SERVICE INFORMATION

FOR

HARLEY-DAVIDSON SPRINT MODEL "R"

FITTING SPECIFICATIONS FOR 1961 SPRINT MODEL CR ENGINE

(Note all dimensions shown are in inches)

ENGINE:

Bore - 2.598"
Stroke - 2.835"
Compression Ratio - 9.5 to 1
Displacement - 15.208 cu. in. (246.3 cu. cm.)

VALVES	
Fit in guide (Exhaust)	.001
Fit in guide (Intake)	.001
VALVE SPRINGS	
OUTER	55 pounds at 1.417"
	105 pounds at 1.102"
INNER	27 pounds at 1.219"
	48 pounds at .964"
ROCKER ARM	
Shaft fit in bushings	.0005 to .0015
End play (Just free)	
PISTON	
Fit in cylinder	.0045
Compression ring end clearance (both)	.010 to .016
Compression ring side clearance (both)	.001 to .002
Oil control ring end clearance	.010 to .016
Oil control ring side clearance	.001 to .002
Piston pin fit in piston	light press @ 70° F.
Piston pin fit in connecting rod	.0006 to .0012 loose
CONNECTING ROD	
Endplay between flywheels	.004 to .008
Fit on crankpin bearing	.0005 to .001
OIL PUMP PRESSURE	
Minimum	3 lbs./sq. in. at 25 M.P.H.
TAPPETS	
Tappet clearance in guide	.0002 to .0005
Tappet clearance (valve lash) check when engine is hot.	Intake - .004
	Exhaust - .006
GEARCASE	
Cam shaft in crankcase bushing	.0005 to .0015
Cam shaft end play	.001 to .004
(Select spacer washers as required)	
FLYWHEEL ASSEMBLY	
Runout mainshafts	.001 maximum
FLYWHEEL MAINSHAFT (PINION SIDE)	
Shaft fit in cam shaft support plate bushing	.0005 to .002

IGNITION

Breaker point gap setting	.018
Spark plug gap setting	.020 to .025
Spark to occur at 40^{o} to 41^{o} (13/32 in.) BTC	

TRANSMISSION:

CLUTCH

Type	Wet - Multiple disc
Spring: Free length	1.79 in.
Setup	59 lbs. at 1.20 in.

PRIMARY DRIVE

Type:	Gear Driven

STARTER

Starter crank must engage and release properly.

GEAR BOX

Shifter mechanism must operate freely in all positions	
Gear shifter cam assembly end play in cases	.004 to .008
Gear shifter cam clearance in right side cam bushing	.0005 to .0015
Gear shifter cam clearance in left side cam bushing	.0005 to .0015
Shifter fork clearance on gear shifter cam	.001 to .0015
Shifter pawl carrier shaft in cover bushing	.0005 to .0015
Shifter pawl carrier shaft in crankcase bushing	.0005 to .0015

MAINSHAFT GROUP

Mainshaft end play	.001 to .004
Sprocket gear on mainshaft	.0005 to .0015
Mainshaft 3rd gear on mainshaft	.001 to .002

COUNTERSHAFT GROUP

Countershaft end play	.004 to .008
Countershaft low gear on countershaft	.001 to .002
Countershaft 2nd gear on countershaft	.001 to .002

CAPACITIES

Gas Tank - 4.5 Gallons (U.S.)
Oil Sump - 2 Quarts (U.S.)

NOTE: (a) Safe Maximum R.P.M. 8,500
(b) Only caster oil is to be used in oil sump.

SPRINT MOTORCYCLE

REMOVING ENGINE FROM CHASSIS

NOTE: Use metric tools.

1. Clean engine thoroughly with "Gunk" to remove all road dirt. Remove "Gunk" and dirt with water spray and blow engine dry with compressed air. Drain oil from crankcase (See Rider Handbook).

Remove the following parts from left side of motorcycle.

2. Remove spark plug cable and spark plug.
3. Turn off fuel supply.
4. Remove fuel supply line at fuel supply valve.
5. Remove left foot rest and brake pedal.
6. Remove left side cover - held by 5 Allen screws.
7. Remove master link from chain and remove chain from drive sprocket.
8. Remove nuts from two upper engine mounting bolts, but do not remove bolts.

Remove the following parts from the right side of the motorcycle.

9. Remove clutch control wire from clutch release lever by rotating lever forward with a wrench, and disengage clutch cable.
10. Remove tachometer drive plate and spark control cable from circuit breaker plate.
11. Remove wires from circuit breaker and pull wires out of compartment.
12. Remove exhaust pipe attaching nuts and washers at cylinder exhaust port and rear mount.
13. Exhaust pipe is now free and may be put aside.
14. Remove carburetor at base and place on front fender at front fork. Care should be taken so that parts do not fall into intake port.
15. Remove foot peg and shifting mechanism.
16. Remove front upper engine mounting bolt.
17. Remove rear upper mounting bolt and gently pivot the engine so that the cylinder head comes to rest on the floor.

18. While supporting the engine from below, remove the lower mounting bolt. Care must be taken in removing the last mounting bolt so that the engine does not drop.

INSTALLING ENGINE IN CHASSIS

To install the engine assembly into the frame simply reverse order of disassembly noting the following.

Circuit breaker:

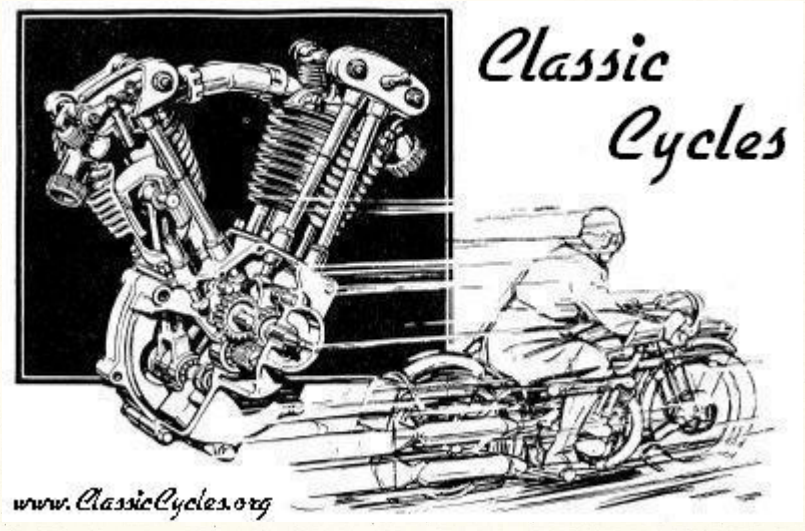
Both black wires are connected to circuit breaker wire stud screw.

Rear Chain:

Replace rear chain on engine sprocket before left side cover is installed.

OIL:

Fill oil sump with 2 Quarts (U. S.) of caster oil.



SPRINT ENGINE DISASSEMBLY

CYLINDER HEAD

NOTE: Remove parts in order, according to sequence listed below. Do not remove pressed in parts such as valve guides and bushings unless replacement is necessary.

1. Tappet cover (2 capscrews, washers and gaskets).

2. Intake and exhaust rocker cover (2), (5 capscrews, washers and gaskets). (Exhaust cover removal frees overhead oil return pipe).

3. Rocker arm shaft end cap (2), (2 capscrews, washers and gaskets).

4. Rocker arm oil feed pipe (3 bolts and 6 washers).

5. Rocker arm oil feed pipe, and side end cap (2), (2 capscrews, washers and gaskets).

6. Intake manifold and insulator, (2 nuts and washers).

7. Cylinder head (4 nuts and washers). Frees 2 push rods (which are interchangeable with each other), and push rod housing rubber gasket.

8. Rocker arm shaft:

NOTE: Rocker arms do not have to be removed to take valves out.

(a) Rocker arm bushings press-fitted in head (4). Cylinder head must be heated to a temperature of 250° Fahrenheit before removal or installation of rocker arm bushings.

(b) If bushings were worn and have been replaced they must be line reamed to size. Before reaming, drill a 3 mm (. 118 in.) hole in intake (left) bushing. Use reamer, Part No. 97314-61P, to ream bushings.

9. Intake valve disassembly. Use tool Part No. 97290-61P to remove valve keepers, upper collar, inner and outer spring and lower collar.

NOTE: (a) Intake and exhaust rocker arms are not interchangeable.

(b) Valves are not interchangeable.

(c) Valve seats (pressed-in) are not interchangeable. The cylinder head must be heated to a temperature of 540° Fahrenheit before removal or installation of valve seat inserts.

(d) Valve guides (pressed-in) are not interchangeable. The head must be heated to a temperature of 250° Fahrenheit before removal or installation of valve guides. Guides must be reamed to size, if replaced, with reamer Part No. 97310-61P. The valve guides must be reamed to 7. 52 mm (. 296 in.) to obtain the proper clearance.

(e) Valve keepers and keys are to be kept in sets.

CYLINDER AND PISTON

1. Cylinder (pulls off from 4 studs).

NOTE: Cylinders can be bored only to 0. 2 mm (. 0079 in.) oversize at which time it is necessary to replace the cast iron sleeve. The cylinder must be heated to a temperature of 300° to 360° Fahrenheit to remove or install cylinder liner.

2. Cylinder base and push rod housing gaskets.

3. Piston pin, wire lock rings (2).

4. Piston - heat piston to 250° F. and push pin out.

5. Piston rings:

   (a) Upper compression (Chrome ring).
   (b) Lower compression ring (has step on side marked "Top").
   (c) Oil control (Slotted).

6. Piston (large valve pocket installed toward intake valve side).

RIGHT SIDE CRANKCASE (OUTSIDE)

1. Tachometer drive plate (3 cap screws)

2. 11-4 mm Allen socket screws

3. Remove crankcase dip stick.

4. Remove crankcase cover and disassemble cover.

NOTE:; Rotate clutch release lever to free cover.

5. Remove 2 slotted screws holding breaker plate. Remove breaker plate and governor assembly from cover.

6. Remove clutch release lever from cover by removing nut, lockwasher and lock ring.

7. Disconnect breather hose from crankcase breather.

NOTE: Do not disassemble release lever unless necessary.

CAM SHAFT

1. 2 nuts and locks

2. Cam support plate with ball bearing.

3. Cam shaft shim

4. Cam shaft with gear

5. Tappets (2) (Identify as to correct location).

OIL PUMP

1. Nut.

2. Lock ring.

3. Drive gear pulled with tool Part No. 97292-61P. (Use a cap having center for puller on shaft end).

4. Pump scavenger pipe connection, pipe, and 2 brass washers.

5. To disassemble oil pump remove (4) bolts and locks and the following:

   (a) Scavenger side cover.
   (b) Feed side cover.
   (c) Rubber "O" ring on feed side cover.
   (d) Scavenger gear.
   (e) Feed idler gear.
   (f) Feed gear key.
   (g) Scavenger idler gear.
   (h) Feed gear.

CLUTCH

1. Use tool Part No. 97293-61P to compress clutch spring. The end bolts screw into the crankcase cover screw holes in right crankcase. Turning center screw compresses spring for easy removal of lock ring.

2. Clutch plate lock ring.

3. Clutch release cup.

4. Clutch release thrust bearing.

5. Remove the following parts as an assembly:

   (a) Clutch stud nuts (4).
   (b) Locks (4).
   (c) Releasing disc.
   (d) Outer plate.
   (e) Drive plates (4); driven plates, lined (4).
   (f) Backing plate with studs.
   (g) Springs (6)

6. Hub nut. (Hold hub with tool Part No. 97291-61P).

7. Hub nut lock.

8. Hub (loose on shaft) (small hole away from engine).

9. Clutch ring gear.

10. Shifter pawl carrier.

PINION GEAR

1. Pinion gear nut and lock.

2. Gear.

3. Key (timed to one of 3 keyways in shaft) (Be sure to mark shaft keyway which is used).

4. Pinion gear thrust washer.

5. Pull pinion drive gear with tool Part No. 97294-61P.

LEFT SIDE CRANKCASE (OUTSIDE)

1. 5 - 4 mm Allen socket screws.

2. Kickstarter lever, kickstarter sector gear, spring, stop bushing on stud, acorn nut, washer and stop stud.

NOTE: Clamp kickstarter sector gear stud in vise and rotate cover to take strain off stop stud while removing stop stud.

3. Kickstarter starter gear.

   Remove lock ring, cup, spring, clutch, gear and lock ring.

4. Drive chain cover, 3 nuts and plain washers.

5. Rear chain drive sprocket - remove lock washer and nut.

CRANKCASE (INSIDE)

1. Remove 3 Allen screws, 7 bolts and washers which connect crankcase halves.

2. Remove oil scavenger and pressure screens.

3. Remove lock ring on pinion shaft with lock ring pliers.

4. Separate crankcases by attaching tool Part No. 97295-61P to right side of crankcase over flywheel pinion shaft. Tap guide pins out of left side of crankcase while working tool. This will separate crankcases and remove flywheel assembly from right side of case.

NOTE: Care should be taken not to cock cases upon separation.

5. Right side crankcase (Transmission disassembly):

   (a) Cotter pins (2).
   (b) Shifter fork pins (2).
   (c) Press out mainshaft with tool Part No 97293-61P. (Also frees countershaft, shifter forks and gears).

   (d) Remove lock ring from shifter cam shaft.
   (e) Remove shifter cam shaft and washers.

6. Press flywheel assembly from left case use tool Part No. 97295-61P.

7. Left side crankcase:

   (a) Sprocket seal spacer bushing.
   (b) Clutch gear.
   (c) Washer.

8. Left side crankcase transmission countershaft ball bearing (blind) removed with Snap-On puller tool Part No. A-78 if necessary.

9. Mainshaft bearing - Remove seal spacer, seal and press out ball bearing.

10. Remove right crankcase main bearing lock ring and press ball bearing from crankcase.

11. Press out transmission mainshaft and countershaft ball bearings.

12. Press out camshaft bushing from inside of crankcase if worn and needs replacing. After new bushing has been installed, it must be line reamed with reamer, Part No. 97318-61P.

13. Press out tappet bushings from outside of crankcase.

SERVICING SPRINT FLYWHEEL ASSEMBLY

NOTE: 1) An arbor press of approximately 10 ton capacity is needed to assemble and disassemble crankpin in flywheels.
2) Flywheel support plate 96137-52 machined from 1/2 in. thickness to 7/16 in. thickness - or 96137-52A already 7/16 in. thick - must be used to fit between flywheels when pressing out crankpin.

Flywheel Disassembly

Support inner surface of gear side (right) flywheel on support plate (support plate between flywheels) in arbor.press. Using circular drift, press crankpin out of flywheel. Support inner surface of left flywheel on support plate and press out crankpin.

Flywheel Assembly

Place outside surface of gear side flywheel on press plate.

NOTE: Place Part No. 45752-52 or its equivalent (a spacer) between flywheel and press plate to allow for projecting portion of crankpin when pressing crankpin into flywheel.

Apply oil to both the bore and the crankpin surface. Assemble washer, placing chamfer of washer towards shoulder of crankpin. Align oil holes. Press crankpin in place. Blow through oil hole in shaft to check alignment. Apply oil to crankpin and flywheel bore. Assemble roller and cage assembly. Assemble connecting rod.

NOTE: Whenever the crankpin, connecting rod or crankpin roller bearing require servicing, the practice is to replace all of these parts including the thrust washer with a completely new set of parts, since no oversize bearings are available.

Assemble washer with chamfer toward shoulder of crankpin. Position and align left flywheel with the right one with a straight edge. Press left flywheel on to crankpin. By pressing lightly, then rotating assembly, and pressing again, etc., cocking of flywheel on crankpin can be avoided. Press flywheel tightly against crankpin shoulder. Support flywheel assembly on V-blocks at bearing surfaces. Set indicator on end of gear shaft and rotate noting variation. Turn flywheel around in V-blocks and indicate end of left flywheel shaft. Hold assembly in one hand and strike flywheel at proper place with lead or copper hammer to improve alignment. Repeat. If necessary, pinch in vise to align in other direction.

NOTE: Tool Part No. 96650-30 flywheel truing stand can also be used to align flywheels, but remove flywheel assembly from between centers while striking with lead or copper hammer.

SPRINT ENGINE ASSEMBLY

INSTALLING FLYWHEELS IN RIGHT CRANKCASE

NOTE: Install parts in order according to sequence listed below.
(All gaskets should be replaced with new ones.)

1. Clamp left flywheel shaft of flywheel assembly securely in vise (use copper jaws).

2. Apply a small amount of oil to pinion shaft. With pinion shaft main bearing installed in right side crankcase, set crankcase on pinion shaft. Screw flywheel assembly installation tool Part No. 97297-61P on pinion shaft and draw flywheel assembly into position with tool.

3. Install pinion gear shaft bearing lock ring in shaft groove with lock ring pliers.

TRANSMISSION

1. Install gear shifter cam in right crankcase. Install cam right spacer (variable thickness) to obtain specified end play. Secure with lock ring.

2. Install countershaft shifter clutch and low gear (recessed side toward gear case) on countershaft. Install countershaft assembly in countershaft bearing in right side case. Countershaft shifter fork must also be positioned and installed at the same time.

NOTE: Shifter forks are positioned with shoulder toward left side of engine.

3. Install mainshaft low gear, 2nd gear, 3rd gear and shifter clutch on mainshaft. Insert mainshaft assembly in mainshaft bearing in right side case. Mainshaft shifter fork must be positioned and installed at the same time.

4. Align shifter fork pin holes with corresponding grooves in gear shifter cam and install shifter fork pins and cotters.

5. Install clutch gear thrust washer (use correct thickness to obtain specified end play) on clutch gear and install clutch gear in left crankcase.

6. Install gear shifter cam left spacer (use proper thickness to obtain specified end play) and countershaft thrust washer (use proper thickness to obtain specified end play) on their respective shaft ends.

7. Place crankcase gasket on right side case and slip left case down onto right case. Position clutch gear by rotating to be certain correct gear mesh is made. Install 7 crankcase bolts, plain washers, nuts and 3 Allen cap screws. Tap crankcase bosses at dowel pin locations while carefully drawing crankcases together evenly with bolts.

PINION GEAR

1. Install gear assembly on pinion shaft taper.

2. Install pinion gear thrust washer (chamfered side against shaft key and pinion gear).

3. Insert key in correct keyway on shaft according to mark made in disassembly.

4. Install pinion gear so that keyway with punch mark aligns with key.

5. Install lock washer and nut and tighten temporarily by holding connecting rod with hand.

CLUTCH

1. Install gear shifter pawl carrier assembly in right case (be certain pawl carrier return spring is properly positioned with offset toward crankcase).

2. Install clutch shell gear on transmission mainshaft. Install clutch hub, lock and hubnut. Use Part No. 97291-61P tool to hold hub when tightening clutch hub nut. Now tighten pinion gear nut securely to about 35 ft-lb torque. Hold clutch sheel from turning while tightening nut.

3. If clutch plates have been disassembled, reassemble as follows: Install alternately clutch drive plates and clutch driven plates (lined) until five drive plates and five driven plates have been installed alternately on clutch backing plate. Install clutch outer plate. Position releasing disc on clutch backing plate studs and secure with locks and nuts.

4. Install clutch plate assembly on hub.

5. Place release cup and thrust bearing on pressure plate and compress spring with tool Part No. 97293-61P.

6. Install clutch plate lock ring.

OIL PUMP

1. Install scavenger gear in front upper hole of main body. Install scavenger idler gear in front lower hole of main body. Turn pump over and assemble feed gear and feed gear key on scavenger idler gear shaft. Install feed idler gear on scavenger gear shaft. Position feed side and scavenger side covers on pump main body. Install "O" ring on feed side cover.

2. Install oil pump scavenger line in crankcase (be certain scavenger line tube washer is in place). Position oil pump assembly in crankcase making certain the oil return line rubber "O" ring is in correct position.

3. Screw oil pump scavenger line connection into oil pump body with one brass washer on each side of the scavenger line. Do not tighten this fitting as yet.

4. Insert four oil pump body bolts and locks and draw down carefully.

5. Tighten oil pump scavenger line connection.

6. Wipe oil pump scavenger gear shaft taper clean and install oil pump drive gear, (small cutout on gear facing outside) lock and nut.

7. Install oil filter screens in order as follows:

   (a) Spring
   (b) Large Screen
   (c) Small Screen
   (d) Gasket
   (e) Cover

TAPPETS AND CAM GEAR

1. Install tappets (identified as to proper location when disassembled).

2. Install cam gear shaft assembly. Be certain to align timing mark on cam gear with corresponding mark on pinion gear.

3. Install cam shaft thrust washer and support plate and secure.

4. See Page 16 for cam timing.

RIGHT SIDE CRANKCASE COVER

1. Install spark advance unit and circuit breaker assembly in cover. Adjust circuit breaker plate assembly in accordance with factory timing mark on housing and plate. Install two breaker plate screws, lock washers and nuts, then tighten.

2. Position cover gasket on the crankcase and install cover assembly, making certain that the rubber "O" ring is in position on the shifter pawl carrier shaft. Also make certain that spark advance unit fits over cam shaft. Insert and start the 11 Allen cap screws seeing that the cover gasket is in alignment. When all screws have been started, draw them down tightly.

CIRCUIT BREAKER ASSEMBLY

NOTE: Install mainshaft sprocket (shoulder side toward crankcase), lock washer and nut. This is done so that tool Part No. 97291-61P may be used to turn engine shaft over.

1. The points open as engine shaft is cranked counterclockwise through compression stroke. (Circuit breaker cam rotates clockwise).

2. Adjust circuit breaker point gap to .018 in. (Use an .018 wire feeler gage). Rotate cam slightly beyond position where points are fully open.

   Adjust the gap as required by loosening lock screw of the fixed contact and shifting it by means of a screw driver inserted in the special notch provided. After gap has been adjusted, retighten the lock screw and recheck the gap.

PISTON

1. Insert one piston pin lock ring in piston. Apply light coat of oil to piston pin bosses and piston pin. Warm the piston and insert piston pin in one pin boss. Position piston so the intake valve head pocket is facing up and slip piston pin through connecting rod upper bushing and pin boss. Tuck a clean rag in the crankcase opening around connecting rod and install 2nd piston pin lock ring. Remove rag.

2. Dip the piston rings in light oil and install starting with the oil control ring, then lower compression ring. (Be certain that this ring is installed with the step on the inner diameter so the word "Top" is up), and last the chrome upper compression ring. Position rings so gaps are not in alignment with each other, that is, stagger the ring gaps.

CYLINDER

1. Install the cylinder base gaskets on the cylinder. Oil cylinder walls lightly. Carefully crank engine to bottom dead center and install cylinder on the four cylinder-to-head mounting studs, approximately 1-1/2" to 2" down on studs. Again carefully rotate engine to bring piston up into alignment with cylinder bore. (If tool is used to compress rings, it should be installed on piston before cylinder is installed). The top compression ring can be compressed and positioned with the fingers and the piston moved into the cylinder bore. Follow same procedure for 2nd compression ring and oil control ring.

NOTE: Wide gentle chamfer at base of cylinder bore makes installation of rings without the use of compressor by hand very simple.

2. Hold lower push rod housing rubber gasket between cylinder and crankcase and slide cylinder down into position.

3. Checking Timing:

   Temporarily clamp cylinder to crankcase by using spacers under diagonal stud nuts.

   When engine is out of the frame (circuit breaker wires removed), a test lamp and battery are needed. Connect one lead from engine to negative battery terminal. Connect another lead from positive battery terminal to test lamp, and test lamp to circuit breaker wire stud screw.

   When points are closed test lamp will be on. Rotate engine counterclockwise until test lamp just goes out. Piston should now be 13/32 in. before top center.

   To check if piston is 13/32 in. B. T. C., take the measurement from top of cylinder to piston with a scale when piston is at top center. Now add 13/32 in. and this sum will be the dimension required for timing.

   If light goes out before this dimension is reached, timing is advanced and circuit breaker must be rotated clockwise. If light goes out after this dimension is reached, timing is retarded and circuit breaker must be rotated counterclockwise. Always tighten circuit breaker screws before checking timing.

NOTE: If cylinder head is on, the procedure is the same except that a dial indicator is used through the spark plug hole and set at zero when piston is at top dead center. Timing light should go out when piston is .406 in. B. T. C.

CYLINDER HEAD

1. Oil valve stems lightly and insert the intake valve in its guide. Clamp valve spring compressor tool Part No. 97290-61P in a vise - stationary jaw down and position cylinder head with intake valve head resting on stationary jaw of tool. Install lower valve spring collar, inner spring, outer spring and upper valve spring collar over valve stem and guide. Compress valve spring assembly and install valve keepers. Release from spring compressor and follow same procedure for exhaust valve assembly.

2. Position the intake rocker arm in cylinder head. Insert the rocker arm shaft into the shaft bushing from the left side just far enough to be seen before it enters the rocker arm. Slip rocker arm thrust washers (according to disassembly), into position. Continue through with rocker arm shaft until shaft end can be seen emerging from the rocker arm, install the remaining shaft thrust washers and continue through with rocker arm shaft.

NOTE: See that valve stem aligns with rocker arm pad. Thrust washers should be arranged on either side of rocker arm to obtain this alignment and permit a very slight amount of end play.

Follow same procedure on exhaust rocker arm assembly. Install the two rocker arm shaft flange cover gaskets and the flange covers that are drilled for oil feed line connections to the valve side of the cylinder head. Install the push rod side rocker arm shaft flange cover gaskets and covers.

3. Install new rocker arm return oil pipe seals on the oil return pipe and insert it in oil return hole in lower left side of left crankcase.

4. Position the push rods in the cylinder push rod housing. IMPORTANT: The inside push rod (that is closest to the flywheel assembly) is the intake, and the outside push rod is the exhaust. They cross each other resulting in the intake push rod being above the exhaust push rod when the head is installed.

5. Position upper tappet housing rubber gasket over push rods and install cylinder head assembly over the four mounting studs but leave enough gap between the cylinder head and cylinder to hold the push rods in position with a needle nose pliers. With one push rod so held, the corresponding rocker arm can be rocked down far enough to engage the tappet adjusting screw with the push rod ball end, thus, holding the push rod in position. Follow this same procedure for the other push rod. Slip cylinder head down, install the four cylinder head nut washers and nuts and secure the head. (About 25 ft-lb torque on head nuts).

6. Insert the crankcase connection end of the rocker arm oil feed line between the cylinder head rocker arm housings and position it along the lower right side of the cylinder and cylinder head. It will lie between the cylinder head fins. Position one feed line connection washer on each side of the feed line connection and install the longest feed line connector in the crankcase — Do not tighten yet. Make certain the oil feed line connections line up properly with the rocker arm flange cover holes and install the two short feed line connectors with a washer on each side of the connection. (Use fingers to start these connectors.) Now tighten all three feed line connectors.

TAPPET ADJUSTMENT

1. Rotate engine with spark plug removed until either rocker arm indicates a valve is fully open. The opposite valve tappet adjustment can now be made. Loosen tappet adjusting screw lock nut and back out tappet adjusting screw far enough to allow a feeler gauge (as specified) to be inserted between the rocker arm and the valve stem. Tighten the lock nut and recheck clearance with feeler gauge. Rotate engine until the valve that has been adjusted is fully open and follow same procedure. Again rotate engine and check clearance at each valve stem.

2. Position the exhaust valve cover gasket and install the exhaust valve cover over the oil return pipe, install five washers and cap screws and secure the cover. Position valve adjusting cover gasket and cover, and install two washers and cap screws and secure the cover. (Do not make covers real tight).

CARBURETOR AND INTAKE PIPE

1. Position carburetor insulating block on cylinder head. Install intake pipe and secure with two washers and nuts.

MAINSHAFT SPROCKET AND STARTER ASSEMBLY

1. Place chain cover over mainshaft sprocket and secure with washers and nuts.

2. Install the starter clutch gear lock ring, starter clutch gear, starter clutch, starter clutch spring, spring collar and lock ring.

3. Assemble kickstarter, crank gear and starter spring in left crankcase cover as follows:

   Install starter spring on starter crank gear and insert in cover bushing being sure to locate spring loop on pin which projects from cover. Install starter crank on shaft. Rotate crank clockwise 1-1/2 turns, holding in position so stop pin can be inserted in cover to engage back side of gear. Install starter crank gear stop bumper on stop pin. Install acorn nut and washer on stop pin.

4. Relocate crank in proper position for starting and install clamping bolt.

CAMSHAFT TIMING

1. All the clearance must be taken up in pushrods before beginning to check the cam timing.

2. Timing should be read when valve has raised .039" (starting at zero with no valve clearance) and should be as follows: Intake opens 42^{o} BTC
   Exhaust opens 74^{o} ATC

PRIMARY GEAR RATIO TABLE #1 (STD.)

PRIMARY DRIVE:

33 T Clutch Drive Gear
69 T Clutch Shell Gear

PRIMARY DRIVE RATIO: 2.09 to 1

TRANSMISSION RATIOS:

High Gear:	1 to 1
Third Gear:	1.102 to 1
Second Gear:	1.402 to 1
First Gear:	2.043 to 1

PRIMARY GEAR RADIO TABLE #2 (SPECIAL P.O. ONLY)

PRIMARY DRIVE:

29 T Clutch Drive Gear
69 T Clutch Shell Gear

PRIMARY DRIVE RATIO: 2.52 to 1

"CR" PRIMARY RATIO (STD.) — 33T Engine / 69T Clutch — 2.09 Ratio

TRANSMISSION SPROCKET

REAR SPROCKET	13T	14T	15T	16T	17T	18T
38T	6.11	5.67	5.29	4.96	4.67	4.41
48T	7.72	7.16	6.69	6.27	5.90	5.57
49T	7.88	7.31	6.83	6.40	6.02	5.69
50T	8.04	7.46	6.96	6.53	6.14	5.80
51T	8.20	7.61	7.10	6.66	6.27	5.92
52T	8.36	7.76	7.24	6.79	6.39	6.04
* 55T	8.84	8.21	7.66	7.18	6.76	6.39
* 60T	9.65	8.96	8.36	7.84	7.37	6.96
* 65T	10.45	9.70	9.06	8.49	7.99	7.55
* 70T	11.25	10.45	9.76	9.14	8.60	8.13

"CR" PRIMARY RATIO (SPECIAL) P.O. — 29T Engine / 73T Clutch — 2.52 Ratio

TRANSMISSION SPROCKET

REAR SPROCKET	13T	14T	15T	16T	17T	18T
38T	7.35	6.83	6.37	5.97	5.62	5.31
48T	9.29	8.63	8.05	7.55	7.10	6.71
49T	9.48	8.81	8.22	7.70	7.25	6.85
50T	9.68	8.99	8.39	7.86	7.40	6.99
51T	9.87	9.16	8.55	8.02	7.55	7.13
52T	10.06	9.34	8.73	8.18	7.69	7.27
* 55T	10.64	9.88	9.22	8.65	8.14	7.69
* 60T	11.61	10.78	10.06	9.43	8.88	8.39
* 65T	12.58	11.69	10.90	10.22	9.62	9.09
* 70T	13.55	12.58	11.74	11.01	10.36	9.78

* SPROCKETS MARKED BY ASTERISK ARE MADE TO BOLT OVER A 38 TOOTH SPROCKET

SPRINT SERVICE TOOLS

QTY.	PART NO.	
1	94401-61P	Snap-on Tool Kit Consists of:

Combination Wrench 7 MM
" " 16 MM
" " 17 MM
Open End Wrench 8 MM x 10 MM
" " " 9 MM x 11 MM
" " " 12 MM x 14 MM
" " " 17 MM x 19 MM
Box Wrench 6 MM x 7 MM
Allen Wrench 5 MM
" " 6 MM
" " 12 MM
3/8" Dr. Socket 10 MM Single Hex
3/8" Dr. Socket 14 MM Double Hex
3/8" Dr. Socket 17 MM Double Hex
1/2" Dr. Socket 22 MM Double Hex
1/2" Dr. Socket 24 MM Double Hex
1/2" Dr. Socket 27 MM Double Hex
1/2" Dr. Socket 32 MM Double Hex
Adjustable Wrench
Metal Tool Box for above

1	95017-61	Lock Ring Pliers
1	96137-52A	Flywheel Support Plate
1	97175-61P	Clutch Lock Tool
1	97290-61P	Valve Spring Compressor
1	97291-61P	Transmission and Clutch Sprocket Wrench
1	97292-61P	Two Jaw Puller (small)
1	97293-61P	Clutch Spring Compressor
1	97294-61P	Engine Pinion Puller
1	97295-61P	Tool for removing flywheels from gear side bearing
1	97297-61P	Tool for installing flywheels in gear side bearing
1	97300-61	Crankcase Assembling Screw
1	97305-61	Fort Tube Tool
1	97310-61P	Valve Guide Reamer
1	97314-61P	Rocker Arm Bushing Reamer
1	97318-61P	Camshaft Bushing Reamer

Accessories are available for the Hall-Toledo Model EJ Eccentric Valve Seat Grinder to be used on the Sprint "CR".