

SERVICE MANUAL

APPLYING TO
THE FOLLOWING
HARLEY-DAVIDSON
MOTORCYCLES—
1940 to 1947 INCLUSIVE

O.H.V. Engine Models

61 Cu. In. (1000 c.c.)

74 Cu. In. (1200 c.c.)

Side Valve Engine Models

74 Cu. In. (1200 c.c.)

80 Cu. In. (1300 c.c.)



Printed in the United States of America

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Product: 1940-1947 Harley-Davidson Motorcycle Service Repair Workshop Manual

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GENERAL SPECIFICATIONS

MODEL	E and EL	F and FL	U and UL	UH and ULH
Type of Engine	61 Cu. In. O.H.V. Twin	74 Cu. In. O.H.V. Twin	74 Cu. In. Side Valve Twin	80 Cu. In. Side Valve Twin
Cylinder Bore	3 $\frac{5}{16}$ "	3 $\frac{7}{16}$ "	3 $\frac{5}{16}$ "	3 $\frac{7}{16}$ "
Stroke	3 $\frac{1}{2}$ "	3 $\frac{31}{32}$ "	4 $\frac{9}{32}$ "	4 $\frac{9}{32}$ "
Piston Displacement	60.32 Cu. In.	73.66 Cu. In.	73.79 Cu. In.	78.75 Cu. In.
Compression Ratio (Low compression engine)	E Model 6.5 to 1	F Model 6.6 to 1	U Model 5.0 to 1	UH Model 5.2 to 1
Compression Ratio (High compression engine)	EL Model 7.0 to 1	FL Model 7.0 to 1	UL Model 5.5 to 1	ULH Model 5.7 to 1
Horsepower (N.A.C.C. Rating)	8.77	9.44	8.77	9.44
Wheelbase	59 $\frac{1}{2}$ "	59 $\frac{1}{2}$ "	59 $\frac{1}{2}$ "	59 $\frac{1}{2}$ "

ENGINE (SERIAL) NUMBER

In identifying a motorcycle as to its year and model, do not trust simply to knowledge of original differences in equipment and general appearance of one year's model as compared with another. Always identify by Engine (Serial) Number.

Example: 46 EL 2222

46
Year

EL
Model

2222
Serial Number

TIRE INFLATION PRESSURES

	FRONT	REAR	SIDE CAR	PACKAGE TRUCK
Solo—Rider Only 4.00" x 18" Tire 5.00" x 16" Tire	14 lbs. 12 lbs.	16 lbs. 14 lbs.		
Solo—Rider and One Passenger 4.00" x 18" Tire 5.00" x 16" Tire	18 lbs. 12 lbs.	26 lbs. 16 lbs.		
Sidecar—Rider and One Sidecar Passenger or 150 lb. Sidecar Load 4.00" x 18" Tire 5.00" x 16" Tire	20 lbs. 14 lbs.	24 lbs. 16 lbs.	14 lbs. 14 lbs.	
Package Truck—Rider and 150 lb. Truck Load 4.00" x 18" Tire 5.00" x 16" Tire	22 lbs. 14 lbs.	30 lbs. 20 lbs.		16 lbs. 14 lbs.

Tire inflation pressures are based on rider and passenger weight of approximately 150 lbs. each; Package Truck load 150 lbs.

When these loads are exceeded by 50 lbs. or more, increase tire pressure as follows: For each 50 lbs. of overload, increase pressure of rear tire 2 lbs.; front tire, 1 lb; sidecar or package truck tire, 1 lb.

STANDARD GEAR RATIOS

MODEL	SOLO OR SIDECAR	TYPE OF TRANSMISSION	ENGINE SPROCKET	HIGH GEAR RATIO
E and EL	Solo	3 Speed	22	3.90 to 1
		4 Speed	23	3.73 to 1
	Sidecar	3 Speed—Reverse	18	4.76 to 1
		4 Speed	20	4.29 to 1
F and FL	Solo	3 Speed	23	3.73 to 1
		4 Speed	23	3.73 to 1
	Sidecar	3 Speed—Reverse	20	4.29 to 1
		4 Speed	21	4.08 to 1
U and UL	Solo	3 Speed	21	4.08 to 1
		4 Speed	22	3.90 to 1
	Sidecar	3 Speed—Reverse	18	4.76 to 1
		4 Speed	20	4.29 to 1
UH and ULH	Solo	3 Speed	22	3.90 to 1
		4 Speed	23	3.73 to 1
	Sidecar	3 Speed—Reverse	19	4.51 to 1
		4 Speed	20	4.29 to 1

GASOLINE AND OIL CAPACITIES

MODEL	74" AND 80" SIDE VALVE	61" AND 74" O.H.V.
Left Gasoline Tank	2 U.S. Gallons	2 U.S. Gallons
Right Gasoline Tank	2 U.S. Gallons	1¼ U.S. Gallons
Reserve Gasoline Supply (included above)	Approximately 1 U.S. Gallon	Approximately 1 U.S. Gallon
Oil Tank	1 U.S. Gallon	1 U.S. Gallon
Transmission	1½ U.S. Pints	1½ U.S. Pints

Memoranda

INSTRUMENT PANEL SIGNAL LIGHTS

1946 and Earlier Models: Green light in left side of instrument panel indicates whether or not generator is charging.

Red light in right side of instrument panel indicates whether or not oil is circulating.

1947 Models: Red light marked "GEN" in center of instrument panel indicates whether or not generator is charging.

Red light marked "OIL" in center of instrument panel indicates whether or not oil is circulating.

All Models: When switch is turned "ON" preparatory to starting engine, both lights should go "ON." (Exception: When switch is turned "ON" immediately after engine has been primed by cranking, oil pressure signal may not light, but will light after a few seconds. This is due to oil pressure built up by cranking and is most likely to be noticed in cold weather.)

With engine started and running at a fair idling speed, both lights should go "OFF." At slow idling speed or under about 20 miles per hour road speed in high gear, generator signal will normally flash "ON" and "OFF" because at that speed generator output is very low and unsteady.

Should generator signal fail to go "OFF" at speeds above approximately 20 miles per hour, generator is either not charging at all or its output is not up to normal and it should be inspected at once.

Should oil circulation signal fail to go "OFF" at speeds above idling, it is most likely due to: empty oil tank; oil supply badly diluted, or using very light grade of oil and pump not building up normal pressure; if freezing weather, oil feed pipe may be clogged with ice or sludge. However, it may be: grounded oil signal switch wire, faulty signal switch; or oil pump in bad order. Give due attention to oil supply and, if signal still does not operate normally, check to see if oil returns to tank. To do this, remove oil tank cap and, with engine running, look for pulsating return of oil. A small flashlight is an aid in making this check. If oil is returning, motorcycle can be driven slowly, but no further than absolutely necessary before checking and servicing oiling system. If oil is not returning, do not drive further before having the fault corrected; as engine is likely to be damaged.

STARTING ENGINE

When starting engine, gear shifter handle must be in neutral and clutch fully engaged. Spark should be fully advanced or nearly so.

Note: Choke lever positions are as follows:

O.H.V. Engine: Choke lever all the way down, choke is "closed"; choke lever all the way up, choke is "open."

Side Valve Engine: Choke lever all the way up, choke is "closed"; choke lever all the way down, choke is "open."

All Models: Starting Cold Engine: Set choke lever in fully-closed position, open throttle wide, and with ignition switch "OFF," prime cylinders by operating starter crank once or twice.

Then, with choke lever set $\frac{1}{4}$ or $\frac{1}{2}$ closed in mild weather, $\frac{3}{4}$ or fully closed in extremely cold weather, and throttle slightly open, turn ignition switch "ON" and start engine with vigorous strokes of starter.

CAUTION: It is only in extremely cold weather that engine may start best with choke fully closed, and even then, it will have to be moved from this position immediately after engine starts. Under no conditions will engine continue to run with full choke.

As soon as engine starts, set throttle for moderate idling speed while warming up or until ready to set motorcycle in motion.

As engine warms up and misfires due to an over-rich mixture, gradually move choke lever toward open position. After engine has thoroughly warmed up, move choke lever to fully open position.

Starting Warm Engine: This applies to engine half way between hot and cold. Move choke lever to $\frac{1}{4}$ closed position and with throttle closed, operate starter once or twice. Then, with throttle $\frac{1}{4}$ to $\frac{1}{2}$ open, turn ignition switch "ON" and operate starter. Soon after engine starts, choke lever should be moved back to fully open position. Remember: This procedure calls for having throttle part way open during starting strokes after switch has been turned "ON."

Starting Hot Engine: If engine has been shut off for only a brief period and is at about normal running temperature, it is not necessary to use choke lever. Simply close throttle, turn ignition switch "ON" and operate starter. With some engines, depending on carburetor adjustment, hot starting is more dependable if starter is given one stroke before turning ignition switch "ON."

When a hot engine does not start readily, that is, with two or three starter strokes, it is usually due to an over-rich (flooded) condition, and the proper procedure then is to open throttle wide so more air can enter, closing it quickly as engine starts.

TO STOP ENGINE

Stop engine by turning ignition switch "OFF." If engine should be stalled or stopped in any other way than with switch, turn switch "OFF" at once to prevent battery from being discharged through circuit breaker points.

Don't idle engine unnecessarily with motorcycle standing.

RUNNING IN NEW ENGINE

Don't run new motorcycle faster than 35 miles per hour the first 250 miles; 40 miles per hour the second 250 miles; 45 miles per hour (sidecar) or 50 miles per hour (solo) the next 500 miles. Avoid running at or near top speed for long distances below 2000 miles.

2. Too hot a spark plug for the kind of service or for type of engine.
3. Defective spark plugs.

If engine overheats:

1. Insufficient oil supply, or oil not circulating.
2. Leaking valves.
3. Heavy carbon deposit.
4. Carburetor high speed adjustment too lean.
5. Ignition timing too late.

If engine detonates:

1. Unsuitable fuel (octane rating too low).
2. Heavy deposit of carbon on piston head and in combustion chamber (decreases combustion space, thereby increasing compression ratio. The higher the compression ratio, the higher the octane rating of fuel required).

If oil does not return to oil tank:

1. Oil tank empty.
2. Scavenger pump gear key sheared.
3. Oil feed pump not functioning.

If engine uses too much oil:

1. Breather valve incorrectly timed.
2. Oil pressure too high—readjust oil pump.
3. Piston rings badly worn or in bad condition otherwise.
4. O.H.V. Engine—intake valve spring cover oil return line clogged with carbon or sludge. One or more push rod cover cork washers in bad condition or a push rod cover not seating properly against its washer.
5. Chain oiler adjusting screw adjusted for an excessive amount of oil.

Excessive vibration:

1. Cylinder bracket loose or broken.
2. Engine mounting bolts loose.
3. Broken frame.
4. Front chain badly worn, or links tight as a result of insufficient lubrication.
5. Transmission and/or transmission sub-mounting plate loose in chassis.

Generator

If generator does not charge:

1. Brushes badly worn.
2. Brushes sticking in holders.
3. Relay, or current and voltage regulator, not grounded.
4. Defective relay or current and voltage regulator.
5. Commutator dirty or oily.
6. Positive brush holder grounded.
7. Generator "relay" terminal grounded.
8. Loose or broken wire in generator-battery circuit.
9. Broken field coil wire or loose terminal (both coils).

10. Commutator shorted.
11. Defective armature.

If generator charging rate is below normal:

1. Regulating brush not properly adjusted.
2. Current and voltage regulator not properly adjusted.
3. Broken field coil wire or loose terminal (one coil).
4. Commutator worn and not turning true with shaft—throws brushes at high speed.
5. Commutator dirty or oily.
6. Brushes gummy and sluggish in holders.
7. Defective armature.

Carburetor

If carburetor floods:

1. Float set too high.
2. Float valve sticking.
3. Float valve and/or valve seat worn or damaged.
4. Dirt or other foreign matter between float valve and its seat.
5. Carburetor float not located correctly in bowl—may be binding.

Transmission

If transmission shifts hard:

1. Bent shifter rod.
2. Clutch dragging slightly.
3. Transmission oil too heavy (winter operation).
4. Shifter forks (inside transmission) sprung as a result of using too much force when shifting.
5. Corners worn off shifter clutch dogs (inside transmission)—makes engagement difficult.

If transmission jumps out of gear:

1. Shifter rod improperly adjusted.
2. Shifter forks (inside transmission) improperly adjusted.
3. Shifter engaging parts (inside transmission) badly worn and rounded.

If clutch slips:

1. Clutch controls improperly adjusted.
2. Insufficient clutch spring tension.
3. Worn and/or oil soaked friction discs.

If clutch drags or does not release:

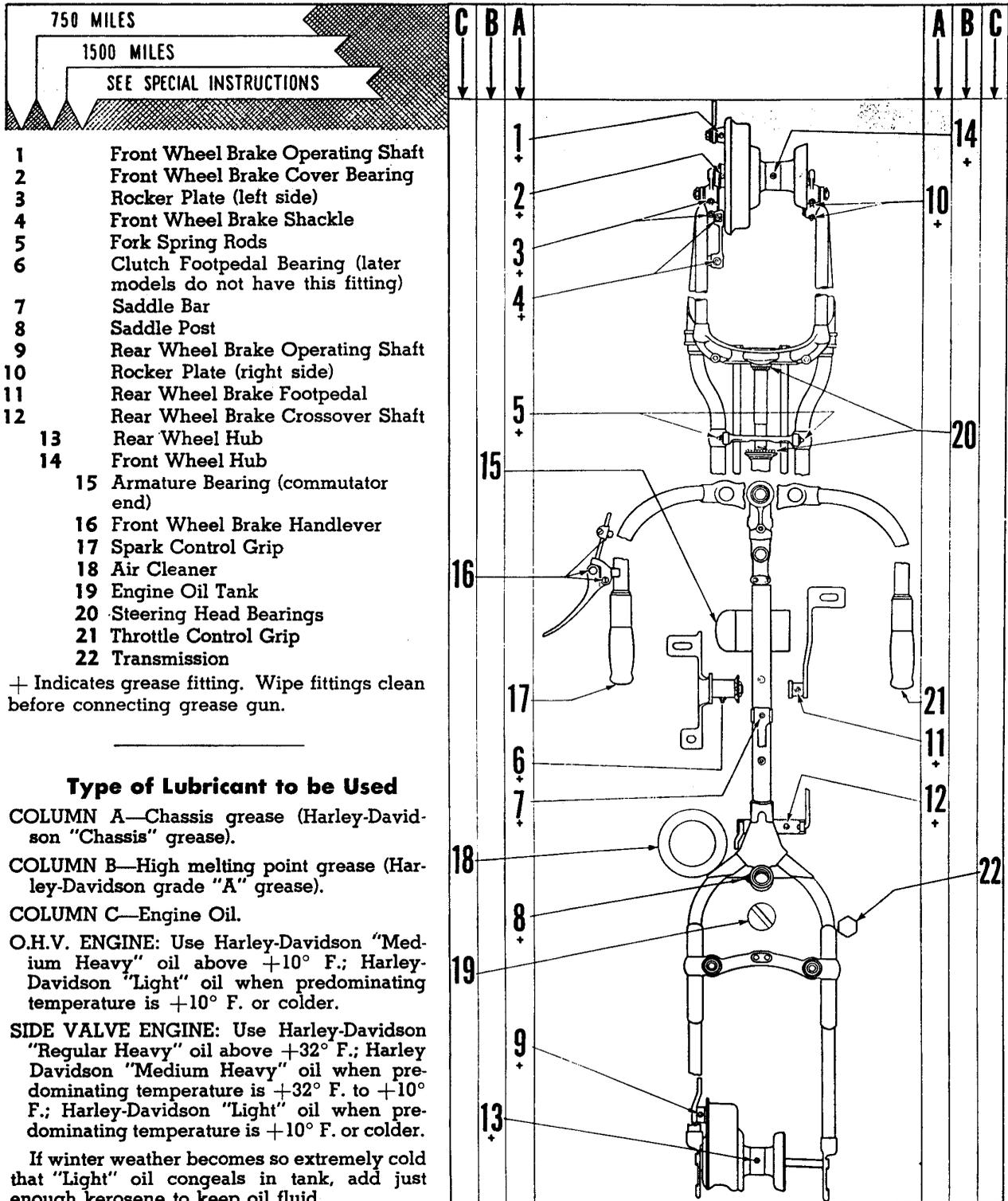
1. Clutch controls improperly adjusted.
2. Clutch spring tension too tight.
3. Friction discs gummy.
4. Clutch key ring badly worn.

If clutch chatters:

1. Clutch disc rivets loose.
2. Clutch sprung disc too flat.

(Continued on next page)

LUBRICATION CHART



ILLUS. 1

6. Check adjustment of chains and readjust if needed. Again, check lubrication of front chain and readjust chain oiler if found necessary. Clean and lubricate rear chain.
7. Check adjustment of brakes. Readjust controls if needed.
8. Check wheel mounting socket screws and tighten if needed. These screws must be kept very tight.
9. Check axle nuts and fork rocker plate stud nuts for looseness.
10. Check level of battery solution and add distilled water if needed. See that terminals are clean and connections tight.
11. Inspect all wiring connections and tighten any found loose. Check switches, lights, etc.
12. Check carburetor-manifold cap screws and manifold nuts.
13. Road test motorcycle to check carburetor adjustment and all-around performance.

At First 1500 Miles

1. Check condition of oil in tank to determine if oil change is needed.
2. Check level of oil in transmission and add oil if needed. Use same grade of oil used in engine. See "Transmission Lubrication," Page 144.
3. Lubricate all points indicated for 750 mile attention on Lubrication Chart.
4. Lubricate wheel hubs at 1500 mile intervals as indicated on Lubrication Chart.
5. Oil all control joints, namely clutch, gear shifter, brakes, front brake control wire, and spark and throttle control wires at ends of their respective housings.
6. Check adjustment of chains. Adjust if needed. Again, check lubrication of front chain. Clean and lubricate rear chain and check for broken rollers, loose pins or cracked side plates.
7. Check adjustment of gear shifting control. Adjust if needed.
8. Check adjustment of clutch and clutch control. Adjust if needed.
9. Check adjustments of brakes and brake controls. Adjust if needed.
10. Check all nuts, bolts and screws and tighten any found loose. Particular attention should be given to engine mounting bolts, cylinder head bracket bolts or nuts, transmission mounting stud nuts, and wheel mounting socket screws.
11. Check front and rear wheel for loose or broken spokes and rim damage.
12. Check level of battery solution and add distilled water if needed.
13. Engine should be given a complete tune-up including: Checking circuit breaker points, ignition timing, valve tappets, spark plugs, draining and flushing carburetor bowl, cleaning and flushing gasoline strainer, carburetor adjustment, and cleaning muffler outlet. Service air cleaner if motorcycle is so equipped.
14. Road test motorcycle to check carburetor adjustment and all-around performance.

preceding three service jobs conclude what is considered initial servicing. Further servicing should be given according to schedule of "Regular Interval Inspection and Maintenance," which follows below.

REGULAR INTERVAL INSPECTION AND MAINTENANCE

After schedule of initial servicing of new motorcycle has been completed, this maintenance schedule is then to be followed at regular intervals not exceeding 1500 miles.

1. Check condition of oil in tank to determine if oil change is needed.
2. Lubricate all points indicated for 750 mile attention on Lubrication Chart.
3. Lubricate wheel hubs at 1500 mile intervals as indicated on Lubrication Chart.
4. Oil all control joints, namely, clutch, gear shifter, brakes, front brake control wire, and spark and throttle control wires at ends of their respective housings.
5. If motorcycle is equipped with air cleaner, inspect and service if needed. See "Servicing Air Cleaner," Page 10.
6. Remove rear chain, check for broken rollers, loose pins or cracked side plates, and then clean and lubricate as per instructions under "Lubricating Drive Chains," Page 12. Check front chain for ample lubrication. Adjust chains.
7. Flush chain oiler passage as explained under "Lubricating Drive Chains," Page 12.
8. Check clutch and clutch control adjustments. Readjust if needed.
9. Check brakes. Readjust controls if needed.
10. Check all nuts, bolts, and screws and tighten any found loose.
11. Check wheel mounting socket screws and tighten if needed. These screws must be kept very tight.
12. Check axle nuts and fork rocker plate stud nuts for looseness.
13. Check front and rear wheel for loose or broken spokes and rim damage.
14. Clean and flush gasoline strainer.
15. Remove carburetor bowl drain plug and flush bowl.
16. Check level of battery solution and add distilled water if needed.
17. Inspect all wiring connections. Check switches and lights.
18. Completely tune up engine, including: Checking circuit breaker points, ignition timing, valve tappets, spark plugs, carburetor adjustment, and cleaning muffler outlet.
19. Note that generator and oil pressure signal lights, in switch panel, go out when engine is running above idling speed.

20. Road test motorcycle to check carburetor adjustment and all-around performance.

Once every 5000 miles, or at least once a year (if total yearly mileage is less than 5000 miles), lubricate commutator end bearing of generator with high melting point grease (Harley-Davidson grade "A" grease).

CARE AND LUBRICATION OF DRIVE CHAINS

Adjusting Drive Chains

Inspect the adjustment of chains at least every week and adjust them if necessary. Adjustment of front chain can be checked through inspection hole provided in chain guard. Chains must not be allowed to run loose enough to strike guards or other chassis parts, because when that loose, they cause motorcycle to jerk when running at low speed, and there is excessive wear of chains and sprockets. The rear chain requires more frequent adjustment than front chain. As chains stretch and wear in service, they will run tighter at one point on the sprockets than at another. Always check adjustment at the tightest point and adjust chains at this point so that they have about ½-inch free movement up and down, midway between sprockets. Do not adjust tighter because running chains too tight is even more harmful than running them too loose.

Inspect chains occasionally for links in bad condition. If any are found, make repairs or renew the chain. The rear chain can be taken apart and removed after locating and taking out the spring locked connecting link. The front chain is not, however, originally provided with such a connecting link and whether or not one has at sometime been installed in making repairs, it will be necessary to remove the engine sprocket before chain can be taken off.

To Adjust Front Chain

Loosen the four stud nuts and one cap screw underneath transmission. This permits moving transmission backward or forward by means of adjusting screw at rear of transmission on right side. Turn adjusting screw to *right to tighten* chain—to *left to loosen* chain. When chain is correctly adjusted, securely tighten stud nuts and cap screw and recheck chain, as tightening stud nuts and cap screw sometimes changes chain adjustment. Also check transmission mounting plate bolts occasionally and keep them tight.

Adjusting front chain changes the adjustment of rear chain, therefore, rear chain must also be adjusted.

Moving transmission to adjust front chain, also affects adjustment of gear shifter and clutch controls. Therefore, each time front chain is adjusted, these controls will need to be adjusted or at least their adjustment will have to be checked. See "Checking and Adjusting Clutch Control," Page 15, and "Checking and Adjusting External Shifter Control," Page 14.

To Adjust Rear Chain

Remove rear axle nut and lock washer and loosen brake sleeve nut. Also loosen rear wheel adjusting screw lock nuts (one on each side of frame).

Turn adjusting screws to move rear wheel as necessary to correctly adjust chain. Assuming that wheel was correctly aligned the last time chain was adjusted, turning each screw an equal number of turns will maintain alignment.

When correct adjustment of chain is attained, securely tighten brake sleeve nut, rear axle nut and adjusting screw lock nuts. Then recheck chain adjustment, as tightening brake sleeve nut and axle nut sometimes changes chain adjustment.

Check alignment of wheel in chassis. This can be done by measuring the distance from inner side of chain to tire rim. For 5.00" x 16" tire rim, the distance should be approximately 1-3/16", and for 4.00" x 18" tire rim, the distance should be approximately 1 5/8". Distance between chain and rim should be checked at four equidistant points around rim, and if it happens to be out of true sideways to any appreciable degree, this will have to be taken into consideration. If measurement indicates wheel is out of alignment in chassis, it must be corrected, and of course, chain adjustment will have to be rechecked.

After adjusting rear chain, rear brake may be found too tight. Check and adjust if necessary. See "Adjusting Rear Wheel Brake," Page 20.

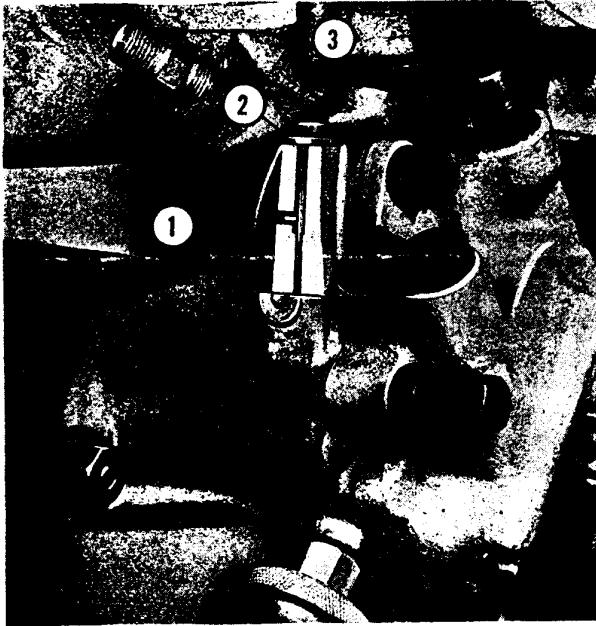
LUBRICATING DRIVE CHAINS

Lubricating Front Chain

Front chain is automatically lubricated by engine oil pump. Chain oiling is adjustable and occasional readjustment may be needed to meet lubrication requirements of varied operating conditions.

As nearly everyone knows through experience, the good performance and life of a front chain depends entirely upon its ample lubrication. The quantity of oil required for ample lubrication is very slight. However, oiling must be constant. If oiling fails for a period of only a few hours or a few hundred miles, especially when operating at high speed, chain is likely to be ruined. Initial oiling adjustment is set at the factory as closely as possible to normal service requirements; however, the quantity of oil involved is so small, initial adjustment cannot always be trusted as final. Standard factory setting of chain oiler adjusting screw (Item (17), Illus. 56, or Item (3), Illus. 3) is as follows: *O.H.V. Models*—1 full turn open; *Side Valve Models*—1 ½ turns open. A 1/16" washer and required number of .002" washers are placed under screw head so that when screw head bottoms against washers point of screw is the specified number of turns off its seat.

At the intervals specified under "Initial Servicing of New Motorcycle," Page 10 and "Regular Interval Inspection and Maintenance," Page 11, remove inspection hole cover from chain guard and make a very close inspection of chain. If chain appearance



ILLUS. 3

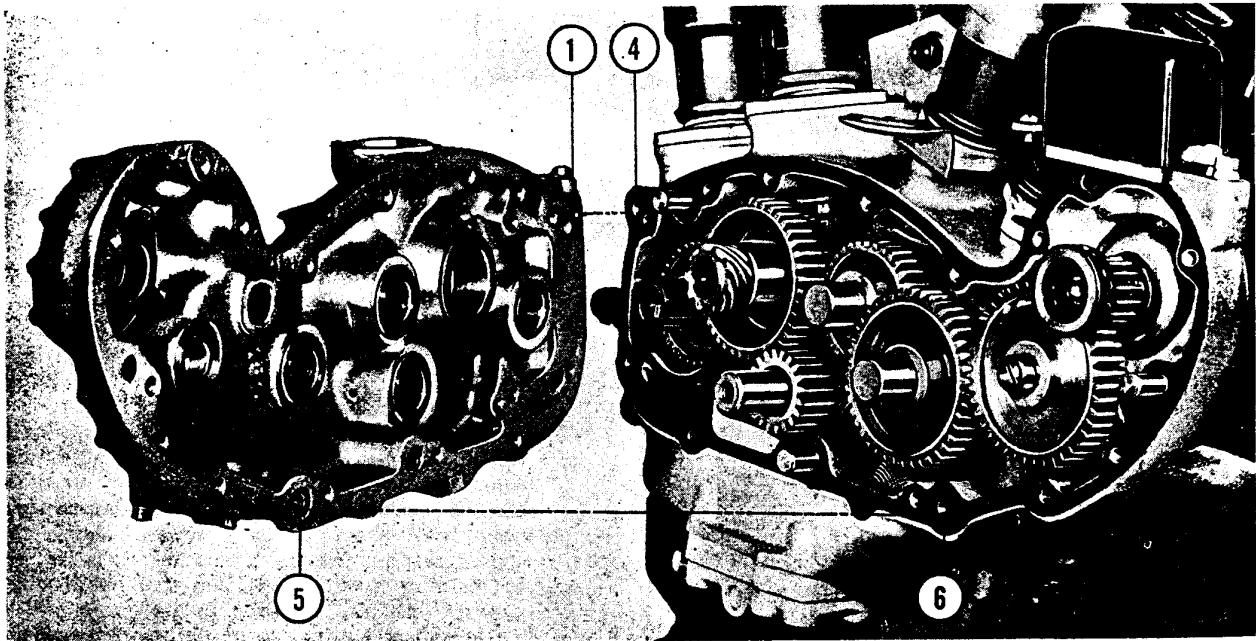
CHAIN OILER ADJUSTING SCREW AND OIL PASSAGE
(SIDE VALVE ENGINE)

1. Chain oil passage in gear case cover.
2. Chain oiler adjusting washers.
3. Chain oiler adjusting screw.

raises the least doubt as to its getting ample lubrication, add one or two more .002" washers under head of chain oiler adjusting screw. A well lubricated chain not only has an oily surface, but is also clean and free of discoloration. If chain has a brownish hue, and rusty appearance at side and center plates, it is under-lubricated even though the surface may be oily.

Since the quantity of oil involved is very small, the opening through which oil bleeds to chain is regulated by adjusting screw to a very small orifice. Sediment and gummy matter accumulated in oil supply deposits in and around this orifice and gradually decreases the oil supplied to chain. In other words, a chain that has been lubricating perfectly the first 2000 miles may run short of oil the second 2000 miles. Therefore, even though inspection indicates chain is amply lubricated, it is advisable at intervals of approximately 2000 miles, to loosen the chain oiler adjusting screw, and back it up about two turns. Operate this way a few miles and then turn screw back down moderately tight against its adjusting washers. This procedure flushes away accumulated sediment and restores oil orifice to its original size.

The same result can be accomplished if compressed air is available, by completely removing screw and washers, flushing opening with gasoline and blowing out. When this procedure is followed, care must be taken not to lose any of the thin washers under screw head, otherwise when screw is installed, it will not have the same adjustment as it did before being removed.

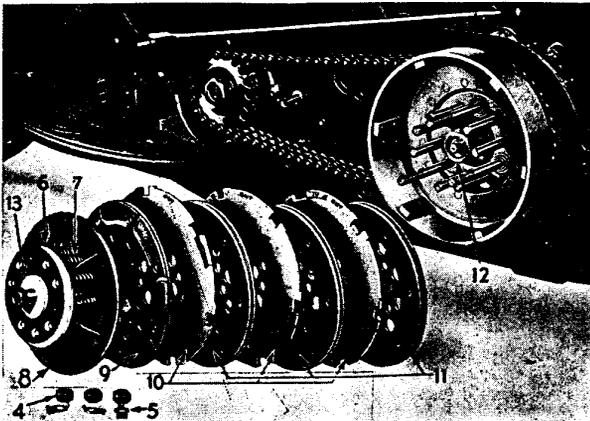


ILLUS. 4

GEAR CASE COVER REMOVED (SIDE VALVE ENGINE)

1. Chain oil passage in gear case cover.
4. Chain oil passage in crankcase.
5. Flutter valve installed in cover—assists in retrieving oil from outside breather oil trap in cover.
6. Oil passage in right crankcase through which oil in outside breather oil trap is retrieved by crankcase vacuum.

Clutch hub with back plate is a taper fit on transmission mainshaft, and can now be removed with Harley-Davidson special puller, Part No. 12749-36.



ILLUS. 9
CLUTCH DISASSEMBLED (1941 TO 1947 MODELS)

4. Spring tension adjusting nuts (three).
5. Spring tension adjusting nut locks (three). See "Footnote."
6. Spring compression collar.
7. Clutch springs (ten).
8. Releasing disc.
9. Sprung disc, to smooth clutch engagement. Friction disc riveted to inner side.
10. Plain steel discs (three). Outside marked.
11. Lined discs (three).
12. Clutch hub nut (left thread).
13. Flat Washer—see Footnote.

Footnote: During the 1947 season, spring tension adjusting nut locks (5) were eliminated and adjusting nuts (4) were superseded by self locking nuts. Flat washer (13) used only when disassembling clutch.

Disassembling Clutch

1941 to 1947 Models

(To Identify Items, Refer to Illus. 9 and 137)

Remove outer chain guard. Removing nuts (4) allows clutch (Items 2 to 11 inclusive) to come apart as shown in Illus. 137. However, unless springs may need inspection and possibly renewal, it is not necessary to release them. Spring collar (6), springs (7) and outer disc (8) can be removed as an assembly as shown in Illus. 9. This manner of disassembling makes reassembling a much simpler job than when springs are released.

To remove these parts, as an assembly, first obtain a flat washer (13), with approximately the following dimensions: $\frac{1}{8}$ " thick, $1\frac{3}{4}$ " outside diameter, and $\frac{3}{8}$ " center hole. Remove push rod adjusting screw lock nut (3), Illus. 7, and install flat washer over adjusting screw (2), Illus. 7. Then turn lock nut onto adjusting screw, against washer and tighten lock nut until adjusting nuts (4) are free. Bend away nut locks (5), remove nuts (4) and assembly can be pulled off, freeing the other discs. See footnote under Illus. 7.

To remove clutch shell and sprocket, it is first necessary to remove engine sprocket (see paragraph

20 under "Removing Assembled Engine From Chassis For Complete Overhaul," Page 41). Then front chain and clutch sprocket assembly can be taken off.

Clutch hub with back plate is a taper fit on transmission mainshaft and is secured by nut (12) (left thread) and lock washer. To remove clutch hub, see "Removing Clutch Hub," Page 136.

Reassembling Clutch

(Refer to Illus. 8, or 9 and 137)

Inspect all parts carefully.

If lined discs are not badly worn but are oil-soaked, wash them thoroughly in clean gasoline or solvent and dry with compressed air or heat. If discs are found worn to rivet heads, replace with new lined discs; it is impractical to reline old discs.

If clutch has been badly overheated as a result of slippage, and lined discs are found badly glazed and burned, and/or if clutch springs have shrunk as to length, such parts should be replaced.

Free length of new clutch springs is as follows:

1940 and Earlier Models: 2-7/16"

1941 to 1947 Models: 1-31/64"

Reassemble clutch in the reverse order of disassembly.

1940 and Earlier Models: Before installing and tightening clutch hub nut (9) turn nut (8) snug against flange on outer end of hub nut. Clutch hub nut and lock washer (7) can then be installed and nut securely tightened without compressing clutch springs further. After clutch hub nut has been securely tightened, lock it by upsetting edge of washer (7) into slot in spring collar (11).

1941 to 1947 Models: Be sure steel friction discs are assembled with sides stamped "OUT" facing outward. Also, splineways with anti-rattle devices should be staggered in clutch hub shell.

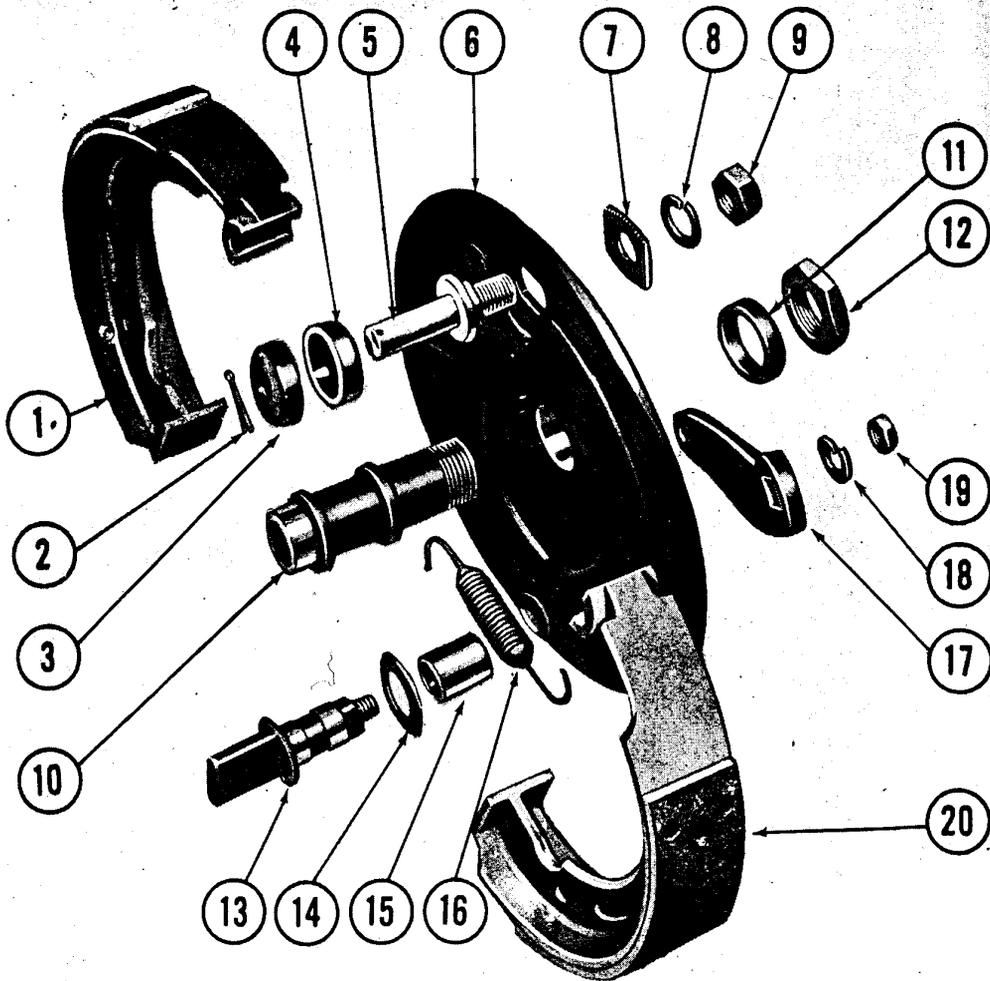
Be sure the three bearing plate retaining springs (29) are properly seated in their grooves in the three longer threaded studs (26). If springs are not seated in their grooves, or are placed on the short studs without grooves, clutch will not release properly.

All Models: After clutch has been reassembled, adjust clutch spring tension per instructions under "Adjusting Clutch Spring Tension," Page 16. With transmission installed in chassis, check and if necessary, readjust clutch control per instructions under "Checking and Adjusting Clutch Control," Page 15.

REAR WHEEL BRAKE ASSEMBLY

(Item Numbers Refer to Illus. 11)

ITEM	NUMBER USED	PART NUMBER	NAME
1	1	4039-38	Brake Shoe and Lining (rear shoe)
2	1	0292	Cotter Pin
3	1	4058-38B	Brake Shoe Cup (outside)
4	1	4058-38A	Brake Shoe Cup (inside)
5	1	4058-38	Brake Shoe Pivot Stud
6	1	4036-37	Brake Side Cover
7	1	4059-35	Brake Shoe Pivot Stud Plate
8	1	0270	Lock Washer
9	1	2634-30A	Brake Shoe Pivot Stud Nut
10	1	4008-36	Rear Axle Sleeve
11	1	3961-30	Rear Axle Sleeve Collar
12	1	3963-30	Rear Axle Sleeve Nut
13	1	4054-37	Brake Operating Shaft
14	1	4055-31	Brake Operating Shaft Spring Washer
15	1	4037-37	Brake Operating Shaft Bushing
16	1	4050-30	Brake Shoe Spring
17	1	4056-36	Brake Operating Lever
18	1	0262	Lock Washer
19	1	0129	Brake Operating Shaft Nut
20	1	4038-38	Brake Shoe and Lining (front shoe)



ILLUS. 11

REAR WHEEL BRAKE DISASSEMBLED

ADJUSTING BRAKES

Adjusting Front Wheel Brake

Loosen adjusting sleeve lock nut and turn adjusting sleeve as necessary to attain correct free movement of hand lever. After correct hand lever adjustment is made, tighten adjusting sleeve lock nut.

Properly adjusted, hand lever will move freely about one-quarter of its full movement before brake starts to take effect. Adjusted tighter brake may drag.

Keep brake control wire well oiled for easy operation.

Adjusting Rear Wheel Brake

Loosen clevis lock nut on brake rod. Remove clevis pin from end of rear brake rod clevis and turn clevis as necessary to attain correct adjust-

ment.

Correctly adjusted, brake will not take effect until pedal is pushed down about an inch. Brake should take full effect at least an inch before pedal bottoms. Turn rear wheel to make sure brake is not too tight and dragging.

Note: If motorcycle is equipped with sidecar, see "Adjusting Sidecar Wheel Brake," before adjusting rear wheel brake.

Adjusting Sidecar Wheel Brake

Disconnect sidecar brake rod (short rod) from brake shaft lever. Adjust rear wheel brake, see "Adjusting Rear Wheel Brake." After rear wheel brake has been correctly adjusted, adjust length of sidecar brake rod so when footpedal is operated, the rear brake starts to take effect slightly before sidecar wheel brake.

SERVICING BRAKES

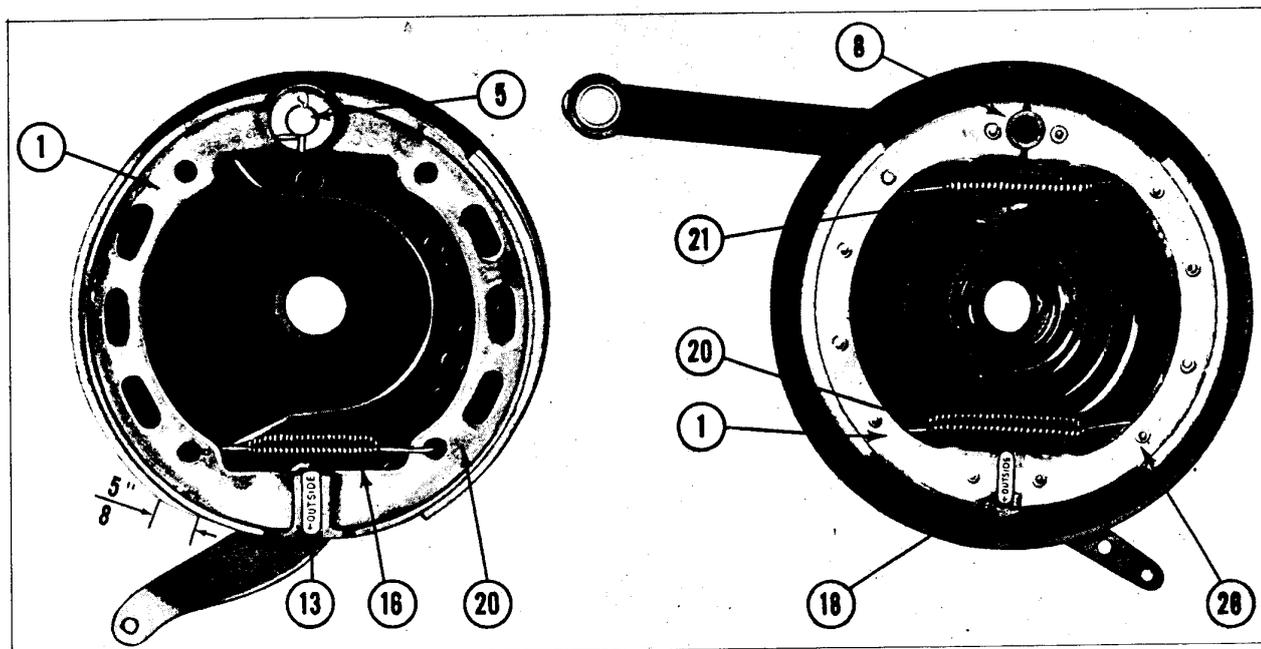
If a correctly adjusted brake does not function normally, new brake shoe linings and/or brake drum are usually needed, however, any worn or damaged parts that affect operation of brake must be renewed.

Remove wheel (see "Wheels, Hubs and Tires," Page 147).

To remove rear wheel brake shoes: (To identify items, refer to Illus. 11). Remove cotter pin (2) and brake shoe cup (3) from pivot stud (5). Pry brake shoes off pivot stud without removing shoe spring (16).

To remove front or sidecar wheel brake shoes: (To identify items, refer to Illus. 10). Place the end of a large screwdriver or other suitable tool between the ends of brake shoes at pivot stud (8) and pry ends of shoes off pivot stud without removing shoe springs (20) and (21). Shoe ends are registered in a groove in pivot stud.

Note: Sidecar wheel brake shoes, brake shoe springs, brake operating shaft and pivot stud, and the manner of assembling these items are the same as applies to "Front Wheel Brake Assembly," Illus. 10 and 12.



ILLUS. 12

FRONT AND REAR BRAKE ASSEMBLIES
(To Identify Items Refer to Illus. 10 and 11)

Relining brake shoes: Clean and inspect all parts. If brake shoes are cracked or otherwise damaged they must be replaced. Brake shoe linings worn down to rivet heads, or impregnated with grease as a result of overgreasing wheel hubs, must be renewed. New linings can be riveted to shoes, or new shoes and linings can be installed.

Linings are the same for both shoes of front and sidocar wheel brakes.

Linings for rear wheel brake are the same for both shoes as received on parts order, however, after lining has been riveted to rear shoe, it must be beveled at lower end for a distance of $\frac{3}{8}$ " as shown in Illus. 12. Rear shoe and lining assembly as received on parts order, has lining beveled at lower end.

When relining a shoe, start at one end and work to other end in order to make lining bear tightly

against shoe and not buckle in the middle. If a riveting machine is not available, set rivets with hand tools, making sure they draw lining tight against shoe.

After relining brake shoes, or fitting new brake shoes and linings, reassemble as shown in Illus. 12.

When installing brake operating shaft (13) or (18), be sure "arrow" points to outside as shown in Illus. 12.

Reinstall brake shoe springs (20) and (21) or (16) as shown in Illus. 12.

Install brake assembly and wheel in motorcycle, and loosen nut on pivot stud (5) or (8), Illus. 12. Apply brake hard and while holding it applied, tighten nut. This centers shoe assembly in brake drum. Adjust brake—see "Adjusting Brakes," Page 20.

ADJUSTING CARBURETOR

(To Identify Items, Refer to Illus. 108)

Before attempting to correct faulty engine performance, attention should be given other items which have a direct bearing on, and can affect carburetor adjustment as well as engine performance.

A. See that throttle and spark controls are correctly adjusted.

B. Remove drain screw from bowl of carburetor. Drain and flush bowl to eliminate dirt and water.

C. Drain and flush gasoline strainer.

D. Check air cleaner to be sure passage of air through cleaner is not restricted by an excessive accumulation of dirt in filter element.

E. Check manifold packing nuts and carburetor mounting screws for tightness.

F. See that spark plugs are clean and correctly adjusted. If condition of spark plugs is questionable, install new ones.

G. Check adjustment of valve tappets.

H. Check compression of both cylinders by operating starter pedal slowly.

I. Check condition and adjustment of circuit breaker contact points.

J. Check for poor or loose connections in wiring, particularly at battery terminals, switch terminals and circuit breaker condenser.

K. Check battery to be sure it is not nearly discharged.

L. Check for intermittent short circuit due to damaged wiring insulation.

M. Check gasoline tank cap to be sure air vent is not plugged.

A carburetor once properly adjusted requires little, if any, readjusting. At the most, it should not be necessary to adjust the needles more than one or two notches richer or leaner to correct mixture for a change in weather conditions.

Both needles (2) and (3) turn down (to right) to make mixture "leaner" at the respective speeds for which they adjust. Backing them out (to left) makes mixture "richer." Both needles are held in whatever positions they may be turned to, by a spring and ball plunger which drops into notches in the needle adjusting screw.

A carburetor that is badly out of adjustment may be readjusted as follows: First, make sure carburetor control wire is adjusted so throttle fully closes and opens with handlebar grip movement. Turn both the low and high speed needles all the way down (to right). Then, back up (to left) low speed needle (3) about 5 turns, and high speed needle (2) about 2 turns. With needles in these positions, engine will start, but mixture will probably be too rich. Start engine and after choke lever has been moved to "open" position and engine is normally hot, correct the adjustment of both needles.

Adjust for low speed first. Turn low speed needle down (to right) one notch at a time until mixture becomes so lean that engine misses and is inclined to stop; then back needle up five to ten notches, or until engine hits regularly with spark advanced and throttle closed or as nearly closed as it can be set and still have engine run at idling speed. Next, adjust throttle lever stop screw (6) as may be necessary to make engine idle at proper speed with throttle fully closed. Turning screw to right makes engine idle faster. Turning screw to left makes engine idle slower. Don't idle an engine at the slowest possible speed, because an extremely slow idling adjustment causes hard starting. Since changing idling speed with throttle stop screw is likely to change low speed mixture to some extent, it will be necessary to again check and correct low speed needle adjustment by the same procedure followed in making the initial adjustment.

Starting and all-around carburetion will be better with low speed adjustment slightly rich rather than as lean as it can be made.

PUSH ROD AND COVER ASSEMBLY (O.H.V. ENGINE)

(Item Numbers Refer to Illus. 15)

ITEM	NUMBER USED	PART NUMBER	NAME
1	1	131-36	Valve Push Rod
5	1	142-40	Push Rod Cover Keeper
6	3	145-36	Push Rod Cover Cork Washer (same as Items 11 and 13)
7	1	134-36	Upper Push Rod Cover
8	1	138-36	Cover Expander Sleeve
9	1	140-36	Push Rod Cover Spring
10	1	146-36	Push Rod Cover Steel Washer
11	See Item 6
12	1	135-40	Lower Push Rod Cover
13	See Item 6

Installing Push Rod Cover Cork Washers (O.H.V. Engine)

(To Identify Items, Refer to Illus. 13 and 15)

After tappets have been uncovered and inspection shows that any cork washers need renewing push rod and push rod cover assembly must first be removed.

1. Before attempting to remove push rod and cover assembly, turn engine until tappet is at its lowest position.
2. Turn adjusting screw lock nut (3) all the way up to end of thread on adjusting screw (2). Turn adjusting screw (2) all the way down into tappet body (4).
3. Remove push rod and cover assembly by prying push rod upward and to one side, but be careful not to bind push rod upper end in aluminum rocker arm housing, because doing so may result in a bent push rod.
4. Install cork washer (6) in aluminum rocker arm housing and cork washer (13) in tappet guide, being careful not to damage them and making sure they are well seated. Install cork washer (11) at upper end of lower push rod cover, as shown in Illus. 15.
5. Reassemble push rod and push rod cover assembly in reverse order of disassembly. See Illus. 14.
6. Readjust valve tappets—see "Adjusting Valve Tappets, (O.H.V. Engine)," Page 22.

Adjusting Valve Tappets (Side Valve Engine)

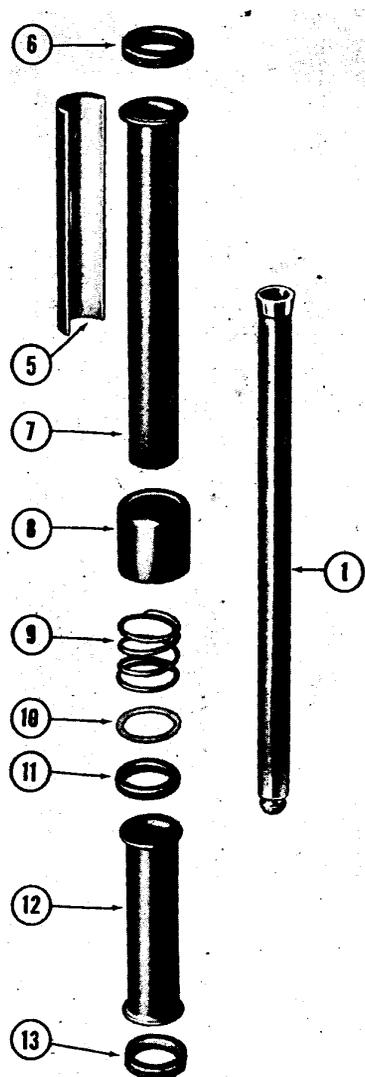
To get the maximum power and best all-around performance from an engine, keep valve tappets properly adjusted. They must be adjusted after grinding valves, and should be inspected and, if necessary, adjusted about every 1000 to 1500 miles thereafter.

The need of attention to tappet adjustment is indicated by excessive clicking and noise that develops with too much clearance between tappets and ends of valve stems.

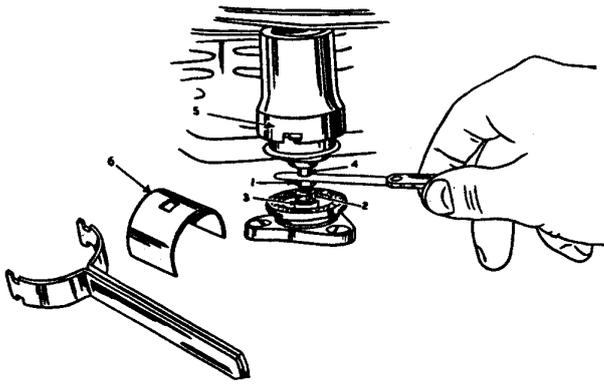
Engine must be cold.

To uncover tappets, first lift cover spring ring with Harley-Davidson special spanner, Part No. 11959-39 (one furnished in each tool kit), and latch it in slots in upper spring cover. Keeper can then be removed and lower cover telescoped into upper cover.

As each tappet is adjusted, first make sure it is at its lowest position, by turning engine ahead until the like tappet in the other cylinder is at its highest position (valve fully open).



ILLUS. 15
PUSH ROD COVER DISASSEMBLED



ILLUS. 16
ADJUSTING VALVE TAPPETS (SIDE VALVE ENGINE)

1. Tappet adjusting screw—with which adjustment is made, after slightly loosening nut (2).
2. Tappet adjusting screw lock nut.
3. Tappet Body.
4. Valve stem.
5. Valve spring upper cover.
6. Valve spring cover keeper.

The intake valves are those nearest the carburetor.

Adjust tappets so that there is .004" to .005" clearance between intake valve stems and tappets, and .007" to .008" clearance between exhaust valve stems and tappets. An accurate thickness gauge should be used to measure these clearances. If no gauge is available, use one thickness of ordinary writing paper to gauge intake tappet clearance, and two thicknesses of the same paper to gauge exhaust tappet clearance.

Before replacing valve spring covers, inspect the cork washer between each lower cover and tappet guide. If broken or damaged, install a new washer to prevent an oil leak. Also, make sure spring covers are properly seated against cork washers. Otherwise, serious oil leakage will result.

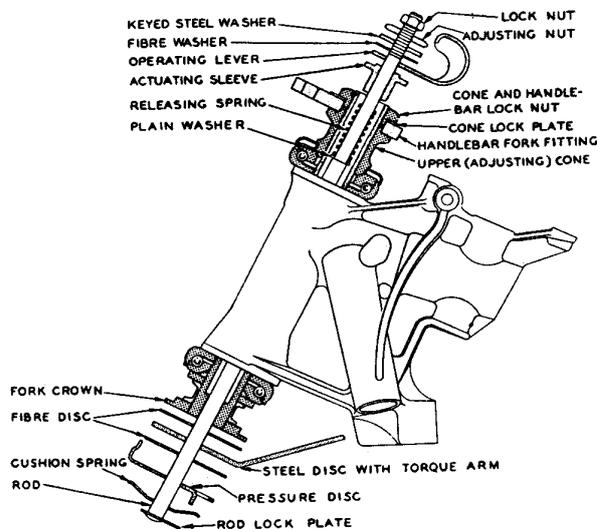
STEERING DAMPER

Steering damper applies steering friction to steady front wheel and prevents wobble in rough going and at higher speeds. For all normal service, keep handle in left side (free) position; move handle to right to apply desired friction.

Assemble in the order shown in Illus. 17. Be sure torque arm engages properly with frame head. Lips on pressure disc must fit into slot in fork crown and slot in rod lock plate. Turn actuating sleeve down and then back it up $\frac{1}{2}$ turn or slightly more. Install

operating lever with handle extending to rear and see if actuating sleeve bottoms when handle is moved to left side position 90° from rear position. If actuating sleeve does bottom remove operating lever and back sleeve up another $\frac{1}{2}$ turn.

Adjust by setting adjusting nut so that operating lever must be moved nearly straight back from free (left side) position, before damper takes noticeable effect. Tighten lock nut.



ILLUS. 17
STEERING DAMPER ASSEMBLY

SERVICING HANDLEBAR CONTROLS

(To Identify Items, Refer to Illus. 19)

To lubricate control parts, or to replace a throttle or spark control wire, or a damaged control wire housing, proceed as follows:

Disconnect control wire at carburetor or circuit breaker. Insert a large heavy screw driver through hole in end of grip as shown in Illus. 18 and turn out end screw (A) by using a wrench on screwdriver. Sometimes this screw is difficult to remove. In this case, insert a punch in slot in screw and strike it two or three sharp blows to start it. After removing grip sleeve assembly (C), working parts are accessible. Remove roller (E), roller block (F), and roller pin (D). Plunger (G), with control wire (H) attached, can now be pulled out of handlebar end. If wire is broken, remove other half from housing at connection end. Wire is fastened into end of plunger by means of a hexagon head screw (I) with a hole through it.

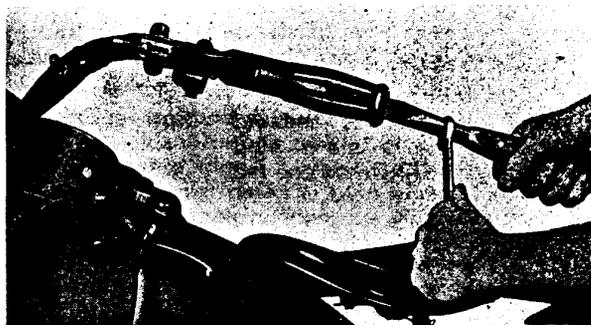
Remove any rust, dirt or gum from grip spiral, handlebar end, wire plunger, and inside of handlebar where plunger operates.

If control wire housing is to be removed, first remove grip control parts as explained above. Then, remove the small lock screw underneath handlebar, just ahead of spiral locating shoulder on bar (on left bar, this screw is under headlamp dimmer switch). After lock screw is removed and housing freed from housing clamp or clamps, it can be pushed out through end of handlebar.

When installing control wire housing, see that housing end is secured in handlebar with lock screw (screw must register in groove in control coil plug) and that housing is secured with clamp or clamps.

When reassembling control parts to handlebars, apply a light coat of grease or a few drops of engine oil to control wire as it is inserted into control housing, and lubricate remaining parts with grease (see "Lubrication Chart," Page 9). Overgreasing of these parts will cause a messy condition.

End screw (A) can best be started, without danger of crossing threads, by holding grip sleeve assembly



ILLUS. 18
REMOVING HANDLEBAR GRIP SLEEVE ASSEMBLY

(C) back with slight pressure against screw while starting screw in handlebar end. This squares screw with end of grip sleeve, aligning threads. Always tighten screw securely.

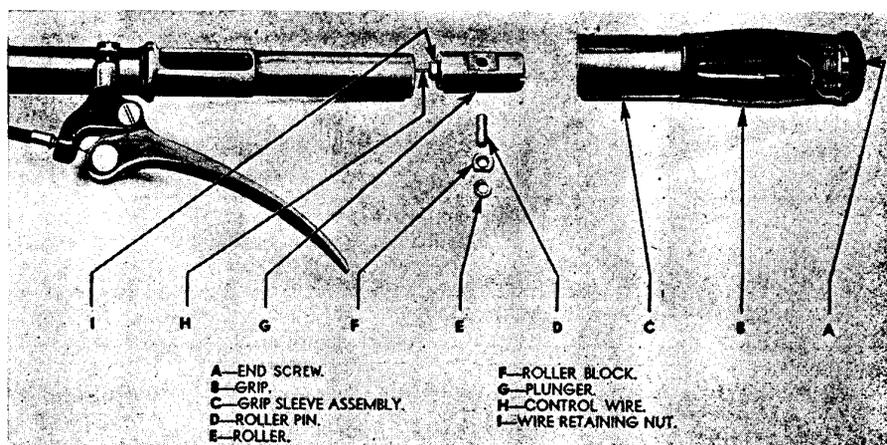
After throttle and/or spark controls are completely assembled, connect control wire at carburetor and/or circuit breaker.

Adjust throttle control so throttle closes and opens fully with throttle control grip movement. There should be about 1" to 1½" between end of throttle control wire housing and throttle lever when lever is in fully closed (forward) position.

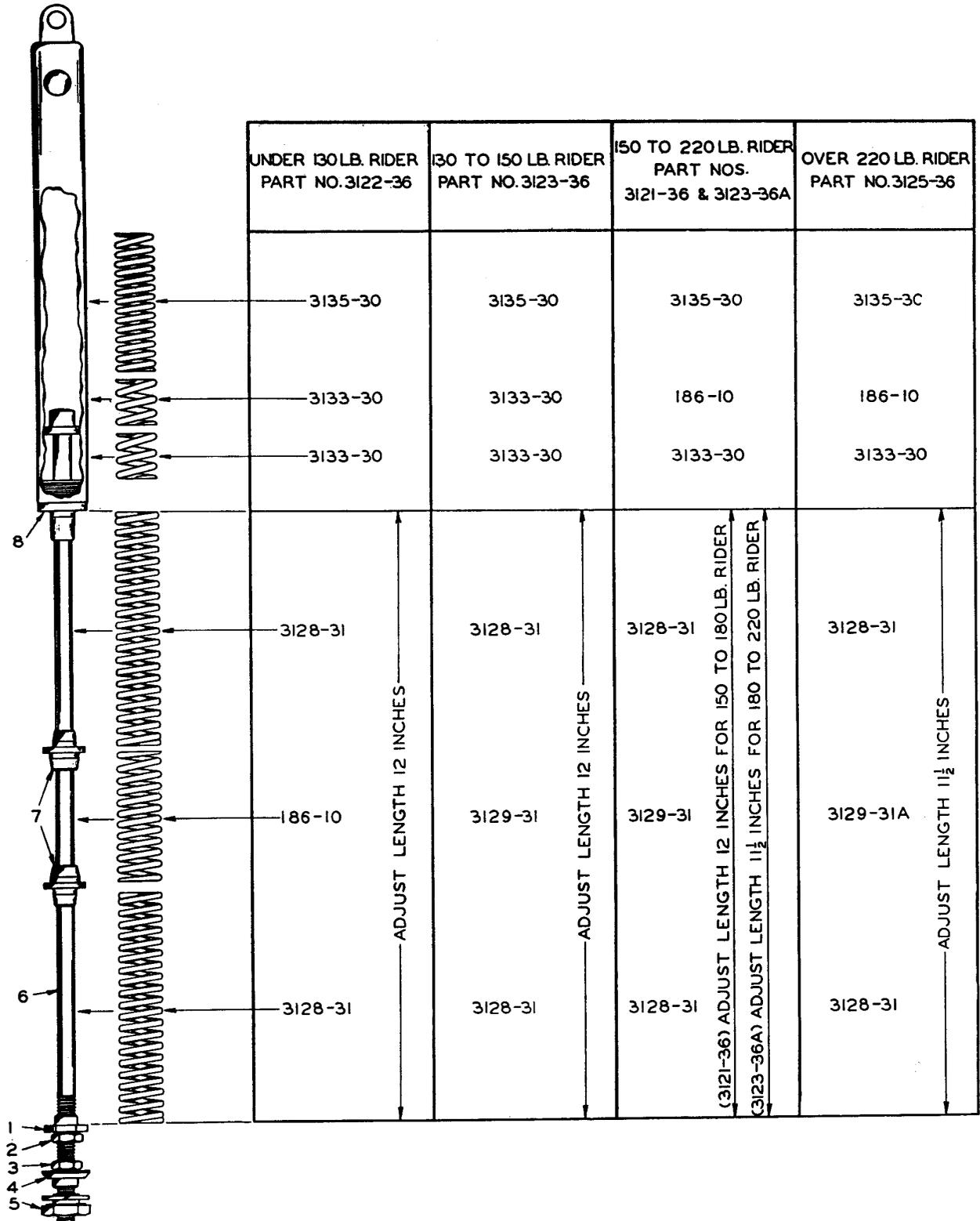
With circuit breaker in fully advanced position, be sure end of spark control wire points directly to hole (in which it is to be secured) in advance and retard lever—1946 and Earlier Models; or timing adjusting stud—1947 Models.

O.H.V. Models: Allow about ½" of spark control wire housing to extend beyond clamp. Side Valve Models: allow about 2" of spark control wire housing to extend beyond clamp.

All Models: Adjust spark control wire so circuit breaker advances and retards fully with spark control grip movement.



ILLUS. 19
CONTROL GRIP DISASSEMBLED



ILLUS. 20
 SPRING SADDLE POST ASSEMBLY
 Standard Assembly (150 to 180 lb. Rider) Par. No. 3121-36.

ADJUSTING OIL FEED PUMP

Standard factory setting of maximum pressure adjusting screw is as follows:

1940 O.H.V. Model: (To identify item (14), refer to Illus. 56). End of adjusting screw (14) $\frac{3}{8}$ " from outer end of valve chamber. Average maximum oil pressure at this setting is about 15 lbs.

1941 to 1947 O.H.V. Models: (To identify item (14), refer to Illus. 56). End of adjusting screw (14) $\frac{3}{8}$ " from outer end of valve chamber. Average maximum oil pressure at this setting is about 30 lbs.

1940 and earlier Side Valve Models: (To identify item (2), refer to Illus. 57.) Adjusting screw (2), nine full turns open. Turn adjusting screw all the way down until it bottoms lightly against valve. Don't force it. Then back up screw nine full turns. Average maximum oil pressure at this setting is about 20 lbs.

1941 to 1947 Side Valve Models: (To identify item (2), refer to Illus. 57). End of adjusting screw (2) $\frac{3}{8}$ " below top of pump body. Average maximum oil pressure at this setting is about 35 lbs.

All Models: Turning adjusting screw to right increases oil pressure; turning adjusting screw to left decreases oil pressure.

Note: Maximum oil pressure varies considerably with hot or cold oil.

REMOVING AND INSTALLING OIL PUMP WITH ENGINE INSTALLED IN CHASSIS (O.H.V. Engine)

(To Identify Items, Refer to Illus. 56)

Removing Oil Pump

1. Remove stop lamp switch and oil pressure switch. Remove oil return pipe. Remove oil feed pipe and install nipple cap, Part No. 3583-15 on oil tank feed pipe nipple to prevent oil from running out, or drain tank.
2. **1940 Model pump** is secured to crankcase by six nuts—after removing the six nuts, remove pump cover and gasket; **1941 and later Model pump** is secured by one cap screw, one flat head screw and five nuts, one of the nuts is extra long to provide wrench clearance and its location should be noted, so it will be put back on same stud when reinstalling pump—after removing nuts and screws, remove pump cover (29), governor rotor (28), cover plate (26) and gaskets (25) and (27).

All O.H.V. Models: Unless new gaskets are available, be very careful not to damage or break the old ones. These are special gaskets as concerns both thickness and holes for oil passages. It is not advisable to attempt to replace them with "home-made" gaskets. Leaving out a hole or getting one in the wrong location is enough to put the entire oiling system out of commission. When

new gaskets are needed, they should be replaced with "factory-made" gaskets.

3. Place a small piece of rag or paper in feed oil hole in bottom of pump body to prevent gear key dropping into hole should it fall out of drive shaft when removing scavenger pump gear (23). Remove lock ring (24) from groove in outer end of shaft and slide gear off shaft. Remove key (21) from drive shaft. Pump body can now be pulled off studs.

Remove feed pump idler gear (5) if it did not come off with pump body.

Slide feed pump gear (6) off shaft and remove key from shaft—occasionally gear will come off with pump body, in which case be careful key is not lost. After gear and key have been removed from shaft, be sure shaft is pulled outward to its limit. If shaft is pushed inward approximately $\frac{3}{8}$ ", key in end of shaft inside gear case may drop out and gear case cover would then have to be removed to install key. See "Servicing Oil Pump (O.H.V. Engine)," Pages 71 and 72.

Installing Oil Pump

1. Be sure all moving parts of oil pump are thoroughly oiled. Clean surface of pump body mounting on crankcase. See that pump body gasket is in good condition, and install it over pump mounting studs. Clean face of oil pump body.
2. Install smaller of the two keys in drive shaft keyway (nearest crankcase) and install feed pump gear (6) so keyway registers with key. Install feed pump idler gear (5) with hub of gear registering in hole counterbored in crankcase.
3. Install pump body making sure the small piece of rag or paper put in oil feed hole in bottom of pump body when removing pump, is still in place to prevent possibility of key dropping into hole should it fall out of shaft when installing scavenger pump gear. Make sure feed pump gear (6) is snug against crankcase when installing pump body, to prevent possibility of key dropping out of shaft.

1941 and later Model Pump: Install flat head screw that secures pump body to crankcase.

4. **All O.H.V. Model Pumps:** Install larger of the two keys in drive shaft keyway (near outer end) and install scavenger pump gear (23) so keyway registers with key. Install new lock ring in groove at outer end of shaft to retain gear. Install scavenger pump idler gear (22).

CAUTION: AFTER GEARS HAVE BEEN INSTALLED BE SURE TO REMOVE CLOTH OR PAPER FROM FEED OIL HOLE IN PUMP BODY.

1940 Model Pump: Install cover gasket, cover, nuts and washers. **1941 and later Model Pump:** Install gasket, cover plate, gasket, governor rotor, cover, nuts, cap screw and washers. Make sure driving tongue on rotor (28) registers in slot in scavenger pump idler gear (22).

5. Tighten cap screw and/or nuts securely.
6. Install oil return pipe (connecting lower end of pipe to pump upper nipple). Install oil feed pipe (connecting lower end of pipe to pump lower nipple) and tighten nipple nuts securely.
7. Install oil pressure switch and stop lamp switch.

REMOVING AND INSTALLING OIL FEED PUMP WITH ENGINE INSTALLED IN CHASSIS

(Side Valve Engine)

(To Identify Items, Refer to Illus. 57—Also Refer to Illus. 21)

Removing Oil Pump

1. Remove oil feed pipe and install nipple cap, Part No. 3583-15, on oil tank feed pipe nipple to prevent oil from running out, or drain tank. Disconnect oil feed pipe from oil pump nipple.
2. Oil pump is secured to engine gear case cover by one cap screw (11) and three nuts (9, 12 and 13). Two of the nuts are extra long to provide wrench clearance, and their location should be noted so they will be put back on same studs when reinstalling pump. After removing screw and nuts, remove pump.

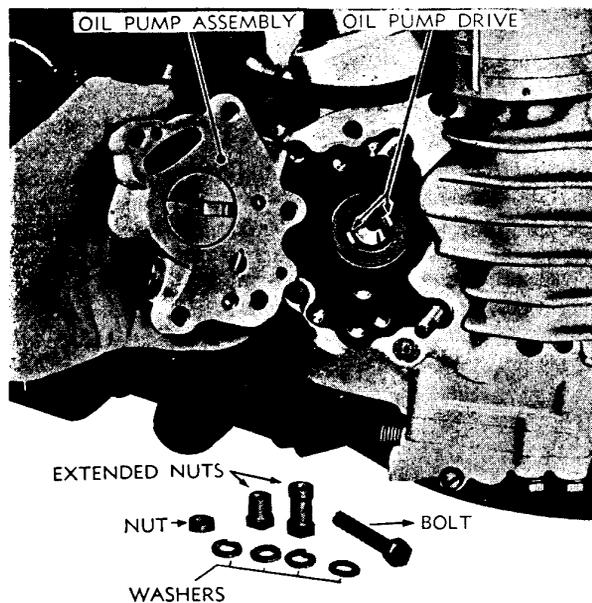
Unless a new gasket (21) is available be careful not to damage or break the old one. This is

a special gasket as concerns both thickness and holes for oil passages. It is not advisable to replace it with a "home-made" gasket. Leaving out a hole or getting one in the wrong location is enough to put the entire oiling system completely out of commission. When a new gasket is needed it should be replaced with "factory-made" gasket.

See "Servicing Oil Feed Pump (Side Valve Engine)," Pages 72 and 73.

Installing Oil Pump

1. Be sure all moving parts of oil pump are thoroughly oiled. Clean surface of pump body mounting on gear case cover. See that gasket is in good condition, and install it over pump mounting studs. Clean face of pump body.
2. Start pump on mounting studs, turn engine slowly and press lightly against pump until driving dogs on end of cam gear shaft line up with and drop into driving slot in oil pump rotor (17).
3. Install cap screw and lock washer, and install the three lock washers and nuts (two are extension nuts) on pump mounting studs. Make sure to replace the two extension nuts on the studs from which they were originally removed.
4. Tighten cap screw and three nuts securely.
5. Install oil feed pipe and tighten nipple nuts securely.



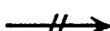
ILLUS. 21
OIL PUMP REMOVED (SIDE VALVE ENGINE)

LEGEND FOR ILLUS. 22 AND 23— O.H.V. ENGINE OILING AND BREATHER SYSTEM

- A. Feed section of oil pump.
- B. Check valve.
- C. Maximum oil pressure regulating valve.
- D. Governor rotor with centrifugal valve which controls oil pressure at low and intermediate speeds.
- E. Front chain oiler adjusting screw.
- F. Scavenge section of oil pump.
- G. Pinion gear shaft through which oil is forced to connecting rod lower bearings, from which it splashes to cylinder walls, pistons, main bearings, etc.
- H. Timed "Rotary" crankcase breather valve. Rotary breather valve is timed to open on downward stroke of pistons, allowing crankcase exhaust air to expel scavenge oil from crankcase into timing gear case. This interval is indicated by arrows . During this interval, the two small ports in breather valve are closed. Rotary breather valve closes on upward stroke of pistons, creating vacuum in crankcase. During this interval both small ports in breather valve line up with passages in crankcase. Oil is then retrieved by vacuum from outside breather oil trap (J) in crankcase, and valve spring covers as indicated by arrows .

J. Outside breather oil trap.

K. Crankcase oil scavenging sump.

-  Feed oil from tank to engine. Oil is forced through passages as indicated, to connecting rod lower bearings, and through passages and pipe to rocker arms, push rods, and valve stems.
-  Scavenge oil (return oil) from engine to oil tank. Oil is pumped from engine through passages as indicated.
-  By-pass oil. Surplus oil over and above the volume required to attain the pressure to which pump is adjusted, escapes past

pressure regulating valve (C) and, flowing through passage indicated, discharges directly into timing gear case where it lubricates timing gears, and then settles into scavenger pump sump from which it is returned to tank.

 Oil retrieved by vacuum. As oil accumulates in valve spring covers and outside breather oil trap (J) in crankcase, it is retrieved by crankcase vacuum through passages and push rod covers as indicated.

 Scavenge oil and crankcase exhaust air from crankcase sump (K). Exhaust air expels scavenge oil from crankcase, through rotary breather valve (H), into timing gear case where the oil settles into scavenger pump sump and is returned to tank.

 Crankcase exhaust air. Escapes from timing gear case through outside breather passage, which terminates in front chain guard. Any oil still carried by exhaust air is trapped in outside breather oil trap (J) and retrieved by vacuum.

 Front chain oil. Oil is bled from by-pass oil for front chain lubrication, through passages indicated which terminate in outside breather passage. Exhaust air delivers oil to chain. Oil is regulated by adjusting screw (E).

Note: Oil to rocker arms and valve stems is metered through a fixed orifice in each rocker arm shaft and no adjustment for more or less oil is provided.

CAUTION: Since oil supplied to overhead fittings is sucked back into crankcase through push rod covers by crankcase vacuum, it is essential that push rod covers and rocker arm housings be well sealed to maintain maximum vacuum and prevent oil leakage. When reassembling push rod covers, make sure that both ends of covers are properly seated against cork washers.