60 inch	40.64 mm
Valve Spring Length		
Valve Open	1.055 inch	26.80 mm
Valve Closed	1.346 inch	34.19 mm
Spring Load At 1.35 inch (Valve Closed)	25 lb	11.3 kg
Spring Load At 1.05 inch (Valve Open)	55 lb	24.9 kg

Gear Backlash

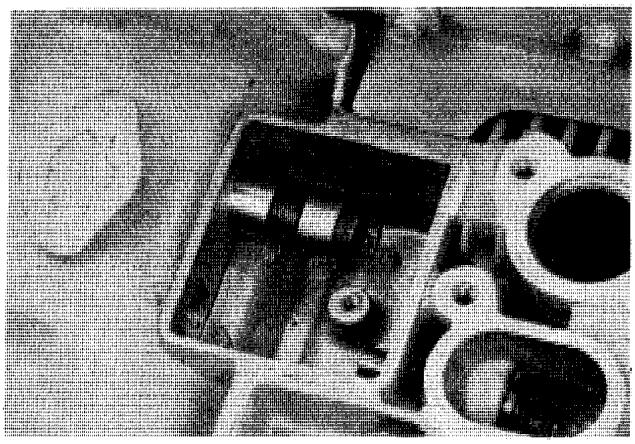
Timing Gear - MIN	0.001 inch	0.025 mm
- MAX	0.005 inch	0.127 mm

STEP 29



Remove the inlet valve tappet.

STEP 30

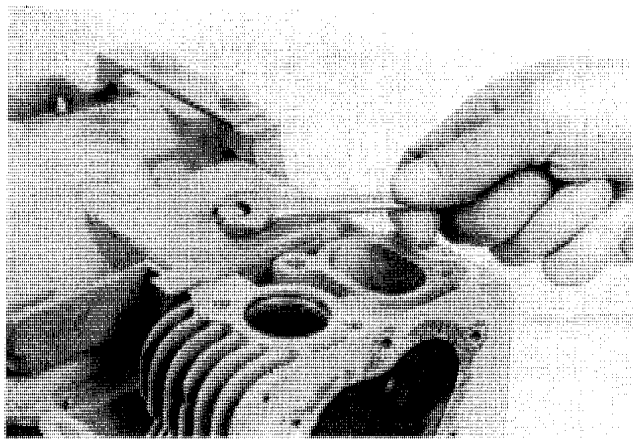


Remove the exhaust valve tappet.

STEP 31

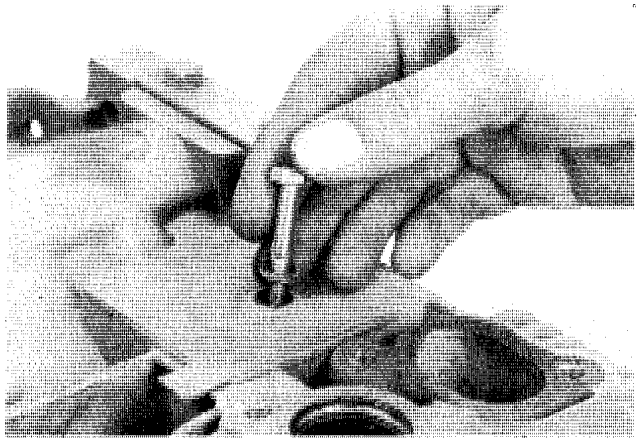
Follow STEPS 2 to 8 for removal of the right hand cylinder head.

STEP 32



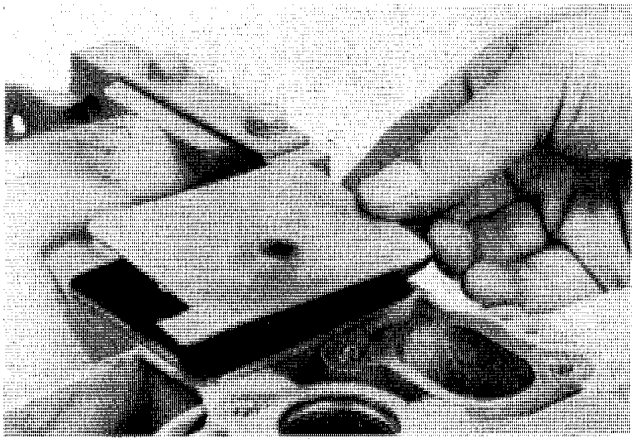
Loosen the valve chest cover bolt.

STEP 33



Remove the bolt and copper sealing washer.

STEP 34



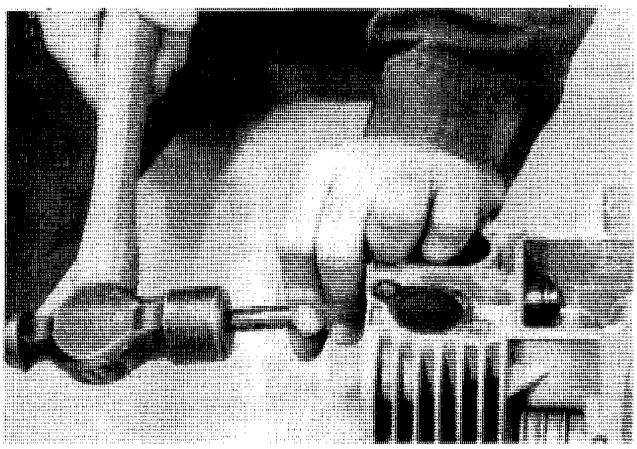
Remove the valve cover.

Valve Guide Replacement

STEP 62

Before removing valve guides, remove carbon and other deposits from the top surface of the guides to prevent damage to the guide bores when removing the guides.

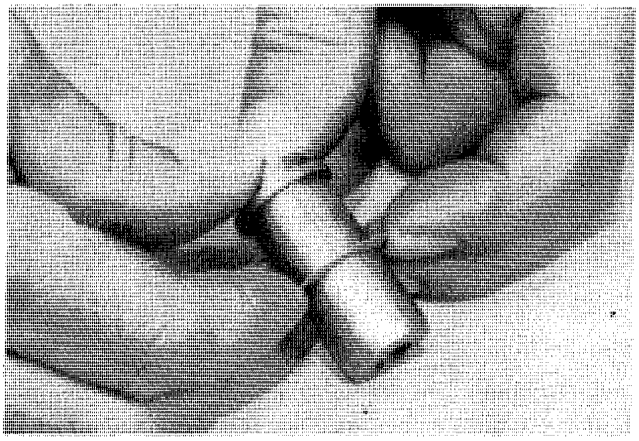
STEP 63



Use a valve guide removal tool to drive the valve guide from the bore.

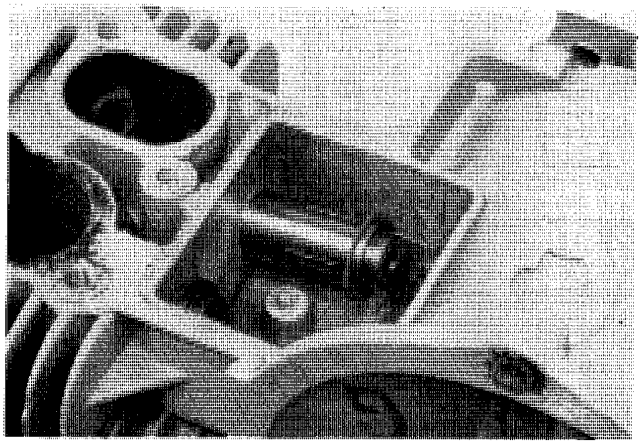
NOTE: *Inlet valve guides only have a gasket installed.*

STEP 64



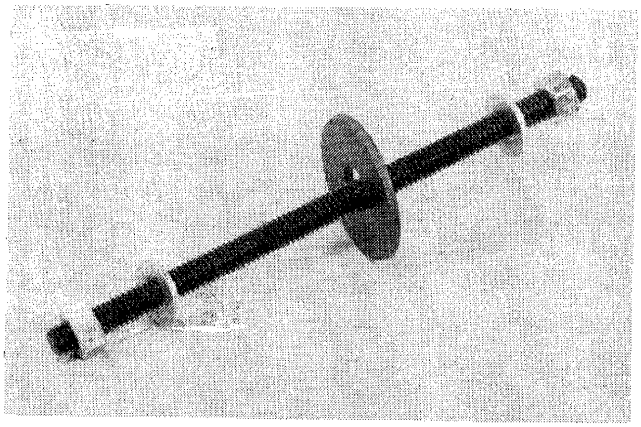
Install a new gasket on the inlet valve guide.

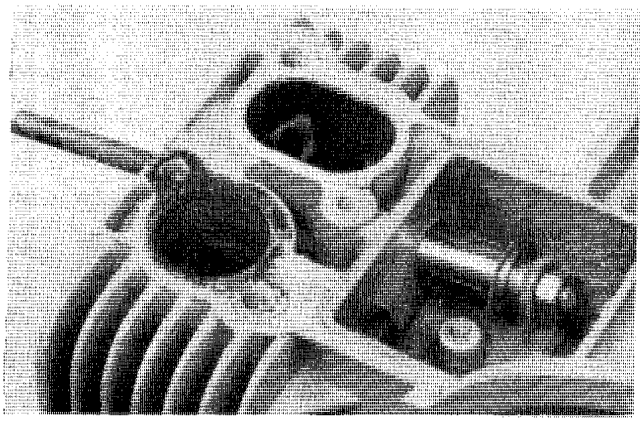
STEP 65



Lubricate the valve guide and valve guide bore with clean engine oil and install the guide into the bore as shown.

STEP 66

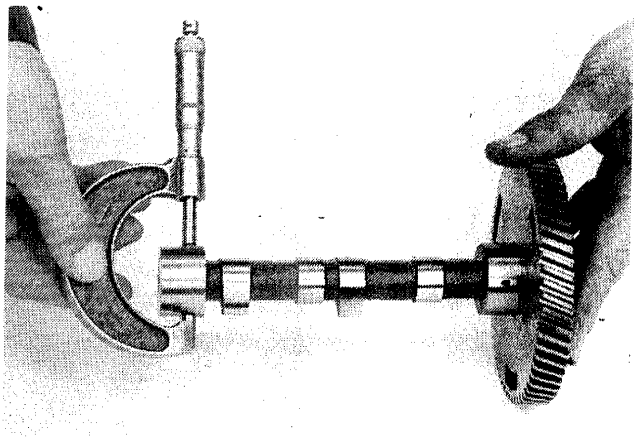


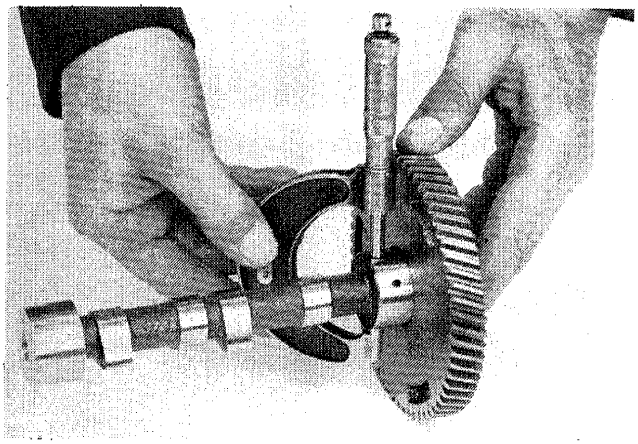


Use the valve guide installation tool to pull the valve guide into the bore. Make sure the guide is seated against the housing. Repeat STEPS 62 to 66 for the exhaust valve guide.

Inspection

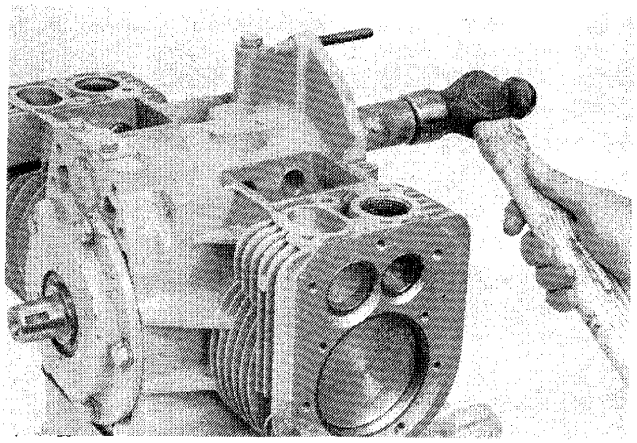
STEP 117





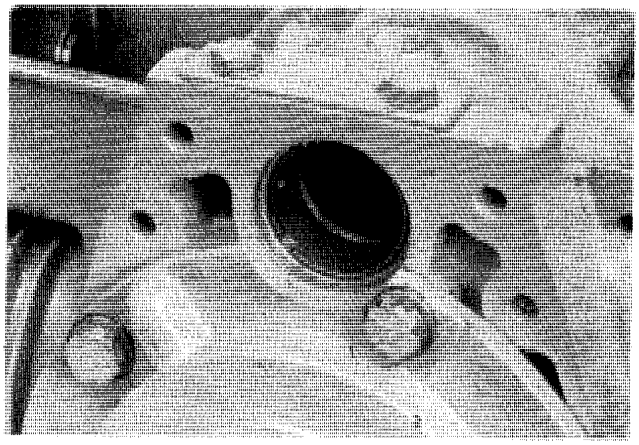
Put the camshaft on a clean workbench and measure the bearing journal diameters. Take two readings at right angles. The journals must measure between 1.3745 inch and 1.3740 inch (34.91 mm and 34.90 mm). If the journals measure less than 1.3740 inch (34.90 mm) the camshaft must be replaced.

STEP 118



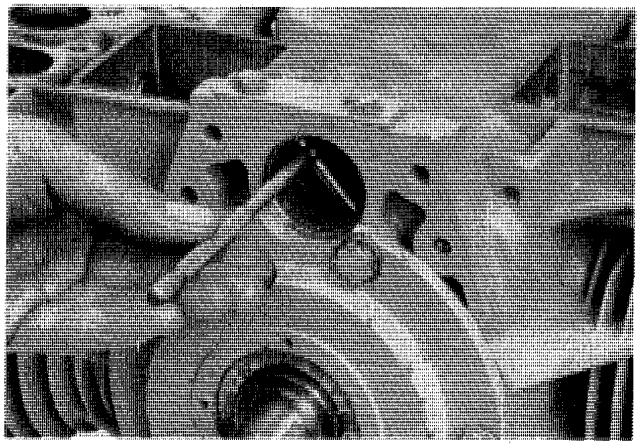
Use a suitable punch to drive out the camshaft end plug.

STEP 119



Inspect the camshaft bushing for wear or damage.

STEP 120



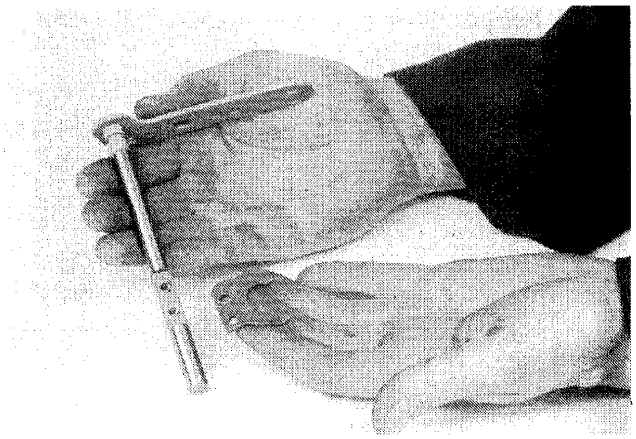
Measure the camshaft bushing diameters. Take two readings at right angles. The bushing must be 1.3755 inch (34.938 mm) to 1.3775 inch (34.986 mm) to give a camshaft journal clearance of 0.0015 inch (0.038 mm) to 0.003 inch (0.076 mm).

Inspection

STEP 160

Inspect the governor control yoke faces which contact the governor cup for damage or wear. Replace if necessary.

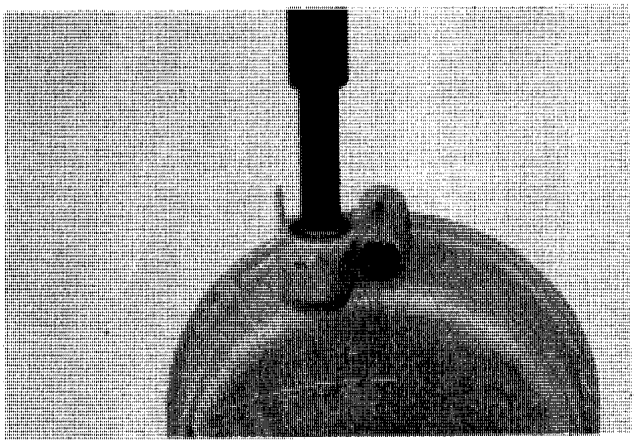
STEP 161



Inspect the governor control shaft for damage or wear. Replace if necessary.

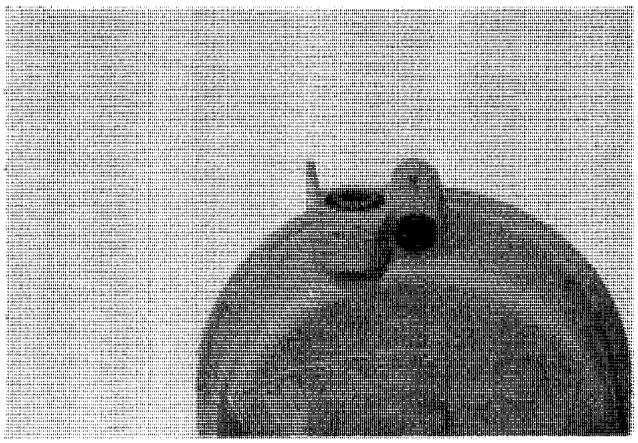
Assembly

STEP 162



Lubricate a new governor shaft bearing with clean engine oil and use a suitable tool to press the bearing into the housing.

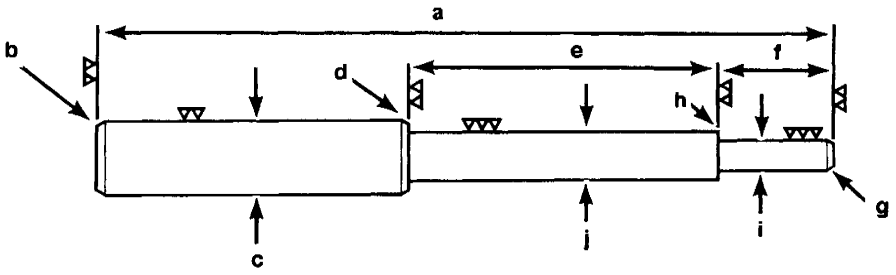
STEP 163



Install a new governor shaft seal.

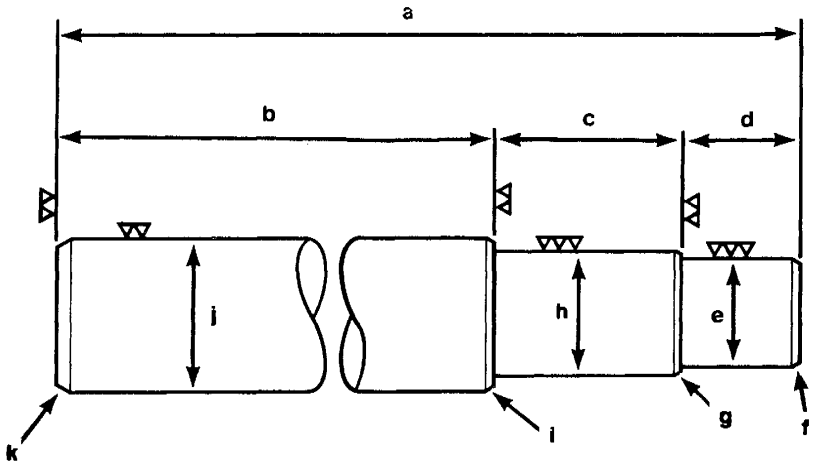
TOOLS TO BE MADE LOCALLY

a = 7.9 INCH (190 MM)
b = 0.079 INCH (2.0 MM)
c = 0.79 INCH (20 MM)
d = 0.039 INCH (1.0 MM)
e = 3.15 INCH (80 MM)
f = 1.18 iINCH (30 MM)
g = 0.039 INCH (1.0 MM)
h = 0.12 INCH (3.0 MM)
i = 0.2740 TO 0.2748 INCH (6.96 TO 6.98 MM)
j = 0.51024 TO 0.51103 INCH (12.96 TO 12.98 MM)



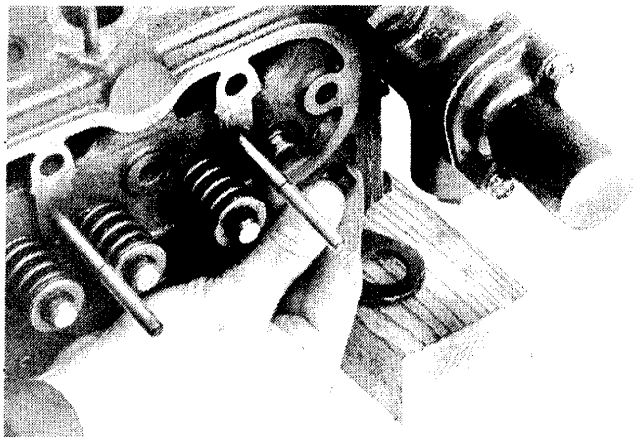
1. VALVE GUIDE REPLACER

a = 5.40 INCH (137 MM)
b = 3.94 INCH (100 MM)
c = 0.98 INCH (25 MM)
d = 0.47 INCH (12 MM)
e = 0.4295 TO 0.4314 INCH (10.90 TO 10.95 MM)
f = 0.039 INCH (1.0 MM)
g = 0.012 INCH (0.3 MM)
h = 0.5083 TO 0.5102 INCH (12.90 TO 12.95 MM)
i = 0.039 INCH (1.0 MM)
j = 0.79 INCH (20 MM)
k = 0.079 INCH (2.0 MM)



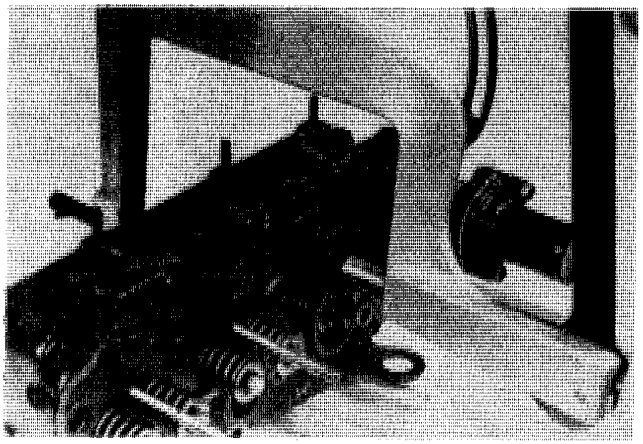
2. ROCKER BUSH REPLACER

STEP 45



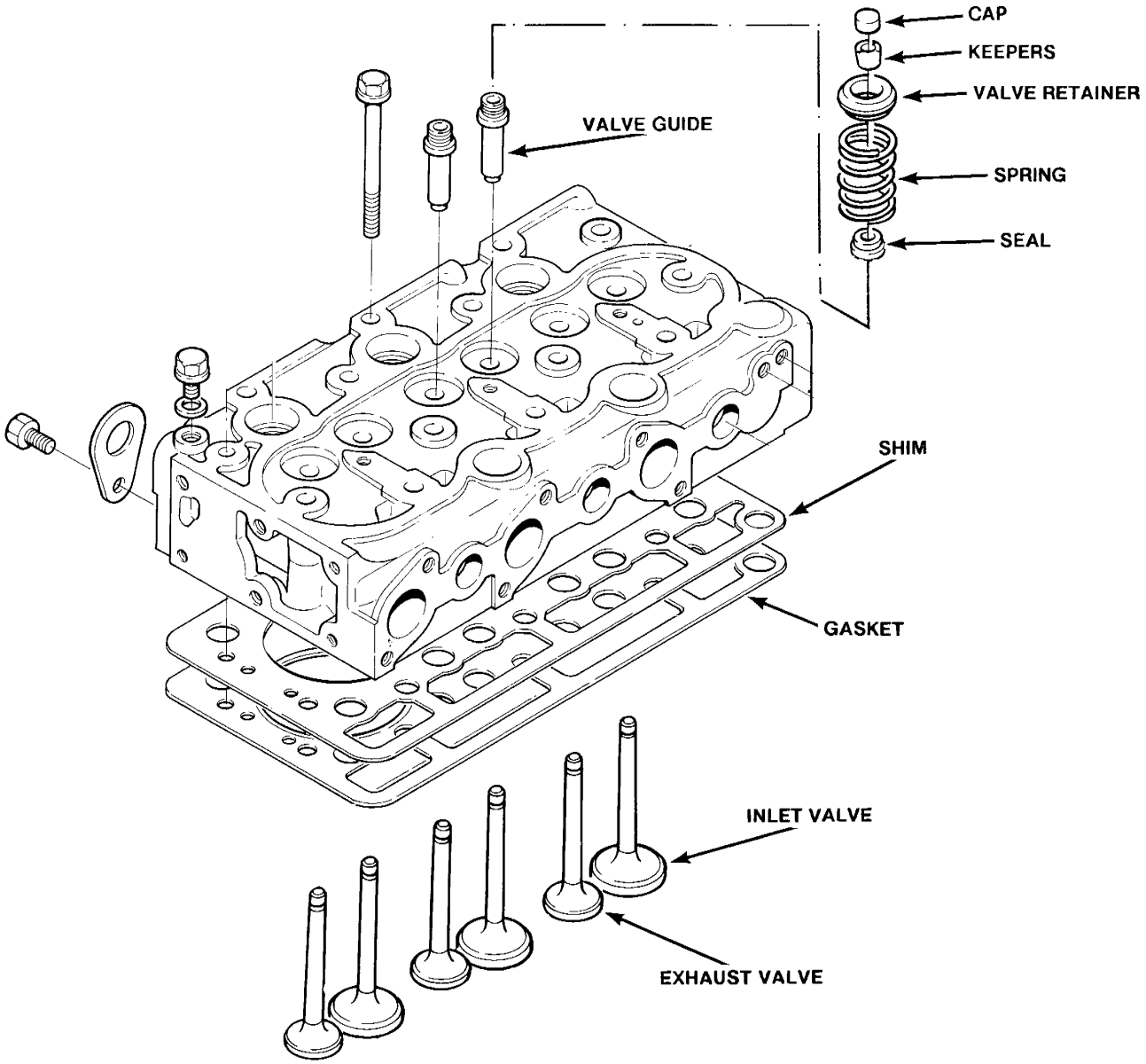
Remove and discard the valve seal from the valve guide in the cylinder head.

STEP 46

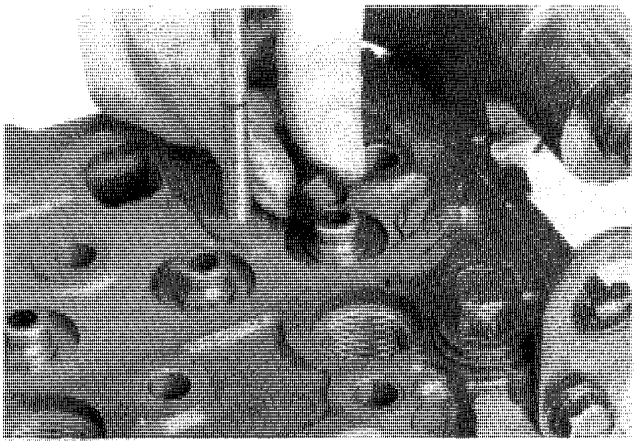


Repeat the valve removing procedure for the other valves. The sequence of the valves is No. 1:- exhaust - inlet, No. 2:- exhaust - inlet, No. 3:- exhaust - inlet.

Assembly

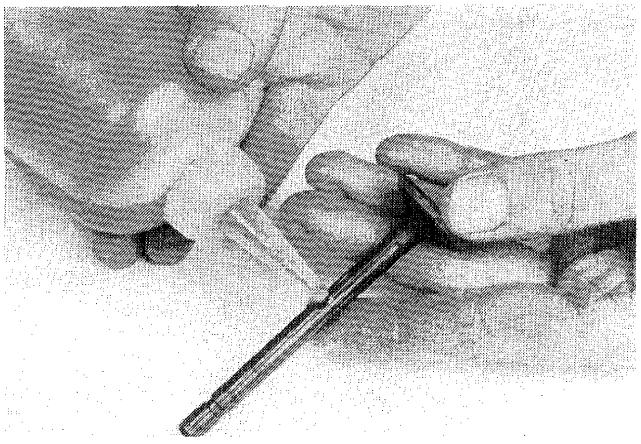


STEP 74



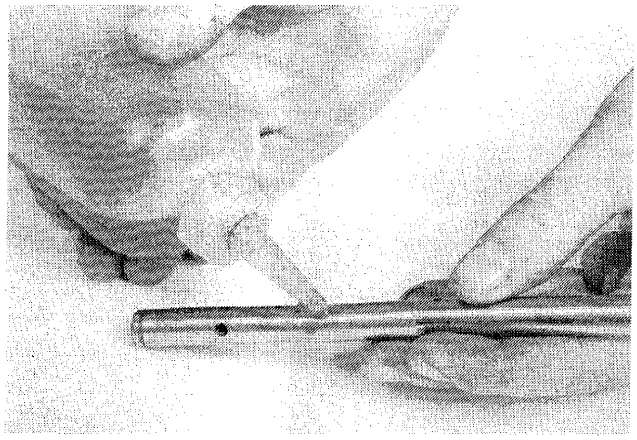
Fit a new valve seal onto the valve guide.

STEP 75



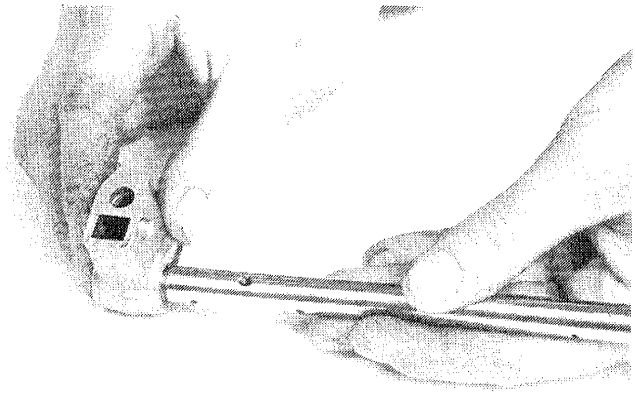
Lubricate the stem of the No. 1 exhaust valve with clean engine oil.

STEP 117



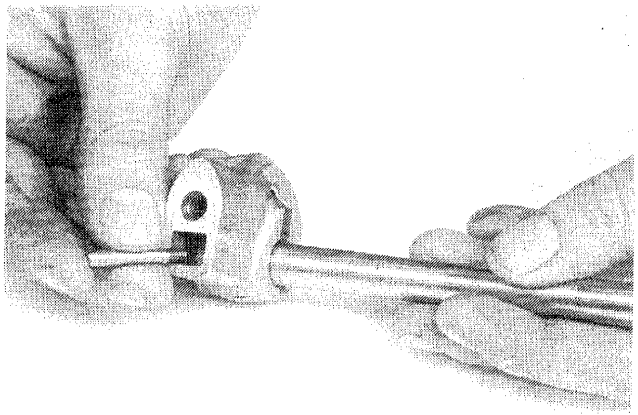
Lubricate the rocker shaft with clean engine oil.

STEP 118



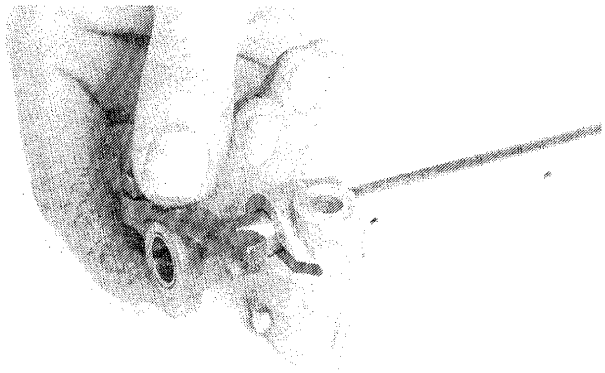
Align the lubrication hole in the shaft support with the threaded hole in the rocker shaft.

STEP 119



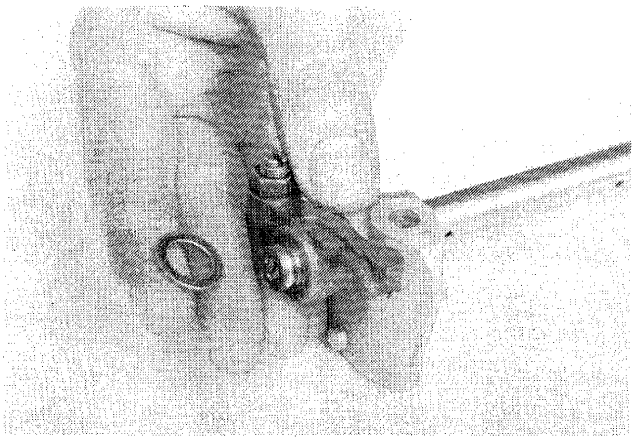
Push the shaft support into position then install and tighten the lubrication screw.

STEP 120



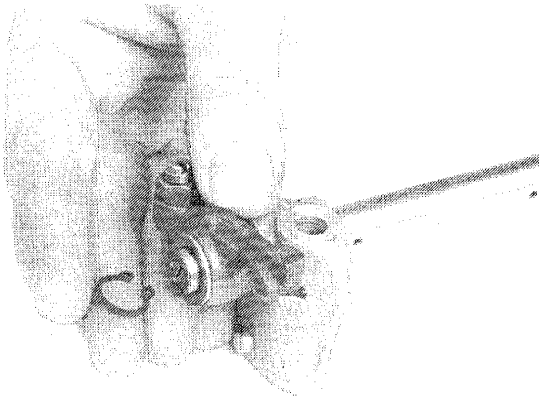
Fit the rocker for the No. 3 inlet valve.

STEP 121



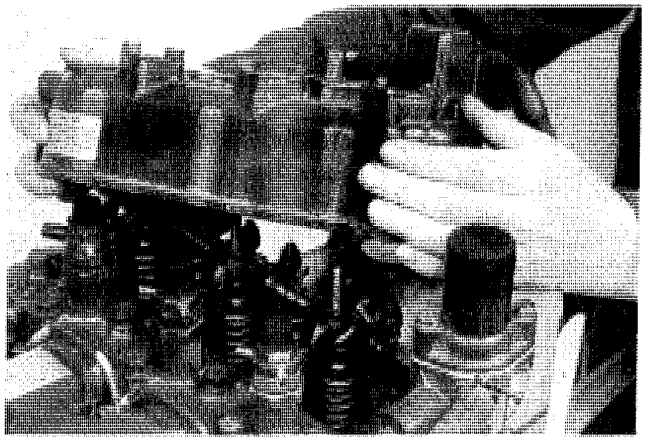
Install the washer.

STEP 122



Install the snap ring.

STEP 168

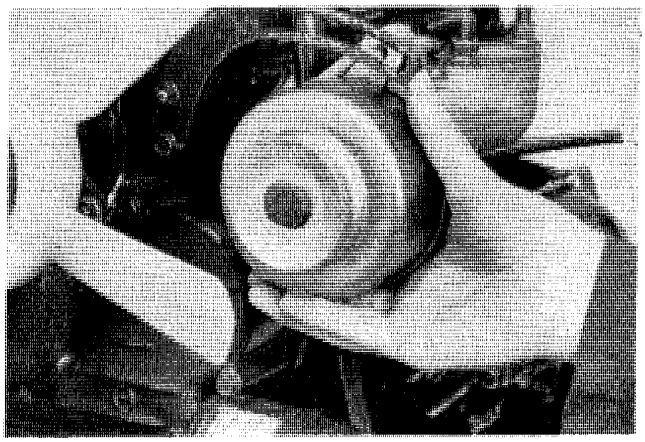


Install the rocker shaft cover.

STEP 169

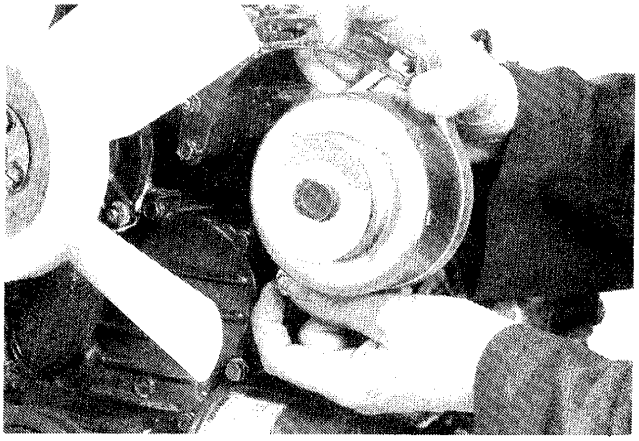
Install the three nuts and new washers onto the studs. Evenly tighten the nuts.

STEP 170



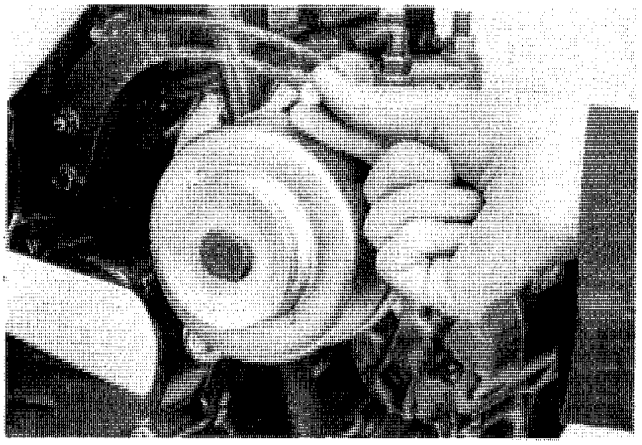
Put the dynamo into position so that the lug with the threads is at the top.

STEP 171



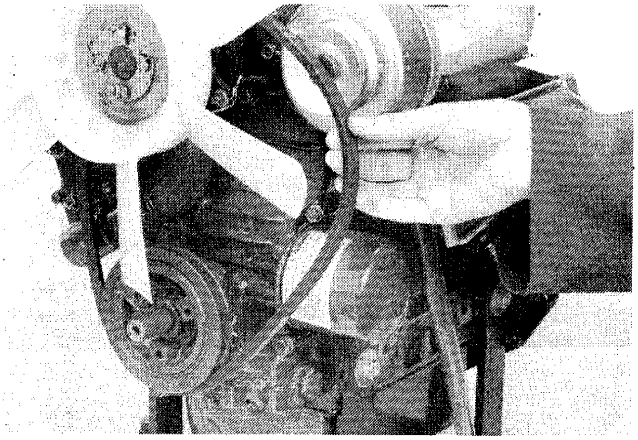
Install the long bolt, spring and plain washers through the bottom lug in the dynamo and the timing gear cover. Fit the nut.

STEP 172



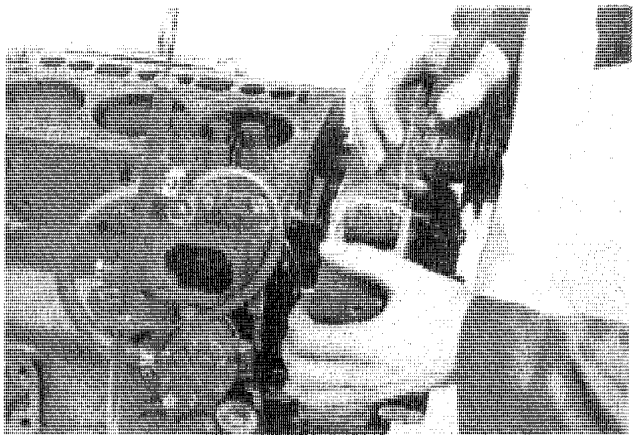
Install the short bolt and washers through the stay and into the top dynamo lug.

STEP 173



Check the condition of the fan belt then fit it onto the pulleys.

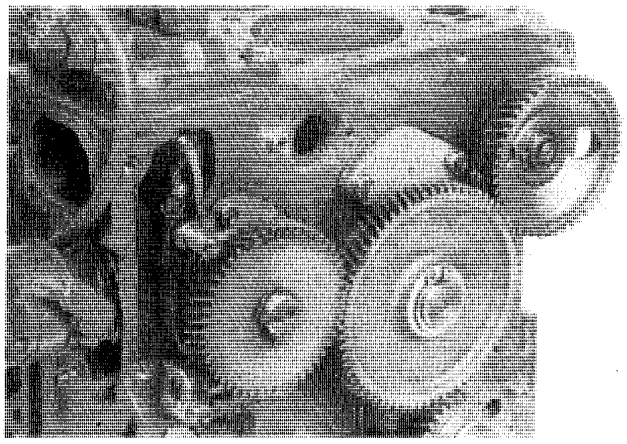
STEP 5



Remove the timing cover. Refer to Section 2045.

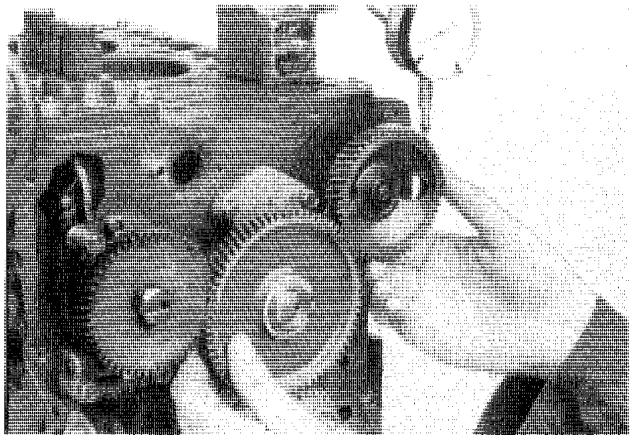
NOTE: *The procedure given in Section 2045 shows the cylinder head in position. The procedure is the same.*

STEP 6



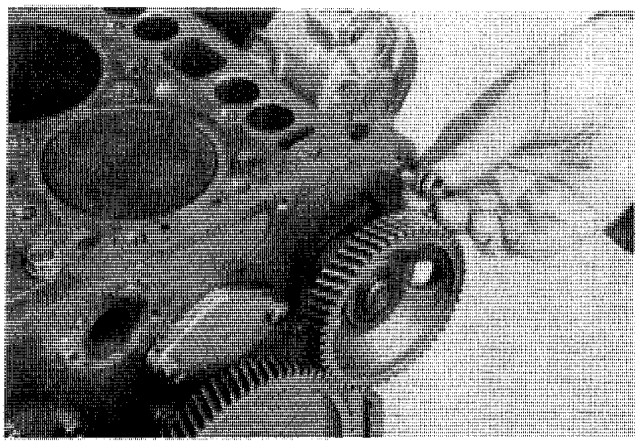
Check all the gears for damage. Install new gears as necessary.

STEP 7



Put the pointer of a dial gauge onto one tooth of the engine camshaft gear. Hold the idler gear in position then move the camshaft gear to check the amount of backlash. The movement must be between 0.0017 to 0.0079 inch (0.042 to 0.2 mm). Install a new idler gear and camshaft gear if the backlash is more than 0.0079 inch (0.2 mm).

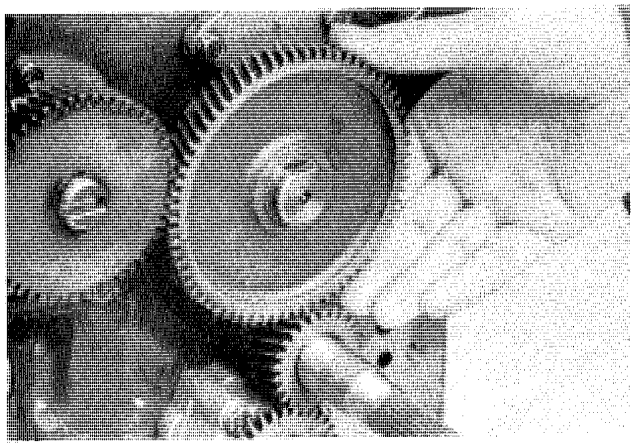
STEP 8



Remove the two setscrews and spring washers from the camshaft retaining plate.

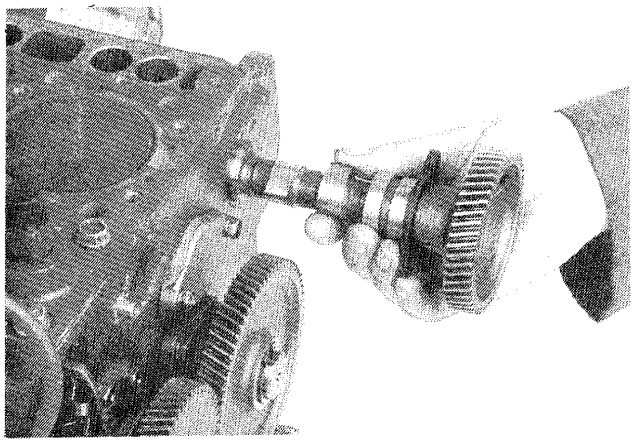
Installing The Engine Camshaft

STEP 45



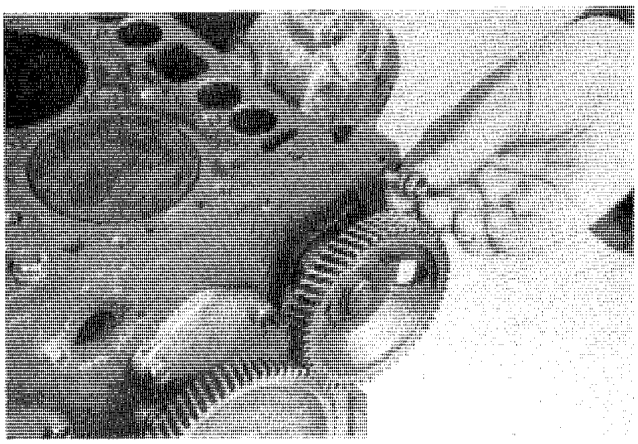
Check that the timing marks on the fuel camshaft gear, crankshaft gear and idler gear align.

STEP 46



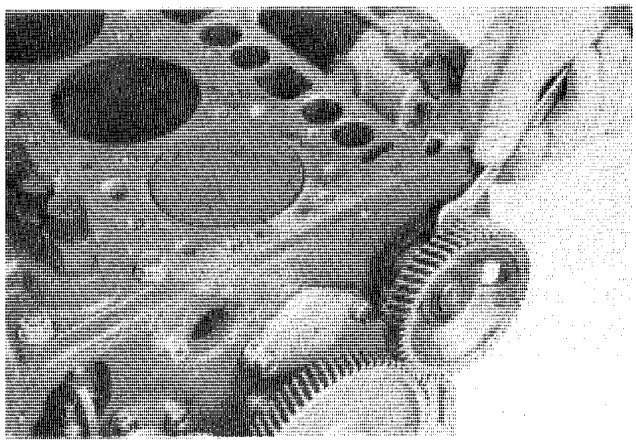
Lubricate the engine camshaft with clean engine oil. Carefully install the camshaft into the engine block so that the mark on the gear aligns with the mark on the idler gear.

STEP 47



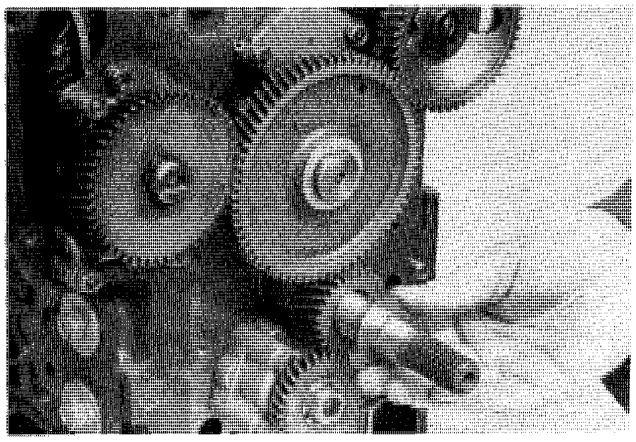
Align the holes in the retaining plate with the holes in the engine block. Install the two setscrews and spring washers.

STEP 48



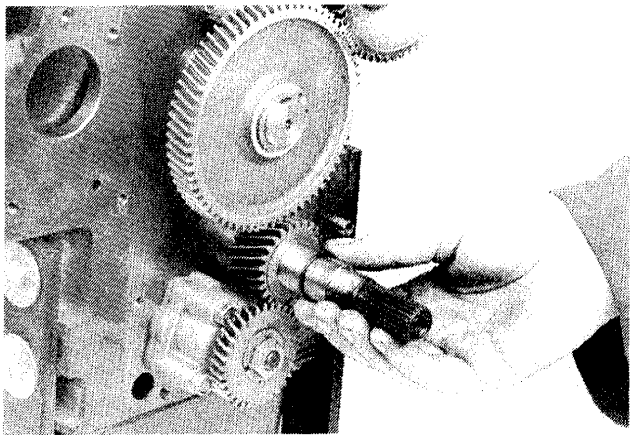
Evenly tighten the two setscrews.

STEP 49



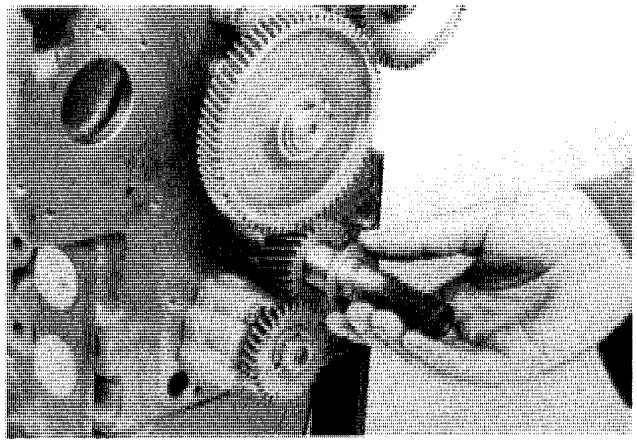
Install the spacer onto the crankshaft.

STEP 88



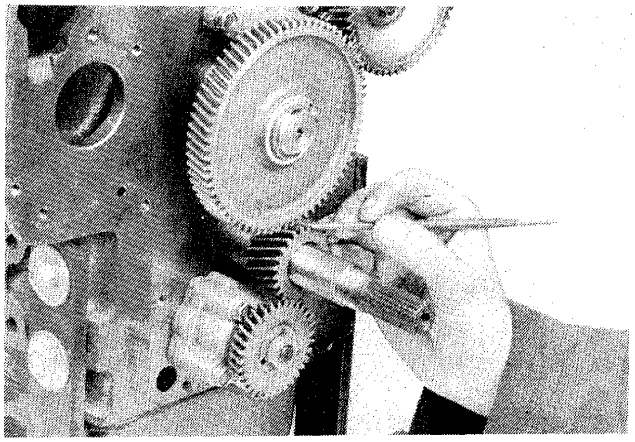
Remove and discard the o-ring.

STEP 89



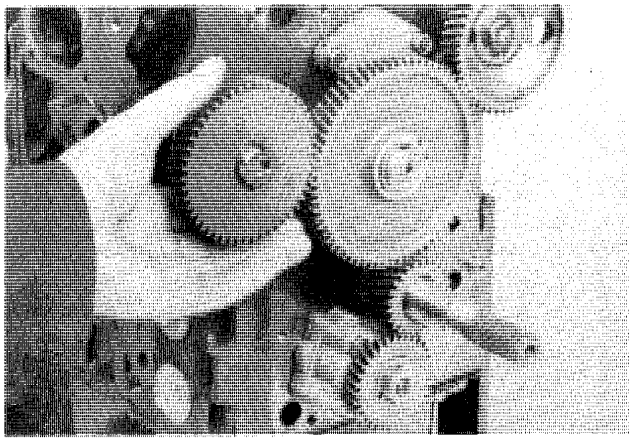
Remove the spacer.

STEP 90



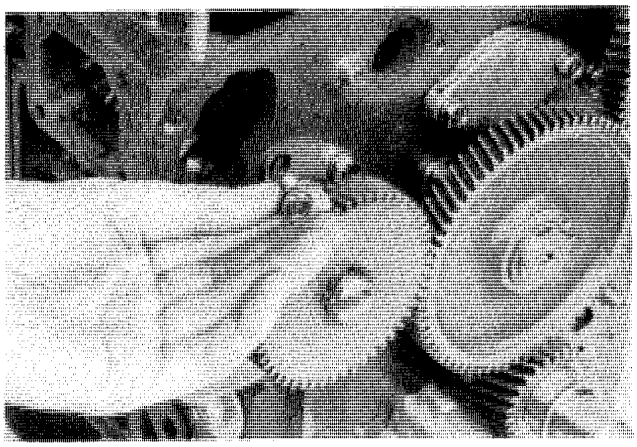
Turn the flywheel until the mark on the crankshaft gear is at the top. Check that the No 1 piston is at top center and the 1TC mark on the flywheel is aligned with the mark on the engine end plate.

STEP 91



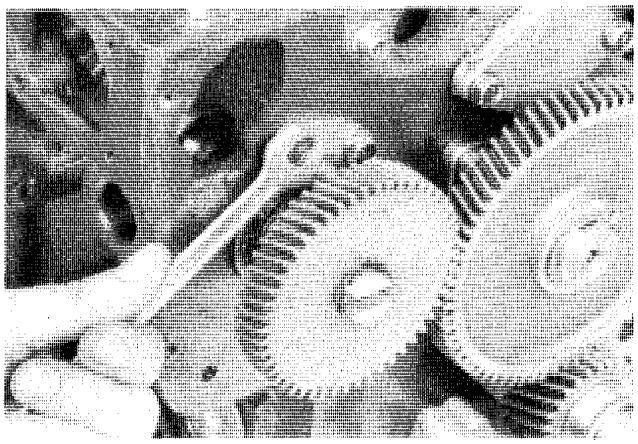
Lubricate the fuel camshaft with clean engine oil. Carefully install the camshaft into the engine block so that the mark on the gear aligns with the mark on the idler gear.

STEP 92



Align the holes in the retaining plate with the holes in the engine. Install the two setscrews and spring washers.

STEP 93



Evenly tighten the two setscrews.

SPECIAL TORQUES

Cylinder Head Bolts (Tighten In Three Stages):		
Graphoil Gasket	14 to 16 lb ft	19 to 22 Nm
Asbestos Gasket	16 to 18 lb ft	22 to 24 Nm
Connecting Rod Bolts	12 to 14 lb ft	16 to 19 Nm
Oil Pan Setscrews	18 to 23 lb ft	24 to 31 Nm
Drain Plug	18 to 23 lb ft	24 to 31 Nm

STANDARD TORQUES

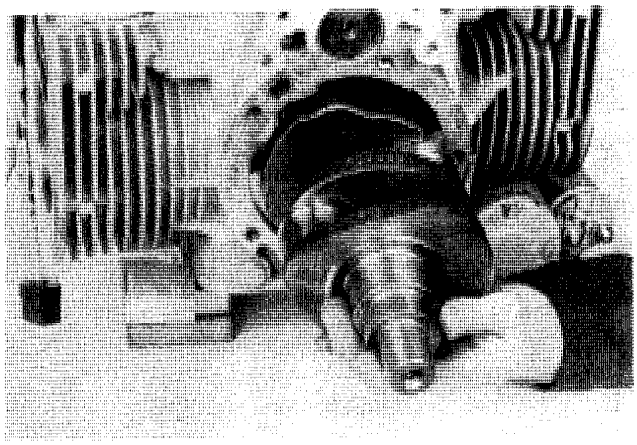
Where no special torque data is specified, the following torque figures must be applied. Threads must be clean and lubricated with clean engine oil. Always tighten in two stages, 50% of figure and the full tightness.

1/4 Inch Diameter Engine Block		
Studs and Nuts	7 to 9 lb ft	10 to 12 Nm
5/16 Inch Diameter Engine Block		
Studs and Nuts	8 to 10 lb ft	11 to 14 Nm

Machining The Cylinder Liners

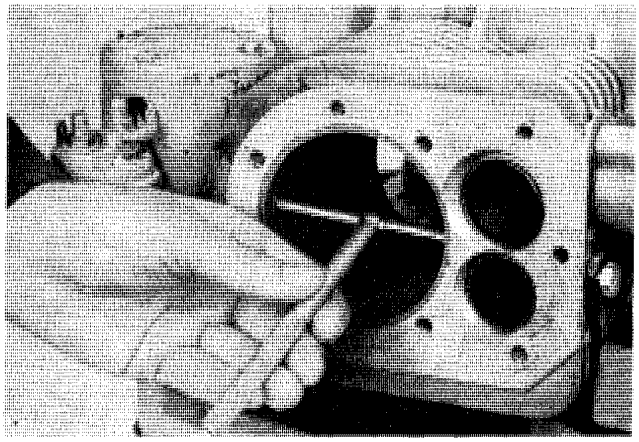
Machining

STEP 29



Before machining the cylinder liners, remove the crankshaft. Refer to Section 2035.

STEP 30



Machine the liner bore to the next oversize diameter (see STEP 28 for sizes of available parts).

CAUTION: *If the boring machine is not operated correctly, it will produce a rough bore finish which cannot be honed to the correct surface finish. Machining must be done by qualified service personnel who are careful in their work.*

Honing

STEP 31

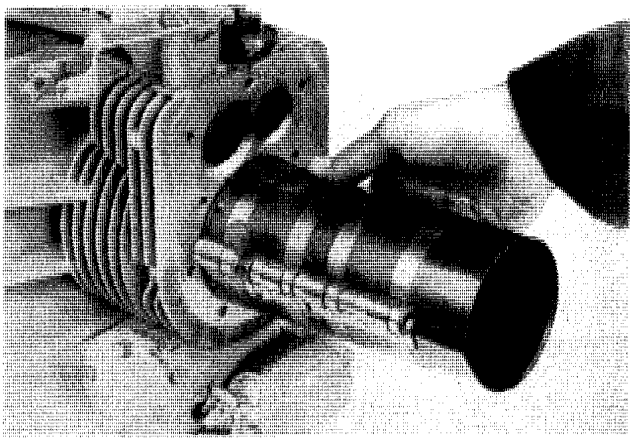
Do the following to get the correct bore finish:

1. Use a power drill which will operate at between 250 to 450 RPM. Follow the hone manufacturer's instructions for the use of a lubricant/coolant to keep the stones free of foreign material.
2. Install the hone into the bore then adjust to fit the smallest diameter. When adjusted correctly, the hone will not vibrate in the bore.
3. Start the power drill then move the hone up and down the bore 40 times every minute. Check the diameter of the bore regularly in the positions shown in STEP 28. The hone must produce a crosshatch pattern 23 degrees to the horizontal.
4. Use a finner grit stone to reach the correct liner bore finishes of 20 to 40 RMS.
5. After machining, clean the liner walls with a clean cloth, warm water and a mild detergent soap. After cleaning the liner walls, clean the walls again with clean engine oil.

NOTE: *Clean the liner walls until a clean white cloth keeps completely clean, one cleaning operation is not enough.*

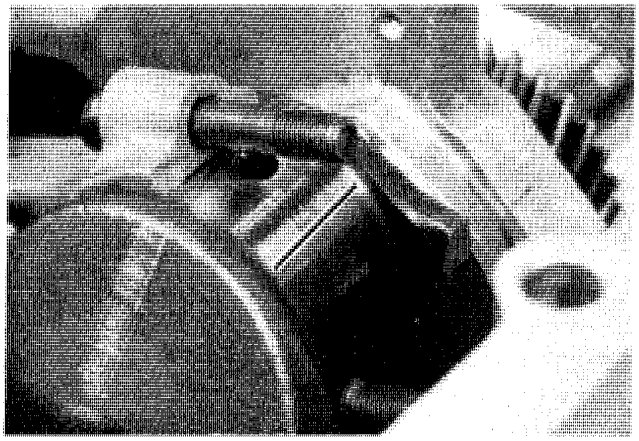
IMPORTANT: *DO NOT use gasoline, diesel fuel or kerosene to clean the liner walls because these fluids will not remove the abrasives from the liner surface.*

STEP 70



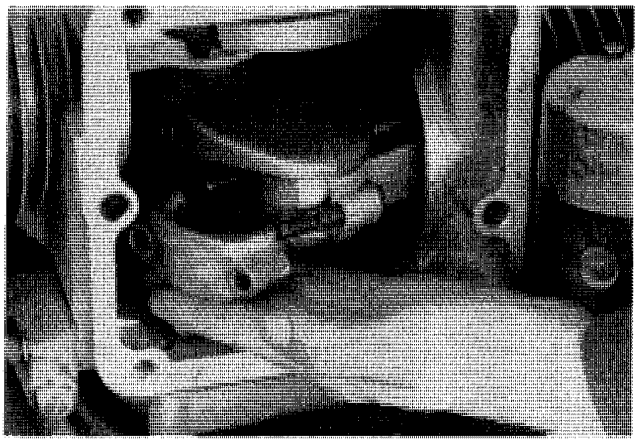
Use a piston ring compressor to compress the rings. Push the piston into the bore using a hammer shaft. Take care not to damage the liner bore or crankshaft with the bolts in the connecting rod.

STEP 71



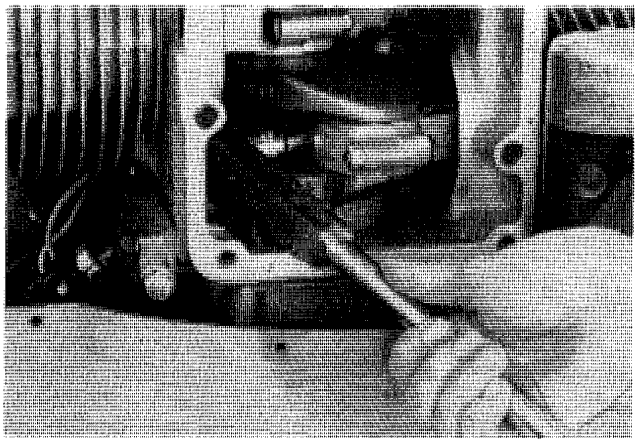
Fit the connecting rod onto the crankshaft. Turn the crankshaft until the bearing diameter is approximately 30 degrees from bottom center. Use a small amount of petroleum jelly to hold a piece of 'Plastigage' across the complete width of the bearing surface. The 'Plastigage' must also be in a position so that it will be 0.25 inch (6 mm) from the center of the cap when the cap is installed.

STEP 72



Install the end cap so that the marks align.

STEP 73



Install the two locknuts and evenly tighten to a torque of 12 to 14 lb ft (16 to 19 Nm).

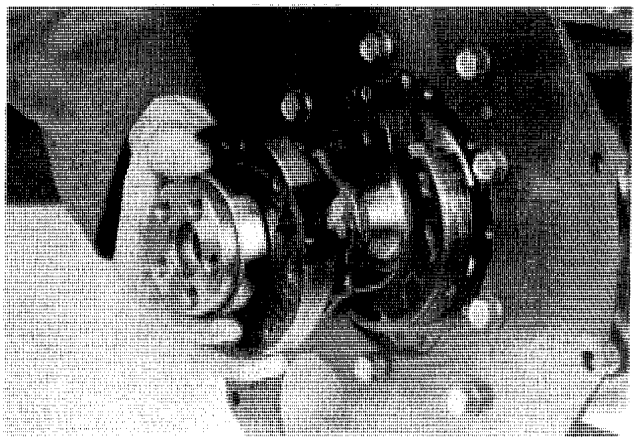
IMPORTANT: *The crankshaft must not rotate during this operation.*

TABLE OF CONTENTS

THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

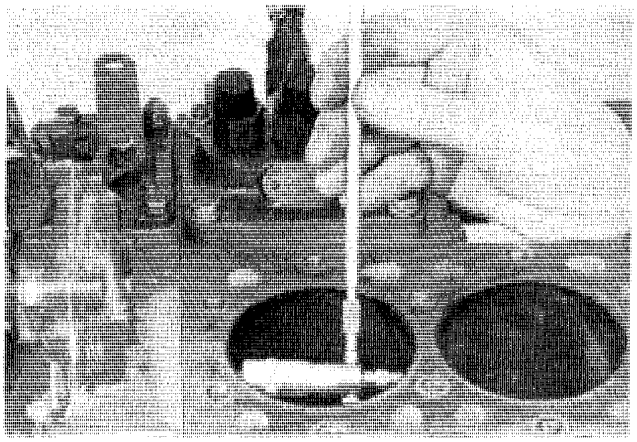
Machining The Cylinder Liners

STEP 16



If a cylinder liner has too much wear, remove the crankshaft. Refer to Section 2035.

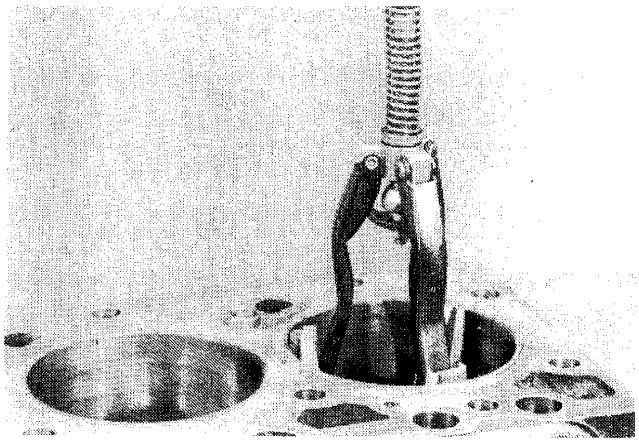
STEP 17



Machine the liner bore to a diameter of 2.8543 to 2.8550 inch (72.500 to 72.519 mm).

NOTE: *If necessary remove the engine and fuel camshafts. Refer to Section 2020.*

STEP 18



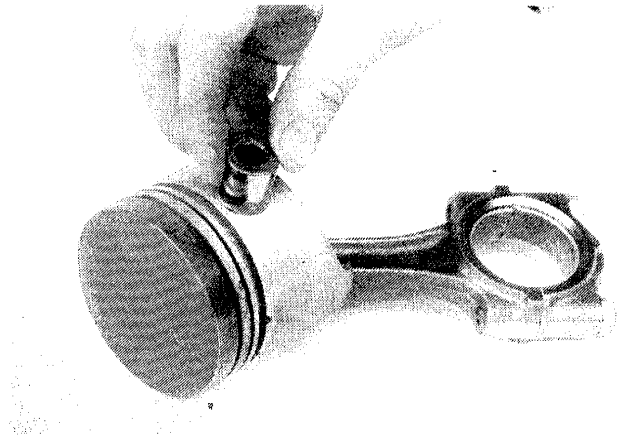
Do the following to get the correct liner bore finish:

1. Use a power drill to operate a liner hone. Use a lubricant/coolant with the hone to keep the hone and stones free of foreign material.
2. Start the hone at the top of the cylinder bore and operate the hone up and down until the correct cross-hatch pattern is reached. The correct cross-hatch pattern is 40 to 60 degrees from the horizontal.
3. Use a 80 to 150 grit stone to reach the correct cross-hatch pattern.
4. Use a 250 to 300 grit stone to reach the correct cylinder bore finish (1.2 to 2 μm max).
5. After machining, clean the liner walls with a clean clotch, warm water and a mild detergent soap. After cleaning the liner walls, clean the liner walls again with clean engine oil.

NOTE: *Clean the liner walls until a clean white cloth keeps completely clean, one cleaning operation is not enough.*

IMPORTANT: *DO NOT use gasoline, diesel fuel or kerosene to clean liners because these fluids will not remove the abrasives from the liner surface.*

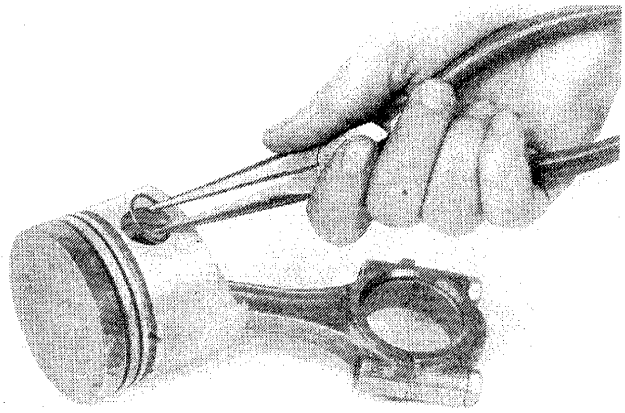
STEP 59



Lubricate the piston pin with clean engine oil. Fit the pin into the piston and connecting rod so that both snap rings can be installed.

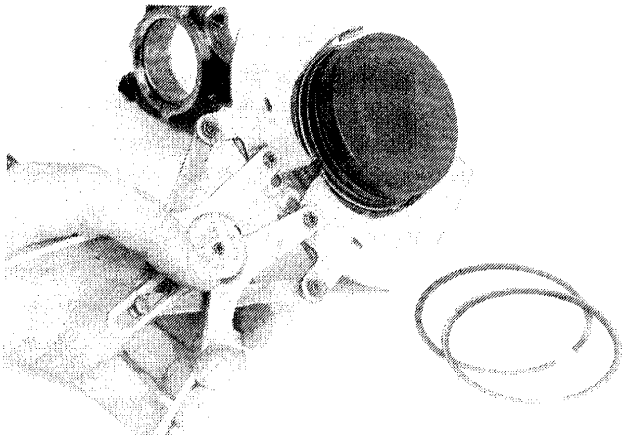
NOTE: *If the piston pin is difficult to install, put the piston in warmer water to increase the size of the pin hole.*

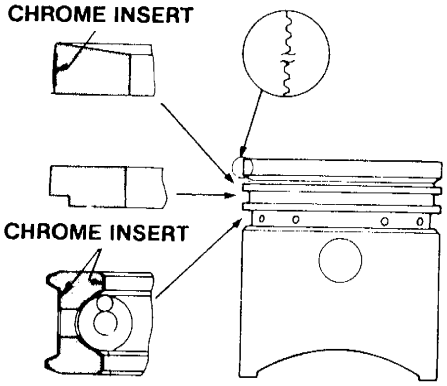
STEP 60



Install both snap rings into the grooves in the piston.

STEP 61





Fit the oil control and two compression rings into the grooves in the piston. Make sure that the letter 'T' near the end of each ring is toward the top of the piston.

CAUTION: *DO NOT over expand the piston rings. Always wear eye protection when removing or installing piston rings.*

SPECIAL TORQUES

Cylinder Head Bolts (Cold)		
Asbetos Gasket	16 to 18 lb ft	22 to 24 Nm
Graphoil Gasket	14 to 16 lb ft	19 to 22 Nm
Flywheel Mounting Bolt	50 to 55 lb ft	65 to 75 Nm
Oil Pan	8 to 23 lb ft	24 to 31 Nm
Intake Manifold Mounting Screws	6 to 10 lb ft	8 to 14 Nm
Oil Pump	7 to 9 lb ft	10 to 12 Nm
Exhaust Manifold Mounting Screws	9 to 11 lb ft	12 to 15 Nm

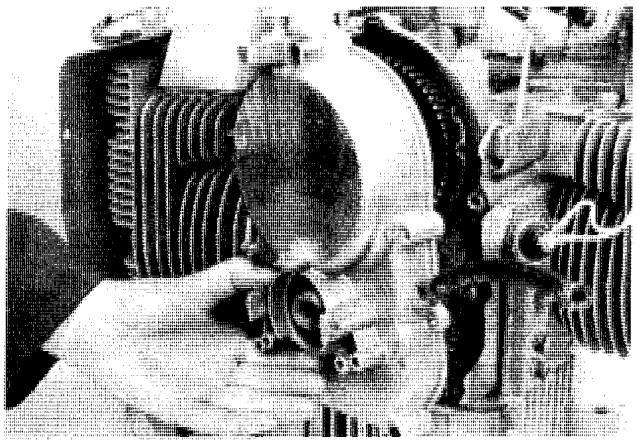
STANDARD TORQUES

Where no special torque data is specified, the following torque figures must be applied. Threads must be clean and lubricated with clean engine oil. Always tighten in two stages, 50% of figure and the full tightness.

1/4 Inch Diameter Engine Block Studs and Nuts	7 to 9 lb ft	10 to 12 Nm
5/16 Inch Diameter Engine Block Studs and Nuts	8 to 10 lb ft	11 to 14 Nm

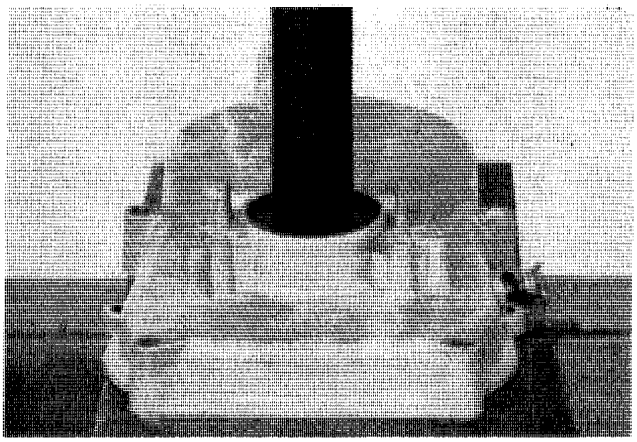
REAR CRANKSHAFT OIL SEAL REPLACEMENT

STEP 33



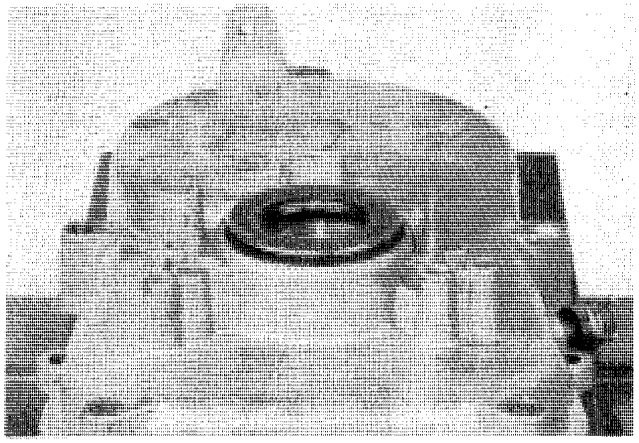
Remove the flywheel guard, flywheel, ignition system and timing cover. See Section 2045.

STEP 34



Put the timing cover on a press and use an acceptable tool to press the seal from the timing cover.

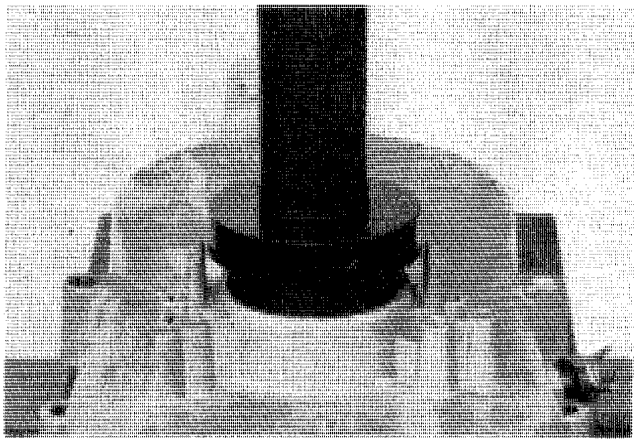
STEP 35



Fill the space between the seal lips of a new oil seal with Case multi-purpose grease and install into the housing.

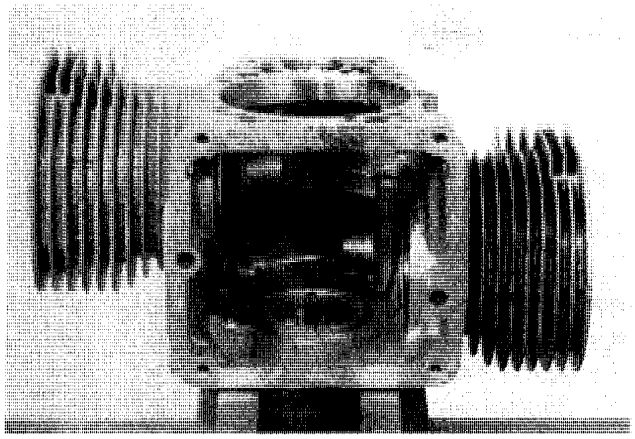
NOTE: *Open side inwards.*

STEP 36



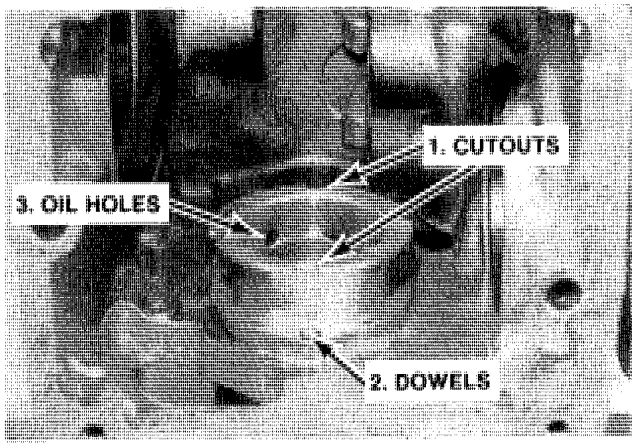
Use the special tool CAS-1658-2 to press in the oil seal.

STEP 72



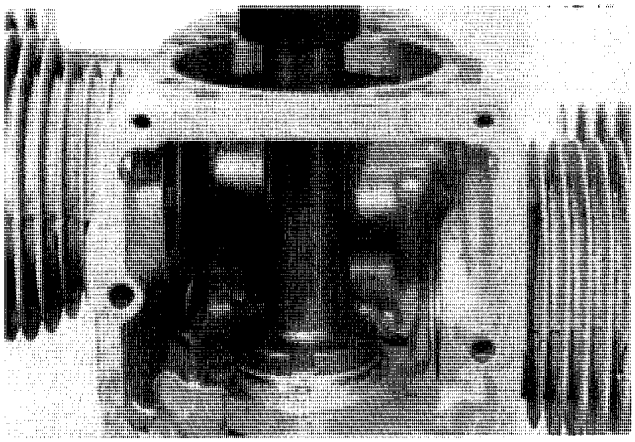
Install the engine block on a press as shown.

STEP 73



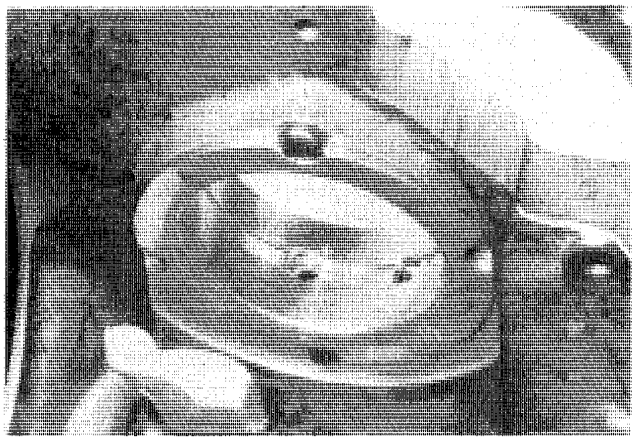
Replacement rear main bearing are supplied with a built in thrust washer. The cutouts in the thrust washers must be aligned with the dowels in the engine block. Install the new rear main bearing in the engine block making sure the oil holes in the bearing align with the oil holes in the engine block and the cutout align with the dowels.

STEP 74



Use the special tool CAS-1658-4 to press the bearing into the block until the thrust face is seated against the engine block.

STEP 75



Make sure the cutouts in the thrust washer fit over the dowels and that at least half the oil holes are open as shown.

SPECIAL TORQUES

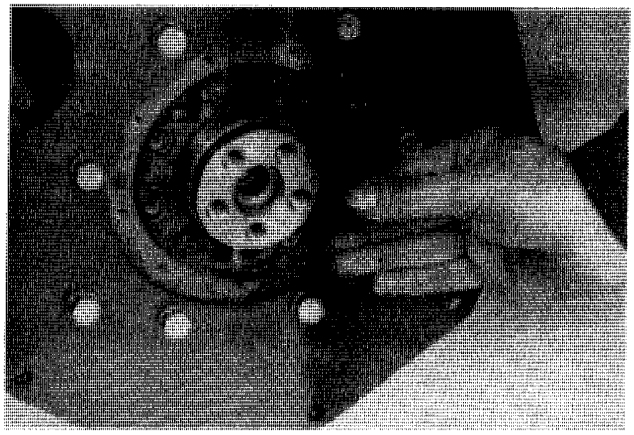
Main Bearing Bolts - No. 1	14.5 to 17.4 lb ft	19.6 to 23.5 Nm
- No. 2 & 3	21.7 to 25.3 lb ft	29.4 to 34.3 Nm
Bearing Retaining Bolts (Through Engine Block)	22 to 25 lb ft	30 to 34 Nm
Rear Seal Housing Setscrews	7.2 to 8.7 lb ft	10 to 12 Nm
Flywheel Bolts	40 to 43 lb ft	54 to 59 Nm

STANDARD TORQUES

Where no special torque data is specified, the following torque figures should be applied. Threads should be lubricated with engine oil or chassis grease. Apply minimum figure to bolts that have previously been used. Always tighten bolts in two stages, 50% of figure then full tightness.

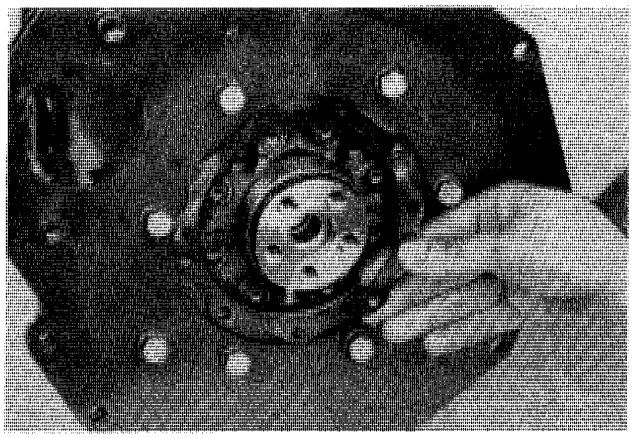
BOLT TYPE	TORQUE	BOLT SIZE							
		M6	M8	M10	M12	M14	M16	M18	M20
STANDARD NO NUMBER SS41, S20C	MAX (lb ft)	6.9	15.2	33.3	53.5	92.6	141.0	209.8	389.3
	MIN (lb ft)	5.8	13.0	28.9	46.3	79.6	123.0	180.0	245.9
	MAX (Nm)	9.3	20.6	45.1	72.6	125.5	191.2	284.4	392.2
	MIN (Nm)	7.8	17.7	39.2	62.8	107.9	166.7	245.2	333.4
SPECIAL NUMBER 7 S43C, S84C (REFINED)	MAX (lb ft)	8.3	20.3	41.2	66.5	108.5	166.4	235.1	318.2
	MIN (lb ft)	7.2	17.4	35.4	57.1	91.1	144.7	202.2	271.2
	MAX (Nm)	11.3	27.5	55.9	90.2	147.1	225.5	318.7	431.5
	MIN (Nm)	9.8	23.5	48.0	77.5	123.6	196.1	274.6	367.7
SPECIAL NUMBER 9 SCM435, SCr435 (REFINED)	MAX (lb ft)	10.5	25.3	52.1	86.8	144.7	224.2	296.5	419.5
	MIN (lb ft)	9.0	21.7	44.8	75.9	123.0	191.7	253.2	361.6
	MAX (Nm)	14.2	34.3	70.6	117.7	196.1	304.0	402.0	568.7
	MIN (Nm)	12.3	29.4	60.8	103.0	166.7	259.9	343.2	490.3

STEP 33



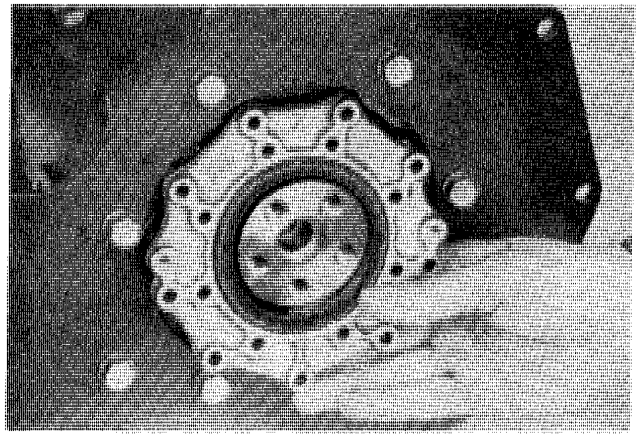
Fit a new gasket onto the end of the crankshaft No. 1 main bearing.

STEP 34



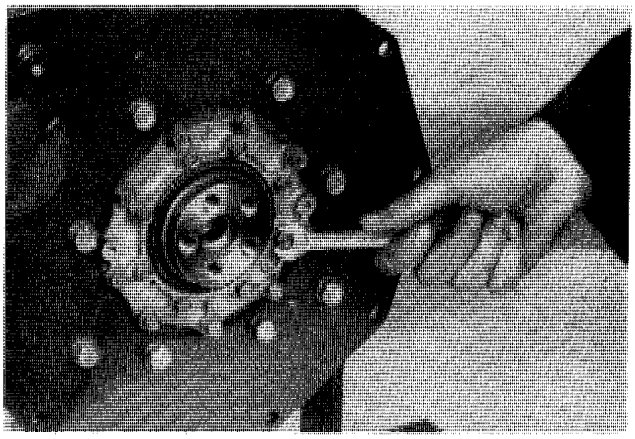
Fit a new gasket onto the engine block.

STEP 35



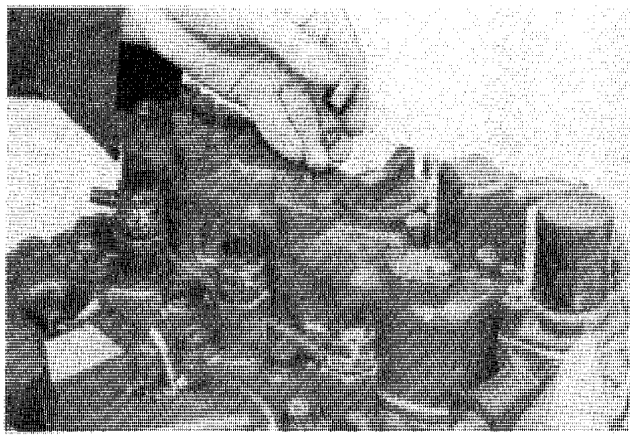
Carefully install the seal assembly onto the crankshaft so that the mark is at the top.

STEP 36



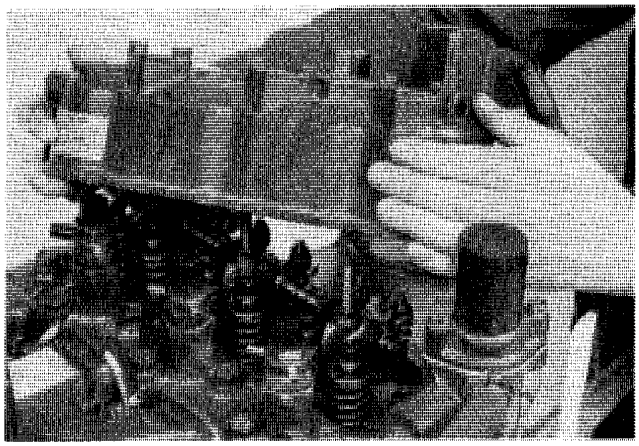
Install the seventeen setscrews and spring washers into the seal housing. Evenly tighten to a torque of 7.2 to 8.7 lb ft (10 to 12 Nm) in a diagonal sequence.

STEP 37



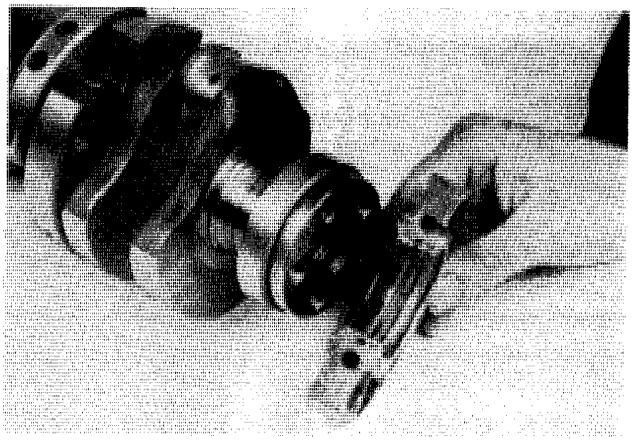
Remove the three nuts and washers from the rocker shaft cover. Discard the washers.

STEP 38



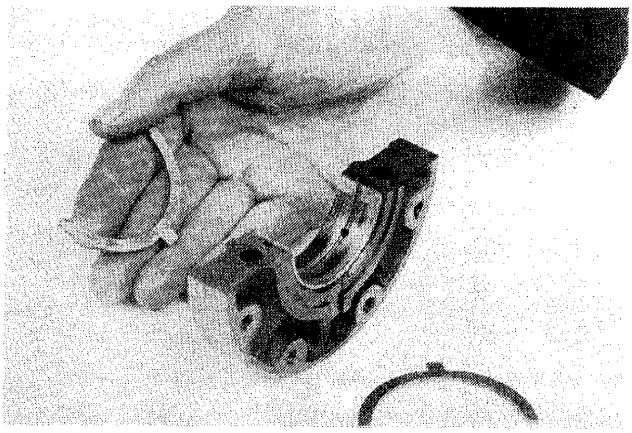
Remove the rocker shaft cover.

STEP 81



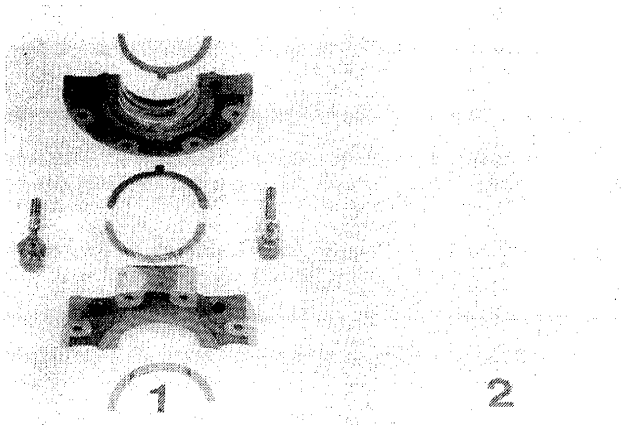
Remove the bottom bearing half.

STEP 82



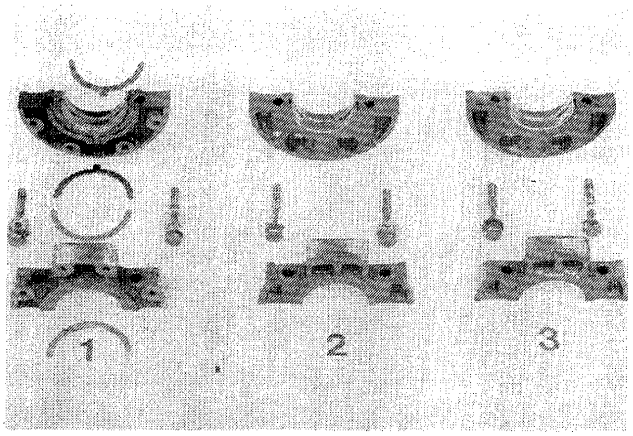
Remove the thrust washers from the bottom bearing half.

STEP 83



Put all the bearing parts on a clean work area.

STEP 84

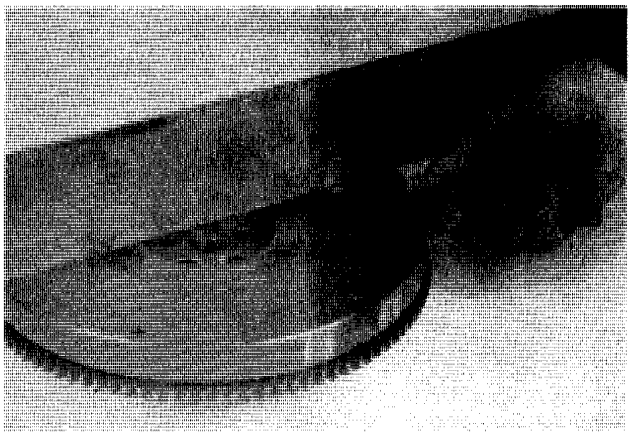


Repeat the removal procedure for the No. 2 and No. 3 main bearings. Align the parts with the correct bearing number so that they can be installed in their original position.

NOTE: *These main bearings do not have thrust washers. There alignment numbers are on the side toward the No. 1 main bearing.*

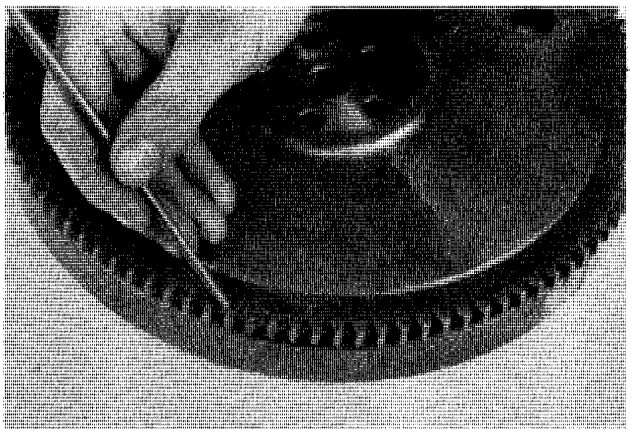
FLYWHEEL
Inspection

STEP 124



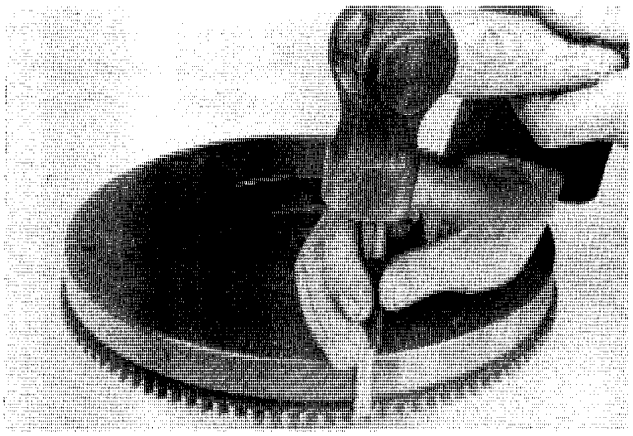
Put the flywheel on a bench so that the ring gear is at the bottom. Use an accurate straight edge and feeler gauge to check for flatness. Install a new flywheel if the flatness error is more than 0.006 inch (0.152 mm).

STEP 125



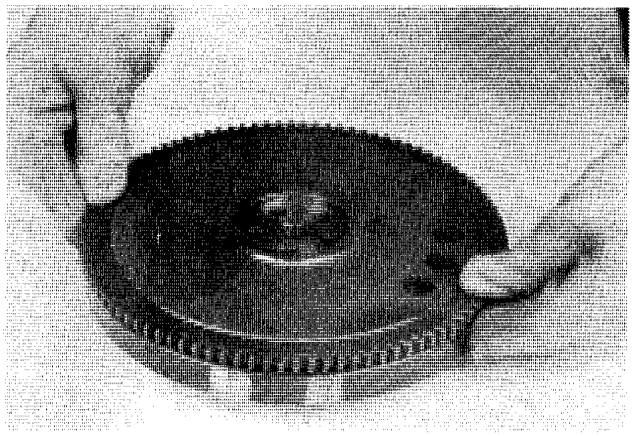
Inspect the ring gear for damage and cracks on the teeth. Do the following to replace the ring gear.

STEP 126



Put the flywheel on a bench so that the ring gear is at the bottom. Split the ring gear then drive it off the flywheel.

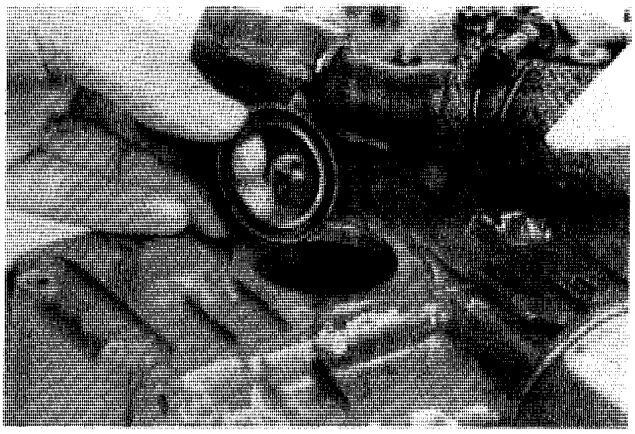
STEP 127



Heat the ring gear in an oven to 400 to 520°F (200 to 270°C) and fit onto the flywheel. Permit the ring gear to cool before installing onto the crankshaft.

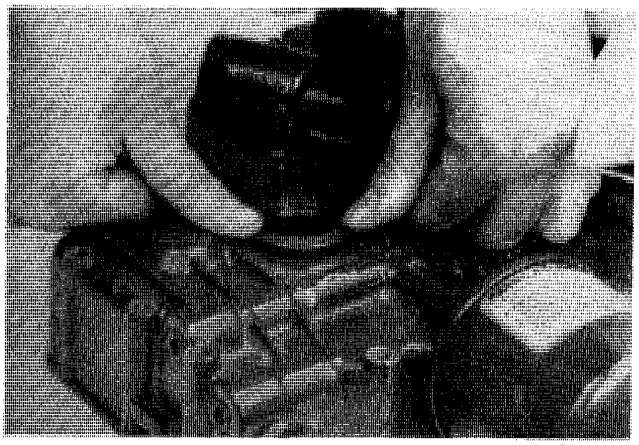
WARNING: *Always wear heat protective gloves to prevent burning your hands when handling heated parts.*

STEP 175



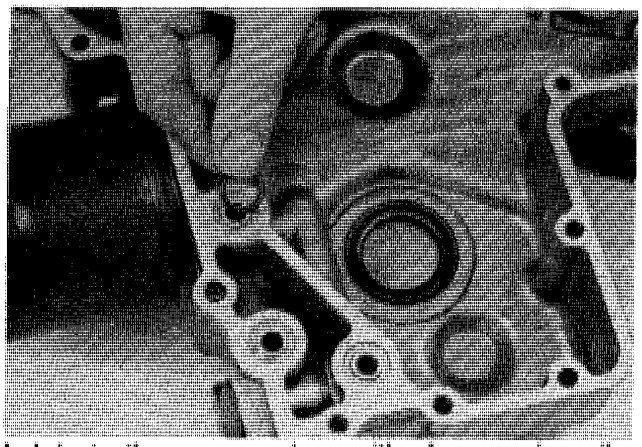
Lubricate a new crankshaft seal with petroleum jelly. Fit the seal into the bore so that the wire insert is to the inside of the timing gear cover.

STEP 176



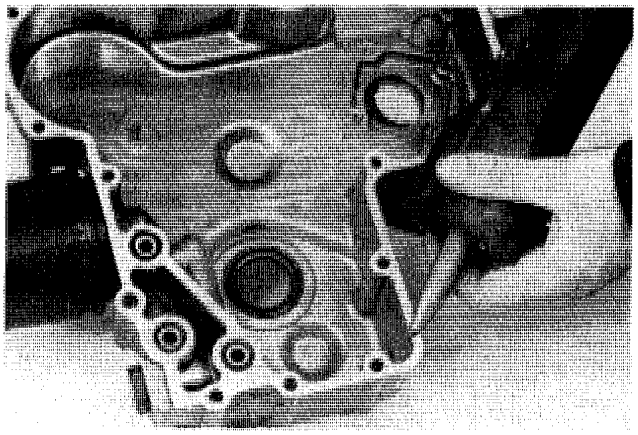
Press the seal level with the outside face of the timing gear cover.

STEP 177



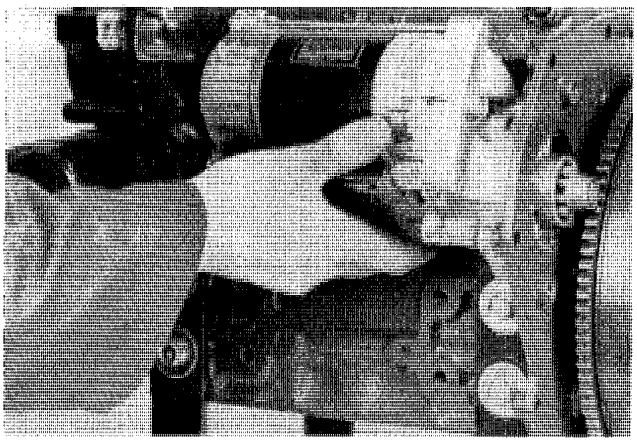
Lubricate three new o-rings with clean engine oil. Fit the o-rings into the grooves in the timing cover.

STEP 178



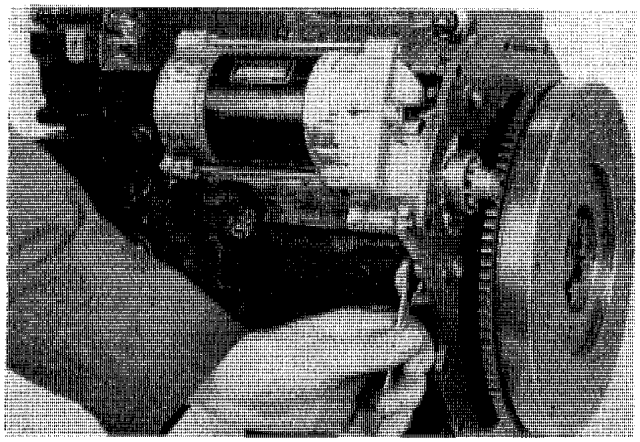
Follow the timing gear cover installation procedure at STEP 101, Section 2045.

STEP 179



Put the starter motor into position.

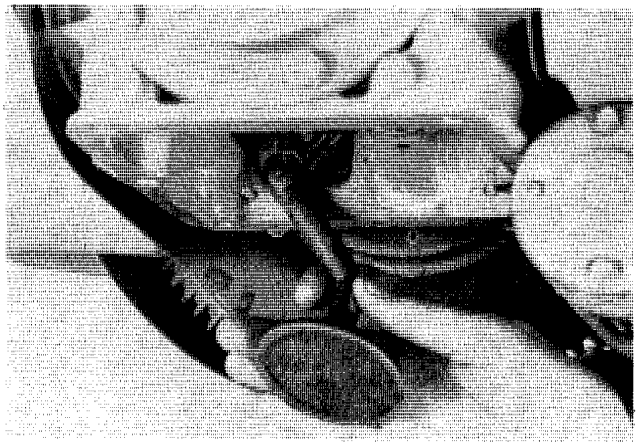
STEP 180



Install and evenly tighten the two retaining bolts and spring washers.

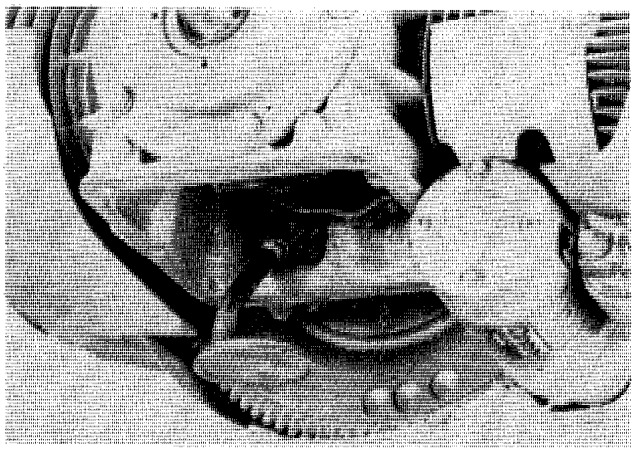
Installation

STEP 10



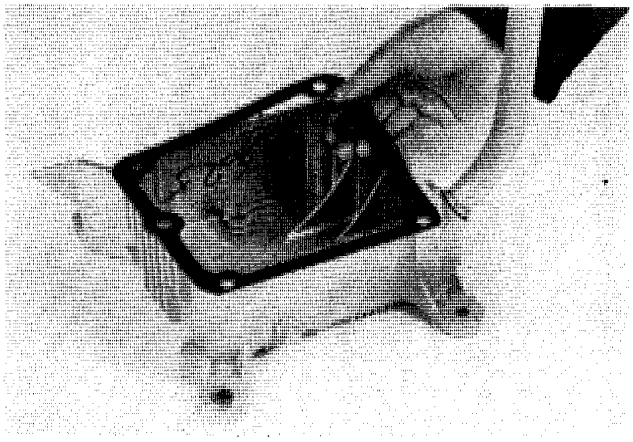
Fit the oil strainer into the oil pump.

STEP 11



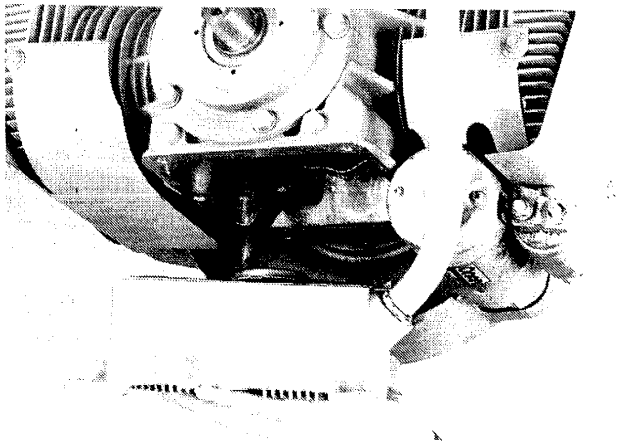
Tighten the oil strainer then check that the strainer is parallel with the joint face of the engine block.

STEP 12



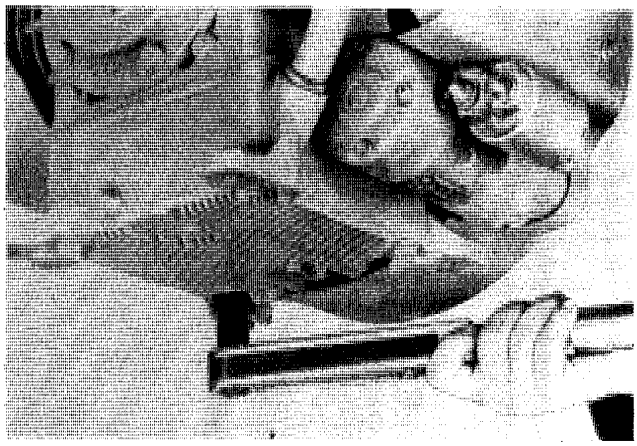
Put a new gasket onto the joint face of the oil pan.

STEP 13



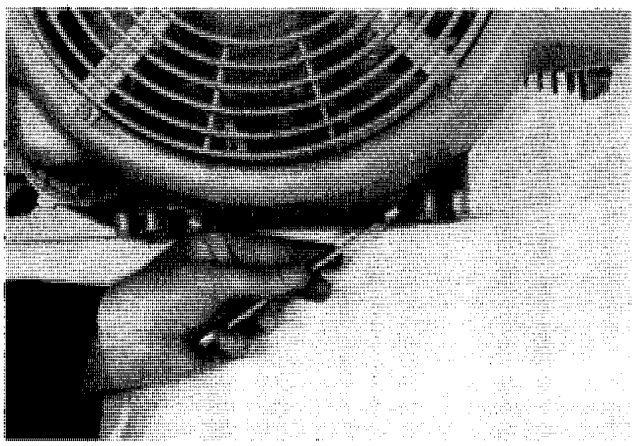
Put the oil pan into position on the engine block.

STEP 14



Install the four long setscrews and spring washers then evenly tighten to a torque of 18 to 23 lb ft (24 to 31 Nm).

STEP 15



Install and evenly tighten the two setscrews and plain washers into the oil pan and the bottom of the flywheel guard.

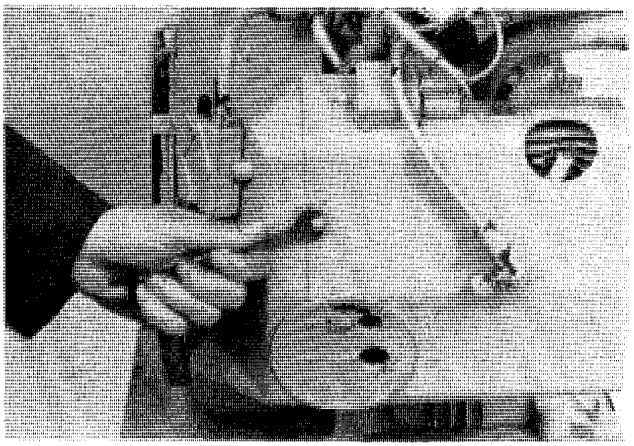
LOW OIL PRESSURE SWITCH

A low oil pressure switch is installed in the oil filter adaptor. The switch will stop voltage flow to the ignition system if the oil pressure is less than 8 PSI (55 kPa)

Removal

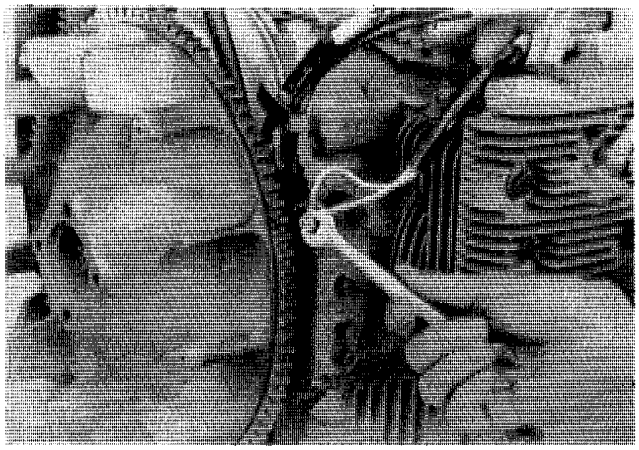
The following procedure shows the engine removed from the machine. Left hand and right hand instructions are from the flywheel end of the engine, looking towards the ouput shaft.

STEP 57



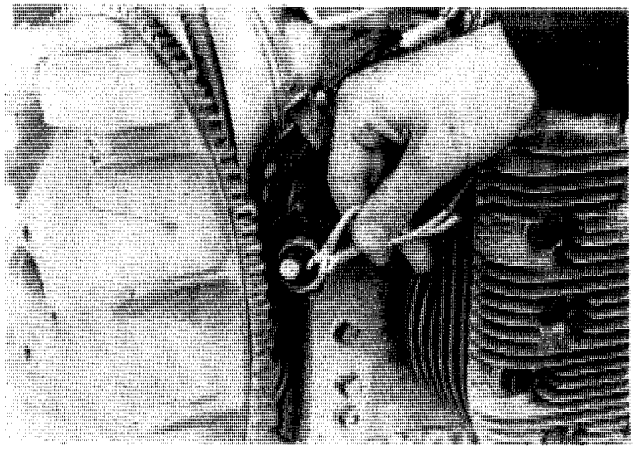
Remove the cylinder head guard on the right hand side (see STEPS 21 to 27).

STEP 58



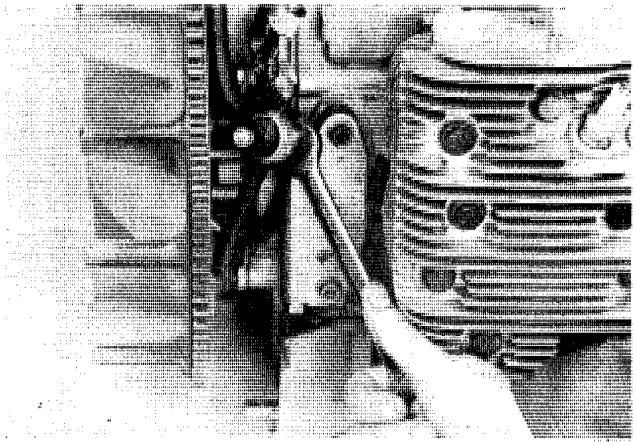
Loosen the nut on the end of the low oil pressure switch.

STEP 59



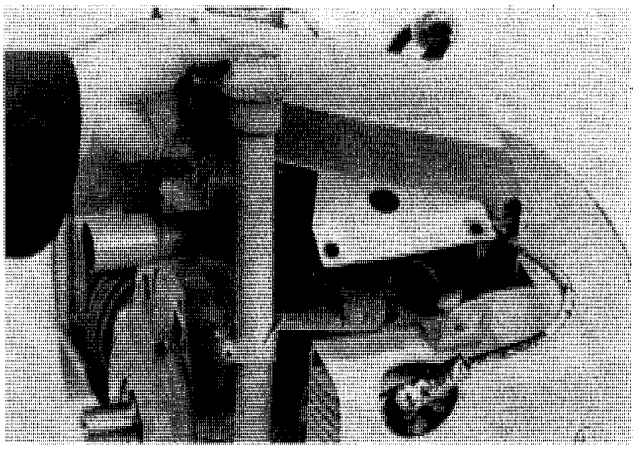
Disconnect the two wires.

STEP 60



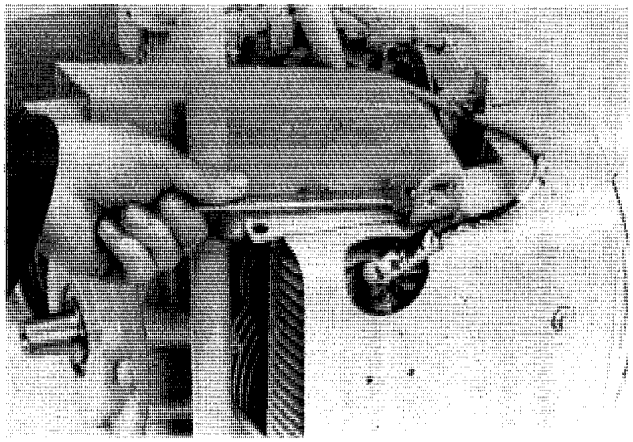
Hold the connector in position.

STEP 99



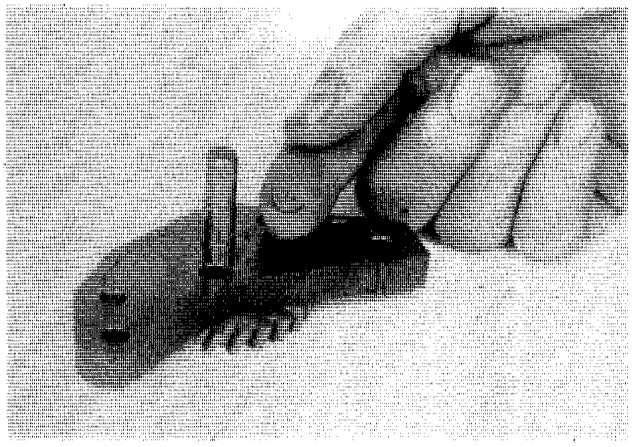
Install the exhaust manifold guard.

STEP 100



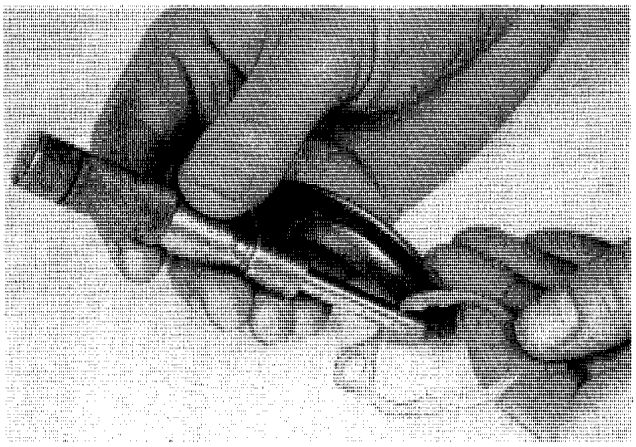
Install and tighten the setscrew.

STEP 146



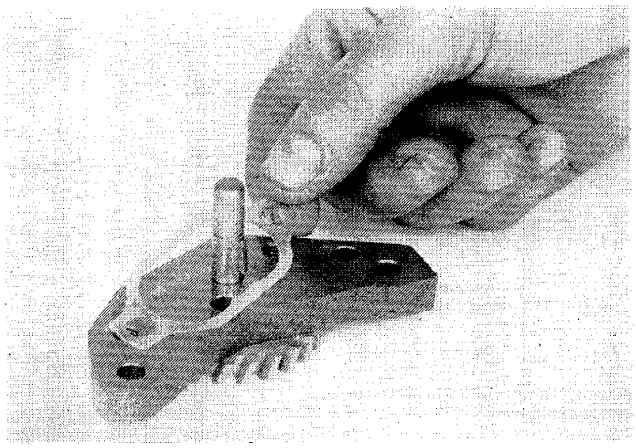
Fit the key into the slot in the drive shaft.

STEP 147



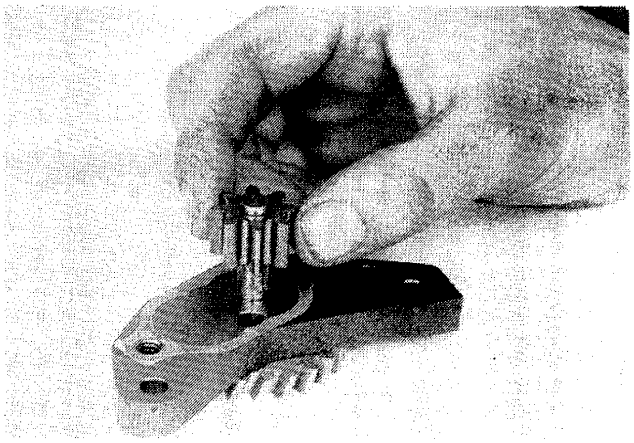
Measure the thickness of the shim gasket. Three different shims can be fitted; 0.005 inch (0.127 mm) 0.007 inch (0.178 mm) or 0.009 inch (0.229 mm). For maximum pump efficiency the thinnest available shim gasket must be fitted, without making the rotors tight in the pump body.

STEP 148



Install the next thinnest shim gasket.

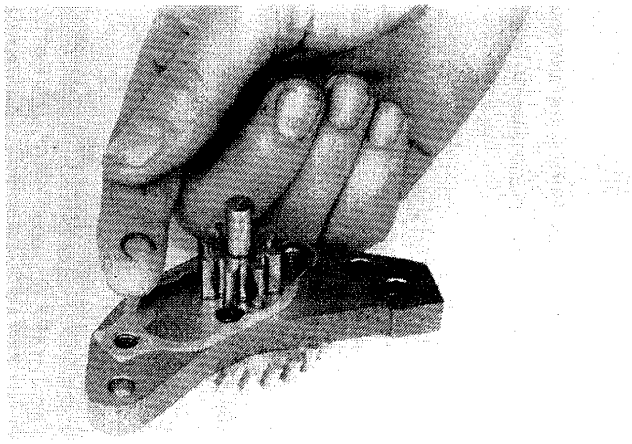
STEP 149



Install the drive rotor.

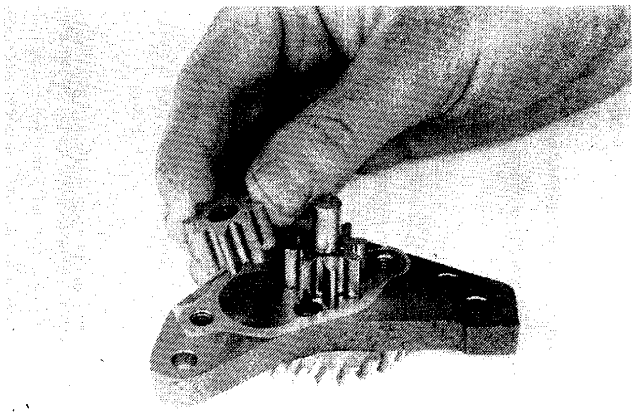
NOTE: *Both rotors have the same dimensions.*

STEP 150



Install the snap ring.

STEP 151



Install the driven rotor.

TABLE OF CONTENTS

THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

IMPORTANT: *This engine was made using the metric measurement system. All measurements and the checks must be made with metric tools to make sure of an accurate reading when inspecting parts.*

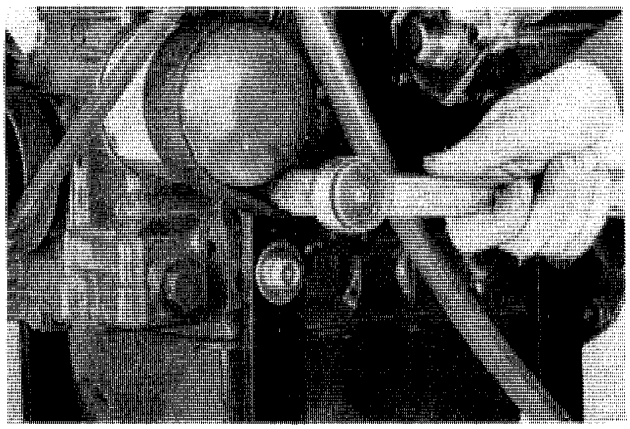
OIL FILTER CARTRIDGE
Removal

he oil filter cartridge is fitted at the front of the ngine block, below the dynamo.

;TEP 29

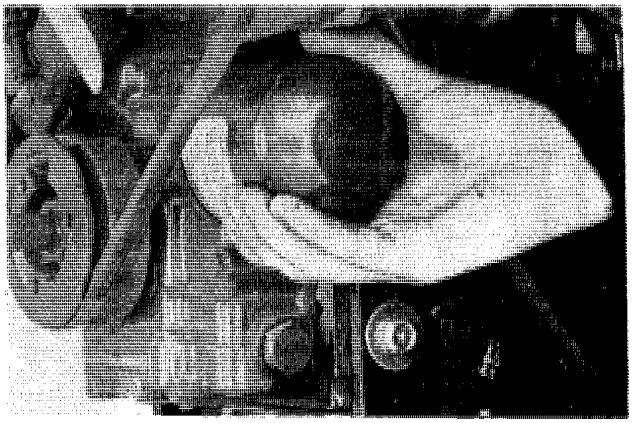
)ut a container under the oil filter cartridge.

STEP 30



Use a strap wrench to turn the oil filter cartridge counterclockwise.

STEP 31

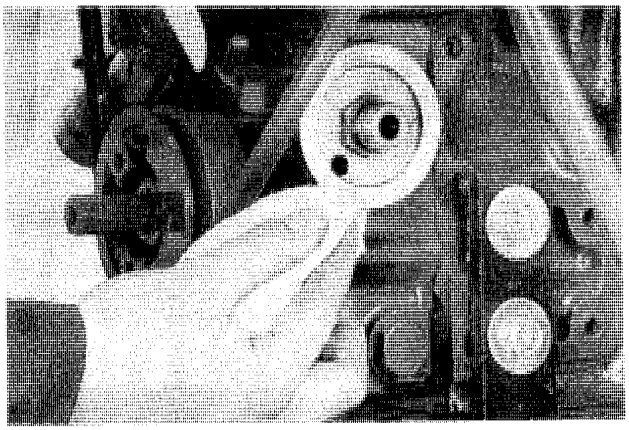


Remove the oil filter cartridge from the engine block.

Installation

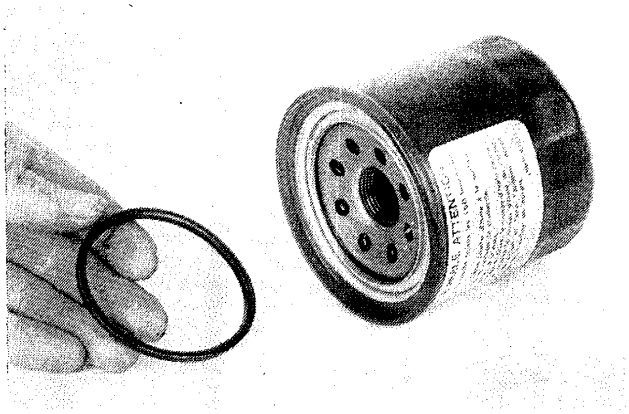
IMPORTANT: *Never try to clean the oil filter cartridge. Always fit a new assembly.*

STEP 32



Clean the filter mounting face on the engine block.

STEP 33



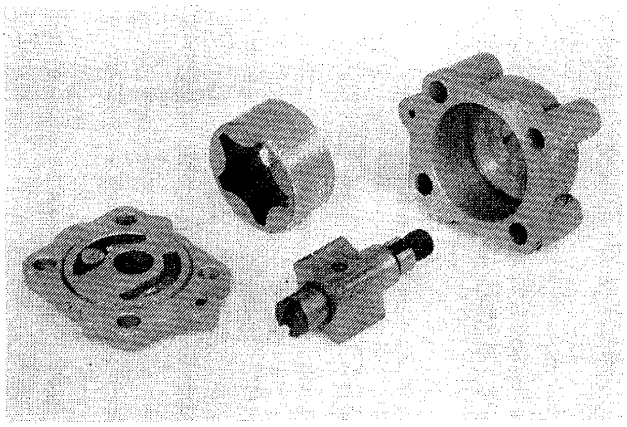
Lubricate a new seal with clean engine oil. Fit the seal into the groove in the oil filter cartridge.

Inspection

STEP 75

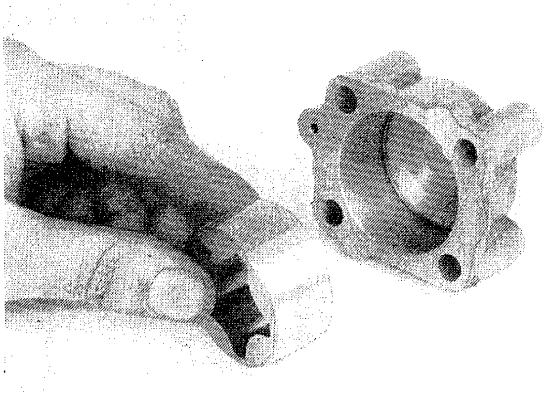
Clean all the parts in kerosene then dry in compressed air. Do Not use a cloth.

STEP 76



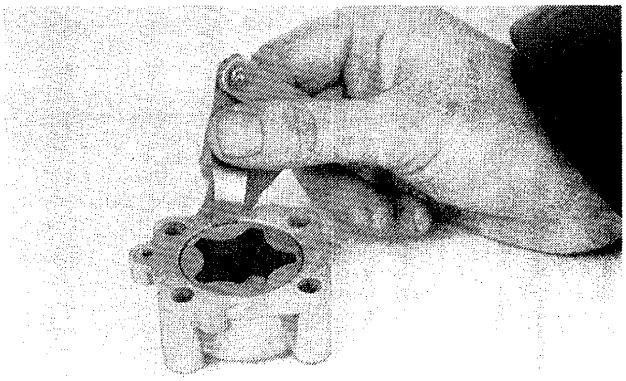
Check all the parts for damage. If there is any damage, install a new lube pump assembly.

STEP 77



Fit the stator in to the pump body.

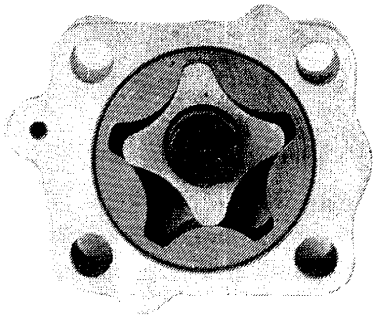
STEP 78



Use feeler gauges to check the clearance between the stator and the pump body. If the clearance is more than 0.010 inch (0.25 mm) install a new lube pump assembly.

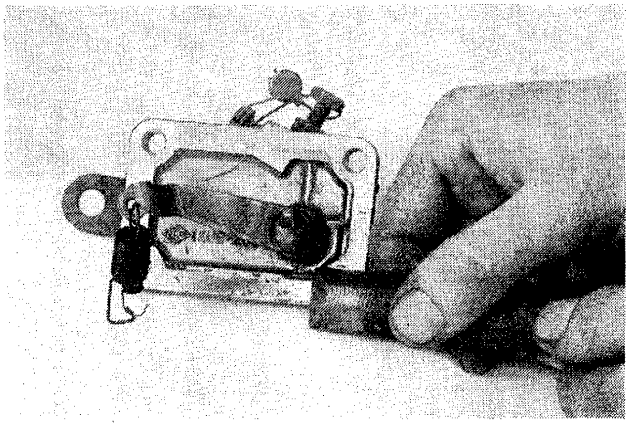
NOTE: *Check the clearance at four opposite points on the stator diameter.*

STEP 79



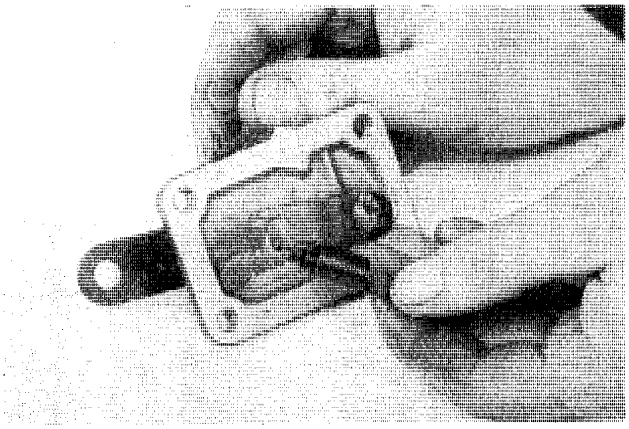
Install the rotor into the stator. Turn the rotor shaft to align a rotor lobe with a stator lobe.

STEP 121



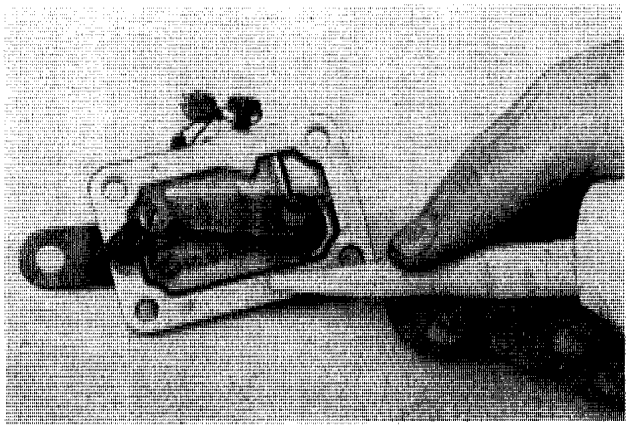
Use a scraper to remove any old joint material from the speed control plate.

STEP 122



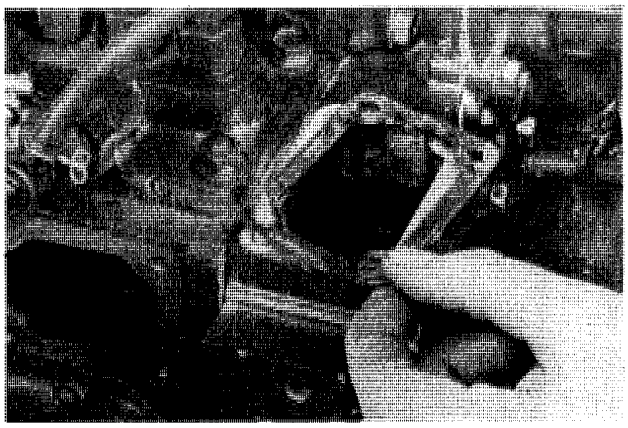
Check that the two governor springs are connected to the lever.

STEP 123



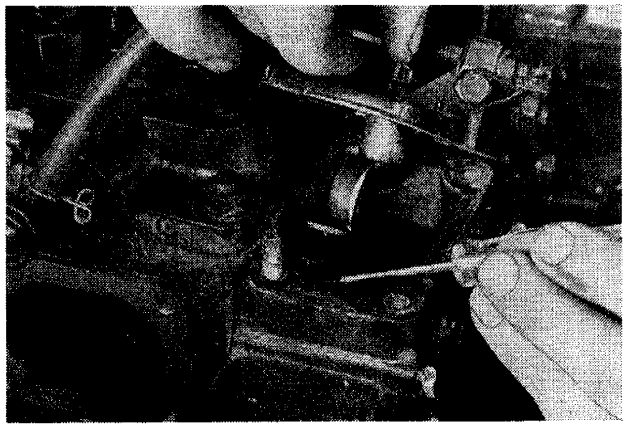
Apply a continous bead of Loctite Superflex Silicone Sealant onto joint face of the speed control plate.

STEP 124



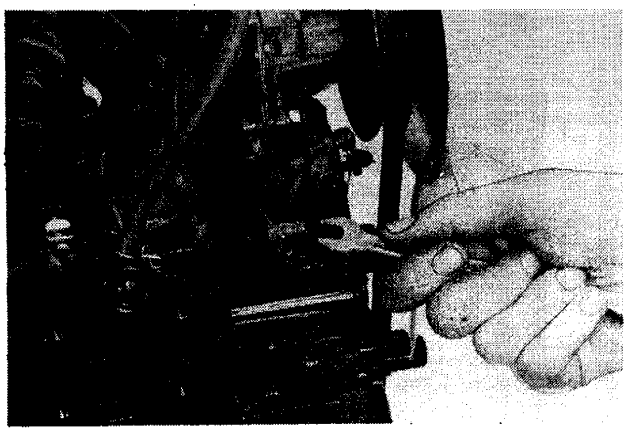
Fit a new gasket onto the timing cover.

STEP 125



Push the governor springs towards the governor fork lever while installing the speed control plate.

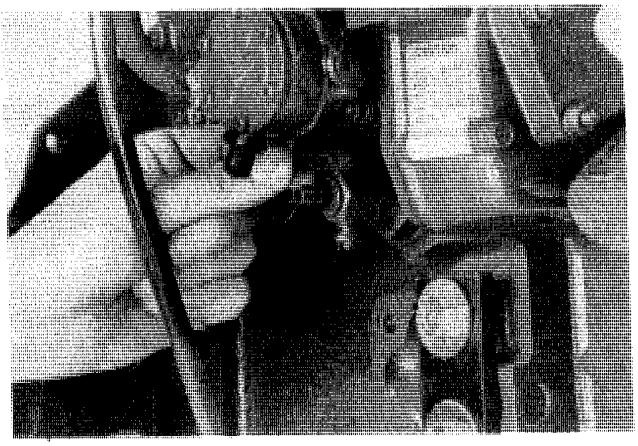
STEP 126



Fit the setscrews, spring washers and nut then evenly tighten.

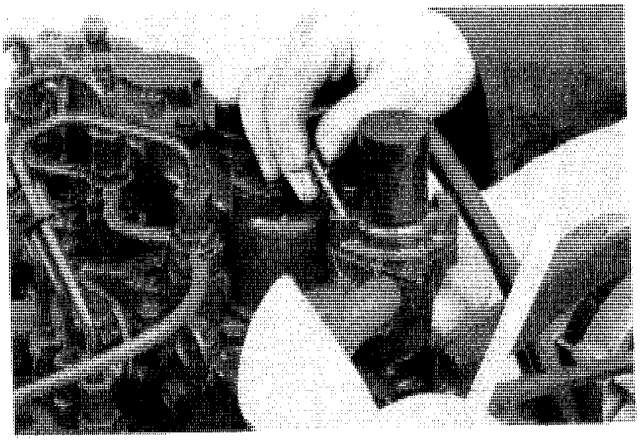
THERMOSTAT
Removal

STEP 1



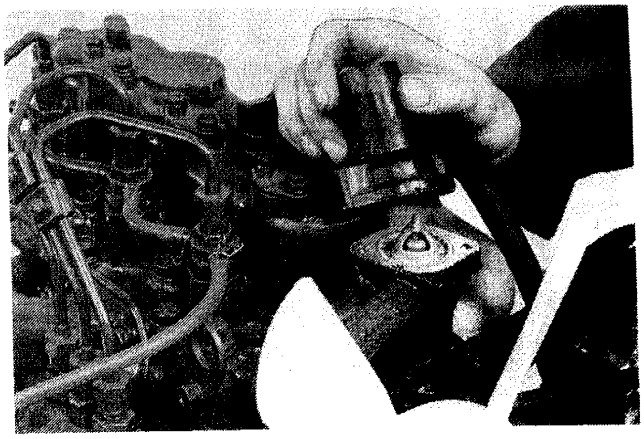
Open the cylinder block drain tap and remove the coolant into a clean container. Close the drain tap.

STEP 2



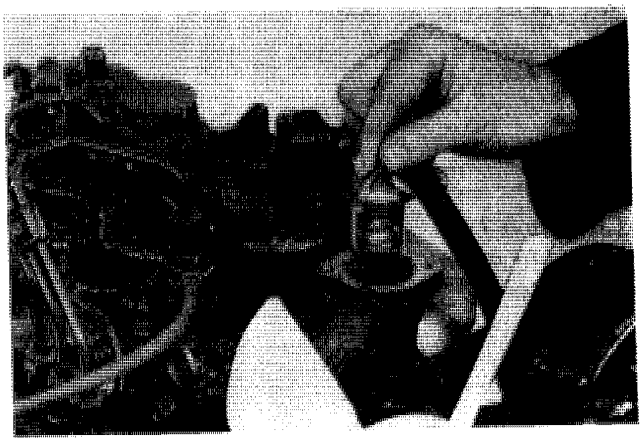
Remove the two setscrews and spring washers from the thermostat cover.

STEP 3



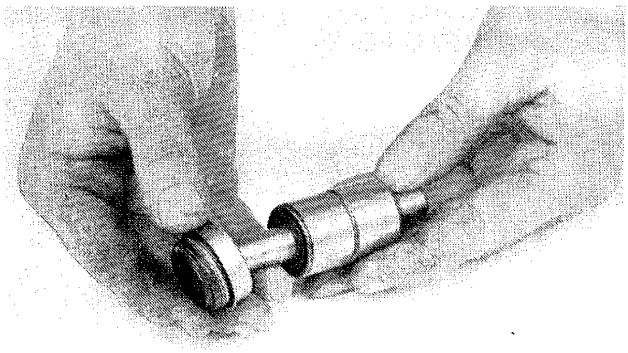
Remove the thermostat cover.

STEP 4



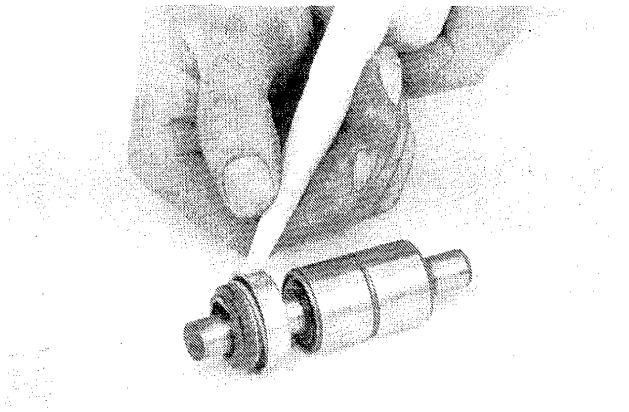
Remove the thermostat.

STEP 39



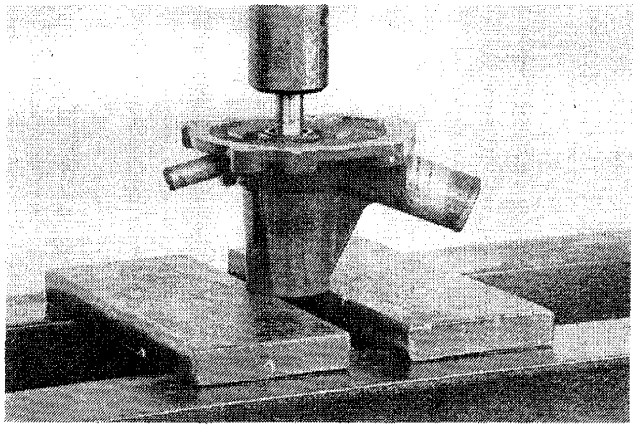
Fit a new spring seal onto the long end of the bearing shaft. The spring must be away from the bearing.

STEP 40



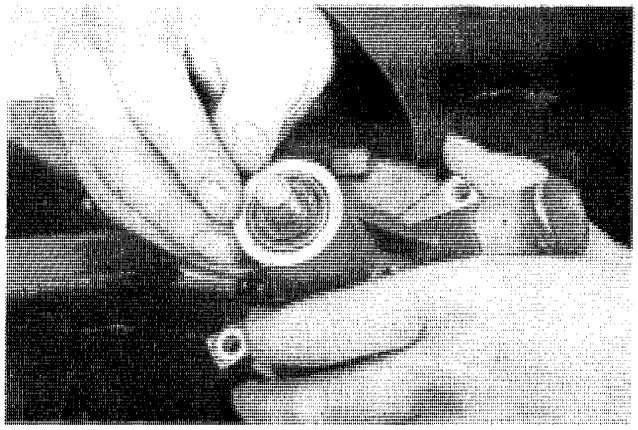
Put a small amount of Loctite Superflex Silicone Sealant onto the outside diameter of the spring seal.

STEP 41



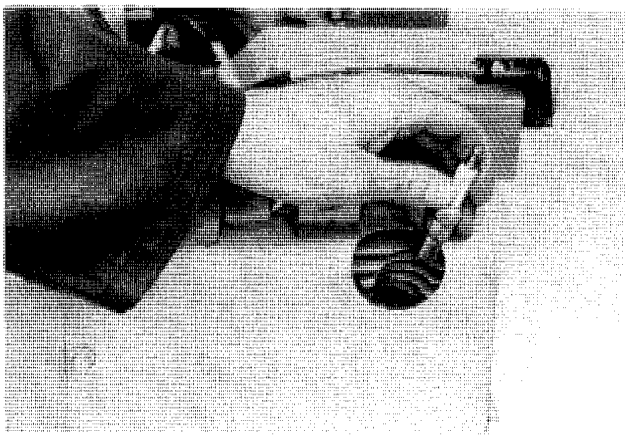
Lubricate the outside of the bearing with petroleum jelly then press the bearing shaft into the pump body.

STEP 42



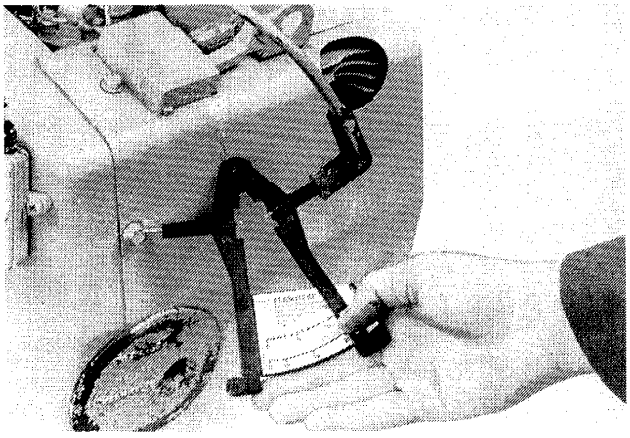
Check that the spring seal is against the shoulder inside the body and the bearing is level with the outside face. Clean any sealant from inside the pump body.

STEP 3



Remove both spark plugs to prevent accidental starting of the engine.

STEP 4



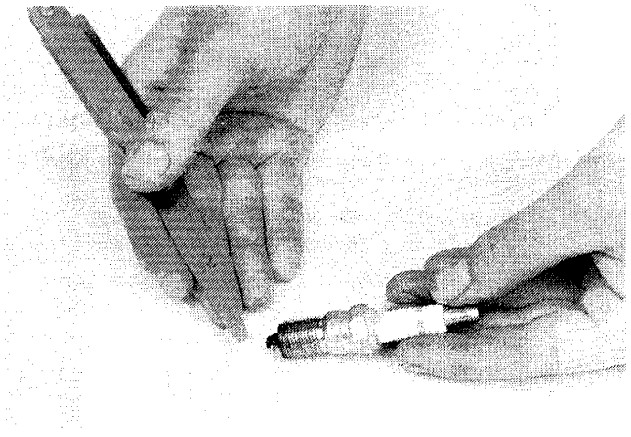
Connect one of the spark ignition leads to an acceptable spark tester. Put the tester to ground away from the spark plug hole in the cylinder head. Turn the key switch to rotate the engine for 5 seconds while looking at the spark on the tester. If the spark occurs regularly there is no fault in the ignition system. Continue with the troubleshooting procedure at STEP 9 if the spark is not regular or there is no spark.

WARNING: *Failure to ground the spark tester away from the spark plug hole can result in the ignition of the cylinder gases.*

STEP 5

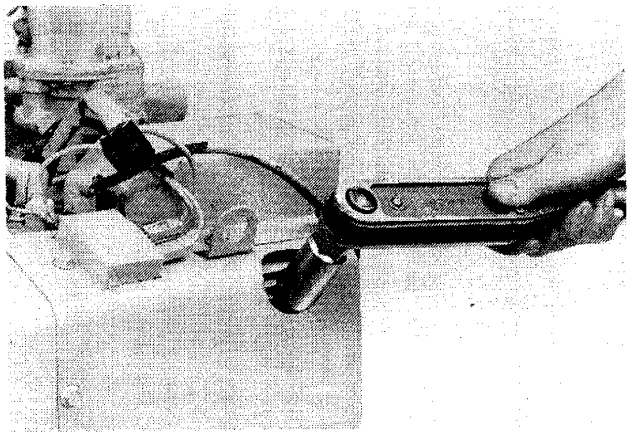
Repeat the spark test using the other spark ignition lead. The fault can be the spark ignition lead.

STEP 6



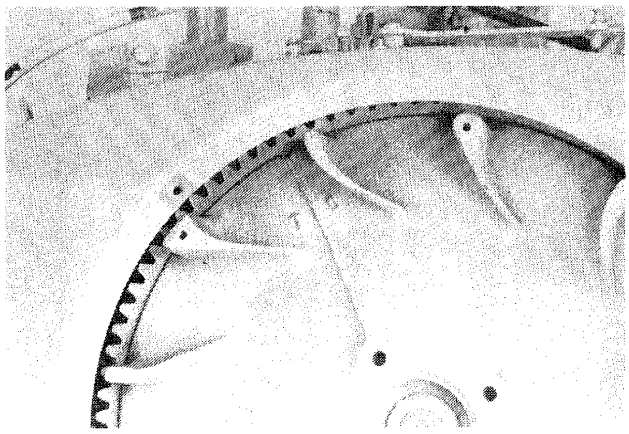
Check the condition of the spark plugs. Install new spark plugs if there is any damage. Measure the gap between the electrodes. Adjust the gap if necessary to 0.025 inch (0.64 mm).

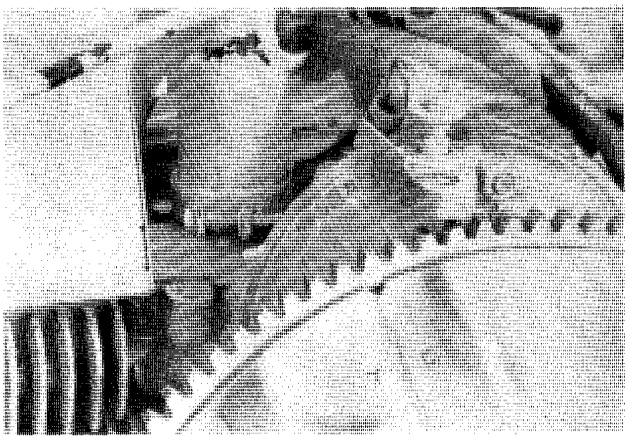
STEP 7



Install the spark plugs into the cylinder head then tighten to a torque of 15 to 20 lb ft (20 to 27 Nm).

STEP 55





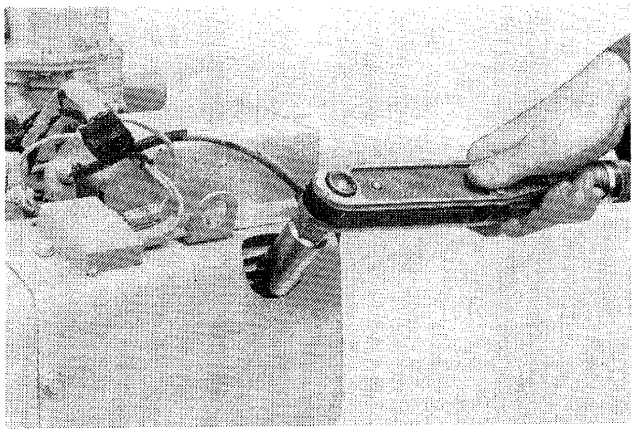
Check the position of the 'TC' mark on the flywheel. It must be in alignment with the 20 degree mark on the timing gear cover.

NOTE: *The flywheel guard has been removed for photographic purposes only.*

STEP 56

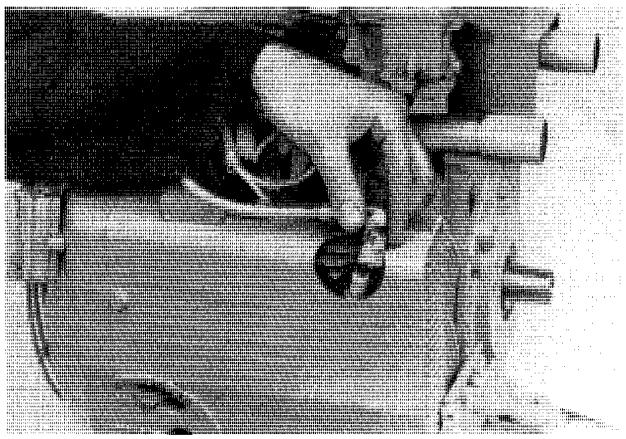
After checking the ignition timing, turn the key swtich to the 'OFF' position.

STEP 57



Install both spark plugs and tighten to a torque of 15 to 20 lb ft (20 to 27 Nm).

STEP 58



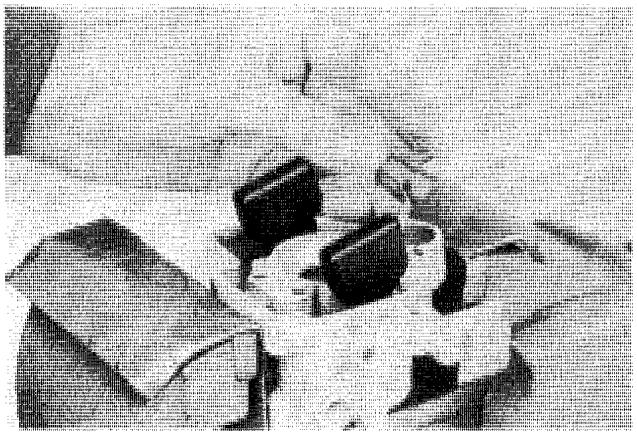
Push the spark ignition leads onto the spark plugs. Test the engine for correct operation.

WARNING: *Never operate the engine in a closed building. Proper ventilation is necessary under all circumstances.*

TABLE OF CONTENTS

THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

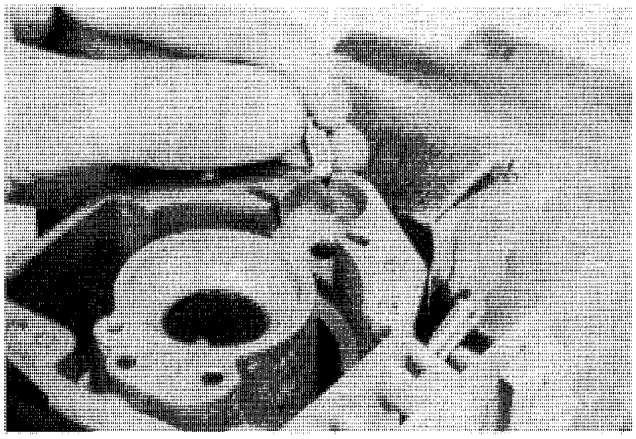
STEP 42



Remove the float assembly.

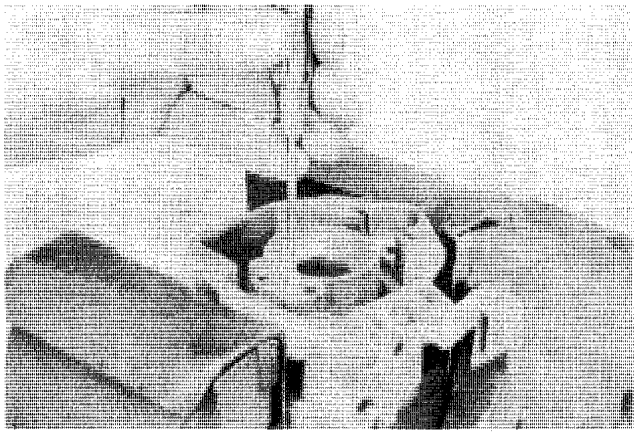
NOTE: *The float valve is connected to the float assembly but can remain in the carburetor body when the float assembly is removed.*

STEP 43



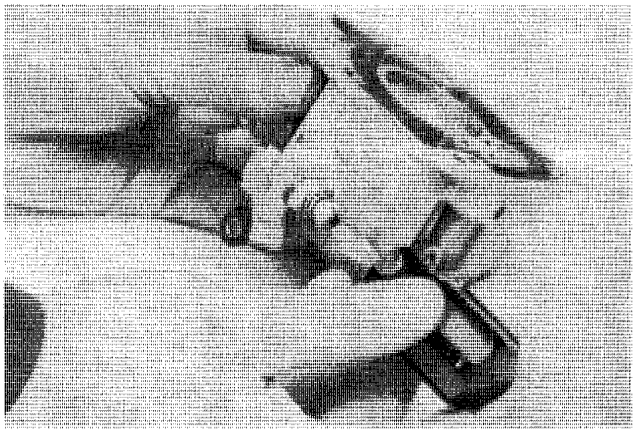
Remove the float valve.

STEP 44



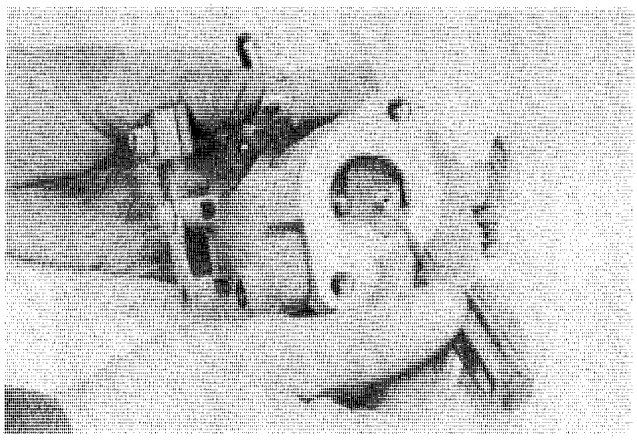
Turn the idle jet counterclockwise to remove it from the carburetor body.

STEP 45



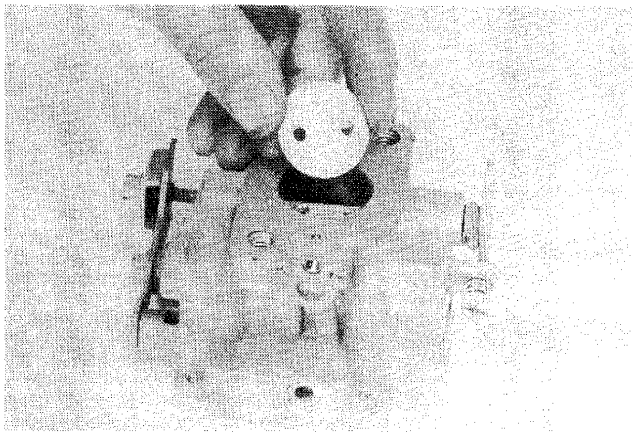
Turn the low idle screw counterclockwise until it is clear of the throttle lever.

STEP 46



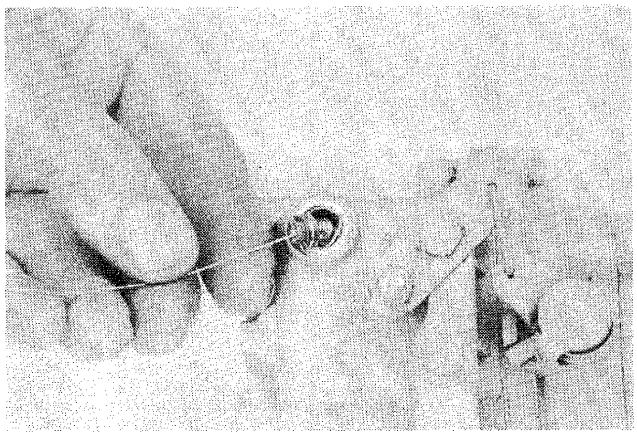
Remove the two screws and spring washers from the throttle plate.

STEP 47



Remove the throttle plate.

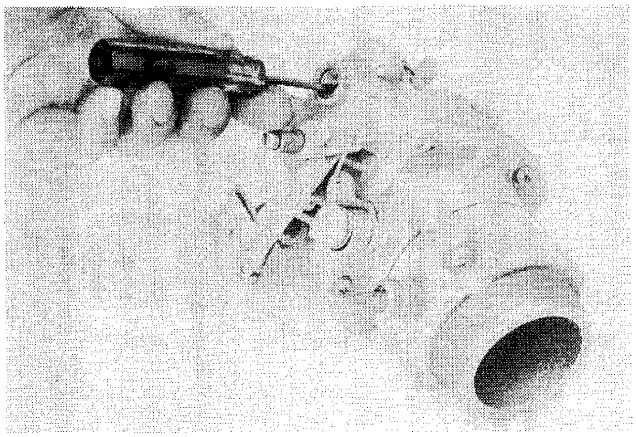
STEP 91



Put a piece of small diameter wire through the hole in the power jet. Bend the end of the wire then install the washer and power jet into the carburetor body.

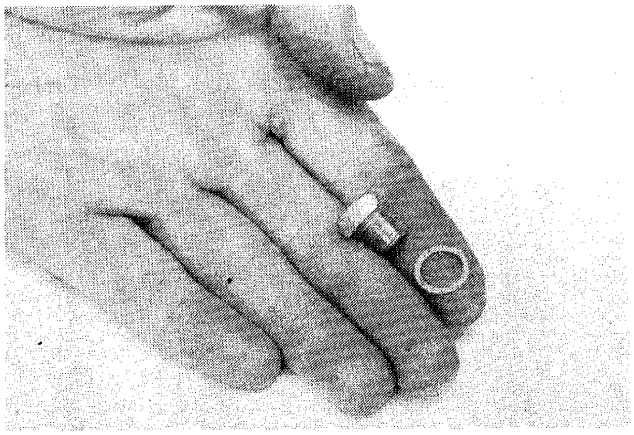
IMPORTANT: *The wire must be smaller in diameter than the hole in the power jet.*

STEP 92



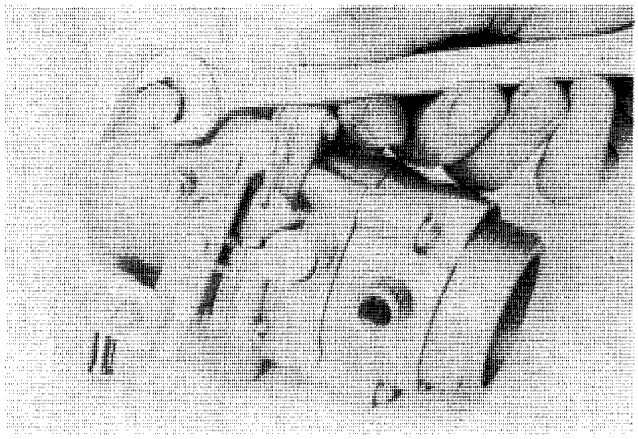
Use a screwdriver to turn the power jet clockwise then carefully remove the wire. Tighten the power jet.

STEP 93



Fit a new copper washer onto the access plug for the power jet.

STEP 94

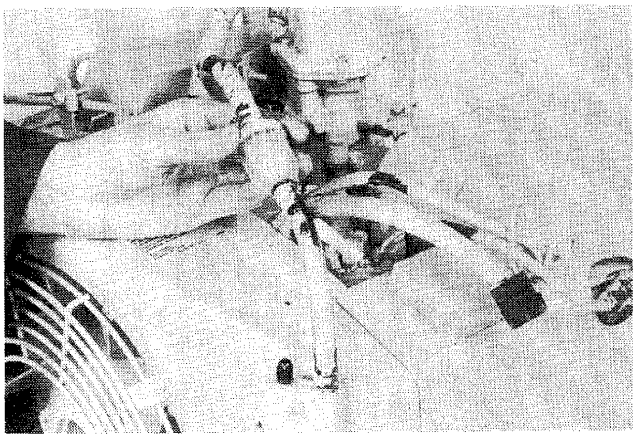


Install and tighten the access plug.

FUEL PUMP AND FILTER
Testing

The fuel pump is actuated by the change in vacuum in the engine block. A vacuum hose connects the fuel pump to the engine block. Parts for the fuel pump are not available. If there is a fault in the supply of fuel to the carburetor, do the following.

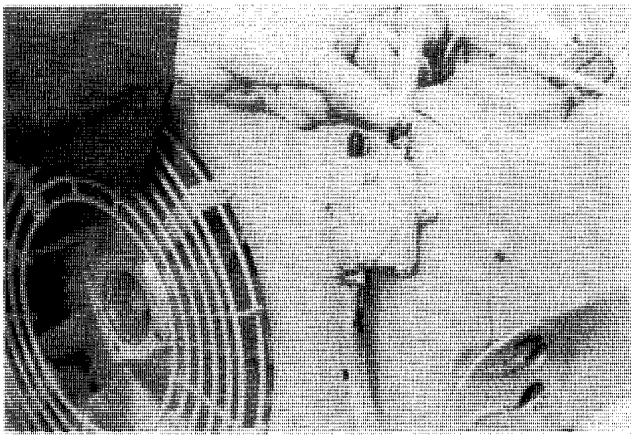
STEP 134



Make sure that there is no restriciton in the fuel filter between the fuel pump and carburetor. Replace the fuel filter if necessary.

NOTE: *Install a new fuel filter so that the arrow is pointing toward the carburetor (direction of flow).*

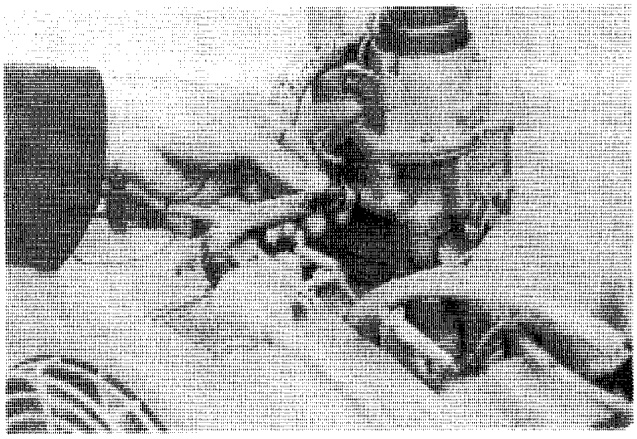
STEP 135



Check that the fuel inlet and outlet hoses on the fuel pump are secure. Replace the hoses if there is any damage.

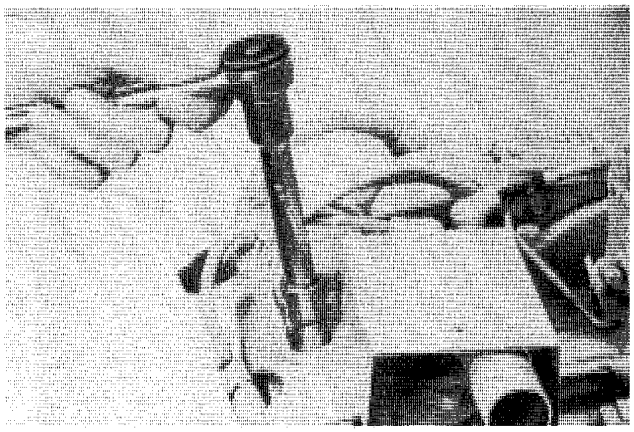
NOTE: *The inlet connection on top of the fuel pump is not used for this engine. DO NOT remove the cap.*

STEP 136



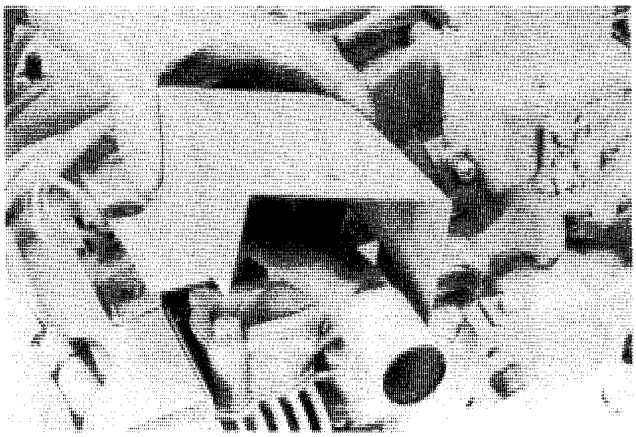
Check that the fuel inlet hose on the carburetor is secure. Replace the hose if there is any damage.

STEP 137



Remove the setscrew from the exhaust manifold guard on the right hand side.

STEP 138



Remove the guard.

SPECIAL TORQUES

	U.S. Value	Metric Value
High Pressure Pipes	11 to 19 lb ft	15 to 25 Nm
Air Removal Screw	10 to 13 lb ft	13.7 to 17.6 Nm
Injection Pump To Engine Block	17 to 20 lb ft	24 to 28 Nm
Exhaust Manifold To Cylinder Head	7 to 8 lb ft	10 to 11 Nm

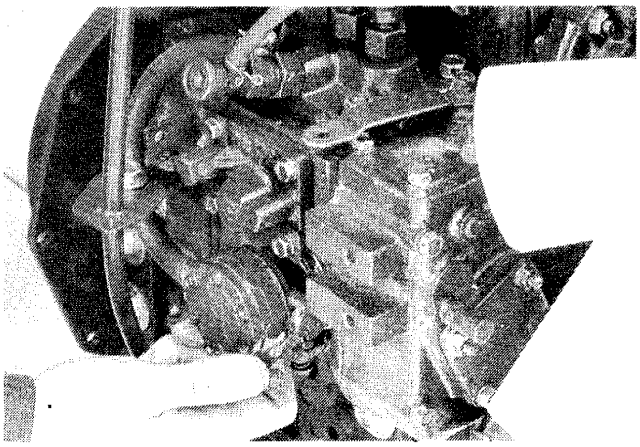
STANDARD TORQUES

Where no special torque data is specified, the following torque figures should be applied. Threads should be lubricated with engine oil or chassis grease. Apply minimum figure to bolts that have previously been used. Always tighten bolts in two stages, 50% of figure then full tightness.

BOLT TYPE	TORQUE	BOLT SIZE							
		M6	M8	M10	M12	M14	M16	M18	M20
STANDARD NO NUMBER SS41, S20C	MAX (lb ft)	6.9	15.2	33.3	53.5	92.6	141.0	209.8	389.3
	MIN (lb ft)	5.8	13.0	28.9	46.3	79.6	123.0	180.0	245.9
	MAX (Nm)	9.3	20.6	45.1	72.6	125.5	191.2	284.4	392.2
	MIN (Nm)	7.8	17.7	39.2	62.8	107.9	166.7	245.2	333.4
SPECIAL NUMBER 7 S43C, S84C (REFINED)	MAX (lb ft)	8.3	20.3	41.2	66.5	108.5	166.4	235.1	318.2
	MIN (lb ft)	7.2	17.4	35.4	57.1	91.1	144.7	202.2	271.2
	MAX (Nm)	11.3	27.5	55.9	90.2	147.1	225.5	318.7	431.5
	MIN (Nm)	9.8	23.5	48.0	77.5	123.6	196.1	274.6	367.7
SPECIAL NUMBER 9 SCM435, SCr435 (REFINED)	MAX (lb ft)	10.5	25.3	52.1	86.8	144.7	224.2	296.5	419.5
	MIN (lb ft)	9.0	21.7	44.8	75.9	123.0	191.7	253.2	361.6
	MAX (Nm)	14.2	34.3	70.6	117.7	196.1	304.0	402.0	568.7
	MIN (Nm)	12.3	29.4	60.8	103.0	166.7	259.9	343.2	490.3

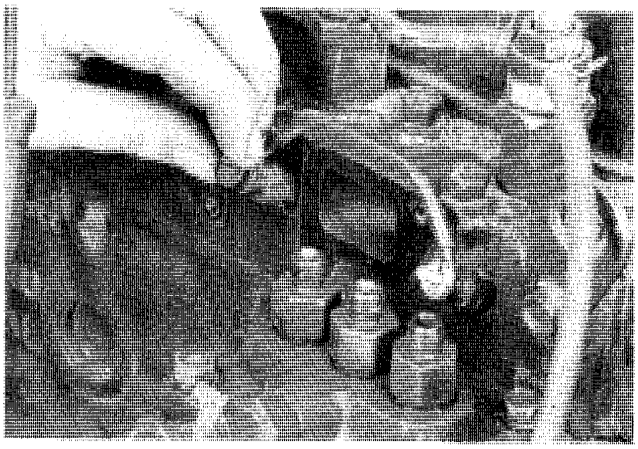
IMPORTANT: *This engine was made using the metric measurement system. All measurements and checks must be made with metric tools to make sure of an accurate reading when inspecting parts.*

STEP 39



Operate the hand lever on the fuel pump until fuel without air is flowing from the air removal screw on the injection pump. Tighten the air removal screw.

STEP 91

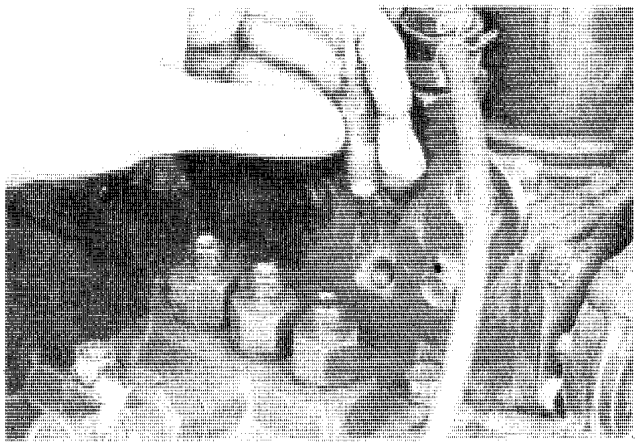


Loosen the nut on the next connected glow plug. Do this to prevent damage to the glow plug lead.

STEP 92

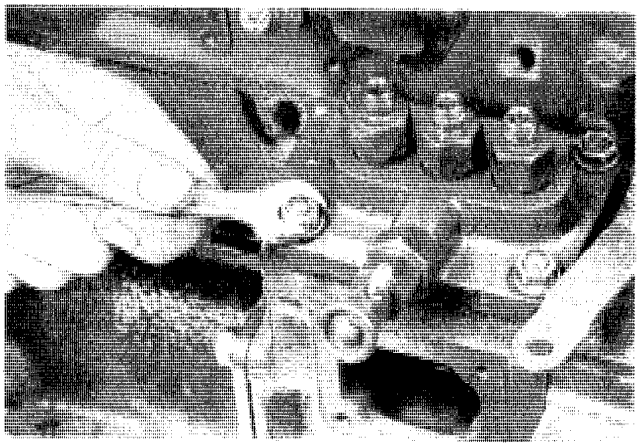
Remove the lead from the glow plug.

STEP 93



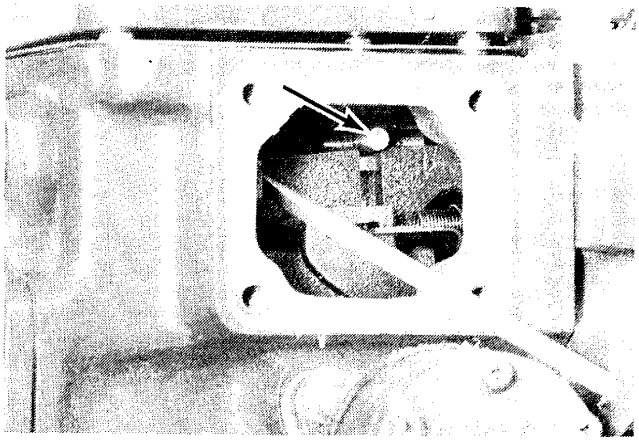
Remove the glow plug taking care not to loose the small washer on the outer threads.

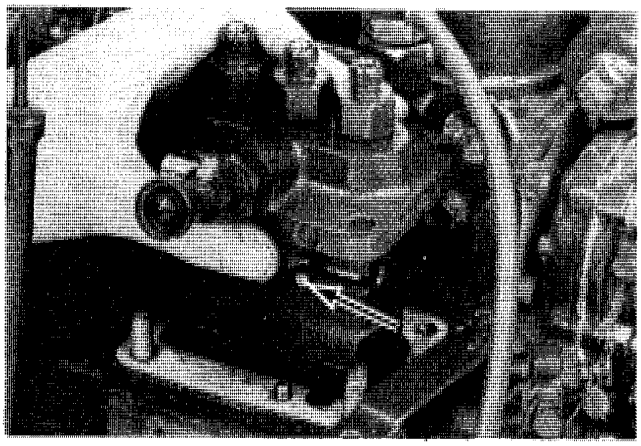
STEP 94



Remove the two setscrews, nuts and spring washers from the injection pump.

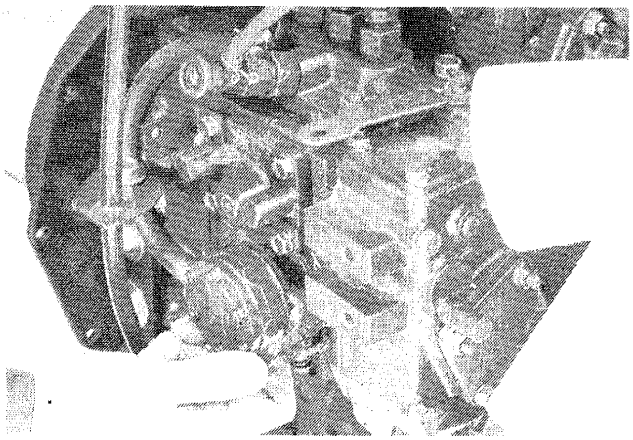
STEP 95





Align the pin on the control rack with the groove in the engine block casting. Carefully remove the injection pump from the engine block.

STEP 140



Operate the hand lever on the fuel pump until fuel without air is flowing from the air removal screw on the injection pump. Tighten the air removal screw.

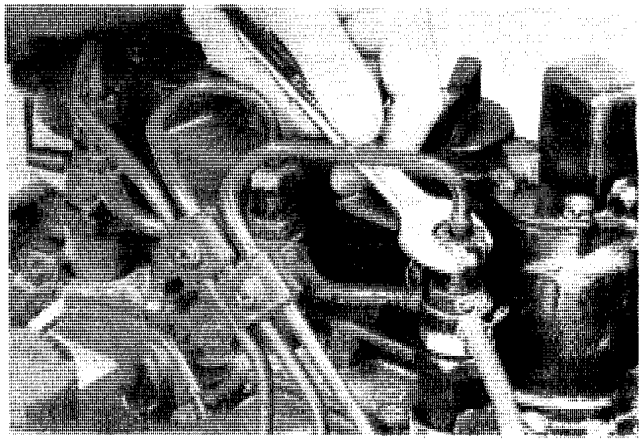
STEP 141

Put all the control levers in neutral then start the engine and check for leaks.

WARNING: *The fuel system operates at high pressure. Fuel with high pressure will pass through the skin and result in serious injury or death. Use a piece of card to check for leaks. never use your hands Always use eye protection.*

WARNING: *Never operate the engine in a closed building. Proper ventilation is required under all circumstances.*

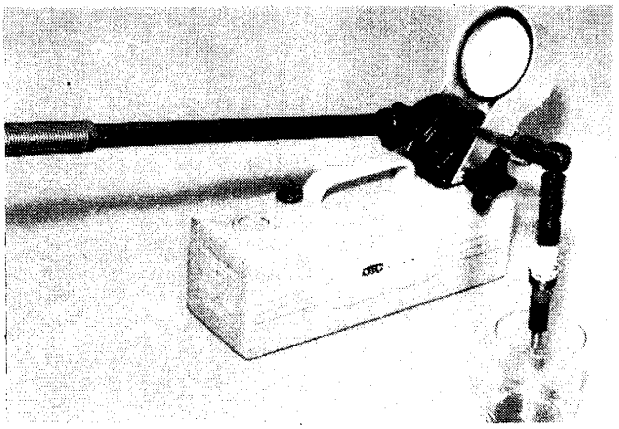
STEP 142



If the engine is running rough, loosen the union on the high pressure pipe at the No. 1 injector. Tighten the union when fuel without air is flowing. Repeat the procedure at the other injectors if necessary.

FUEL INJECTOR TESTER

STEP 16



A diesel Fuel Injector Tester (CAS-10249) is needed for checking and adjusting the injectors. The following instructions will work for all models of testers except for descriptions on adjustments to the tester. Operating instructions are given with the tester.

The tester is used to make the following checks:

1. Check and adjust the injector opening pressure.
2. Check the injector assembly for fuel leakage.
3. Check the injector for accurate spray pattern.

Fuel injectors must be checked on the tester when making the following service operation.

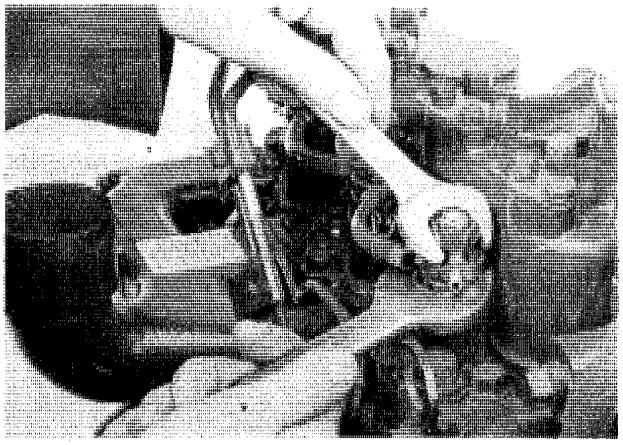
1. An injector that has been removed from the engine for cleaning, must be checked on the tester before the injector can be installed in the engine.
2. A new injector assembly must be checked on the tester before the injector can be installed in the engine.
3. All the injectors must be removed and checked on the tester during an engine overhaul.
4. An injector must be removed and checked on the tester before the injector is disassembled, if the injector is the cause of a loss of engine performance.

Injector Tester Preparation

STEP 17

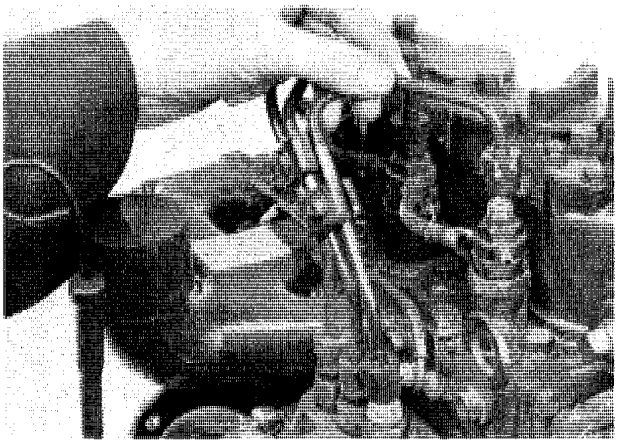
1. Fill the reservoir with clean fuel.
2. Connect the correct connectors to the connection tube.
3. Connect the injector to the tester.
4. To remove the air that is in the system, close the pressure release valve and the gauge protection valve, open the pump valve. Operate the pump rapidly to remove the air from the system.

STEP 52



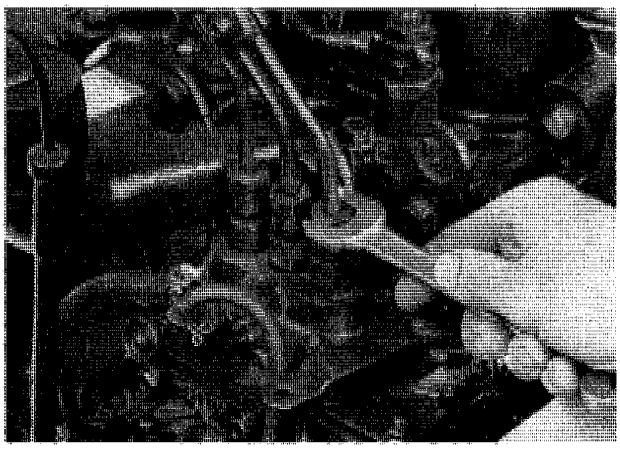
Install and tighten the top nut.

STEP 53



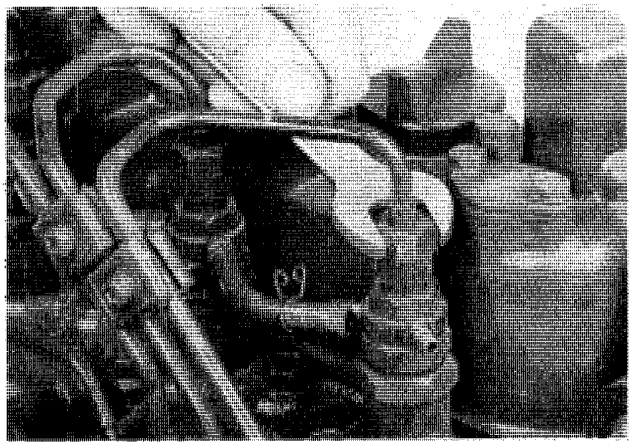
Remove the caps then fit the high pressure pipe onto the injection pump and the injector.

STEP 54



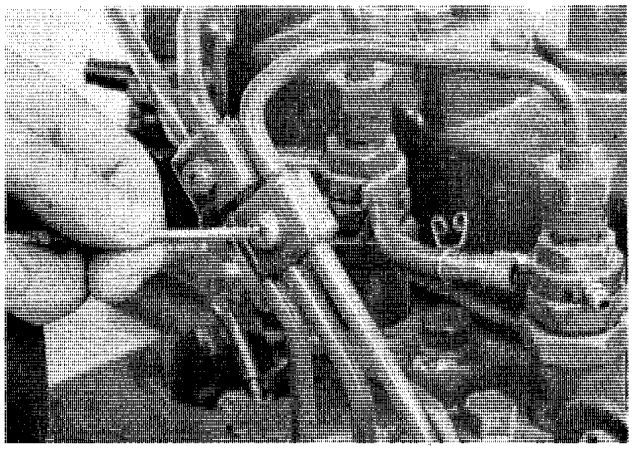
Tighten the union at the injection pump to a torque of 11 to 19 lb ft (15 to 25 Nm).

STEP 55



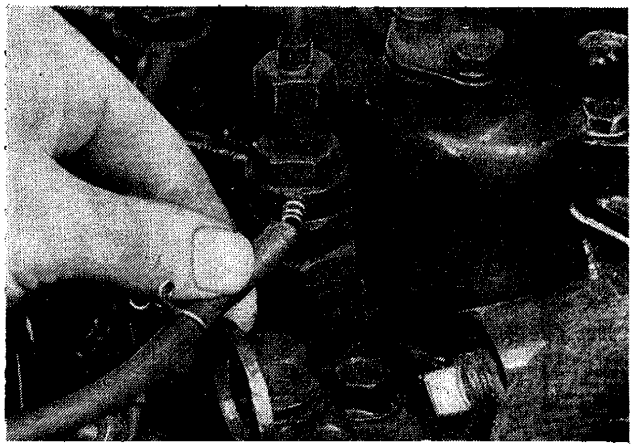
Tighten the union at the injector to a torque of 11 to 19 lb ft (15 to 25 Nm).

STEP 56



Tighten the screw on the pipe clamp.

STEP 57



Fit the leak off hose(s) and clip(s) onto the injector.

TABLE OF CONTENTS

TROUBLESHOOTING THE CHARGING CIRCUIT FOR THE GASOLINE ENGINE

General Inspection

STEP 1

Park the machine on a level surface and lower the attachment to the floor.

STEP 2

Make sure all of the controls are in the NEUTRAL position.

STEP 3

Stop the engine and raise the operator protection bars.

STEP 4

Check the condition of the battery according to the instructions in Section 4005.

STEP 5

Clean the battery posts and the connectors on the battery cables.

STEP 6

Make sure the connections in the charging circuit are tight. See the electrical schematic in Section 4003.

STEP 7

If the alternator still does not operate correctly, perform the following check.

Checking Voltage at the Alternator Terminal

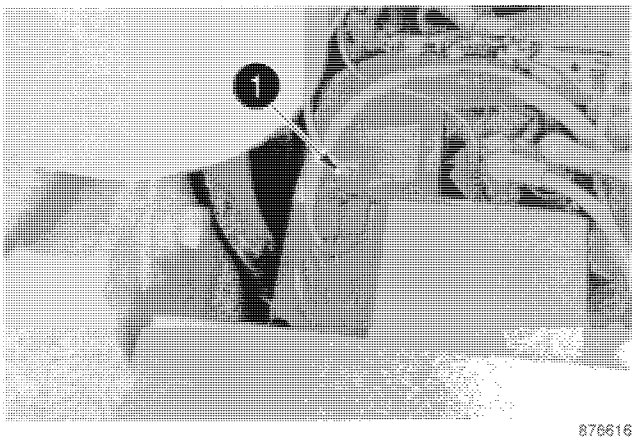
STEP 1

Do the General Inspection procedure above.

STEP 2

Turn the key switch to ON.

STEP 3



1. B+ TERMINAL

Disconnect the connector from the B+ terminal of the voltage regulator.

STEP 4

Connect the negative lead of a voltmeter to a good ground connection. Connect the positive lead of the voltmeter to the terminal in the connector on the wiring harness. The voltmeter must indicate system voltage.

1. If the voltmeter indicates system voltage, connect the connector to the B+ terminal of the voltage regulator and go to Test No. 1.
2. If the voltmeter does not indicate system voltage, there is a problem in the circuit between the connector and the fuse. See the Electrical Schematic in Section 4003 and correct the problem in the circuit. Connect the connector to the B+ terminal of the voltage regulator and repeat the test.

Test No. 1

STEP 1

Do the General Inspection procedure above.

STEP 2

Do Checking Voltage at the Alternator Terminal above.

STEP 3

The following test procedure is for the use of a Sun Electric VAT-33 tester. Other test equipment can be used. Connect the test equipment according to the instructions of the manufacturer of the equipment.

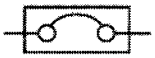
TABLE OF CONTENTS

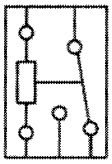
ELECTRICAL SYMBOLS

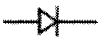
BATTERY, 12 VOLT 

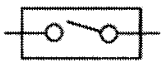
GROUND CONNECTION 

FUSE 

CIRCUIT BREAKER 

RELAY 

DIODE 

SWITCH 

LAMP 

AIR FILTER SWITCH 

HYDRAULIC TEMPERATURE SWITCH 

FUEL LEVEL SENDER 

WATER TEMPERATURE SWITCH 

HYDRAULIC FILTER RESTRICTION SWITCH 

ENGINE OIL PRESSURE SWITCH 

HI00L001

MAINTENANCE

Electrolyte Level

If the battery is a maintenance free battery, check the level of the electrolyte every 1000 hours of operation or six months, whichever occurs first. For all other batteries, check the level of the electrolyte every 250 hours of operation.

NOTE: *A maintenance free battery will have the words Maintenance Free on the decal on the top of the battery. If the center part of the decal has been removed for access to the battery caps, it is possible that the words Maintenance Free have been removed from the decal.*

Check the level of the electrolyte more often during hot weather. The use of a large amount of water by the battery can be caused by high battery temperature or a voltage regulator setting that is too high. Keep the electrolyte level above the top of the plates in the battery at all times to prevent damage to the battery.

NOTE: *On maintenance free batteries it is necessary to remove the center part of the decal for access to the battery caps. Do not discard the center part of the decal. Install the center part of the decal after the battery caps have been installed.*

If the level of the electrolyte is low, add distilled water or other clean water until the electrolyte is just below the cell opening. Do not add more water than is needed. Too much water can cause bad performance, a short service life, and corrosion around the battery.

NOTE: *Add water only. DO NOT add electrolyte.*

Inspecting and Cleaning a Battery

If damage causes an electrolyte leak, replace the battery.

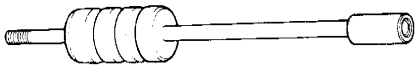
If the battery in your machine has nonspill caps, see Nonspill Caps on page 4005-4 and check the condition of the nonspill caps. See Specifications in Section 4002 to find if the battery in your machine must have nonspill caps.

Inspect the battery at regular intervals for dirt, corrosion, and damage. Electrolyte and dirt on the top of the battery can cause the battery to discharge by making a passage for the current to flow.

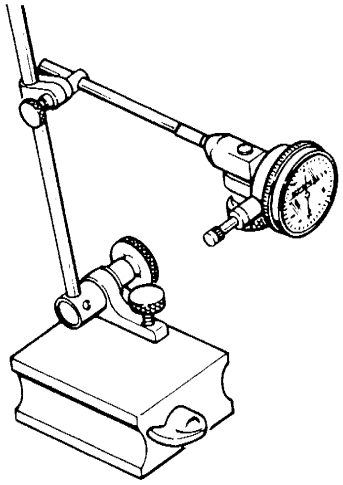
If the battery must be cleaned, remove the battery from the battery carrier and clean the battery, cable terminals, and the battery carrier. When available, use Case Battery Saver and cleaner according to the instructions on the container. Case Battery Saver and Cleaner also helps prevent corrosion. If Case Battery Saver and Cleaner is not available, use baking soda and water as a cleaner. DO NOT permit any type of cleaner to enter the cells of the battery.

Install the battery in the machine and make sure the fasteners are tight. Apply Case Battery Saver and Cleaner or Urethane Seal Coat to the cable terminals to prevent corrosion. See the Parts Counter Catalog. DO NOT apply grease.

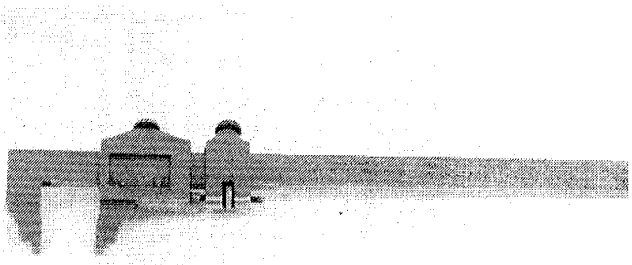
SPECIAL TOOLS



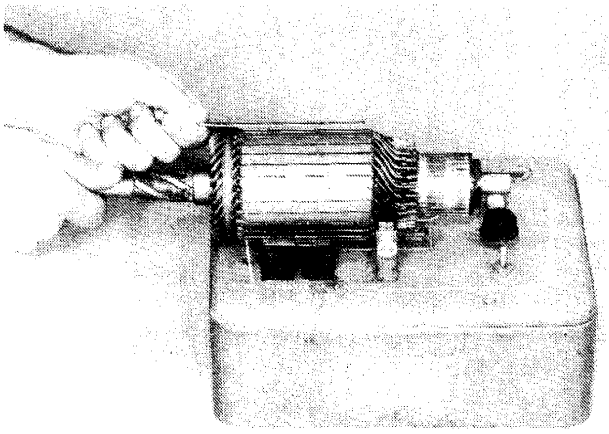
4. IMPULSE EXTRACTOR



5. DIAL GAUGE



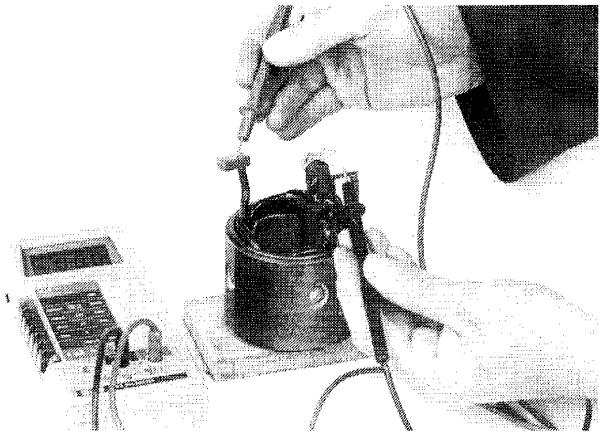
6. VERNIER (CAS-10525)



7. ARMATIGE TESTER
"GROWLER"

Testing The Field Coil

STEP 42

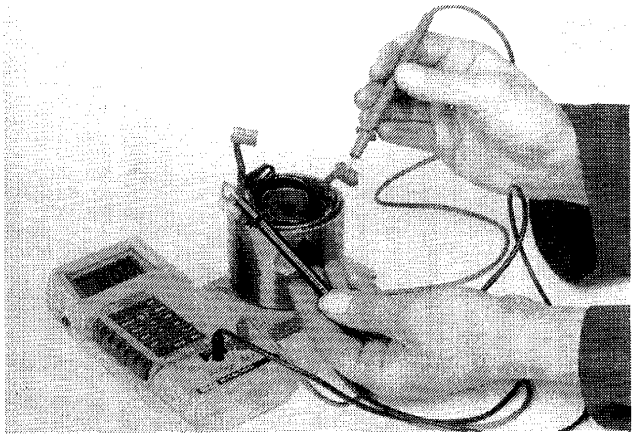


Select the 20 MΩ range on the multimeter. Connect the probes between the brushes. If there is no continuity, the field coil is open and must be replaced.

STEP 43

Select the 20 MΩ range on the multimeter. Connect one probe to the field coil and the other probe to the field frame. Replace the field frame if there is continuity.

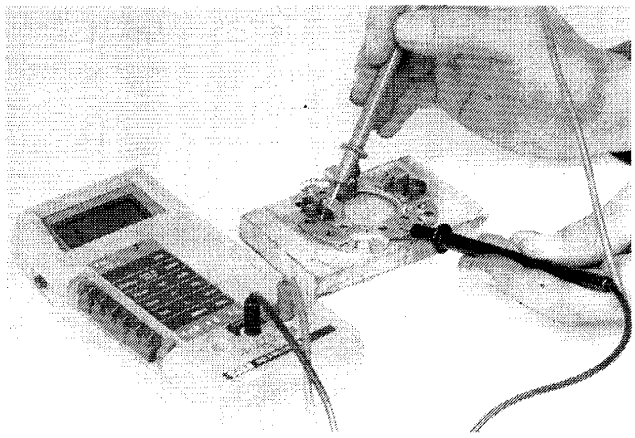
STEP 44



Select the 20 MΩ range on the multimeter. Connect one probe to the field coil and the other to the brush. If there is no continuity replace the field coil.

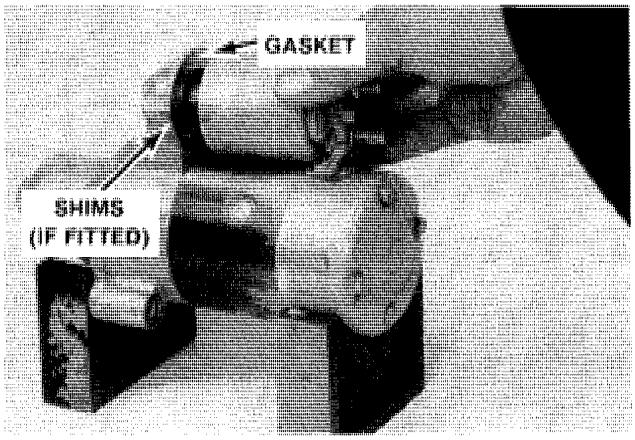
Testing The Brush Holder And Brushes

STEP 45



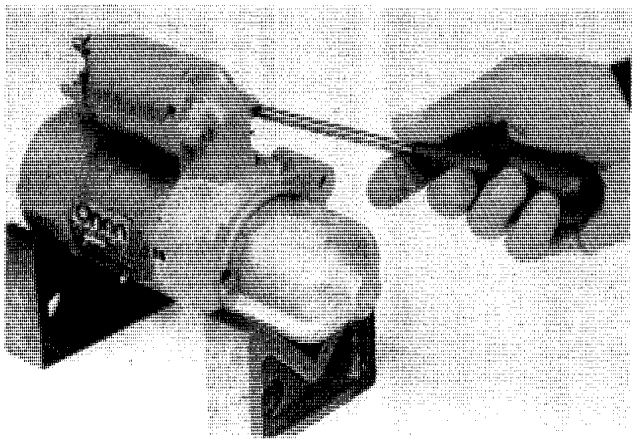
Select the 20 MΩ range on the multimeter. Connect one probe to the positive side of the brush holder and the other probe to the brush holder base. Replace the brush holder if there is continuity.

STEP 78



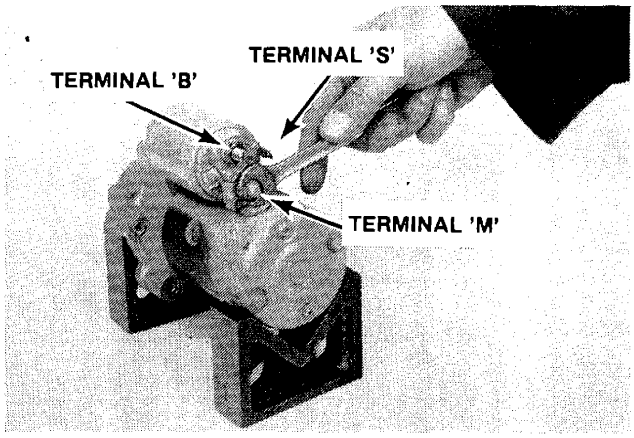
Install the solenoid, spring, gasket and shims (if fitted) as maked on removal.

STEP 79



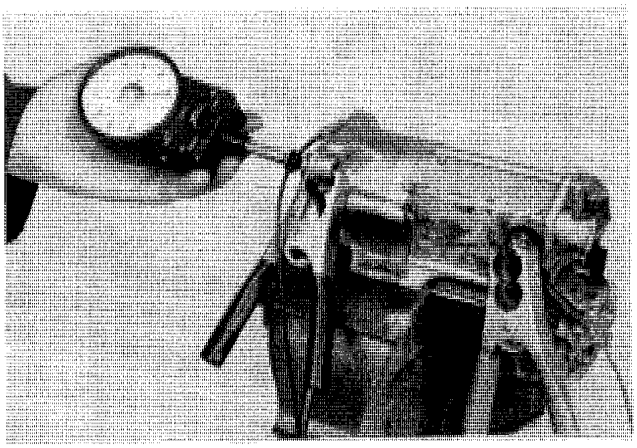
Install and tighten the solenoid screws to a torque of 54 lb in (6Nm).

STEP 80



Intall and tighten the 'M' terminal lead to the solenoid.

STEP 12



Use a mechanical revolution indicator Case Part No. CAS-10067 to measure the speed of the output shaft. Record the shaft speed.

STEP 13

Record the reading on the ammeter. Release the button on the remote start switch then turn the load control to the OFF position.

STEP 14

The starter motor is acceptable if it gives the following results during the No Load Test;

(i) ammeter reading . . . 180 amperes maximum
(ii) output shaft speed . . . . 3500 rpm minimum

If the results are not correct, check the following problems and causes.

1. Low Output Shaft Speed And A High Ammeter Reading.

   This problem is caused by one or more of the following faults;
   (a) Worn or damaged bearing(s)
   (b) A damaged armature shaft
   (c) Loose pole shoes touching the armature
   (d) A damaged armature winding
   (e) A damaged field coil

2. Output Shaft Does Not Rotate And A High Ammeter Reading.

   This problem is caused by one or more of the following faults;
   (a) A damaged motor terminal connection
   (b) A damaged field coil
   (c) Damaged bearings

3. Output Shaft Does Not Rotate And A Zero Ammeter Reading

   This problem is caused by one or more of the following faults;
   (a) An open circuit in the field coil
   (b) A damaged armature winding
   (c) Brush(es) not touching the commutator segments because of wear, weak springs or high mica insulation between the segments.

4. Low Output Shaft Speed And A Low Ammeter Reading.

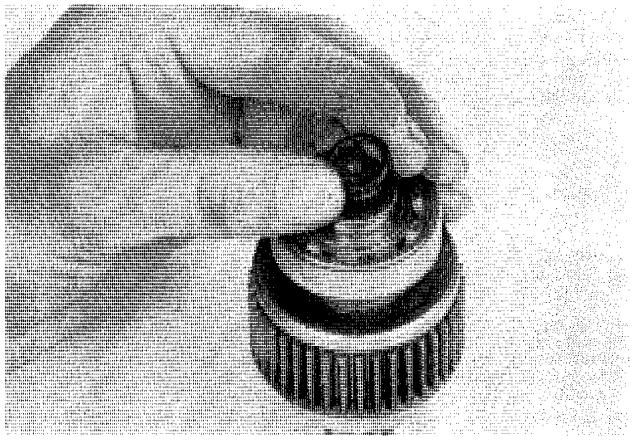
   This problem is caused by one or more of the following faults;
   (a) Dirt or corrosion on electrical connections
   (b) Damaged wiring
   (c) Dirt on commutator segments
   (d) Any fault in Problem No. 3

5. High Output Shaft Speed And A High Ammeter Reading.

   This problem is caused by a short circuit in the field circuit.

NOTE: *A short circuit in the field coil is difficult to find. Install a new field coil then repeat the No Load Test to check for an improvement in the operation of the start motor.*

STEP 63

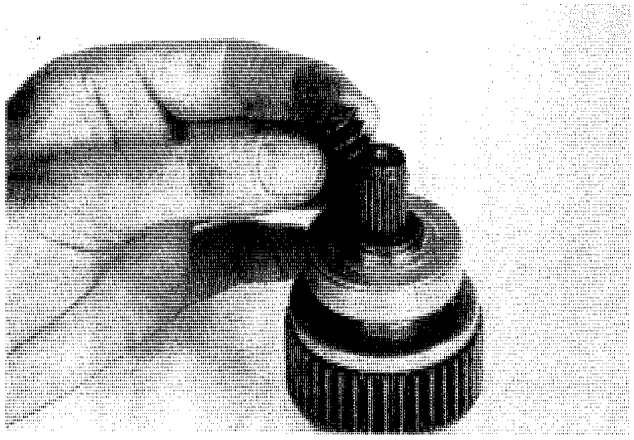


Install the spacer onto the pinion shaft.

STEP 64

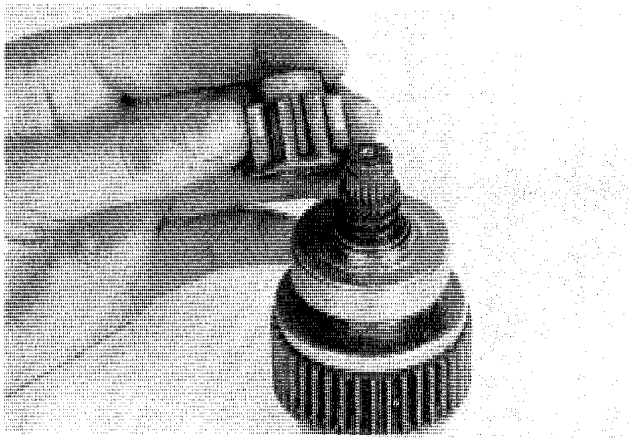
Fit the bearing plate onto the pinion shaft so that the flat end face is toward the bearing.

STEP 65



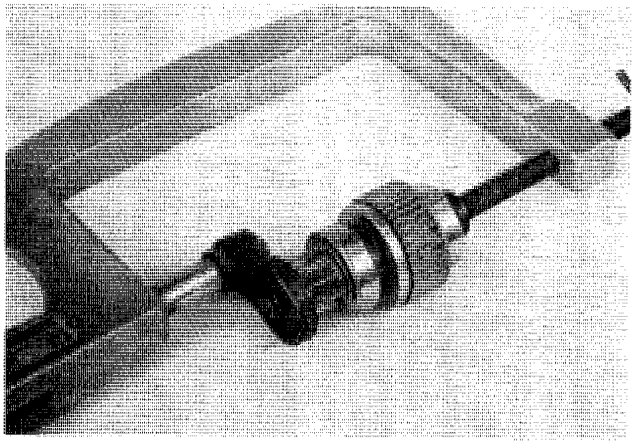
Install the small spring.

STEP 66



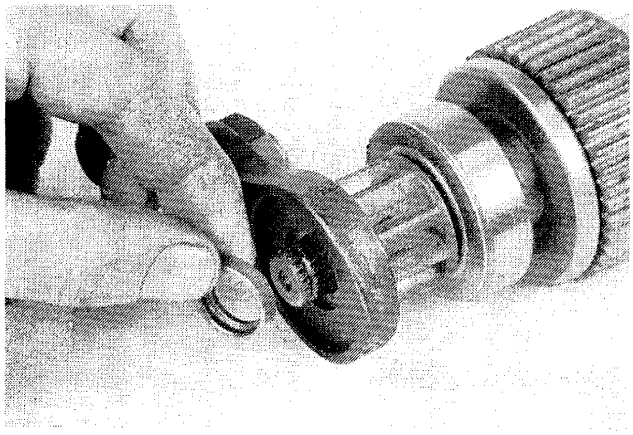
Install the drive gear.

STEP 67



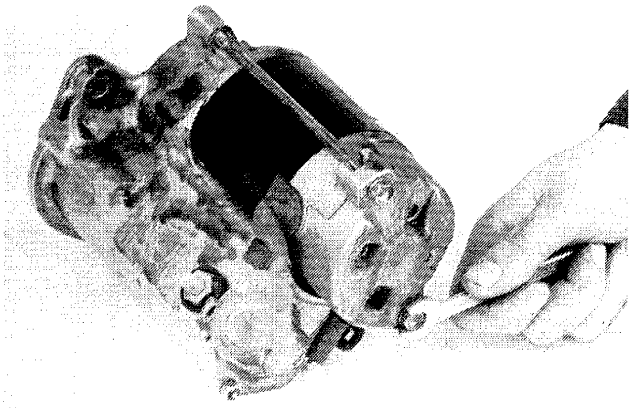
Use a valve spring compressor to hold the drive gear onto its seat.

STEP 68



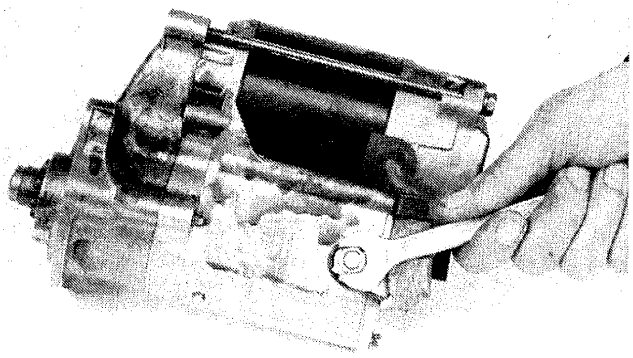
Fit the collar onto the shaft so that the larger inside diameter is away from the drive gear.

STEP 110



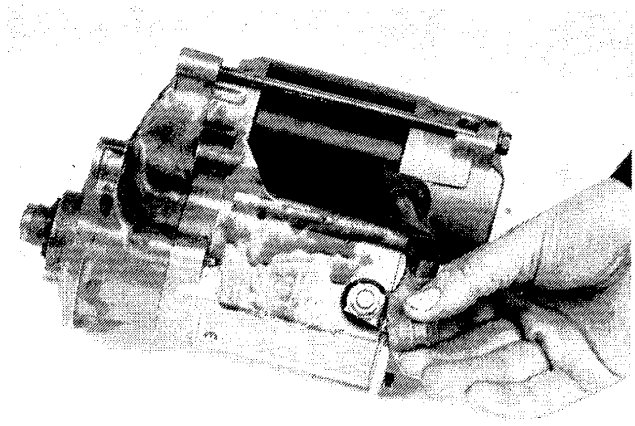
Install the two long retaining bolts and evenly tighten.

STEP 111



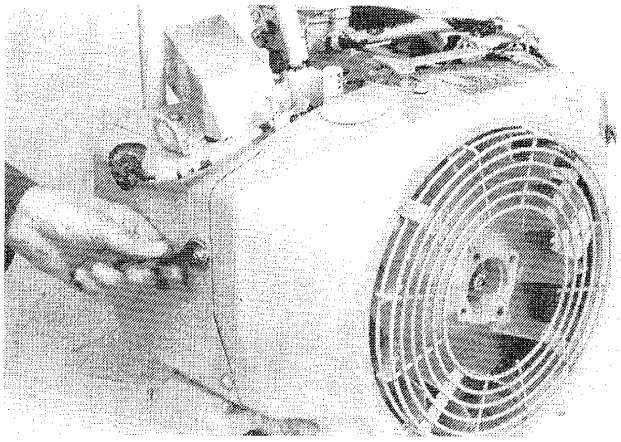
Fit the power lead onto the motor terminal then install and tighten the nut and lockwasher.

STEP 112



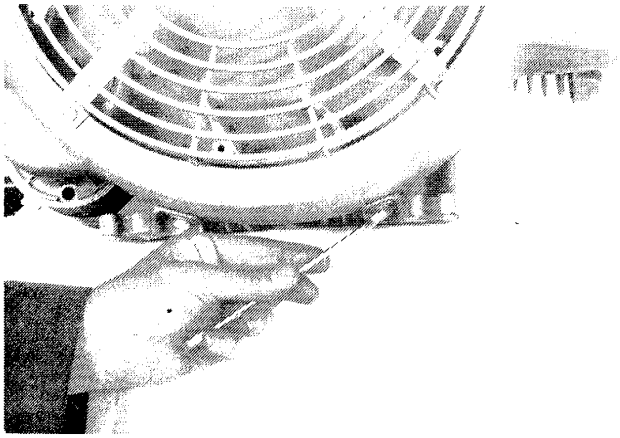
Fit the rubber boot over the motor terminal.

STEP 24



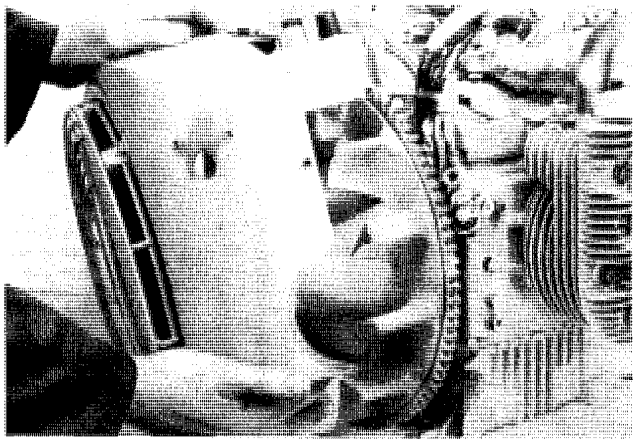
Remove the three setscrews from the top and left hand side of the flywheel guard.

STEP 25



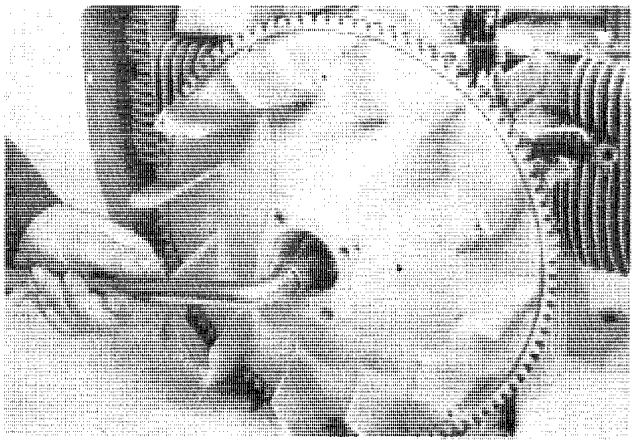
Remove the two setscrews and spring washers from the bottom of the flywheel guard.

STEP 26



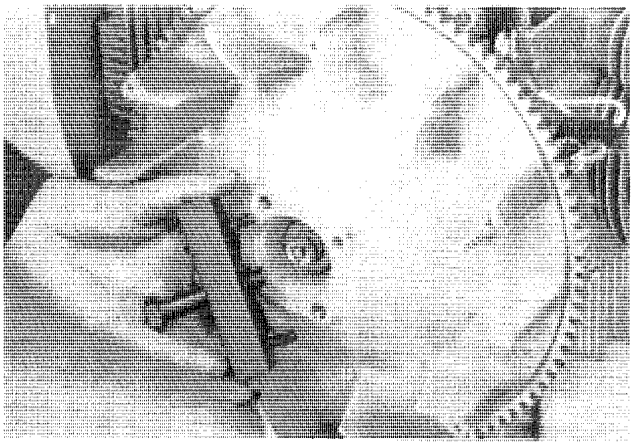
Remove the flywheel guard.

STEP 27



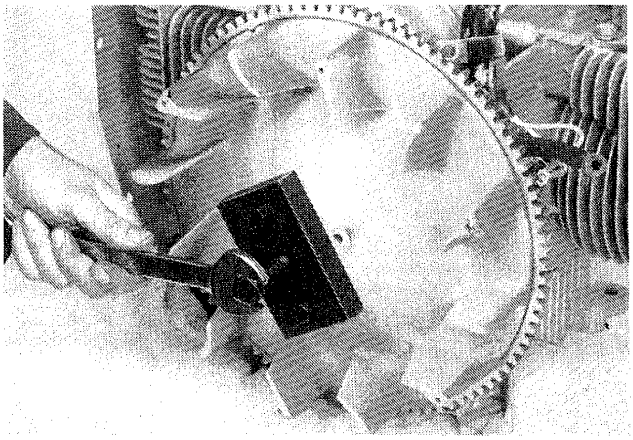
Turn the flywheel retaining bolt two revolutions counterclockwise.

STEP 28



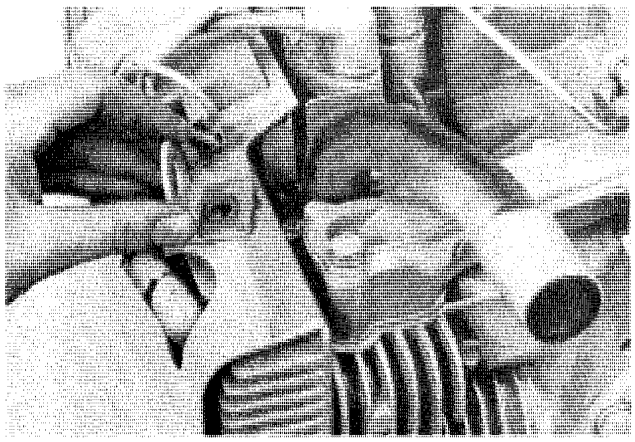
Use an acceptable puller to remove the flywheel.

STEP 29



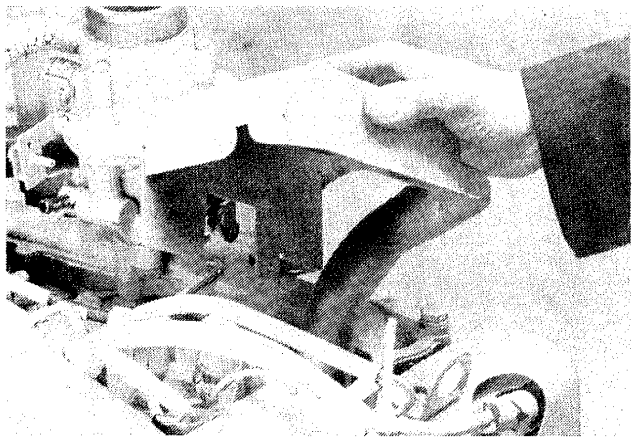
Install the puller. Tighten the center bolt to release the flywheel from the taper on the crankshaft.

STEP 68



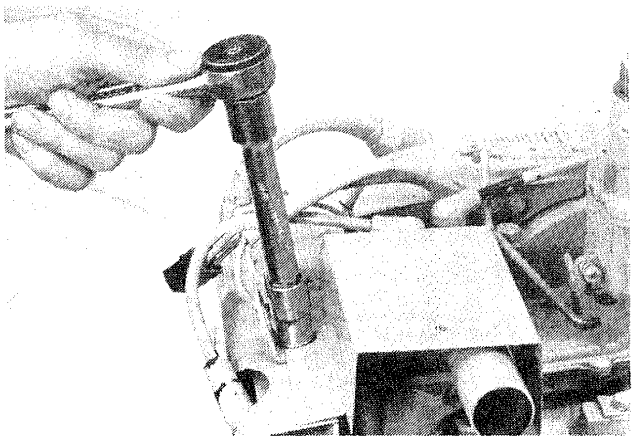
Put the lifting bracket into position.

STEP 69



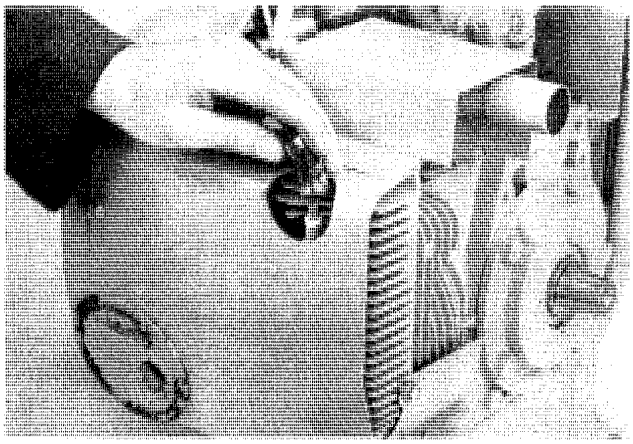
Install the exhaust manifold guard.

STEP 70



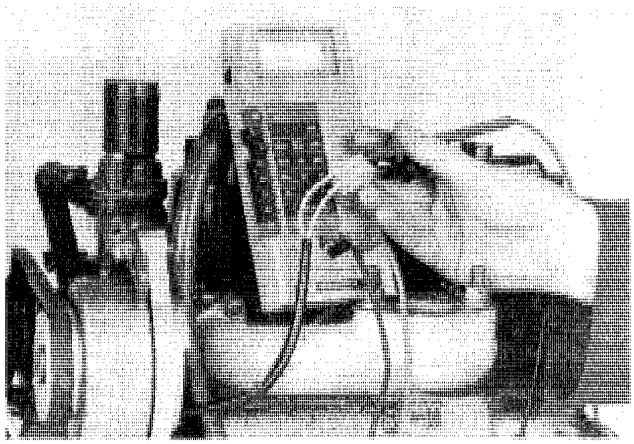
Install and tighten the setscrew.

STEP 71



Push the spark ignition lead onto the spark plug on the right hand side.

STEP 12



Connect the multimeter lead to the two alternator leads. Record the reading on the multimeter.

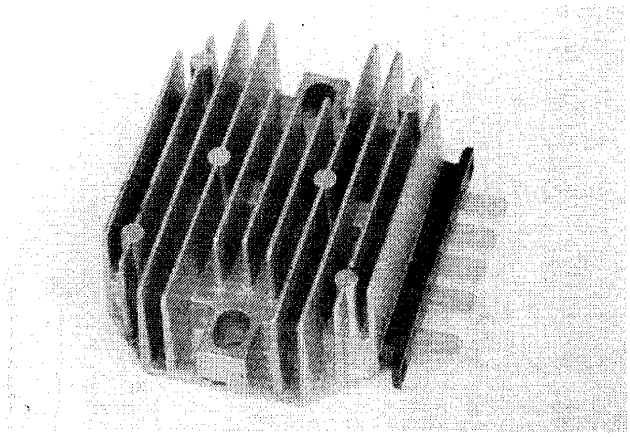
STEP 13

The reading in STEP 6 must be 14 to 15A. If the reading is not correct there is a fault in the regulator and/or the alternator.

The reading in STEP 11 must be 20V or more. If the reading is not correct there is a fault in the alternator.

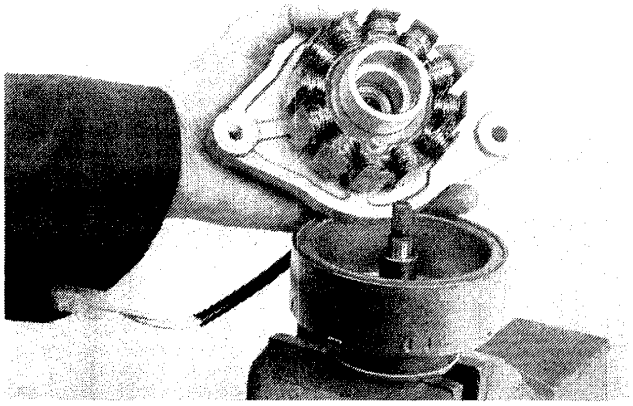
NOTE: *If the reading in STEP 11 is correct but the reading in STEP 6 is not correct, there is a fault in the regulator.*

STEP 14



The regulator is a sealed unit. If there is a fault, install a new regulator then repeat the troubleshooting procedure.

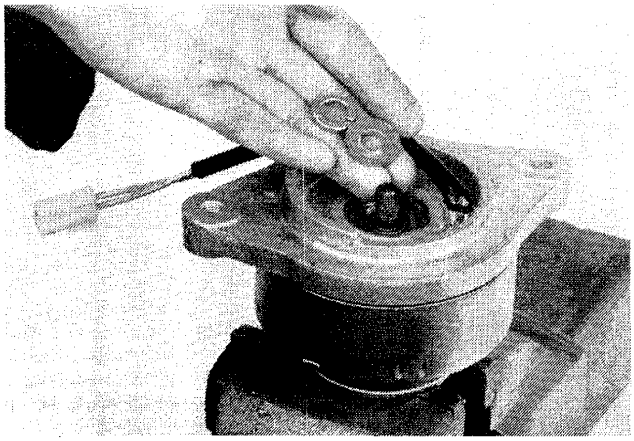
STEP 54



Fit the stator assembly into the rotor.

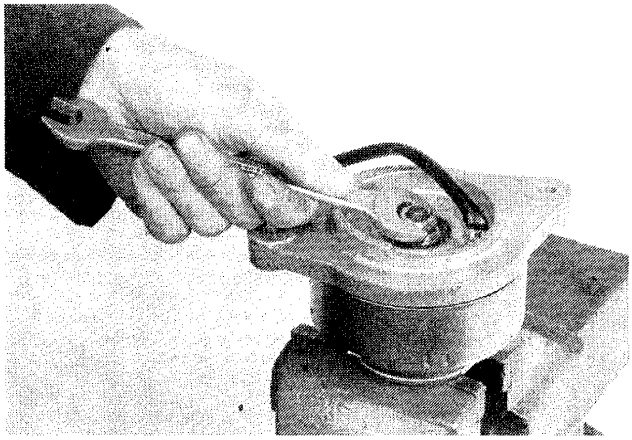
NOTE: *The rotor has strong magnets inside. The magnets will pull the stator into the rotor with force.*

STEP 55



Install the plain washer and then the spring washer.

STEP 56



Install the nut and tighten.

REMOVAL OF A MOTOR

STEP 71
Tilt the ROPS canopy forward according to instructions in this section.

STEP 72
Remove the dirt and grease from the motor to be removed and the area around the motor.

STEP 73
If equipped with an auxiliary control valve, remove the dirt and grease from the connections to the auxiliary control valve and the area around the auxiliary control valve.

STEP 74
Raise the wheels off the floor and use an acceptable support to hold the machine in place.

STEP 75
Loosen and remove the wheel nuts and remove the wheels.

STEP 76
Loosen and remove the nuts and lock washers that hold the cover for the motor sprocket.

STEP 77
Remove the cover.

STEP 78
If the gasket for the cover is damaged during removal of the cover, remove the gasket from the cover, and frame if necessary.

STEP 79
Loosen and remove the cap screw and flat washers that hold the sprocket on the shaft.

STEP 80
If equipped with an auxiliary control valve do steps 81 through 87.

STEP 81
Have available a container that will hold at least six U.S. gallons (23 litres) and drain the oil from the reservoir.

STEP 82
Disconnect the top, front and rear hoses from the auxiliary control valve.

STEP 83
Install a plug in each hose and a cap on each fitting.

STEP 84
Disconnect the hose from the power beyond outlet in the auxiliary control valve.

STEP 85
Install a plug in the hose.

STEP 86
Loosen and remove the elbow from the power beyond fitting.

STEP 87
Install a plug in the power beyond fitting.

STEP 88
Disconnect the hoses from the pump.

STEP 89
Install a plug in each hose and a cap on each fitting.

STEP 90
Disconnect the tee from the case drain port if the left motor is being removed or disconnect the hose from the case drain port if the right motor is being removed.

STEP 91
Install a plug in the tee or hose and a cap on the fitting.

STEP 92
Loosen and remove the nuts and lock washers from the bolts that hold the motor.

STEP 93
Remove the bolts.

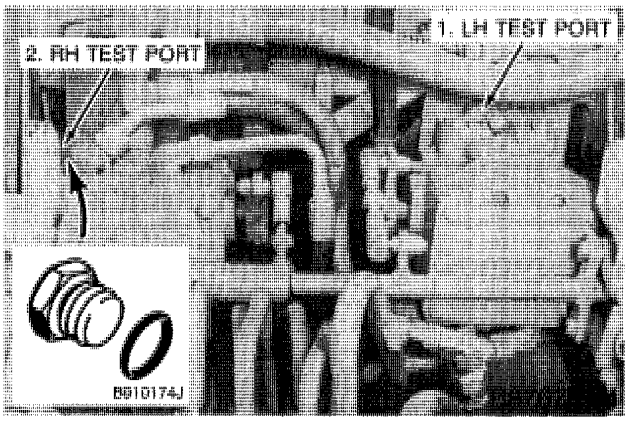
STEP 94
Disengage the motor from the frame and remove the motor and hoses.

CHECKING CHARGE PRESSURE

1. Run the engine at low idle. Raise the parking latch levers and slowly move the direction control levers into FORWARD until the pins for the parking latch engage each drive sprocket. With the pins engaged, the machine will not move.

2. Stop the engine and remove the seat.

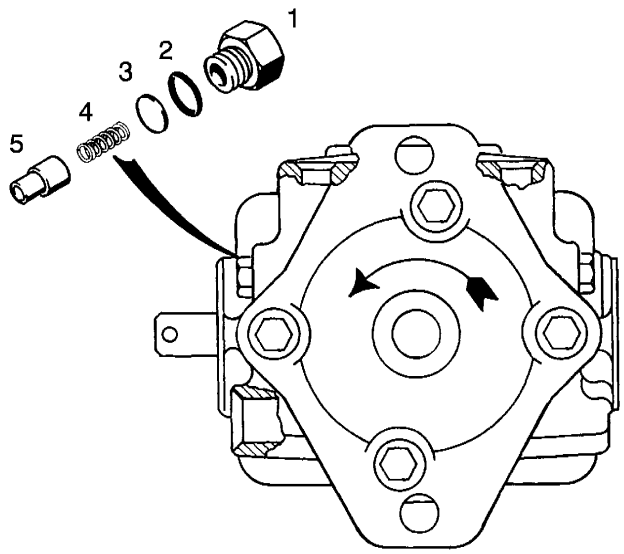
3. Connect a 400 psi (2758 kPa, 28 bar) pressure gauge to the piston pump as shown below. The threads in the LH piston pump are 1/8 inch pipe thread. The threads in the RH piston pump are 1/2-20 straight thread O-ring.



4. Make sure the gauges and hoses are out of the way. Operate the loader to heat the oil to operating temperature.

5. Increase the engine speed to full throttle. Keep the direction control levers in NEUTRAL. The pressure must be 150 psi (1034 kPa, 10.3 bar) minimum. Record the pressure.

6. Stop the engine. If the charge pressure is correct, go to step 8. If the charge pressure is less than specified, remove and inspect the plug, shims, spring, and poppet of the charge relief valve.



1. Plug
2. O-ring
3. Shim(s)
4. Spring. Free length 1.051 inch (26.7 mm) compressed length 0.707 inch at 4.3 to 5.2 pounds (17.96 mm at 2 to 2.4 kg)
5. Poppet

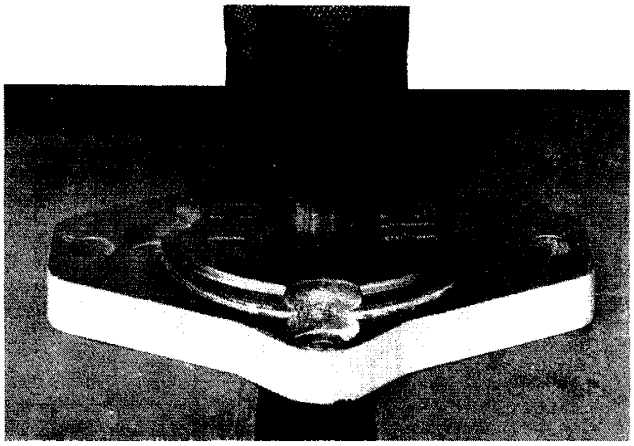
7. If the parts are good, install shims to increase the charge pressure. If you still cannot get the correct pressure, disassemble and inspect the charge pump and piston pump.

8. After you get the correct charge pressure in NEUTRAL, do the following steps:

9. Start and run the engine at full throttle. Slowly move the direction control levers forward to load the piston pumps without decreasing the engine speed. Read the pressure gauge again. The pressure must be within 50 psi (345 kPa, 3.4 bar) of the pressure in step 5.

10. Stop the engine. If the charge pressure is less than specified, there is excessive leakage in the hydrostatic system. Disassemble and inspect components in the following sequence: charge pump, piston pump, drive motor.

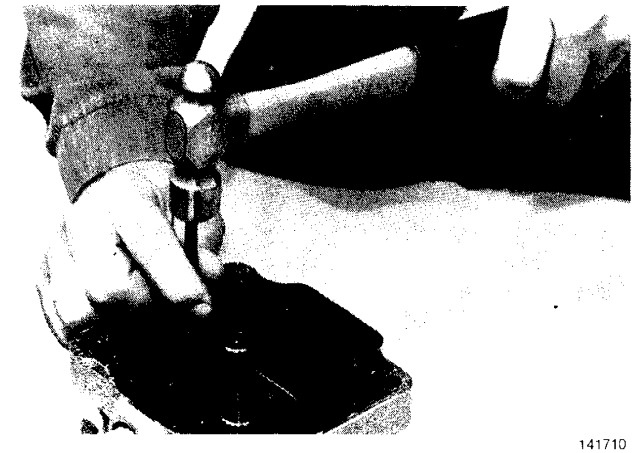
STEP 40



142028

Use an acceptable driver and press the needle bearing out of the drive end cover.

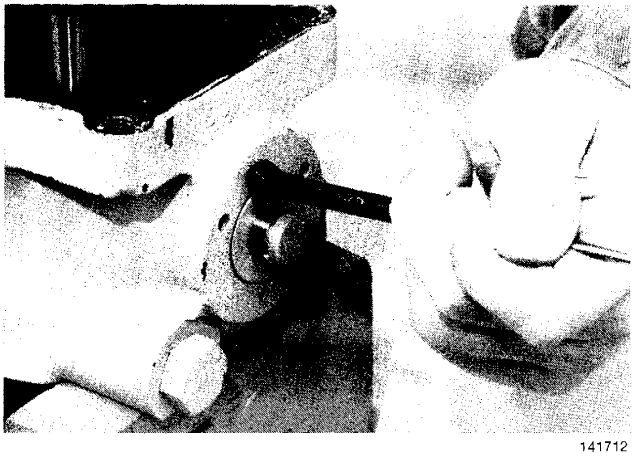
STEP 41



141710

Put the housing on blocks and drive out of the swash plate the two roll pins that hold each trunnion.

STEP 42



141712

Remove the trunnions as shown.

STEP 43

141807

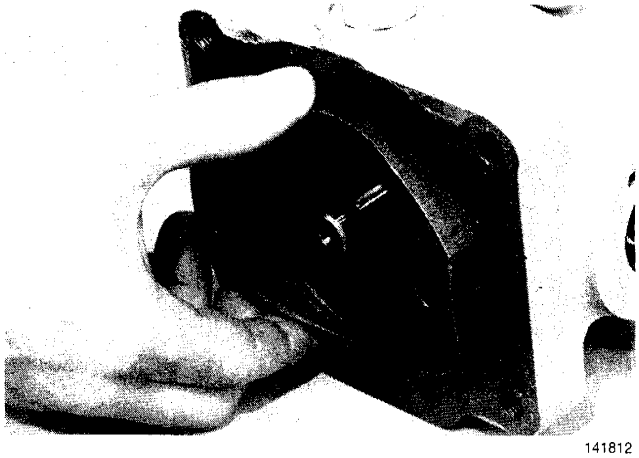
Remove the flat washers.

STEP 44

141810

Remove the seals.

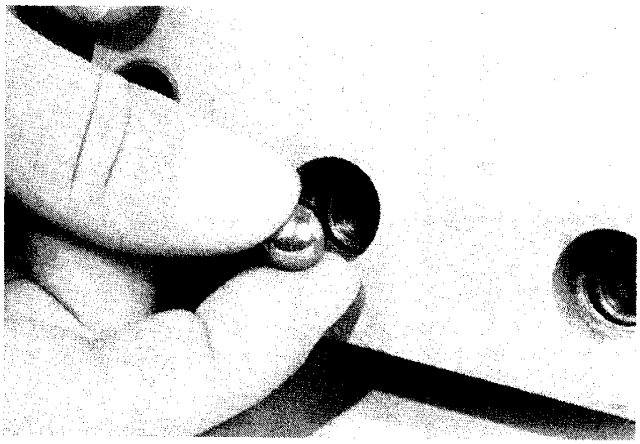
STEP 45



141812

Remove the swash plate and the four roll pins.

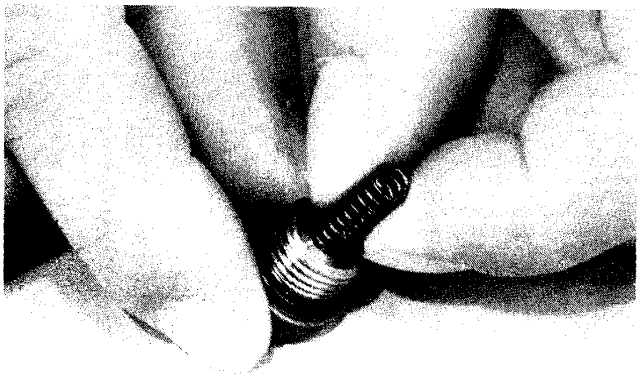
STEP 88



142330

Install the steel balls in the port end cover for the piston pump for gasoline engines.

STEP 89



142327

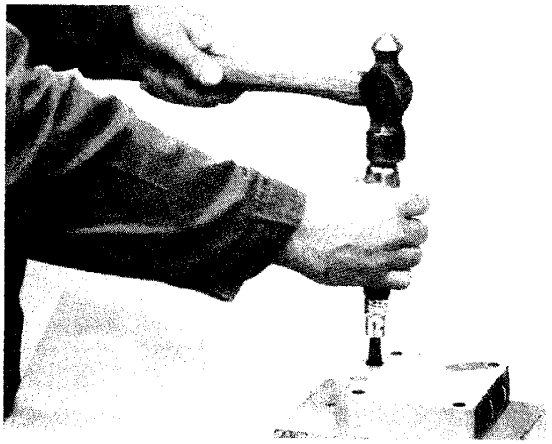
Install a spring in each plug.

STEP 90

142331

Install the plugs.

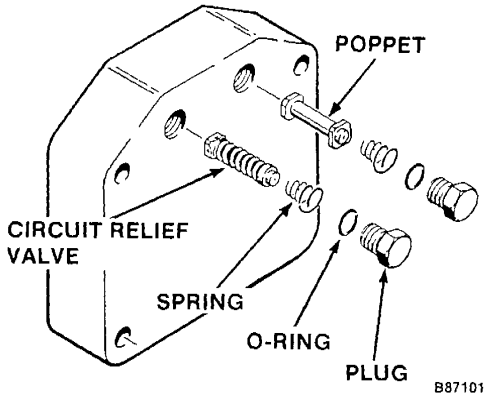
STEP 91



141605R

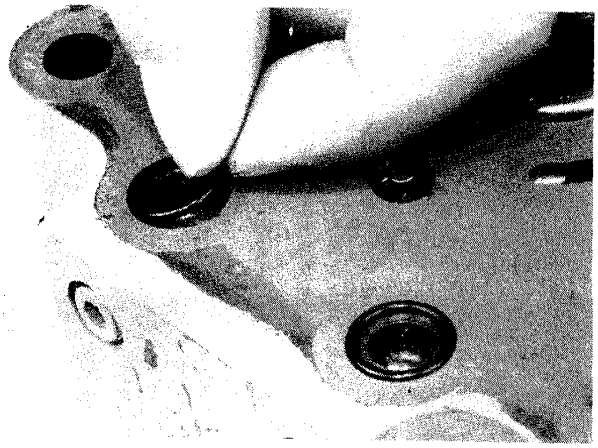
Put the port end cover on blocks and tighten the plugs.

STEP 92



Fasten the port end cover for the piston pump for the diesel engine in a vise that has soft jaws and install the circuit relief valve, poppet, springs and plugs. Tighten the plugs.

STEP 93



142336

Install new O-rings in the grooves in the port end cover.

6007

SPROCKETS, CHAINS AND AXLE HOUSINGS

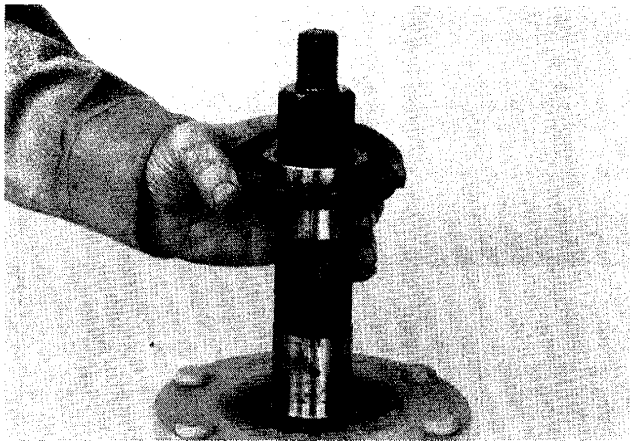
TABLE OF CONTENTS

CASE CORPORATION

8-68290

Printed in U.S.A.
Issued July 1987

STEP 81



876755

Remove the seal and outer spacer.

Inspection

STEP 82

Clean the bearings in cleaning solvent and remove all grease from the bearings.

STEP 83

Remove the grease from the bore of the axle housing.

STEP 84

Inspect the rollers of the bearings for flat areas, pitting, scoring and other damage. If any of these faults are present, install a new bearing.

STEP 85

Inspect the bearing cups for flat areas, pitting, scoring and other damage. If any of these faults are present, install a new bearing cup.

NOTE: *If a bearing or bearing cup is replaced, both parts must be replaced at the same time.*

STEP 86

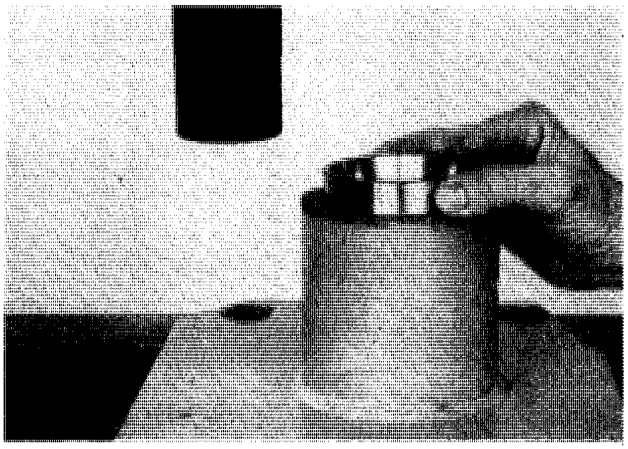
Check the splines on the axle and in the axle sprocket for wear and damage.

STEP 87

Check the spacers for wear (groove) where the seal touches the spacer. If there is too much wear on the outer spacer, a new outer spacer must be installed. If there is too much wear on the inner spacer and there is only one wear line, the inner spacer can be installed with the wear line toward the axle sprocket.

Assembly

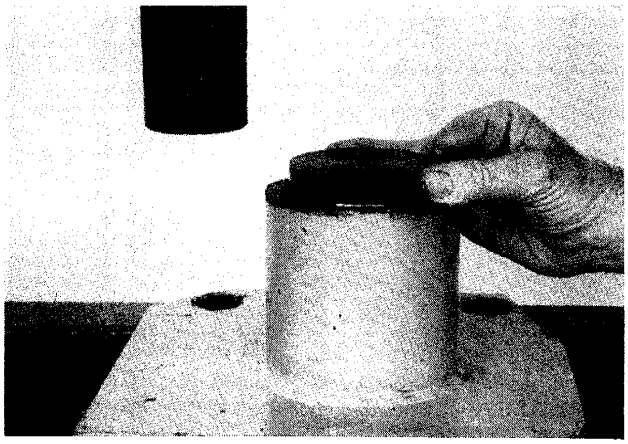
STEP 88



876760

Start a bearing cup into the axle housing.

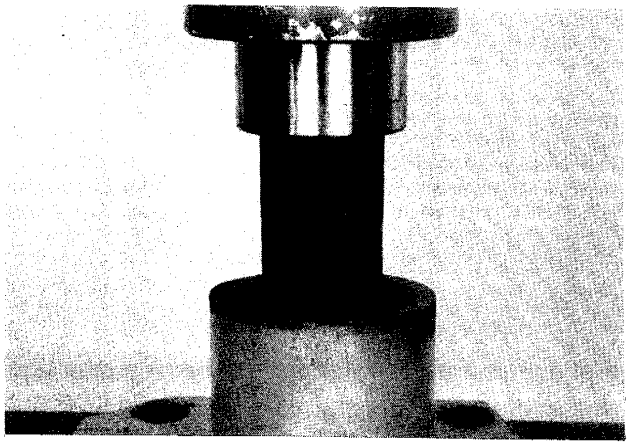
STEP 89



876759

Install an acceptable driver.

STEP 90



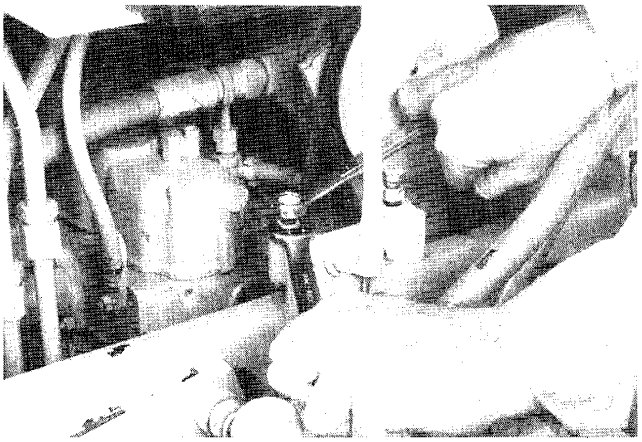
876758

Press the bearing cup all the way into the axle housing.

STEP 91

Use the same method to install the other bearing cup.

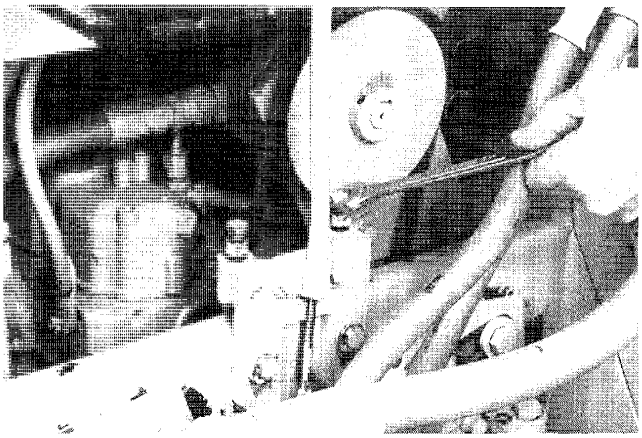
STEP 8



876800

Loosen the lock nut on each adjusting screw.

STEP 9



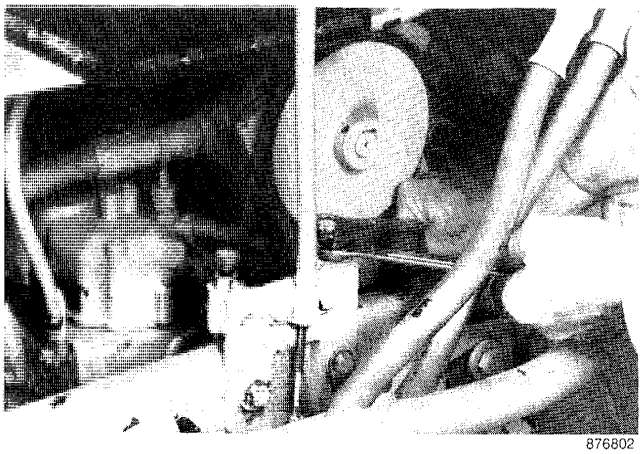
876801

Turn the adjusting screws into the cable support several turns. Turn the adjusting screws in equal amount to keep the support level.

STEP 10

Check the deflection of the drive belts.

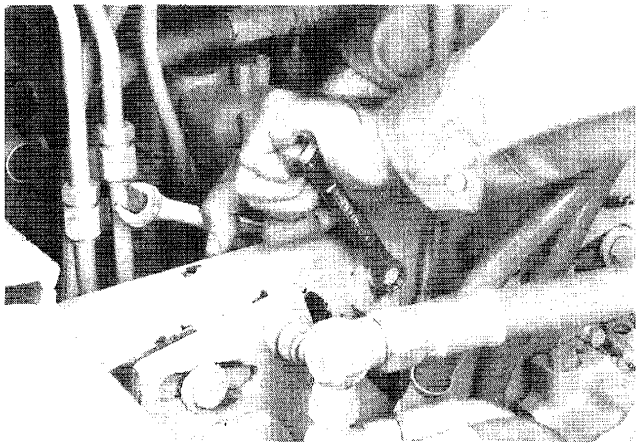
STEP 11



876802

When the deflection is correct, tighten the lock nuts on the adjusting screws.

STEP 12



876799

Tighten the nuts on the bolts

STEP 13

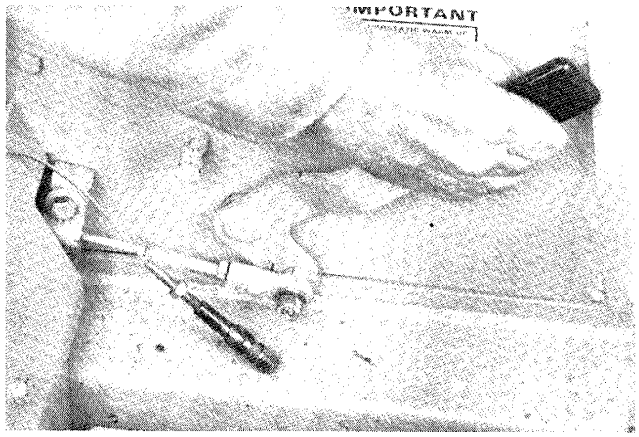
Fasten the ROPS canopy in the normal position according to instructions in Section 6000.

Major Adjustment

STEP 14

Tilt the ROPS canopy forward according to instructions in Section 6000.

STEP 15



876791

Move the clutch lever to OFF.

LOADER CONTROL VALVE

Removal

STEP 1
See Tilting the ROPS Canopy Forward in Section 9003 and do steps 1 through 10.

STEP 2
Remove the cap from the hydraulic reservoir.

STEP 3
Drain the oil from the hydraulic reservoir. The hydraulic reservoir holds approximately 22 U.S. quarts (20.8 litres) of oil.

STEP 4
Clean the loader control valve and the area around the loader control valve.

STEP 5
Disconnect the tubes from the loader control valve.

STEP 6
Install a plug in each tube and a cap on each fitting.

STEP 7
If the machine is equipped with auxiliary hydraulics, disconnect the hose from the loader control valve.

STEP 8
Install a plug in the hose and a cap on the fitting.

STEP 9
Disconnect the linkage from the spools in the loader control valve.

STEP 10
Loosen and remove the self-locking nuts, flat washers, and bolts that fasten the loader control valve to the mounting plate.

STEP 11
Remove the loader control valve.

Installation

STEP 1
Remove the plugs from the tubes and the caps from the fittings.

STEP 2
Put the loader control valve on the mounting plate. Install the bolts, flat washers, and self-locking nuts that fasten the loader control valve. Tighten the self-locking nuts.

STEP 3
Connect the tubes to the fittings in the loader control valve.

STEP 4
If the machine is equipped with auxiliary hydraulics, remove the plug from the hose and the cap from the fitting. Connect the hose to the loader control valve.

STEP 5
Connect the linkage to the spools.

STEP 6
Make sure the drain plug is tight. Fill the hydraulic reservoir with oil. See Section 8001 for the correct oil.

STEP 7
Install the cap on the hydraulic reservoir.

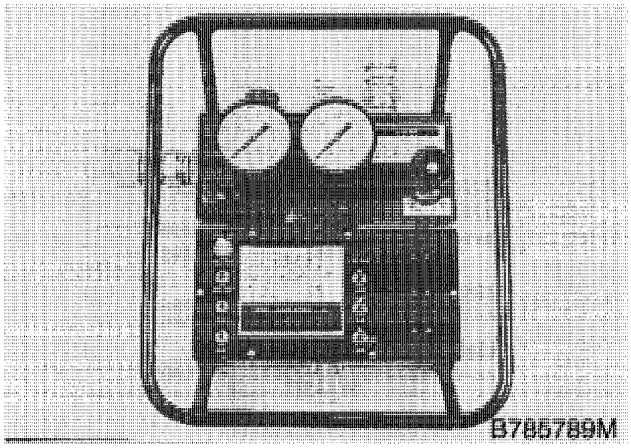
STEP 8
See Fastening the ROPS Canopy in the Operating Position in Section 9003 and do steps 1 through 6.

STEP 9
Start and run the engine at idle. Operate the loader control levers to completely extend and retract the lift and bucket cylinders to remove any air from the hydraulic system.

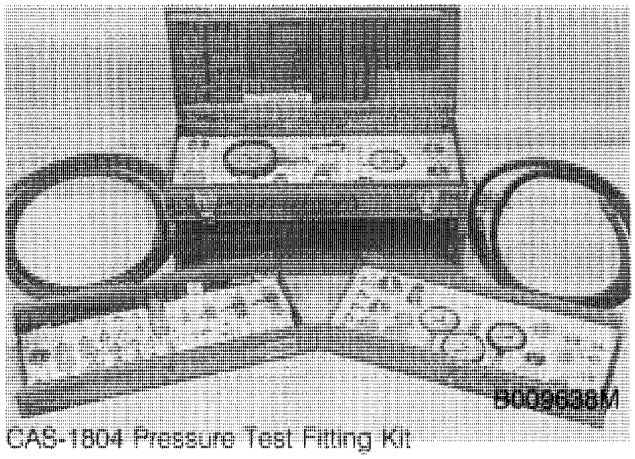
STEP 10
Lower the loader bucket to the floor. Stop the engine.

STEP 11
Check for oil leakage. Check the level of the oil in the hydraulic reservoir and add oil as necessary.

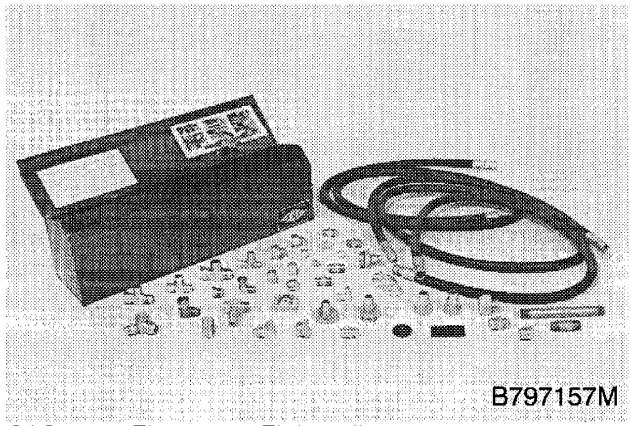
SPECIAL TOOLS



CAS-10280 or OEM-1239 Flowmeter

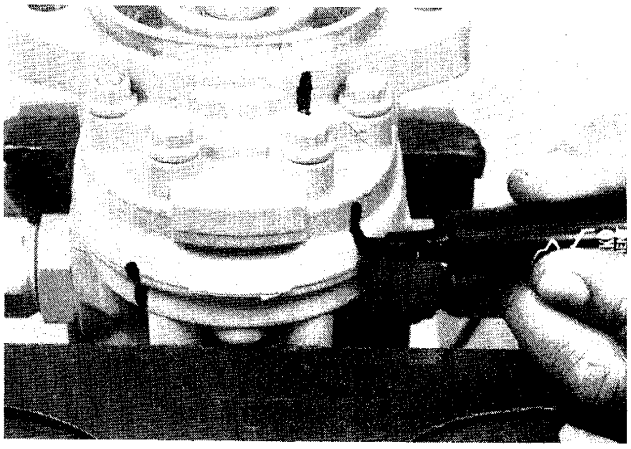


CAS-1804 Pressure Test Fitting Kit



CAS-1808 Flowmeter Fitting Kit

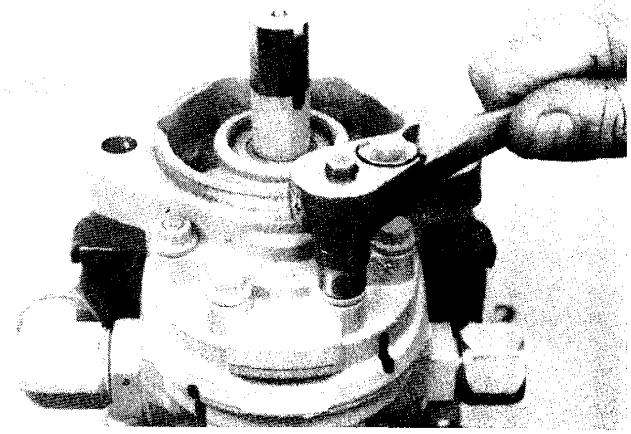
STEP 7



704313

Make marks on drive end cover, gear housing, and port end cover to help in assembly.

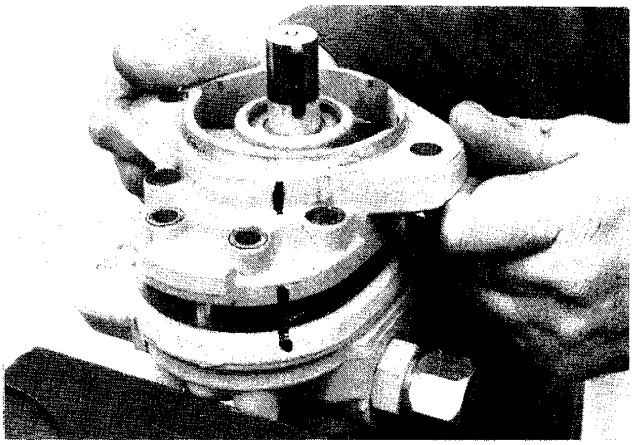
STEP 8



704318

Loosen and remove the ferry head screws.

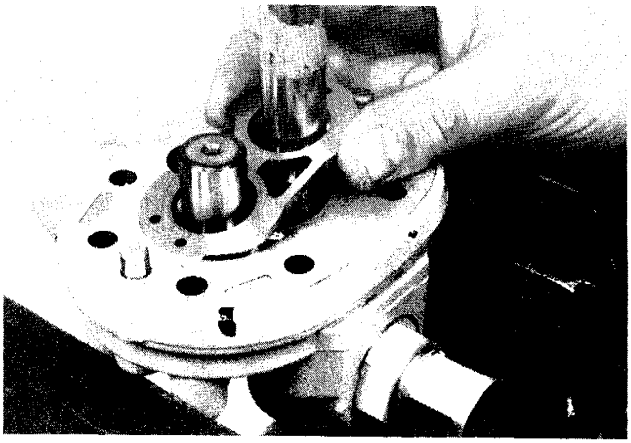
STEP 9



704322

Remove the drive end cover.

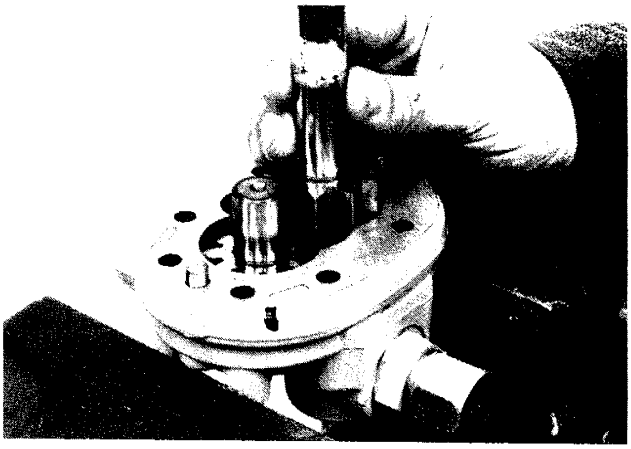
STEP 10



704324

Remove the wear plate.

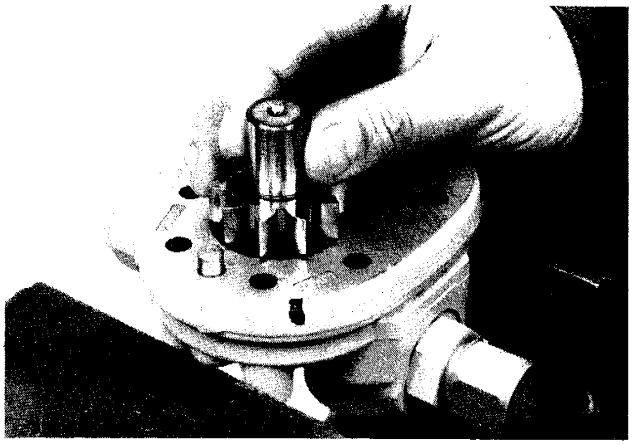
STEP 11



704327

Remove the drive gear.

STEP 12



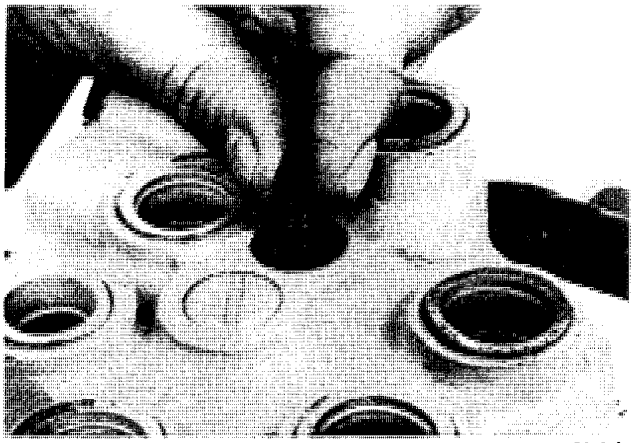
704328

Remove the driven gear.

SPECIFICATIONS

Pressure setting of main relief valve	See Section 8002
Spool travel	
Bucket spool, neutral to pressure	.25 inch (6.4 mm) in and out
Lift spool, neutral to pressure	.31 inch (7.9 mm) in and out
Lift spool, neutral to float	.44 inch (11.2 mm)
Spool in	Pressure at A port
Spool out	Pressure at B port
Port threads	
All ports	7/8 inch-14 straight thread, O-ring
Special torques	
Detent stud	5 to 8 pound-feet (7 to 10 Nm)
Allen screws for detent housing	10 to 13 pound-feet (13 to 17 Nm)
Mounting bolts for loader control valve	10 to 12 pound-feet (14 to 16 Nm)
Centering springs	Compressed length of .930 inch at 21 to 25 pounds (23.6 mm at 9.5 to 11.3 kg)

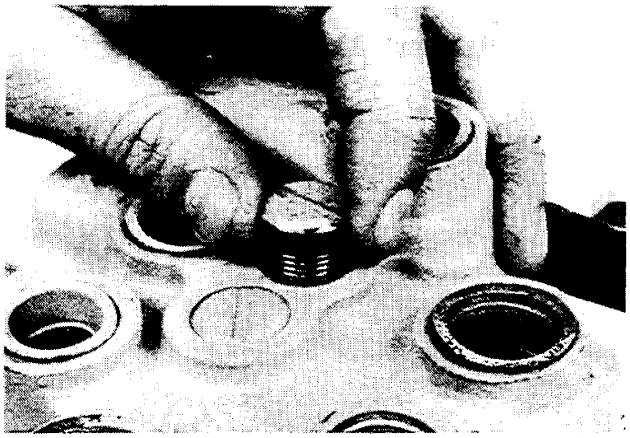
STEP 42



704913

Install the spring in the poppet.

STEP 43



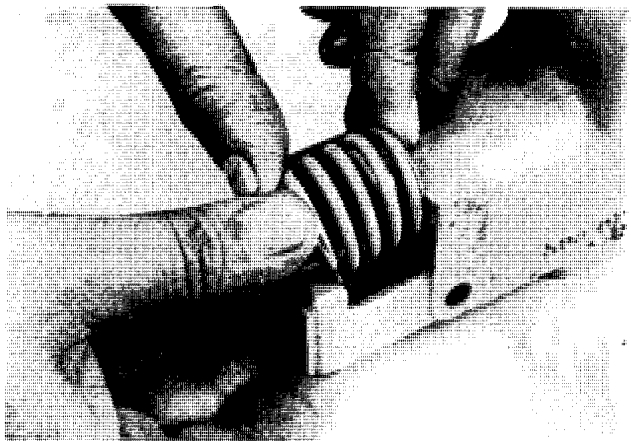
704911

Install the plug.

STEP 44

Repeat steps 40 through 43 to install the other load check valve.

STEP 11



704523

Install the spring seats and centering spring.

STEP 12

704526

Install the washer.

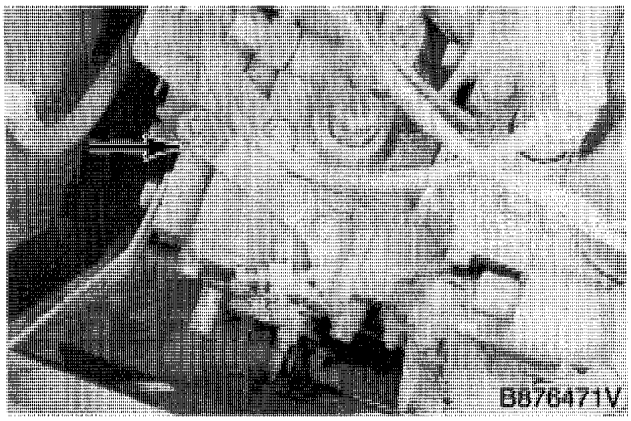
STEP 13

704519

Use the vise to push in the spool to compress the centering spring. Fasten the auxiliary control valve in the vise to keep the centering spring compressed. Install the retaining ring.

Diesel Engine

STEP 6

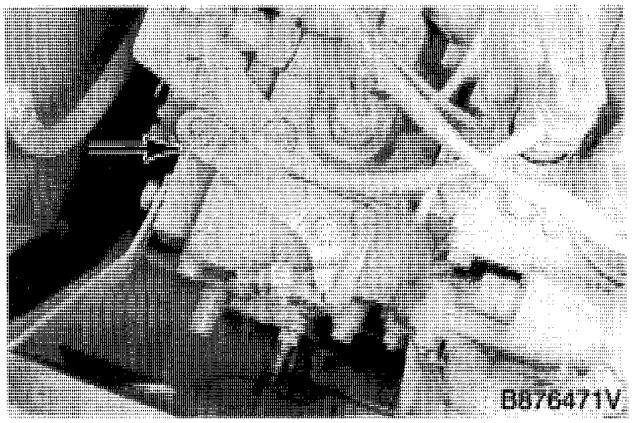


Disconnect the throttle cable from the arm on the fuel injection pump.

STEP 7

Use a tachometer to check the engine speeds. Hold the arm on the fuel injection pump in low idle position and in full throttle position. Compare the engine speeds with the specifications on page 2. If the engine speeds are not correct, adjust the low idle and full throttle stops on the fuel injection pump.

STEP 8



Put the throttle lever in LOW idle. Install the throttle cable in the wire lock on the arm of the fuel injection pump. Hold the arm against the low idle stop and tighten the wire lock.

STEP 9

Put the throttle lever in FULL throttle. The arm on the fuel injection pump must be against the full throttle stop.

ALL BUCKETS

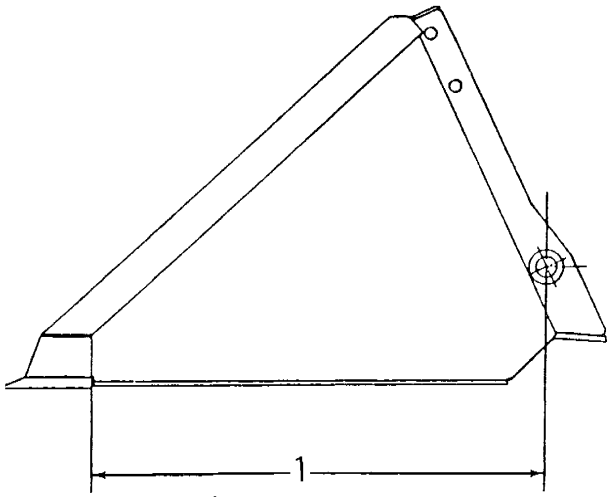
Replacement of Cutting Edge

STEP 1
If the bucket is not removed, put the bucket at an acceptable height and put supports under the bucket to hold the bucket in place.

STEP 2
If the bucket is not removed, disconnect the wiring from the alternator.

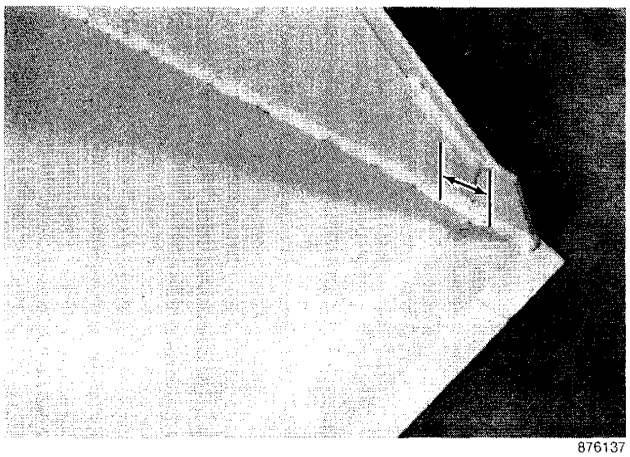
STEP 3
Use carbon arc rod or an acetylene cutting torch to remove the cutting edge. Keep distortion to a minimum amount when removing the cutting edge.

STEP 4
When removing the weld at the rear of the cutting edge, cut off the cutting edge according to the dimension shown in the illustration.



1. *Part No. D138898 and D138921 ..... 20-3/4 Inches (527.5 mm)*

STEP 5



Cut through each corner of the bucket in the area shown.

STEP 6
Use a grinder to remove any welds or extra metal on the bucket that will prevent the new cutting edge from fitting correctly.

STEP 7
Put the new cutting edge in place and use C-clamps to hold the cutting edge in place. See the illustration for step 4 for the correct dimension to the rear of the cutting edge.

STEP 8
See the next page for weld specifications. Use E7018 welding rod.

STEP 9
When welding the top of the bucket floor to the rear of the cutting edge:

1. Start at one end of the bucket and weld toward the center until one welding rod is used.

2. Start at the center of the bucket and weld in both directions from center until one welding rod is used.

3. Start at the end of the bucket and weld toward the center until one welding rod is used.

4. Continue to weld the cutting edge to the bucket using this method until the cutting edge is completely welded.

STEP 10
Connect the wiring to the alternator.