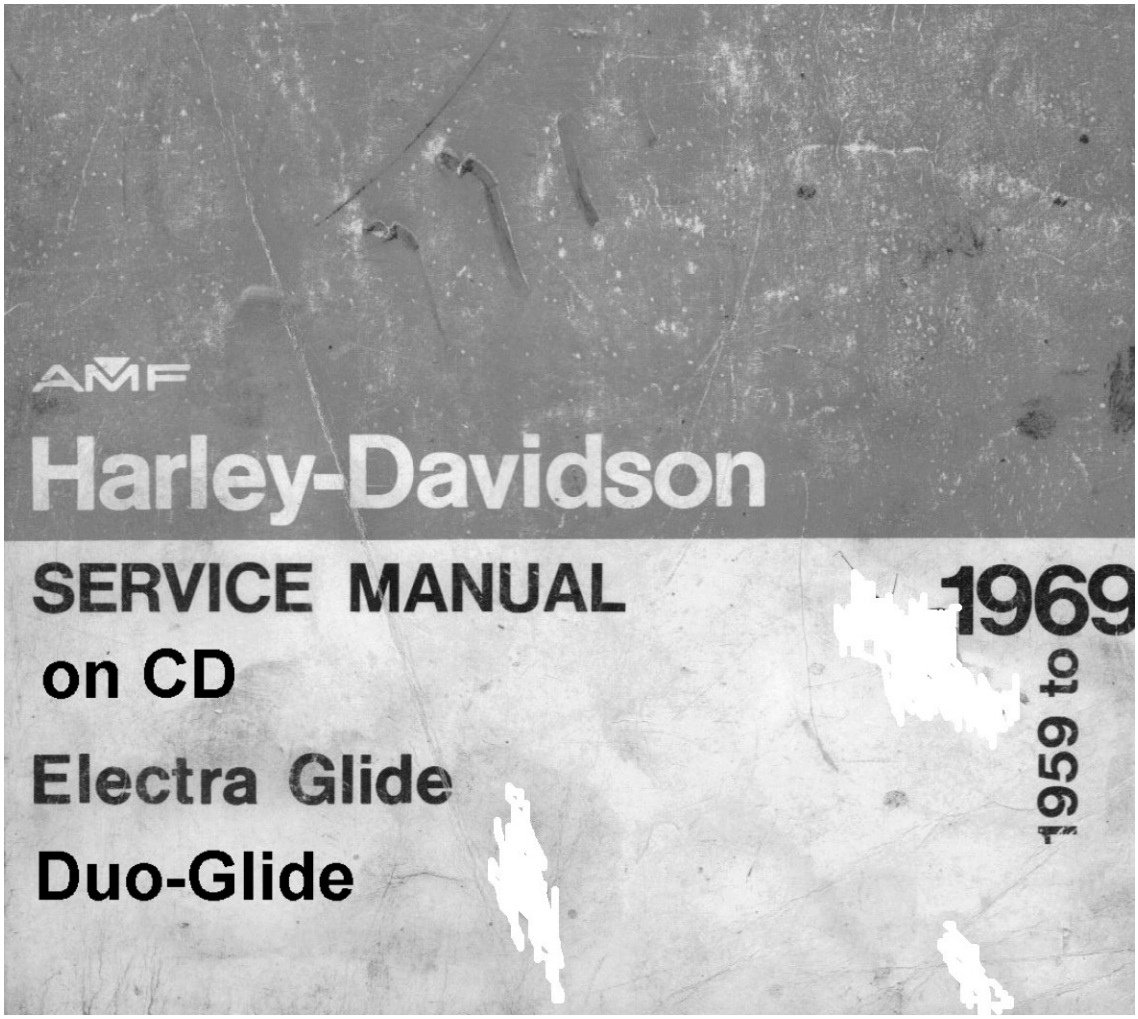
AMF
Harley-Davidson
SERVICE MANUAL
1969
1959 to
on CD
Electra Glide
Duo-Glide

# FOREWORD

This service and repair manual has been prepared with two purposes in mind. First, it will acquaint the reader with the construction of the Harley-Davidson product and assist him in performing basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson mechanic the latest field-tested and factory-approved major repair methods. We sincerely believe that this manual will make your association with Harley-Davidson products more pleasant and profitable.

## HOW TO USE YOUR SERVICE MANUAL

Your Service Manual is arranged for quick, easy reference. This manual is divided into numbered sections entitled "Chassis," "Engine" and "Transmission." Sections are then divided into sub-sections. The Engine Section, for example, is comprised of "Cylinder" and "Crankcase" sub-sections.

Use this manual as follows:

1. Check the Table of Contents located in the front of each section to find subject desired.
2. Page number is listed across from subject.
3. Each section is printed with section number for quick general location of subject. Page number consists of section number and sub-section letter and sub-section page number.
4. Information is presented in a definite order as follows:

   Minor adjustments
   Minor maintenance or repair
   Complete disassembly
   Cleaning
   Major maintenance or repair
   Assembly

In figure legends the number following a name of a part indicates the quantity necessary for one complete assembly.

All information or servicing a part should be read before repair work is started to avoid needless disassembly.

## USE GENUINE REPLACEMENT PARTS

To insure a satisfactory and lasting repair job, follow the manual instructions carefully and use only genuine Harley-Davidson replacement parts.

This is your insurance that the parts you are using will fit right, operate properly and last longer. When you use genuine Harley-Davidson parts you use the best.

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Revised: 3-68

# TABLE OF CONTENTS (CONT)

# 1959 to 1969 ELECTRA GLIDE DUO-GLIDE SERVICE MANUAL



*The maintenance and repair information in this manual applies to the 1959 to 1969 Harley-Davidson Duo-Glides and Electra Glides*


PART NO. 99482-69

Printed in U.S.A.

# PRODUCT 1

## TABLE OF CONTENTS

# GENERAL

## SPECIFICATIONS

DIMENSIONS

| | |
|---|---|
| Wheel Base | 60 in. |
| Overall Length | 92 in. |
| Overall Width | 35 in. |

CAPACITIES

| | |
|---|---|
| Fuel Tanks | 3-1/2 Gallons (U.S.)<br>5 Gallons (U.S.) (1965 and later) |
| Oil Tank | 1 Gallon (U.S.) |
| Transmission | 1-1/2 Pints |

ENGINE

| | |
|---|---|
| Model Designation Letters | FL - FLH |
| Number of Cylinders | 2 |
| Type | 45 Degree V Type |
| Horsepower FLH | 66.0 HP at 5,600 R.P.M. |
| FL | 57.0 HP at 5,200 R.P.M. |
| Taxable Horsepower | 9.44 |
| Bore | (87.3mm) 3-7/16 in. |
| Stroke | (100.8mm) 3-31/32 in. |
| Piston Displacement | (1,207 cc) 73.66 cu. in. |
| Torque FLH | 65 lb-ft at 3,200 R.P.M. |
| FL | 62 lb-ft at 3,200 R.P.M. |
| Compression Ratio FLH | 8 to 1 |
| FL | 7.25 to 1 |
| Spark Plug (Heat range for average use) | No. 3-4 |

NOTE: The engine (serial number is stamped on the left side of the engine crankcase. Always give this number when ordering parts or making an inquiry.

TRANSMISSION

| | |
|---|---|
| Type | Constant Mesh |
| Speeds - Foot Shift | 4 Forward |
| Hand Shift | 4 Forward |
| | (Optional) 3 Forward and 1 Reverse |

SPROCKETS AND GEAR RATIOS

| SPROCKET TEETH ALL MODELS | 4 SPEED TRANSMISSION | | | 3 SPEED TRANSMISSION | | | |
|---|---|---|---|---|---|---|---|
| Clutch . . . . . 37<br>Transmission . . 22<br>Rear Wheel . . . 51 | SOLO | | SIDECAR | SOLO | | SIDECAR | |
| | FL | FLH | FL and FLH | FL | FLH | FL | FLH |
| Engine Sprocket | 23 | 24 | 21<br>22 (1965 and later) | 23 | 24 | 19 | 21<br>22 (1965 and later) |
| High Gear Ratio | 3.73 | 3.57 | 4.08<br>3.90 (1965 and later) | 3.73 | 3.57 | 4.50 | 4.08<br>3.90 (1965 and later) |

TIRE DATA

| TIRE SIZE | | TIRE PRESSURE - POUNDS | | |
|---|---|---|---|---|
| | | FRONT | REAR | SIDECAR |
| SOLO RIDER | 5.10 x 16<br>5.00 x 16 | 20<br>12 | 24<br>18 | |
| RIDER AND ONE PASSENGER | 5.10 x 16<br>5.00 x 16 | 20<br>12 | 26<br>20 | |
| RIDER AND ONE SIDECAR PASSENGER OR 150 LB. LOAD | 5.10 x 16<br>5.00 x 16 | 22<br>14 | 26<br>20 | 20<br>14 |

Above tire inflation pressures are based on rider and passenger weights of approximately 150 lbs. each. For each 50 lbs. extra weight, increase pressure of rear tire 2 lbs., front tire 1 lb., and sidecar tire 1 lb. IMPORTANT: Above tires supplied as original equipment are identified on the sidewall as follows: Goodyear 5.10 x 16 Speed Grip and Goodyear 5.00 x 16 Super Eagle 100. These tires are of special design to provide maximum roadability, and should be used exclusively for replacement. CAUTION: Use only 5.00/5.10 x 16 inner tubes with 5.10 x 16 size tires — 5.00 x 16 tube does not fit correctly.

# SERVICE

## SERVICING A NEW MOTORCYCLE

PREDELIVERY

Service operations to be performed before delivery to customer are specified in the Setting Up Instructions and Important Instructions included with new vehicle.

CHECK AT FIRST 500 MILES

1. Drain oil tank through drain plug, flush with kerosene and refill with fresh oil.
2. Clean oil filter (if applicable). Clean overhead valve and tappet oil supply screen.
3. Drain transmission through drain plug and refill to level of filler opening with fresh oil. Use same grade oil used in engine.
4. Lubricate all points indicated for 2000 mile attention in the regular service intervals chart.
5. Aim headlight.
6. Inspect and service air cleaner if needed.
7. Check adjustment of chains and readjust if necessary.
8. Check lubrication of front chain and readjust chain oiler adjusting screw if necessary (1964 and earlier Models).
9. Check lubrication of rear chain and readjust chain oiler (if provided).
10. Check wheel mounting bolts and tighten if needed. These bolts must be kept very tight.
11. Check level of solution in battery and add distilled water if needed. See that terminals are clean and connections tight.
12. Check tightness of all cylinder head bolts and all cylinder base nuts, and tighten where necessary.
13. Check brake adjustment and hydraulic fluid level.
14. Check tire pressure and inspect tread.
15. Check front fork bearing adjustment.
16. Clean carburetor gas strainer.
17. Clean chain housing magnetic plug (if applicable).
18. Inspect and clean spark plugs.
19. Check ignition timing and circuit breaker point gap.
20. Check all nuts, bolts and screws, and tighten any found loose.
21. Check and tighten wheel spokes.
22. Check clutch adjustment.
23. Road test.

CHECK AT FIRST 1000 MILES

1. Drain oil tank and refill with fresh oil.
2. Clean oil filter (if applicable).
3. Check level of oil in transmission and add oil if needed. Use same grade of oil used in engine.
4. Service air cleaner.
5. Check adjustment of chains and adjust if necessary.
6. Check lubrication of front chain and readjust chain oiler adjusting screw if necessary (1964 and earlier Models).
7. Check lubrication of rear chain and readjust chain oiler (if provided).
8. Check level of solution in battery, and add distilled water if needed. See that terminals are clean and connections tight.
9. Check circuit breaker point clearance and adjust if necessary.
10. Check brake adjustment and hydraulic fluid level.
11. Check clutch adjustment.
12. Check tire pressure.
13. Road Test.

Above operations are described fully in section pertaining to particular part of motorcycle. See table of contents for location.

## REGULAR SERVICE

The following chart outlines recommended Maintenance and Lubrication intervals after performance of service on a new motorcycle and the initial break-in period. Refer to Figure 1B-1 when using the chart.

IMPORTANT: To prevent over-greasing, use hand grease gun on all grease fittings.

REGULAR SERVICE INTERVALS CHART

| REGULAR SERVICE INTERVAL | FIG. 1B-1 & 1B-1A INDEX NO. | GREASE | FIG. 1B-1 & 1B-1A INDEX NO. | OIL | FIG. 1B-1 & 1B-1A INDEX NO. | SERVICE |
|---|---|---|---|---|---|---|
| EVERY 1,000 MILES | | | 14 | Rear Chain (if chain oiler not used) | 24 | Air Cleaner |
| | | | | | 25 | Battery |
| | | | | | 26 | Rear Chain Adjustment |
| | | | | | 33 | Hydraulic Brake Fluid |
| EVERY 2,000 MILES | 10 | Saddle Post | 15 | Clutch Hand Lever | 27 | Oil Filter |
| | 9 | Saddle Bar Bearing | 5 | Brake Hand Lever | 28 | Fuel Strainer |
| | 8 | Rear Brake Pedal Bearing | 23 | Clutch Control Cable | 29 | Tappet Oil Screen (if applicable) |
| | | | 20 | Front Brake Cable | | |
| | 11 | Foot Shift Lever Bearing | 7 | Throttle Control Cable | 34 | Front Chain Adjustment (1965 and later) |
| | 1 | Hand Clutch Booster Bearing | 12 | Spark Control Cable (1964 and earlier) | 30 | Front Chain Oiler |
| | 17 | Front Wheel Hub Thrust Bearing (1966 & earlier) | 21 | Clutch Booster Lever Rod Clevis (1967 and earlier) | 31 | Rear Chain Oiler |
| | | | | | | Circuit Breaker Points |
| | 18 | Rear Wheel Hub Thrust Bearing (1966 & earlier) | | Shifter Control Joints | | Clutch Adjustment |
| | | | 4 | Generator Bearing (1960 and earlier) | | Brake Adjustment |
| | | Foot Clutch Pedal Bearing | 19 | Saddle Post Roller and Bolt | | |
| | 22A | Rear Fork Pivot Bearing (1962 Model) | | | | |
| EVERY 5,000 MILES OR 1 YEAR (whichever comes first) | 7 | Throttle Control Spiral | | | | Replace: |
| | | | | | 32 | Spark Plugs |
| | 6 | Spark Control Spiral (1964 and earlier) | | | 27 | Oil Filter Element |
| | | | | | 31 | Time Ignition |
| | 2 | Front Wheel Hub (Center) (1966 and earlier) | | | | Switch Tires |
| | | | | | 4 | Check Generator Brushes |
| | 13 | Rear Wheel Hub (Center) (1966 and earlier) | | | 35 | Check Shock Rubber Bushings |
| | | Sidecar Wheel Hub (Center) (1966 and earlier) | | | | |
| | 16 | Compensating Engine Sprocket (1964 and earlier) | | | | |
| | 31 | Circuit Breaker Camshaft | | | | |
| | | Speedometer and Tachometer Cables | | | | |

REGULAR SERVICE INTERVALS CHART (CONT)

| REGULAR SERVICE INTERVAL | FIG. 1B-1 & 1B-1A INDEX NO. | GREASE | FIG. 1B-1 & 1B-1A INDEX NO. | OIL | FIG. 1B-1 & 1B-1A INDEX NO. | SERVICE |
|---|---|---|---|---|---|---|
| EVERY 10,000 MILES | 22<br>4 | Repack Rear Fork Pivot Bearings (1959 to 1961 Models)<br>Generator Bearing (1961 and later) | | | | |
| EVERY 50,000 MILES | 3 | Repack Steering Head Bearings | | | | |
| WEEKLY | | | | | | Check Tires<br>Check Battery |

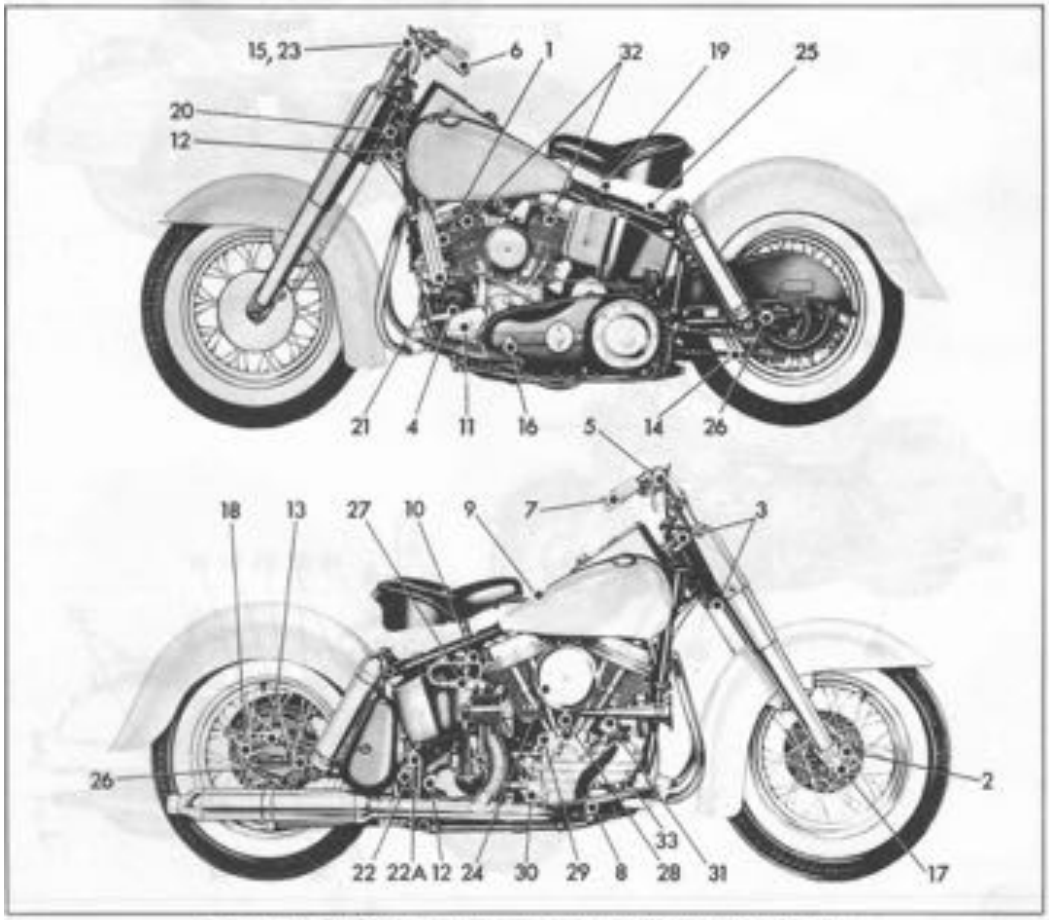



Figure 1B-1A. Lubrication and Service Chart (1964 & earlier Models)

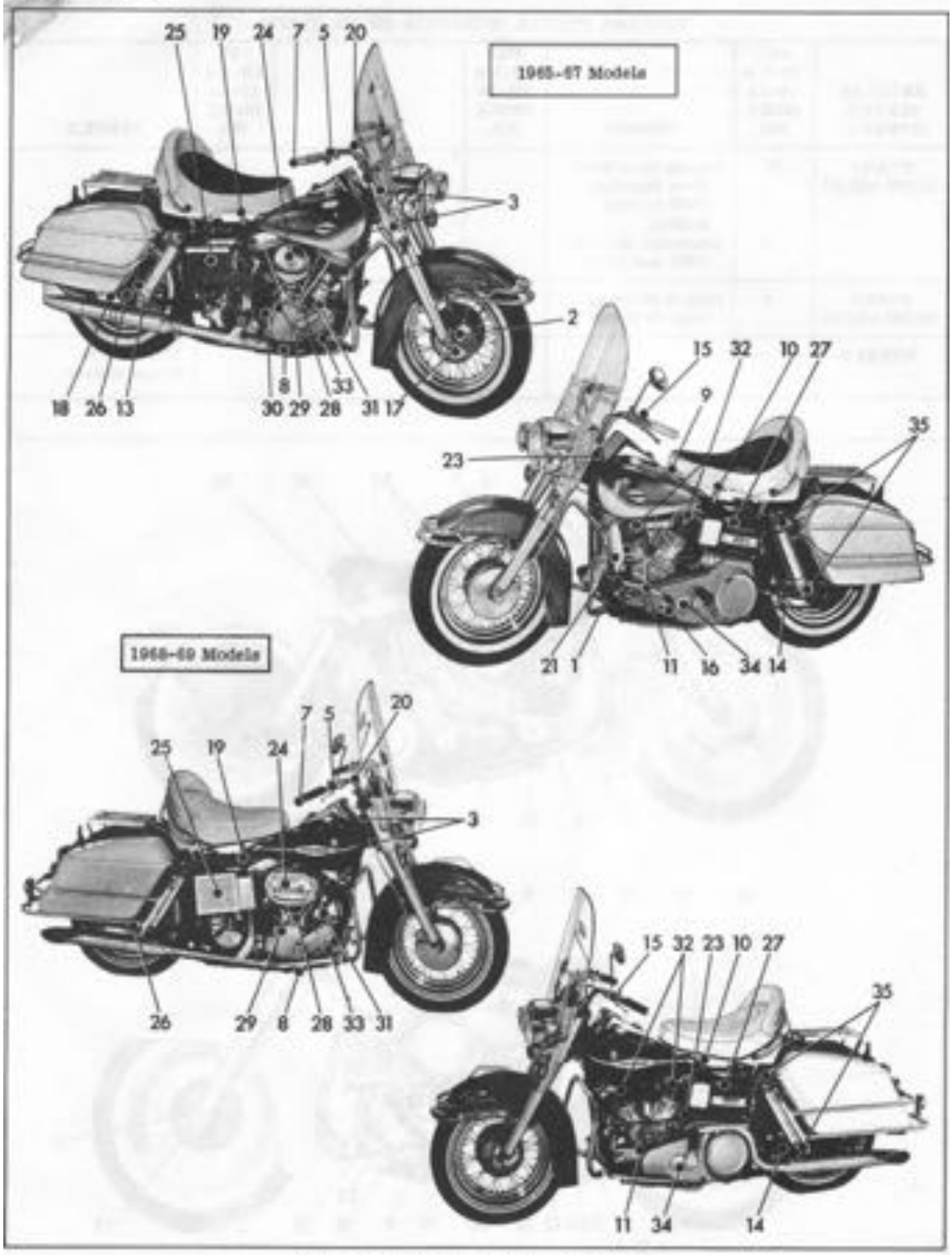



Figure 1B-1. Lubrication and Service Chart

SERVICE INTERVAL ENGINE AND TRANSMISSION

| | 300 MILES | 1,000 MILES | 2,000 MILES | 5,000 MILES or 1 YEAR | SPRING AND FALL |
|---|---|---|---|---|---|
| ENGINE OIL | Check | Check | Change | | Change |
| TRANSMISSION OIL | | Check | | Change | Change |

LUBRICANTS TO USE
ENGINE AND TRANSMISSION

HARLEY-DAVIDSON OIL

Use proper grade of oil for the lowest temperature expected before next oil change period as follows:

| Use Harley-Davidson Oil | Use Grade | Air Temperature (Cold Engine Starting Conditions) |
|---|---|---|
| Medium Heavy | 75 | Above 40°F. |
| Special Light | 58 | Below 40°F. |
| Regular Heavy | 105 | Severe operating conditions at high air temperatures. |

HARLEY-DAVIDSON GREASE - ALL GREASE

Use for all bearings on motorcycle, except where other special lubricants are recommended.

HARLEY-DAVIDSON CHAIN GREASE, CHAIN SAVER AND CHAIN SPRAY.

Designed especially as a chain lubricant. Penetrates inner bearings for a long chain life.

# LOCATING TROUBLES

The following check list will be helpful in locating most operating troubles:

### IF ENGINE STARTS HARD

1. Spark plugs in bad condition, or partially fouled.
2. Spark plug cables in bad condition and "leaking."
3. Circuit breaker points out of adjustment or in poor condition.
4. Battery nearly discharged.
5. Loose wire connection at one of battery terminals, or at coil or circuit breaker.
6. Carburetor not adjusted correctly.
7. Defective ignition coil.
8. Defective condenser.
9. Engine and transmission oil too heavy. (Winter operation).
10. Engine ignition spark not timed properly.
11. Circuit breaker cam sticking in advance position.

### IF ENGINE STARTS BUT RUNS IRREGULARLY OR MISSES

1. Spark plugs in bad condition, or partially fouled.
2. Spark plug cables in bad condition and "leaking."
3. Spark plug gap too close or too wide.
4. Circuit breaker points out of adjustment or in need of cleaning.
5. Condenser connections loose.
6. Defective ignition coil.
7. Defective condenser
8. Battery nearly discharged.
9. Loose wire connection at one of battery terminals, or at coil or circuit breaker.
10. Intermittent short circuit due to damaged wiring insulation.
11. Water or dirt in fuel system and carburetor.
12. Gasoline tank cap vent plugged or carburetor vent line closed off restricting fuel flow.
13. Carburetor not adjusted correctly.
14. Weak or broken valve springs.

### IF CRANKING MOTOR DOES NOT OPERATE OR DOES NOT TURN ENGINE OVER.

1. Ignition switch is not on.
2. Transmission is not in neutral.
3. Discharged battery, or loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay or solenoid defective.
5. Clutch slipping.
6. Electric starter shaft pinion gear not engaging.

### IF ENGINE TURNS OVER BUT DOES NOT START

1. Gasoline tank empty.
2. Gasoline valve shut off.
3. Gasoline line clogged.
4. Discharged battery or loose or broken battery terminal connection. Check by turning light switch "ON."
5. Fouled spark plugs.
6. Spark plug cables in bad condition and "leaking."
7. Badly oxidized ignition circuit breaker points.
8. Circuit breaker points and/or ignition timing badly out of adjustment.
9. Loose wire connection at one of battery terminals, or at coil or circuit breaker.
10. Defective ignition coil.
11. Defective condenser.
12. Clutch slipping and starter not turning engine over.
13. Sticking valves, or tappets too tight.
14. Engine flooded with gasoline as a result of over-choking.
15. Engine and transmission oil too heavy (winter operation).

### IF A SPARK PLUG FOULS REPEATEDLY

1. Too cold a plug for the kind of service or for type of engine.
2. Piston rings badly worn or in bad condition otherwise.

### IF ENGINE PRE-IGNITES

1. Excessive carbon deposit on piston head or in combustion chamber.
2. Too hot a spark plug for the kind of service or for type of engine.
3. Defective spark plugs.
4. Ignition timing too advanced.

### IF ENGINE OVERHEATS

1. Insufficient oil supply, or oil not circulating.
2. Leaking valves.
3. Heavy carbon deposit.
4. Carburtor adjustment too lean.
5. Ignition timing too late.
6. Low power - circuit breaker cam sticking in retard position.

### 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. Piston rings badly worn or in bad condition otherwise.
3. Chain oiler adjusting screw adjusted for an excessive amount of oil.
4. Oil leak to outside.

**EXCESSIVE VIBRATION**

1. Cylinder head 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.
6. Wheels and/or tires defective.

**IF GENERATOR DOES NOT CHARGE**

1. Brushes badly worn.
2. Brushes sticking in holders.
3. Voltage regulator not grounded.
4. Voltage regulator incorrectly adjusted.
5. Defective voltage regulator.
6. Commutator dirty or oily.
7. Positive brush holder grounded.
8. Generator "A" terminal grounded.
9. Loose or broken wire in generator-battery circuit.
10. Broken field coil wire or loose terminal (both coils).
11. Commutator shorted.
12. Defective armature.

**IF GENERATOR CHARGING RATE IS BELOW NORMAL**

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

**IF CARBURETOR FLOODS**

1. Float set too high (1966 & earlier).
2. Inlet valve sticking.
3. Inlet valve and/or valve seat worn or damaged.
4. Dirt or other foreign matter between valve and its seat.
5. Carburetor float not located correctly in bowl - may be binding (1966 & earlier).
6. Carburetor inlet lever not set correctly (1967).
7. Excessive "pumping" of hand throttle grip.

**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.
5. Clutch discs warped.

**IF CLUTCH CHATTERS**

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

**IF BRAKE DOES NOT HOLD NORMALLY**

1. Brake shoes improperly adjusted.
2. Brake controls binding.
3. Brake linings impregnated with grease as a result of over-lubrication.
4. Brake linings badly worn.
5. Brake drum badly worn or scored.
6. Brake shoes not centered.

(Hydraulic brake only)

1. Master cylinder low on fluid.
2. Brake line contains air bubbles.
3. Master or wheel cylinder piston worn.

# CHASSIS 2

## TABLE OF CONTENTS

# DRIVE

## CHAINS

GENERAL

Chain adjustment must be checked at regular intervals of 1000 miles for rear chain and 2000 miles for front chain. Rear chain requires more frequent attention than front, or primary chain. As chains stretch and wear, they run tighter at one spot than another. Always adjust free movement at tightest spot in chain to allow specified play midway between sprockets. Do not adjust tighter. Running chains too tight will result in excessive wear, particularly on chain tensioner shoe of 1965 and later models.

Inspect chains frequently for cracked, broken, or badly worn links. The rear chain may be taken apart for replacement or repair at the connecting, or master link. The front chain does not have a connecting link. It is necessary to remove the engine sprocket before the chain is removed for replacement. Repair of the rear chain is not recommended. See "Stripping Motorcycle for Engine Repair," Section 3A, for engine sprocket removal.

FRONT CHAIN ADJUSTMENT

1964 and earlier Models:

To adjust front chain loosen four nuts and one cap screw that secure the transmission to its mounting plate and bracket on the right side frame tube. Move the transmission backward or forward by means of the adjusting screw at the rear of the transmission on the right side. Turn adjusting screw clockwise to tighten chain and counterclockwise to loosen chain. Specified front chain play is 1/2 in. for 1964 & earlier models. When correctly adjusted, tighten the transmission securely to its mounting. Check mounting plate bolts occasionally and keep them tight.

Adjusting front chain requires adjustment of rear chain. Moving the transmission to adjust the front chain may require adjustment of gear shifter and clutch controls. Readjust if necessary (see "Adjusting Clutch Control," Section 4B, and "Adjusting Shifting Linkage," Section 4D).

1965 and later Models (Fig. 2B-1)

Remove rear pivot bolt from left footboard and swing rear end of footboard down, away from chain cover. Remove 8 cover attaching screws and remove cover. Front chain tension is adjusted by means of a shoe (1) which is raised or lowered underneath the chain to tighten or loosen it. The shoe support bracket (2) moves up or down in slotted backplate (3) after loosening center bolt (4) in backplate nut. Adjust shoe support as necessary to obtain specified up and down free movement in upper strand of chain, midway between sprockets and retighten bolt securely.

Front chain adjustment:
5/8 to 7/8 in. chain slack with cold engine
3/8 to 5/8 in. chain slack with hot engine.

Shoe support bracket (2) and outer plate (5) have two sets of shoe attaching holes (A and B) so that entire assembly can be inverted to accommodate various sprocket sizes or chain lengths. To change over, remove center bolt (4), remove two shoe attaching capscrews (6) from set of holes (A), invert shoe and attach to alternate set of holes (B) with capscrews (6). Invert support bracket and outer plate and reattach with center bolt engaged in backplate nut.

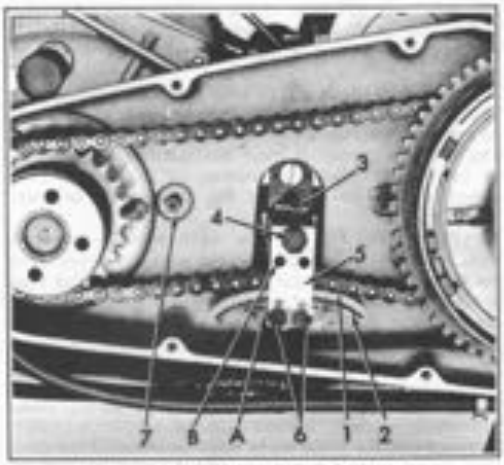



Figure 2B-1. Adjusting Front Chain (1965 and later)

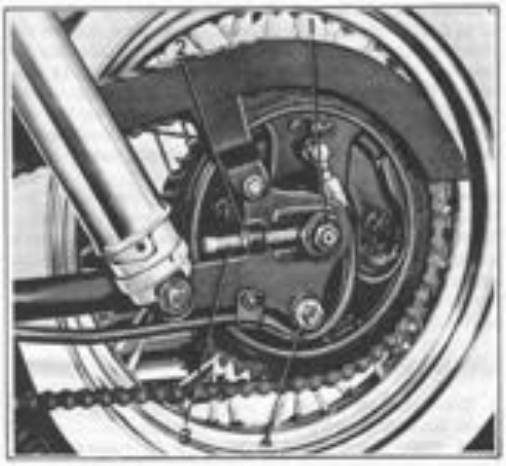


Figure 2B-1A. Adjusting Rear Chain

REAR CHAIN ADJUSTMENT (Fig. 2B-1A)

Remove the rear axle nut, lock washer, and loosen brake sleeve nut (1) and brake anchor stud nut (4). Loosen the lock nuts on wheel adjusting screws (2). Turn the adjusting screws as necessary to correctly adjust the chain. Turn each screw (3) an equal number of turns in order to keep wheel in alignment. Check correct alignment of the wheel to see that the tire runs in center of rear fork and also that the rear sprocket runs centrally in the chain. Specified rear chain play is 1/2 in. When readjustment is completed, be sure to securely tighten the sleeve nut, anchor stud nut, axle nut, and adjusting screw lock nuts in that order.

FRONT CHAIN LUBRICATION

1964 and earlier Models:

A well lubricated chain has an oily surface and is clean and free of discoloration. If chain has a brownish hue and a rusty appearance at the side and center plates, it is under-lubricated even though the surface may be oily. Readjust the front chain oiler as follows: Loosen lock nut (1, Fig. 2B-2) and turn adjusting screw (2, Fig. 2B-2) outward for more oil; turn screw inward for less oil. Turn screw only a fraction of a turn at a time. Lock adjusting screw in place with lock nut.

The adjusting screw fits into an orifice through which engine oil bleeds to the chain and controls the flow of oil by controlling the size of the orifice. Since very little oil is needed to lubricate the chain, the orifice is very small. Sediment and gummy matter accumulate in the oil supply and form deposits in and around this orifice, gradually decreasing the oil supplied to the chain. A chain that has been lubricated perfectly the first 2000 miles may run short of oil the second 2000 miles. For this reason, even though inspection indicates the chain is amply lubricated, it is advisable to flush away accumulated sediment and restore the orifice to its original size at intervals of approximately 2000 miles. To do this, loosen the chain oiler adjusting screw, and back it out exactly two full turns. Tighten lock nut. Operate this way for a few miles and then reset screw to its established setting. To reset adjusting screw to its established setting, turn adjusting screw inward exactly two full turns and lock in place with lock nut.

If established setting of adjusting screw should become completely lost while making readjustment or flushing orifice, back up lock nut and turn the screw inward until its point bottoms lightly but firmly against its seat. Then back screw out about 1-1/4 turns and establish this setting with lock nut. This is the approximate original factory setting.

1965 and later Models:

A fixed amount of oil is supplied through an oil line from metering orifice in the oil pump. Oil drops on front chain from oiler outlet tube (7, figure 2B-1). Excess oil collects at rear of chain compartment and is drawn back into engine gearcase breather.

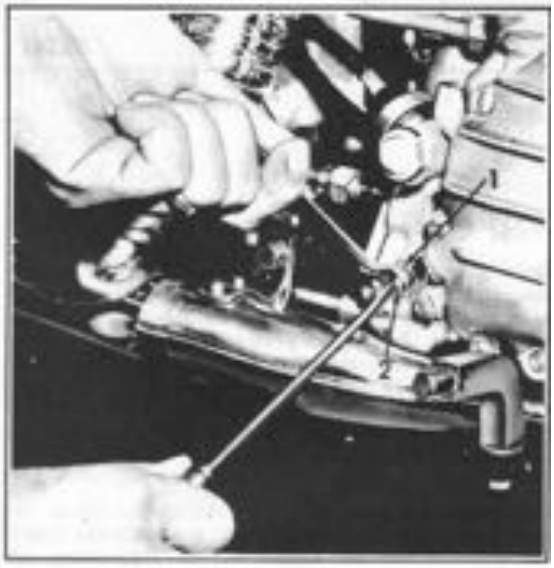



Figure 2B-2. Adjusting Front Chain Oiler (1963 & earlier)

When the front chain adjustment is checked at 2000-mile intervals, also check to see that oil comes out of oiler tube when engine is running, when viewing through cover inspection hole. If oil does not come from oiler, the supply orifice at pump is probably blocked due to accumulation of dirt, and requires cleaning. To do this, remove orifice screw and washer from oil pump and blow out passage to chain compartment with compressed air.

REAR CHAIN LUBRICATION

Under normal operating conditions brush the dirt off and lubricate the rear chain at 1000-mile intervals. Lubricate with Harley-Davidson "Chain Saver" if available; if not, use lightest engine oil available.

If motorcycle is equipped with rear chain oiler, disregard above instructions and proceed as follows: At regular 2000-mile intervals, make a close inspection of rear chain. If rear chain does not appear to be getting sufficient lubrication, or if there is evidence of an over-supply of oil, proceed as follows:

CHAIN GUARD OILER: On 1964 models equipped with front chain guard oiler, the rear chain receives its lubrication from the rear chain oiler outlet tube located at the rear of the front chain guard back. A shelf inside the front chain guard picks up oil thrown off by the front chain. This oil drains out through a small tube onto the rear chain.

Check the front chain oiler adjustment as explained previously under "FRONT CHAIN LUBRICATION". Normally, if the front chain oiler is adjusted for correct front chain lubrication, the rear chain will be adequately lubricated.

If the rear chain is dry, the oiler outlet tube may have become blocked with dirt. This may occur when motorcycle is operated under extremely dusty or dirty conditions. Check to see that oiler outlet tube is open by inserting a 1/8" dia. wire into the tube behind the chain guard.

OIL RETURN LINE BLEED TYPE OILER: This rear chain oiler is located on the oil return line at the oil pump. To adjust the chain oiler, follow the same procedure explained in adjusting the front chain oiler (1964 and earlier Models).

Normal setting of adjusting screw is 1/4 turn open. If orifice becomes blocked it will be necessary to clean as follows:

Back out adjusting screw lock nut as far as possible without allowing the adjusting screw to turn.

Turn adjusting screw inward until it bottoms on its seat. Keep a count of the number of turns.

Remove adjusting screw and clean orifice with compressed air.

Re-install adjusting screw and turn it inward until it bottoms on its seat.

Turn adjusting screw outward the same number of turns determined in step 2 and lock in place with locking nut.

LUBRICATION - UNUSUAL CONDITIONS

If the motorcycle is operated under extremely dusty or dirty conditions, whether equipped with a rear chain oiler or not, additional lubrication of the rear chain may be advisable. Remove chain from motorcycle. Soak and wash thoroughly in a pan of kerosene. Remove chain from kerosene and hang so kerosene will drain off. Immerse in a pan of grease heated to consitency of light engine oil, or use light engine oil. While immersed, move chain around to be sure that hot grease or oil works through all inside parts. After removing, allow chain to drain and wipe all surplus grease or oil from surface of chain. Install chain on motorcycle. Inspect connecting link and spring clip closely for bad condition. Replace if at all questionable. Be sure spring clip is properly and securely locked on pin ends with open end trailing direction of chain travel.

REMOVING AND INSTALLING REAR CHAIN

Locate and remove spring on connecting link. Free-fit connecting link used on early models can be removed by hand. Connecting link having press fit in side plate can be pressed apart with Chain Tool, Part No. 95020-38 which is supplied in accessory rider tool kit. A Shop Tool is available under Part No. 95021-29 for this purpose. To install new press fit connecting link, use Rear Chain Assembling Tool, Part No. 95020-66.

REPAIRING DRIVE CHAINS

To repair a chain, remove damaged link or links by pushing out pins with chain repair tool. Assemble new links and secure with connecting links. Front chain is a double-row or duplex chain; rear chain is a single-row chain. The chain tool furnished in the tool kit is designed to accommodate both. Note: Repair of front chain by use of a repair link is not recommended for chain tensioner equipped models. Entire chain should be replaced. This will avert chain breakage and possible damage to the crankcase.

GAUGING CHAIN WEAR

When chain has been removed for cleaning, check it for elongation caused by wear as follows:

1. Lay chain on a flat surface.

2. Take up the play in the links by pushing the chain ends toward each other, a few links at a time.

3. When the chain is fully compressed, measure its length. Stretch the chain to its full length and measure again. Replace rear chain if play exceeds 1 in.; replace front chain if play exceeds 1 in.

NOTE

Front chain is not equipped with a connecting link so it may be checked only if it has been opened for repair. Front chain of models with tensioner shoe should not be opened. Replace chain when you run out of shoe adjustment.

REMOVING AND INSTALLING FRONT CHAIN

1964 and earlier Models:

Remove chain guard cover. If motorcycle is equipped with compensating sprocket, use Compensating Sprocket Shaft Nut Wrench, Part No. 94557-55, to remove compensating sprocket shaft nut. If not equipped with compensating sprocket, use Crank Pin Nut Wrench, Part No. 94545-26, to remove nut. Loosen nut by striking wrench handle several sharp blows with hammer. Remove push rod adjusting screw lock nut (nut on center screw of clutch sprocket), slip washer (any steel washer 1-3/4 in. in diameter with 3/8 in. hole) over push rod adjusting screw and replace lock nut. Remove three spring tension adjusting nuts and pull clutch outer disc and spring collar assembly off clutch drive hub pins. Move clutch sprocket and engine sprocket off shafts.

1965 and later Models:

Remove chain housing cover and lower front chain tensioner shoe as previously described under "Front Chain Adjustment, 1965 and Later". Then remove engine sprocket and clutch sprocket as described above.

NOTE

Engine sprocket is aligned with clutch sprocket by a selection of spacers between sprocket and crankcase bearing. Reinstall same thickness of spacers as you removed, or determine correct spacer size as follows:

With clutch disassembled from clutch hub and compensating sprocket disassembled from sprocket shaft as shown, determine spacer (6) thickness as follows:

| | Example |
|---|---|
| 1. Measure from chain cover surface to clutch disc friction surface | 2.000 in. |
| 2. Add dimension to secure alignment (constant) | .200 in. |
| 3. Total | 2.200 in. |
| 4. Measure from chain cover surface to Timken Bearing Inner Race (1965-68) or Shield Washer (1969) | 2.773 in. |
| 5. Subtract Total (Step 3) from measurement (Step 4) | 2.200 in. |
| 6. Spacer thickness | .573 in. (.576 in.) |

Spacers come in .516, .546, .576, .606, .636, and .666 thicknesses. In this case a .576 in. thick spacer would be used to obtain chain alignment.

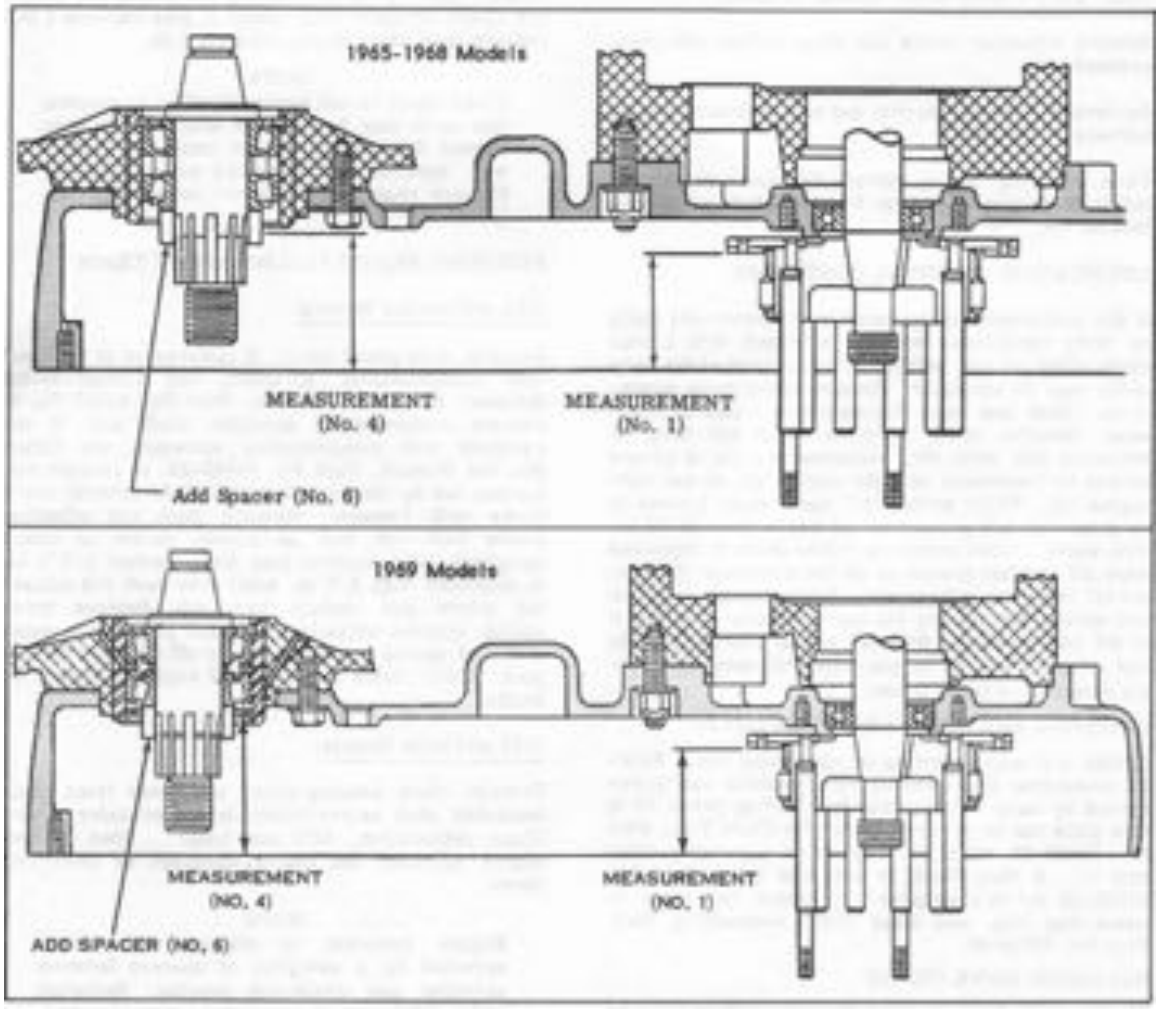



Figure 2B-2A. Determining Engine Sprocket Spacer Thickness to Secure Chain Alignment

# WHEELS

GENERAL

Good handling of a motorcycle at any speed will result in maximum tire mileage. Tires must be transposed at regular intervals for best performance and long life.

The larger the tire size and higher the average road speed, the more essential it is that wheels and tires be given proper attention. A tire kept in continuous solo motorcycle front end service long enough to allow tread to wear irregular and peaked, may cause high speed weave, especially if over-inflated.

At regular intervals of approximately 5000 miles or when a solo motorcycle develops handling irregularities at high speed, check the following list for possible causes:

1. Loose wheel axle nuts.

2. Excessive wheel hub bearing play.

3. Loosened spokes.

4. Rear wheel out of alignment with frame and front wheel.

5. Rims and tires out-of-true sideways (tire run-out should not be more than 3/64 in.).

6. Rims and tires out-of-round or eccentric with hub (tire run-out should not be more than 3/32 in.).

7. Irregular or peaked front tire tread wear. Determine mileage since tires were last transposed. If mileage is found to be 2500 or more, transpose front and rear wheels and tires even though irregular wear or peaking of front tread is not noticeable.

8. Tires over-inflated. Check "Tire Data," Section 1A. Do not over-inflate.

9. Tire and wheel unbalanced. Static balancing alone may be satisfactory if dynamic balancing facilities are not at hand, however both are recommended.

10. Steering head bearings loose. Correct adjustment and replace pitted or worn bearings and races. See Section 2F.

11. Shock absorber not functioning normally. Check possible causes. See "Forks," Section 2F.

12. Rear fork bearings loose. Check possible causes. See "Forks," Section 2F.

13. Heavy front end loading. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage, tends to cause unstable handling. Extra equipment on the front end should be held down to a minimum.

In most every case, high speed handling faults are caused by one or more of the above conditions being present on the motorcycle. The possible exception will be the case where there is serious frame or fork misalignment.

Switching wheels and tires approximately every 5000 miles and inflating to recommended pressure are of major importance. In many cases, this attention alone applied to a solo motorcycle will remedy faulty handling at higher speeds.

It is advisable to rebalance wheels and tires, at least statically, whenever casing and/or tube is replaced.

SERVICING WHEELS

Front and rear wheels may be removed as necessary for wheel or tire service. When removing a wheel, apply brake to hold drum securely while pulling wheel from drum. When detached from drums, Duo-Glide and Electra-Glide wheels are interchangeable.

REMOVING FRONT WHEEL (Fig. 2C-1)

Block motorcycle under frame until front wheel is clear of ground. Disassemble in following order:

Remove the cotter pin (1), axle nut (2) and flat washer (3). Servi-Car wheel disassembly includes removing bushings (4); also remove the five wheel mounting socket screws (5), loosen the two slider cap nuts (7) and remove axle (6). Remove front wheel, leaving the brake drum in its place over the brake shoes.

When replacing the wheel, assemble in reverse order. Important: Clamping faces on wheel hub and brake drum must be clean so that wheel will be true and tight against brake drum when socket screws are tightened. Securely tighten wheel mounting socket screws (5) and axle nut (2), and then tighten the two slider cap nuts (7). This will insure correct alignment of fork sides.

REMOVING REAR WHEEL (DUO-GLIDE AND ELECTRA-GLIDE)

Elevate motorcycle rear end with service stand, or suitable blocking under frame so rear wheel is off the ground. Remove two rear screws from fender support, and raise end of fender as shown in Fig. 2C-2. Remove the five socket screws (4) that secure wheel to brake drum. The socket screw wrench can be inserted only at the rear of axle; turn wheel to bring each screw to this position.

Remove axle nut (3) and axle nut lock washer (2). Remove axle (1) from brake drum side of motorcycle and then remove spacer (5) from between wheel hub and right axle clip. Apply rear brake and remove wheel.

NOTE

Foot Brake Lever Locking Tool, Part No. 95875-58, can be used to lock brake. To

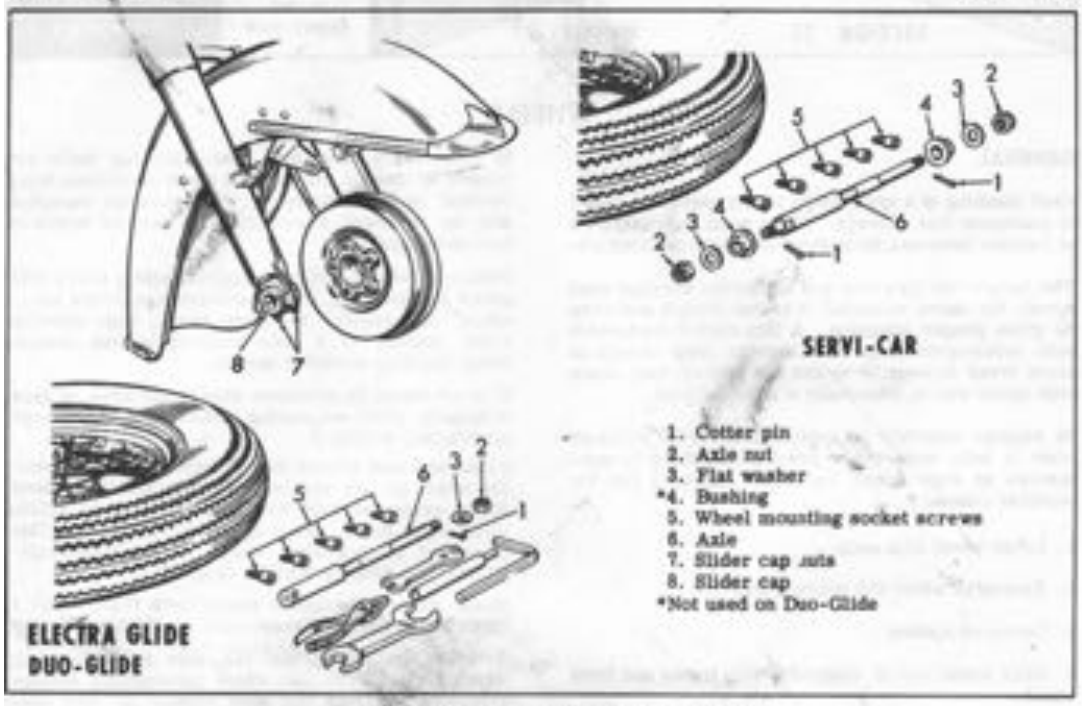



Figure 2C-1. Removing Front Wheel

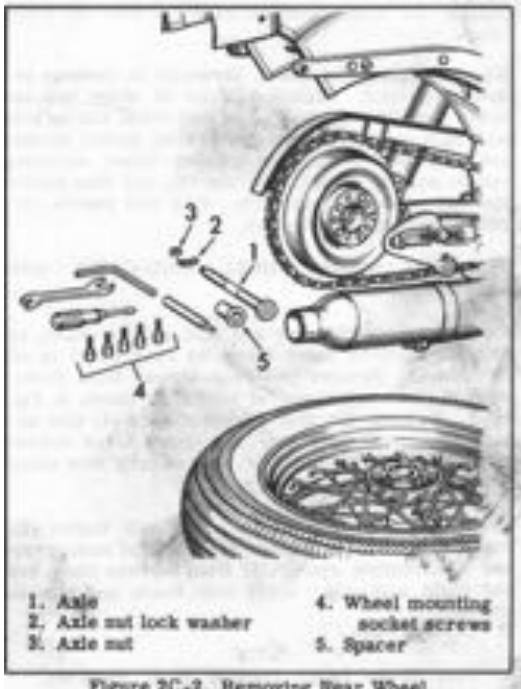



Figure 2C-2. Removing Rear Wheel

use tool, raise right side foot board, slip tool over brake lever stop pin, depress brake pedal and rotate tool so that cam on tool end locks brake pedal in depressed position.

When installing wheel, reverse the removal procedure. Important: Clamping faces on drum and wheel hub must be clean so that wheel will be true and tight against brake drum when socket screws are tightened. Securely tighten the five wheel socket screws before tightening the axle nut (3). To avoid possibility of wheel working loose and damaging clamping flange, it is important that socket screws be pulled very tight.

REMOVING SIDECAR WHEEL.

Raise wheel by blocking up under sidecar chassis. Loosen nut that secures fender front bracket to sidecar step lug. Loosen the fender inner brace clip bracket nut. Remove outside axle nut, lock washer and outer brace. Hinge fender forward, taking care to provide slack for taillamp wiring. Remove extension nut, axle nut and washer. Pull wheel from axle with brake drum attached.

Detachment of wheel from brake drum is necessary only when wheel or brake drum is to be replaced or wheel interchanged. To detach wheel from brake drum, remove the five wheel mounting socket screws that secure wheel to brake drum.

To replace wheel, reverse removal procedure. Tighten wheel mounting socket screws securely to

avoid possibility of wheel working loose and damaging hub flange.

SERVICING 1966 AND EARLIER ROLLER BEARING WHEEL HUBS (Fig. 2C-3)

All spoked wheel hubs are identical. However, keep parts for all wheels separated. Bearing assemblies (20, 21 and 11, 12) and thrust bearing adjusting shims (7) have been fitted at the factory, and subsequent hub repairs may have included installing oversize bearings. A transposition of parts will result in oversize or undersize fit.

DISASSEMBLING ROLLER BEARING WHEEL HUB (Fig. 2C-3)

Remove five thrust bearing cover screws (1) and lock washers (2). Lift off thrust bearing outer cover (3), cork grease retainer (4), thrust bearing housing (5), gasket (6), a number of adjusting shims (7) which varies with the hub, thrust washer (8), thrust bearing sleeve (9) and another thrust washer (10).

Remove bearing rollers (11) and retainer (12), and roller retainer thrust washer (13).

Turn hub over and remove spring lock ring (14), retaining washer (15), hub inner sleeve (16), cork grease retainer (17), spring lock ring (18) and roller bearing washer (19).

Large diameter retainer (21) and bearing rollers (20) are then free to be removed from hub shell (22).

INSPECTION AND REPAIR (Fig. 2C-3)

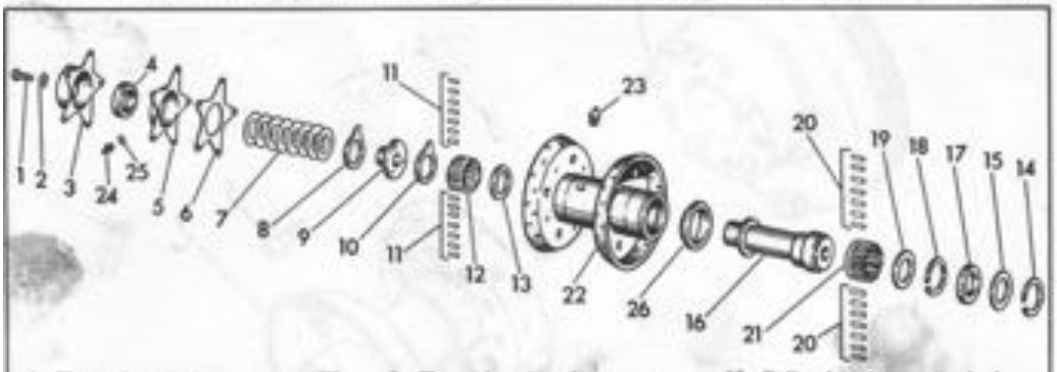
Clean and dry all parts and inspect for wear. If excessive sideplay is present, one or more bearing adjusting shims (7) must be added. Thrust bearing sleeve (9) must be free with thrust bearing outer cover (3) completely screwed down. A clearance of .005 in. to .007 in. is correct. Leave cork grease retainer (4) out of thrust assembly while determining correct adjustment of thrust sleeve, and reinstall it when adjustment is completed.

Excessive radial (up and down) play in wheel hub bearings can be taken up by fitting oversize rollers (11 and 20). Bearing rollers are available from .001 in. undersize to .001 in. oversize in steps of .0002 in. Select roller size that will give .001 in. to .0015 in. clearance.

ASSEMBLING ROLLER BEARING WHEEL HUB (Fig. 2C-3)

Assemble hub components in reverse order of disassembly. Closed sides of roller bearing retainers (12 and 21) go toward center of hub. Be sure to include a plain washer (25) under grease fitting (24) in thrust bearing housing (5). Failure to do so will cause end of fitting to crimp adjusting shims (7).

Apply a thin coating of "Grease-All" grease to rollers, races and thrust washers. After final assembly, inject 1 ounce additional grease into hub. Carefully check hub to avoid a bearing fit too tight. Roller bearings must turn freely and have slight play. Do not over-lubricate hub. An over-lubricated hub will throw grease that may get into brake assembly.




1. Thrust bearing cover screw (5)
2. Thrust bearing cover screw lock washer (5)
3. Thrust bearing outer cover
4. Cork grease retainer
5. Thrust bearing housing
6. Thrust bearing housing gasket
7. Thrust bearing adjusting shim (varies) (each .002 in. thick)
8. Thrust washer (2) (see item 10)
9. Thrust bearing sleeve
10. Thrust washer (see item 8)
11. Bearing roller (12)
12. Roller retainer
13. Roller retainer thrust washer
14. Roller bearing spring lock ring (2) (see item 18)
15. Retaining washer
16. Hub inner sleeve
17. Cork grease retainer
18. Roller bearing spring lock ring (see item 14)
19. Roller bearing washer
20. Bearing roller (14)
21. Roller retainer
22. Hub shell
23. Grease fitting (2)
24. Grease fitting (see item 23)
25. Plain washer
26. Roller retainer thrust collar

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2C-3. Wheel Hub (1966 and earlier) - Exploded View

Servicing 1967 AND LATER BALL BEARING WHEEL HUB (Fig. 2C-3A)

Front and rear wheels have permanently lubricated and sealed, retainer type ball bearings. The wheel hub has one bearing opposite the brake side. The brake drum has one bearing (front wheel) and two bearings (rear wheel).

Bearings require no interval attention. Excessive looseness or roughness in the bearings when wheel is turned indicates worn bearings, and they must be replaced.

DISASSEMBLING BALL BEARING WHEEL HUB AND BRAKE DRUM

Remove 5 wheel mounting socket screws (1) and remove brake drum (2) from wheel hub (9). Remove bearing spacer (3) from wheel hub. Press bearing or bearings (8) out of brake drum with suitable plug from wheel hub side. Wheel hub ball bearing locknut (4) has a left hand thread. Using tool, Part No. 94630-67 engage slot and turn to right to remove nut from hub. Remove seal (5), and spacer (6) from wheel hub. Press bearing (7) out of wheel hub with suitable plug from brake drum side.

INSPECTION AND REPAIR

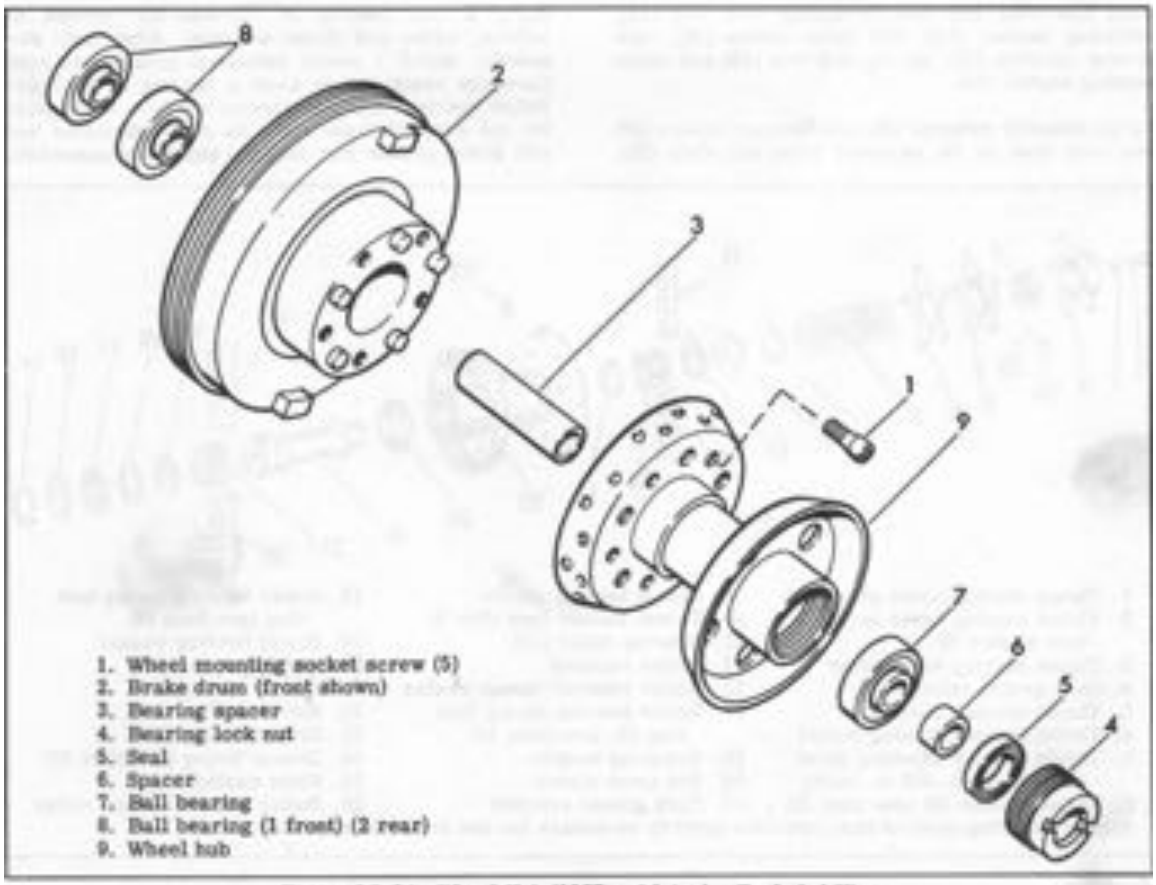
Turn bearings by hand to check for roughness and check also for excessive looseness of the inner and outer race. Inspect seal lip for wear or damaged rubber. Replace defective parts.

ASSEMBLING BALL BEARING WHEEL HUB AND BRAKE DRUM

Assemble hub and brake drum components in reverse order of disassembly.

When assembling bearings, apply a liberal quantity of grease to fill space on both sides of bearing in wheel hub and on inside bearing of brake drum.

Important: Clamping faces on drum and wheel hub must be clean so that wheel will be true and tight against brake drum when socket screws are tightened.




1. Wheel mounting socket screw (5)
2. Brake drum (front shown)
3. Bearing spacer
4. Bearing lock nut
5. Seal
6. Spacer
7. Ball bearing
8. Ball bearing (1 front) (2 rear)
9. Wheel hub

Figure 2C-3A. Wheel Hub (1967 and later) - Exploded View

## REPLACING REAR WHEEL SPROCKET

To replace a worn rear wheel sprocket remove wheel from motorcycle as described in "Removing and Installing Rear Wheel." Disassemble brake drum from wheel. Chisel heads off all rivets and dowel pins from brake shell side and punch them out. If the rivet holes are not worn, use the rivet holes again. If the rivet holes are found slightly worn or elongated and drum is in good condition, drill a new set of rivet holes in drum flange midway between original dowel and rivet holes.

To drill new rivet holes, proceed as follows using new sprocket as a template for locating holes.

1. Drill a hole from the brake shell side.

   Size: 1958 to early 1961 - 5/32 in. dia. drill
   Early 1961 and later - .1935 in. dia. (No. 10 drill) for 3/16" rivet

2. Drill one hole and insert rivet (do not head rivet).

3. Drill a hole directly opposite first hole and insert rivet (do not head rivet).

4. Drill remaining 14 rivet holes.

5. Remove rivets and separate sprocket from drum.

6. Remove burrs from newly drilled holes.

Whenever a rear wheel sprocket is replaced it is very important to drill new dowel holes to insure a press fit for the dowel pins. Use the new sprocket as a template and drill the four dowel pin holes 3/16 in. dia. for a press fit.

Position sprocket and drum on center support flange of Riveting Jig, Part No. 95600-33B. Proceed as follows, inserting and seating dowel pins first, and then rivets.

1. Insert dowel pins and rivets from brake shell side.

2. Use hollow driver and seat dowel pins and rivets at the same time driving sprocket and hub flange together.

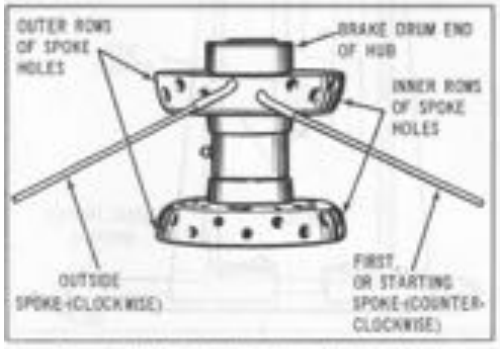



Figure 2C-4. Starting Spokes in Wheel Hub


Figure 2C-5. Spoking Wheel

3. Use punch to flare dowel pin ends and rivet ends until heads extend 3/64 in. above sprocket face for 5/32 in. rivet size and 3/32 in. for 3/16 in. rivet size. Use concave end punch for small diameter rivets and dowel pins. Use flat end punch for larger diameter rivets.

4. Rivet opposite dowel pins and rivets until all are in place.

## SPOKING WHEELS

Front, rear (motorcycle) and sidecar wheels are spoked identically. Spoke holes in hub flanges are in two rows around flange, ten inner row holes and ten outer row holes in each flange.

All spokes must be inserted from inside of flange.

1. Place hub on bench with brake drum end of hub up.

2. Insert spokes in ten inner spoke holes of brake side flange (see Fig. 2C-4).

3. Swing loose end of spokes counterclockwise as far as hub will allow without turning hub.

4. Place rim over hub (with tire valve hole 90 degrees to 180 degrees from hub grease fitting) and insert spokes in upper row of holes in rim that angle in same direction as spokes.

NOTE

18 in. rim is placed over hub, either side down; 16 in. rim is placed over hub with tire valve hole down (opposite brake drum side of hub).

Just start nipples on spokes as they are inserted in rim.

5. Insert spokes in outer ten holes of flange and swing spokes clockwise (see Fig. 2C-5).

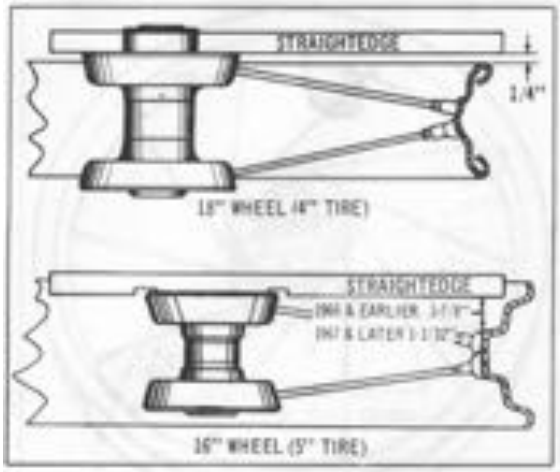



Figure 2C-6. Centering Wheel Rim

6. Select any outer spoke, cross it over four inner spokes (A, B, C and D) and insert spoke in nearest upper rim hole and start nipple. Follow same procedure with balance of spokes.

7. Turn rim and hub over. Repeat operations 2, 3, 5 and 6, except in operation 3 swing spokes clockwise and in operation 5 swing spokes counterclockwise.

NOTE

Outer spokes on both sides point in same direction.

TRUING WHEEL

1. Install truing arbor in wheel hub and place wheel in Wheel Truing Stand, Part No. 95500-29A. Secure arbor nuts so that hub will turn on its bearings.

2. Turn each nipple on just far enough to cover spoke threads.

3. Start at valve hole and tighten all nipples three full turns each, using special Nipple Wrench, Part No. 94681-39. If further tightening is needed to pull spokes snug, tighten all nipples one full turn at a time until spokes are snug.

4. Check rim for centering sideways with hub, for running true sideways and concentricity. Centering rim sideways with hub and truing rim sideways must be done as one operation.

Rim must be properly centered sideways in relation to hub for correct alignment and "tracking" of front and rear wheels. Fig. 2C-6 shows method of using a straightedge to determine correct sideways centering of wheel rims as specified. Straightedge should be a perfectly straight metal bar; except on 1967 and later 16" wheels it must be notched out to clear hub flange edges as shown in figure 2C-6.

For 15 in. wheel (5.00 in. tire), place straightedge across hub on brake side and measure the distance from straightedge to rim well as shown.

For 18 in. wheel (4.00 in. tire), lay straightedge across brake side spoke flange of hub and measure distance from straightedge to rim as shown.

Adjust truing stand gauge to side of rim well as shown in Fig. 2C-7 so rim at highest point will strike gauge as wheel is rotated slowly. Loosen nipples at highest point of rim on gauge side and tighten nipples on opposite side the same amount. Repeat this operation until rim runs true sideways. Reverse loosening and tightening of nipples as explained above if rim moves too far away from gauge. After each loosening and tightening of spokes, check rim in relation to hub as explained in above paragraphs. Rim should be trued to within 1/32 in. sideways runout.

After rim has been centered sideways with wheel hub and runs true sideways, check it for concentricity. Adjust truing stand gauge to rim tire bead seat as shown in Fig. 2C-8. If rim runs eccentric (radial runout), nipples must be loosened at points rim does not contact gauge, and nipples tightened at points rim contacts gauge. Amount nipples are to be loosened or tightened is determined by the amount rim is out of round. Rim should be trued to 1/32 in. or less radial runout.

5. After above operations have been checked and corrected, start at valve hole and tighten nipples one turn at a time all the way around rim until spokes are normally tight. While tightening nipples, repeatedly check rim with gauge according to instructions in step 4.

After all nipples have been pulled up until spokes are normally tight and wheel is true, or nearly so, seat

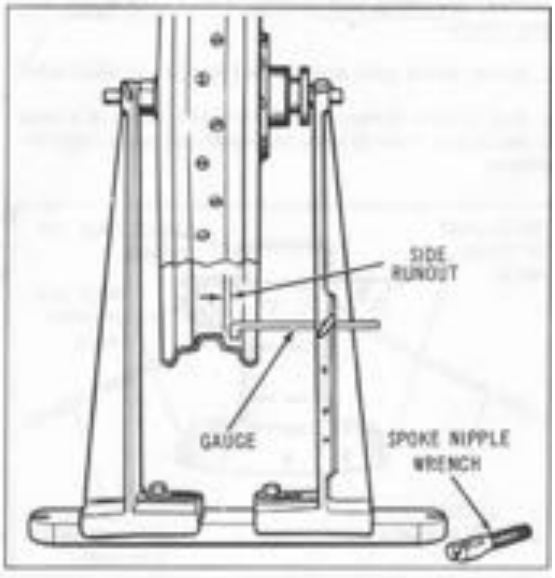



Figure 2C-7. Truing Rim Sideways

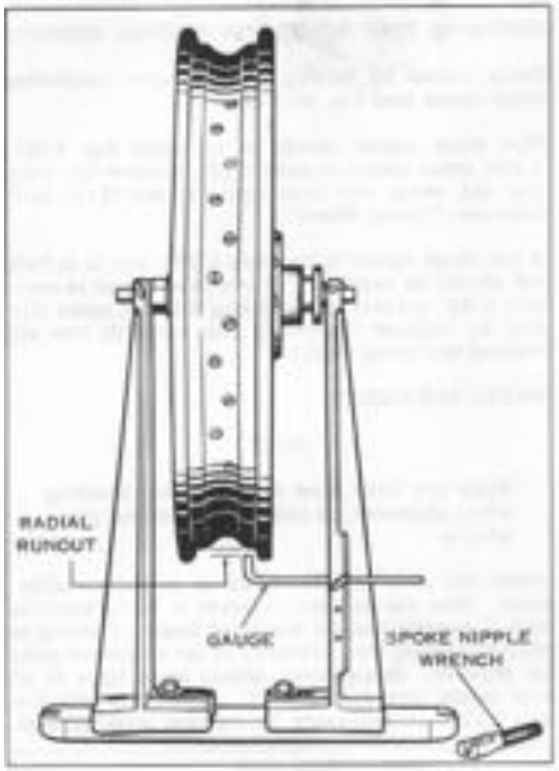



Figure 2C-8. Truing Rim Concentric with Hub

each spoke head into hub flange with a sharp blow, using a flat nose punch and hammer. Then retighten all nipples and finish truing wheel. This method allows spokes to be drawn tighter at the start and prevents possibility of spokes loosening, due to spoke heads seating into flange, after wheel is put into service.

**CAUTION**

Do not tighten spokes too tight or nipples may draw through rim, or hub flanges may be distorted. If spokes are left too loose, they will continue to loosen when wheel is put in service.

6. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

REMOVING AND INSTALLING TIRES

Wheel rims are of the drop-center type, having a depression or "well" in center of rim. Rim-well, being smaller in circumference than rest of rim, allows one casing bead to fit loosely in it while other bead is being worked over edge of rim.

REMOVING TIRE FROM RIM

Remove wheel; lay wheel on its side.

Remove valve cap and valve core to free all air from tube. Remove valve stem nut (18 in. rim).

Loosen both beads from rim flanges by stepping on sides of tire or by using a tire tool. Stand or kneel on tire opposite valve to push bead into rim-well.

Using tire tools (not sharp instruments), start upper bead over edge of rim at valve. Don't use force when starting bead over edge of rim with tire iron, because bead wires may be broken or stretched and tire ruined. Carefully remove tube before attempting to remove second bead.

Push lower bead into rim-well on one side and insert tire iron on opposite side and pry bead over flange. After a portion of second bead is started over rim edge, tire can be further removed from rim without aid of tire iron.

It is not always necessary to completely remove casing from rim. Removing one side allows tube to be removed and reinstalled and also allows inside of casing to be inspected.

MOUNTING TIRE ON RIM

Before installing tube in tire, all dust and dirt, particularly hard particles which might chafe an inflated tube, must be removed. Wipe tube and inside of tire thoroughly with clean, dry cloth. If rim is dirty or rusty, clean with a stiff wire brush. Be sure to examine a used tire carefully for fabric injuries that may damage tube.

Before mounting tire, see that rubber rim strip is in place in rim-well, and that rim strip valve hole registers with valve hole in rim.

Tire balance mark on Firestone tires is a red triangle and on Goodyear tires a red dot.

**CAUTION**

Use correct inner tube for tire size. See "Tire Data" Section 1A.

Insert tube in tire, (placing valve at tire balance mark). Swab thoroughly all around base of tube, between the tube and side walls of tire with a heavy suds solution of tire mounting compound and water. Bead seat of tire should not be coated. Inflate tube just enough to round it out. With wheel lying flat, place tire on rim and align valve with hole in rim.

Push bottom bead into rim-well near valve and hold in well while forcing remaining portion of bead over rim flange with a tire tool.

Spread tire and insert valve through hole in rim.

Force upper bead over rim flange and into well at point opposite valve. Stand or kneel on this side of tire to hold it in well and pry remaining portion of tire over rim flange. While forcing bead over rim flange, keep as much bead as possible in rim-well. Be careful not to damage beads or pinch tube. Inflate tire to recommended pressure and check valve for leak. See tire inflation pressures in "Tire Data," Section 1A.

After inflating to recommended pressure, completely deflate to smooth out any wrinkles in tube and allow tube to find its place, free from strain or stress. Again inflate to recommended pressure and check valve for leak.

CHECKING TIRE TRUENESS SIDEWAYS (LATERAL RUNOUT)

Check runout by turning wheel on axle, measuring amount of sideways displacement from a fixed point near the tire (see Fig. 2C-8A).

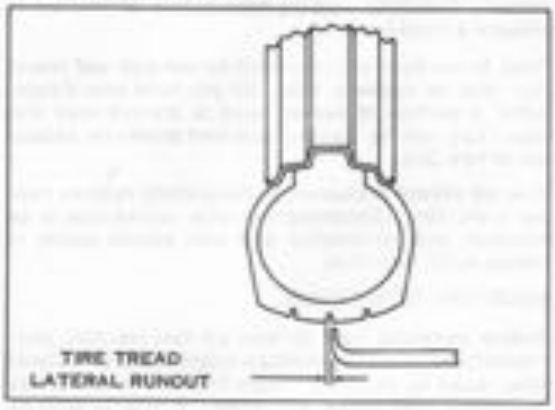



Figure 2C-8A. Checking Tire Lateral Runout

Tire tread runout should be no more than 3/64 in. If tire tread runout is more then 3/64", remove tire from rim and check rim bead side runout to see if rim is at fault (see "Truing Wheel").

If rim side runout is less than 1/32", tire is at fault and should be replaced. If rim side runout is more than 1/32", correct by tightening selected spoke nipples as outlined previously, reinstall old tire and recheck tire tread lateral runout.

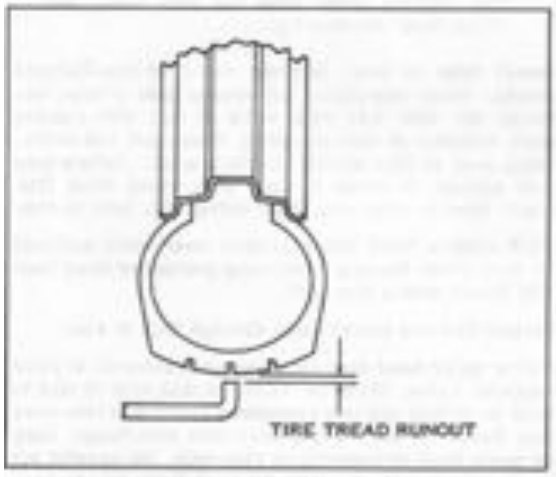



Figure 2C-8B. Checking Tire Radial Runout

CHECKING TIRE ROUNDNESS (RADIAL RUNOUT)

Check runout by turning wheel on axle, measuring tread runout (see Fig. 2C-8B).

Tire tread runout should be no more than 3/32". If tire tread runout is more 3/32", remove tire from rim and check rim bead runout to see if rim is at fault (see "Truing Wheel").

If rim bead runout is less than 1/32", tire is at fault and should be replaced. If rim bead runout is more than 1/32" correct by tightening selected spoke nipples as outlined previously then reinstall tire and recheck tire tread runout.

WHEEL ALIGNMENT

NOTE

Rims and tires must be true before checking wheel alignment, as outlined in previous paragraphs.

Front and rear wheels should be in perfect alignment. This can be easily checked on the motorcycle with a straight wooden board or length of string by placing against tire sidewalls as far up toward axles as possible. Straightedge should touch tires at all four points (see Fig. 2C-8C). Adjust rear wheel in axle clips as necessary to correct misalignment.

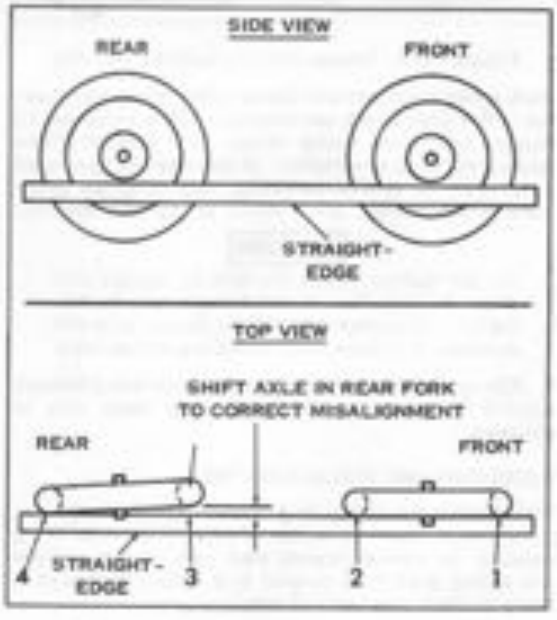



Figure 2C-8C. Wheel Alignment Diagram

# HANDLEBAR

## SERVICING HANDLEBAR CONTROLS

NOTE

Spark control information applies to earlier models having manual spark advance.

Handlebar controls for throttle and spark advance must operate freely. If a control becomes stiff and hard to adjust, parts must be removed and cleaned of caked grease, gum and dirt. A kinked control coil must be replaced if complete straightening cannot be accomplished.

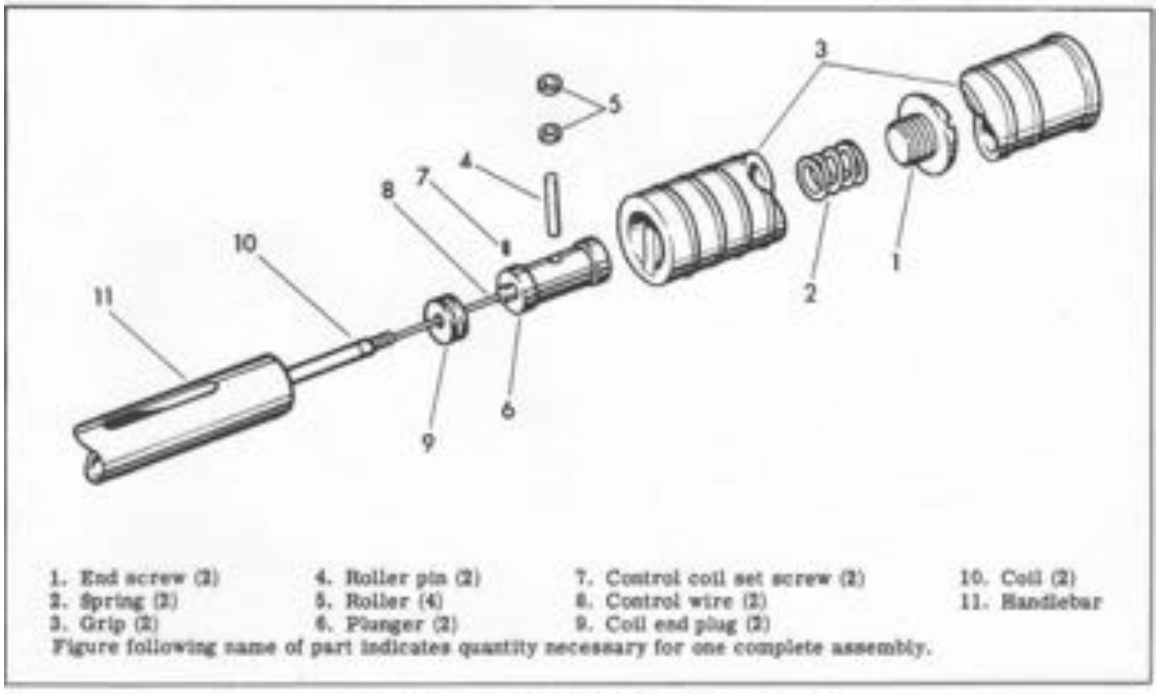
DISASSEMBLING HANDLEBAR CONTROLS (Fig. 2D-2)

Disconnect control coil and wire at carburetor or circuit breaker. Loosen clip which secures spark control coil to upper frame tube.

Insert a large screwdriver through hole in end of grip as shown in Fig. 2D-1 and loosen handlebar end screw (1). Handlebar end screw and spring (2) will remain inside grip. Remove grip sleeve assembly (3), exposing working parts.

Slip two rollers (5) off roller pin (4) and remove roller pin from plunger (6). Plunger with control

Figure 2D-1. Removing Handlebar Controls




1. End screw (2)
2. Spring (2)
3. Grip (2)
4. Roller pin (2)
5. Roller (4)
6. Plunger (2)
7. Control coil set screw (2)
8. Control wire (2)
9. Coil end plug (2)
10. Coil (2)
11. Handlebar

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2D-2. Handlebar Controls - Exploded View

wire (8) may be pulled through handlebar. If the control wire is broken, remove lower end at carburetor or circuit breaker. The control wire is fastened into the end of the plunger by means of set screw (7).

If control coil is to be removed, loosen the lock screw under the horn or starter button retainer on the handlebar that positions the coil end plug (9) in handlebar. The throttle end plug lock screw is exposed on the underside of the right handlebar. After loosening, control coils and end plugs may be pulled out of handlebar ends.

INSPECTION AND REPAIR

Clean all parts in solvent. Be sure they are free from rust, gum and dirt. Inspect all parts including inside of grip and replace all worn parts.

ASSEMBLING HANDLEBAR CONTROLS (Fig. 2D-2)

Slip control coil through handlebar and secure at end plug with lock screw through handlebar (screw must register in groove of end plug). Slip roller pin through plunger and assemble rollers to ends of roller pin, rounded side out. Attach control wire to plunger assembly by means of the set screw (7).

Apply a light coat of grease or oil to control wire as it is inserted into coil. Lubricate remaining parts with grease. Turn grip onto handlebar with rollers following spiral grooves inside grip.

Handlebar end screw may be started without danger of crossing threads by holding grip sleeve assembly back slightly when starting screw in handlebar end. This squares screw with end of grip sleeve, aligning threads. Tighten screw securely.

Connect throttle and/or spark control wires at carburetor and circuit breaker. Adjust throttle control so throttle closes and opens fully with grip movement. Allow about 3/8 in. of throttle control coil to extend beyond carburetor control coil clip when throttle is in a closed position.

With circuit breaker in fully-advanced position, the end of the spark control wire must point directly at hole in timer adjuster stud. Allow about 3/8 in. of spark control coil to extend beyond clamp. Adjust spark control so circuit breaker advances and retards fully with spark control grip movement.

# FRAME

## FRAME

To rough check a frame for correct alignment, see Fig. 2E-1. The dimensions shown will provide basic information to determine whether a frame is enough out of alignment to require a major realigning job or replacement.

Straightening a badly bent frame requires special tools and fixtures for holding, bending and gauging. If frame straightening facilities are not available locally, damaged frames may be returned to the factory for repair (through authorized Harley-Davidson dealers only).

NOTE

Replace all badly bent or broken frames. The cost of repair would be prohibitive.

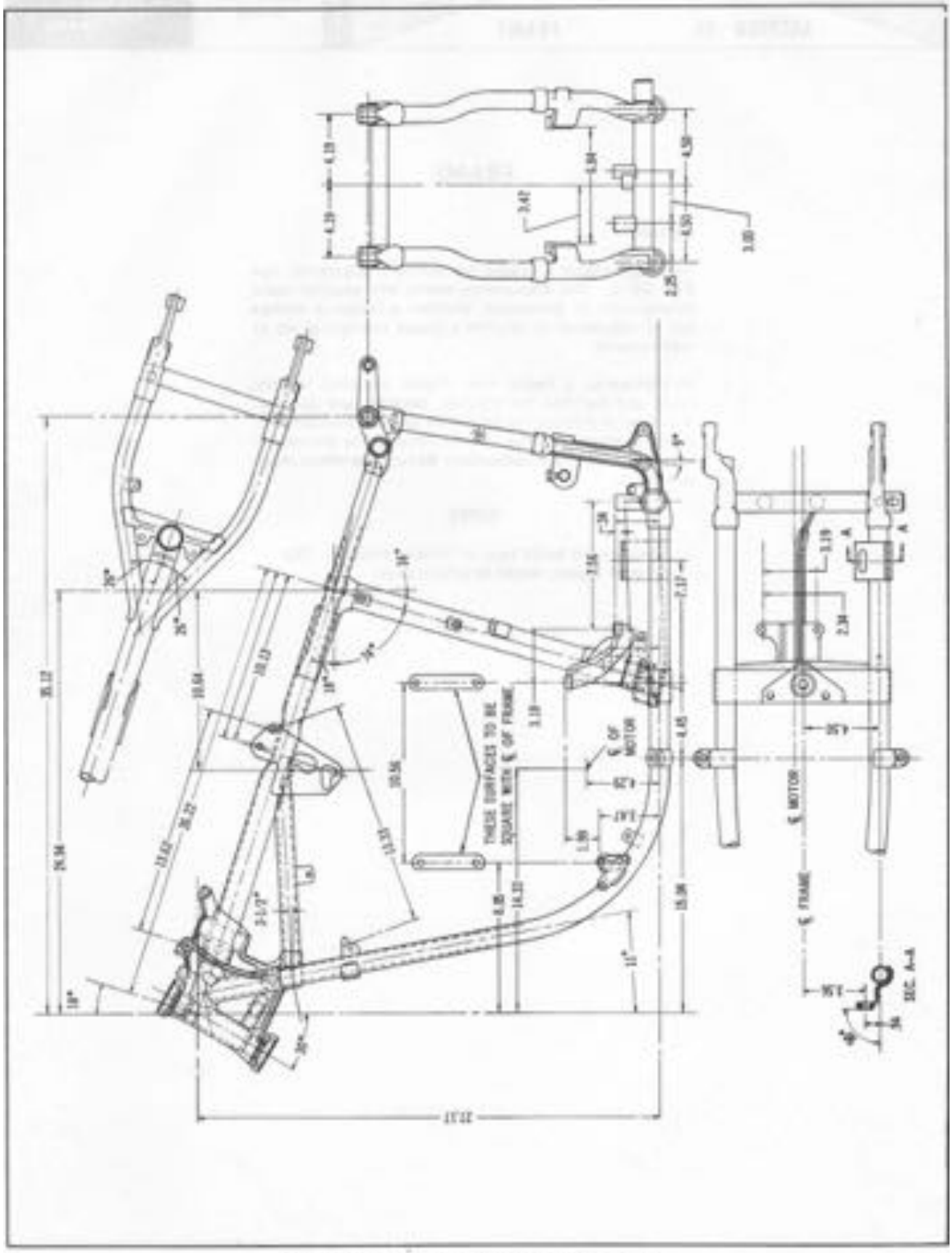



Figure 2E-1. Frame with Basic Dimensions

# FORKS

## GENERAL

The Hydra-Glide fork is comprised of two sets of telescoping tubes that work against springs, with an oil filled (hydraulic) dampening mechanism to control the action. The unit is engineered to give long service with a minimum of repair. Oil change is not necessary unless oil has been contaminated or leakage has occurred.

DUO-GLIDE (NON-ADJUSTABLE). The non-adjustable Duo-Glide fork, as illustrated in Fig. 2F-3, is for use on a solo motorcycle. The fork "trail" (the distance, at ground level, from the fork stem axis to a perpendicular through the wheel axle) is set and cannot be adjusted. This fork may be recognized by the two hexagon head upper bracket bolts (2, Fig. 2F-3) in the slider tube tops.

DUO-GLIDE (ADJUSTABLE). The adjustable Duo-Glide fork is for use on a motorcycle which operates with and without a sidecar. It is essentially the same as the non-adjustable fork except it has a two-position bracket that allows the trail to be changed for best solo or sidecar-equipped operation, also a steering damper adjusting mechanism which dampens the steering head to suit conditions and rider preference. All other adjustments and repairs are made exactly as on the non-adjustable fork. This fork may be recognized by the reversible bracket bolt washers, bolt and stem design (18, 19, 20, Fig. 2F-4) as described in "Adjusting Front Fork Trail."

SERVI-CAR (NON-ADJUSTABLE). The Servi-Car fork is a combination of the above forks. It has greater trail than the non-adjustable Duo-Glide fork, but is itself non-adjustable. The stem and bracket are the same as the adjustable fork except for the bracket bolt washers. In appearance, it is similar to the adjustable fork.

## CHANGING OIL

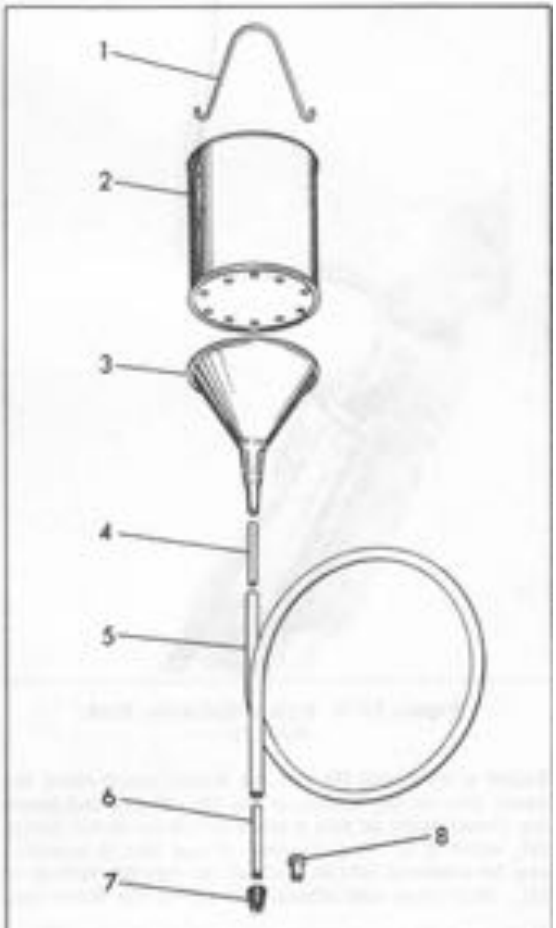
DUO-GLIDE (NON-ADJUSTABLE). Remove upper bracket bolt (2, Fig. 2F-3) at top of each fork tube.

DUO-GLIDE (ADJUSTABLE) AND SERVI-CAR. Remove fork cover side panels or headlamp housing and fork filler screws (23, Fig. 2F-4).

ALL MODELS. Remove drain plug, Fig. 2F-3 at the outside bottom of each slider tube with a 3/16 in. Allen wrench and drain. Draining speed will be increased by gently flexing the fork as it empties. Replace drain plugs and pour 6-1/2 oz. of Harley-Davidson Hydra-Glide Fork oil into each tube, 7 oz. if fork has been disassembled and washed. Measure amount very carefully. Flow of oil into tubes will be increased if fork is worked up and down during filling operation. Replace upper bracket bolts and tighten securely.

The fork filling device shown in Fig. 2F-1 will hasten and simplify the filling operation. The unit consists of a Neoprene (not rubber) stopper to fit the hole in the top of the fork, a length of flexible tubing, a funnel and an appropriate size can, soldered to the top of the funnel.

To make a filler can, drill a dozen 1/4 in. holes in the bottom of a one quart tin can (2), near the outside edge. Shape the bottom of the can with a light hammer so that it is dished upward to assure complete draining of oil through the holes.




1. Bail
2. Filler can
3. Tin funnel
4. Metal tubing
5. Flexible tubing
6. Metal tubing
7. Rubber plug
8. Fork tube cap

Figure 2F-1. Fork Filler Can Components

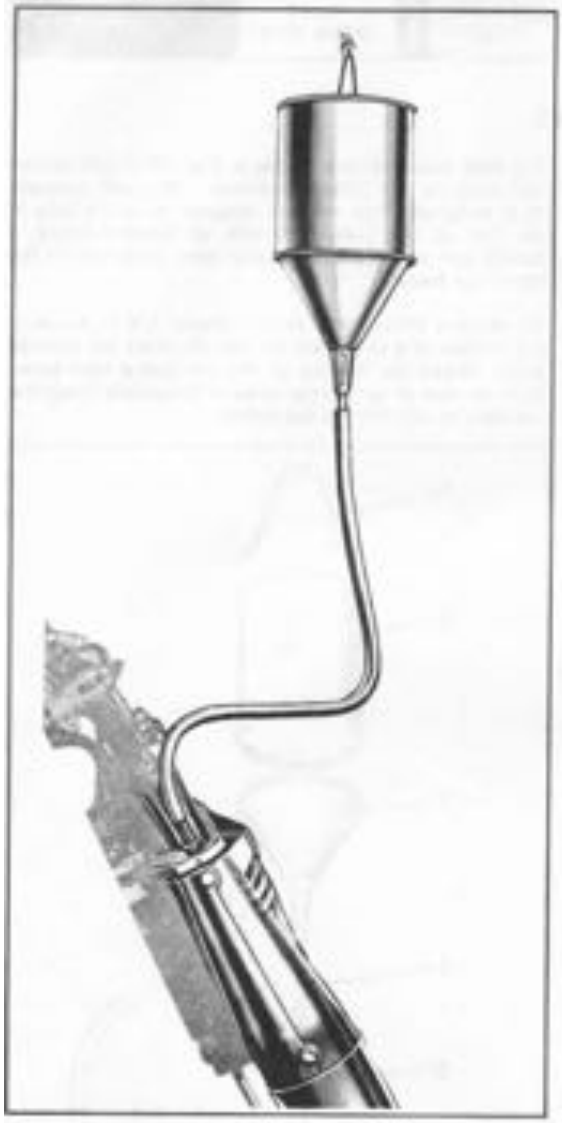


Figure 2F-2. Filling Hydraulic Fork with Oil

KEY FOR FIGURE 2F-3

1. Fork stem nut
1A. Nut lock (63 models)
2. Fork upper bracket bolt and valve (2)
3. Tube plug oil seal (2)
4. Fork upper bracket cover
5. Handlebar and fork bracket
6. Head bearing nut
7. Head bearing (2)
8. Fork bracket clamping stud (2)
9. Fork bracket with stem
10. Fork slider cover (2)
11. Slider tube plug (2)
12. Fork spring (2)
12A. Spring spacer (1965-1966)
13. Damper valve stud lock nut (2)
14. Fork slider tube (2)
15. Slider tube snap ring (2)
16. Damper tube bushing gasket (2)
17. Damper tube lower bushing (2)
18. Damper valve stud gasket (2)
19. Damper tube valve (2)
20. Spring ring (2)
21. Spring ring washer (2)
22. Upper oil seal felt washer (2)
23. Upper oil seal (2)
24. Slider (2)
25. Slider upper and lower bushing (2 each)
26. Head bearing (see item 7)
27. Lower head bearing guard

Figure following name of part indicates quantity necessary for one complete assembly.

Select a tin funnel (3) with the funnel mouth about the same size as the bottom of can (2). Swage and shape the funnel spout so that a piece of 1/4 in. metal tubing (4), about 2 in. long, (a piece of fuel line is suitable) can be soldered into it. Solder (3) onto the bottom of (2). Improvise and attach bail (1) to the filler can.

Make plug (7) from a rubber bottle stopper purchased from a drug store. Rubber stopper should be 1 in. to 1-1/8 in. long, and its largest diameter about 5/8 in.

Hold rubber stopper in vise and drill a 3/32 in. hole lengthwise through the center. Then enlarge the hole with a 1/4 in. drill. After hole is drilled in the stopper, insert a 1/4 in. rod through the hole and grind the stopper to a 5/8 in. diameter at the large end, and slightly under 1/2 in. diameter at the small end, straight taper between ends, to form the plug.

Slightly flare one end of a piece of 1/4 in. tubing (6), about 2 in. long and insert into plug (7). Attach filler can to plug with transparent flexible tubing (5) about 2 feet long. See Fig. 2F-2.

Push the plug into the filler hole in fork top, Fig. 2F-2. Pour exact amount of oil into can. Work fork up and down. Air escaping through oil in filler can as fork is pushed downward will cause the oil to bubble violently, but because the bottom of the can serves as a baffle, no oil will be lost. Compressing the fork forces air out, releasing it draws oil into fork.

After the can appears to be empty, allow several minutes for can to completely drain then work fork once more. This assures getting into fork side the full quantity of oil poured into can.

INSPECTION PROCEDURE

If hydraulic fork does not work properly; that is, if it leaks oil or lacks original snubbing action, check the following before disassembling:

If oil leaks from vent hole in upper bracket bolt (2, Fig. 2F-3 and filler screw 23, Fig. 2F-4) when fork flexes, check for over-filling. Drain and refill with exact amount of oil.

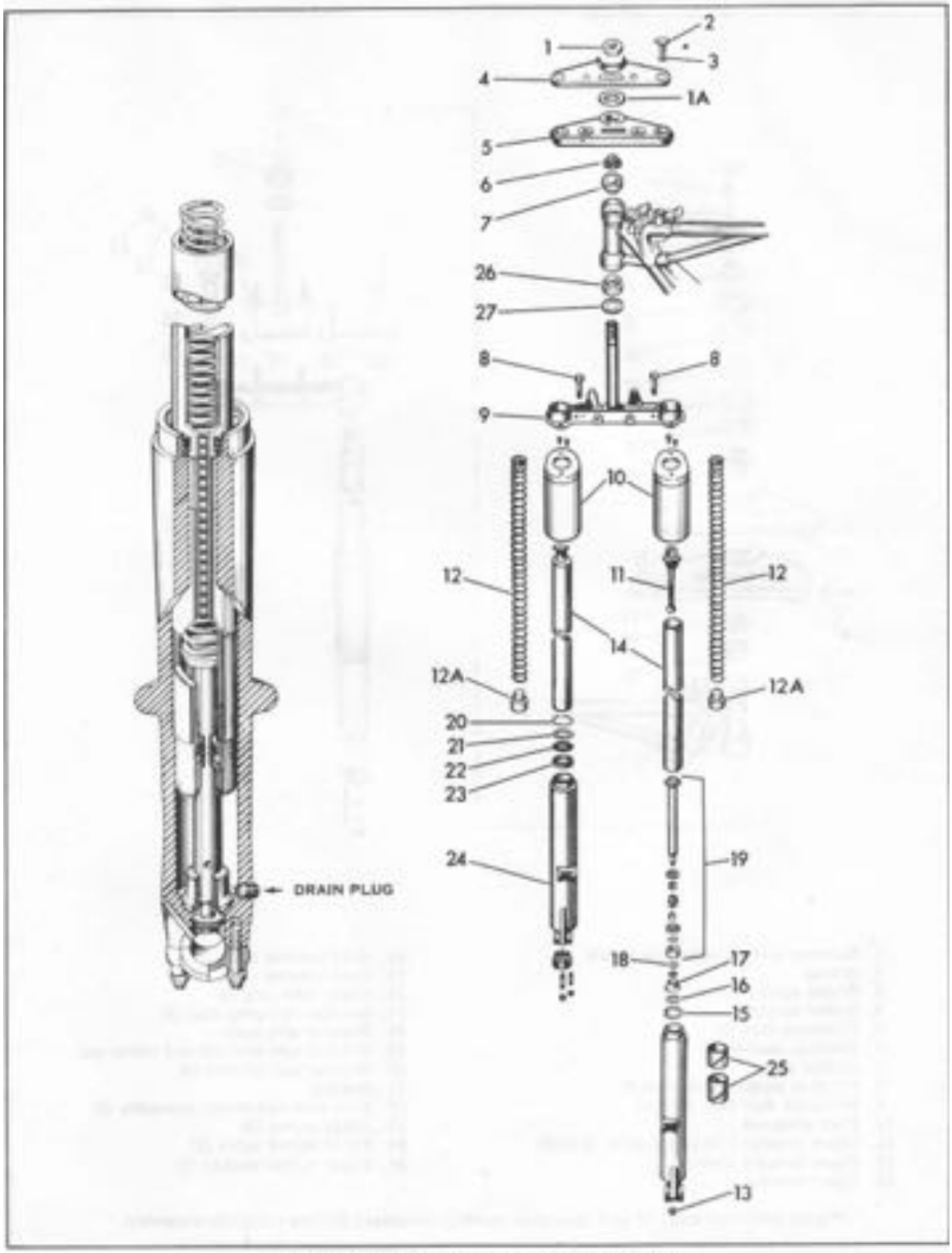
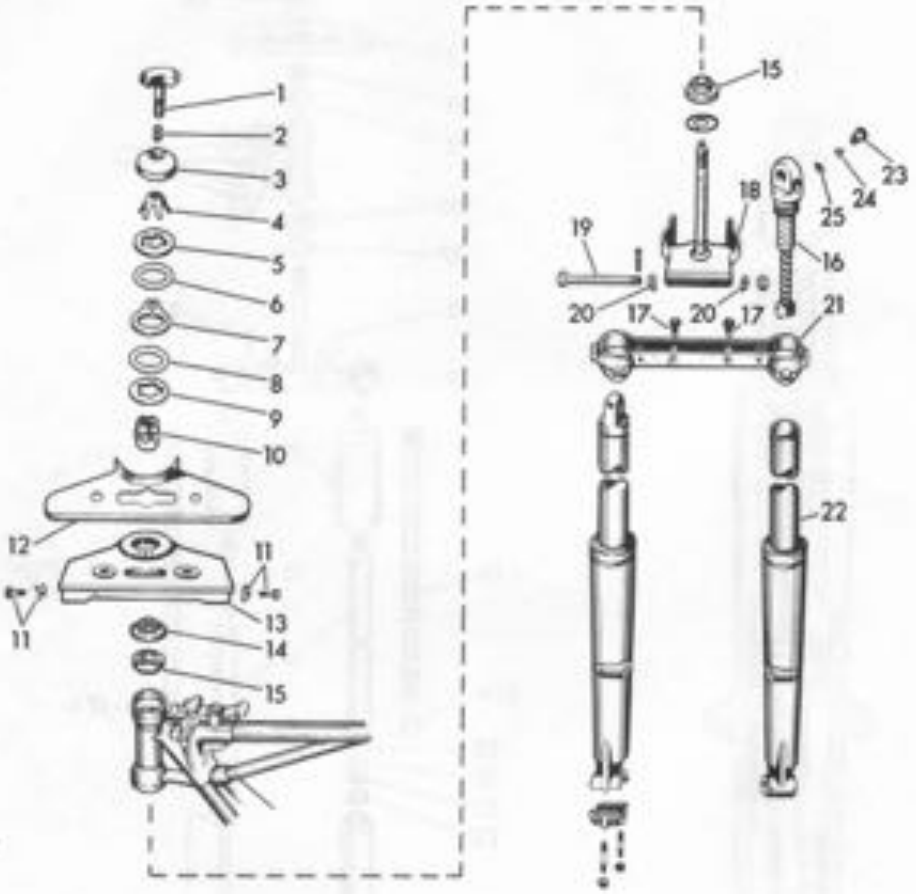



Figure 2F-3. Hydra-Glide Fork - Exploded View




1. Steering damper adjusting screw
2. Spring
3. Spider spring cover
4. Spider spring
5. Pressure disc (2)
6. Friction washer (2)
7. Anchor plate
8. Friction washer (see item 6)
9. Pressure disc (see item 5)
10. Fork stem nut
11. Upper bracket bolt and washer (2 each)
12. Upper bracket cover
13. Upper bracket
14. Head bearing nut
15. Head bearing (2)
16. Slider tube plug (2)
17. Bracket clamping stud (2)
18. Bracket with stem
19. Bracket bolt with nut and cotter pin
20. Bracket bolt washer (2)
21. Bracket
22. Fork tube and slider assembly (2)
23. Filler screw (2)
24. Filler screw valve (2)
25. Filler screw washer (2)

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2F-4. Adjustable Fork - Exploded View

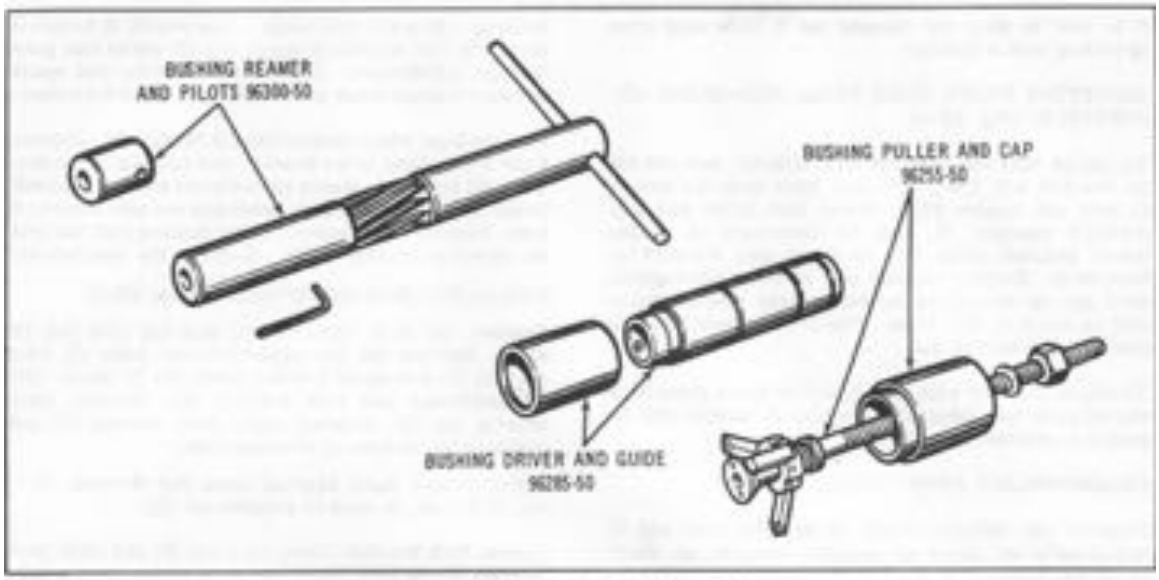



Figure 2F-5. Fork Rebushing Tools

If oil leaks from vent hole in upper bracket bolt when fork tubes contain correct amount of oil, check breather valve in upper bracket bolt or hole. To replace breather valve, place bolt in vise and tap back three stake locks with small punch and hammer. Pry valve from recess with length of stiff wire. If unable to free valve, drill hole in valve larger and pry valve out with small pin or screwdriver. In some cases, it is necessary to drill and tap hole in valve and pull it out with tap. Insert new valve assembly and stake three spots on bolt lip.

If fork action is stiff or soft and spongy and breather valves are functioning and oil content is correct, damper valves in fork tubes are inoperative. Fork must be disassembled. If fork is submerged in water, oil must be replaced at once. Water will rust damper tube valve parts. In neglected cases, the valves may stick and result in almost no snubbing action.

If oil bypasses slider tube bushings and leaks at top of sliders, bushings are worn and must be replaced. To replace slider bushings, fork must be disassembled. If slider bushings are worn, water will contaminate oil. Oil will appear emulsified, aerated and light brown.

If fork slider has play on slider tubes, bushings are worn and must be replaced. Fork must be disassembled. However, it is not necessary to disassemble entire fork and steering head unless desired.

## DISASSEMBLING FRONT FORK SLIDER AND TUBES

If necessary repairs involve only sliders and slider tubes, the entire fork need not be disassembled.

To remove sliders and slider tubes, proceed as follows:

Remove front wheel as described in "Wheels," Section 2C. Remove front brake hand lever coil clip on fender. Turn off axle sleeve nut and pivot stud nut, and pull brake side cover and shoe assembly plus axle sleeve off fork. Remove front fender.

Loosen fork bracket clamping studs (6, Fig. 2F-3 or 17, Fig. 2F-4). Remove the two upper bracket bolts with oil seals (2 and 3, Fig. 2F-3; 23, Fig. 2F-4). Pull fork slider and slider tube assemblies out bottom of slider covers.

Proceed with fork slider and slider tube disassembly and repair as described in a following paragraph, "Disassembling Front Fork."

## DISASSEMBLING FORK SLIDER

The slider only may be removed without disassembling remainder of fork assembly as follows:

Remove front wheel axle as described in "Wheels", Section 2C, and fender mounting screws from slider.

Right slider may be removed after turning off damper valve stud lock nut (13, Fig. 2F-3).

To remove left slider, first remove wheel, brake drum and brake side cover as described in "Disassembling Front Fork Slider and Tubes" above, and damper valve stud lock nut (13, Fig. 2F-3).

## ADJUSTING STEERING DAMPER (DUO-GLIDE ADJUSTABLE AND SERVI-CAR)

Turn steering damper adjusting screw (1, Fig. 2F-4) clockwise to apply dampening action and counterclockwise to reduce dampening action. Apply steering damper only when operating under conditions where some degree of dampening stabilizes steering.

It is best to keep the damper set a little snug when operating with a sidecar.

ADJUSTING FRONT FORK TRAIL (DUO-GLIDE ADJUSTABLE) (Fig. 2F-4)

To adjust fork trail for use with sidecar, turn off nut on bracket bolt (19). Tap bolt head back far enough to pry out washer (20). Grasp fork tubes and pull forward sharply. It may be necessary to loosen upper bracket bolts (11) to move fork forward or backward. Revolve bracket bolt washers 180 degrees until pin on washer is forward. Seat washer pin in slot in bracket (21) boss. Tap bracket bolt (19) into position and turn on nut.

To adjust fork for solo riding, follow same procedure except push fork tubes back and insert washer (20) so pins are rearward.

DISASSEMBLING FRONT FORK

Prepare for disassembling by raising front end of motorcycle on stand or suitable support, so wheel is off the floor.

Remove front and side fork trim panel or headlamp housing. Remove headlamp. Disconnect at terminal strip the two headlamp wires and all wires that pass through handlebars. Disconnect throttle and spark advance cables from carburetor and circuit breaker.

Remove front wheel as described in Section 2C. Remove front brake hand lever bracket and coil clip on fender. Turn off front axle sleeve nut and pivot stud nut, and pull brake side cover and shoe assembly and axle sleeve off fork. Remove front fender.. Slider bushing play can best be checked at this point. Remove the handlebars.

DUO-GLIDE (NON-ADJUSTABLE) (Fig. 2F-3)

Remove the fork stem nut (1) and nut lock (1A) (if used). Remove the two upper bracket bolts (2) with oil seal (3) and upper bracket cover (4) (if used). Lift off handlebar and fork bracket (5). Remove head bearing nut (6). Remove upper head bearing (7) and pull fork out bottom of steering head.

Note: Frame head bearing Lock Nut Wrench, Part No. 96219-50, is used to remove nut (6).

Loosen fork bracket clamping studs (8) and slide fork bracket (9) off fork tubes with fork slider covers (10). Turn out two slider tube plugs (11) and invert sliders to drain out oil and remove fork springs (12).

Figure 2F-6. Removing Fork Slider Bushing

Figure 2F-7. Driving in Fork Slider Bushing

Figure 2F-8. Reaming Replacement Bushing

Remove damper valve stud lock nut (13) from bottom of slider and pull slider tube (14) out of slider (24). Pinch out snap ring (15) from lower end of slider tube and drop out damper tube lower bushing (17). Discard gaskets (16 and 18). Slide out damper valve assembly (19). Snap out spring ring (20), washer (21), felt washer (22) and pry out oil seal (23).

DUO-GLIDE (ADJUSTABLE) AND SERVI-CAR (Fig. 2F-4)

Prepare for disassembly as described in paragraph above. Turn out steering damper adjusting screw (1) and lift out parts 2 through 9. Parts 5, 7 and 9 may be loosened by inserting a screwdriver tip between parts and prying upward.

Turn off stem nut (10). Remove upper bracket bolts and washers (11) and lift off bracket cover (12) and upper bracket (13). Remove head bearing nut (14). Lift out upper head bearing (15) and slip fork assembly out of frame steering head.

NOTE: Frame head bearing Lock Nut Wrench, Part No. 96219-50, is used to remove nuts (10) and (14).

Remove slider tube plugs (16) and loosen clamping studs (17). Slip fork tube and slider assembly (22) out of bracket (21). Slider tube and slider disassembly is the same as described for non-adjustable fork.

STEERING HEAD BEARINGS

Each steering head bearing consists of two pieces,

Figure 2F-9. Indicating High Point

the bearing outer race, and the roller bearing with inner race. The outer races are pressed into the steering head cups in the frame head. The lower roller bearing is assembled over the fork stem and the upper roller bearing is held in place on the fork stem by the bearing lock nut on the upper threaded end of the fork stem.

After fork is removed inspect bearings and races for pitting, roughness or wear. Roughness of the roller bearings can be determined by rolling the bearings on the bearing races by hand. If bearings or races require replacement it is best to replace them in sets.

To replace bearing race, knock head cup from steering head using a suitable drift. Press new bearing race in new head cup and then press assembly into frame head. If you wish to use old head cups, holes must be drilled in back side of cup so that race can be driven out by using small diameter drift or by some other improvised means.

NOTE: Two types of bearings and races and head cups are in use. These parts are not interchangeable. 1960 and later bearing has 19 rollers and must be used with bearing race which is 27/64 high - 1.980 O.D. 1960 and later head cup must be used with this bearing race for proper press fit.

1959 and earlier bearing has 16 rollers and must be used with bearing race which is 3/8 high - 1.969 O.D. 1959 and earlier head cup must be used with this bearing race for proper press fit.

REPLACING FRONT FORK SLIDER BUSHINGS

The front fork slider bushings (25, Fig. 2F-3) may be replaced using three special tools.

1. Part No. 96255-50, Fork Slider Bushing Puller.

2. Part No. 96285-50, Bushing Driver and Guide.

3. Part No. 96300-50, Bushing Reamer and Pilots.

REMOVING SLIDER BUSHINGS. Position fork slider in vise as shown in Fig. 2F-6.

Remove spring ring, steel retaining washer and felt wiper from slider upper end. Pry out oil seal with large screwdriver.

Install Fork Slider Bushing Puller, Part No. 96255-50, so the three claws expand inside the tube under the upper, or shorter bushing. Place puller cap in oil seal counterbore, apply oil to screw threads and

steel washer. Turn nut down against puller cap and use engine sprocket wrench on nut to extract bushing. See Fig. 2F-6.

Remove lower bushing in the same manner.

INSTALLING FORK SLIDER BUSHINGS. New, replacement bushings are installed with Fork Slider Bushing Driver and Guide, Part No. 96285-50.

Wash out fork slider and lubricate slider bore with engine oil. Position new lower bushing in bushing driver guide to compress bushing, then place driver guide with bushing in slider oil seal counterbore as shown in Fig. 2F-7.

Drive bushing through the driver guide into fork slider. Bushing is positioned correctly in slider bore when second groove from top on driver is flush with top edge of driver guide. Do not drive bushing deeper than specified, or it will collapse enough so it cannot be finish-reamed.

Install upper bushing in the same manner lower bushing was installed. Drive it into slider until lower groove on driver is flush with top of driver guide. This positions upper bushing 1/16 in. below slider oil seal counterbore.

REAMING BUSHINGS. The Fork Slider Bushing Reamer with pilots, Part No. 96300-50, is used to ream the bushings to finished size.

Attach long pilot to reamer as shown in Fig. 2F-8. The long pilot fits into the unfinished lower bushing, acting as a guide, while reaming the upper bushing. Do not drop reamer into bushing. Slowly lower reamer into cutting position and ream bushing, turning reamer clockwise. Continue turning reamer clockwise as it is being extracted when cut is finished.

Remove long pilot from reamer and attach short pilot. Finish lower bushing in same manner as upper bushing. Use caution when passing reamer cutters through the upper bushing.

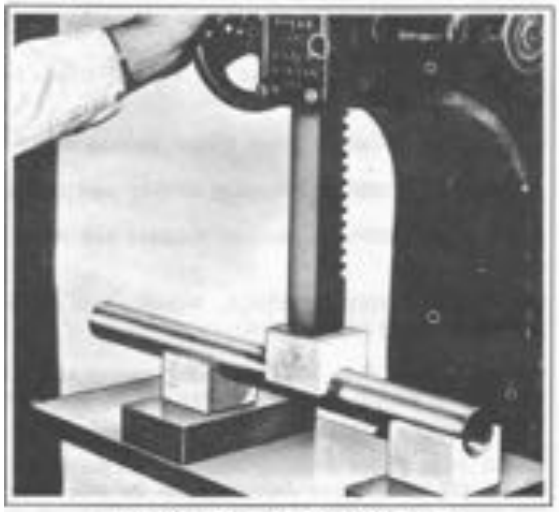


Figure 2F-10. Pressing High Point

INSPECTING AND SERVICING FRONT FORK

Clean and air dry all parts. Inspect outside of slider tubes and inside of slider for scratches, grooves, nicks and scoring. Minor burrs may be taken off with a fine oil stone. Replace all badly worn parts.

Inspect damper tube valve parts for rust and broken springs. Replace broken springs and all valve parts that are deeply pitted or otherwise in unusable condition.

Inspect slider tube plug for loose or displaced fork upper baffle cups and broken spring. Solder loose cups in place and replace any broken parts. Be sure cups are arranged with slots for oil passage on alternate sides. Improper arrangement may cause oil leak at upper bracket bolt.

STRAIGHTENING FORK TUBES

Straightening fork tubes requires several special tools including hydraulic or arbor press, dial indicator and straightening blocks. If facilities are not available locally, fork tubes may be returned to the factory for straightening.

IMPORTANT

Repair fork tubes must be sent to the factory through an authorized Harley-Davidson dealer.

Never attempt to straighten a fork tube that has a sharp angle bend. It should be scrapped because the metal is stretched.

Before beginning the straightening operation, clean the fork tube. Locate bends with dial indicator. A fork tube is usually bent in two or three places, seldom only one. Place fork tube on straightening blocks. Correct bend in tube with an arbor or hydraulic press.

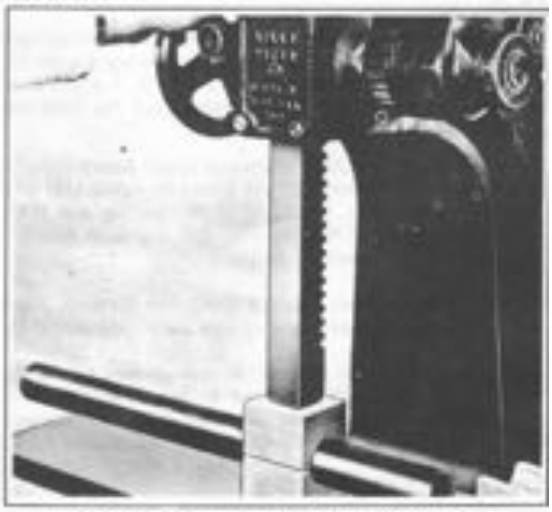


Figure 2F-11. Pressing Fork Tube Round

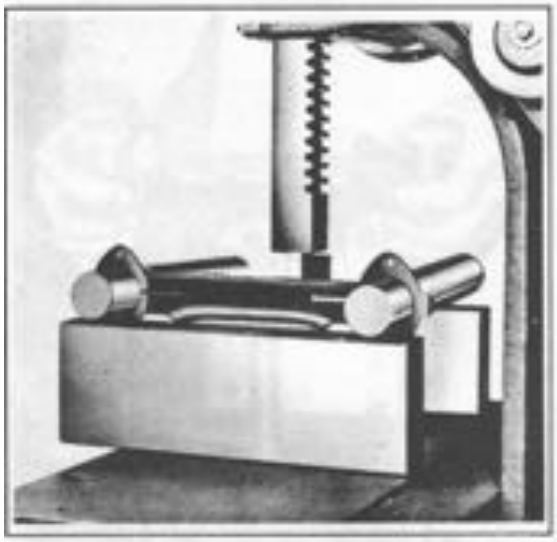


Figure 2F-12. Correcting Bracket Bow

Find the highest point out of round with a dial indicator (Fig. 2F-9) and mark with chalk. Press high point as shown in Fig. 2F-10. Repeat indicating and pressing operations until tube is within .003 in. to .004 in. of being straight.

Sometimes fork tubes are out of round, especially at the point it is clamped in the fork bracket. Place tube in straightening blocks and press until perfectly round as shown in Fig. 2F-11, checking with dial indicator and micrometer. Finally, check tube by inserting in new fork slider. Work tube up and down. If it does not bind, it is straight.

STRAIGHTENING FORK STEM AND BRACKET ASSEMBLY

Straightening a fork stem and bracket assembly requires a great deal of skill, experience and several tools and fixtures. Special tools necessary include Fork Tube Straightening blocks, Part. No. 96245-50, four blocks are needed; Bending Bar, Part No. 96806-40; Fork Stem and Bracket Aligning Gauge, Part No. 96245-51. In addition, the following pieces of bar stock are needed: Two bars, 1-5/8 in. diameter, about 12 in. long; two bars 1 in. x 4 in. x 12 in. (approximately); assorted pieces of rectangular bar stock to use in transmitting arbor press pressure to unit to be straightened.

If facilities are not available locally, fork stem and bracket assembly may be sent to factory for straightening providing it is not badly bent or broken.

NOTE

Repair fork stems and bracket assemblies must be sent to factory through authorized Harley-Davidson dealers.

To straighten stem and bracket, proceed as follows: Insert the two 1-5/8 in. x 12 in. bars in fork bracket

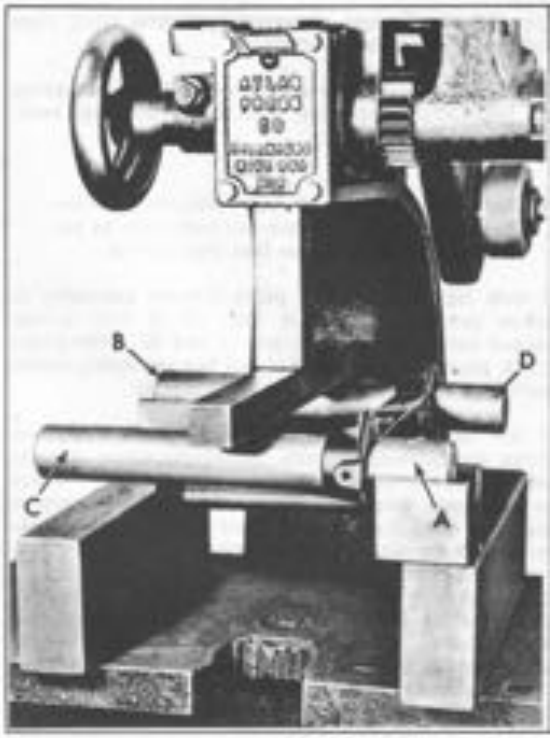



Figure 2F-13. Straightening Two Twisted Legs

Figure 2F-14. Checking Bracket Alignment

and secure with two clamping studs. Sometimes the bracket is so badly bent that the bars cannot be inserted. In this case, press the bars into place with an arbor press, then press on the front edge of bracket to correct the "bow" distortion as shown in

Fig. 2F-12. Repeat pressing operation along edge until bars are loose in bracket.

A bracket assembly is usually out of alignment along the horizontal centerline, with one or both legs bent.

NOTE

Reference to vertical and horizontal centerlines applies to bracket and fork stem as positioned on arbor press (see Fig. 2F-12).

If both legs are twisted, place bracket assembly on arbor press as shown in Fig. 2F-13 with blocks placed under two low legs only (A and B). With press block placed across bracket and bar assembly, press until high legs (C and D) are in alignment.

If one leg is bent, place bracket and bar assembly on three straightening blocks, two blocks under straight leg and one block under low end of other leg. Place press block diagonally across bracket assembly to high leg until high leg is forced down and into alignment with the other three leg ends.

Place the fork stem and bracket assembly on the four straightening blocks located on the surface plate (see Fig. 2F-14). If the legs rest squarely on straightening blocks, the bracket assembly is correctly trued on a horizontal plane. If bracket is not true, press again, checking alignment after each operation.

Use a square to check if bracket assembly is bent, distorted or out of parallel on a horizontal plane as shown in Fig. 2F-15. Place bracket and bar assembly in a heavy vise and straighten using the Bending Bar.

Check fork stem alignment with Fork Stem and Bracket Aligning Gauge as shown in Fig. 2F-16. Use Bending Bar to bring stem into position. Recheck the fork completely.

ASSEMBLING FRONT FORK (DUO-GLIDE NON-ADJUSTABLE) (Fig. 2F-3)

Replace upper oil seal (23) and felt washer (22) in top of fork slider. Wash chips and oil from fork slider and position new oil seal in counterbore. Drive oil seal into counterbore and against seat with driver (Part No. 96250-50) and mallet as shown in Fig. 2F-17. Drive with light blows and stop immediately

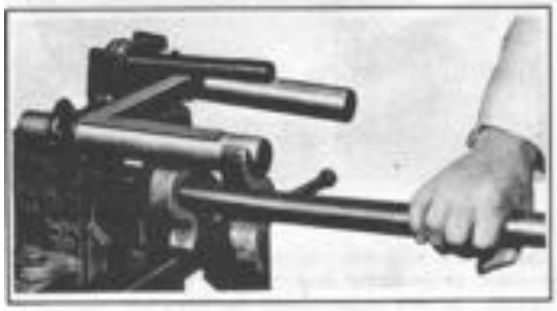


Figure 2F-15. Bending Bracket Legs Parallel

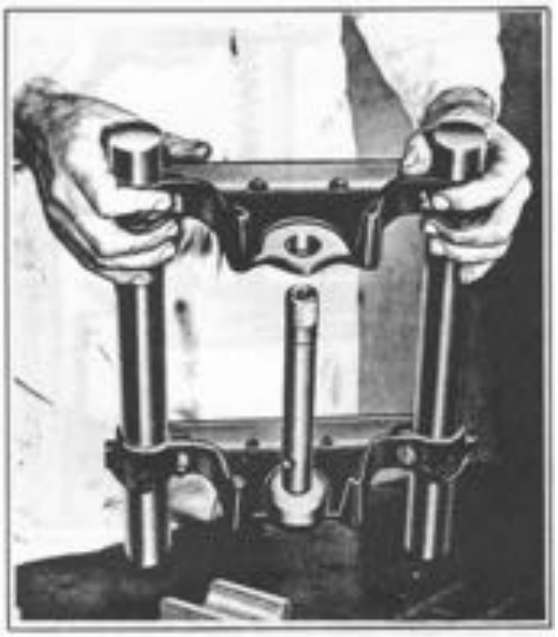


Figure 2F-16. Checking Stem Alignment with Gauge

when seal has bottomed. Insert spring ring washer (21) and spring ring (20). Position spring ring so its gap is directly over water drain hole in slider top.

Clamp a length of about 1 in. steel rod upright in a vise so that 13-1/2 in. extends above top of jaws. Assemble damper valve (19) with gasket (18), lower bushing (17) and lower bushing gasket (16). Make sure all of old gasket is removed before installing new part. Invert slider tube over length of rod in vise and drop damper valve assembly in place. Install snap ring (15) in notch provided in bottom of slider tube. Check clearance between snap ring and lower bushing. If clearance exceeds .004 in., remove snap ring, gasket and lower bushing and insert additional shims to bring to a maximum of .004 in. clearance.

Lubricate outside of slider tube with fork oil and slip slider assembly down over slider tube. Turn lock nut (13) on damper valve stud extending out bottom of slider. Work slider to check for bind. If bind is present, release lock nut, rotate slider 180 degrees and reassemble. Fasten fork slider covers (10) to fork bracket (9), and slip fork bracket over slider tubes. Adjust so 5-1/16 in. of slider tube extends above top of fork bracket and temporarily tighten bracket clamping studs (8).

Pour 7 oz. of Harley-Davidson Front Fork Oil into each slider tube, insert fork springs (12) and turn in slider tube plugs (11).

Press lower head bearing guard (27) and greased lower head bearing (26) onto stem. Install stem in steering head on motorcycle. Grease and position upper head bearing (7). Turn on head bearing nut

Figure 2F-17. Inserting New Oil Seal

(8), until there is noticeable drag in bearing when fork is turned - then loosen nut enough so fork turns freely. Install handlebar and fork bracket (5), bracket cover (4). Securely tighten slider tube plugs. Loosen bracket clamping studs (8) and rotate slider tubes so flats on slider tube plugs are to the sides of the fork assembly. They must be in this position to have the slider tube plugs function properly. Install fork stem nut and then securely tighten bracket clamping studs.

Slip plug oil seal (3) on upper bracket bolt (2) and screw into slider tube plug. Replace handlebar, etc. Reassemble motorcycle in reverse order of disassembly.

ASSEMBLING FRONT FORK (DUO-GLIDE ADJUSTABLE AND SERVI-CAR) (Fig. 2F-4)

Follow procedure described for non-adjustable front fork except for the following points:

1. Position slider tubes in bracket (21) so top of slider tube is exactly 5-1/16 in. above top of bracket, and flat surfaces on slider tube plugs are directly toward side of motorcycle with filler screw (23) toward rear of fork.

Assemble remainder of fork and steering head in reverse order of disassembly.

## SHOCK ABSORBERS

ADJUSTING REAR SHOCK ABSORBER SPRING

The rear shock absorber springs can be adjusted to three positions for the weight the motorcycle is to carry. The average weight solo rider would use the extended spring position (off cam); when in low position (off cam), the cam lobes should be next to each other: that is, single lobes and double lobes matched. If necessary, rotate the cam to line them up properly. A heavy solo rider might require the position with springs slightly compressed (first cam step); buddy seat riders require the fully compressed spring position (second cam step).

To adjust the rear shock absorber springs, turn cushion spring adjusting cam to desired cam position with Spanner Wrench, Part No. 94700-52B. Both cushion spring adjusting cams must be adjusted to the same position. Always back off cam in opposite direction when releasing spring tension to intermediate or solo position.

Note: If shock cam is turned too far so that it falls off top position, it will not be matched correctly with other cam. To correct this condition, continue 180° in same direction until it falls off again and then adjust to desired position.

DISASSEMBLING REAR SHOCK ABSORBER

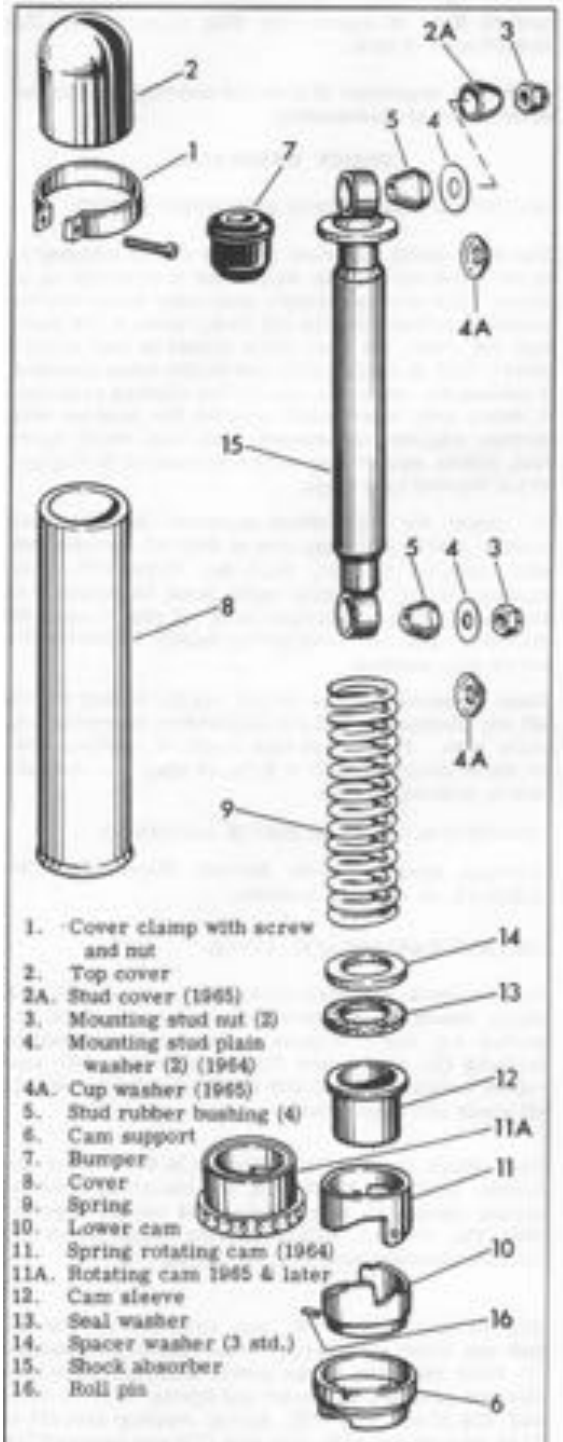
Position motorcycle on Service Stand, Part No. 96810-63, or suitable blocking.

1966 AND EARLIER (FIG. 2F-18)

Loosen shock absorber cover clamp (1) and slip off shock absorber top cover (2), exposing shock absorber top stud. Remove top and bottom mounting stud nut (3), stud cover (2A), washer (4 or 4A), stud rubber bushing (5), and slip shock absorber assembly off upper and lower studs.

Turn shock absorber upside down in Rear Shock Absorber Tool, No. 97010-52A, and compress absorber spring enough to turn lower stud eye 90 degrees. (See Fig. 2F-19.) Release spring compression and remove absorber assembly from tool.

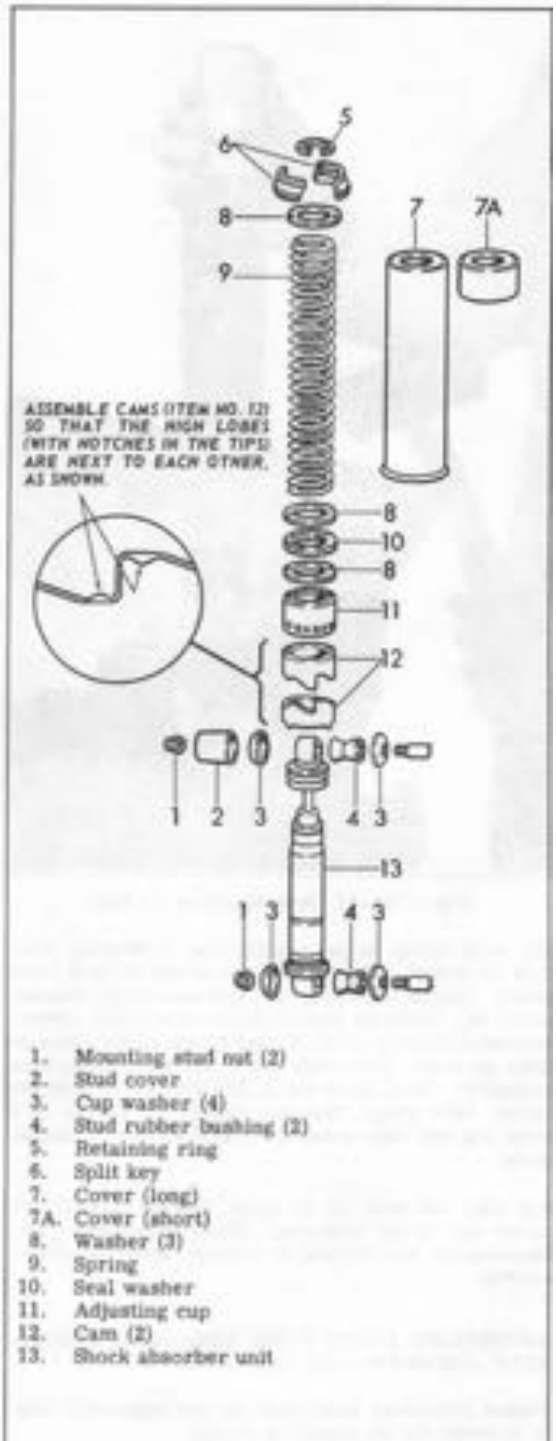
Slip off cam support (6), turn absorber end for end and rap lower end sharply on surface to free bumper (7) from retaining flange inside absorber cover (8). Remove absorber assembly and spring (9) from cover and slip lower cam (10), spring rotating cam (11 or 11A) cam sleeve (12), dirt seal (13) and washers (14) off absorber unit. Shock absorber bumper (7) is split and may be sprung and slipped off absorber piston shaft after it has been extended.




1. Cover clamp with screw and nut
2. Top cover
2A. Stud cover (1965)
3. Mounting stud nut (2)
4. Mounting stud plain washer (2) (1964)
4A. Cup washer (1965)
5. Stud rubber bushing (4)
6. Cam support
7. Bumper
8. Cover
9. Spring
10. Lower cam
11. Spring rotating cam (1964)
11A. Rotating cam 1965 & later
12. Cam sleeve
13. Seal washer
14. Spacer washer (3 std.)
15. Shock absorber
16. Roll pin

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2F-18. 1966 and Earlier Rear Shock Absorber - Exploded View




1. Mounting stud nut (2)
2. Stud cover
3. Cup washer (4)
4. Stud rubber bushing (2)
5. Retaining ring
6. Split key
7. Cover (long)
7A. Cover (short)
8. Washer (3)
9. Spring
10. Seal washer
11. Adjusting cup
12. Cam (2)
13. Shock absorber unit

Figure 2F-18A. 1967 & Later Rear Shock Absorber - Exploded View

1967 AND LATER (Fig. 2F-18A)

Remove top and bottom mounting stud nut (1), upper stud cover (2) if used, and cup washer (3). Slip shock absorber assembly off upper and lower studs. Push rubber bushings (4) from shock absorber mounting eyes. Remove retaining ring (5) from assembly. Place shock absorber in Rear Shock Absorber Tool, Part No. 97010-52A with split key (6) up. Compress absorber spring enough to remove each half of split key (6) from flange on shock eye. Release spring compression and remove absorber assembly from tool. Remaining items can be removed in order shown in Fig. 2F-18A.

INSPECTION

Examine absorber unit for traces of fluid leaking, especially at upper end. Unit should have no leaks and should compress slightly easier than it extends. If possible, compare action with unused unit. Shock absorbers cannot be repaired. Faulty units must be replaced.

Clean and examine all other parts for wear and damage, paying particular attention to the condition of the stud rubbers, the ride control adjustment cams, dirt seal and spring.

ASSEMBLING REAR SHOCK ABSORBER

Rear shock absorber assembly is essentially the reverse of disassembly.

1966 AND EARLIER (Fig. 2F-18)

Apply a thin coat of "Grease-All" grease to the cam sleeve (12) and cam surface of spring rotating cam (11 or 11A), and slip 11 or 11A over 12. Drive roller pin (16) into hole in side of lower cam (10) and position cam support (8) over lower cam with pin in appropriate slot. On 1964 and earlier models, slot marked "A" is for left side assembly, and slot marked "B" is for right side assembly. Either slot can be used on 1965 and later models.

Extend absorber piston rod and slip split bumper (7) over rod. Slide spring (9) into cover (8) and shock absorber into spring. Turn assembly over and rap upper mounting stud loop on surface to seat bumper in flange.

Place dirt seal washer (14) and dirt seal (13) into cover and position assembly of parts 6, 10, 11 or 11A, and 12 on them over absorber. Compress spring in tool and turn lower mounting stud loop 90 degrees to register with notch in cam support.

On 1964 and earlier models, assemble unit to motorcycle so letters "A" and "B" are facing rearward. On later models, shock can be installed with eye in any position.

1967 AND LATER (FIG. 2F-18A)

Apply a thin coat of grease to all surfaces of both cams. Note that cams (12) are identical and be sure to position cam lobes correctly as shown in Fig. 2F-18A inset. Place assembly in compressor tool and compress spring enough to install key halves (6). Release spring compression. Keys will lock into place in inside diameter of covers 7 or 7A. Install retaining ring (5).

Figure 2F-19. Disassembling Shock Absorber (1966 & Earlier Shown)

## REAR FORK

### DISASSEMBLING REAR FORK

To disassemble rear fork, first remove following assemblies:

1. Rear wheel (see Section 2C).

2. Rear brake side cover with connecting control linkage (see Section 2G).

3. Rear shock absorbers (see "Shock Absorbers").

See Fig. 2F-20. Turn back locking ear on pivot bolt lock washer (2) and turn out pivot bolt (1). Remove fork (3) from frame. With appropriate size arbor pin, push out bearing spacer (4), bearing seal (5) and bearing with outer race (6) from each side of fork pivot bearing.

### INSPECTION AND SERVICING

Clean pivot bolt hole in fork and bearing parts. Check for wear of bearing, bearing race and bearing seal.

Rough check the rear fork for correct alignment. Dimensions shown in Fig. 2F-20 will provide enough information to determine if fork is far enough out of alignment to require re-aligning or replacement. Straightening a badly bent fork requires special tools and fixtures for holding, bending and gaging. If facilities are not available locally, damaged rear fork can be returned to the factory for repair through any authorized Harley-Davidson dealer.

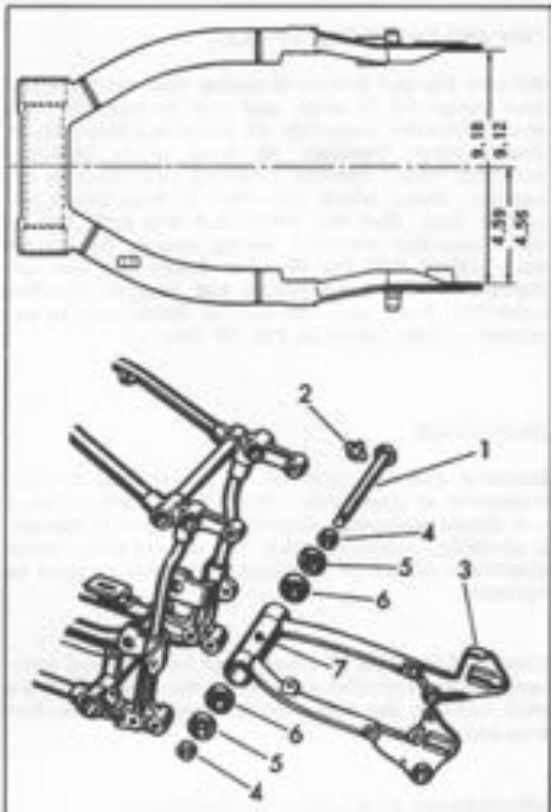
### ASSEMBLING REAR FORK

Press outer bearing races into fork. Grease bearings with Harley-Davidson "Grease-All" grease and insert. Apply additional grease to outside face of bearing so that space between bearing and seal will be filled when seal is installed. Grease bearing seals in groove between sealing lips and press into place. Put bearing spacers over seals.

NOTE

1962 and later models have grease fitting in fork pivot housing. Apply additional quantity of grease to fitting with hand grease gun to fill space between bearings. A very small quantity of grease should be applied to fitting with hand grease gun at 2000 mile intervals.

Assemble pivot bolt with lock washer and tighten bolt to preload bearings one to two pounds as follows:




1. Pivot bolt
2. Pivot bolt lock washer
3. Rear fork
4. Pivot bearing spacer (2)
5. Bearing seal
6. Bearing
7. Grease fitting

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2F-20. Rear Fork - Exploded View

With bearings free, weigh extreme rear end of fork by attaching a spring scale and raising the fork to a horizontal position. Tighten bearing pivot bolt just enough to increase bearing drag one to two pounds.

For example, if fork with bearings free weighs four pounds, tighten pivot bolt until fork movement to horizontal position registers five to six pounds on scale. Lock pivot bolt lock washer.

# BRAKES

## DISASSEMBLING FRONT BRAKE (Fig. 2G-2)

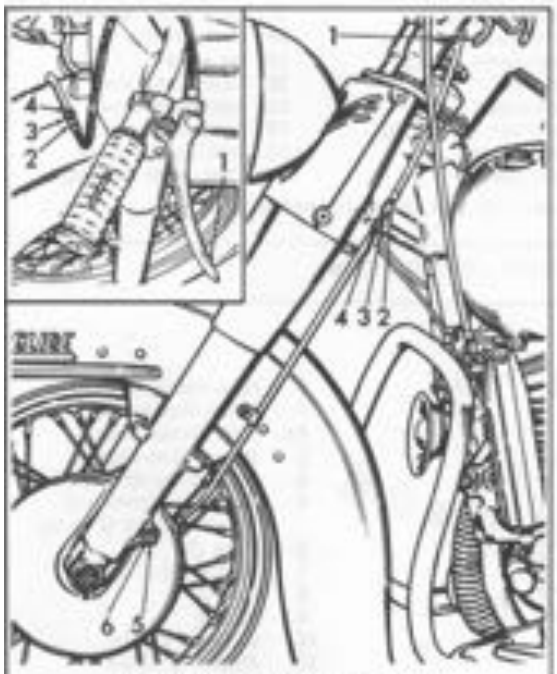
Remove wheel with brake drum from fork as described in 2C. Spring brake shoes out and away from side cover (23) at top to free shoes (2 and 4) and springs (1 and 3) from pivot stud (8) and cam lever (18).

Remove cotter pin (16), cam lever washer (17) from cam lever stud (20). Disconnect cable ferrule from anchor pin in hand lever by loosening clamp nut (10) and depressing brake hand lever. Slip cam lever assembly off stud. Make complete disassembly in order shown.

## INSPECTION AND SERVICING (Fig. 2G-2)

If linings are worn down to rivet heads, impregnated with grease as a result of over-greasing wheel hubs, cracked or ridged badly, they must be replaced. When relining a shoe, start at one end and work to the other to make linings bear tightly against shoe.

If a riveting machine is not available, set rivets with hand tools and bevel lining ends.




1. Front wheel brake hand lever
2. Brake adjusting sleeve
3. Adjusting sleeve lock nut
4. Adjusting sleeve nut
5. Brake shoe pivot stud nut
6. Brake shoe pivot stud

Figure 2G-1. Adjusting Front Brake

Examine drums for ridging and scoring. Surface must be reasonably smooth and flat. If ridged, turn down drums to clean up. Wash cam lever and cam lever stud and check fit. If play exists, force out cam lever bushing (24) and install new part.

## ASSEMBLING FRONT WHEEL BRAKE (Fig. 2G-2)

Assemble in reverse order of disassembly except, for ease of assembly, connect two shoes with top return spring (3). Position unit on pivot stud (8) and cam lever (18). Insert lower spring (1). Spring hooks must be in shoe spacer notch nearest side cover. When reassembling cable ferrule in hand lever anchor pin with side slot, be sure slot is toward inside as shown. Earlier type pin with slotted end should have open end facing downward.

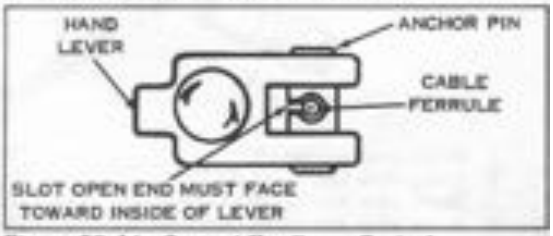



Figure 2G-1A. Correct Handlever Control Cable Assembly

## ADJUSTING FRONT BRAKE CABLE (Fig. 2G-1)

Front brake cable may be adjusted as follows:

Loosen adjusting sleeve lock nut (3) and turn adjusting sleeve nut (4) to obtain desired amount of hand lever (1) free movement; clockwise for less movement and counterclockwise for more movement. About 3/16 in. of brake cable movement should be free, or about 1/4 of the full lever movement. Tighten adjusting sleeve lock nut.

## ADJUSTING FRONT BRAKE SHOES

Raise front wheel off ground so it may be rotated. Loosen brake shoe pivot stud nut (5, Fig. 2G-1) and loosen axle sleeve nut. Apply brake. With brake pressure applied, tighten axle sleeve nut and pivot stud nut. This procedure centers shoes against drum so full lining length contacts drum on brake application.

## DISASSEMBLING REAR WHEEL BRAKE (Fig. 2G-3)

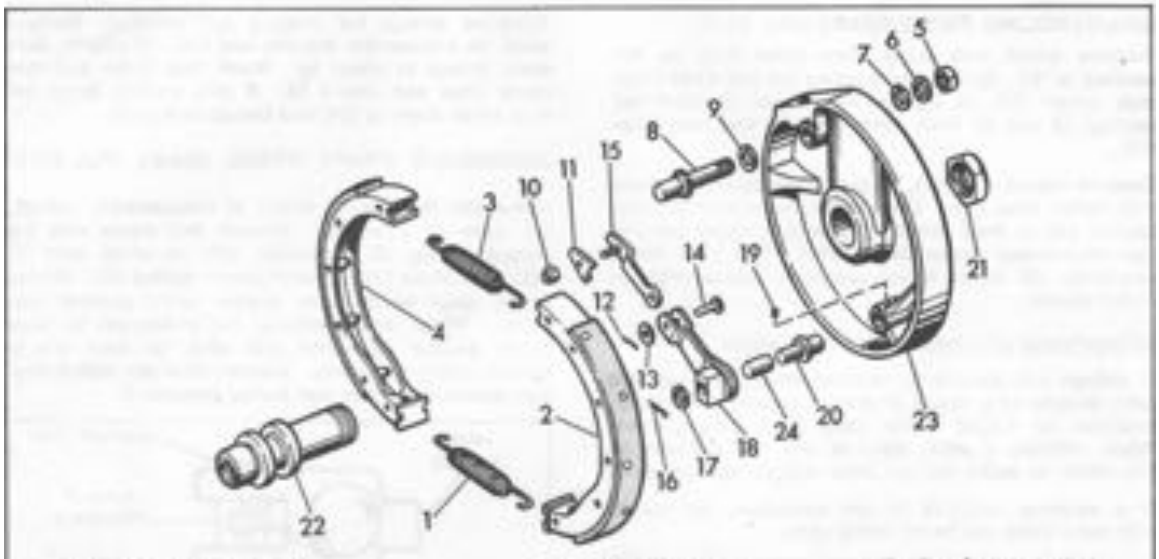
Remove rear wheel from motorcycle as described in Section 2C. Disconnect shoe return spring (1) and slip shoes (2 and 2A) and anchor (lower) spring (3) away from side cover. Remove hold-down springs (4) from side cover. If necessary, remove wheel cylinder by turning out the two cylinder screws (5) on outside of side cover.

INSPECTION AND SERVICING (Fig. 2G-3)

Follow inspection procedure as described in this section under front wheel brake except examine wheel cylinder and side cover for signs of leaking fluid.

NOTE

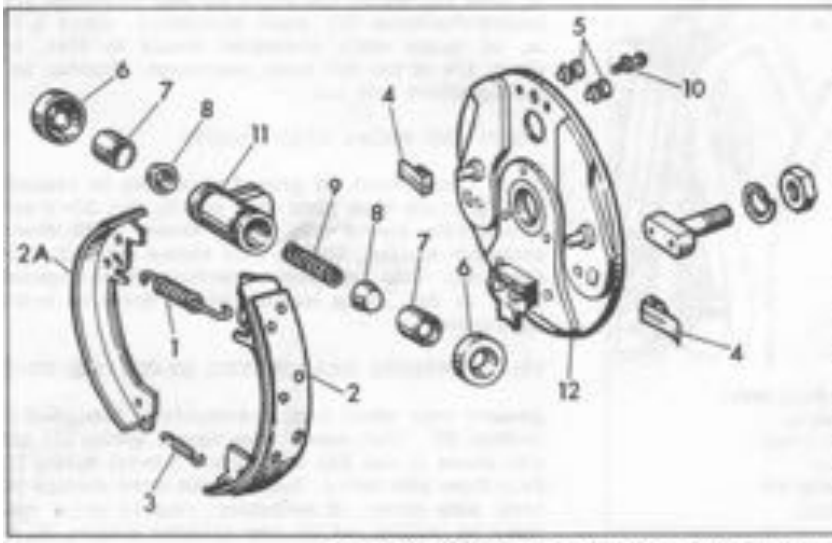
Do not depress rear wheel brake pedal with shoe assemblies disassembled.




1. Brake shoe spring (2)
2. Brake shoe and lining (2)
3. Brake shoe spring (see item 1)
4. Brake shoe and lining (see item 2)
5. Brake shoe pivot stud nut
6. Pivot stud flat washer
7. Pivot stud lock washer
8. Pivot stud
9. Pivot stud washer
10. Clevis clamp nut
11. Cable clevis clamp
12. Cotter pin
13. Flat washer
14. Cam lever clevis pin
15. Cable clevis
16. Cotter pin
17. Cam lever washer
18. Cam lever
19. Set screw
20. Cam lever stud
21. Axle sleeve nut
22. Front axle sleeve
23. Brake side cover
24. Cam lever bushing

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2G-2. Front Wheel Brake - Exploded View




1. Shoe return spring
2. Front brake shoe
2A. Rear brake shoe
3. Brake shoe spring
4. Hold-down spring (2)
5. Cylinder screw and lock washer (2 each)
6. Boot (2)
7. Piston (2)
8. Cup (2)
9. Spring
10. Bleeder nipple
11. Wheel cylinder
12. Brake side cover

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 2G-3. Rear Wheel Brake - Exploded View

If faulty unit is found, install a repair kit. Remove old boots (6), pistons (7), cups (8) and spring (9). Be sure cylinder wall and pistons are free from burrs. Dip replacement parts in brake fluid and assemble. Never dip or wash hydraulic brake cylinder parts in gasoline, kerosene or oil. If necessary to clean parts use denatured alcohol.

NOTE

When linings are worn down at any point so rivet heads come close to contacting drum surface, shoes or linings should be replaced.

Linings and rivets are available separately for 1963 and later rear wheel brakes, but entire shoe and lining assembly must be replaced on 1958 to 1962 models.

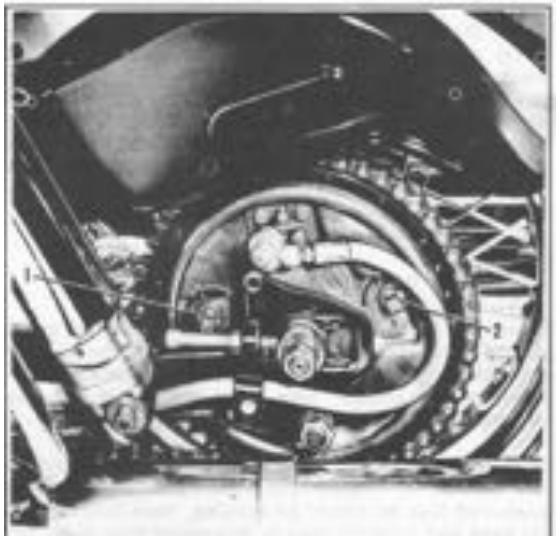
Scored or grooved brake drums should be refinished before installing new shoes or linings. Brake Drum turning arbor, Part No. 97280-60 can be used to refinish brake drum inside diameter on a lathe as necessary to clean up.

Use standard size shoe or lining set for brake drums refinished up to 8.040 in. maximum on inside diameter.

Use a .030 in. oversize shoe or lining set for brake drums refinished over 8.060 in. but not more than 8.100 in. maximum on inside diameter.

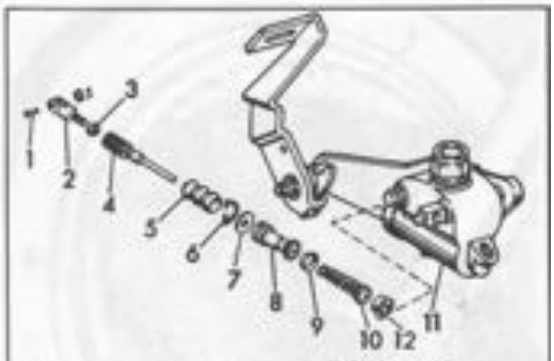
ASSEMBLING REAR WHEEL BRAKE (Fig. 2G-3)

Assemble rear wheel brakes in reverse order of disassembly except: Apply a light coat of grease on hold-down springs (4) and spots on side cover (12) where shoes touch when in operating position.




1. Front brake shoe adjusting cam nut
2. Rear brake shoe adjusting cam nut

Figure 2G-4. Adjusting Rear Brake




1. Rod clevis pin with washer and cotter pin
2. Lever clevis
3. Master cylinder plunger lock nut
4. Master cylinder plunger
5. Cylinder boot
6. Stop wire
7. Stop washer
8. Piston assembly
9. Piston cup
10. Piston return spring
11. Master cylinder
12. Valve

Figure 2G-5. Brake Master Cylinder - Exploded View

**CAUTION**

Front shoe (2) and rear shoe (2A) are of different widths on 1963 and later models. Narrow shoe must be in rear position and wide shoe in front position.

Assemble shoes (2) to lower return spring (3), position shoe assembly on plate anchor block at bottom of side cover and install top spring. Short hook is inserted in elongated hole on front shoe. Reassemble wheel.

ADJUSTING REAR WHEEL BRAKE SHOES (Fig. 2G-4)

Raise rear wheel so it can be turned freely by hand. Brakes are adjusted by means of two adjusting cams located on outside of brake side cover. Turn front adjusting cam nut (1) counterclockwise until wheel has noticeable drag. Spin wheel forward and backward to center shoes. Slowly turn cam nut clockwise until wheel turns freely. Repeat process on rear cam nut (2) which spreads shoes with a clockwise rotation and retracts shoes with a counterclockwise rotation.

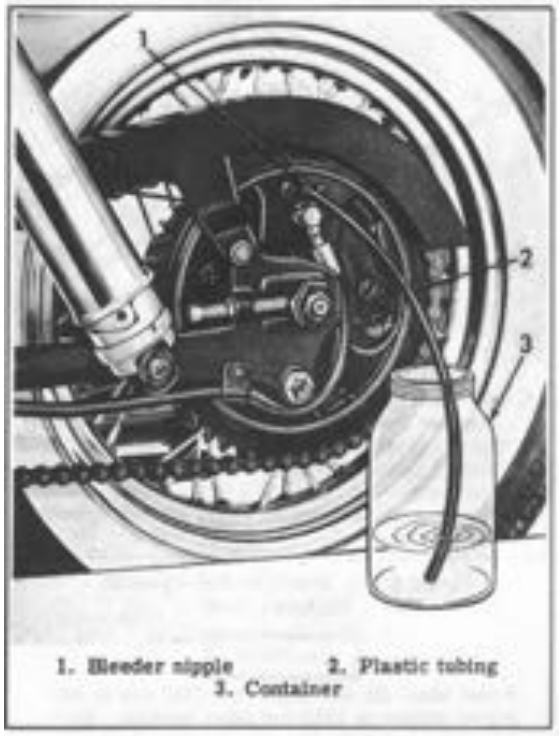
SIDECAR WHEEL BRAKE

Remove wheel with brake drum as described in Section 2C.

Procedure for servicing sidecar wheel brake is the same as for rear wheel brake as given in preceding paragraphs.

DISASSEMBLING BRAKE MASTER CYLINDER (Fig. 2G-5)

It is not necessary to remove master cylinder from motorcycle to remove piston assembly if replacement is required. Remove rear brake rod clevis pin




1. Bleeder nipple
2. Plastic tubing
3. Container

Figure 2G-6. Bleeding Hydraulic Brake System

(1) and loosen cylinder plunger lock nut (3). Turn out lever clevis (2). Pull out plunger (4) and remove boot (5), stop wire (6), stop washer (7), piston assembly (8), cup (9), spring (10) and valve (12).

INSPECTION AND SERVICING (Fig. 2G-5)

Inspect cup (9) and piston rubber parts for wear, softening and enlarging. Examine cylinder walls for scratches and grooves.

ASSEMBLING MASTER CYLINDER (Fig. 2G-5)

Assemble master cylinder in reverse order of disassembly. If repair kit is installed, use all new parts, not just those that look worn. Dip all internal parts in brake fluid before assembly. Replace fluid and bleed brake system.

HYDRAULIC BRAKE LINE

Inspect hydraulic brake line for leaks and possible wear at points where tubing contacts motorcycle. Tubing should be positioned so that it does not touch front chain guard at any point. Replace any metal or rubber tubing which is defective.

BLEEDING HYDRAULIC BRAKE SYSTEM

After servicing rear or sidecar brake system where any hydraulic line or cylinder is opened, it is necessary to bleed the system to expell all air. See Fig. 2G-6.


1. Brake pedal
2. Piston rod
3. Lock nut
4. Plunger
5. Rubber boot

Figure 2G-7. Adjusting Rear Brake Pedal

Slip a length of appropriate size plastic tubing (2) over wheel cylinder bleeder nipple (1, Fig. 2G-6) with the other end in any container (3).

NOTE

Bleed sidecar line first then motorcycle rear wheel.

Open bleeder nipple by rotating counterclockwise about one-half turn. With master cylinder full of fluid at all times, slowly depress foot pedal repeatedly until fluid flows from bleeder nipple free of air bubbles. Add fluid to master cylinder to bring to original level. Close bleeder nipple. Do not re-use fluid unless it is clear and free from sediment. If it is impossible to bleed all air from system, the master cylinder check valve is faulty and a master cylinder repair kit must be installed.

ADJUSTING REAR BRAKE PEDAL (Fig. 2G-7)

When the brake is properly adjusted, the foot pedal should move freely about 1-1/2 in. before the plunger (4) contacts piston in master cylinder and brake takes effect. This contact may be easily felt if pedal is depressed by hand.

Pull rubber boot (5) away from end of master cylinder housing to expose piston push rod link. Holding push rod link in center of opening, work brake pedal (1) back and forth by hand to determine free play.

Adjustment is made by loosening lock nut (3) and turning plunger (4) to shorten or lengthen piston push rod (2) as needed. Tighten lock nut (3).

# SEAT

## SEAT POST SPRINGING

Two seat post spring arrangements are available for each model. A standard spring set is suitable for rider weighing up to 220 pounds. A heavy spring set for weights over that amount include heavier springs and longer guide collars. The heavy set is indicated by a letter "D" (Duo-Glide) or an "E" (Servi-Car) stamped on the upper end of the seat post plunger. See Fig. 2H-1 for cutaway view of seat post springing arrangement. Duo-Glide and Servi-Car assemblies have same number of components with following exceptions: (See Fig. 2H-2.)

Duo-Glide assembly omits seat post recoil spring (14A) and incorporates two auxiliary springs (14 and 17).

## DISASSEMBLING SEAT POST (Fig. 2H-2)

Remove rod lock nut (1) and washer (2) from bottom of frame seat post tube. Pull back of seat upward sharply to break loose seat post rod nut (5) at the base of seat post tube. Unsnap clevis pin spring (3) and pull out clevis pin (4). Tip seat forward and lift out seat post assembly. Disassemble remaining parts in order indicated.

## INSPECTION AND SERVICE

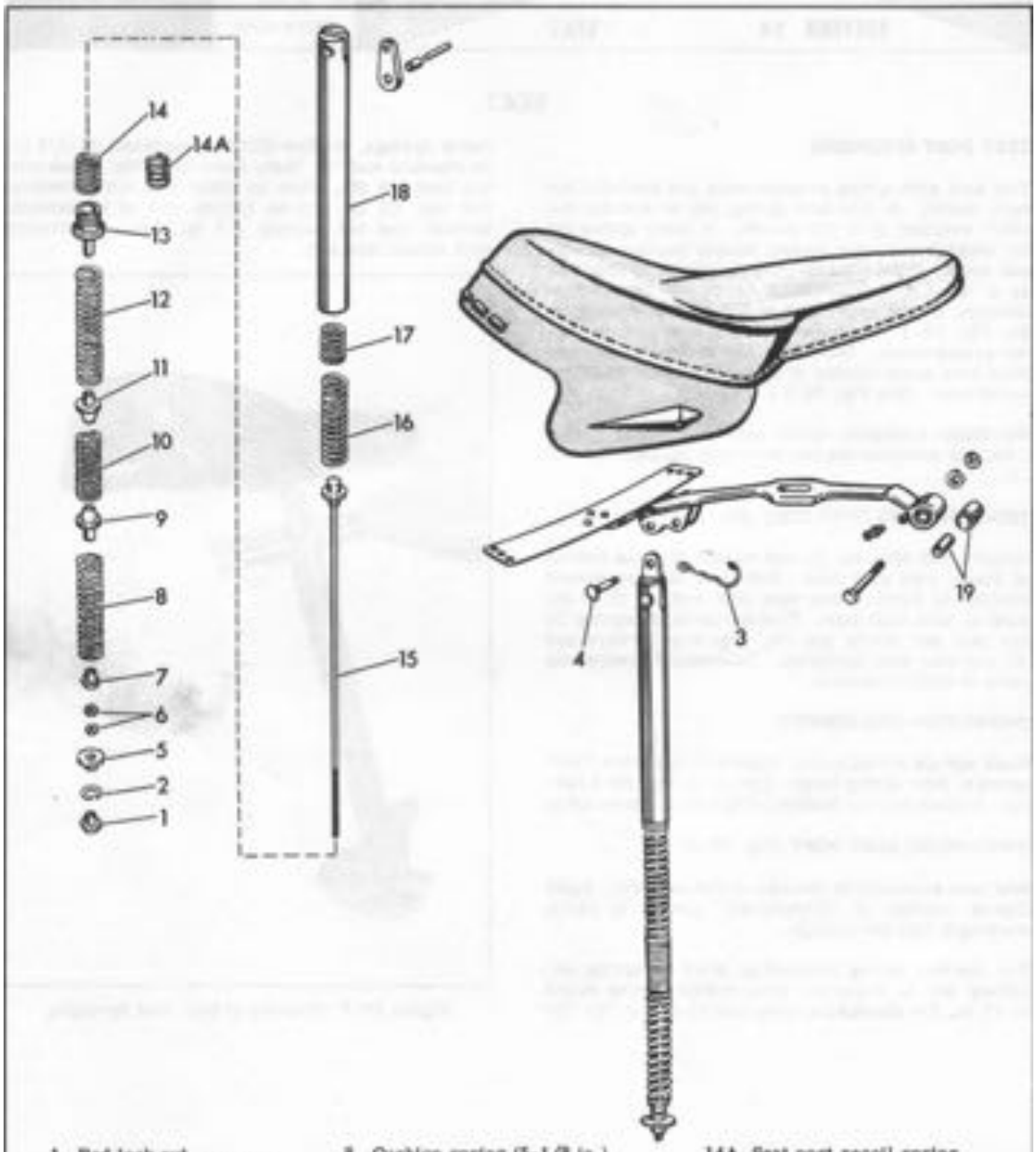
Wash and air dry all parts. Inspect for broken or "set" springs. New spring length appears in Fig. 2H-2 listing. Replace seat bar bushings (19) if worn appreciably.

## ASSEMBLING SEAT POST (Fig. 2H-2)

Seat post assembly is reverse of disassembly. Apply liberal coating of "Grease-All" grease to parts, working it into the springs.

For correct spring preloading, draw up spring adjusting nut to compress total visible spring length to 11 in. for standard springs and 10-1/2 in. for "D" heavy springs, on Duo-Glide assemblies; 11-1/2 in. on standard and "E" heavy Servi-Car sets. Lock with one lock nut (6). Turn on other lock nut. Position rod nut (5) on rod so bottom end of rod extends through rod nut exactly 3/4 in. Lock adjustment with second lock nut.

Figure 2H-1. Cutaway of Seat Post Springing




1. Rod lock nut
2. Rod lock nut washer
3. Clevis pin spring
4. Clevis pin
5. Seat post rod nut
6. Lock nut (2)
7. Spring adjusting nut
8. Cushion spring (5-1/8 in.)
9. Guide collar (2)
10. Cushion spring (2-13/16 in.)
11. Guide collar (see item 9)
12. Cushion spring (5-1/8 in.)
13. Plunger lock nut
14. Auxiliary spring (3-3/4 in.) (Duo-Glide only)
14A. Seat post recoil spring (Servi-Car only)
15. Seat post rod
16. Auxiliary spring (3 in.)
17. Auxiliary spring (2-3/4 in.)
18. Seat post plunger
19. Seat bar bushings

Figure following name of part indicates quantity necessary for one complete assembly.
Dimensions indicate free length of new spring.

Figure 2H-2. Seat Post - Exploded View

# FIBERGLASS BODY CARE AND REPAIR

Parts are made of molded fiberglass. There are 3 types of fiberglass material finishes:

1. Gel Coat finish: This finish is made of a special pigment and blended polyester resin several thousandths of an inch thick.

2. Molded-in-Color finish: This finish is molded into the fiberglass material which is the same color throughout its thickness.

3. Painted finish: This finish is painted on the natural color fiberglass material using standard painting procedure.

The Gel Coat and molded-in-color finishes require minimum care and can be kept new looking by following these easy maintenance rules:

Clean, buff and wax the exterior periodically to renew finish.

An automotive wax type cleaner containing fine rubbing compound is suitable for removing minor scratches and scuffs. Scratches which are not removed by the rubbing compound can be removed by wet sanding with 400 grit sandpaper. Then wet sand with 600 grit sandpaper, rebuff and apply wax polish.

Care should be taken not to cut through the gel coat surface when buffing. A power buffer may be used with care or the surface may be buffed by hand, using a rubbing compound.

Patch and fill in deep scratches, scars and small breaks.

Repair any major breaks as soon as possible, to avoid any additional damage.

For damage to the gel coat finish, you will need a can of Gel Coat of the same color and a small amount of catalyst. For damage to the molded-in-color surface, you will need a can of Filler Coat of the same color and a small amount of catalyst. For deeper holes, breaks, or gouges, you will also need some fiberglass mat and pre-accelerated polyester resin. Gel coat and Filler Coat with catalyst are available in kit form from the Harley-Davidson Motor Co. The other materials including fiberglass mat, and pre-accelerated polyester resin are supplied in fiberglass repair kits which are available at most marine or automotive supply stores.

Damage to the painted type finish can be repaired by sanding, priming and painting using regular painting procedure.

## SURFACE FINISHING

### A. GEL COAT TOUCH-UP AND SURFACE REPAIRS

This type of damage may be classified as damage to the gel coat only, or a hole or gouge that is deep enough to slightly penetrate fiberglass material.

Repair as follows:

1. To be sure that the area to be patched is dry, clean and free of any wax or oil, wash with lacquer thinner.

2. Roughen the bottom and sides of the damaged area, using a power drill with a burr attachment. Feather the edge surrounding the scratch or gouge, being careful not to undercut this edge. See Figure 2J-1.

Figure 2J-1. Roughing Damaged Area

3. A small amount of gel coat, the same color as the finish should be placed in a small can lid or on a piece of cardboard. Use just enough to fill the damaged area. If damage has penetrated through to fiberglass material, an equal amount of fibers, which can be taken from glass mat and shredded into small fibers, should be mixed with the gel coat - using a putty knife or flat stick. Add three drops of catalyst per teaspoon of gel coat using an eye dropper. Be sure to mix the catalyst thoroughly for maximum working time. Maximum working time (pot life) will be about 15 to 20 minutes at which time it begins to "gel". See Figure 2J-2.

4. Fill the scratch or hole above the surrounding undamaged area about 1/16", working the material into the damaged area with the sharp point of a knife. Be careful to puncture and eliminate any air bubbles which may occur. See Figure 2J-3.

NOTE

If fiberglass fibers have not been used in mixture, skip steps 5 thru 7 and proceed with step 8.

5. When the patch feels rubbery to touch (10 - 15 minutes), trim the patch flush with the surface, and then allow to cure completely (30 - 60 minutes). Patch will shrink slightly as it cures, making a depression. See Figure 2J-4.

Figure 2J-2. Mixing Gel Coat and Glass Fibers

Figure 2J-3. Filling Hole or Scratch

Figure 2J-4. Trimming Patch

6. Carefully rough up the bottom and edges of the depression, using the electric drill with burr attachment, as in Step 2. Feather into surrounding gel coat; do not undercut.

7. Again mix a small amount of gel coat with catalyst - do not use glass fibers. Using your finger or putty knife, fill the depression with gel coat 1/16" above the surrounding surface.

8. Spread the gel coat level with the surrounding area and allow to cure (30 - 60 minutes). See Figure 2J-5. Gel coat can be covered with cellophane, if desired, to aid in spreading evenly. Remove cellophane after gel coat has cured.

9. Sand the patched area, using a sanding block with 600-grit wet sandpaper. Finish by buffing with fine rubbing compound such as DuPont #606 and waxing. Weathering will aid to blend touch-up if a slight color difference can be observed. See Figure 2J-6.

Figure 2J-5. Spreading Coat Evenly

Figure 2J-6. Sanding Patch

NOTE

Where surface color of part has changed due to weathering, color match of patch may not be satisfactory. In this case, entire panel must be sprayed.

Thin Gel coat with acetone (1 to 1 ratio) and spray panel, blending sprayed area into a radius or corner on the part. Use a touch-up spray gun such as the Binks Model 15. After Gel coat is hard, buff and polish sprayed area.

## B. MOLDED-IN-COLOR SURFACE REPAIRS

This type of damage consists of a scratch, hole or gouge that is deep enough to slightly penetrate fiberglass material.

Repair as follows:

1. To be sure that the area to be patched is dry, clean and free of any wax or oil, wash with lacquer thinner.

2. Roughen the bottom and sides of the damaged area, using a power drill with a burr attachment. Feather the edge surrounding the scratch or gouge, being careful not to undercut this edge. See Figure 2J-1.

3. A small amount of Filler coat, the same color as the finish should be placed in a small can lid or on a piece of cardboard. Use just enough to fill the damaged area. Add three drops of catalyst per teaspoon of Filler coat using an eye dropper. Be sure to mix the catalyst thoroughly for maximum working time. Maximum working time (pot life) will be about 15 to 20 minutes at which time it begins to "gel".

4. Fill the scratch or hole slightly above the surrounding undamaged area, working the Filler coat into the damaged area with a putty knife. Be careful to puncture and eliminate any air bubbles which may occur. Patch can be covered with cellophane to aid in spreading evenly (see Figure 2J-5). Allow to cure completely before removing cellophane.

5. Sand smooth with 220-grit sandpaper; then use 600-grit for finish sanding. Blend into surrounding area using 600-grit sandpaper. Buff with polishing compound such as DuPont #600 and finish with paste wax.

NOTE

Where surface color of part has changed due to weathering, color match of patch may not be satisfactory. In this case, entire panel must be sprayed.
This Gel coat with acetone (1 to 1 ratio) and spray panel, bleeding sprayed area into a radius or corner on the part. Use a touch-up spray gun such as the Binks Model 15. After Gel coat is hard, buff and polish sprayed area.

C. PATCHING OF HOLES, PUNCTURES AND BREAKS

If possible, work in shaded spot or in a building where the temperature is between 70° and 80°F.

1. Be sure surface is clean and dry where repair is to be made. Remove all wax and dirt from the damaged area.

Figure 2J-7. Sawing Out Damaged Area

2. Prepare injured area by cutting back fractured material to the sound part of the material. A keyhole or electric saber saw can be used to cut out the ragged edges. See Figure 2J-7.

Figure 2J-8. Rough Sanding Inside Surface

3. Rough sand the inside surface, using 80-grit dry sandpaper, feathering back about two inches all around the hole in the area the patch will touch. See Figure 2J-8.

4. Cover a piece of cardboard or aluminum with cellophane and tape it to the outside surface with the cellophane facing toward the hole. Aluminum is used as backing where contour is present. The aluminum

Figure 2J-9. Taping on Backing

should be shaped the same as the contour. See Figure 2J-9.

5. Cut glass mat to shape of hole, about 2" larger than hole.

6. Mix a small amount of pre-accelerated resin and catalyst and daub resin on mat, thoroughly wetting it out. This may be done on a piece of cellophane or wax paper. See Figure 2J-10.

Figure 2J-10. Applying Resin to Mat

NOTE

Mix resin 100 parts to 1 part catalyst for an approximate 30 minutes working time. Only mix enough resin for a given patch.

7. Lay patch over hole, cover with cellophane and squeegee out air bubbles. Allow one to two hours to cure, then remove cellophane. See Figure 2J-11.

Figure 2J-11. Squeegeeing Patch

8. After the patch is cured, remove the cardboard from the outside of the hole and rough sand outside surface, feathering the edge of the hole. See Figure 2J-12.

9. Mask area with tape and paper to protect the surrounding surface; then repeat B Steps 5, 6, 7, and 8, applying patches to outside surface until enough material has been laminated to re-establish the original thickness of the section.

Figure 2J-12. Rough Sanding Outside Surface

10. Allow the patch to cure overnight; then sand with dry 80-grit paper on power sander. Smooth the patch and blend it with surrounding surface. If air pockets are present, puncture and fill with catalyzed resin. Let cure and re-sand. See Figure 2J-13.

Figure 2J-13. Blending Patch with Sander

11. Mix gel coat or filler coat with catalyst. Work Gel Coat into patch with fingers. See Figure 2J-14. Filler Coat should be filled into patch with a putty knife.

12. Patch can be covered with cellophane to aid in spreading evenly (see Figure 2J-5). Allow to cure completely before removing cellophane.

Figure 2J-14. Working Gel Coat into Patch

13. Sand the patch with 220-grit wet sandpaper; then use 600-grit for finish sanding. On painted type surface, paint can be applied at this time. Buff with polishing compound and wax.

NOTE

On Gel Coat finish, it may be necessary to repeat Steps 12 and 13 to insure a smooth, even gel coat surface. See Figure 2J-15.

For large areas the gel coat can also be sprayed.

Figure 2J-15. Buffing Finish

Where surface color of part has changed due to weathering, color match of patch may not be satisfactory. In this case, entire panel must be sprayed.

Thin Gel coat with acetone (1 to 1 ratio) and spray panel, blending sprayed area into a radius or corner on the part. Use a touch-up spray gun such as the Binks Model 15. After Gel coat is hard, buff and polish sprayed area.

Heat lamps may be used if working conditions are cold. CAUTION: Do not place lamp bulb closer than 14 inches to surface or the resin may blister.

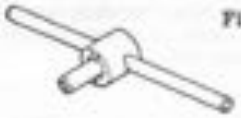
94557-55 COMPENSATING SPROCKET SHAFT NUT WRENCH

Pin spanner wrench for compensating sprocket shaft nut.

94619-35 WHEEL LUG WRENCH

Tool for recessed hex head wheel lug screws.

94630-67 WHEEL HUB BEARING LOCKNUT WRENCH



Fits slotted type locknuts.

94681-39 SPOKE NIPPLE WRENCH

For large wheel spoke nipples (.234" across flats).

94700-52B REAR SHOCK SPANNER WRENCH

Used to adjust rear shock absorber units for more or less spring compression.

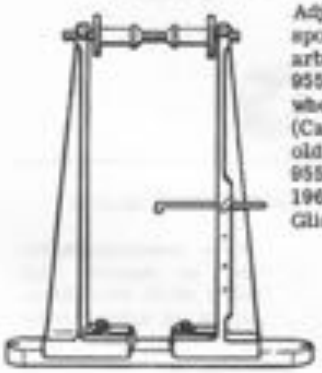
95020-66 REAR CHAIN CONNECTING LINK PRESS TOOL

Used to install press-fit connecting link sideplate supplied with replacement chains.

95021-29 DISASSEMBLING CHAIN TOOL

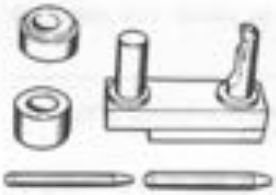
Removes press fit roller pins from all chains.

95000-29A WHEEL TRUING STAND



Adjustable stand for truing spoked wheels. Includes arbor.
95515-30A Arbor for wheels of all models. (Can be used to convert old stand 95500-29).
95522-68 Arbor collar for 1968 and later Electra-Glide wheel (brake side).

95600-33B SPROCKET RIVETING SET



Used to rivet rear sprocket to brake shell. Set consists of riveting block, rivet punch, rivet set, adapter and support flange.

95875-58 BRAKE PEDAL LOCKING TOOL

Used to lock rear brake pedal in depressed position when disassembling wheel from motorcycle.

INTERNAL LOCK RING PLIERS

Special pliers for removing and replacing retaining rings.

96215-49 Small.
96216-49 Large.

96219-50 FRAME HEAD BEARING ADJUSTING CONE, AND LOCK NUT WRENCH

Fits head cone lock nut and head bearing adjusting cone.

96245-51 FORK STEM AND CROSS MEMBER ALIGNING GAGE

Used with fork tube straightening blocks (96246-50) when fork stem is being aligned.

96246-50 FORK TUBE STRAIGHTENING BLOCK

Three recommended for use to support fork tubes while straightening on an arbor press.

96250-50 FORK SLIDER OIL SEAL DRIVER

Used to install fork slider oil seal.

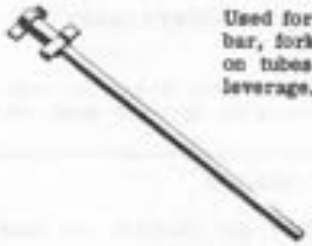
96254-50 FORK SLIDER BUSHING TOOLS FOR HYDRA-GLIDE FORK


Complete set of tools consists of Fork Slider Bushing Puller (1), Bushing Driver (2) and Bushing Reamer (3) with long and short pilots. Tools used to remove worn fork slider bushings, install new parts and ream to size.

94644-65 CHAIN ADJUSTER SHOE BOLT WRENCH

For adjusting chain tension through chain cover access hole.

96806-40 BENDING BAR



Used for straightening handlebar, forks and frames. Hooks on tubes for applying bending leverage.

96810-63 MOTORCYCLE SHOP STAND

Used to support motorcycle on shop or showroom floor to provide sturdy support. Lock bar with curved end slips through motorcycle frame cross tube below transmission. Operating bar fits into socket on either side providing leverage to raise or lower motorcycle rear end.

97010-52A REAR SHOCK ABSORBER TOOL

Compresses rear shock absorber for disassembly or assembly. Holds shock absorber spring in compression while parts are disassembled.

97019-52A Block only for 1967 and later.

97280-60 BRAKE DRUM TURNING ARBOR

Used for refinishing brake friction surface when doing a brake lining job. Fits between lathe centers. Brake drum mounts to arbor, with same bolts used to fasten drum to wheel.

# ENGINE 3

TABLE OF CONTENTS

# GENERAL

## ENGINE SPECIFICATIONS

VALVES (3B)

| | |
|---|---|
| Fit in guide (EX) | .004 - .006 in. |
| Fit in guide (IN) | .002 - .004 in. |
| Spring (FL) | |
| (Outer) | 55 - 65 lbs. at 1-13/32 in. (closed) |
| | 110 - 120 lbs. at 1-1/16 in. (open) |
| Free length | 1-13/16 in. |
| (Inner) | 25 - 35 lbs. at 1-1/4 in. (closed) |
| | 70 - 80 lbs. at 29/32 in. (open) |
| Free length | 1-15/32 in. |
| Spring (FLH) | |
| (Outer) | 105 - 115 lbs. at 1-3/8 in. (closed) |
| | 180 - 190 lbs. at 1 in. (open) |
| Free length | 1-31/32 in. |
| (Inner) | 20 - 30 lbs. at 1-3/16 in. (closed) |
| | 70 - 80 lbs. at 51/64 in. (open) |
| Free length | 1-25/64 in. |
| Tappet adjustment | Hydraulic tappet unit compressed 1/8 in. from fully extended position. |

ROCKER ARM (3B)

| | |
|---|---|
| Fit in bushing | .0005 - .002 in. loose |
| End clearance | .004 - .025 in. |

PISTON (3C)

| | |
|---|---|
| Fit in cylinder | .001 - .002 in. loose |
| Ring gap | .010 - .020 in. |
| Compression ring side clearance | .004 - .005 in. |
| Oil ring side clearance | .003 - .005 in. |
| Piston pin fit | Light hand press at 70° F. |

CONNECTING ROD (3C)

| | |
|---|---|
| Piston pin fit | .0008 - .0012 in. loose |
| End play between flywheels | .006 - .010 in. |
| Fit on crankpin | |
| (1959 & earlier) | .001 - .0015 in. loose |
| (1960 & later) | .0006 - .001 in. loose |

OIL PUMP PRESSURE

| | |
|---|---|
| (3D) | (20 MPH) 25 lbs./sq. in. |
| | (30 MPH) 35 lbs./sq. in. |
| | (60 MPH) 35 lbs./sq. in. |
| | (90 MPH) 35 lbs./sq. in. |

IGNITION TIMING (3D)

| | |
|---|---|
| Breaker point setting | .020 in. gap |
| (Dwell | 90°@ 2000 RPM) |
| Ignition Timing (Retarded) | 5° BTC (1/64 in. before Piston T.C.) |
| (Automatic Advance) | 35° BTC (7/16 in. before Piston T.C.) |
| Spark plug gap setting | .025 to .030 in. |

TAPPETS (3D)

| | |
|---|---|
| Guide fit | .002 tight - .002 loose |
| Fit in guide | .001 - .002 in. loose |
| Roller fit | .0005 - .001 in. |
| Roller end clearance | .008 - .010 in. |

GEARCASE (3D)

| | |
|---|---|
| Timer gear end play | .003 - .007 in. |
| Idler gear end play | .003 - .020 in. |
| Breather gear end play | .001 - .005 in. |
| Cam gear shaft in bushing | .001 - .0015 in. |
| Cam gear shaft in bearing | .0005 - .003 in. |
| Cam gear end play | .001 - .005 in. |
| Intermediate and idler gear (on shafts) | .001 - .0015 in. |
| Oil pump drive shaft (crankcase bushing) | .0008 - .0012 in. |

FLYWHEEL ASSEMBLY (3E)

| | |
|---|---|
| Gear shaft nut torque | 100 ft.-lbs. |
| Sprocket shaft nut torque | 100 ft.-lbs. |
| Crank pin nuts torque | 175 ft.-lbs. |
| Runout (flywheels) | .003 in. maximum at rim |
| Runout (mainshafts) | .001 in. maximum |

SPROCKET SHAFT BEARING (3E)

| | |
|---|---|
| Cup fit in crankcase | .0015 - .0035 in. press |
| Cone fit on shaft | .0002 - .0015 in. press |
| End play | .0005 - .006 in. |

PINION SHAFT BEARINGS (3E)

| | |
|---|---|
| Roller bearing fit | .0004 - .0008 in. loose |
| Cover bushing fit | .0005 - .0012 in. loose |

## ENGINE DESCRIPTION

The Duo-Glide engine is a two-cylinder, four-cycle, air cooled, overhead-valve, V-type engine with 74 cu. in. displacement. It has three major component assemblies: cylinder, crankcase and gearcase.

Cylinder assemblies include cylinder head, valves, rocker arms and piston. Cylinders mount on the engine crankcase in a 45 degree "V," with both connecting rods connected to a single crank pin.

The reciprocating, linear motion of the piston in the cylinder is converted to circular motion in the crankcase. The built-up crankshaft consists of an off-center crank pin interposed between two counterweighted flywheels which rotate on two end shafts (pinion and sprocket shafts) supported by anti-friction roller bearings. The lower end of the rear

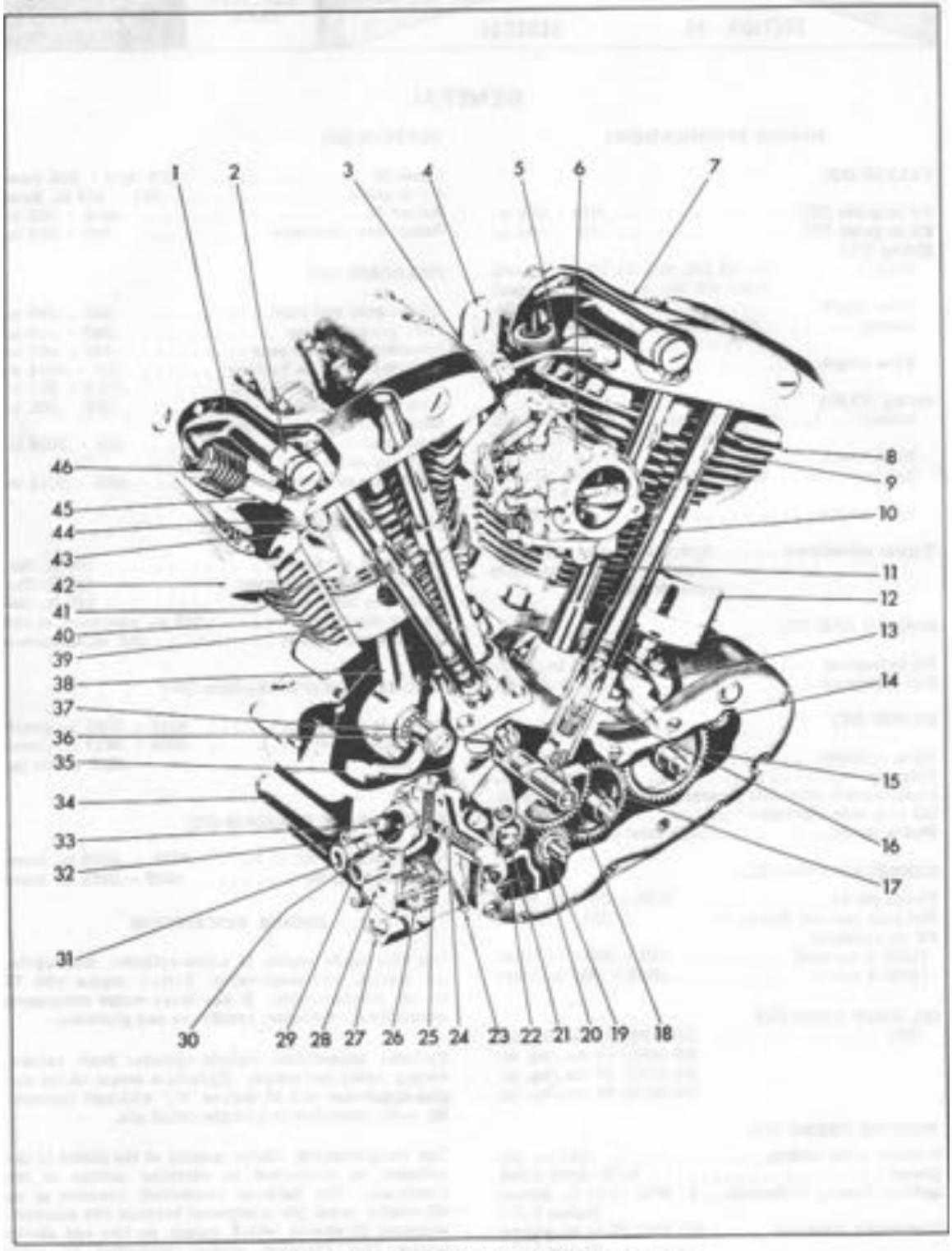



Figure 3A-1. Engine Cutaway (1967 Model Shown)

cylinder connecting rod is forked to fit around the single-end front cylinder connecting rod, allowing a single connecting rod-crankpin connection to the flywheel.

Flywheel rotation is clockwise (viewing engine from right side). Using the front cylinder firing position as a starting point, the rear cylinder fires at 315 degrees rotation (360 degrees minus the 45 degrees between cylinders). The front fires in an additional 405 degrees (360 degrees plus the 45 degrees between cylinders), completing the 720 degrees of flywheel rotation necessary for the four piston strokes.

The gearcase is located on the right side of the crankcase and houses a gear train which operates and times the valves, ignition and crankcase breather. The generator is also driven from the gear train. The rotary crankcase breather valve is located between crankcase and gearcase compartments and functions to relieve crankcase pressure caused by downstroke of pistons, and controls the flow of oil in the lubrication system.

A single cam shaft with four cam lobes is gear driven. The engine valves are opened and closed through the mechanical linkage of tappets, push rods and rocker arms. Tappets serve to transmit the cam action to the valve linkage. Hydraulic lifters installed in the tappets automatically compensate for heat expansion to maintain a no-lash fit of parts. Valve and breather timing are obtained by meshing gearcase gears with timing marks aligned.

Ignition spark is produced by operation of circuit breaker, ignition coil and spark plugs. The breaking of circuit breaker points by a cam on the timer shaft determines the spark timing.

Ignition spark on 1960 and earlier Models and on 1965 and later Models is produced through operation of a single set of circuit breaker points by a double-lobe cam on the timer shaft. The narrow lobe times the front cylinder. The wide lobe times the rear cylinder. Both spark plugs fire each crankshaft revolution. However, the spark in one cylinder occurs ineffectually during its exhaust stroke.

Ignition spark on 1961 to 1964 Models is produced by operation of separate circuit breaker points and ignition coils for each spark plug. The breaking of each set of breaker points by a single-lobe cam on the timer shaft determines the spark timing. The single lobe cam opens the breaker points individually firing alternate cylinders every crankshaft revolution. The front cylinder breaker points (stamped "F" on circuit breaker base) fire the front cylinder and the rear breaker points fire the rear cylinder.

Most other engine components function similar to usual internal combustion engine design. For further description of part function, see pertinent manual sections.

## LUBRICATION

The engine is lubricated by a pressure system circulating oil from the tank through the moving parts and back to tank. For adequate lubrication the tank must contain an ample supply of clean oil at all times.

Oil consumption varies from 250 to 500 miles per quart depending on the nature of service, solo or sidecar, fast or moderate driving, and how well the engine is kept tuned. If mileage is not within this range, see following engine overhaul section.

Remove tank cap and check oil supply at not more than 300 miles after each complete refill. If level is down near "Refill" mark on gauge rod, add oil. When level is down to "Refill" mark, add two quarts. Engine will run cooler and usage will be less with oil level well up in tank.

The oil tank capacity is one gallon. The tank is full when the oil level is about one inch from top. Do not fill above this level. The tank needs some air space. Tighten the cap securely to prevent leakage.

Change oil in new engine after first 500 and 1,000 miles, and at about 2,000 mile intervals thereafter. Completely drain oil tank of used oil and refill with fresh oil. If service is extremely hard, hot, on dusty roads or in competition, drain and refill at shorter intervals. Draining should be done while oil is hot. It is not necessary to drain the crankcase for it does not accumulate more than about 5 oz. of oil at any time. At the time of the first oil change, and along with at least every second oil change thereafter, thoroughly flush and clean out tank with kerosene to remove any sediment and sludge that may have accumulated.

KEY FOR FIGURE 3A-1

1. Rocker arm
2. Rocker arm shaft
3. Carburetor insulator
4. Engine mounting bracket
5. Oil line
6. Carburetor
7. Rocker arm cover
8. Cylinder head
9. Push rod cover keeper
10. Push rod
11. Push rod cover
12. Circuit breaker (timer)
13. Clamp
14. Generator drive gear
15. Idler gear
16. Hydraulic lifter
17. Intermediate gear
18. Tappet and roller assembly
19. Pinion gear
20. Cam gear
21. Breather gear
22. Breather screen
23. Chain oiler screw
24. By-pass valve
25. Oil feed pump drive gears
26. Oil scavenger drive gears
27. Oil feed nipple
28. Oil pump cover
29. Oil return nipple
30. Check valve
31. Breather outlet
32. Chain oil return
33. Oil pressure switch
34. Crankcase
35. Flywheel
36. Crankpin
37. Connecting rod roller bearing
38. Connecting rod
39. Piston
40. Cylinder
41. Overhead oil line
42. Exhaust port
43. Exhaust valve seat
44. Exhaust valve
45. Exhaust valve guide
46. Valve spring

## WINTER LUBRICATION

Combustion in any engine generates water vapor. When starting and warming up in cold weather, especially in freezing or cold weather, the vapor that gets into the crankcase condenses to water before the crankcase is hot enough to exhaust the vapor through the outside breather. If engine is run often enough to get the crankcase thoroughly warmed up, most of this water is again vaporized and blown out through the breather. A moderately driven engine, making short runs and seldom allowed to thoroughly warm up, will accumulate increasing amounts of water in the oil tank. This water will, in freezing weather, become slush or ice and if allowed to accumulate, will block oil lines and damage the engine. Water mixed with oil for some time forms sludge that is harmful to the engine and causes rapid wear of various working parts. In winter the oil should be changed more often than in normal weather. Any engine used for short runs, particularly in commercial service, must have oil changed frequently and tank thoroughly flushed to remove water and sludge, before new oil is put in tank. The farther below freezing the temperature drops, the shorter the oil change interval should be.

## CHANGING OIL

Run engine until it is fully warm. Block motorcycle upright or tilted to right at a slight angle. Remove oil tank plug from bottom of tank at right rear corner. Allow all oil to drain. Replace plug. Pour a quart of kerosene into tank and agitate by rocking motorcycle from side to side. Remove plug and drain. Replace plug and fill with recommended grade oil as follows:

| Use Harley-Davidson Oil | Use Grade | Air Temperature (Cold Engine Starting Conditions) |
|---|---|---|
| Medium Heavy | 75 | Above 40° F |
| Special Light | 58 | Below 40° F |
| Regular Heavy | 105 | Severe operating conditions at high air temperatures. |

Old oil may be removed using a suction gun through filler hole and flushed by squirting kerosene into tank from a gun.

## OIL PRESSURE SIGNAL LIGHT

The oil signal light, located above ignition switch on instrument panel, indicates oil circulation.

If the oil signal light fails to go off at speeds above idling, it is usually due to low or a diluted oil supply. In freezing weather the oil feed pipe may clog with ice and sludge, preventing circulation of oil. A grounded oil signal switch wire, faulty signal switch, or trouble with oil pump will also cause the light to stay on. If the oil signal light fails to go off, always check the oil supply first. Then, if oil supply is normal, look inside the oil tank to determine if oil returns to the tank from the oil return pipe outlet located at front of oil tank near filler hole when the engine is running. If it is returning to the tank there is some circulation, and engine may be run a short distance if necessary. If no oil returns, shut off engine until trouble is located and corrected.

## OPERATING OIL PRESSURE

Operating oil pressure may be checked as follows:

Fill oil tank with Harley-Davidson 75 oil. Disconnect oil pressure switch wire at top of switch and remove switch. Install Oil Pressure Gauge, Part No. 96921-52. Attach gauge bracket to motorcycle and road run or simulate road running until engine is completely warmed. A full operating temperature is essential for accurate gauging. Pressure should be 25 to 28 pounds per square inch at 20 mph. At 30 mph. and over, pressure should be steady at 35 to 38 pounds.

## OIL FILTER (EXTERNAL)

If motorcycle is equipped with an oil filter, thoroughly wash the filter element in clean gasoline or solvent at least once every 2,000 miles when the engine oil is changed. Blow out element with compressed air before installing.

To remove the filter element, take off acorn nut, fiber washer and cup. Remove element retaining nuts and metal element retainer. Then pull element off stud. If upper metal retainer (retainer with five holes in it for oil passage) comes off with the filter element, make sure that it is reinstalled as the upper retainer when replacing the element.

Replace filter element every 5,000 miles.

## OIL FILTER (OIL TANK)

The tank is equipped with a large mouth filler opening and a screw cover with oil filter attached.

Wash filter element (3) in clean gasoline or solvent at 2,000 mile intervals, renew at 5,000 mile intervals. To service filter element, remove cap from oil tank, remove retaining spring (1) and washer (2) and pull out filter. Make certain "O" ring is positioned against filter cup flange (7) when filter is installed in tank.

SERVICING OIL TANK CAP AND FILLER OPENING. To disassemble, follow order shown in Fig. 3A-2. Assembly is reverse order of disassembly. Clean and inspect all parts. Replace any that are worn or damaged.

If oil leak should occur between the tank cap and the filler opening, with cap and gasket in serviceable condition, check the lip of the filler opening. A cap

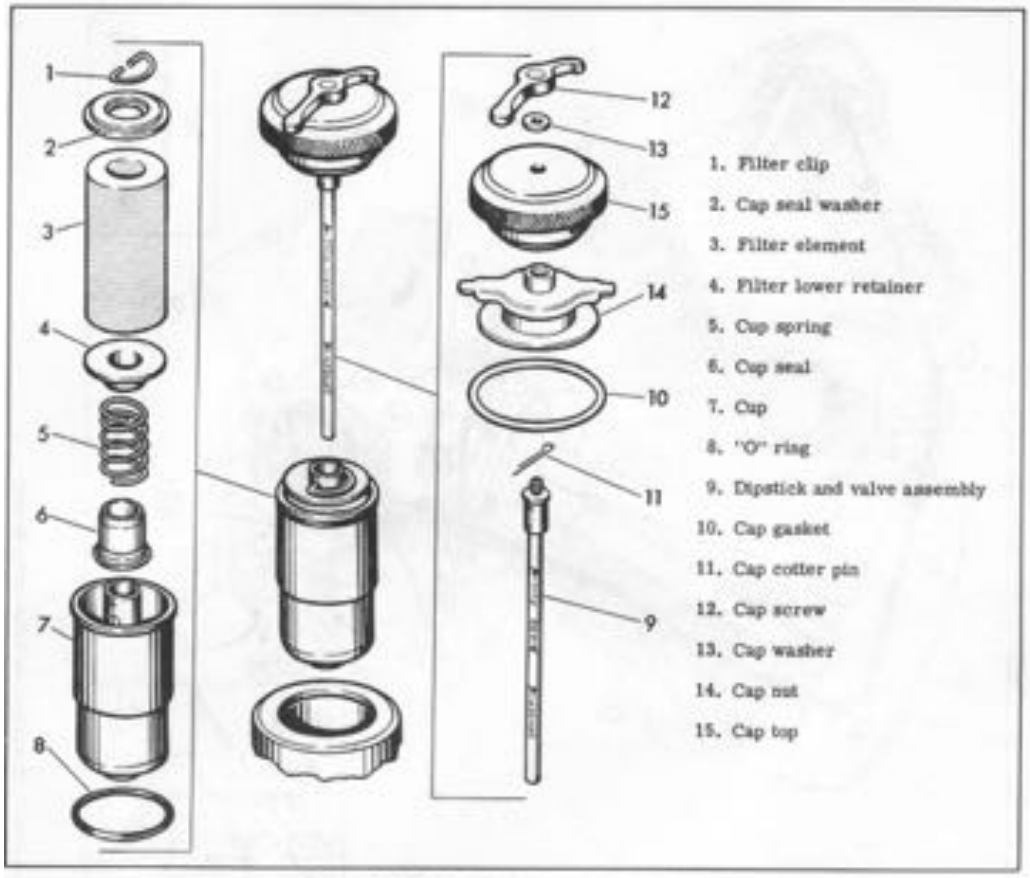



Figure 3A-2. Oil Tank Filter - Exploded View

drawn too tight will bend the lip of the filler opening resulting in an imperfect seal between gasket and lip.

Drain oil from tank. Using a mallet as a driver and a block of wood as a cushion, bend the lip down until flush with sealing surface of tank cap. Remove nicks and rough spots with emery cloth. Flush tank before refilling.

ELECTRA-GLIDE ENGINE OILING AND BREATHER SYSTEM (Fig. 3A-3, 3A-4 and 4A-4A)

1. Gravity feed from tank to feed pump.

2. Feed (pressure) section of oil pump.

3. Check valve prevents gravity oil drainage from tank to engine. Builds up oil pressure to operate oil signal switch.

4. Oil pressure regulating valve limits maximum pressure. Surplus oil is dumped back into gearcase.

5. Oil is forced through pinion gear shaft to lubricate lower connecting rod bearings from which oil splashes to cylinder walls, piston, piston pin and main bearings.

6. Oil is forced through passages or external oil lines to lubricate rocker arm bearings and rods, valve stems, valve springs and push rod sockets. A branch passage supplies oil to the hydraulic lifters. On some models, oil supply is filtered through oil screen (6A).

7. Front chain oil. Oil is bled from by-pass oil for front chain lubrication. On 1964 and earlier models, chain oiler screw on pump is adjustable.

8. Oil drains from cylinder rocker housing through passage in each cylinder, then flows through hole in the base of each cylinder, lubricating cylinder walls, piston, piston rings and main bearings.

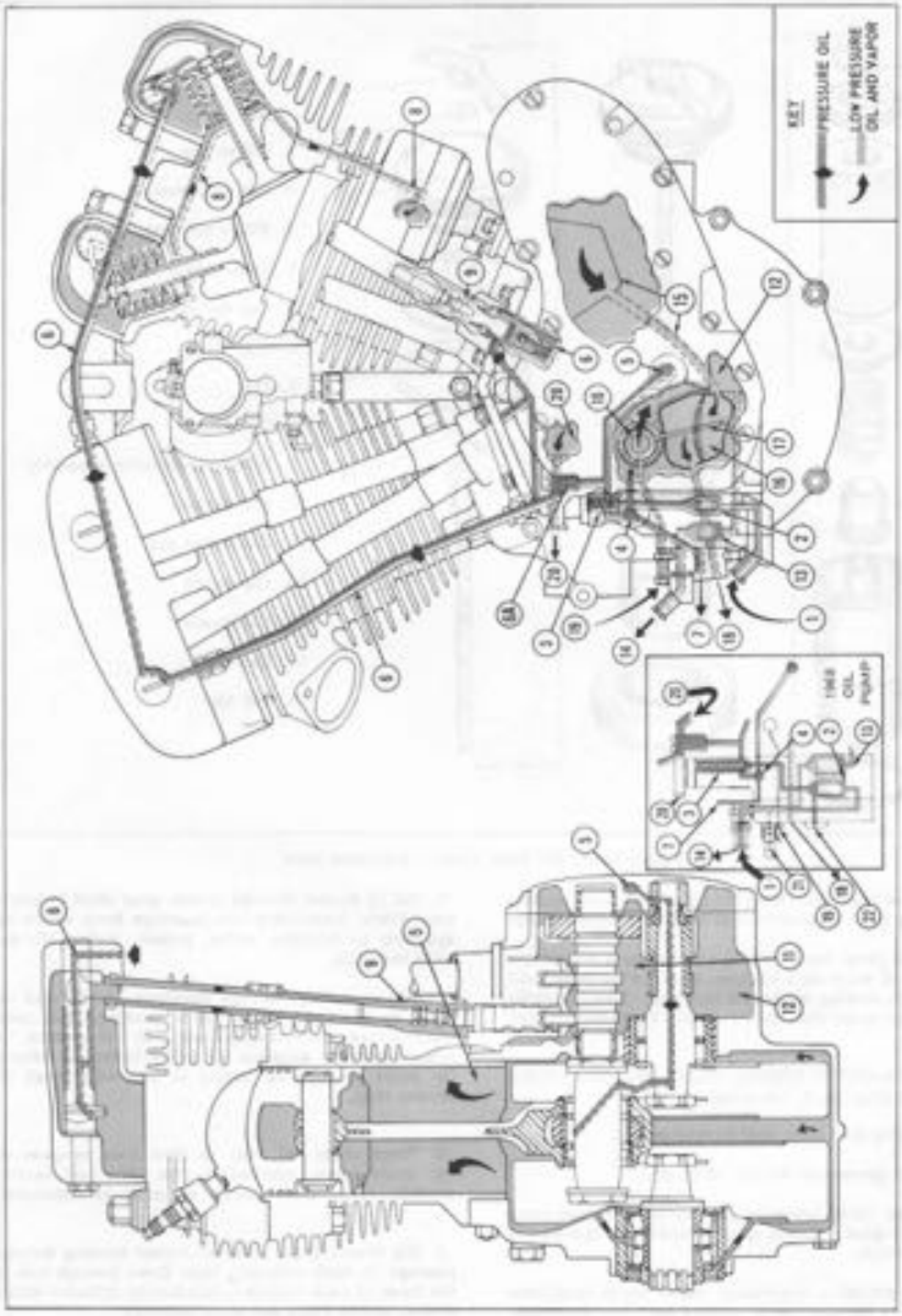



Figure 3A-3. Electra-Glide Lubrication System

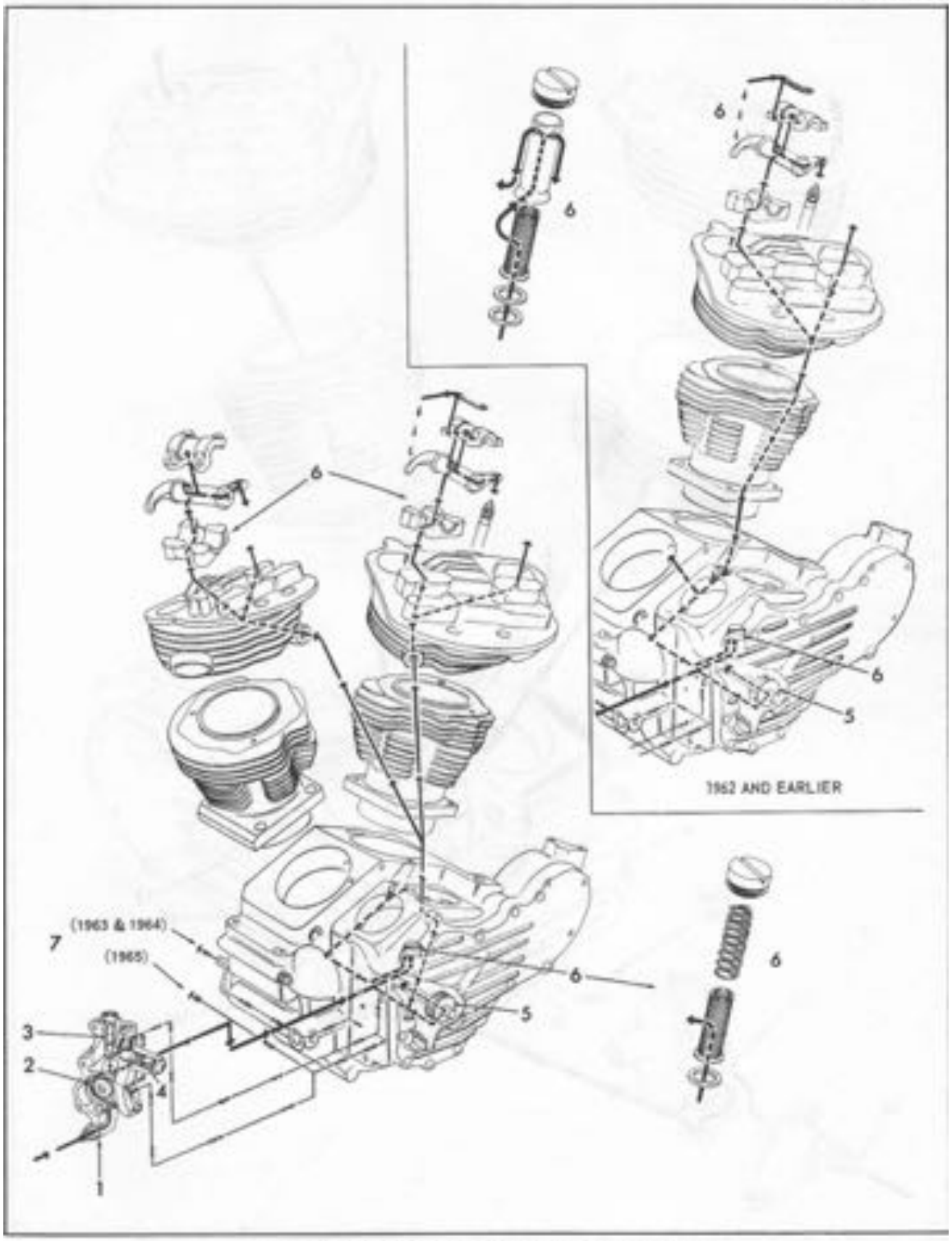



Figure 3A-4. 1963 to 1965 Oil Feed Pressure System

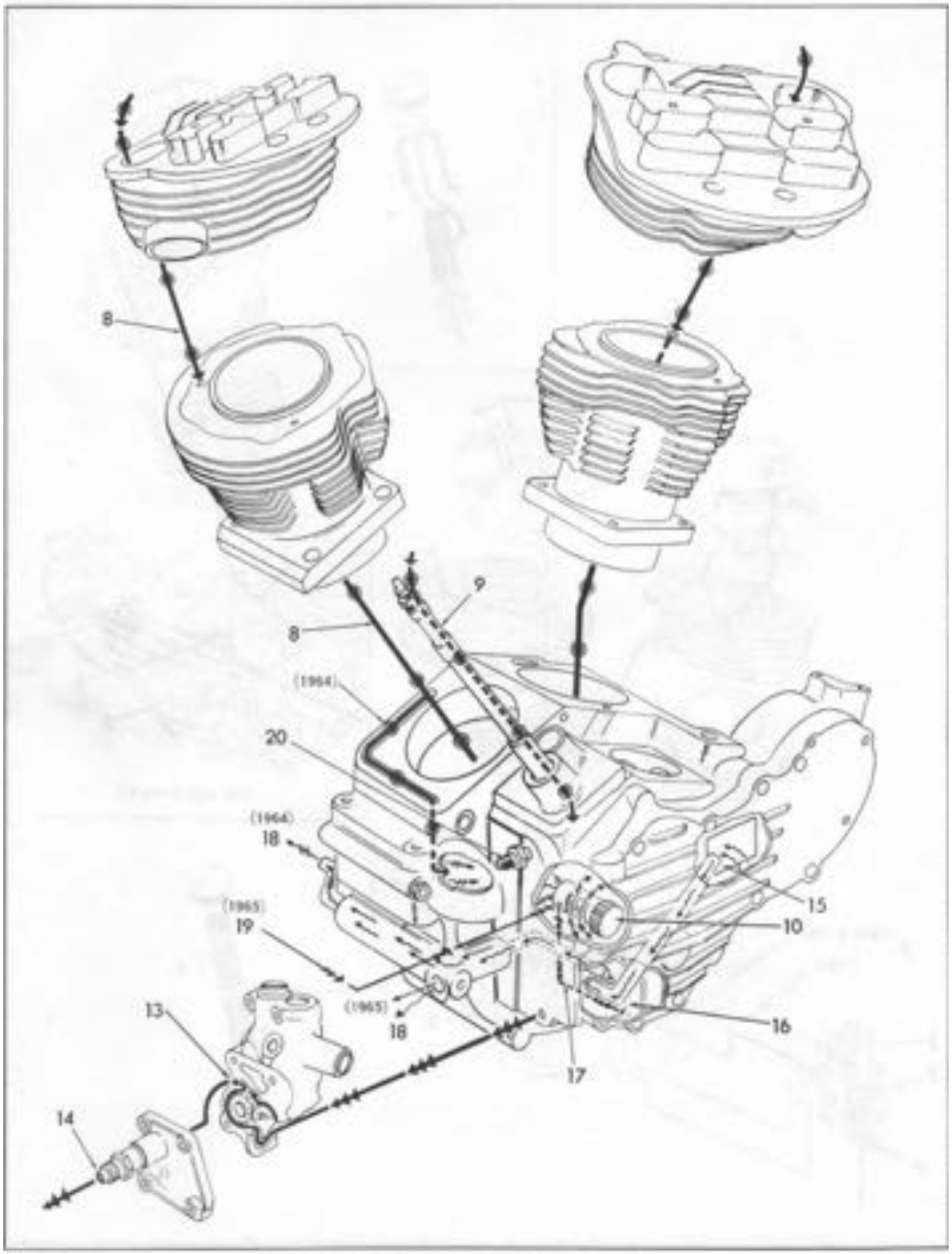



Figure 3A-4A. 1965 and Earlier Oil Scavenger System

9. Oil flows from the rocker arm bearings through push rod covers into the gearcase compartment, lubricating push rods and tappets.

10. Rotary breather valve is timed to open on the downward stroke of pistons, allowing crankcase exhaust air pressure to expel scavenge oil from crankcase breather oil trap into gearcase. Breather valve closes on upward stroke of pistons, creating vacuum in crankcase.

During this interval, the small ports in breather valve line up with passage in crankcase. Oil is then retrieved through passage by vacuum from breather oil trap in crankcase, and (on 1965 model) from front chain compartment.

11. Oil blown and drained into timing gearcase (steps 4, 8 and 9), lubricates generator drive gear, timing gears and gear shaft bearings.

12. Gearcase oil settles in gearcase sump from where it returns to pump.

13. Scavenge (return) section of oil pump.

14. Engine oil return to tank.

15. Exhaust air baffle and transfer passage to breather oil trap.

16. Breather oil trap with screen.

17. Oil transfer passage to breather valve.

18. Crankcase exhaust air escapes from gearcase through outside breather tube on 1965 and later model. Air exhausts to front chain guard on earlier models.

19. Return line from chain housing (1965 and later).

20. Vent line to oil tank and chain housing.

21. Rear chain oiler.

22. Pressure switch fitting.

## ENGINE REPAIR PROCEDURE

### GENERAL

When an engine needs repair, it is not always possible to definitely determine beforehand whether the engine can be repaired by disassembling only cylinders and heads, only gearcase; or whether engine must be completely disassembled for crankcase section repair.

Usually, only upper-end repair is needed and it is recommended procedure to first strip motorcycle for cylinder head, cylinder and piston repair as described in "Stripping Motorcycle for Engine Repair," steps 1 through 10.

After disassembling cylinder head and cylinder it may be found that lower end repair is necessary. This requires removal of engine crankcase from frame as described in steps 10 through 20 in "Stripping Motorcycle for Engine Repair."

In cases where it has been definitely determined beforehand that the lower portion of engine (crankcase) is in need of repair, remove complete engine from chassis before starting disassembly as described in steps 1 through 20 of "Stripping Motorcycle for Engine Repair."

Symptoms indicating a need for engine repair are often misleading, but generally if more than one symptom is present, possible symptom causes can be narrowed down to make at least a partial trouble diagnosis. An above normal comsumption of oil, for example, could be caused by several mechanical faults (see "Locating Operating Troubles," Section 1D). But when accompanied by a blue-gray smoke from the exhaust, and when low compression is present, it indicates the rings need replacing. Low compression by itself, however, indicates improperly seated valves, not worn rings.

A noisy engine is usually caused by loose bearings. Main bearings are generally more durable than rod bearings or bushings so the latter should be suspected first. Certain "knocking" noises may be caused by loose bearings, others by piston slap, a condition where piston or cylinder or both are worn out of round and loose fitting, allowing the piston to slap from front to rear of cylinder as it moves up and down.

Most frequently, valves, rings, pins, bushings and bearings need attention at about the same time. If the symptoms can be narrowed down through the process of elimination to indicate any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

### STRIPPING MOTORCYCLE FOR ENGINE REPAIR

Use the following procedure to strip the motorcycle for either cylinder head and cylinder removal for repair with engine in chassis, or for engine removal for complete overhaul.

1. To remove instrument cover take out mounting base center screw and pry off cover side plate located at trip mileage set screw.

2. Release seat clevis spring, pull clevis pin and tip seat forward.

3. Disconnect fuel lines and interconnecting line from tanks, and drain into a proper container. Gasoline may be pumped out through tank filler opening before disconnecting pipes.

4. Remove upper and lower bolts at the front and the two stud nuts between the gasoline tanks at the rear. Remove tanks. On tank attached hand shift models, remove shift lever bottom bolts so shift lever may be removed with left tank.

5. Remove cylinder head bracket. Note washers between bracket and frame lug, use same washer when bracket is assembled.

6. Remove spark plugs to avoid damaging. Disconnect ground wire at battery.

7. On 1964 and earlier models, turn out center screw and remove horn power pack cover. Disconnect two wires from horn power pack. Remove two bolts mounting horn power pack to bracket. Loosen horn trumpet nut and turn horn power pack off trumpet.

Remove carburetor intake manifold clamps.

8. Remove air cleaner cover, filter element, four bolts, lock washers and air cleaner back plate from carburetor body.

9. Disconnect throttle and choke controls from carburetor. Disconnect fuel and vent lines. Disconnect carburetor support bracket and remove carburetor.

10. On 1964 and earlier models, remove horn trumpet mounting bolt and horn trumpet. Disconnect exhaust pipes from cylinder head ports. Remove regulator mounting screws and move regulator away. It is not necessary to disconnect wires from regulator.

At this stage, the cylinder heads and cylinders may be removed.

To remove engine crankcase or complete engine, continue stripping motorcycle as follows:

11. Remove left footrest and chain guard cover. If motorcycle is equipped with compensating sprocket, use Compensating Sprocket Shaft Nut Wrench, Part No. 94557-55, to remove compensating sprocket shaft nut. If not equipped with compensating sprocket, use 1-3/8 inch socket or box wrench to remove nut. Loosen nut by striking wrench handle several sharp blows with hammer.

On 1965 and later models, remove chain adjuster mounting bolt and large brass starter shaft thrust washer.

Remove push rod adjusting screw lock nut (nut on center screw on clutch sprocket), slip washer (any metal washer about 1-3/4 in. in diameter with 3/8 in. hole) over push rod adjusting screw and replace lock nut. Remove three spring tension adjusting nuts and pull clutch outer disc and spring collar assembly off clutch drive hub pins. Move clutch sprocket and motor sprocket out and remove from shafts.

12. Remove three bolts, attaching chain cover at engine sprocket shaft.

On 1965 and later models, loosen the 5 transmission base mounting nuts. Remove the 4 inner chain guard to transmission attaching bolts. Remove clutch hub using Clutch Hub Nut Wrench Part No. 94645-41 and Clutch Hub Puller, Part No. 95960-41A. Remove shaft key. Remove the 2 inner chain guard stud nuts which attach to starter housing. Remove wire from solenoid. Pull inner chain guard from mainshaft using Puller Part No. 95960-41A which has 4 screws to fit tapped holes in chain housing. Remove chain oiler hose at oil pump. Remove other hoses from connections at back of chain housing.

13. Disconnect timer wire at coil. Disconnect wires from generator. Disconnect wire from oil pressure switch.

15. Drain oil tank and remove oil lines from oil pump. On 1965 and later models, remove crankcase breather pipe.

16. Remove footboard rear stud nut from inside of frame member and front footboard mounting stud bolts from brake master cylinder by removing nut and lock washer on back side. Remove brake master cylinder attaching stud bolt which passes through master cylinder and frame with a lock washer and nut on back side of frame member. Remove brake master cylinder sideplate bolt located behind master cylinder plunger boot. Master cylinder and sideplate assembly is free to swing down away from engine crankcase.

17. Remove exhaust system.

19. On 1964 and earlier models, remove spark advance control wire at circuit breaker. Remove two rear screws from horn trumpet bracket and slip out spark advance control wire.

20. Remove two front and two rear engine mounting bolts. Engine is now completely stripped and may be removed from right side of motorcycle.

Assembly is essentially the reverse order of disassembly.

On 1965 and later models, Loc-Tite "Grade A" should be applied to transmission shaft ball bearing recess in chain housing and on shaft. Pack ball race with grease after housing is tapped in place. Apply aluminum paint to joining surface of chain housing and engine-transmission, also use new cover gasket when reassembling.

NOTE

Leave transmission base mounting nuts loose until engine and transmission are secured to chain housing.

IMPORTANT

After assembly, chain housing must be air tight. Vacuum in chain housing can be checked with Vacuum Gage Part No. 96950-68 and should be 12 in. water or more at 1500 RPM. A lower reading than this indicates an air leak into chain housing at gasket, solenoid, starter shaft or hoses.

# CYLINDER HEAD

## REMOVING CYLINDER HEAD ASSEMBLY

1966 and Later (Fig. 3B-1)

Before removing cylinder head assembly, strip motorcycle as described in "Stripping Motorcycle For Engine Repair," Section 3A. Free carburetor and manifold assembly from motorcycle by removing two manifold clamps and carburetor support bracket nut at crankcase.

Disconnect overhead oil feed line (1) and cylinder interconnecting oil line (1C) at fittings.

Remove spring cap retainers 4A on push rod covers by prying down on cover spring cap with screwdriver wedged between cylinder cooling fins and pulling spring cap retainers out.

Remove five head bolts and washers (2) from each head. Lift cylinder head enough to slip out push rods (3) and push rod covers (4). Remove cylinder head (5). Remove cylinder head gasket (6). Mark push rods so that they will be reassembled in same position.

1965 and Earlier (Fig. 3B-1A)

Disconnect overhead oil feed line (1) at fittings (1963 and later). Remove spring cap retainers 4A on push rod covers by prying down on cover spring cap with screwdriver wedged between cylinder cooling fins and pulling spring cap retainers out.

Remove five head bolts and washers (2) from each head. Lift cylinder head enough to slip out push rods (3) and push rod covers (4). Remove cylinder head (5). Remove cylinder head gasket (6). Mark push rods so that they will be reassembled in same position.

## DISASSEMBLING CYLINDER HEAD

1966 and Later (Fig. 3B-1)

Free the rocker arm cover (9) from cylinder head by removing stud nuts (7). Before further disassembly, carefully check the rocker arm pads and ball sockets for pitting and excessive wear. Also, check the rocker arm shaft (12) for appreciable end play.

Remove rocker arm shaft screw and "O" ring (13), acorn nut and washer (10). Discard shaft screw "O" ring. Tap rocker arm shaft (12) from cover and remove rocker arm (15) and spacer (11). Mark rocker arm shaft and arm in some manner so all parts may be returned to respective locations during assembly. Rocker arms are not interchangeable.

Compress valve springs using Valve Spring Compressor, Part No. 96600-36, and remove valve keys (18) from ends of valve stems as shown in Fig. 3B-2. Mark keys to identify them with their respective valves. Remove valve spring collars (19 and 22), springs (20 and 21) and valves (23). It is customary to reassemble valves in same cylinder head from which they were removed; therefore, before removing, mark them in some manner to identify them with front and rear cylinder head.

1965 and Earlier (Fig. 3B-1A)

Remove the 12 cover reinforcing screws (7) and lift off reinforcing ring (8), rocker arm cover (9) and cover gasket (11). Cover pad (10) is cemented inside cover and needs no attention if in serviceable condition.

Turn off the eight rocker arm bearing stud nuts (12), and lift intake valve oiler (13) off studs. Remove rocker arm bearing halves (14 and 16) with rocker arms (15).

Remove exhaust valve stem pads (17) (if used). Compress valve springs with Valve Spring Compressor, Part No. 96600-36, as shown in Fig. 3B-2. Remove valve key halves (18).

Remove upper valve spring collar (19), outer valve spring (20) and inner valve spring (21) and lower spring collar (22). Slip valves (23) out of valve guides in head.

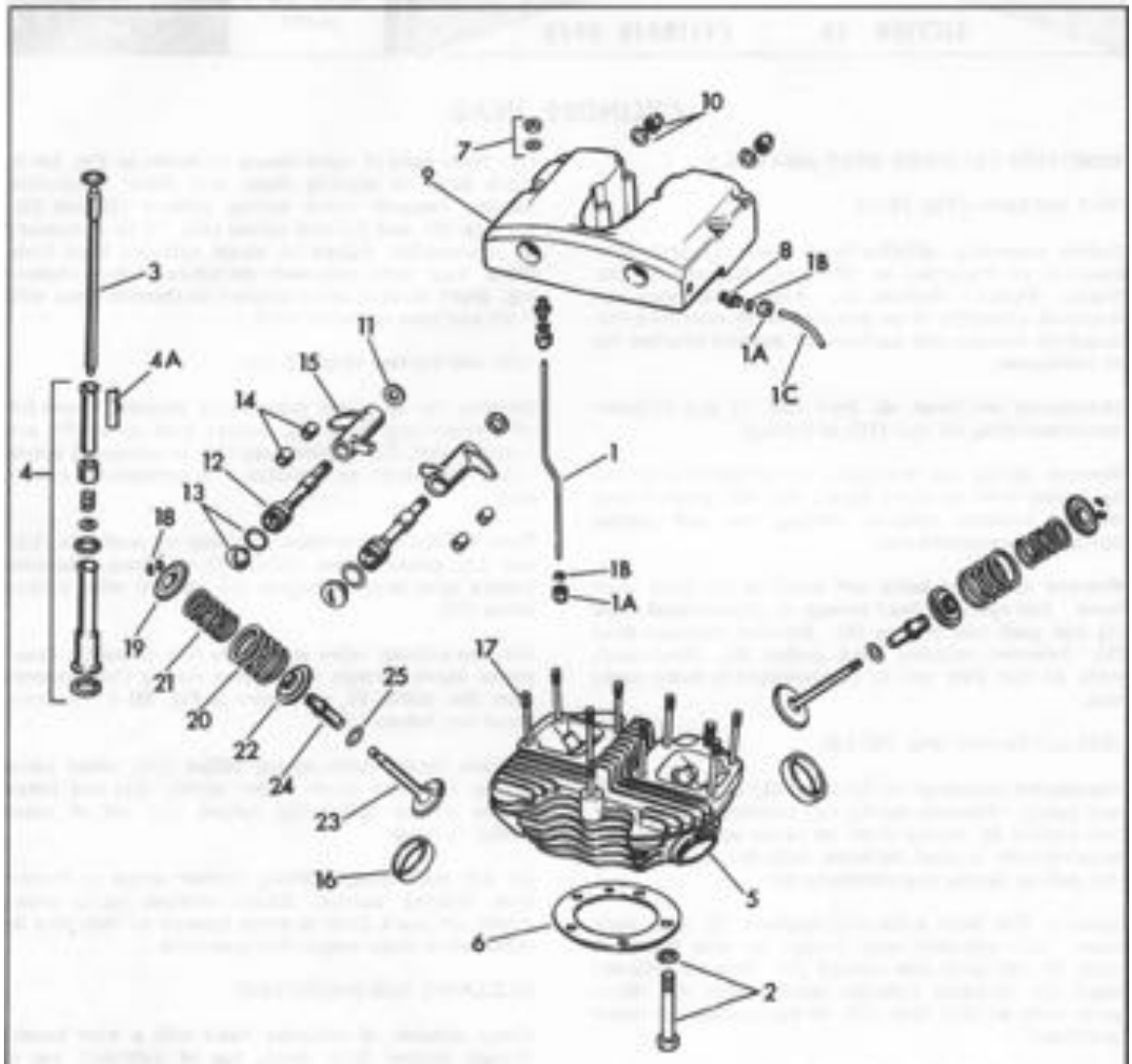
Do not interchange valves, rocker arms or rocker arm bearing halves. Either process parts separately or mark them in some manner so they may be returned to their respective positions.

## CLEANING AND INSPECTION

Clean outside of cylinder head with a wire brush. Scrape carbon from head, top of cylinder, top of bore above ring path, and inlet and exhaust valve ports. When scraping carbon, be careful to avoid scratching or nicking cylinder head and cylinder joint faces or bore. Blow off loosened carbon or dirt with compressed air.

Wash all parts in Harley-Davidson "Gunk Hydro-Seal". Blow out oil passages in head. Be sure they are free of sludge and carbon particles. Remove loosened carbon from valve head and stem with a wire wheel. Never use a file or other hardened tool that will scratch or nick valve. Polish valve stem with very fine emery cloth or steel wool. Check valve stem for excessive wear.

Valve head should have a seating surface about 1/16 in. wide, it should be free of pit marks and burn spots. Exhaust valves should contain carbon that is black or dark brown. White or light buff carbon indicates excessive heat and burning.




1. Overhead oil feed line
1A. Feed line nut (3)
1B. Feed line rubber sleeve (3)
1C. Cylinder interconnecting oil line
2. Head bolt and washer (5)
3. Push rod (2)
4. Push rod cover (2)
4A. Spring cap retainer (2)
5. Cylinder head
6. Cylinder head gasket
7. Rocker housing nut and washer (5)
8. Oil feed line nipple
9. Rocker arm housing
10. Rocker arm shaft acorn nut and washer
11. Rocker arm spacer (2)
12. Rocker arm shaft (2)
13. Rocker arm shaft screw and O-ring (2 each)
14. Rocker arm bushing (4)
15. Rocker arm (2)
16. Valve seat insert (one exhaust, one intake)
17. Rocker housing stud (8)
18. Valve key (2)
19. Upper valve spring collar (2)
20. Outer valve spring (2)
21. Inner valve spring (2)
22. Lower spring collar (2)
23. Valve (one exhaust, one intake)
24. Valve guide (one exhaust, one intake)
25. Valve guide gasket (2)

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3B-1. 1966 and Later Cylinder Head - Exploded View

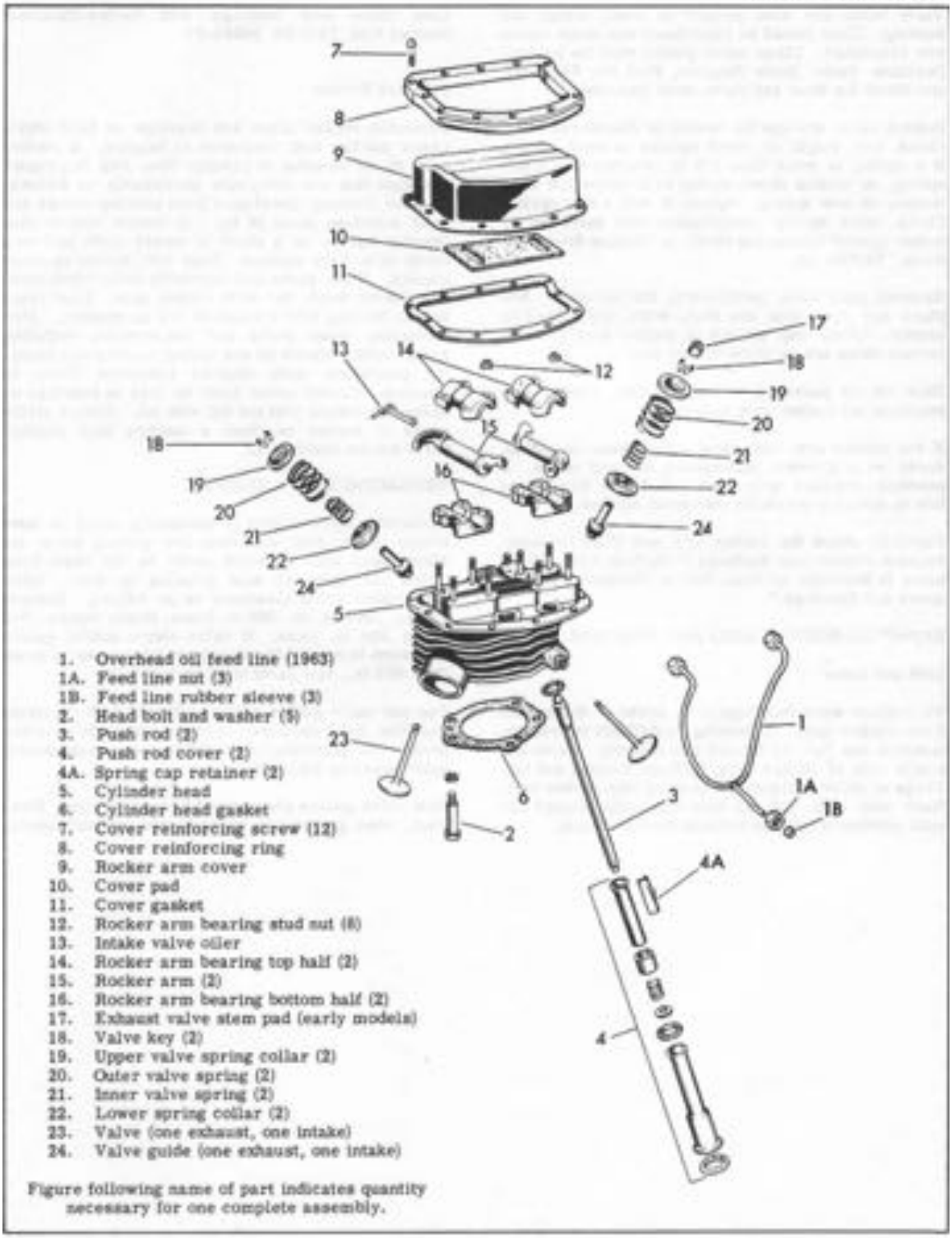



Figure 3B-1A. 1965 and Earlier Cylinder Head - Exploded View

Valve seats are also subject to wear, pitting and burning. They should be resurfaced whenever valves are refinished. Clean valve guides with the Harley-Davidson Valve Guide Reamer, Part No. 94830-47, and check for wear and valve stem clearance.

Inspect valve springs for broken or discolored coils. Check free length or check tension of each spring. If a spring is more than 1/8 in. shorter than a new spring, or tension shows spring to be below low limit tension of new spring, replace it with a new spring. Check valve spring compression with valve spring tester against tolerances shown in "Engine Specifications," Section 3A.

Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken. Check cup at end of rocker arm to make certain there are no chips broken out.

Blow out oil passages in rocker arms, rocker arm bearings and rocker arm covers.

If the rocker arm pads show uneven wear or pitting, dress on a grinder, maintaining original curve. If possible, compare with a new unit during this operation to insure a correctly contoured surface.

Carefully check the rocker arm and shaft for wear. Replace rocker arm bushings if shaft is over .002 in. loose in bushings, as described in "Repairing Rocker Arms and Bearings."

REPAIRING ROCKER ARMS AND BEARINGS

1966 and Later

To replace worn bushings (14), press or drive them from rocker arm. If bushing is difficult to remove, insert a tap (5/8-11 thread) into bushing. From opposite side of rocker arm, drift out bushing and tap. Press or drive replacement bushing into rocker arm, flush with arm end, oil hole correctly aligned and split portion of bushing towards the top of arm.

Line ream new bushings with Harley-Davidson reamer tool, Part No. 94804-57.

1965 and Earlier

Assemble rocker arms and bearings on head (dry). Check rocker arm clearance in bearing. If rocker arm fit in bearing is greater than .002 in., repair bearings that are otherwise serviceable as follows: Remove locating dowel pins from bearing covers and sand matching faces of top and bottom rocker arm bearing halves on a sheet of emery cloth laid on a fairly true firm surface. Sand both halves an equal amount. Wash parts and assemble (with dowel pins) to cylinder head, but omit rocker arm. Line ream hole in bearing with a standard 7/8 in. reamer. Disassemble, wash parts and reassemble, including rocker arm. Check fit and repeat sanding and reaming procedure until desired tolerance fitting is reached. Rocker arms must be free in bearings or hydraulic lifters will not fill with oil. Always strike edges of rocker bearings a medium blow to align parts before checking fit.

REPLACING VALVE GUIDES

Replacing valve guides if necessary, must be done before valve seat and face are ground since the valve stem hole in valve guide is the basis from which all face and seat grinding is done. Valve stem-valve guide clearance is as follows: Exhaust valves, .004 in. to .006 in. loose; intake valves, .002 in. to .004 in. loose. If valve stems and/or guides are worn to exceed the maximum tolerances by more than .002 in., new parts must be installed.

Tap out valve guides with shouldered drift pin (from chamber side) and insert replacement guide on arbor press. Be particularly careful to press replacement guide squarely into hole.

New valve guides are reamed to correct size. However, when guides are pressed into cylinder heads,

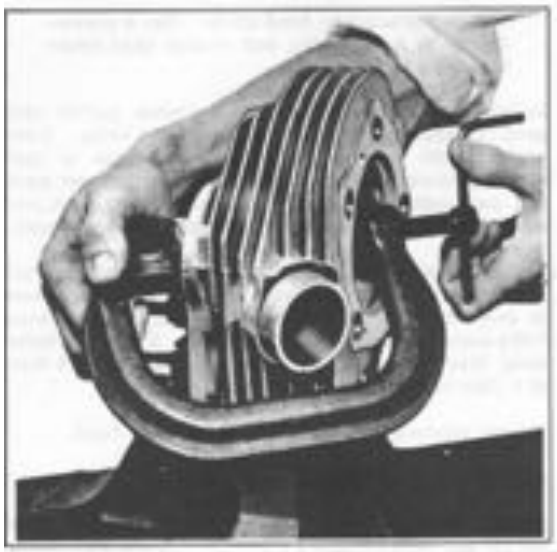


Figure 3B-2. Compressing Valve Spring

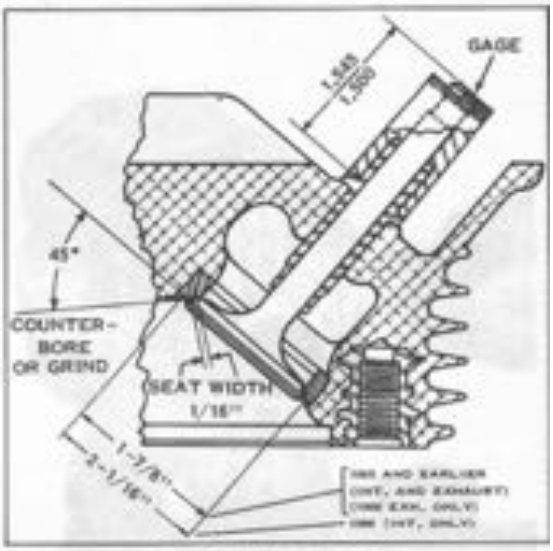



Figure 3B-3. Valve Seat Tolerances

they may close up slightly; also the ends may be burred. Therefore, after new guides are in place, they should be sized and cleaned with Valve Guide Reamer, Part No. 94830-47.

It is of prime importance that valve guides fit tightly in cylinder heads, or valves may not seat properly. If original guide or new standard guide is not a tight press fit, an oversize guide must be installed. Oversize guides can be obtained .001 in. to .006 in. oversize.

REPLACING VALVE SEATS

After installing valve guides, valve seats must be refaced to true them with guides.

If valves have been reseated several times, valve seats may have become too wide and/or valve may be seating itself too deeply in head. When valve seat becomes wider than 1/16 in. (see Fig. 3B-3) valve seat relief must be counterbored or ground to reduce seat to 1/16 in. Counterbore dimensions are shown. Tools for this purpose are available commercially. To determine if valve is seating itself too deeply in head, measure distance from shoulder of valve guide to end of valve stem. See dimension in Fig. 3B-3. When valve stem extends through guide excess of maximum shown valve seat inserts must be replaced.

A special gage is available under Part No. 96490-59A which is used to measure this dimension. The tool consists of gage valves and gage which is placed over the valve stem as shown. If top end of gage valve stem is between steps on gage, the valve seat location is satisfactory.

1966 and later inserts are pressed-in and cylinder heads may be returned to the factory for replacement with new inserts.

1965 and earlier cylinder heads, having cast-in inserts, may be returned to factory through authorized Harley-Davidson dealer for valve seat insert replacement. Heads are bored out to remove old seats, and new seats are pressed into place.

5/32 in. oversize service valve, Part No. 18082-60, is available for replacement of standard size, 1965 and earlier, intake and exhaust valves which are seating too deeply. A new valve seat must be cut in the old valve seat insert with boring or grinding tools according to instructions which come with service valve.

GRINDING VALVE FACES AND SEATS

Valve seat grinding tools and fixtures are available commercially. Grind and seat each valve in same port from which it was disassembled.

Valve face angle is 45° for both intake and exhaust valves, and valve refacing grinder must be adjusted exactly to this angle. It is important to not remove any more metal than is necessary to clean up and true valve face. If grinding leaves the edge of valve very thin or sharp, install a new valve. A valve in this condition does not seat normally, will burn easily and may cause pre-ignition. There is also danger of cracking. Valves that do not clean up quickly are probably warped or too deeply pitted to be used. If end of valve stem shows uneven wear, true end of stem on a valve refacing grinder equipped with suitable attachment.

Standard intake and exhaust valves are made of different materials and must not be interchanged on 1965 and earlier models. Intake valves are marked "IN" on head; exhaust valves are marked "EX". 1966 models have larger intake valve and cannot be interchanged.

Figure 3B-4. Lapping Valves

LAPPING VALVE FACES AND SEATS

If valve faces and seats have been smoothly and accurately refaced, very little lapping will be required to complete seating operation. Apply a light coat of fine lapping compound to valve face, insert valve in guide and give it a few oscillations with Valve Grinding Tool, Part No. 96550-36. Lift valve and rotate it about 1/3 of a turn. Repeat lapping procedure as shown in Fig. 3B-4. After full turn, remove valve, wash valve face and seat, and dry with cloth that is immediately discarded so grinding compound cannot be transferred to engine parts. If inspection shows an unbroken lapped finish of uniform width around both valve and seat, valve is well seated. If lapped finish is not complete, further lapping, or grinding and lapping is necessary.

ASSEMBLING CYLINDER HEAD

Replace valve and valve spring assemblies using Valve Spring Compressor, Part No. 96600-36. Position valve keys so spaces between key halves are equal. Spaces between key halves must face front and rear of engine on intake valves.

Replace rocker arm assemblies. On 1965 and earlier models use new intake valve oiler, making sure intake valve oiler is in place on intake rocker bearing, with oiler tube 3/32 in. from rocker arm. Rocker arms must be free or hydraulic lifters will not fill with oil.

Replace rocker arm cover. In 1965 and earlier models having reinforcing ring, use new cover gasket and pull down cover reinforcing screws evenly to obtain tight seal. On 1966 models, aluminum paint should be used on cover faces and cover nuts tightened evenly to 15 ft. lbs.

IMPORTANT

On 1966 model be sure to see that rocker arm ends do not jam against valve stems as rocker box is installed on head studs. Use a screwdriver to raise valve end of arm when cover assembly is installed.

Install new cylinder head to cylinder gasket and position rear head. Start cylinder head bolts. Turn engine until front cylinder exhaust tappet is just starting upward. Install rear cylinder exhaust push rod and push rod cover. Make certain both push rod ends are properly seated in rocker arm and tappet.

Rotate engine until front cylinder intake tappet is just starting upward. Install rear cylinder intake push rod in same manner as exhaust push rod. Tighten head bolts evenly to insure a proper seal. First turn bolts snug, then using a torque wrench tighten each 1/4 turn at a time until all are drawn to 65 ft. lbs.

Repeat procedure to install front cylinder head.

ADJUSTING TAPPETS (Fig. 3B-5)

Engine must be cold. Loosen tappet adjusting lock nut (1) and turn adjusting screw (2) upward, shortening push rod, until push rod has noticeable shake. Keep push rod from turning by holding with wrench on flats provided at base of push rod (3). Slowly turn push rod adjusting screw downward, lengthening rod, until all shake has been taken up. Mark adjusting screw with chalk and turn it downward exactly four full turns. Lock adjustment by tightening tappet adjusting lock nut. Always adjust tappets with push rod at its lowest position. Lowest position may be found by rotating engine until like tappet (intake or exhaust) in other cylinder is at highest point (valve fully open).

Install push rod cover spring cap retainers.

Always use new gasket at all joints unless otherwise specified. Clean off surfaces with a greaseless solvent (white gasoline is satisfactory) and install gaskets dry. Greased gaskets adhere to joint surfaces and become impossible to remove without damaging joint surfaces.

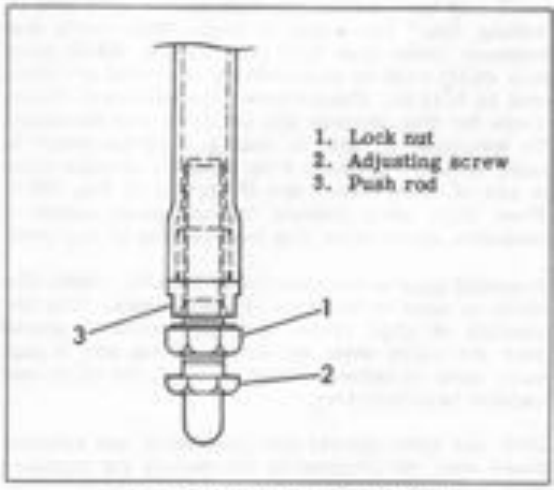


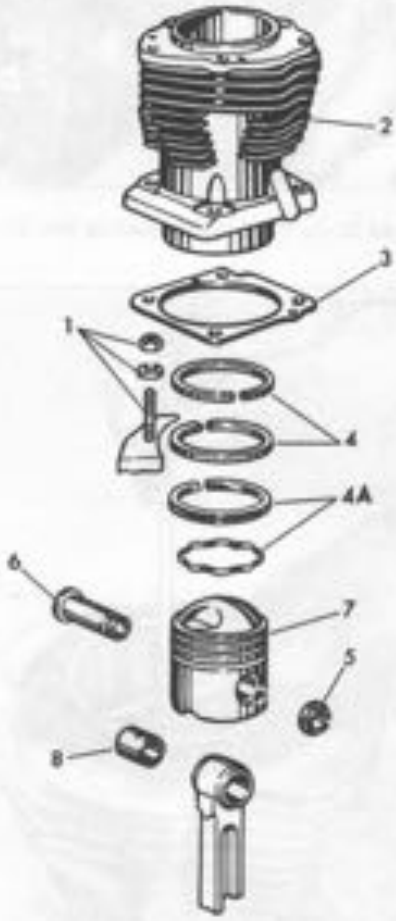

Figure 3B-5. Adjusting Tappets

# CYLINDER

## DISASSEMBLING CYLINDER AND PISTON (Fig. 3C-1)

Strip motorcycle as described in "Stripping Motorcycle for Engine Repair," Section 3A, steps 1 through 10.

Remove cylinder head as described in "Disassembling Cylinder Head," Section 3B.




1. Cylinder base stud nut and washer (4)
2. Cylinder
3. Cylinder base gasket
4. Piston rings (2 compression)
4A. Oil control piston ring and expander spring
5. Piston pin lock ring (2)
6. Piston pin
7. Piston
8. Piston pin bushing

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3C-1. Cylinder - Exploded View

Remove all cylinder base stud nuts and washers (1) except one on rear cylinder using Cylinder Base Nut Wrench, Part No. 94585-30. Raise front cylinder and piston enough to permit placing a cloth over crankcase opening. This will prevent dirt or pieces of broken ring from falling into crankcase. With piston at bottom of stroke, remove cylinder (2). Remove remaining stud nut from rear cylinder. Remove rear cylinder in same manner. Discard cylinder to crankcase gasket (3).

Spring piston rings (4) outward until they clear ring grooves in piston and lift off. Use a commercial ring expander if necessary. Pry right piston pin lock ring (5) off piston pin using the Piston Lock Ring Tool, Part No. 96780-32A and screwdriver as shown in Fig. 3C-2. Right end of piston pin has slots for this purpose. Tap out piston pin (6) and lift off piston (7).

Remove piston pin bushing (8), if necessary (see "Cleaning and Inspection"), using Piston Pin Bushing Tool, Part No. 95970-32A. Do not drive bushing out with a drift pin unless rod is disconnected and well supported around piston pin hole.

## CLEANING AND INSPECTION

Place cylinders and pistons in "Gunk Hydro-Seal" or other carbon and gum dissolving agent until deposits are soft. Scrub piston dome and outside of cylinder to remove deposits. Where carbon deposit is thick and hard, it is advisable to scrape carbon before cleaning. Use a putty knife or ground tip on an old file. Use care to keep from scraping into aluminum of piston.

Wash all parts in solvent and blow dry with compressed air. Force air through feed and return oil passages in cylinder. Clean piston ring grooves with a piece of compression ring ground to a chisel shape.

Examine piston pin to see that it is not pitted or scored. Check the piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored. A piston pin, properly fitted, is a light hand press fit in piston and has .001 in. clearance in connecting rod upper bearing. If piston pin to bushing free fit exceeds .002 in., replace worn parts, (see "Connecting Rod Bushings").

If piston pin is to be used again, examine lock ring on unslotted end of pin. If ring is tight in its groove, it is not necessary to remove it. When a new ring is required, clean ring groove and install ring before pin is installed in piston. The piston pin included with new piston assembly will have lock ring already installed on unslotted end.

Figure 3C-2. Removing Piston Pin Lock Ring

Examine piston and cylinder for cracks, burrs, burned spots, grooves and gouges.

Check rods for up and down play on lower bearings. See Fig. 3C-3. When up and down play is detected and either rod has more than 3/32 in. side shake at extreme upper end, lower bearing should be refitted. This requires removing and disassembling engine crankcase (see Section 3E).

RE FINISHING CYLINDERS

Gauge pistons and cylinders to see if they are worn to the point where cylinders must be rebored and oversize pistons installed. Inside and outside micrometers used for piston to cylinder fitting should be checked together to be sure they are adjusted to read exactly the same. Subtract piston measurement from bore measurement to obtain clearance. Bore measurement of a cylinder should be taken in ring path, starting about 1/2 in. from the top of cylinder, measuring front to rear then side to side. Repeat procedure at the center and at the bottom of ring travel (see Fig. 3C-4). This process will determine if cylinder is out of round or "egged" and will also show any cylinder taper or bulge.

Pistons are measured front to rear at base of piston skirt as shown in Fig. 3C-5. Pistons are cam ground to an egged or oval shape so only front and rear surfaces are touching cylinder wall.

If cylinders are not scuffed, scored and are worn less than .002 in., it is not necessary to rebore oversize at time of cylinder repair. It may be done at time of next complete engine overhaul. If desired, a new piston may be installed to reduce clearance for more quiet operation.

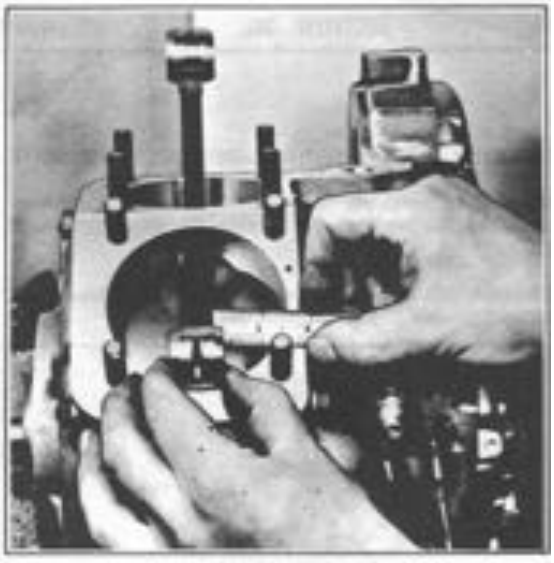


Figure 3C-3. Checking Connecting Rod Fit

Figure 3C-4. Measuring Cylinder Bore

If cylinders show more than .002 in. wear, they should be rebored and/or honed to next standard oversize and refitted with corresponding pistons and rings.

Pistons are regularly supplied in the following oversizes: .005, .010, .020, .030, .040, .050, .060 and .070 in. Oversize pistons have their oversize stamped on head; 10, 20, etc.

Cylinders can be refinished oversize with a hone only, or with a boring bar followed by a finishing hone. In general practice only cylinders not scored and not badly worn are refinished entirely with a hone. Cylinders badly worn or deeply scored are first rebored to nearly the required oversize and then are finish-honed to exact size. Exact final size of the cylinder bore is determined by size of the piston to be used in that cylinder. Measure piston diameter accurately as described previously, then add desired piston clearance in cylinder. This will equal the exact final size to which cylinder bore should be refinished, example: the .020 in. oversize piston to be used measures 3.4575 in., adding .001 in. (desired clearance) equals 3.4585 in. (finish-honed size). When cylinders require reboring to beyond .070 in. oversize to clean up, their oversize limit has been exceeded and the cylinders must be replaced.

When cylinders are worn less than the .002 in. maximum, and reboring is unnecessary, unless they are scuffed or grooved the same pistons may be used with the replacement of rings and the roughing of cylinder walls to facilitate ring seating. Use No. 150 carborundum emery cloth to rough walls.

FITTING PISTON RINGS

Piston rings are of two types - compression (plain face) and oil control ring. The two compression rings

Figure 3C-6. Measuring Ring Side Clearance

are positioned in the two upper piston ring grooves with the stamped word "TOP" or a dot (.) upward. Rings are regularly supplied in the following oversizes to fit standard oversize pistons: .010, .020, .030, .040, .050, .060 and .070 in.

Compression rings must have proper side clearance in ring grooves. Check with thickness gauge as shown in Fig. 3C-6. Ring gap (space between ends) must also be as specified, see "Specifications", Section 3A.

Figure 3C-5. Measuring Piston

Figure 3C-7. Checking Ring Gap

The oil ring is a full width slotted oil control ring using a spring expander.

Figure 3C-9. Assembling Rings with Ring Expander

To check ring gap, place a piston in cylinder with top end of piston about 1/2 in. from top of cylinder. Place ring in cylinder bore squarely against piston and check gap with thickness gauge (see Fig. 3C-7).

Use only standard size rings and piston in standard bore, and only matching oversize rings and piston in the same oversize bore.

If gap is less than specified, ring ends may butt under expansion, and be scored or broken. Compression ring gap may be increased by filing with fine-cut file.

Figure 3C-10. Replacing Rod Bushing

Use a commercially available piston ring expander (Fig. 3C-9) to guide and slip rings over the piston into their respective grooves without over expanding or twisting rings and damaging the finely finished piston surface.

## CONNECTING ROD BUSHING

When connecting rod bushing is tight in rod but is worn to excessive pin clearance (.002 in. or more) it is possible to service by reaming oversize and fitting an oversize pin. However, it is recommended that a new bushing be installed and reamed to fit a standard pin, except when piston to be used had previously been fitted with oversize pin, or pin is loose in bosses, necessitating fitting with an oversize pin. The objection to fitting upper end oversize is that considerably more time is required for the job. New pistons, standard or oversize, obtained from factory are supplied correctly fitted with standard pin, and may be installed in a short time if the rod bushing is already reamed to standard size. If bushing has been reamed oversize, either a new bushing must be installed and reamed to standard size or piston must be reamed oversize to fit an oversize pin, which involves extra time.

When replacing bushings in connection with only a top overhaul, use Harley-Davidson special tools as shown in Fig. 3C-10, Bushing Tool, Part No. 95970-32A and Connecting Rod Clamping Fixture, Part No. 95952-33. Be careful to start new bushing with oil slot in alignment with oil slot in rod.

Ream new bushing to size with Special Reamer, Part No. 94800-26. A properly fitted pin should have .001 in. clearance; with this clearance, pin will have just noticeable shake in bushing. Fitting tighter is likely to result in a seized pin or bushing loosened in rod. Oversize piston pins are available .002, .004, .006 and .008 in. oversize.

## STRAIGHTENING CONNECTING RODS

In refitting and reassembling connecting rods, and finally fitting pistons, rods may be bent or twisted, throwing upper bearing and lower bearing out of alignment with each other.

After pistons have been installed, rods must be checked and re-aligned as necessary. If a rod is bent or twisted, piston has a "cocked" relation to cylinder bore and the result is excessive noise and rapid wear.

Check rod alignment with Piston Squaring Plate, Part No. 96179-18 as shown in Fig. 3C-11. Be sure crankcase face is clean and free from burrs so that squaring plate seats fully.

NOTE

Piston skirt is cut away at bottom (below piston pin) for flywheel clearance, therefore, it cannot be used with squaring plate for checking rod alignment. Temporarily install a 61 O.H.V. piston to check rod alignment.

If a rod is in perfect alignment piston bottom will rest squarely on plate when flywheels are turned so that crank pin is in forward and rear position. This check, to be accurate, depends upon checking with crank pin alternately in both forward and rear positions. It is the change of rod angle, resulting from changing crank pin from one position to the other that influences the seat of piston on squaring plate and thus indicates whether or not rod is in alignment.

Insert narrow strips of paper of equal thickness underneath piston, one on each side, below piston pin, as shown in Fig. 3C-11. Press piston down lightly with finger tips resting on center of piston head and pull first one paper, then the other, partially from underneath piston. If piston is perfectly square (rod in alignment), both will have the same amount of drag.

If rod proves to be out of alignment, it can be straightened by means of a bar inserted through piston pin, as shown in Fig. 3C-12. Use a bar with a diameter as close to the hole diameter in the piston pin as possible. The manner in which piston seats on squaring plate indicates as follows:

1. Piston high on same side, both crank pin positions; rod is bent.

2. Piston high on opposite sides as crank pin position is changed; rod is twisted.

Figure 3C-11. Checking Rod Alignment

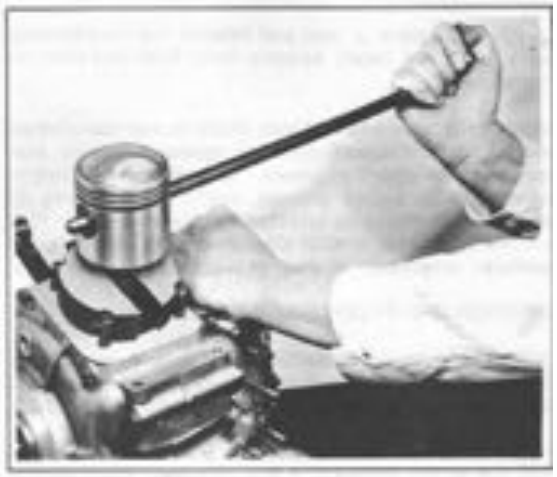


Figure 3C-12. Straightening Connecting Rod

3. Piston square or nearly square with crank pin in one position and high on one side with crank pin in other position; rod is bent and twisted.

Correct as follows:

1. To straighten a bent rod, insert straightening bar through piston pin hole on low side of piston and apply upward force.

2. To straighten a twisted rod, insert straightening bar through piston pin hole on high side of piston, and if crank pin position is to front apply force to rear - if crank pin position is to rear apply force to front.


Figure 3C-13. Piston with Web on Right Side

3. To straighten a bent and twisted rod (combination of a bend and twist) remove bend first and then remove twist.

After rods have been aligned check to see that pistons center in crankcase cylinder opening, without side pressure on upper rod ends. If further realigning is necessary to center pistons, correct by dressing off end of rod bushing on interfering side with a file. This allows the piston to shift slightly on rod to find a more suitable alignment of rod, piston, and cylinder bore.

ASSEMBLING CYLINDER AND PISTON

Attach piston to connecting rod with a piston pin. Position piston so lug on piston pin boss inside piston skirt is to right side of engine. See Fig. 3C-13.

Clean lock ring groove and install lock ring on end of pin that is not slotted if it was removed. Start slotted end of pin into piston boss from left side and drive through in the same manner in which pin was removed.

If the piston is heated in boiling water, the pin may be inserted into piston as a slip fit.

After pin is in place, clean lock ring groove and install the other lock ring (see Fig. 3C-14). It is important that special Lock Ring Tool, Part No. 96780-32A be used for installing lock rings.

Figure 3C-14. Inserting Piston Pin Lock Ring

Figure 3C-15. Slipping Cylinder over Piston

NOTE

Lock ring is expanded just enough to go over end of pin. Other means of installing may over-expand ring and possibly crack it. Make sure ring groove is clean and that ring seats firmly in groove.

A lock ring incorrectly installed will soon loosen in service and finally come off pin, resulting in both piston and cylinder being damaged beyond repair. Never install a used lock ring or a new one that has been installed and then removed. Always use an unused lock ring.

Lubricate cylinder walls, pistons, pins and rod bushings with engine oil. Rotate rings until gaps are equidistant around rear piston. Turn engine until crank pin is at bottom center. Install new cylinder base gasket. Position Piston Inserter Ring Tool, Part No. 96333-51A on rear piston and slip rear cylinder down over piston as shown in Fig. 3C-15.

Install lock washers and nuts and pull them down evenly. Repeat process to assemble front cylinder.

Assemble cylinder heads and remaining portions of motorcycle as indicated in "Assembling Cylinder Heads," Section 3B, and reverse order of "Stripping Motorcycle for Engine Repair," Section 3A, steps 10 through 1.

# GEARCASE

## OIL PUMP

### GENERAL

The oil feed pump and scavenger (oil return) pump are gear type pumps housed in one pump body and located on rear of gearcase on right side of motorcycle. The feed pump incorporates an automatic by-pass valve that reroutes surplus oil (above the amount needed to lubricate the engine) directly to the gearcase. A ball check valve is located ahead of the pressure regulating valve to prevent oil drainage from tank, and to operate the pressure switch.

Under normal operating conditions, the pump is a comparatively trouble free unit. The most common trouble with pump operation is the introduction into the pump of a metal or hard carbon chip. If either gets between the gear teeth, it is possible to shear a key, fracture a gear or break off a gear tooth.

If oil fails to return to the tank, check the scavenger pump gear drive shaft key. When the engine receives no lubrication (oil remains in tank), the drive shaft key on the feed pump drive gear may be sheared. Both conditions together could be caused by shearing of the oil pump (gearcase) drive gear key. In cold weather slush ice formed from moisture condensation in oil may block oil passages and cause any of above troubles.

### DISASSEMBLING OIL PUMP (Fig. 3D-1)

NOTE

See Fig. 3D-1 or 3D-1A corresponding to pump being worked on.

The oil pump may be removed from the motorcycle as a unit only if the engine is removed from the chassis. The oil pump may be disassembled, piece-by-piece without removing gearcase cover, with engine in chassis as follows:

Disconnect oil lines and oil pressure switch (1) from pump. See Fig. 3D-1B or 3D-1D. Remove nuts and washers or bolts and lock washers (2) from gearcase studs, that hold oil pump cover in place. Remove oil pump cover (3) and gasket (4). Remove lock ring (5), drive gear (6), gear key (7) and idler gear (8). Remove two oil pump body mounting stud nuts (9) and slip pump body (10) off studs and gear drive shaft (11). Remove drive gear (12), key (13), and idler gear (14).

Turn relief valve plug (15) out of pump body and remove relief valve spring (16) and valve (17). Remove check valve spring cover screw (18), valve spring (19) and ball (20). On adjustable chain oiler equipped models, loosen chain oiler adjusting screw lock nut (21) and turn in adjusting screw (22). Count the turns necessary to bottom screw then remove. Bottom and turn out same number of turns when assembling. Remove chain oiler screw (22A). Oil pump nipples (24) may be turned out of pump cover to facilitate cleaning.

To remove oil pump unit from gearcase with engine removed from chassis, remove gearcase cover screws, cover and gasket. (See "Gearcase Timing Gears".) Turn pinion gear nut off pinion shaft using the special tool, Gear Shaft Nut Socket Wrench, Part No. 94555-55 (left hand thread). Pull pinion gear using Pinion Gear Puller and Installer, Part No. 96830-51, remove key, spring, spacing collar and oil pump pinion shaft gear. Pry spring ring off pump drive gear shaft and remove drive gear and key. Remove pump body nuts and bolts (2 and 9) and slip pump with drive shaft (11) out of gearcase. Pump is then disassembled as above.

### CLEANING AND INSPECTION

Thoroughly clean all parts in cleaning solvent and blow pump body passages clear with compressed air. Inspect valves and valve seats for pitting and wear. Replace pump having worn or damaged valve seat. Inspect keys and keyways. Inspect scavenger and feed pump gear teeth for gouging or cracking caused by foreign materials going through pump. Pump shafts and bushings normally last lifetime of engine.

### ASSEMBLING OIL PUMP

Oil pump is assembled in reverse order of disassembly. Do not mix gears and keys - return to correct location. Oil pump gaskets should always be replaced. Use only "factory made" gaskets. Lock rings are often damaged when removing them. It is advisable to install a new lock ring when assembling pump. Make sure ring is engaged and seated in retaining groove.

Bolts and nuts must be drawn down evenly to approximately 50 inch-pounds, but no more than 60 inch-pounds torque (four to five foot-pounds).

This is important because the oil pump cover gasket and body gasket are made from plastic material. If overtightened, the plastic material will be squeezed out of place and eliminate pump gear side clearance which may seize and damage the pump parts.

If a leakage problem exists, disassemble pump and inspect all gasket surfaces making sure they are flat and smooth. Install new gaskets and reassemble pump, tightening four bolts and two nuts evenly to 50 inch-pounds torque.

On late models, oil hose connections have one piece band type clamps and must be replaced each time hoses are connected. Use Hose Clamp Tool Part No. 97087-65 to squeeze clamps tight as shown in Fig. 3D-1C.

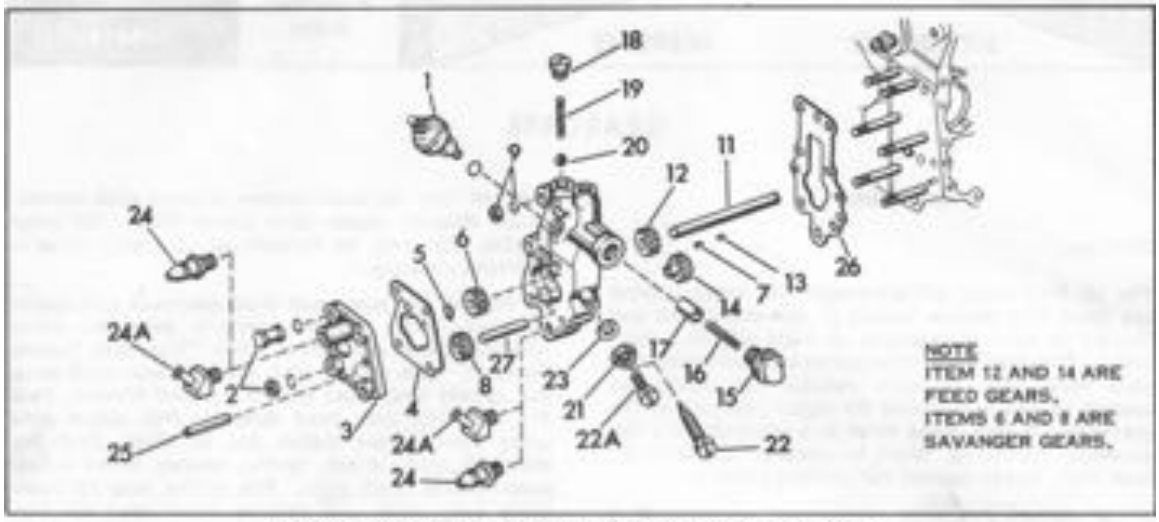



Figure 3D-1. Oil Pump - Exploded View (1967 and Earlier)

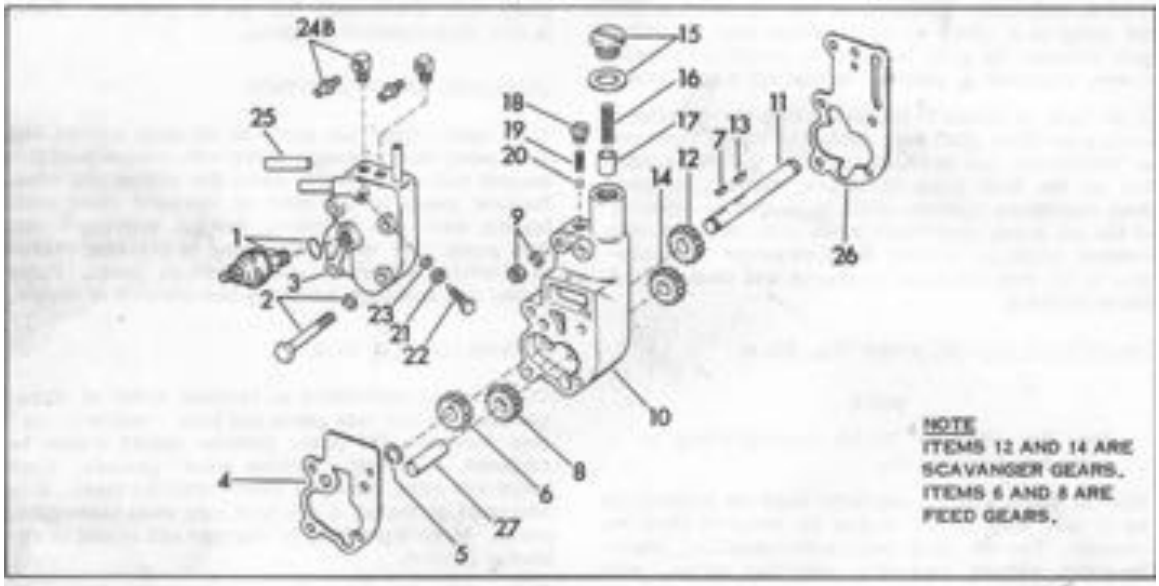



Figure 3D-1A Oil Pump - Exploded View (1968 and Later)

KEY FOR FIGURES 3D-1 AND 3D-1A

1. Oil pressure switch
2. Cover stud nut or bolt and washer
3. Oil pump cover
4. Cover gasket
5. Lock ring
6. Drive gear
7. Gear key
8. Idler gear
9. Oil pump body mounting stud nuts and washers (2)
10. Oil pump body
11. Oil pump gear drive shaft
12. Drive gear
13. Gear key
14. Idler gear
15. By-pass valve plug
16. By-pass valve spring
17. Check valve spring cover
18. Check valve spring cover screw
19. Check valve spring
20. Check valve ball
21. Chain oiler adjusting screw lock nut
22. Chain oiler adjusting screw
22A. Chain oiler screw (1965-67)
23. Chain oiler adj screw washer
24. Oil line nipple (2) (1964 and earlier)
24A. Oil line nipple (2) (1965)
24B. Oil line nipple (2) (1968)
25. Chain oiler pipe
26. Body gasket
27. Idler gear shaft

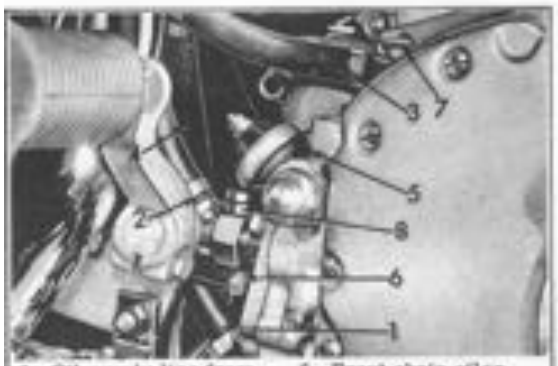
Figure following name of part indicates quantity necessary for one complete assembly.

## VALVE TAPPETS AND GUIDES

GENERAL

The tappet assembly consists of tappet, roller and hydraulic unit. The tappet and roller, under compression force from valve spring, follow the surface of the revolving cam. The linear motion produced is transmitted to the valve stem by the hydraulic unit, push rod and rocker arm. The hydraulic unit contains a piston or plunger and cylinder plus a ball check valve which allow the unit to pump itself full of engine oil to take up all play in the entire valve train. On late 1966 and some earlier models, oil is filtered through screen located beneath plug in crankcase (7, Fig. 3D-1B or 3D-1D).

When hydraulic units are functioning properly the assembly operates with no tappet clearance. The




1. Oil supply line from tank
2. Oil return line to tank
3. Vent line to oil tank
4. Vent line to chain housing
5. Return line from chain housing
6. Front chain oiler line to chain housing
7. Overhead and tappet oil screen plug
8. Rear chain oiler adjusting screw

Figure 3D-1B. Oil Pump and Connecting Lines (1965-67 Models)

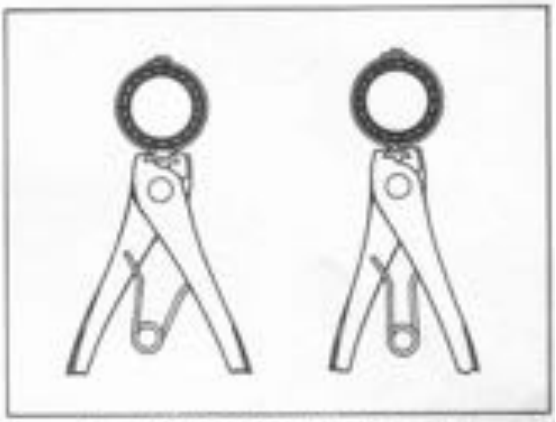
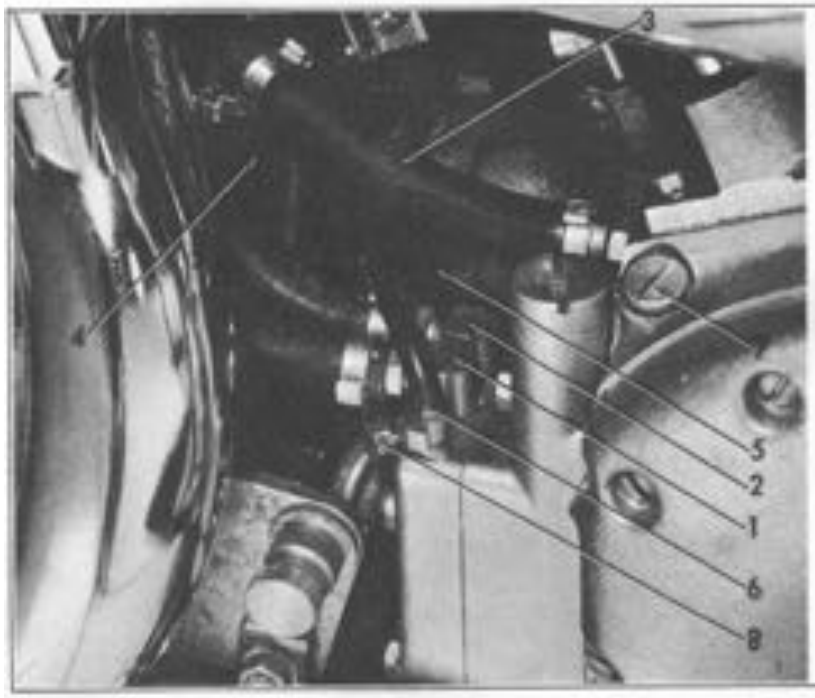


Figure 3D-1C. Hose Clamp Connection




1. Oil supply line from tank
2. Oil return line to tank
3. Vent line to oil tank
4. Vent line to chain housing
5. Return line from chain housing
6. Front chain oiler line to chain housing
7. Overhead and tappet oil screen plug
8. Rear chain oiler adjusting screw

Figure 3D-1D. Oil Pump and Connecting Lines (1968 Models)

units automatically compensate for heat expansion to maintain a no-clearance condition.

It is normal for tappets to click when engine is started after standing for some time. Hydraulic units have a definite "leak down" rate which permits the oil in the hydraulic unit cylinder to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain no-clearance operation. Push rod assemblies are functioning properly if they become quiet before or as engine reaches full operating temperature.

DISASSEMBLING TAPPETS (Fig. 3D-2)

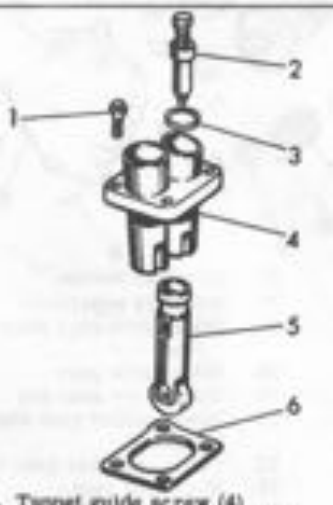
If engine cylinder head is not disassembled, remove push rod cover spring cap retainer. Lift push rod covers and retract push rod adjusting screw until push rod may be lifted out of ball sockets.

Turn out tappet guide screws (1). Lift out hydraulic units (2). Loosen tappet guides by tapping gently with rawhide or soft metal hammer. Insert thumb and forefinger into push rod opening in tappet guide and press tops of tappets against side of guides.

Remove tappet and guide assembly. Be careful to avoid dropping a tappet through guide mounting hole and into gearcase. Slip push rod cover cork washers (3) out of top of tappet guide (4). Pull tappet and roller (5) out bottom of tappet guide and remove tappet guide gasket (6).

CLEANING AND INSPECTION

Wash all parts except hydraulic units and gaskets in grease solvent. Hydraulic unit parts are selectively




1. Tappet guide screw (4)
2. Push rod hydraulic unit (2)
3. Push rod cover cork washer (2)
4. Tappet guide
5. Tappet and roller assembly (2)
6. Tappet guide gasket

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3D-2. Tappet Assembly - Exploded View

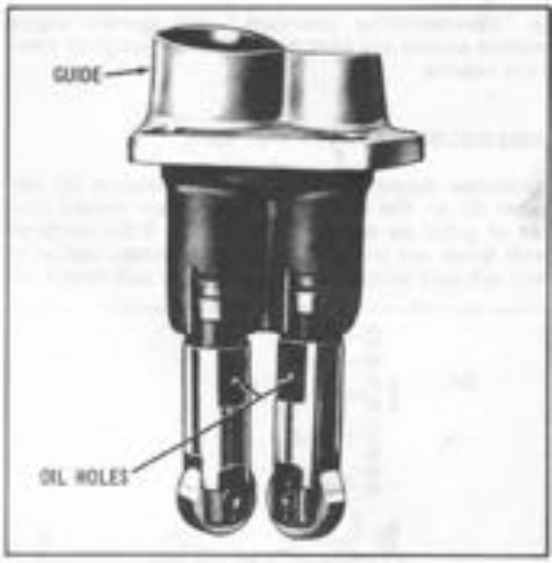



Figure 3D-3. Inserting Tappets on Guide

fitted and may not be interchanged so they must be individually and separately washed. Twist and pull hydraulic piston and spring from cylinder and wash parts.

Blow out oil passages in tappets, tappet guides and hydraulic units with compressed air. Insert a length of wire into oil channel openings in tappet guide to make sure passages are open. Air dry all parts.

Examine cams through tappet guide holes in gearcase for nicked, grooved or chipped condition. Examine tappet-guide matching surfaces for scuffing or grooving.

When tappet fit in guide exceeds maximum tolerance shown in "Engine Specifications" by .001 in. or more, replace worn parts. If roller is loose, force out pin on arbor press, insert new parts and peen or stake pin ends.

Check roller end clearance. Replace all units exceeding tolerances listed in specifications.

CHECKING HYDRAULIC UNITS (2, Fig. 3D-2)

Hydraulic units may be checked as follows: Wash and air dry piston and cylinder. Blow out cylinder from bottom to make sure ball and seat are dry. Insert piston in cylinder. Hold in an upright position and press down piston, until spring touches cylinder, without covering hole in bottom of cylinder. Hold for count of 6 and release. If piston bounces back, unit is serviceable. If piston does not bounce back, cover hole in bottom of cylinder and repeat above process. If piston does not bounce back, unit is worn and must be replaced. If piston bounces back, ball is not seating, and unit should be replaced. Before replacing hydraulic units, check possibility of plugged or partially plugged screen under large cap screw located near rear tappet guide. Remove screen as described

in "Disassembling Gearcase," and operate engine without screen and cork washers long enough to compare results.

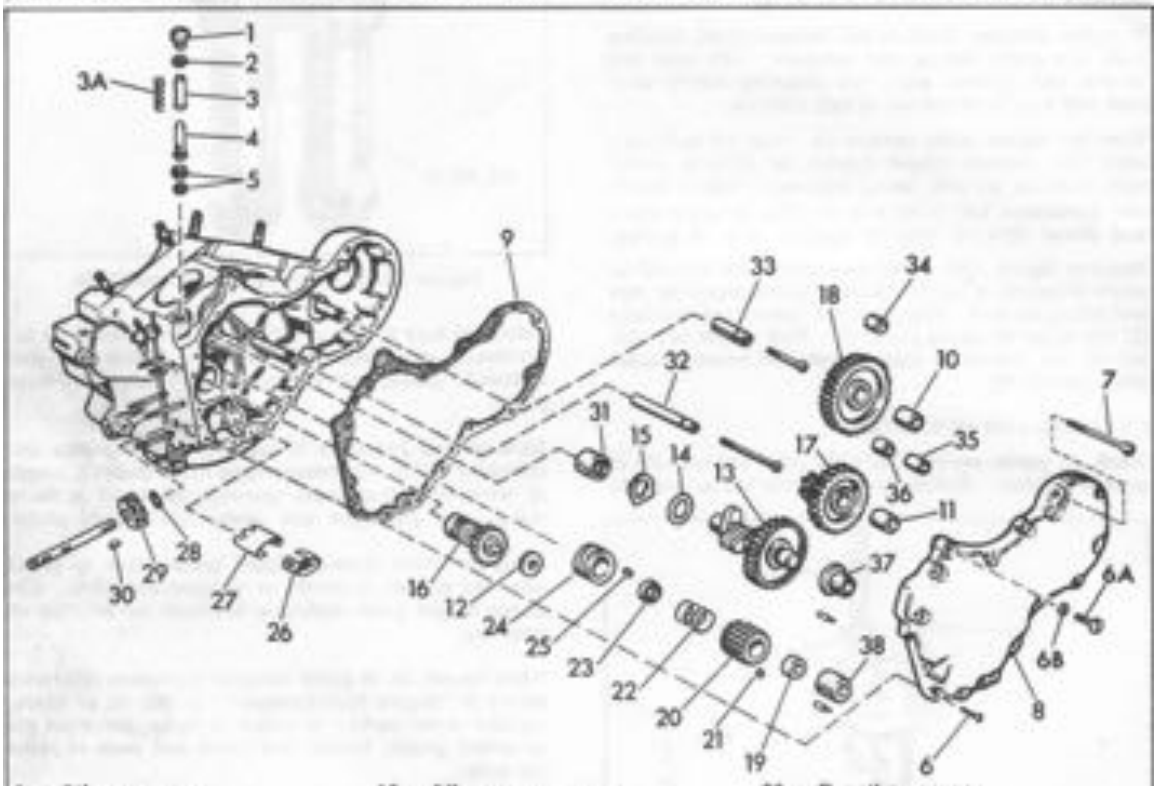
ASSEMBLING TAPPETS (Fig. 3D-2)

Assemble tappets as follows: Slip tappets (5) into guide (4) so flat surfaces on tappets are toward center of guide as shown in Fig. 3D-3. If flat surfaces with holes are not toward center of guide, engine oil will not feed across and one hydraulic unit cannot fill with oil. Assemble tappet guide gasket dry and insert tappet assembly in place on gearcase, holding tappets in place with thumb and forefinger as when unit was removed.

Assemble push rod cover cork washers, push rod hydraulic units and tappet guide screws.

Assemble remainder of push rod assembly in same order disassembled.

Adjust tappet clearance as described in Section 3B-5.




| | | | | | |
|---|---|---|---|---|---|
| 1. | Oil screen cap | 10. | Idler gear spacer | 26. | Breather screen |
| 2. | Cap gasket | 11. | Intermediate gear spacer | 27. | Breather separator |
| 3. | Oil screen body (not used on 1963 and later models) | 12. | Breather valve spacing washer | 28. | Oiler drive gear shaft spring ring |
| 3A. | Spring (1963 and later) | 13. | Cam gear | 29. | Oiler drive gear |
| 4. | Oil screen | 14. | Cam gear spacing washer | 30. | Oiler drive gear key |
| 5. | Oil screen seal (2) (1963-66) (1 used on 1963 models) | 15. | Cam gear thrust washer | 31. | Needle roller cam shaft bearing |
| 6. | Gear cover screw (12) | 16. | Breather valve and gear | 32. | Circuit breaker gear stud |
| 6A. | Gear cover oil passage screw (1963) | 17. | Circuit breaker gear | 33. | Idler gear stud |
| 6B. | Screw brass washer (1963) | 18. | Idler gear | 34. | Idler gear bushing |
| 7. | Generator fastening screw (2) | 19. | Gear shaft nut | 35. | Circuit breaker gear bushing (2) |
| 8. | Gear cover | 20. | Pinion gear | 36. | See item 35 |
| 9. | Gear cover gasket | 21. | Pinion gear key | 37. | Gearcase cover cam shaft bushing |
| | | 22. | Pinion gear spring | 38. | Gearcase cover pinion gear bushing |
| | | 23. | Gear shaft pinion spacer | | |
| | | 24. | Oil pump pinion shaft gear | | |
| | | 25. | Oil pump pinion shaft gear key | | |

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3D-4. Gearcase - Exploded View

## GEARCASE TIMING GEARS

GENERAL

The gearcase, located on the right side of the engine crankcase, contains a train of gears which transmit engine power to the cam shaft, crankcase breather, timer, oil pump and generator. The gearcase is lubricated with engine oil through the by-pass circulatory system and through the breather valve from engine crankcase.

All gear shafts run in bushings except the crankcase side of the cam shaft which operates in a needle roller bearing. The circuit breaker (timer) gear and intermediate gear turn on stationary shafts and are fitted with bronze bushings.

DISASSEMBLY (Fig. 3D-4)

Before disassembling gearcase, it is advisable to remove push rods, tappets, push rod hydraulic units and tappet guides as described in "Disassembling Tappets."

Remove oil screen cap (1), gasket (2), screen body (3) or spring (3A) screen (4), and screen seal (1 or 2 used) (5). Remove screen from screen housing by rotating screen until notch in screen lines up with key in housing.

Remove 12 gearcase cover screws (6), oil passage screw (6A) with washer (6B), and two long generator fastening screws (7), and remove generator.

Remove two timer-to-motor bolts and slip timer assembly out top of gearcase.

Tap gearcase cover with wood or rawhide mallet to loosen and remove gearcase cover (8) and gearcase cover gasket (9).

Remove idler gear spacer (10) and circuit breaker gear spacer (11). Make a mark on one of the spacers to insure its assembly to the same gear. The spacers look identical but one may be thicker than the other.

Remove breather valve spacing washer (12).

Remove cam gear (13), spacing washer (14), and thrust washer (15).

Remove breather gear (16), circuit breaker gear (17) and idler gear (18).

Remove pinion gear shaft nut (19) which has a left-hand thread. Use Gear Shaft Nut Socket Wrench, Part No. 94555-55. Pull pinion gear (20) using Pinion Gear Puller and Installer, Part No. 96830-51 as shown in Fig. 3D-5. Tool has lefthand threads.

Remove key (21). Slip off spring (22), gear shaft pinion spacer (23), oil pump pinion shaft gear (24) and key (25).

Slip breather screen (26) and separator (27) out of pocket in gearcase.

Remove oiler drive gear shaft spring ring (28), oiler drive gear (29) and oiler drive gear key (30).

If necessary, remove oil pump stud nuts and washers and remove oil pump from gearcase. See "Disassembling Oil Pump."

CLEANING AND INSPECTION (Fig. 3D-4)

Wash and air-dry all parts. Wash inside of case. If crankcase is to be disassembled, wash parts after complete disassembly. If it is not to be repaired, be careful to get no grease solvent into crankcase when washing gearcase.

Inspect oil screen (4) carefully to make sure mesh is open. Holding screen to light is not an absolute check. It is possible for oil screen to be plugged or partially plugged with tiny lint-like fibers and still permit light to pass. Replace plugged or partially plugged screen. Probe oil screen hole in gearcase with a length of wire formed to a short hook to determine if there are any additional oil screen seal gaskets (5) in hole. More than the prescribed number will block off oil feed channel when screening unit is assembled.

Inspect breather screen (26). It must be clean and unobstructed.

Inspect cam gear and pinion gear bushings (37 and 38) in gearcase cover for pitting, scuffing and grooving. Determine amount of pinion and cam shaft wear in cover bushings. If it exceeds maximum tolerance shown in "Engine Specifications," Section 3A, by .001 in., install new bushings.

Inspect circuit breaker and idler gear fit on respective shaft. Examine bushings (34, 35 and 36) and stud shaft for pitting, grooving or scuffing. If amount of wear exceeds maximum tolerance shown in "Engine Specifications" by .001 in., replace bushings and/or stud shafts (32 and 33).

Attach dial indicator to gearcase cover mounting screw hole and determine amount of pinion shaft play in right main roller bearing. When tolerance in "Engine Specifications" is exceeded by .001 in., bearings should be replaced.

Inspect needle bearing (31) for wear, broken or gouged bearings. If end of cam shaft shows any appreciable wear (.003 in. or more), needle bearing is probably worn to a point where replacement of bearing and cam shaft are advisable.

Needle bearing can be removed and installed in crankcase without disassembling crankcase with Puller Tool, Part No. 95760-69. Press needle roller bearing into crankcase with Tool, Part No. 97272-60, as shown in figure 3D-9. Press from heavier end having the manufacturer's name only. Pressing from opposite end will crush roller race and bind rollers. Push new bearing into crankcase from gearcase side. Pinion shaft main roller bearing may be replaced only when crankcase is disassembled (see "Disassembling Crankcase," Section 3E).

Figure 3D-5. Pulling Pinion Gear

Inspect gears for wear. Assemble pinion and cam gears to respective positions in gearcase. Mesh is considered ideal when no play between gears can be felt and cam gear can be moved back and forth along shaft axis without restriction. Omit cam gear end spacer in assembly for purposes of this check and attach cover with at least four cover screws.

REPLACING GEARCASE COVER BUSHINGS (Fig. 3D-6)

Remove pinion shaft cover bushing using Puller Tool, Part No. 95760-69 (Fig. 3D-6).

Install new pinion gear shaft bushing (38) in hole in cover as follows:

Position bushing in cover so oil hole in bushing is exactly in line with lubrication channel outlet in cover. Press in bushing on arbor press until top of bushing is flush with cast bushing boss on cover. Locate and center punch new dowel pin location 1/8 in. or more from original location. Drill No. 31 hole 3/16 in. deep. Press in bushing until it bottoms on shoulder in cover boss hole. Continue drilling dowel pin hole to depth of 9/32 in. from top of bushing. Drive in new dowel pin and carefully peen edges of hole to lock pin in place.

To replace cam shaft cover bushing, proceed as follows:

Use Puller Tool, Part No. 95760-69, to extract old bushing. Make a mark on outside of bushing boss to locate original dowel pin hole. Press in new bushing with arbor press until shoulder is against cover boss. Locate new dowel pin hole at least 1/8 in. from original hole, centerpunch and drill No. 31 hole exactly 9/32 in. deep. Drive in new dowel pin and peen bushing edges over dowel to secure it.

Drill lubrication oil hole through wall of bushing with 5/32 in. drill, using oil hole in bushing boss as a drill guide.

Pinion shaft and cam shaft bushings must be line reamed to remove burrs and irregularities from hole

Figure 3D-6. Removing Pinion Shaft Cover Bushing

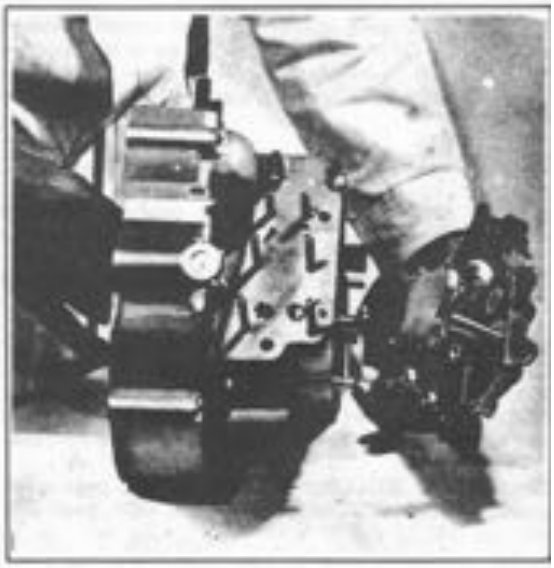


Figure 3D-7. Line Reaming Cover Bushing

and to insure perfect alignment. If crankcase is not disassembled, use any right crankcase side. Fasten cover in place with at least four screws.

To ream pinion shaft bushing, insert reamer pilot in right crankcase roller race. Insert 9/16 in. Pinion Shaft Cover Bushing Reamer, Part No. 94805-57, through pilot and push into cover bushing until it bottoms (see Fig. 3D-7), then give reamer one complete turn to size bushing. Rotate reamer the same direction (clockwise) during extraction.

To ream cam gear cover bushing, insert Cam Gear Shaft Bushing Reamer, Part No. 94802-36, through needle bearing in crankcase, into cover bushing. Turn reamer until it bottoms in gearcase cover.

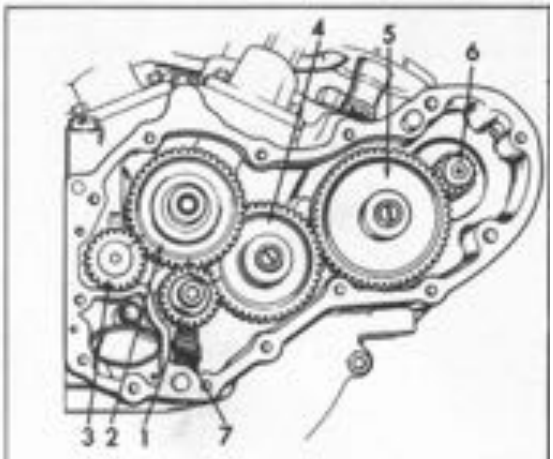
Bushings in circuit breaker and idler gears may be pressed out on an arbor press using a suitable drift pin, and new bushings pressed in.

ASSEMBLY

Before assembling gear train, determine amount of end play in breather gear as follows: Assemble breather gear and dry cover gasket to gearcase. Select spacer washer (use washer disassembled unless it is known to give incorrect spacing) and position on end of breather gear. Place a steel straightedge across gearcase at spacer. With thickness gauge, measure distance between straightedge and spacer. Subtract .006 in. (amount gasket will compress) from this figure to determine gear end play. An end play tolerance of .001 to .005 in. is correct. If end play exceeds maximum, insert thicker spacer. Breather valve and gear spacer washers are available .115, .120 and .125 in. thick.

Establish proper cam gear end play as follows: Install thrust washer, spacing washer and cam gear. Position cover gasket and secure cover with at least four screws. Measure cam shaft end play between cam gear and cover bushing with thickness gauge through tappet guide hole in gearcase. End play should be from .001 to .005 in. If measurement is under or over tolerance, remove cover and replace spacing washer with one to give suitable clearance. Cam gear spacing washers are available .050, .055, .060, .065 and .070 in. thick.

Make final gearcase assembly including all parts




1. Pinion gear
2. Cam gear
3. Breather gear
4. Circuit breaker gear
5. Idler gear (not marked)
6. Generator drive gear (not marked)
7. Oil pump drive gear (not marked); secured on end of pump drive shaft with key and spring ring

Figure 3D-8. Timing Gears with Timing Marks Aligned

in approximate reverse of disassembly order. Breather, cam, pinion and circuit breaker gears contain timing marks which must be aligned or matched as shown in Fig. 3D-8. Rotate gear train and note if it revolves freely. A bind indicates gear are meshed too tightly. Make sure circuit breaker and idler gear spacers are assembled to their respective shafts.

Apply a coat of non-hardening gasket sealer to crankcase and cover gasket surface. Position new cover gasket and secure cover with all cover screws. Pour about 1/4 pint of engine oil over gears to provide initial lubrication before securing cover.

Assemble remainder of gearcase, generator and circuit breaker in reverse of order removed.

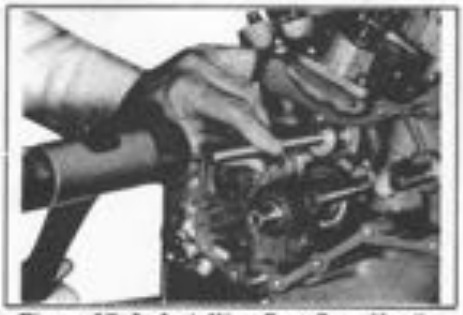


Figure 3D-9. Installing Cam Gear Needle Bearing in Crankcase

# CRANKCASE

GENERAL

When rod bearings, pinion shaft bearings or sprocket shaft bearings are in need of repair, the engine must be removed from the motorcycle as described in "Stripping Motorcycle for Engine Repair," Section 3A. It is recommended procedure to check and make repairs to cylinder heads, cylinders and gearcase at the same time, or in other words, perform an entire engine overhaul.

Flywheel End Play Check:

Before starting crankcase disassembly, check flywheel assembly end play to determine sprocket shaft bearing wear using a dial indicator. Assemble engine sprocket and nut or compensating sprocket to sprocket shaft before taking reading to assure accurate measurement. Attach indicator securely to crankcase with indicator stem resting on end of sprocket shaft. Measure total endplay by lifting flywheel assembly vertically using a screwdriver as a pry as shown in Figure 3E-17A. If play exceeds .006 maximum allowable endplay bearings must be replaced if found worn or damaged. If not worn, shimming can be used to take up endplay as described on page 3E-10.

Starting with the 1969 model season, the sprocket shaft bearing was changed as shown in Fig. 3E-3. The new bearing is locked in place with a combination lock ring-spacer which is located in a groove between the two bearing outer races. As with 1968 and earlier bearings, if any part of the bearing set requires replacement the entire bearing assembly, including bearings, races, lock ring and inner race spacer, must be replaced as a set.

DISASSEMBLING CRANKCASE

Remove cylinder heads as described in "Disassembling Cylinder Head," Section 3B.

Remove cylinders as described in "Disassembling Cylinder," Section 3C.

Remove gearcase parts as described in "Disassembling Gearcase," Section 3D. See "Crankcase," above for checking procedure before starting crankcase disassembly.

Refer to Fig. 3E-1 and proceed as follows:

Remove crankcase bolt (1), stud (2), crankcase breather stud assembly (3) or (3A), stud (4), top and right crankcase studs (5) and two lower crankcase studs (6). It is necessary to remove only one stud nut and slip stud and other nut out opposite side of crankcase.

Refer to Fig. 3E-2 and continue disassembly:

Position crankcase with gearcase (right side) up. Tap crankcase with rawhide or soft metal mallet to

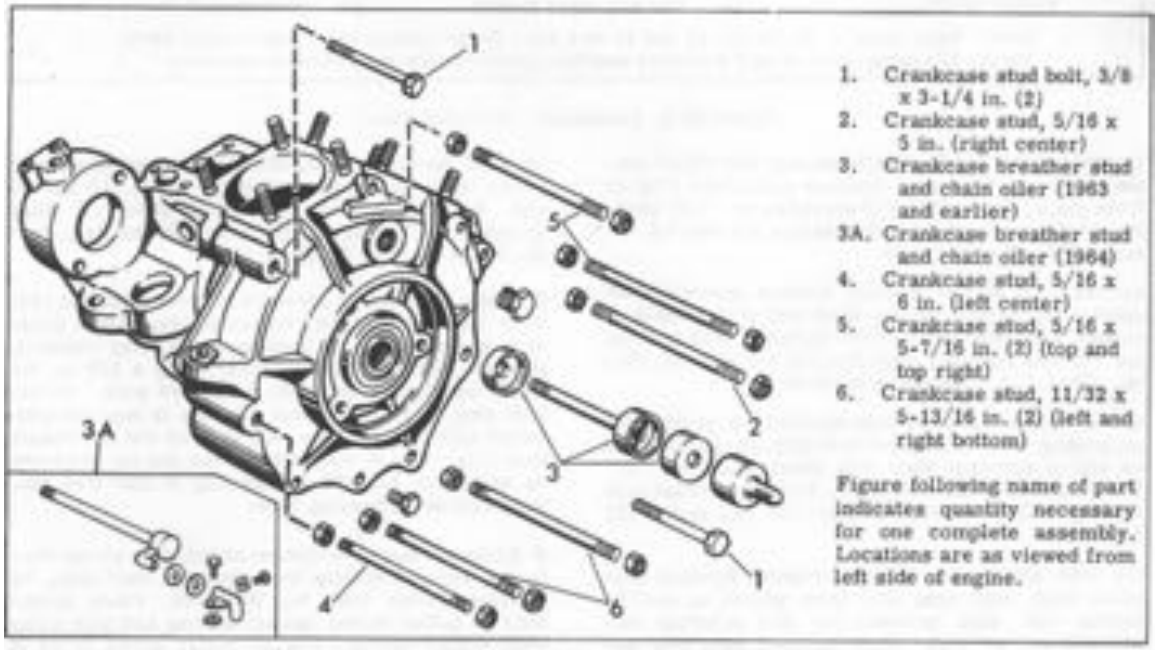
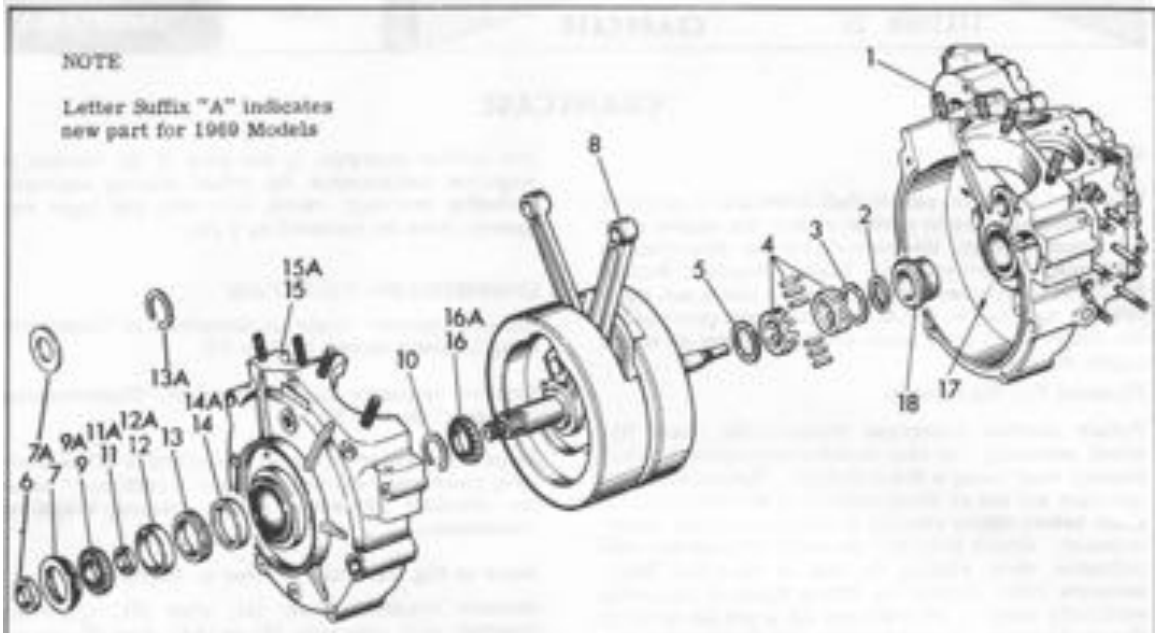



Figure 3E-1. Crankcase Studs - Exploded View




1. Right crankcase half
2. Spiral lock ring
3. Bearing washer (2)
4. Bearings and retainer
5. Bearing washer (see item 3)
6. Sprocket shaft spacer
7. Sprocket shaft bearing nut
7A. Sprocket shaft bearing seal washer (1969)
8. Flywheel and rod assembly
9. Sprocket bearing half
9A. Sprocket bearing half (1969)
10. Outer race snap ring (1968 & earlier)
11. Bearing inner spacer
11A. Bearing inner spacer (1969)
12. Bearing outer race
12A. Bearing outer race (1969)
13. Bearing outer spacer
13A. Outer race snap ring (1969)
14. Bearing outer race
14A. Bearing outer race (1969)
15. Left crankcase half
15A. Left crankcase half (1969)
16. Sprocket bearing half
16A. Sprocket bearing half (1969)
17. Pinion shaft bearing race lock screw (2)
18. Pinion shaft bearing race

Note: Keep parts 9, 11, 12, 13, 14 and 16 as a set. Do not transpose or interchange parts. Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3E-2. Crankcase - Exploded View

loosen top half. Lift right crankcase half (1) off pinion shaft main bearings. Remove spiral lock ring (2) from pinion shaft with tip of screwdriver. Lift bearing washers (3 and 5) with bearings and bearing retainers (4) off pinion shaft.

On 1968 and earlier models, remove sprocket shaft spacer (6) secure pinion shaft end of flywheels in copper vise jaws and turn out sprocket shaft bearing nut (7) with Sprocket Shaft Bearing Nut Wrench, Part No. 97235-55A. Thread is lefthand.

Mount flywheel and left case assembly on press table supporting case on parallel bars (Fig. 3E-4) and press on end of sprocket shaft with arbor press until flywheel assembly (8) drops out, freeing sprocket side bearing half (9 or 9A), washer (7A) and spacer (11 or 11A).

On 1968 and earlier models, remove flywheel side outer race snap ring (10) from groove in case by prying end with screwdriver and inserting thin screwdriver or knife blade between snap ring and case.

On 1968 and earlier models only, reposition case on press table and press out outer races (12 and 14) and bearing spacer (13) from case (15) using Sprocket Shaft Bearing Outer Race Press Plug, Part No. 97194-57 (Fig. 3E-5).

On 1969 models, tap out bearing races (12A and 14A) from opposite sides of crankcase hole, using a brass drift and hammer. If bearing set is being replaced, remove lock ring-spacer (13A) using a 1/8 in. pin punch or similar tool with a tapered point. Rotate lock ring in groove so that one edge is near oil hole. Insert tool into oil hole with tapered end underneath lock ring. Tap on tool to force one end out of groove as shown in Fig. 3E-6. Starting at this free end, push ring out of bearing bore.

If flywheels are to be disassembled, grip pinion shaft in vise and pull bearing from sprocket shaft using the Bearing Puller Part No. 96015-56. Place hooked ends of puller halves behind bearing and hold collar over puller halves. Engage puller screw cross in puller slots and pull bearing off by tightening puller

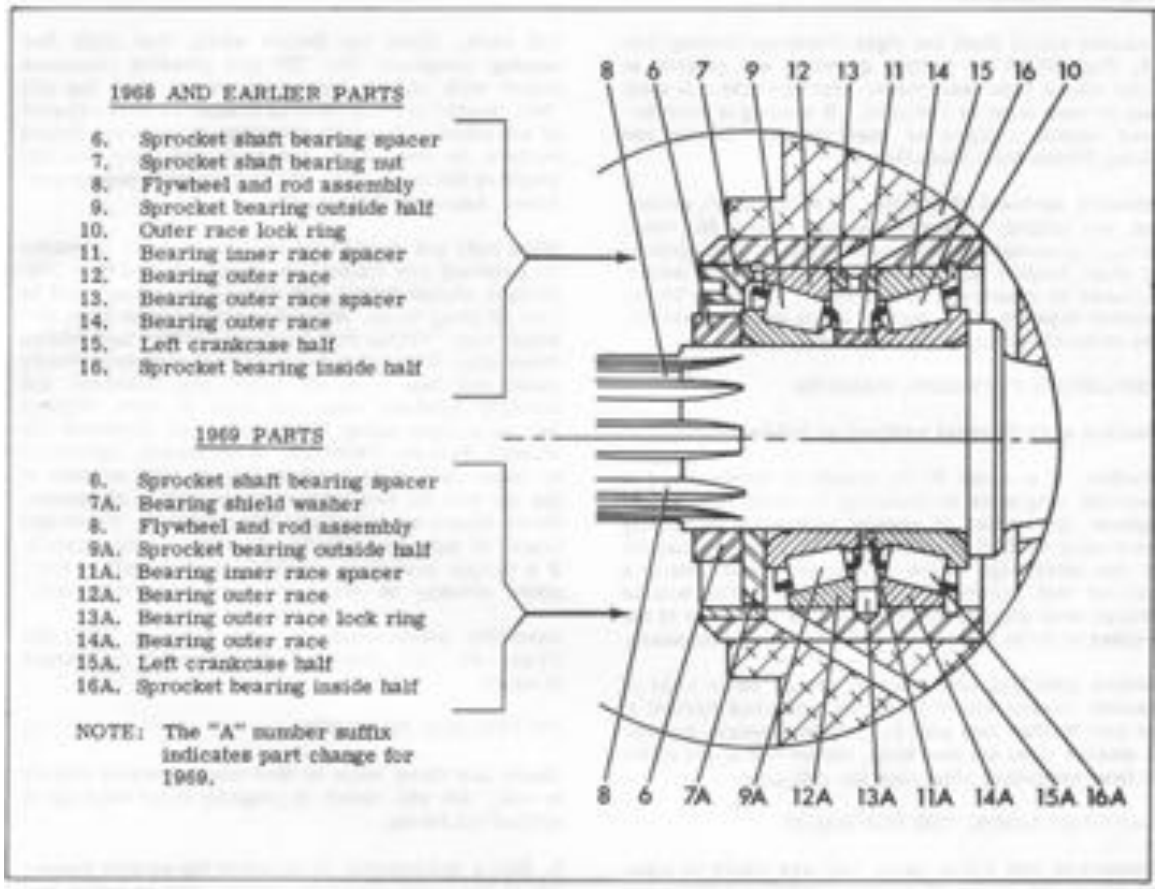



Figure 3E-3. Sprocket Shaft Bearing Assemblies - Section View

screw against sprocket shaft center as shown in Fig. 3E-7. Keep bearings in a set with proper bearing outer races.

DISASSEMBLING FLYWHEELS (Fig. 3E-8)

Grip pinion shaft in copper covered vise jaws so shafts are in vertical position. Insert a rod about 5 in. long and 1/2 in. in diameter through holes in flywheels to keep them from turning. Remove lock plate screw (1), lock plate (2) and crank pin nut (3). Strike left flywheel with soft metal mallet at about 90 degrees from crank pin hole on wheel periphery to loosen. Lift left flywheel (4) off crank pin.

Hold down bearing assembly with a short length of pipe or tubing so connecting rods (5) may be slipped off bearings. Remove bearings (6). Hold together in set until bearings are washed and refitted to crank pin.

Remove lock plate screw (7), lock plate (8) and gear shaft nut (9). Tap pinion shaft (11) out of flywheel (10). Remove key (12) from shaft.

Clamp crank pin in vise. Remove lock plate screw (13), lock plate (14) and crank pin lock nut (15). Tap crank pin (16) out of flywheel and remove key (17).

Grip sprocket shaft in vise and remove lock plate screw (18), lock plate (19) and sprocket shaft lock nut (20). Remove sprocket shaft (21) by tapping it out of flywheel, and remove key (22).

CLEANING AND INSPECTION

Wash all parts in grease solvent and blow dry with compressed air. Examine crank pin for wear, grooving and pitting. If the surface is at all worn, replace with new pin. Examine flywheel washers (23 and 24). If either washer is worn and grooved, it should be renewed.

Examine connecting rod lower races. If they appear slightly grooved or shouldered where edge of bearing rollers ride, they may be lapped out and oversize bearing rollers installed. If they appear badly worn, grooved or pitted, new rods should be installed, preferably as an assembly with new bearings and crankpin.

Examine pinion shaft and right crankcase bushing (see 18, Fig. 3E-2) for pitting, grooving and gouging at point where right main roller bearings ride. A shaft that is worn must be replaced. If bushing is worn beyond repair, replace as described in "Truing and Sizing Pinion Shaft Main Bearing."

Examine sprocket shaft outer races for wear, grooving, and pitting. Examine bearing rollers for wear, pitting, grooving and heat discoloration. The sprocket shaft Timken tapered roller bearings are manufactured in selectively fitted sets. The same serial number appears on all parts. If any part is unusable, the complete set must be replaced.

REPLACING FLYWHEEL WASHERS

Replace worn flywheel washers as follows:

Washer is a close fit in recess in flywheel and is secured originally by punching flywheel metal tight against the washer at several points. It is usually necessary to drill a small hole (1/8 in. or smaller) at the outer edge of the washer to permit getting a pointed tool underneath to pry it out. The hole is drilled only slightly deeper than the thickness of the washer to avoid removing more metal than necessary.

Before installing new washer, scrape outer edge of washer recess where metal was punched against it so new washer may seat fully against recess bottom. If washer does not seat fully, forked rod is not likely to have necessary clearance for side play.

LAPPING CONNECTING ROD RACES

Connecting rod lower races that are likely to clean up within the range of oversize bearing rollers and are otherwise in serviceable condition, should be trued and sized with Connecting Rod Lapping Arbor, Part No. 96740-36, as shown in Fig. 3E-9.

Turn lap in lathe at 150 to 200 rpm. Adjust lap by means of adjusting nut to a dragging but free fit in rod race. Clean lap before using, then apply fine lapping compound (No. 220 grit grinding compound mixed with oil) to lap. A loose or tight lap will "bell mouth" bearing race so it must be kept adjusted at all times. To avoid grooving or tapering lapped surface in rod, work rod back and forth the full length of the lap holding rod as near race end as possible. Lap rods individually.

When rods are lapped true and all traces of pit marks or grooving are cleaned up, wash rods and blow dry. Surface should have a soft velvety appearance and be free of shiny spots. Assemble crank pin on right flywheel (see "Fitting Rod Bearings" before assembling flywheels). Wipe pin taper and flywheel taper perfectly clean and free from oil. Insert key in keyway and position flywheel over pin held in vise. Tighten nut very tight using Crank Pin and Flywheel Nut Wrench Part No. 94545-26. If necessary, tighten nut to make lock plate notches line up with corners of the nut with the lock washer screw hole in alignment. Never loosen nut to achieve this register. Never use length of pipe over handle of crank pin nut wrench. If a torque wrench is available tighten nuts to foot-pound reading as given in "Engine Specifications."

Assemble pinion shaft to right flywheel, with the Crank Pin and Flywheel Nut Wrench or Torque Wrench.

FITTING ROD BEARINGS

There are three ways to determine oversize rollers to use. All will result in properly fitted bearings if applied correctly.

1. Use a micrometer to measure the outside diameter of the crank pin at its center. Use an inside micrometer or telescoping hole gauge to measure the inside diameter of the rod races. Subtract the diameter of the crank pin from the inside diameter of the bearing race. Subtract from this figure the standard allowance for bearing running fit size. This answer, divided by two will give proper roller size. To find

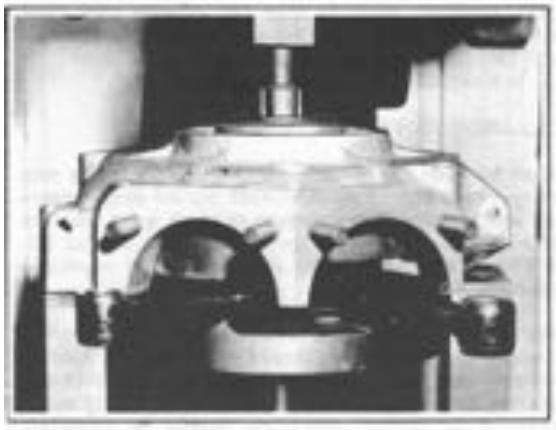


Figure 3E-4. Pressing Flywheels Out of Crankcase

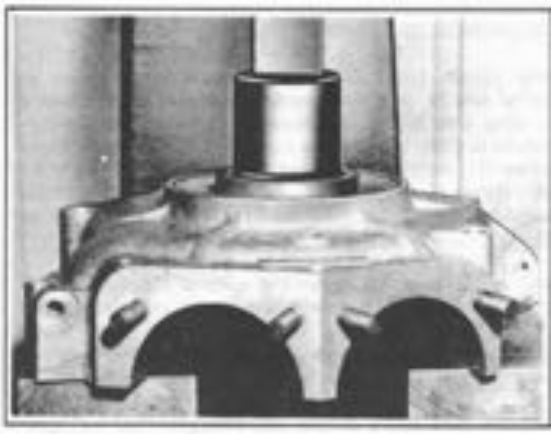


Figure 3E-5. Pressing Bearing Races Out of Crankcase - 1968 and Earlier Only

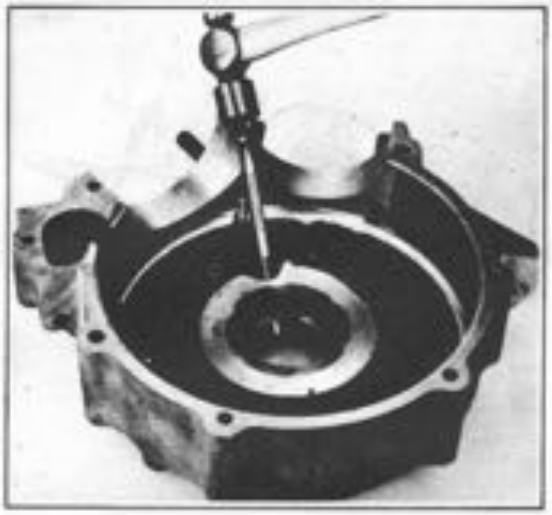


Figure 3E-6. Removing Lock Ring - 1969 Model

oversize amount of bearing, subtract from this figure the diameter of a standard roller.

Example:

The rod bearing race measures 1.6263 in. after lapping and truing. The crank pin is slightly worn and measures 1.2485 in. Subtract 1.2485 in. from 1.6263 in. The answer, .3778 in., represents the diameters of both rollers (one on each side) plus clearance for running fit. Subtract minimum clearance for running fit (.001 in.). The answer (.3768 in.) is then divided by two to get the diameter of each oversize roller. In this case it would be .1884 in. To find how much oversize each roller must be, subtract from this figure the diameter of a standard roller, or .1875 in. Rollers must be .0009 in. oversize.

2. Install any new set of oversize rollers to bearing races and position on crank pin. Slip rods over bearings. If they will not fit, it is obvious rollers are too large and a smaller size must be tried. If they fit and spin freely, install a larger set of rollers. Try various roller sizes until the rods will turn with a very slight drag. This is a plug fit. Determining running fit is merely a matter of subtracting one half the desired running fit clearance (.0005 in.) from the roller size to find the running fit roller size.

It may be easier to gauge a plug fit as follows:

3. Fit any size rollers into races. Position bearings in rods. Support rods and bearings with left hand. Drop crank pin (not attached to flywheel) through crank pin hole. Plug fit has been achieved when crank pin will slide slowly through hole from its own weight. Running fit is then determined by subtracting

Figure 3E-7. Pulling Bearing from Sprocket Shaft

one half running clearance from oversize of rollers used to make plug fit.

Example:

Plug fit is achieved with .0009 in. oversize rollers. By subtracting from this one half the minimum clearance (.0005 in.) it is determined that a .0004 in. oversize roller set will give desired running fit.

If lower end race of one rod is found to be slightly larger than the other, select rollers to fit the larger rod race and lap smaller rod race to same size as larger race rather than fitting rollers of two sizes.

When rods are correctly fitted with required bearing clearance, extreme upper end of female (forked) rod will have just barely noticeable side shake while the upper end of the male rod will have .025 in. to 1/32 in. (.031 in.) side shake. All fitting and checking must be made with bearings, rods and crank pin clean and free of oil.

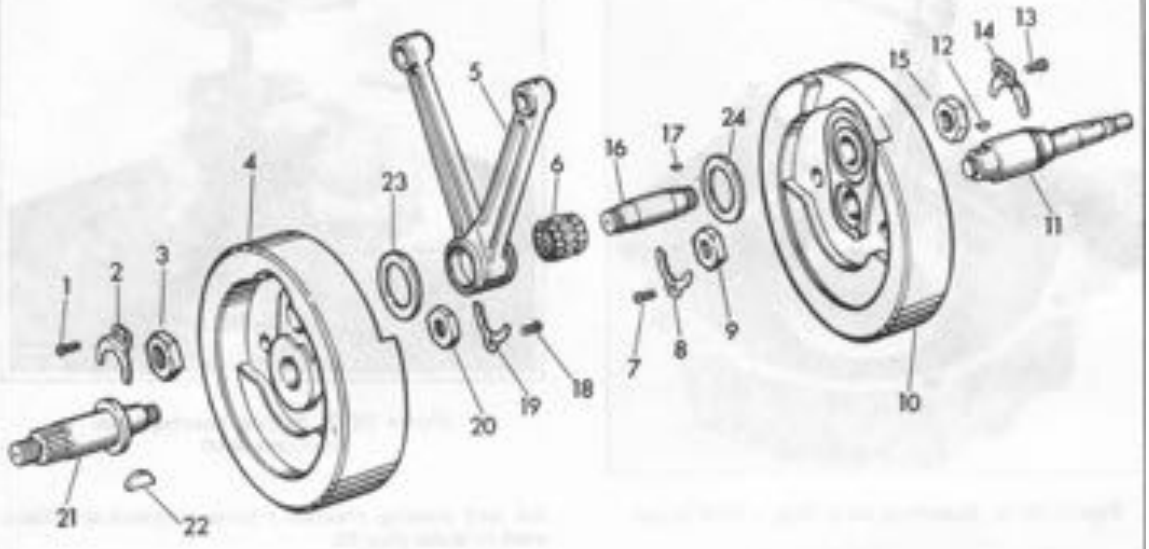
Fitting bearings tighter than described may result in seizing and bearing damage when heat expands parts.

Check overall width of roller retainer assembly. It must be less than width of female rod end.

## ASSEMBLING FLYWHEELS

After correct connecting rod bearing fit has been attained, clean and assemble parts as follows: Install sprocket shaft to left flywheel and pinion shaft and crank pin to right flywheel. Check to make sure oil passages through pinion shaft, right flywheel and crank pin are clear by blowing compressed air into hole near end of pinion shaft.

Position right flywheel assembly in vise, crank pin up. Wipe crank pin taper clean. Slip bearings and connecting rods over crank pin with forked rod to




1. Lock plate screw (4)
2. Lock plate (2)
3. Crank pin nut (2)
4. Left flywheel
5. Connecting rods (one forked, one single end)
6. Bearing rollers and retainers
7. Lock plate screw (see item 1)
8. Lock plate (2)
9. Gear shaft nut (2)
10. Right flywheel
11. Pinion shaft
12. Pinion shaft key
13. Lock plate screw (see item 1)
14. Lock plate (see item 2)
15. Crank pin lock nut (see item 3)
16. Crank pin
17. Crank pin key
18. Lock plate screw (see item 1)
19. Lock plate (see item 8)
20. Sprocket shaft nut (see item 9)
21. Sprocket shaft
22. Sprocket shaft key
23. Flywheel washer (2)
24. Flywheel washer (see item 23)

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 3E-8. Flywheel Assembly - Exploded View

rear cylinder. Wipe crank pin hole in left flywheel clean and dry. Install left flywheel and tighten nut lightly. Hold steel straightedge along outer face of wheel rims at 90 degrees from crank pin as shown in Fig. 3E-10. Tap outer rim of top wheel until wheels are concentric. Tighten nut. Recheck with straightedge at frequent intervals. Use soft metal hammer to realign wheels. To prevent flywheel assembly from turning in vise while tightening nut, insert a rod 5 in. long and about 1/2 in. in diameter through holes in flywheels and between vise jaws so that rod bears against some part of the vise.

When nut is fairly tight, install flywheel assembly in Flywheel Truing Device, Part No. 96650-30. Adjust so centers are snug. Wheels must turn freely but shafts may not be loose in centers. If flywheel assembly is either loose or squeezed, indicators will not indicate accurately. Adjust indicators to take reading as near to flywheels as possible, so pointers read at about the middle of the scales.

Turn flywheels slowly and observe the movement of indicator pointers. Movement toward flywheels indicate high points of shafts. Find highest point of

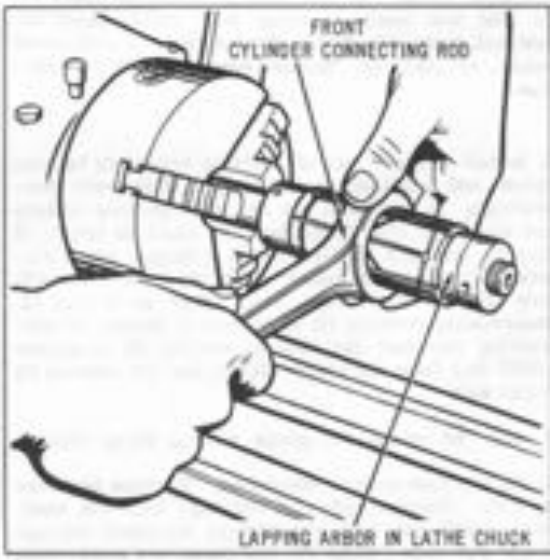



Figure 3E-9. Lapping Connecting Rod Bearing Race

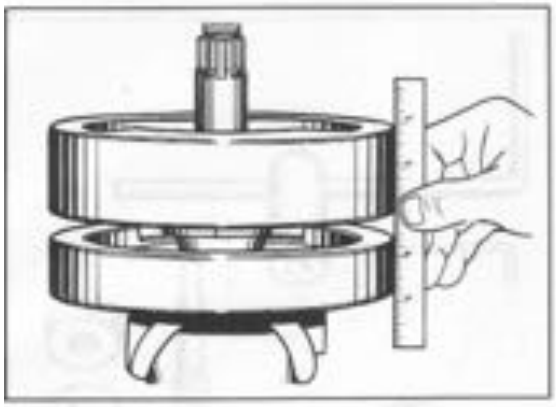


Figure 3E-10. Squaring Flywheel Faces

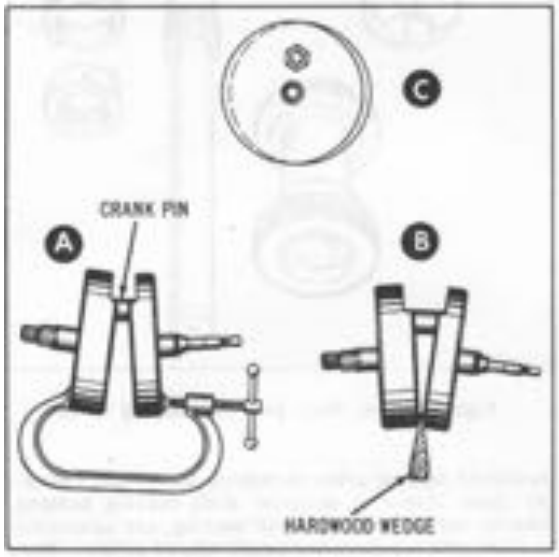



Figure 3E-11. Correcting Flywheel Alignment

each shaft and chalk-mark flywheel rims at those points. Loosen centers slightly, just enough so looseness may be detected, and make corrections as follows:

Flywheels may be out of true three ways, A, B and C, Fig. 3E-11 or a combination of two of the three ways.

When wheels are both out of true as indicated in "A," tighten a C-clamp on rims of wheels opposite crank pin and lightly tap the rim at the crank pin with lead or copper mallet.

When wheels are both out of true as indicated in "B", drive a hardwood wedge between the wheels opposite the crank pin and lightly tap the rims near the crank pins with a mallet.

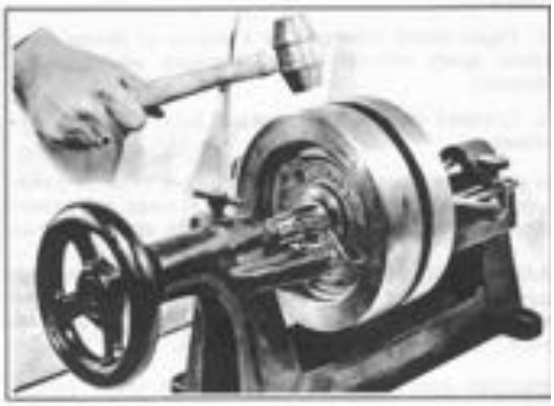


Figure 3E-12. Truing Flywheels on Truing Stand

When wheels are out of true as indicated in "C," strike the rim of the wheel a firm blow at about 90 degrees from crank pin on high side (see Fig. 3E-12).

When wheels are out of true in a combination of any of conditions shown, correct A or B first, tapping rim of offending wheel only, and then correct condition C.

The number of blows required and how hard they should be struck depends on how far shafts are out of true and how tight nuts are drawn. Remember that centers must be loosened slightly before striking flywheels. Making them too loose may result in damaged centers. Never strike wheels a hard blow near crank pin. This could result in a broken crank pin.

Readjust centers, revolve wheels and take reading from indicator. Repeat truing operation until indicated run out does not exceed .001 in. (each graduation on indicator is .002 in.).

If it is impossible to true wheels, check for a cracked flywheel, damaged or enlarged tapered hole, or a sprocket or pinion shaft worn out of round at surface where indicator reading is being taken. When wheels are true, position in vise and draw crank pin nuts very tight using Crank Pin and Flywheel Nut Wrench, Part No. 94545-26, or use torque wrench and tighten to foot-pound reading given in "Engine Specifications." Check connecting rod side play with thickness gauge as shown in Fig. 3E-13. If it is greater than tolerance shown in "Engine Specifications," Section 3A, draw up crank pin nuts until within tolerance. Insufficient play between rods and flywheel face is caused by one of the following conditions:

1. Flywheels and crank pin assembled with oil on tapers and nuts over-tightened. Disassemble, clean, reassemble.

2. New flywheel washers installed and not fully seated. Disassemble, inspect, replace deepest seating flywheel or exchange crank pin. As last resort, grind down width of forked rod.

3. Taper holes enlarged as a result of having been taken apart several times. Replace wheel seating deepest.

4. Cracked flywheel at tapered hole. Replace flywheel.

If sides of forked rod are ground to get desired clearance, backs of bearing retainers must be ground down to remain narrower than width of female rod.

After rod sideplay is checked and adjusted, crank pin nut pulled very tight and lock plate and screw installed, again recheck wheel trueness on truing device. Correct any run-out as above.

TRUING AND SIZING PINION SHAFT MAIN BEARING

Before fitting new pinion shaft main bearings, lap bearing race in crankcase to true it and remove traces of wear shoulder at sides of roller paths. Using Crankcase Main Bearing Lap, Part No. 96710-40, consisting of lapping shaft, handle, lapping arbor and guide sleeve (Fig. 3F-14).

A race that is worn beyond limits of oversize bearings must be replaced. To remove worn bearing race, remove two bearing race lock screws (17, Fig. 3E-2) from inside of case. Heat case to 275 - 300 degrees F. Heating expands case and makes it possible to remove bearing race using less force. Press worn race (18, Fig. 3E-2) out and new race in. New race must be lapped slightly to true and align with left case bearing, and to attain a size compatible with roller sizes available.

LAPPING ENGINE MAIN BEARINGS (Fig. 3E-15). Secure right and left crankcase halves with three crankcase stud bolts (top center and bottom left and right). The sprocket shaft bearing outer races and large spacer must be installed in left crankcase.

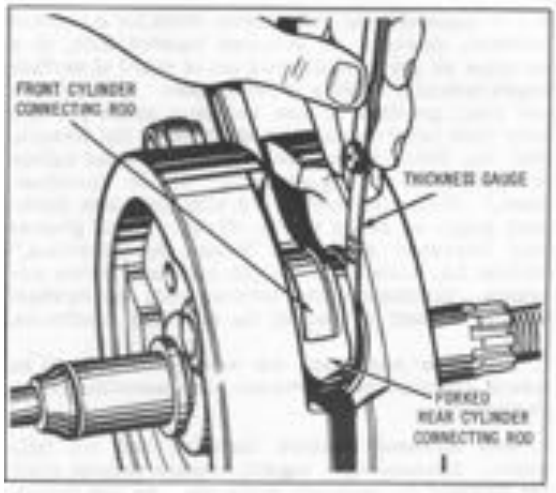



Figure 3E-13. Checking Connecting Rod Sideplay

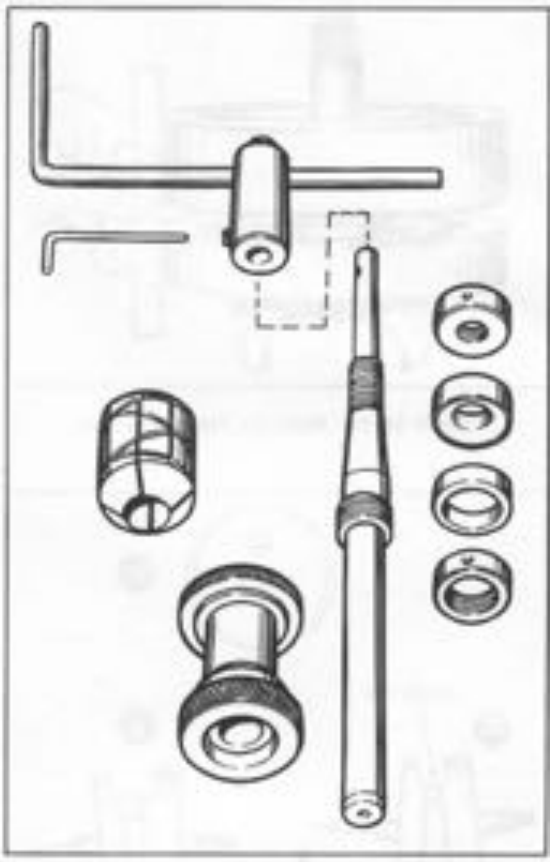


Figure 3E-14. Main Bearing Lapping Tools

Assemble lapping arbor to lapping handle and assemble guide sleeve to sprocket shaft bearing bushing. Sleeves for use with tapered bearing, are assembled to case with bearings and small spacer collar. Turn sleeve parts finger tight.

Insert lap shaft with arbor assembled through pinion bearing bushing and into guide sleeve. Tighten arbor expansion collars using a length of 5/32 in. rod as spanner until arbor begins to drag. Do not adjust arbor snug in bushing or bushing will "bell," a condition where hole is larger at ends than it is in the center.

Withdraw arbor far enough to coat lightly with fine lapping compound. Do not apply a heavy coat. Reposition lap in bushing and turn handle at moderate hand speed. Work lap back and forth in bushing as it is revolved to avoid grooving and tapering.

At frequent intervals, remove lap from crankcase, wash and inspect bushing. Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance. If necessary, flush off lap in cleaning solvent, air dry and apply fresh, light coat of fine lapping compound.

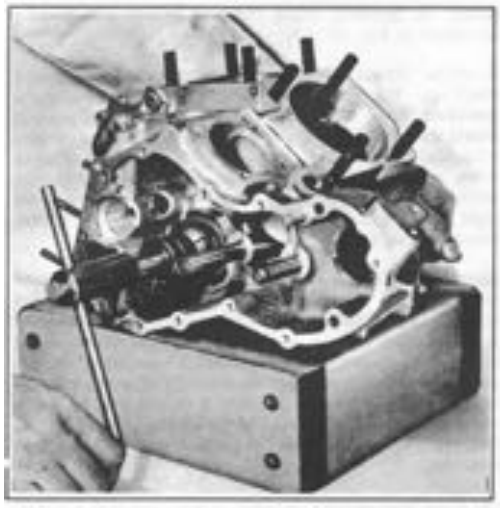


Figure 3E-15. Lapping Pinion Shaft Main Bearing Race

FITTING PINION SHAFT BEARING

The fitting of pinion shaft bearing is done in much the same way as fitting lower rod bearings (see "Fitting Rod Bearings"). A plug fit is first determined using the pinion shaft that will be used on engine being overhauled, or spare shaft of exactly same size. When a plug fit has been found, pinion shaft will enter bearing slowly under its own weight, will turn with only a very light drag and will have no perceptible shake.

A running fit is determined from a plug fit by subtracting one half the desired running fit clearance from the size of the plug fit rollers.

Example:

Running fit clearance is .0005 to .001 in. loose. See "Engine Specifications," Section 3A. If a plug fit was achieved with .0006 in. oversize rollers, subtract one half running fit clearance from plug fit roller oversize. Use figure representing middle or average of tolerance span, .00075 or .0008 in. One half the average of tolerance (.0004 in.), subtracted from roller oversize (.0006 in.), indicates that .0002 in. oversize rollers should be used to produce a suitable running fit.

Oversize rollers are available in .0002, .0004, .0006, .0008 and .001 in. sizes. All calculations should therefore be made to nearest available even-numbered size. In the example above, it would be possible to arbitrarily decide upon .0006 in. as a running fit rather than the .0008 in. if desired. Final decision would rest largely upon intended use of motorcycle. For highspeed work, the more free fit would be better, while the closer tolerance is suited to road use at average speeds. This consideration may be made in fitting all tolerances.

All fitting must be done with bearings that are clean and dry. Oiled surfaces will take up some clearance and give a false reading.

FITTING SPROCKET BEARING

If Timken tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. Make certain all parts of bearing are installed in exactly the same order they were removed. If any part of bearing assembly is worn, entire assembly should be replaced.

ASSEMBLING CRANKCASE (Fig. 3E-2)

Install flywheel side outer race snap ring (10 or 13A) in case. Using arbor press and Outer Race Press Plug, Part No. 97194-57 to press outer race parts into crankcase bushing one at a time as shown in Fig. 3E-3. Press the races into the case with widest ends outward to match taper of bearings. Be sure the first race bottoms on the snap ring and each successive part tight against the one before.

Install bearing and spacer on sprocket shaft using Bearing Installing Tool, Part No. 97225-55. Press the parts on using sprocket shaft spacer (11) as a pressing spacer only. Turn tool screw onto sprocket shaft thread and tighten securely. Remove

Figure 3E-16. Pressing Bearing on Sprocket Shaft

Figure 3E-17. Pressing Flywheel into Crankcase

tool handle and slip the bearing small end up over sprocket shaft, starting it squarely. Install the small bearing spacer and the sprocket shaft spacer. Place tool sleeve on spacers and press bearing against

Figure 3E-17A. Checking Flywheel End Play

flange on flywheel using the tool driver and handle as shown in Fig. 3E-16.

Position flywheel assembly in vise with sprocket shaft up. Slip crankcase half, with outer race parts installed, over shaft. Slip bearing over tool screw, small end down toward bearing inner spacer. Position tool sleeve and turn on driver. Turn driver down against sleeve pressing bearings tightly together as shown in Fig. 3E-17. Bearings must be tight against the bearing spacer to provide correct bearing clearance.

Before proceeding with further assembly, check to see that the bearing is not preloaded by shaking crankcase half and feeling for a slight amount of play of crankcase half on bearing. Note: If there is no noticeable shake, or if flywheel assembly does not rotate freely in bearing, disassemble bearing and add a .003 shim, Part No. 23741-55, on one side of inner race spacer (11 or 11A, Figure 3E-3). Again install bearing with tool and recheck for slight play in bearing.

On 1968 and earlier models, install bearing lock nut (7) in crankcase using Sprocket Shaft Bearing Nut Wrench, Part No. 97235-55A. Nut should be started by hand. Thread is left hand. Final tightening may be left until case is assembled.

Remove assembly from vise and install bearing washer (5), bearings (4) and bearing washer (3) to pinion shaft. Install new spiral lock ring (2) to groove in pinion shaft. Slip right case half over bearing and against left case half after applying a coat of non-hardening gasket sealer to parting surfaces.

See Fig. 3E-1. Align case halves and tap crankcase stud bolts (6 and 5) into holes. These two studs properly align the case halves and must be installed before remaining studs. Start nuts and tighten until snug. Insert remaining studs and bolt and tighten all nuts securely.

Check exact amount of flywheel endplay with a dial indicator as directed at the beginning of this Section to determine if within specified limits. See Figure 3E-17A.

Tighten 1968 and earlier sprocket shaft bearing nut. Install sprocket spacer (6 or seal washer 7A and spacer, Fig. 3E-2) and sprocket or sprocket shaft extension. Start sprocket nut and tighten securely.

NOTE

Sprocket must be aligned with rear sprocket through use of correct thickness sprocket spacers. Method for checking and determining correct spacer thickness is given in Section 2B of this manual.

# FUEL SYSTEM

## MODEL HD CARBURETOR

DESCRIPTION (See Fig. 3F-1)

The Model HD carburetor is a dual-venturi, diaphragm-type carburetor with an automatic economizer and accelerating pump.

The fuel inlet needle is operated through a compression-spring balanced lever that is controlled by the diaphragm to regulate the flow of fuel into the metering chamber. The amount of fuel going into the carburetor metering chamber is exactly equal to the amount of fuel being used by the engine.

This type of fuel supply control operates at any tilt angle and is resistant to any vibration which could cause a poor fuel-air mixture or flooding.

The small primary venturi is offset to the bottom of the large secondary venturi where the main nozzle outlet protrudes from the metering chamber. The accelerating pump discharges into the small venturi to take advantage of the venturi pressure drop that breaks up the solid stream of accelerating-pump fuel.

The accelerating unit is a positive-acting plunger type pump that is connected to the throttle shaft through a cam lever. The pump plunger is a spring-loaded leather cup that operates in a smooth plastic cylinder, and draws its fuel directly from the metering chamber to provide extra fuel for accelerating.

The automatic economizer is a hydraulically-operated enrichment valve that controls the main-nozzle fuel mixture at very low engine speeds. The valve opens an auxiliary fixed main jet as the venturi air flow decreases, allowing the fuel mixture to be maintained at a full-power richness. As the air flow through the carburetor increases, or as the engine speed increases, the valve closes to prevent an over-rich mixture at intermediate speeds.

## OPERATION

STARTING OPERATION (Fig. 3F-2)

Choke is in the closed position and the throttle is a slightly open position. As the engine is cranked, the entire metering system--idle, intermediate, and nozzle--is subjected to engine suction which is transmitted to the fuel chamber via the metering

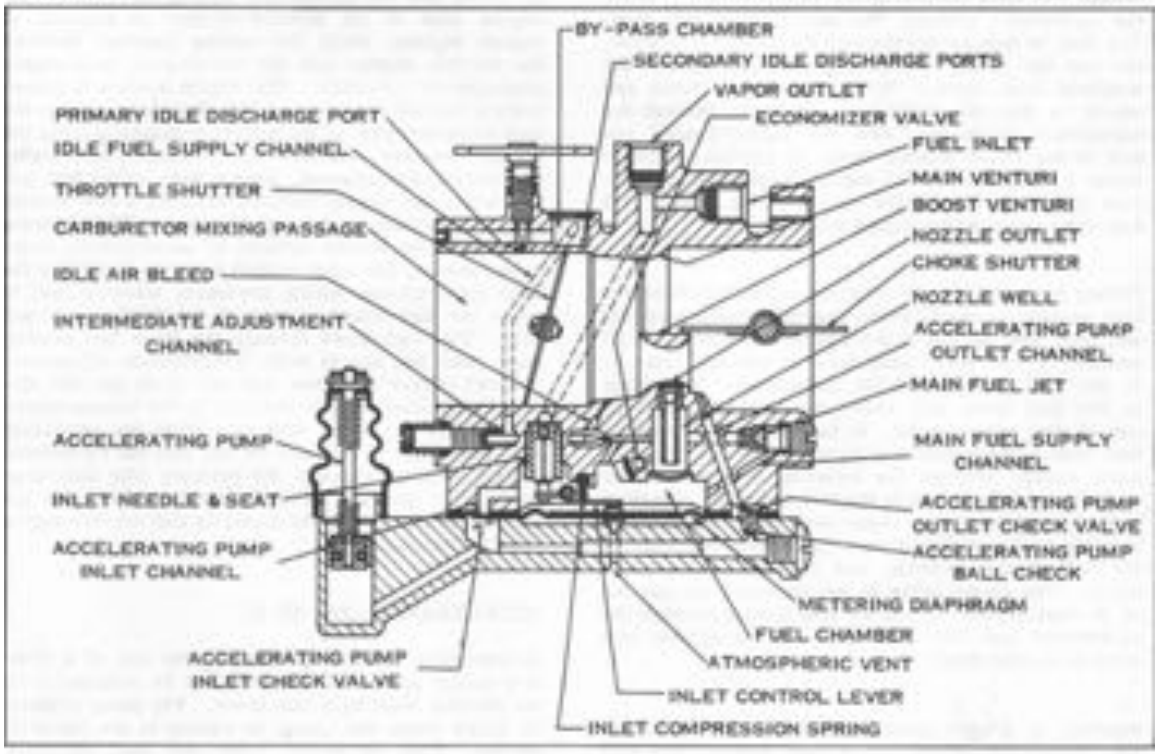



Figure 3F-1. Carburetor Cross Section - Model HD

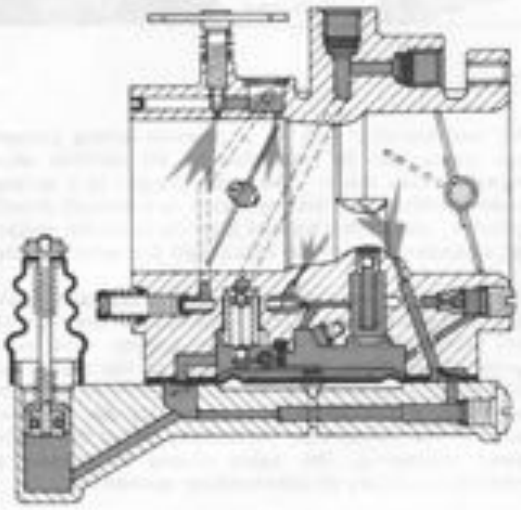


Figure 3F-2. Starting

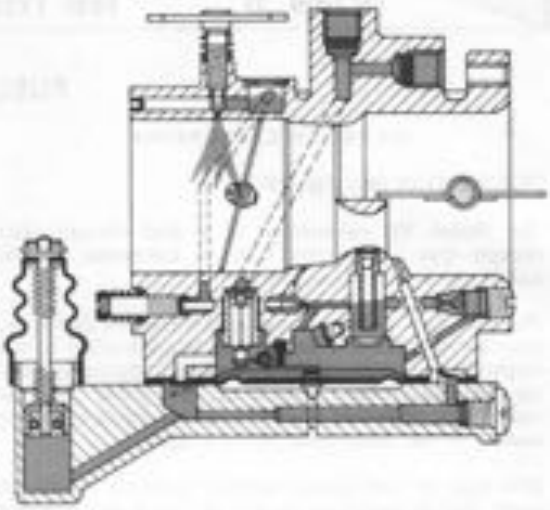


Figure 3F-3. Idle

channels, creating a low pressure on the fuel side of the metering diaphragm. Atmospheric pressure from the atmospheric vent moves the metering diaphragm toward the inlet control lever to allow fuel to enter the carburetor through the inlet needle and seat. The fuel is then forced through the metering system, out into the carburetor mixing passage, and into the manifold and engine. When the engine fires and starts to run, the volume of air drawn through the carburetor increases, and the spring-loaded top half of the choke shutter opens to provide the additional air required by the engine, to prevent an over-rich mixture. The choke can then be moved to a half-open position for engine warm-up.

During hot weather, or after an engine has been run long enough to reach stable operating temperatures, and then shut off for a short period of time, a small amount of fuel vapor may form in the fuel lines or in the fuel chamber of the carburetor. The vapor in the fuel lines will enter the fuel inlet and rise out of the vapor outlet, to be vented back into the fuel tank. The vapor that forms in the fuel chamber must escape through the metering system because there is no other vent to the fuel chamber. Starting a warm engine where vapor may be in the system, is most easily accomplished by placing the choke in the half-closed position, and starting as described above. The choke helps to get the vapor quickly out of the fuel system so that the fuel flowing through the carburetor and fuel line can cool the system to a normal temperature.

Starting is always more easily accomplished using the choke--full choke for a cold engine, and half choke for a warm engine.

IDLE OPERATION (Fig. 3F-3)

The throttle shutter is slightly open when the engine is idling and the carburetor mixing passage on the engine side of the throttle shutter is exposed to engine suction, while the mixing passage between the throttle shutter and the air cleaner is at nearly atmospheric pressure. The engine suction is transmitted through the primary idle discharge port to the fuel chamber side of the metering diaphragm via the bypass chamber, idle fuel supply channel, intermediate adjustment channel, nozzle well, main fuel jet, and main fuel supply channel, creating a sub-atmospheric pressure, in the fuel chamber. The metering diaphragm is forced upward by atmospheric pressure, moving the inlet control lever to overcome the inlet compression spring pressure, allowing fuel to enter the fuel chamber through the inlet needle and seat. The fuel flows through the main fuel supply, main fuel jet, nozzle well, intermediate adjustment channel (where it mixes with air from the idle air-bleed) idle fuel supply channel, to the bypass chamber, where it mixes with air from the secondary idle discharge ports, and on out into the carburetor mixing passage through the primary idle discharge port. The mixture of well-atomized fuel and air then travels through the manifold and into the engine combustion chamber.

ACCELERATION (Fig. 3F-4)

Acceleration is accomplished by the use of a positive-action accelerating pump that is actuated from the throttle shaft by a cam lever. The pump cylinder is filled when the pump is raised to the top of its stroke. Fuel is drawn from the fuel chamber, through the accelerating pump inlet channel, past

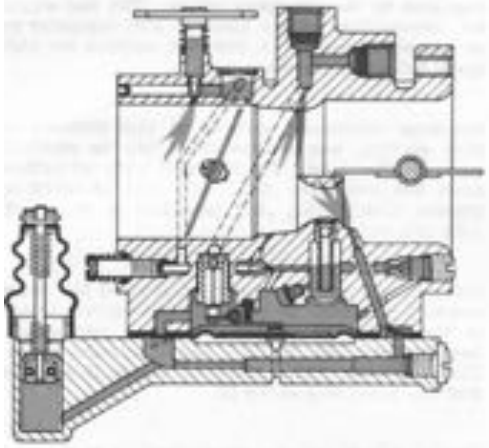


Figure 3F-4. Accelerating

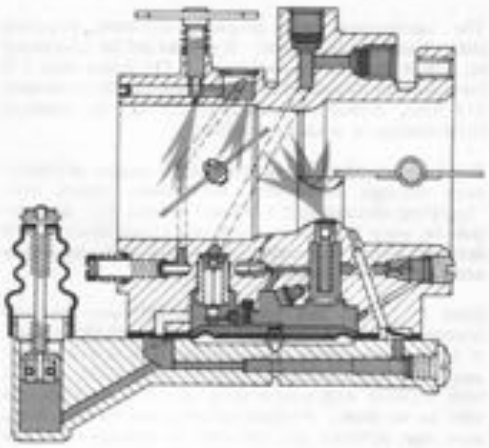


Figure 3F-5. Intermediate Speed

the inlet check valve. The outlet check valve is closed to prevent air from being drawn into the accelerating pump system. As the accelerating pump is depressed, the pressure of the fuel closes the inlet check valve, the fuel flows through the pump channels, past the outlet check valve, through the accelerating pump outlet channel, and through the boost venturi into carburetor mixing passage.

INTERMEDIATE OR CRUISE OPERATION (Fig. 3F-5)

Fuel is delivered into the carburetor as described in idle operation, and the same fuel channels are in use. As the throttle shutter opens to increase engine speed, the secondary idle discharge ports are exposed to engine suction, and fuel is delivered from both the primary and secondary idle discharge ports to supply the additional fuel demanded by the engine. As the throttle shutter is opened farther, the air velocity through the boost venturi increases, creating a low pressure area at the nozzle outlet. Fuel flows from the fuel chamber through the nozzle outlet via the nozzle well, main fuel jet, main fuel supply channel, and economizer valve when the pressure at the nozzle outlet is less than the pressure in the fuel chamber. At the idle and lower intermediate speeds, the check ball in the economizer valve is away from the valve seat, allowing free flow from the fuel chamber through the economizer valve to the nozzle well and nozzle outlet. Fuel flow from the primary and secondary idle ports decreases as fuel flow from the nozzle outlet increases.

HIGH-SPEED OPERATION (Fig. 3F-6)

Fuel flow from the nozzle outlet increases as the shutter is opened past the intermediate position to

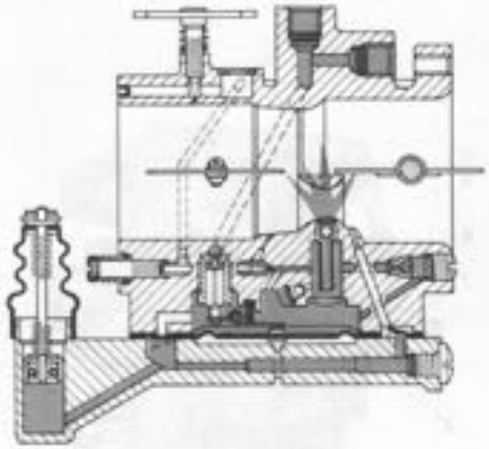


Figure 3F-6. High Speed

the fully-open position. The fuel is delivered through the nozzle outlet from the fuel chamber via the main fuel supply channel and the main fuel jet. The increased pressure difference between the small venturi and the metering chamber, plus the force of fuel flowing through the economizer valve, causes the check ball to seat, stopping the flow of fuel from this part of the main metering system. This gives increased economy at high speeds. The diaphragm action and the method of fuel delivery to the fuel chamber is the same as previously described.

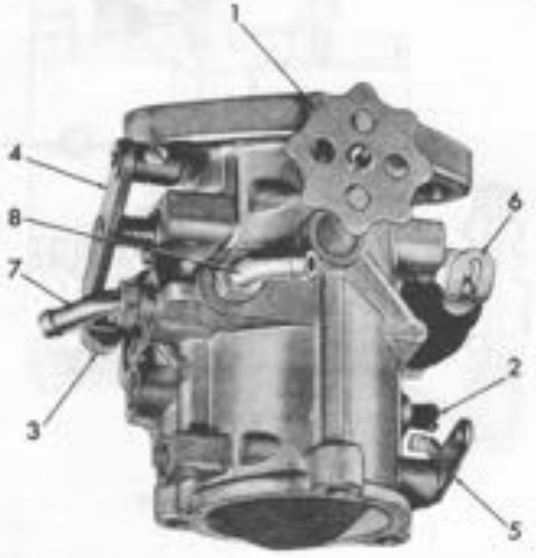
ADJUSTING CARBURETOR (See Fig. 3F-7)

The carburetor, once properly adjusted, requires little if any readjustment. It should not be necessary to adjust the low speed needle (1) more than 1/8 turn and the intermediate speed needle (2) more than 1/4 turn, richer or leaner, to correct the mixture for a change in weather conditions.

Before attempting to correct faulty engine performance through carburetor adjustment, check over "Locating Operating Troubles," Section 1C. In addition be sure air cleaner element is not blocked with dirt and check manifold connections to be sure they are tight and not leaking air.

Inlet fitting (7) and vent fitting (8) have strainer screens located in threaded holes in carburetor body. If faulty carburetion indicates fuel flow is restricted, remove elbow fittings (7 and 8) from body, extract both screens with a bent wire, and blow out passages with an air hose. Replace screens and elbows, being sure that screens are not bent or damaged so as to allow dirt to pass through.

Check to see that carburetor vent line hose leading from fitting (8) to gas tank is not blocked off. Also see that gas tank cap vent is not clogged. Either condition will restrict fuel flow.




1. Low speed needle
2. Intermediate speed needle
3. Throttle stop screw
4. Throttle lever
5. Choke lever
6. Accelerating pump
7. Inlet fitting
8. Vent fitting

Figure 3F-7. Model HD Carburetor Adjustments

The fuel supply for low engine speed is completely regulated by the low speed needle. The fuel supply for intermediate engine speed is also regulated by an adjustable needle. A fixed jet supplies the high speed fuel requirements.

Operating conditions, such as at high altitudes or hard service, may require other than the standard main fuel fixed jet. The following main jet orifice sizes are available: .049, .051, .053 (standard on Electra Glide), .055, .057 (standard on Sporster), .059, .061 and .063.

Both the intermediate speed needle and low speed needle turn inward (to right) to make mixture leaner at the respective speeds for which they adjust. Backing them out (to left) makes mixture richer. Closed throttle idling speed of engine is adjusted with idle speed stop screw (3).

Correct adjustment can be determined in the shop and verified by road test according to the following procedure.

1. Make sure carburetor control wire is adjusted so throttle lever (4) fully closes and opens with handlebar grip movement.

2. Turn both the low speed needle (1) and the intermediate speed needle (2) all the way in (to right). Do not close off either needle too tightly or damage to needle and seat may result.

3. Back up (to left) both needles about 7/8 turn. With needles in this position, engine will start, but low speed mixture will probably be too rich.

4. Start the engine and after it has reached operating temperature and the choke has been moved to the open position, adjust throttle control so engine runs at approximately 2000 RPM.

5. Without changing throttle setting, turn intermediate needle slowly in direction which produces highest engine speed (RPM). Engine should not miss or surge at this adjustment position.

6. Back off intermediate needle 1/8 turn to slightly richen mixture. This is the correct intermediate needle adjustment.

7. Readjust idle needle and idle speed stop screw to produce a smooth idle at desired idle speed (900 to 1100 RPM).

NOTE

Use of an electric tachometer is recommended.

8. Changing either mixture setting also affects the other setting to some degree. Therefore, it will be necessary to recheck the low speed mixture after the intermediate mixture final setting is obtained.

CHECK LIST

The following check list should be used to correct the most common carburetor defects.

1. Check accelerator pump operation.

2. Blow out passages through high speed screw plug hole.

3. Tighten cover screws and pressure-test inlet valve.

4. Check intermediate adjustment spring, needle, and needle seating.

5. Test main nozzle ball check valve with tool.

6. Inspect idle needle and seat.

7. Inspect choke relief disc.

8. Inspect and clean discharge ports, diaphragms and gaskets, screens and passages. Diaphragm plate must not turn.

9. Check inlet lever setting - must be flush to 1/64 inch above floor of casting. Lever and needle must be the shackled type.

10. Test economizer ball check valve with tool.

11. Check assembly order - gasket next to body, then diaphragm, last cover.

NOTE

A more detailed guide is given at the end of this Section.

TESTS (checks and tests for carburetor performance)

ALL TESTS SHOULD BE PERFORMED, IN THE SEQUENCE SHOWN BELOW, BEFORE FURTHER DISASSEMBLY OR REPAIRS ARE MADE.

PRIOR TO REMOVAL OF CARBURETOR FROM ENGINE

1. The accelerator pump should be inspected for proper operation first. Remove air cleaner, prime carburetor by inserting a toothpick through small hole in bottom of plastic pump cover and gently working diaphragm several times. Operate the throttle lever both rapidly and slowly several times, with the fuel valve turned on. The pump should deliver a strong and constant jet of fuel with each stroke. Failure to do so indicates diaphragm valves or pump plunger as being defective.

2. In cleaning of high, intermediate and low speed channels, the following procedure, most likely, will dislodge any loose dirt lodged in the passages.

Remove high speed screw plug located on rear side of carburetor, opposite intermediate adjustment needle. Lightly seat intermediate needle and apply air hose pressure (90 pounds maximum) to screw plug hole. Open intermediate and idle needles three or four turns and again apply 90 pounds maximum air pressure. Reset both adjustment screws (see ADJUSTING CARBURETOR). Evaluate carburetor's performance by road testing.

3. Check inlet needle and seat for leakage, as follows:

See that all plastic cover screws are tight. Remove fuel and vent lines, install bulb tester, Part No. 94750-68, to carburetor fuel inlet fitting, plug vent fitting with finger and pressurize tester noting any leakage. A moistened needle and seat should hold 1 to 1-1/2 pounds approximately, and release at approximately 3 to 5 pounds. A dry needle and seat will not hold as well as a moist one. See Fig. 3F-7A.

Figure 3F-7A. Checking Inlet Needle and Seat for Leakage

REMOVE CARBURETOR BUT DO NOT DISASSEMBLE

4. Inspect intermediate adjustment needle and spring to see if spring coils are binding before needle seats. If needle does not seat grind a small amount of material from each end of spring. You can check to see if needle is seating by applying blue dye to needle taper and screwing down lightly into seat and noting mark on needle taper.

5. Check main nozzle ball check valve for leakage, as follows:

Seal one side of venturi with finger and apply alternate pressure and vacuum by mouth using grommet end of tool, Part No. 96960-68, seated in venturi as shown in Fig. 3F-7B.

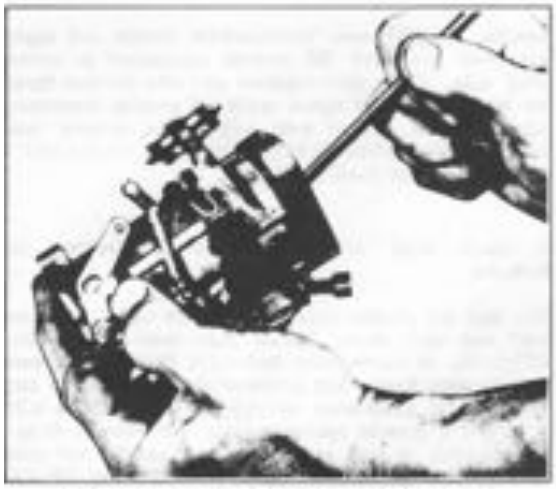


Figure 3F-7B. Checking Main Nozzle Ball Check Valve for Leakage

Vacuum should release ball, and pressure should seat ball in nozzle assembly.

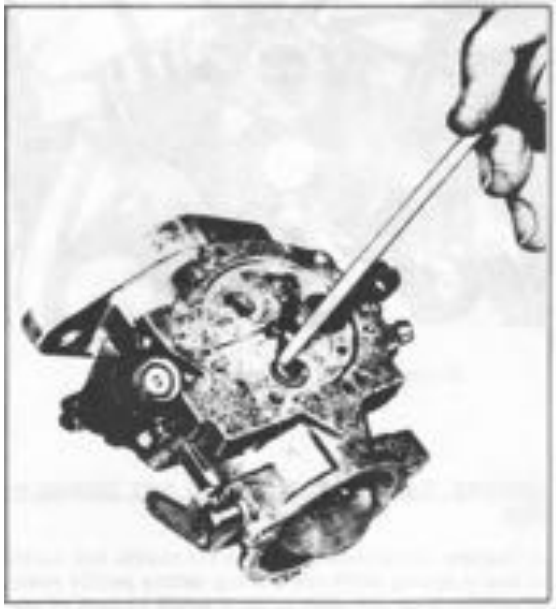


Figure 3F-7C. Removing Main Nozzle Welch Plug

If leakage is evident, carburetor must be disassembled and main nozzle check valve assembly replaced. To replace main nozzle, puncture welch plug with pointed tool, avoiding center, as shown in Fig. 3F-7C. Remove nozzle welch plug and use stepped end of punch, Part No. 96962-68, on nozzle, tapping it through into venturi using plastic hammer. See Fig. 3F-7D. Use larger end of tool to install the new check valve in the same manner. See Fig. 3F-7E.

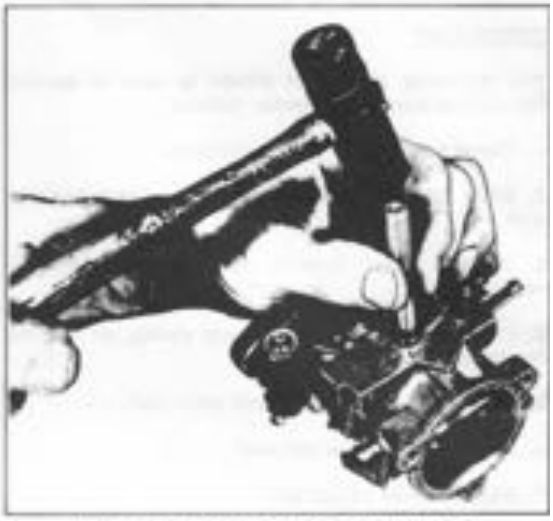


Figure 3F-7D. Removing Main Nozzle

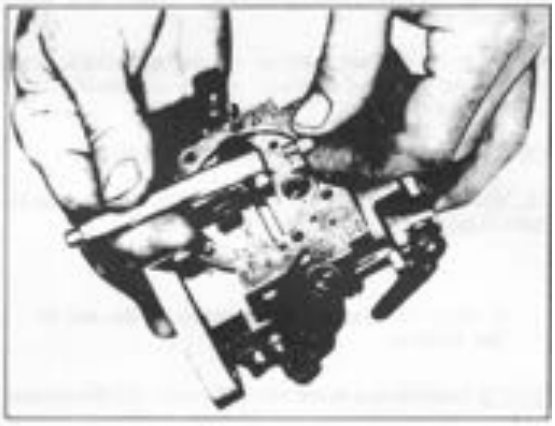


Figure 3F-7E. Installing Main Nozzle

6. Inspect idle needle and seat in carburetor bore for any distortion or a cracked casting.

7. Inspect choke relief disc (upper half of choke) for distortion or stress cracks at the area rotating on choke shaft.

DISASSEMBLY, INSPECTION AND REPLACEMENT OF PARTS

REPLACE DAMAGED PARTS ONLY AFTER COMPLETING ALL TESTS.

8. Remove plastic diaphragm cover. Inspect accelerator pump leather for fold-over or coil spring out of correct position.

Check accelerator pump outlet ball check valve to see that ball is free (Late 1968).

Inspect gasket and diaphragm for distortion or misplacement on carburetor body. Diaphragm must not

be stretched or have a rippled appearance particularly within the valley portion which should be uniform in shape. (Gasket should be assembled next to body.)

Lightly make attempt to rotate metal diaphragm washer, riveted to upper side of diaphragm. If diaphragm plate rotates freely with no drag, replace diaphragm assembly. Diaphragm plate should not be loose.

Prior to removal of the inlet lever the initial needle seat leakage test should be performed 10 to 12 times with the bulb tester, as follows: Close bulb valve. Apply pressure to the inlet, sealing the vent fitting. Open bulb valve and again apply pressure. This repetition checks the sealing of the needle in the seat insuring that it is not sticking open at lever pin or at groove in needle.

9. Inspect inlet needle lever for correct adjustment. It should be flush with surrounding floor of carburetor body. If not equipped with shackled needle, replace with kit No. 27588-66. Tighten seat to 45 in.-lbs. torque. See Fig. 3F-7F.

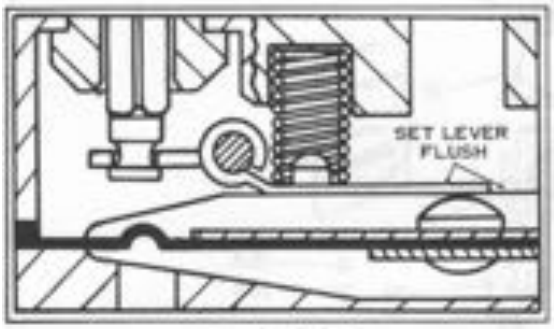



Figure 3F-7F

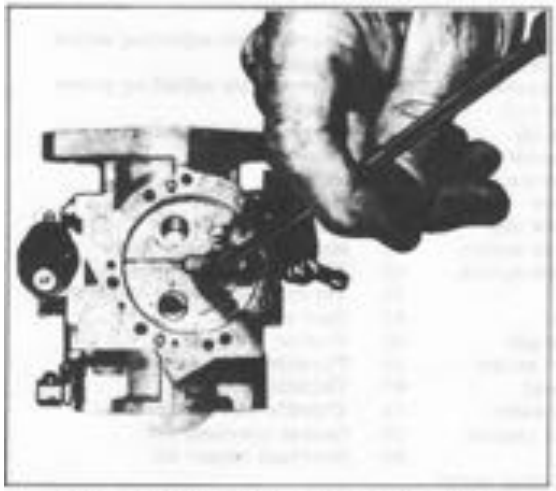


Figure 3F-7G. Checking Economizer Ball Check Valve for Leakage

10. Test economizer ball check for leakage and correct operations as follows:

Using hose end of tool, Part No. 96960-68, place it over economizer welch plug hole so it seals off surrounding area. With alternate pressure and vacuum applied with mouth, as shown in Fig. 3F-7G, ball check should release and seal. Replace any defective parts.

After plastic cover has been removed, remove welch plug at idle adjuster, all gaskets, diaphragms, needle and seat, and high speed nozzle before cleaning carburetor in a caustic carburetor cleaner, since the caustic cleaner will damage gasket material and the high speed nozzle plastic check ball. Only gaskets which are in perfect condition should be reused. The metal parts may also be cleaned in lacquer thinner with a small brush and blown dry.

Inspect by attempting to rotate, or move all welch plugs in body. A close inspection of wall area around welch plugs can disclose a leaking condition. Whenever a welch plug is removed, a new one should be reinstalled. If leakage is suspected due to rough or damaged welch plug seat in casting, apply a small amount of seal-all to edge of welch plug after installing it in recess.

After carburetor has been reassembled, recheck accelerator pump per item 1 under TESTS.

DISASSEMBLING CARBURETOR (See Fig. 3F-8)

Remove idle (24) and intermediate (35) fuel adjustments.

Remove two throttle shutter screws (48) and the throttle shutter (47). The sides of the shutter are tapered 15° to conform to the throttle bore. Observe the direction of this taper and the position of the shutter so that it can be reassembled later in the correct position.

Remove the accelerating-pump-lever retaining screw (3) and pull the throttle-shaft assembly (42) out of the carburetor body. Remove compression spring (46), washers (45), and shaft dust seals (44).

Remove six screws and washers (20) and the body cover (18).

Remove accelerating pump plunger assembly (1).

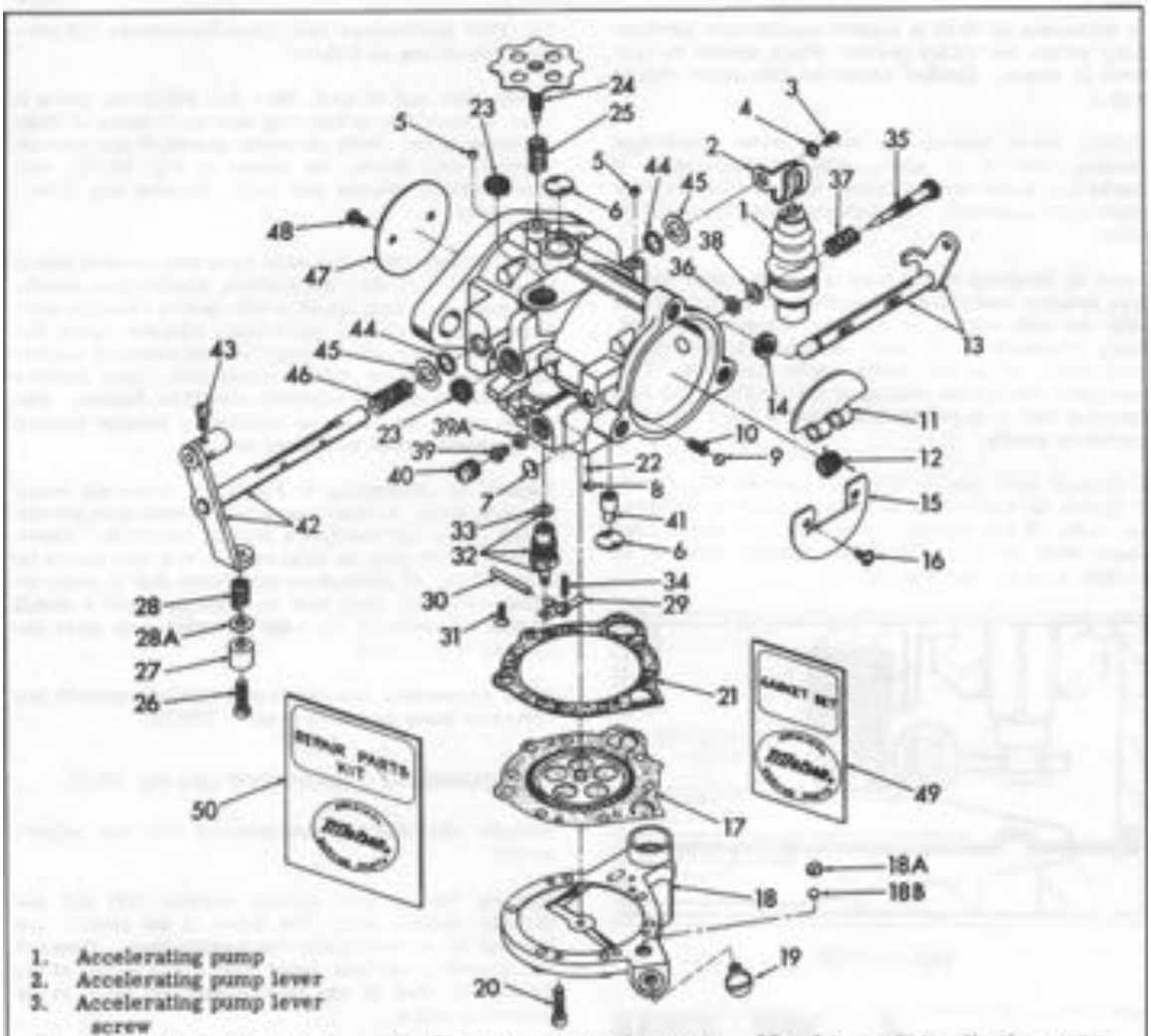
Remove channel plug screw (19).

Remove metering diaphragm (17).

Remove metering-diaphragm gasket (21). Note that the gasket is assembled next to the body casting.

Remove fulcrum-pin retaining screw (31), fulcrum pin (30), inlet control lever (29), and metering spring (34).

Remove the inlet needle (32).




1. Accelerating pump
2. Accelerating pump lever
3. Accelerating pump lever screw
4. Accelerating pump lever screw L.W.
5. Channel plug (2)
6. Welch plug
7. Welch plug
8. Welch plug
9. Choke shaft friction ball
10. Choke shaft friction spring
11. Choke shutter (top)
12. Choke shutter spring
13. Choke shaft assembly
14. Choke shaft dust seal
15. Choke shutter (bottom)
16. Choke shutter screws
17. Diaphragm
18. Cover
18A. Accelerating pump check ball retainer
18B. Accelerating pump check ball
19. Diaphragm cover plug screw
20. Diaphragm cover screws (6)
21. Diaphragm cover gasket
22. Economizer check ball
23. Fuel filter screen (2)
24. Idle adjustment screw
25. Idle adjustment screw spring
26. Throttle stop screw
27. Throttle stop screw cup
28. Throttle stop screw spring
28A. Throttle stop screw spring washer
29. Inlet control lever
30. Inlet control lever pin
31. Inlet control lever screw
32. Inlet needle and seat
33. Inlet needle seat gasket
34. Inlet control lever tension spring
35. Intermediate adjusting screw
36. Intermediate adjusting screw packing
37. Intermediate adjusting screw spring
38. Intermediate adjusting screw washer
39. Main jet
39A. Main jet gasket
40. Main jet plug screw
41. Main nozzle check valve
42. Throttle shaft assembly
43. Throttle lever wire block screw
44. Dust seal (2)
45. Washer (2)
46. Throttle shaft spring
47. Throttle shutter
48. Throttle shutter screws
49. Gasket overhaul set
50. Overhaul repair kit

Figure 3F-8. Model HD Carburetor - Exploded View

Remove the inlet seat and cage assembly (32), using a 3/8" thin wall hex socket wrench. Note the position of the inlet seat insert with the contoured side toward the outside of the cage and the smooth side toward the inside of the cage.

Remove the inlet seat gasket (33), using a small tap or bent wire.

Remove plug screw (40).

Remove fixed main jet (39) and gasket (39A).

Remove main-nozzle welch plug (6) by drilling 1/8" diameter hole off center and just breaking through the welch plug. Do not drill deeper than the welch plug because this would probably damage the nozzle assembly. Pry out the welch plug with a small punch, being careful not to damage the casting counterbore edges around the plug.

Remove idle-port welch plug (6), using the same procedure described above.

Remove welch plug (8) and economizer check ball (22). Pry out the welch plug carefully, using a small punch.

Remove two choke-shutter screws (16) and the bottom half of the choke shutter (15).

Pull the choke-shaft assembly (13) out of the body. This will release the top half of the choke shutter (11), the spring (12), the choke friction ball (9), and friction ball spring (10).

Remove the choke-shaft dust seal (14).

## CLEANING, INSPECTION AND REPAIR

The carburetor body can be cleaned in commercial carburetor solvent such as Hydroseal to remove varnish from the channels and metering chamber.

NOTE

All gaskets, rubber gaskets, seals and plastic parts, including items 18, 22 and 41, should be removed and only metal parts cleaned in Gunk Hydroseal cleaning solution.

All channels and orifices in the carburetor and pump-body castings should be cleaned with compressed air. DO NOT use wires or drills to clean small holes. These might cause burrs or change the size of the holes.

Inspect all parts for wear or damage paying particular attention to the following:

Examine pump body casting for breaks and cracks.

The inlet control lever must rotate freely on the fulcrum pin and forked end must engage slot in inlet needle (see Fig. 3F-8A). The spring (34) should not be stretched or distorted.

Inspect the inlet needle (32) cone point for wear and scratches. Inspect the lever (29) contact end for burrs and wear.

## ASSEMBLING CARBURETOR (See Fig. 3F-8)

Make certain that all parts are kept clean during reassembly. Do not use cloths to wipe or dry parts. Lint or threads can easily block small orifices. Welch plugs should be seated with a flat-end punch of a slightly smaller diameter than the welch plug. The seated plug should be flat, not concave, to assure a tight fit around the circumference.

The metering spring (34) should be seated into the counterbore in the body casting, and located on the protrusion on the inlet control lever (29). The lever should be adjusted flush with the floor of the metering chamber by bending diaphragm end of lever as necessary.

Two torque values are important: (1) the inlet seat assembly (32) should be tightened to 40-45 inch pounds; and (2) the accelerating-pump channel plug (19) should be tightened to 23-28 inch pounds.

## TROUBLE SHOOTING GUIDE (See Fig. 3F-8)

The following symptoms and possible causes with corrective service can be used as a guide in servicing the carburetor.

### A. Idle System

1. Idle operation too lean.

(a) Dirt in idle fuel channels - blow out with compressed air.

(b) Intermediate adjustment (35) closed or adjusted too lean - readjust.

(c) Welch plug (6) or channel plugs (5) missing or not tightly sealed - re-seat or replace plugs.

(d) Nozzle check valve (41) not sealing - blow out with compressed air, or replace. (See "Check List" No. 5.)

2. Idle operation too rich.

(a) Carburetor flooding - see Item E.

(b) Idle adjustment screw (24) point damaged - replace the adjustment.

(c) Idle adjustment hole damaged, forced oversize, or casting cracked in the idle port area - replace carburetor.

B. Intermediate System

1. Lean operation at steady speeds between 15 and 65 m.p.h.

(a) Intermediate adjustment (35) adjusted too lean - readjust.

(b) Dirt in intermediate fuel ports or supply channels - remove welch plug (6) and channel plugs (5) and blow out with compressed air.

(c) Welch plug (6) or channel plugs (5) not tightly sealed - re-seat or replace plugs.

(d) Nozzle check valve (41) not sealing - blow out with compressed air, or replace. (See "Check List" No. 5.)

(e) Intermediate adjustment packing (36) missing or damaged - replace.

(f) Economizer check ball (22) stuck closed - remove welch plug (8) and check ball (22) and blow out channel with compressed air. (See "Check List" No. 10.)

2. Rich operation at steady speeds between 15 and 65 m.p.h.

(a) Intermediate adjustmsent (35) adjusted too rich - readjust.

(b) Fixed main jet (39) too large, not tightly in place or missing - seat firmly, or replace jet.

(c) Carburetor flooding - see Item E.

(d) Nozzle check-valve welch plug (6) not tightly sealed - re-seat or replace.

(e) Choke valve partially closed - see that choke friction spring (10) and choke friction ball (9) are correctly assembled.

C. Nozzle System

1. Lean operation at speeds above 60 m.p.h.

(a) Dirt in nozzle system - remove main fuel jet plug screw (40) and blow channels out with compressed air.

(b) Main fuel jet (39) too small or damaged - replace.

(c) Main fuel jet plug screw (40) not tightly sealed - tighten to stop air leak.

(d) Nozzle check valve (41) damaged - replace. (See "Check List" No. 5.)

(e) Nozzle check valve (41) not seated correctly in casting - re-seat flush with nozzle-well surface.

2. Rich operation at speeds above 60 m.p.h.

(a) Main jet (39) too large, not tightly in place or missing - seat firmly or replace.

(b) Carburetor flooding - see Item E below.

(c) Economizer check ball (22) not seating - remove welch plug (8) and check ball (22) and blow channel out with compressed air. (See "Check List" No. 10.)

D. Accelerating Pump System

1. Lean acceleration.

(a) Incorrect carburetion adjustment - readjust idle (24) and intermediate adjustments (35).

(b) Dirt in acceleration fuel channels - blow out all channels in diaphragm cover (18) and the accelerating pump discharge channel in the body casting. (See "Check List" No. 1.)

(c) Accelerator pump assembly (1) damaged or worn - replace assembly. (See "Check List" No. 1.)

(d) Diaphragm cover plug screw (19) loose or missing - tighten or replace.

(e) Diaphragm (17) flap check valves damaged or worn - replace diaphragm.

(f) Economizer check ball (22) stuck closed - remove welch plug (8) and check ball (22) and blow channel clean with compressed air. (See "Check List" No. 10.)

E. Carburetor Flooding

1. Dirt in inlet needle and seat assembly (32) - remove and clean, or replace. (See "Check List" No. 3.)

2. Inlet seat gasket (33) missing or damaged - replace.

3. Inlet control lever (29) not correctly adjusted - readjust lever flush with metering chamber wall. (See "Check List" No. 9.)

4. Diaphragm (17) incorrectly installed - replace or correct installation.

5. Inlet control lever pin (30) loose or not correctly installed - tighten retaining screw (31) and correct installation.

6. Inlet control lever (29) tight on lever pin (30) - replace damaged part, or clean dirt from these parts.

7. Inlet needle or seat (32) damaged or worn - replace the assembly.

F. General Operation

1. Lean operation in all speed ranges.

(a) Filter screens (23) plugged or dirty - clean or replace.

(b) Inlet control lever (29) incorrectly adjusted - readjust lever flush with wall of metering chamber. (See "Check List" No. 9.)

(c) Diaphragm cover plate (18) loose - tighten six screws (20).

(d) Air leak in metering system - all channel plugs, plug screws, and lead plugs to be tightly sealed.

(e) Inlet tension spring (34) stretched or damaged - replace.

2. Rich operation in all speed ranges.

(a) Carburetor flooding - see Item E.

(b) Choke valve not staying fully open - see that choke friction spring (10) and friction ball (9) are assembled correctly.

(c) Inlet control lever (29) incorrectly adjusted - readjust lever flush with wall of metering chamber. (See "Check List" No. 9.)

## MODEL M CARBURETOR

DESCRIPTION

The model M carburetor is a plain tube carburetor containing a venturi, and a discharge nozzle through which fuel is drawn into the air stream passing through the venturi. The quantity of fuel is metered by two jets or openings, one for low and one for high speed, before entering the nozzle.

Needle valves in the low and high speed passages allow the carburetor to be adjusted for the slightly varying and individual needs of the engine. Once a carburetor is adjusted, it requires little if any attention. At most, two "clicks" or notches richer or leaner on the needles are all that should be necessary to correct air-fuel mixture for changes in weather conditions. All carburetor final adjustments should be made with the engine at full operating temperature.

ADJUSTING CARBURETOR

Before attempting to correct faulty engine performance through carburetor adjustment, check over "Locating Operating Troubles", Section 1C. In addition, be sure air cleaner element is clean and check carburetor and manifold connections to be sure they are tight and not leaking air.

Both high and low speed needles (1 and 2, Fig. 3F-9), are turned clockwise, or in, to make leaner mixture, and counterclockwise, or out, to make mixture richer. Both needles are held to whatever position they are set by a spring and ball plunger which drops into notches in the needle adjusting screw.

A carburetor may be adjusted as follows:

Turn both low and high-speed needles all the way in (clockwise). Back out the low speed needle five turns. Back out the high-speed needle two turns. With needles in these positions, the engine will start but the mixture will be too rich. Advance spark all the way or nearly all the way, whichever is best. Warm engine to full operating temperature and correct adjustment of both needles.

Adjust low speed first, with engine at operating temperature and idling. Turn needle in, one notch at a time, until mixture becomes so lean that the engine misses and acts starved. Back out the needle 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.

Adjust throttle lever stop screw (5, Fig. 3F-9) to make engine idle at desired speed with throttle fully closed. Turning screw clockwise makes engine idle faster. Never set idle adjustment to slowest possible speed. An extremely slow idle causes bearing wear, oil consumption and slow speed accelerating difficulties.

Make final readjustment on low speed needle. Try one notch at a time, first in and then out, to see if engine picks up speed or runs more smoothly. Starting and all around carburetion will be better with low speed adjustment set slightly rich rather than lean. If necessary, make further adjustment on idle stop screw to obtain desired idling engine speed. Retard spark completely. If carburetor is properly adjusted, engine will continue to run evenly and smoothly, though more slowly.

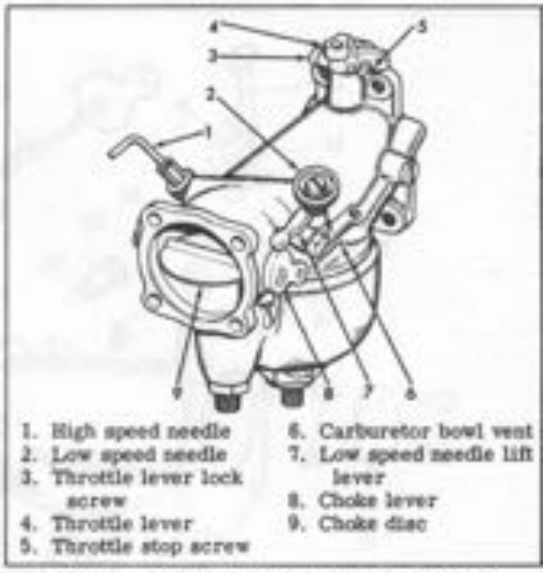



Figure 3F-9. Model M Carburetor Controls and Adjustments

During high speed operation, fuel is metered by a fixed jet which has no adjustment. However, the high speed needle may be used as "trimmer valve" to supplement the fuel flowing through the jet during extremely high speed operation (opened amount which achieves best results). It may be closed during operation at high altitudes to keep mixture from becoming too rich in the rarified air.

DISASSEMBLING CARBURETOR (Fig. 3F-9A)

Disconnect carburetor from motorcycle as follows:

Remove air cleaner cover, element and back plate.

Disconnect fuel line with strainer at carburetor.

Disconnect throttle control wire.

Remove carburetor support from top center crankcase bolt.

Remove intake (choke) lever stud nut and washer. Twist intake lever off intake lever rod, and remove intake lever rod from carburetor.

Remove four carburetor fastening bolts and pull carburetor out to right.

Disassemble carburetor as follows:

Remove bowl lock nut (1), gasket (2), main nozzle retainer spring (3) and main nozzle (4). Remove bowl (5) and bowl cover gasket (6).

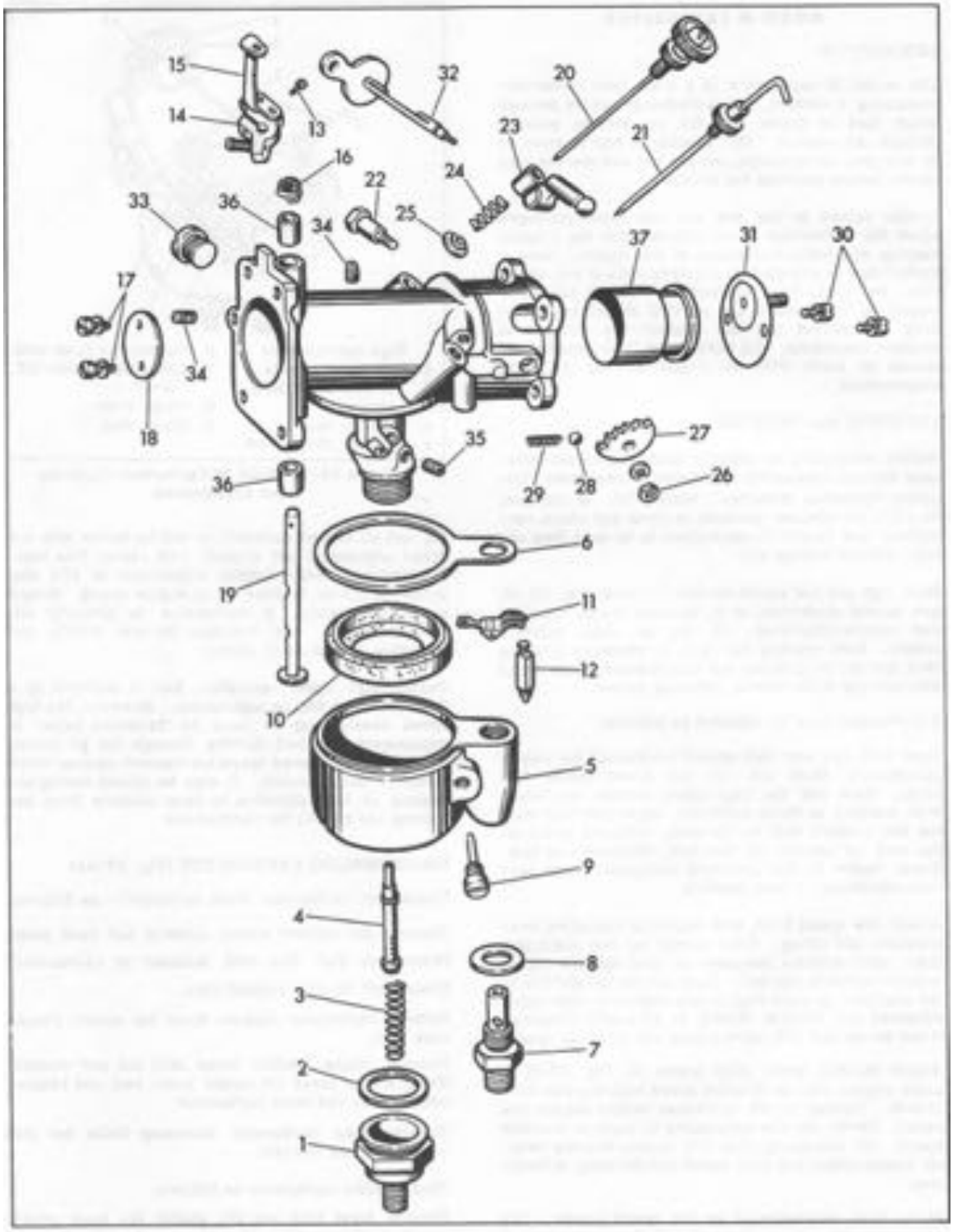



Figure 3F-9A. Model M Carburetor - Exploded View

LEGEND FOR FIGURE 3F-9A

1. Bowl lock nut
2. Lock nut gasket
3. Main nozzle retainer spring
4. Main nozzle
5. Bowl
6. Bowl cover gasket
7. Float valve seat
8. Float valve seat gasket
9. Float lever pin
10. Float
11. Float lever
12. Float valve
13. Throttle stop lock screw
14. Throttle lever
15. Throttle lever arm
16. Throttle shaft spring
17. Throttle shaft screw (2)
18. Throttle disc
19. Throttle shaft
20. Low speed needle valve
21. High speed needle valve
22. Needle valve lever screw
23. Needle valve lever
24. Needle valve lever spring
25. Lever spring collar
26. Air intake shaft nut and washer
27. Air intake shaft stop
28. Friction ball
29. Friction spring
30. Air intake disc screw (2)
31. Air intake disc
32. Air intake shaft
33. Idle hole body plug
34. Idle passage plug screw (3)
35. Fixed jet
36. Throttle shaft bushing (2)
37. Venturi (1-5/16")

Figure following name of part indicates quantity necessary for one complete assembly.

Remove float valve seat (7) and gasket (8). Turn out float lever pin (9) and slip float (10), float lever (11) and float valve (12) out of bowl.

Loosen throttle stop lock screw (13) and slip throttle lever (14) off throttle shaft with throttle lever arm (15) and throttle shaft spring (16).

Remove throttle shaft screws (17), slip throttle disc (18) out of slot in throttle shaft and pull out throttle shaft (19).

Remove low speed needle valve (20) and high speed needle valve (21).

Remove needle valve lever screw (22), needle valve lever (23), lever spring (24) and lever spring collar (25).

Remove air intake shaft nut and washer (26), air intake shaft stop (27), friction ball (28) and friction spring (29).

Remove air intake disc screws (30), air intake disc (31) and pull out air intake shaft (32).

Remove idle hole body plug (33) two idle passage plug screws (34) and carburetor fixed jet (35).

CLEANING, INSPECTION AND REPAIR (Fig. 3F-9A)

Place all parts except gaskets and float in "Gunk Hydro-Seal" or other carbon and gum dissolving agent. Wash, and dry all parts with compressed air. Blow air through all carburetor barrel passages as shown in Fig. 3F-9B. Never scrape carbon deposits from carburetor barrel or other parts with knife or other steel instrument.

Check throttle shaft fit in throttle shaft bushings (36). If excess play exists, use an appropriate size drift pin to remove old bushings. Press in replacement parts and line ream with a .250 in. drill.

Examine carburetor venturi (37). If it is extremely loose or pitted, slip out and replace.

Check float valve and float valve seat seal as follows:

Assemble parts 12 through 7 to carburetor bowl (5). Hold bowl upside down so float valve closes. Suck on bottom of float valve seat. If valve leaks, replace valve and seat.

If float is damaged or logged, replace with new part. Cut cement seal around float screw which secures float to float lever. Remove float screw and assemble new float to lever but leave screw loose. Position bowl so it is upright (the way it fits on carburetor barrel) with gasoline inlet on far side. Pull float toward you to the limit of the slot in float lever and about 1/16 in. to left of center line (see Fig. 3F-9C). This provides clearance in float bowl. Tighten float screw and cement float screw to float with any cement that is impervious to gasoline, or thick shellac.

Check float lever as follows:

Turn assembled float bowl upside down. Measure distance from lip of float bowl to top of float directly opposite float lever. This distance should be exactly 1/4 in. When adjusting carburetor float, do not bend float lever while installed in bowl. Adjusting in this manner bends and spreads fingers between which head of float needle fits and develops lash or lost motion between float and needle. Float and lever assembly should be removed from bowl, and lever then bent as required.

Check needle head fit in float lever. It should be a free fit to about .003 in. clearance. To check clearance with float assembled, hold needle against seat with small screwdriver without restricting float lever. Move float up and down and observe free play between needle head and float lever (see Fig. 3F-9C).

ASSEMBLING CARBURETOR

Assemble carburetor in reverse order of disassembly. Pay particular attention to the following points.

Install venturi with choke end (small end) facing air intake opening.

Install throttle shaft from bottom of carburetor so counterbored screw head notches are facing left side of carburetor when viewing carburetor from throttle shaft end. Notice that an edge of throttle disc has a flat on each side. Pass this edge of disc through

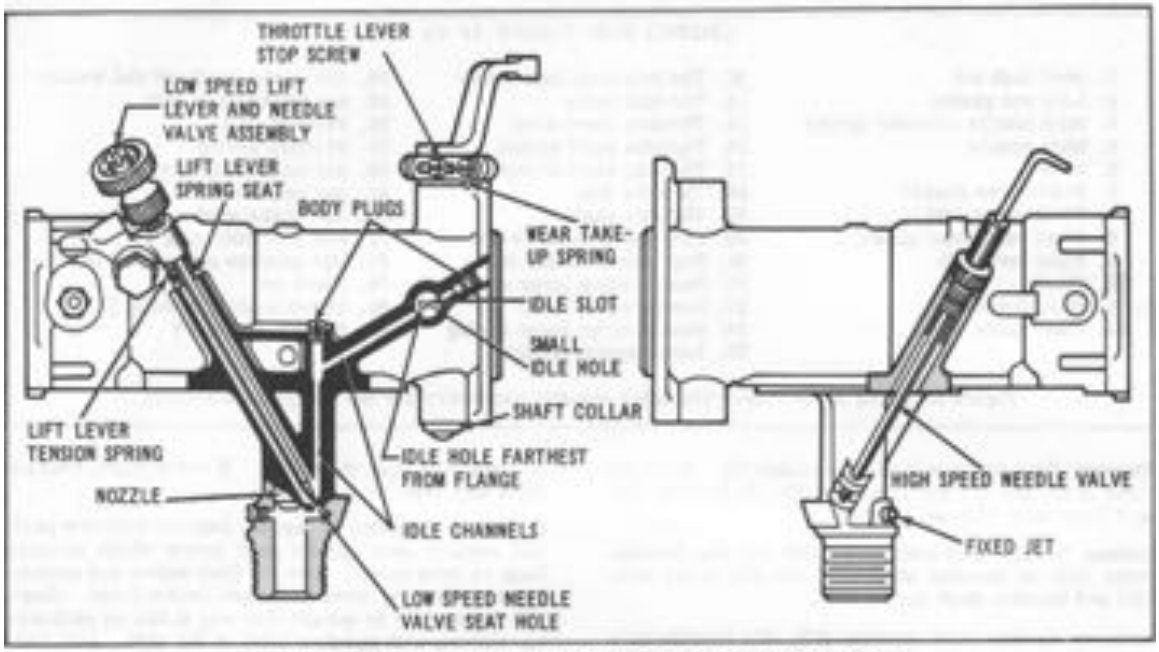



Figure 3F-9B. Model M Carburetor Passages and Needle Seats

throttle shaft, close throttle and insert throttle shaft screws (17) but do not tighten. Shift disc slightly until it seats all the way around carburetor throat. Tighten screws. Work disc several times. If there is any bind, loosen screws and reposition disc.

Position both throttle disc and throttle lever in wide open position before tightening throttle stop lock screw.

Throttle lever and shaft should open and close with just a slight drag. If too loose, loosen stop lock screw and compress parts on throttle shaft with fingers while tightening.

Install only replacement throttle disc containing same identification number on face. With disc correctly installed and closed, the number will be on right half of disc when viewed through manifold end of carburetor.

After assembly, adjust carburetor as described in "Adjusting Carburetor."

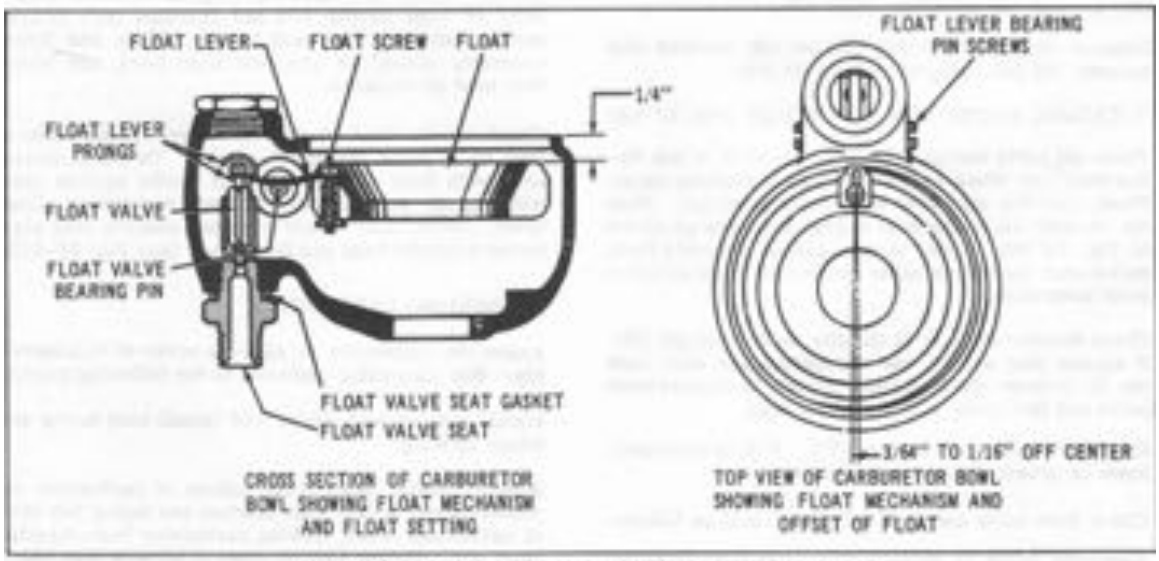



Figure 3F-9C. Adjusting Model M Bowl Float and Needle

## MODEL DC CARBURETOR

DESCRIPTION

The model DC carburetor is a plain tube carburetor; that is, its main fuel-air mixture passage consists of a venturi section and discharge nozzle. A fixed jet and adjustable high-speed needle valve of limited size meter the high-speed fuel supply as it is fed into the venturi section of the throttle barrel. The low-speed needle valve meters the low-speed fuel-air mixture supply as it is fed into the throttle barrel near the throttle disc. There are no moving parts except the throttle shaft and disc and the bowl float mechanism.

ADJUSTING CARBURETOR (Fig. 3F-9D)

A properly adjusted carburetor requires little readjustment. It should not be necessary to change the adjustment of the low-speed needle more than 1/8 turn and the high-speed needle more than 1/4 turn, richer or leaner, to obtain correct mixture for a change in weather conditions.

Before attempting to correct faulty engine performance through carburetor adjustment, eliminate other possible causes for poor engine performance such as bad spark plugs, improper spark timing, misadjusted tappets, dirty air cleaner, or leaky carburetor and manifold connections.

The air-fuel mixture for low engine speed is regulated by the low-speed needle. The fuel supply for high engine speed is regulated by a combination fixed jet and adjustable needle. The fixed jet dominates the regulation of high-speed fuel supply. The high-speed needle provides a means of supplementing, to a limited degree, the fuel supplied by the fixed jet, when it is found that slightly enriching the mixture improves engine performance.

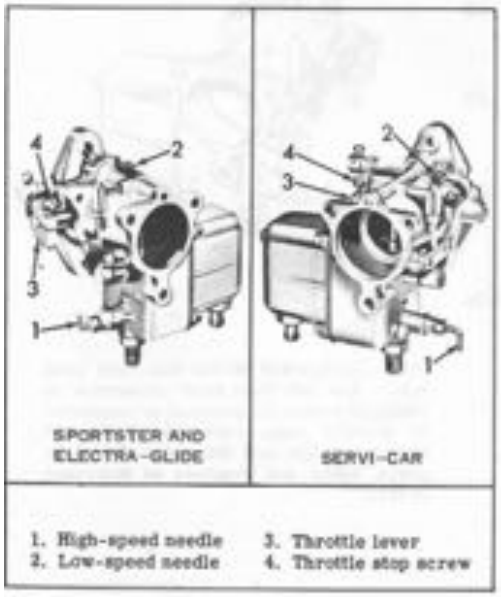



Figure 3F-9D. Model DC Carburetor

Both the high-speed needle (1) and low-speed needle (2) turn inward (clockwise) to make mixture leaner at the respective speeds for which they adjust. Backing them out (counterclockwise) makes mixture richer.

A carburetor may be adjusted as follows:

1. Make sure carburetor control wire is adjusted so throttle lever (3) fully closes and opens with handlebar grip movement.

2. Turn both the high- and low-speed needle (1 and 2) all the way in (clockwise). Do not close off either needle too tightly or damage to needle and seat may result.

3. Turn low-speed needle (2) (counterclockwise) about 1-1/2 turns. With needle in this position, engine will start, but low-speed mixture will probably be too rich.

4. Start the engine and after it has reached operating temperature and the choke has been moved to the open position, correct the adjustment of low-speed needle. Turn low-speed needle (2) in (clockwise) 1/8 turn at a time until mixture becomes so lean that engine misses and is inclined to stop; then, back needle out (counterclockwise) 1/8 turn, or until engine hits regularly with spark advanced and throttle closed and engine running at idle speed. Starting and all around carburetion will be better with low-speed adjustment slightly rich, rather than too lean.

5. Adjust throttle lever stop screw (4) as necessary, to make engine idle at proper speed with throttle fully closed. Turn screw clockwise to make engine idle faster and counterclockwise to make engine idle slower. Do not idle an engine at the slowest possible speed because an extremely slow idling adjustment causes hard starting. Changing the idle speed with throttle stop screw is likely to change the low-speed mixture slightly. It will, therefore, be necessary to again check and correct low-speed needle adjustment by the same procedure followed in making the initial adjustment.

6. Check high-speed adjustment, after low-speed adjustments have been completed. Run motorcycle or Servi-Car on the road at various speeds between 20 miles per hour and maximum speed. Have spark fully advanced. Best all-around engine performance can usually be found with the high-speed needle (1) set from 3/4 to 1-1/4 turns open.

DISASSEMBLING CARBURETOR

Disconnect carburetor from motorcycle as follows:

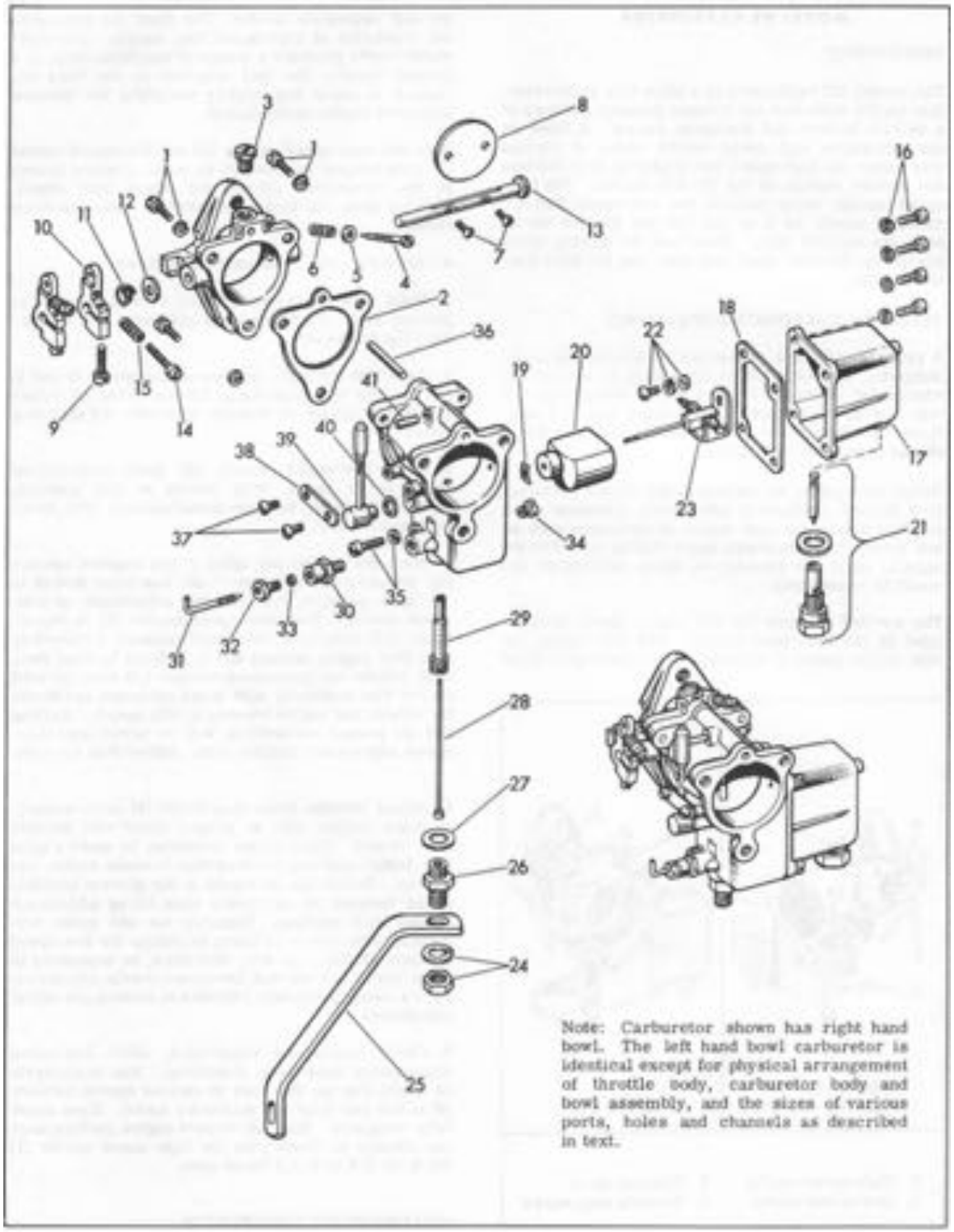



Figure 3F-9E. Model DC Carburetor - Exploded View

LEGEND FOR FIGURE 3F-9E

1. Throttle body screw and washer (3)
2. Body gasket
3. Idle hole body plug
4. Low-speed needle valve
5. Low-speed needle valve washer
6. Low-speed needle valve spring
7. Throttle shaft screw (2)
8. Throttle disc
9. Throttle lever clamping screw
10. Throttle lever
11. Throttle shaft spring
12. Throttle shaft washer
13. Throttle shaft
14. Throttle lever stop screw
15. Throttle lever stop screw spring
16. Bowl mounting screw (4)
17. Bowl
18. Bowl gasket
19. Float nut
20. Float
21. Float valve and seat
22. Float lever screw and washers
23. Float lever and bracket assembly
24. Support bracket nut and lock washer
25. Support bracket
26. Bowl nut
27. Bowl nut gasket
28. Idle tube assembly
29. Main nozzle
30. High-speed needle valve extension housing
31. High-speed needle valve
32. High-speed needle valve packing nut
33. High-speed needle valve packing
34. Carburetor jet
35. Drain plug and gasket
36. Idle passage tube
37. Throttle shaft screw (2)
38. Vent clamp
39. Vent housing
40. Vent gasket
41. Idle bleed tube

Figure following name of part indicates quantity necessary for one complete assembly.

Remove air cleaner cover, air cleaner cartridge and back plate. Turn off fuel supply at valve and disconnect fuel line at carburetor.

Disconnect throttle control wire.

Remove carburetor support (if used).

Remove two carburetor fastening bolts and pull carburetor out.

The DC type carburetor consists of three main subassemblies; throttle body, carburetor body, and bowl assembly.

THROTTLE BODY DISASSEMBLY (Fig. 3F-9E)

To disassemble the throttle body, remove three throttle body screws and lock washers (1), body gasket (2), idle hole body plug (3), low-speed needle valve (4), washer (5) and needle valve spring (6).

Remove throttle shaft screws and lock washers (7) and free throttle disc (8) from shaft.

Loosen throttle lever clamping screw (9) from lever (10) and free spring (11), washer (12) and shaft (13) from throttle body. If necessary, remove stop screw (14) and spring (15) from throttle lever.

CARBURETOR BOWL DISASSEMBLY

To disassemble the carburetor bowl, remove four bowl attaching screws and washers (16). Tap bowl (17) lightly to break free from carburetor body. Remove gasket (18). Unscrew flat speed nut (19) from float rod and free float (20). Remove matched float valve and seat assembly (21). Remove float lever screw, lock washer and float washer (22) to free float lever and bracket assembly (23).

CARBURETOR BODY DISASSEMBLY

To disassemble the carburetor body, remove support bracket nut and lock washer (24), and support bracket (25) (if used). Remove bowl nut (26) and gasket (27). The idle tube (28) extends up through the nozzle and venturi into the upper wall of the body.

NOTE

Ordinarily the idle tube will remain in the body when the bowl nut is removed. If for any reason it should stick in the bowl nut, do not attempt to remove it from the nut.

If the tube remains in the body when the bowl nut is removed, remove it gently by moving the plug end of the tube back and forth, and pulling at the same time.

The nozzle (29) is screwed into the body and shoulders against the casting at the top. Use a good screwdriver for removing and replacing nozzle. Preferably grind a pilot on the end of a special screwdriver to fit the inside of the nozzle and grind the sides to clear the 3/8-24 thread hole. At the same time grind the blade to fit the nozzle slot. The slot is .051 in. wide.

Remove the high-speed needle valve extension housing (30) to free high-speed needle valve (31), packing nut (32) and packing (33).

Remove the high-speed metering plug or fixed jet (34) located directly opposite the high-speed needle valve hole.

Remove drain plug and gasket (35) and free idle passage tube (36).

Remove screws (37) and clamp (38) to free vent housing assembly (39), vent gasket (40), and idle bleed tube (41) from carburetor body.

CLEANING, INSPECTION AND REPAIR

Place all parts except gaskets and float in "Gunk Hydro-Seal." Wash and dry all parts with compressed air. Blow air through all passages. Never scrape carbon deposits from carburetor parts with knife or other steel instrument. Replace any gaskets that are badly worn or damaged.

Ordinarily a good cleaning in "Gunk Hydro-Seal" will be all that is necessary to clean out carburetor passages; however, if after considerable use a heavy "crust" forms, it may be essential to clean out passages with appropriate size drills. For this reason, all drill sizes needed for a complete carburetor cleaning operation are given throughout the cleaning, inspection and repair procedure.

THROTTLE BODY

After the carburetor has been in service for some time, the interior of the throttle barrel, idle port holes at the closed disc edge and idle or low-speed needle passages may accumulate a "crust" which will interfere with the idling and "off idling" characteristics. Clean the body and parts in "Gunk Hydro-Seal." If the throttle shaft (13) shows considerable wear (over .002 in. at the bearings), replace with new shaft.

Clean out the idle port holes located next to the disc (closed position) in the throttle body. Use the exact drill size specified below for the particular carburetor being worked on, being extremely careful not to increase the original hole size.

| Model (Marked on Carburetor) | Drill Sizes |
|---|---|
| DC-1, 1L, 1M, 10 | 70 (.028) |
| DC-2 | 56 (.0465 |

The idle passage holes are the same for all DC carburetors and may be cleaned and checked as follows:

The idle or low-speed needle hole in which the needle seats is .043 in. diameter (#57 drill). This hole meets the angular hole inside the throttle barrel. The angular hole drill size is .0635 in. diameter (#52 drill).

CARBURETOR BOWL

Examine the carburetor body and bowl joint faces for scratches and damage that may result in fuel leakage. Replace, if necessary. Suck on bottom of float valve and seat (21). If valve leaks, replace valve and seat.

Figure 3F-9F. Engaging Model DC Float Lever in Valve Stem Groove

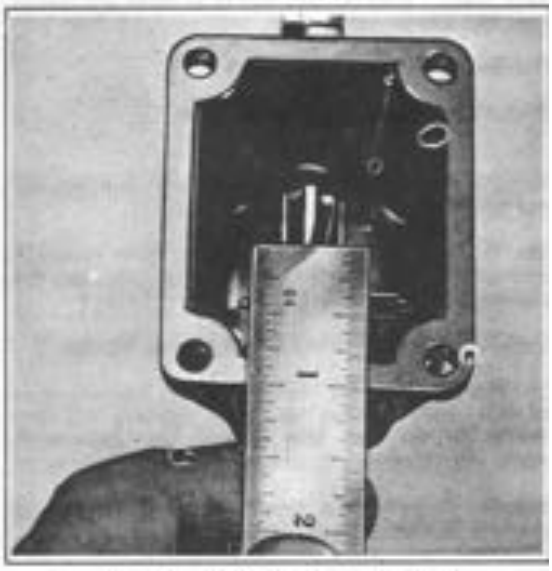


Figure 3F-9G. Checking Model DC Float Setting

CHECK AND SET FLOAT ROD

Assemble float valve and seat assembly (21). Install float lever bracket screw (22) loose, so that bracket can be adjusted if necessary. Insert float valve and seat (21) about halfway into bowl.

Position float rod at the same time for easy engagement of nylon lever fingers in float valve stem groove (see Fig. 3F-9F). Turn float valve into bowl and tighten against gasket.

NOTE

Under no condition, screw valve seat fitting with valve into bowl without first removing bowl from carburetor body, because fingers of nylon lever will be damaged if not properly engaged. To drain bowl, remove drain plug (35).

Check float lever setting with carburetor bowl held upside down, measuring the distance from top of float rod to outer edge of bowl flange opposite fuel inlet fitting as shown in Fig. 3F-9G. This measurement should be taken when lever is at the point where float valve seats lightly. Move float lever up and down to determine this seating point. Note that measurement is taken from outer edge of bowl opposite the fuel inlet fitting. Float rod position from edge should be 1 in. plus or minus 1/64 in. If setting is not 1 in. with float valve closed, adjust slotted float lever bracket.

When correct position of float rod is obtained, tighten bracket screw securely and recheck setting of float rod. Install float (20) on rod, flat side up, fastening with speed nut (19).

CARBURETOR BODY

To clean the idle tube (28) and idle feed hole, blow through the tip end. Do not use drills in end of tube or in small feed hole at bottom.

Clean the nozzle (29) bleed holes with a #54 drill (.055) and the main passage with a #17 drill (.173). Clean the high-speed needle seat holes with the exact drill size specified below for the particular carburetor being worked on.

| Model | Drill Size |
|---|---|
| DC-1, 1L, 1M, 10, 6, 7, 12 | 55 (.052) |
| DC-2 | 70 (.028) |

Be extremely careful not to change size of holes during the cleaning operation.

Examine the two bowl vents in the carburetor body, to make sure both holes are open. One hole is the brass tube permanently swaged into the body. The second hole is located adjacent to the brass tube in the bowl cavity of the main body.

The idle or low-speed mixture channel at the top of the main body accommodates the idle tube (36). When fully seated, tube will extend beyond body face through gasket (2) into the throttle body corresponding hole. The idle tube serves two purposes, one for lining up the throttle body and the other to reduce the size of idle mixture passage. It is important that no leakage occurs between the main body and throttle body. Examine the joint faces for nicks or damage, particularly where the low-speed or idle mixture enters the throttle body.

The idle or low-speed air bleed is located in the idle mixture channel, top of main body, with the entrance on middle side of body through idle bleed tube (41) and nozzle vent housing (39). The air entering the bleed mixes with fuel delivered by idle tube and passes to the throttle body.

The nozzle (29) is air bled through a passage in the main body and nozzle vent housing (39), side opposite carburetor bowl.

Be extremely careful not to damage or enlarge any of these passages. Check the nozzle vent housing assembly fit on carburetor body. These parts should fit snug and without play.

ASSEMBLY

Assemble carburetor in reverse order of disassembly. Pay particular attention to the special instructions below.

CARBURETOR BODY

Install vent housing assembly (39), gasket (40), idle bleed tube (41), clamp (38), and screws (37). Start tube into holes first, then tap housing into place. Pull clamp (38) just tight enough so that outer ends of clamp touch body bosses.

Install drain plug and gasket (35) and high-speed fixed jet (34).

Position high-speed needle valve housing (30) in body, with needle valve (31), packing nut (32) and packing (33) assembled in housing.

When installing this set of parts in the main body, always back out the needle valve so the point will not enter the valve hole in the main body when the housing is pulled up tight. Pull up the packing nut just enough to prevent the needle valve from turning too freely.

Be very careful not to jam the needle valve into the seat hole, and deform the hole entrance.

Since the fixed jet supplies the main bulk of fuel to the nozzle and is supplemented by a maximum fixed amount from the high-speed needle valve, turning the needle valve completely off may, under certain conditions, cause the mixture delivered by the nozzle to be too lean. Turning the needle valve on three to four turns will cause the nozzle mixture to be definitely on the "rich" side but not excessively rich for normal conditions. As a rule, keep the high-speed needle valve setting as "lean" as possible, consistent with good performance. See "Adjusting Carburetor."

Assemble the nozzle (29) in place using an improvised screwdriver as described under "Carburetor Body Disassembly."

Turn the entire body upside down, drop in the idle tube (28), small end first, jiggle the body, and the tube will Locate itself in the body hole. Do not bend, twist or damage the idle tube in any way. Press on plug end of tube until tube is seated and the bottom of the plug extends approximately 1/32 in. out of nozzle passage. When installing bowl nut (26) and gasket (27), spring tension will hold the idle tube firmly in place.

Assemble support bracket (25), nut and lock washer (24).

## CARBURETOR BOWL

Assemble bowl to carburetor main body with four attaching screws (16) and gasket (18).

## THROTTLE BODY

Install throttle shaft (13), counterbored screw head notches facing towards carburetor main body. Position throttle disc (8) in shaft, milled side up and facing carburetor body. Insert and tighten shaft screws (7). Work disc several times. If there is any binding, loosen screws and reposition disc.

Install only replacement throttle disc containing same identification number on face. With disc correctly installed and closed, the number will be on top half of disc facing carburetor main body.

Install screw (14) and spring (15). Assemble throttle lever to shaft (10) with spring (11) and washer (12) allowing slight end play in the shaft when lever assembly is clamped tight. Position throttle disc and throttle lever in wide open position before tightening screw (9).

Install low-speed needle valve (4), washer (5) and spring (6). Be careful not to jam the low-speed needle point into its seat. Install idle hole body plug (3). Install idle passage tube (36) in carburetor body, chamfered end out. Install a new throttle body gasket (2), position throttle body in place and insert screws and lock washers (1).

The Model DC carburetor is attached to the manifold flange with certain thickness gasket and certain length cap screws. If for any reason the overall gasket thickness is reduced and no change is made in the cap screw length, the cap screw may bottom on the head of the lower throttle body screw (1). If it does bottom, a broken throttle body will result.

After assembly, adjust carburetor as described in "Adjusting Carburetor."

All pertinent calibration and setting figures not given in prior information appear in following chart.

Calibration and Setting Chart

| DC Model | Idle Bleed | Idle Tube Feed | Fixed Jet | Turns High-Speed Setting | Turns Idle Speed Setting | Throttle Disc Mark |
|---|---|---|---|---|---|---|
| DC-1 | #53 (.0595) | #69 (.0293) | #9 (.067) | 3/4 to 1-1/4 | 3/4 to 1 | 9A |
| DC-1L | #53 (.0595) | #69 (.0293) | #4 (.0625) | 3/4 to 1-1/4 | 1 to 1-1/4 | 9A |
| DC-1M | #53 (.0595) | #69 (.0293) | #1 (.052) | 3/4 to 1-1/4 | 1 | 9A |
| DC-10, 6, 12 | #53 (.0595) | #69 (.0293) | #4 (.0625) | 3/4 to 1-1/4 | 1 to 1-1/4 | 9A |
| DC-2 | #51 (.067) | #70 (.028) | #20 (.0452) | 3/4 to 1-1/4 | 1 to 1-1/4 | 12 |
| DC-7 | #53 (.0595) | #69 (.0293) | - (.070) | 3/4 to 1-1/4 | 1 to 1-1/4 | 9A |

## MODEL MD CARBURETOR (1966 AND LATER SERVI-CAR)

GENERAL

See Figure 3F-12. On the Model MD carburetor, fuel enters carburetor at inlet connection (A) flowing past inlet needle and seat (C) into the fuel bowl. Fuel flows from bowl past main nozzle adjusting screw (T) into main nozzle orifice (W) and into nozzle sump (Z).

Idle and slow speeds: Fuel reaching its level in the carburetor passes main adjusting screw (T) through main nozzle orifice (W) and into idle tube (L). High manifold vacuum at throttle disc (G) draws this fuel upward past idle tube outlet orifice (M) where it mixes with air from channel (P) adjusted to requirements by idle mixture adjustment screw (O) through channel (J) and into air stream at idle discharge ports (H) where it mixes with additional air passing the slightly opened throttle disc (G).

High speeds and full power: When engine is pulling a load throttle disc (G) has opened further reducing suction and minimizing fuel discharge at (H) and increasing air flow to a high velocity through venturi (R). This air draws fuel from main nozzle (Y) supplied from bowl, past main nozzle adjusting screw (T) through orifice (W). As engine speed or load increases air is automatically bled into the main nozzle through tube (U) which causes a proper proportion of fuel drawn from sump (Z) in relation to adjustment to be metered at that speed range.

ADJUSTING CARBURETOR (Fig. 3F-13)

A carburetor once properly adjusted requires little if any readjustment. Before attempting to correct faulty engine performance through carburetor adjustment, eliminate all other possible causes for engine trouble. Such as bad spark plugs, incorrect spark timing, misadjusted tappets, dirty air cleaner, or leaky carburetor and manifold connections.

Idle mixture adjustment screw (1), turns to the right to enrich mixture for the idle speed range. Backing it out (turning left) makes mixture leaner.

Main nozzle adjusting screw turns to the right to lean mixture for the high speed range. Backing it out (turning left) makes mixture richer.

INITIAL ADJUSTMENT

Completely close (turn clockwise) both adjusting

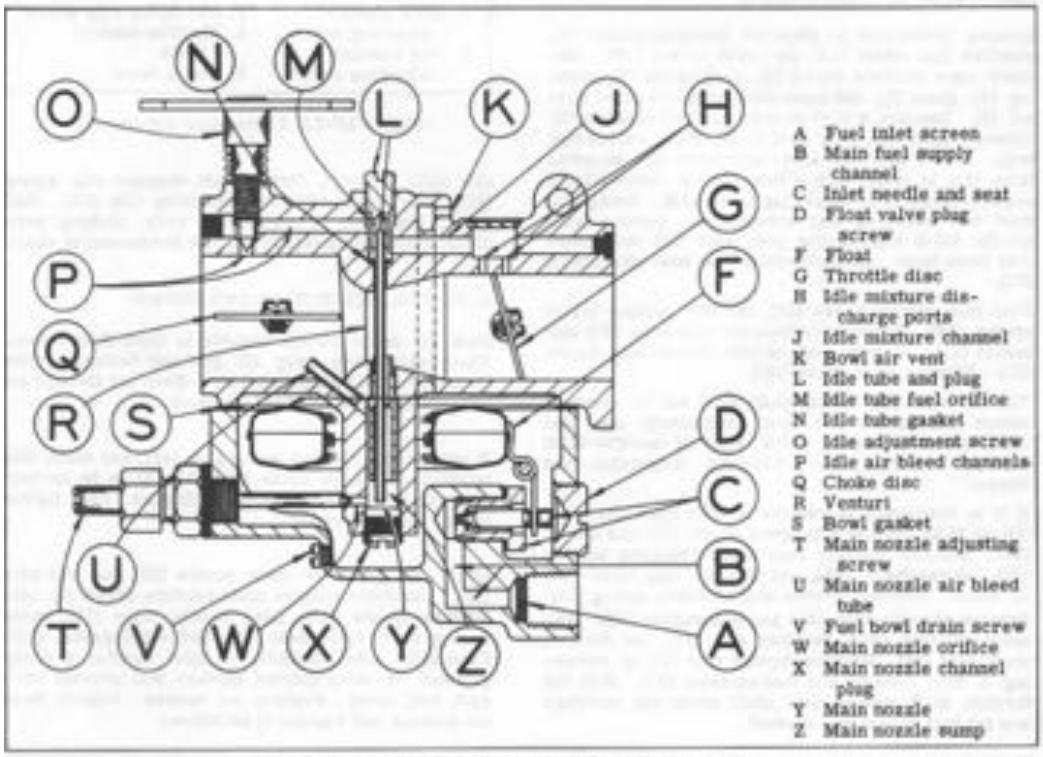



Figure 3F-12. MD Carburetor Cross Section

screws until snugly seated without forcing, then open them up to the normal setting as follows:

Main mixture (1) - 1-1/2 turns open
Idle mixture (2) - 3/4 turn open

Above normal settings are approximate and will vary for individual engines and operating conditions.

Closed throttle, idling speed of engine is adjusted with idle speed stop screw (3). Before making this adjustment, be sure throttle control wire is so adjusted that throttle fully closes with outward handle bar grip movement; engine should be at normal operating temperature.

Turn screw (3) to the right for faster idling speed; to the left for slower idling.

Readjusting idling speed may change idling mixture slightly, therefore after making this adjustment, it may be found necessary to make minor readjustment of adjusting screw (1). Final adjustment of the main mixture may be made after a performance check under road load conditions.

DISASSEMBLING CARBURETOR (Fig. 3F-14)

Disconnect throttle and choke wires from the carburetor connection. Shut off fuel supply and remove the hose from the carburetor nipple. Remove carburetor from the intake manifold.

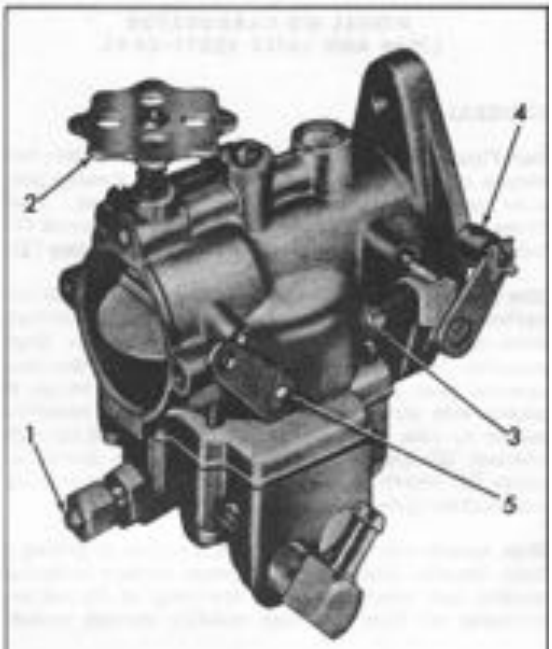
Remove carburetor to manifold mounting gasket (1), gasoline line elbow (1A) and inlet screen (1B). Remove main mixture screw (2), packing nut (3), packing (4), gland (5), and main packing screw gland gasket (6). Remove 4 bowl screws and lockwashers (7). Remove bowl (8), and gasket (9) from carburetor body. Screw out float lever pin-screw (10) securing float (11) to bowl; with a heavy blade screwdriver, remove large float bowl plug screw (12). Using tool Part No. 94816-62 and screwdriver, remove inlet needle valve (13), spring (14), seat (15) and gasket (16) from bowl. Remove small float bowl plug screw (17).

Free idle mixture screw (18), and idle mixture screw spring (19). Remove carburetor idle tube (20) and gasket (21). Remove main nozzle channel plug screw (22). Remove main nozzle (23).

The throttle and choke shaft need not be removed unless carburetor has been excessively used and examination discloses undue wear of throttle shaft and its bearings. See "Cleaning, Inspection, and Repair."

If it is necessary to remove throttle shaft and lever (26 or 26A), remove idle speed screw (24) and spring (25). Remove throttle stop lever retaining screws (27), lockwashers (28), and throttle stop lever (29) (if used). Remove throttle shaft friction spring (30). Remove throttle stop (31) and lockwasher (32). Remove throttle shaft retainer clip (33), and throttle shaft seal (34). Remove throttle disc (36) by removing 2 disc screws and lockwashers (37). Pull out throttle shaft making sure shaft seals and bushings are not lost in removal of shaft.

If it is necessary to remove choke shaft and lever (38), remove choke disc (39), screws and lockwashers (40). Remove choke shaft retainer clip screw (41), lockwasher (42), and retaining clip (43). Pull choke shaft out of carburetor body, making sure choke shaft spring (44) is not lost in removal of shaft.




1. Main mixture adjusting screw
2. Idle mixture adjusting screw
3. Idle speed stop screw
4. Throttle control lever
5. Choke lever

Figure 3F-13. Carburetor Adjustment

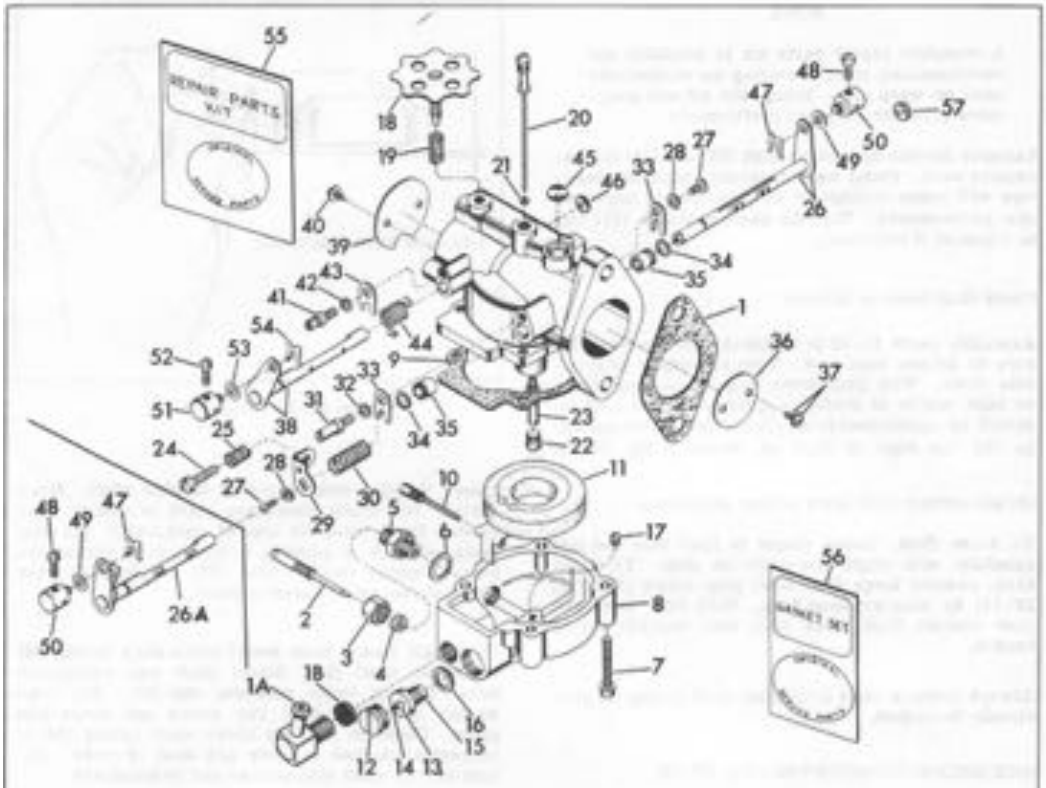
CLEANING, INSPECTION AND REPAIR

Soak all parts except gaskets in Gunk Hydro-Seal. Thoroughly wash away all grit and sediment, then blow dry with compressed air. Blow air through all internal fuel and air bleed channels.

If necessary, remove welch plug (45), and check idle mixture discharge ports (Fig. 3F-12) to be certain they are not wholly or partially plugged. Then tightly install new welch plug.

Wash and blow out main nozzle (23) and idle tube (20). Carefully inspect main mixture screw (2), idle mixture screw (18), inlet needle valve (13), valve spring (14), valve seat (15), and valve gasket (16). Especially note condition of inlet needle; a badly grooved or worn pointed surface will prevent correct fuel level. Replace as needed. Inspect float for leakage and replace if necessary.

Always renew gaskets and main mixture screw packing (4) when reassembling.




1. Carburetor to manifold gasket
1A. Gasoline line elbow
1B. Inlet screen
2. Main mixture screw
3. Main mixture screw packing nut
4. Main mixture screw packing
5. Main mixture screw gland
6. Main mixture screw gland gasket
7. Bowl screws and lockwashers (4 each)
8. Carburetor bowl
9. Body gasket
10. Float lever pin-screw
11. Float
12. Float bowl plug screw (large)
13. Inlet needle valve
14. Inlet needle valve spring
15. Inlet needle valve seat
16. Inlet needle valve gasket
17. Float bowl plug screw (small)
18. Idle mixture screw
19. Idle mixture screw spring
20. Carburetor idle tube
21. Idle tube gasket
22. Main nozzle channel plug screw
23. Main nozzle
24. Idle speed screw
25. Idle speed screw spring
26. Throttle shaft and lever (to late 1963)
26A. Throttle shaft and lever (late 1963)
27. Retaining screw (2) (to late 1963)
28. Lockwasher (2) (to late 1963)
29. Throttle stop lever (to late 1963)
30. Throttle shaft friction spring
31. Throttle stop
32. Throttle stop lockwasher
33. Throttle shaft retainer clip
34. Throttle shaft seal
35. Throttle shaft bushing
36. Throttle disc
37. Throttle disc screws and lockwashers (2 each)
38. Choke shaft and lever
39. Choke disc
40. Choke disc screws and lockwasher (2 each)
41. Choke shaft retainer clip screw
42. Choke shaft retainer clip lockwasher
43. Choke shaft retainer clip
44. Choke shaft spring
45. Body channel welch plug
46. Choke shaft bearing welch plug
47. Wire connection retainer clip washer
48. Throttle wire retainer screw
49. Throttle wire connection lockwasher
50. Throttle wire connection
51. Choke wire connection
52. Choke wire retainer screw
53. Choke wire connection lockwasher
54. Wire connection retainer clip washer
55. Repair parts kit
56. Gasket set
57. Throttle shaft bearing Welch plug (late 1963)

Figure 3F-14. Model MD Carburetor - Exploded View

NOTE

A complete repair parts kit is available and recommended when servicing an excessively used or worn unit. Using this kit will guarantee accurate work and performance.

Examine throttle and choke shaft (26) and (38) for excessive wear. Undue wear of throttle shaft and bearings will cause leakage of air resulting in improper idle performance. Throttle shaft bushings (35) can be replaced if necessary.

Check float level as follows:

Assemble parts 10-16 to carburetor bowl cover. Be sure to tighten inlet seat. Turn assembled float upside down. With float lever tang resting on spring so inlet needle is seated, a measurement of 1/64 in. should be maintained from edge of bowl (less gasket) to the top edge of float as shown in Fig. 3F-15.

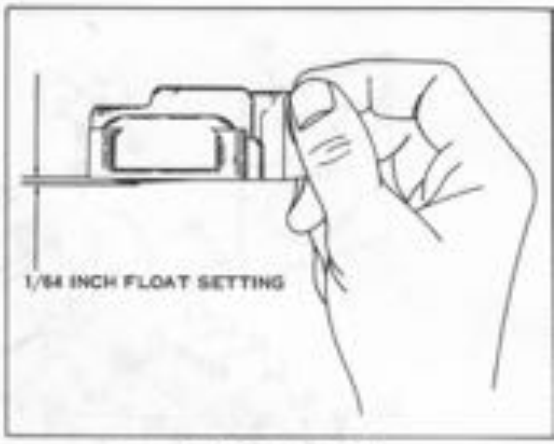



Figure 3F-15. Float Setting

Obtain correct float level setting as follows:

To raise float, insert finger in float hole and pull carefully with slight pressure on float. To lower float, remove large float bowl plug screw (12, Fig. 3F-14) to uncover float tang. Hold float down and push against float lever tang with screwdriver to bend it.

Always recheck float level after each setting as previously described.

ASSEMBLING CARBURETOR (Fig. 3F-14)

To reassemble carburetor reverse the disassembly procedure. Be sure to tighten idle tube (20). Check the float to make sure it moves freely and is set at specified level.

Insert throttle disk in slot in throttle shaft. Make certain that small identifying mark is visible when viewed from manifold end of carburetor and that mark on disk is pointing to the base of carburetor bore. Tighten throttle disc (36) on its shaft after stop and clip are secured in place.

To install choke, first insert choke shaft spring (44) on choke shaft (38). Insert shaft into carburetor body. Put on choke retaining clip (43). Put lockwasher on choke shaft clip screw and screw into place. Check to see that choke shaft spring (44) is correctly attached to lever and shaft of choke. Attach disc on shaft with screws and lockwashers.

Bolt carburetor to manifold.

After assembly, adjust carburetor as described in "Adjusting Carburetor," "Initial Adjustment."

## FUEL STRAINER

MODEL M CARBURETOR

The fuel strainer, located underneath the carburetor float bowl, contains a fine mesh screen through which the fuel is forced to pass, trapping bits of dirt and any water that find their way into the fuel system. The unit should be cleaned and flushed at 2,000 mile intervals unless more frequent cleaning is indicated by irregular carburetion.

To clean the strainer, turn off fuel supply, turn off lower knurled cap and clean strainer. Washers need not be replaced unless they are faulty. The cap is replaced fingertight.

## AIR CLEANER

The air cleaner consists of a back plate, filter element and cover, arranged so all air drawn into carburetor passes through the filter. A mesh element traps all air borne dust to keep it from entering carburetor and engine.

METAL MESH TYPE FILTER ELEMENT

In normal service on hard surfaced roads, remove air cleaner mesh, wash in gasoline, and saturate with engine oil at least every 1,000 miles, or oftener under dusty service conditions. In extremely dusty service, clean and oil filter mesh every 100 miles or at least once a day.

DRY CORRUGATED TYPE FILTER ELEMENT

In normal service on hard surfaced roads, remove air cleaner cartridge every 1,000 miles, and shake cartridge by tapping lightly to remove loose dirt. If surfaces of element are oily or sooted, wash in gasoline. In extremely dusty service, both cleaning and cartridge replacement should be done more often.

## FUEL TANK

GENERAL

The fuel tanks are of welded steel construction.

Fuel tanks are treated to resist rusting. However, when motorcycle stands unoperated for any reasonable length of time, tanks should be drained and the tank interior bathed with an oil-fuel mixture of equal proportions. The fuel will evaporate leaving a protective oil film on tank walls. Moisture formation and subsequent damage may also be avoided by using only "good grade" anti-knock ethyl fuels with moisture absorbing additives.

REPAIRING LEAKING TANKS

Tank leaks may be arc welded, gas welded or soldered. However, only firms or persons qualified to make such repairs should be entrusted with the operation.

**WARNING**

If ALL traces of fuel are not purged, an open flame repair may result in a tank explosion. Extreme caution in all tank repair is recommended.

## FUEL SUPPLY VALVE

DIAPHRAGM TYPE WITH STRAINER (Fig. 3F-16)

The supply valve is located under the fuel tank. The valve has two handles; one is marked "reserve" and the other is unmarked. Fuel to carburetor is shut off when both handles are in horizontal position.

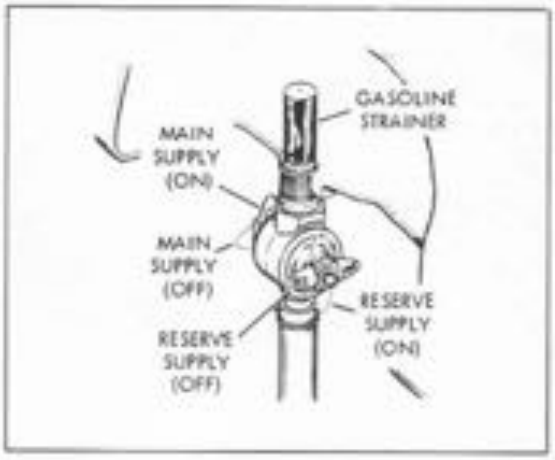



Figure 3F-16. Diaphragm Type Fuel Supply Valve and Strainer

Turning the unmarked handle to vertical position turns on main fuel supply; turning "reserve" handle to vertical position turns on reserve supply.

The fuel strainer is located on top of the supply valve inside the fuel tank. If the supply of fuel is impeded, as indicated by irregular carburetion, remove the supply valve from the tank and thoroughly clean the strainer. Be sure to drain the tank before removing the supply valve.

Before installing supply valve, coat threads with a fuel sealer.

## FUEL SUPPLY VALVE (INTERNAL TANK TYPE)

Fuel supply is shut off when plunger for reserve supply valve, located just ahead of the left tank filler cap, is turned down fingertight against its seat. The plunger is unscrewed (but not lifted) to use main fuel supply. The plunger is lifted to use reserve supply.

## ALIGNING FUEL SHUT-OFF VALVE FITTINGS

When a left tank has been repaired the fuel shut-off valve should be realigned using Gas Shut-Off Valve Tool, Part No. 96365-42. The tool aligns top and bottom holes and correctly spaces them so the fuel shut-off valve operates without binding.

The tool consists of four parts: 1. Aligning bar; 2. T-Handle; 3. Spacing Handle; 4. Stop Sleeve.



Use the tool as follows:

Remove left tank from motorcycle and disassemble all fuel fittings. Shift spacing handle in aligning bar so larger portion marked "aligning" is through hole. Turn aligning bar into bottom hole in tank and bend bottom of tank as needed to make end of bar line up with top hole in tank. Insert T-handle end fitting through top of tank and turn in part way.

Back out aligning bar until spacing handle may be shifted to portion marked "spacing." Turn aligning bar and spacing handle into each other until they are tight. Strike T-handle several sharp blows with hammer to square to tank fitting.

Remove tool and assemble valve rod and tank fittings.

94545-26 SPROCKET NUT WRENCH

94546-41 FLYWHEEL SHAFT NUT WRENCH

Fits 1-5/16" and 1-3/16" Nuts.

94555-55 GEAR SHAFT NUT SOCKET WRENCH

Fits pinion gear nut which secures pinion gear to gear shaft.

94585-30 CYLINDER BASE NUT WRENCH (5/8")

94590-30 CYLINDER HEAD BOLT WRENCH (9/16")

94645-41 CLUTCH HUB NUT WRENCH

94750-68 CARBURETOR LEAKAGE TESTER

Used to check inlet valve and internal leakage.

94800-26 SPIRAL EXPANSION REAMER

Used for reaming pistons and upper connecting rod bushings.

94802-36A CAM GEAR SHAFT BUSHING REAMER

Used to fit cam gear shaft bushings on 61, 74, OHV Models.

94804-57 ROCKER ARM BUSHING REAMER

Used to line ream replacement rocker arm bushings to correct size.

94805-57 PINION SHAFT BUSHING REAMER AND PILOTS

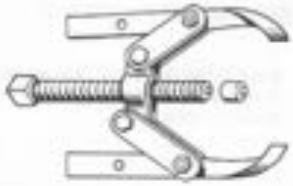
Used to size pinion shaft gear case cover bushing.

94830-47 VALVE GUIDE REAMER

Fits valve guides on 61, 74 OHV Models.

95635-46 ALL PURPOSE CLAW PULLER

Has center adapter for pulling parts from a small diameter shaft.

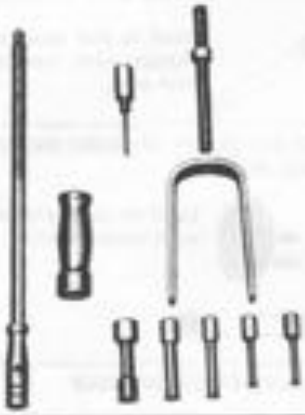


95637-46 WEDGE ATTACHMENT FOR CLAW PULLER

Used in combination with claw puller for pulling close fitting gears or bearings.

95760-69 BUSHING AND BEARING PULLER TOOL SET

For removing bushings and bearings.



95952-33 CONNECTING ROD CLAMPING TOOL

Used to hold connecting rod firmly so accurate work can be done when fitting piston pin bushing without disassembling crankcase.

95960-41A CLUTCH HUB AND CHAIN HOUSING PULLER

Four holes fit clutch hub studs. Four bolts fit tapped holes in chain housing.

95970-32A PISTON PIN BUSHING TOOL

Used to remove and replace piston pin bushings without removing connecting rod from crankcase.

96015-56 SPROCKET SHAFT EXTENSION AND BEARING PULLER

96137-52A FLYWHEEL SUPPORT PLATE

Used with arbor press to press Timken bearing onto sprocket shaft.

96179-18 PISTON SQUARING PLATE

Used on assembled crankcase to determine if a connecting rod is out of true.

INTERNAL LOCK RING PLIERS

Special pliers for removing and replacing retaining rings.

96215-49 Small
96216-49 Large

96333-51A PISTON INSERTER RING TOOLS

Used to insert pistons with rings into cylinders. Tool compresses rings to bore size.

### 96365-42 FUEL SHUT-OFF VALVE TOOL

Used on 1965 and earlier models with fuel shut-off valve on top of left fuel tank. Aligns top and bottom holes in tank and spaces them correctly.

### 96490-59A VALVE SEATING GAGE SET

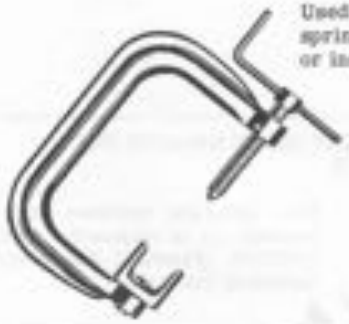
For checking valve seat location on 74-OHV models. Tool consists of two valves and gage having a step to show limits to which valve seat should be ground.

96492-66 Gage Valve only - 1966 Intake

### 96550-36 VALVE LAPPING TOOL

Used to rotate valve when grinding or lapping seat surfaces.

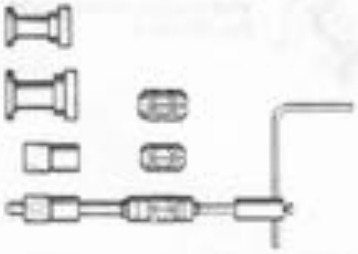
### 96600-36 VALVE SPRING COMPRESSOR



Used to compress valve springs while removing or installing valves.

### 96710-40 CRANKCASE MAIN BEARING LAP

Aligns right and left main bearing races as well as lapping to size.



### 96740-36 CONNECTING ROD LAPPING ARBOR

Used to lap connecting rod bearing races when fitting new rollers.

### 96780-32A PISTON LOCK RING TOOL

Used to remove and install piston pin lock rings.

96783-66 extra plug for late 1966 Models with thick wall piston pin.

### 96795-47 TORQUE WRENCH

Range 0 to 100 FT.-LBS. (1200 IN.-LBS.). Used to tighten head cylinder, manifold and generator bolts (etc.) where a definite, uniform tightness is specified. Also used with Valve Spring Tester Fixture, Part No. 96796-47.

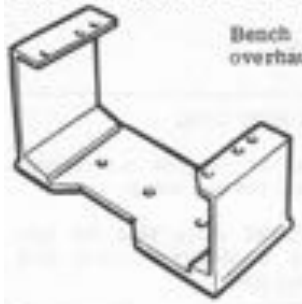
### 96650-30 TRUING STAND

Used to true flywheel shaft alignment. Measures and indicates alignment to .001".

96796-47 VALVE SPRING TESTER

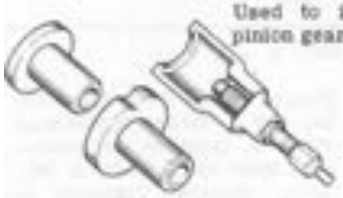
Special fixture with adjustable platform used with torque wrench part No. 96795-47.

96815-46 ENGINE REPAIR STAND



Bench stand which simplifies overhaul work.

96830-51 PINION GEAR PULLER AND COLLARS



Used to install and remove pinion gear.

96921-52 OIL PRESSURE GAUGE

Used to check oil pump pressure under actual operating conditions. Attaches to motorcycle. Graduated 0-60 pounds.

Includes adapter to attach hose fitting to 1958 and later 1/8 NPT thread oil pump outlet.

96950-68 VACUUM GAGE, 30" WATER

Measures chain case vacuum to detect air leaks.

96960-68 CARBURETOR CHECK VALVE TOOL

For Tillotsen diaphragm carburetor.

96962-68 CARBURETOR MAIN NOZZLE PUNCH

For Tillotsen diaphragm carburetor.

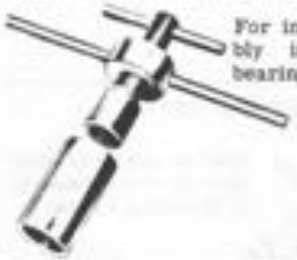
97087-65 HOSE CLAMP PLIERS

Used for tightening band type metal clamps on oil lines.

97194-57 TIMKEN BEARING OUTER RACE PRESS PLUG

For installing and removing Timken bearing outer race in crankcase

97225-55 SPROCKET SHAFT BEARING TOOL



For installing flywheel assembly into crankcase Timken bearing.

97235-55B SPROCKET SHAFT BEARING NUT WRENCH

For installing sprocket shaft bearing nut in conjunction with 97225-55 (Flywheel Assembly Installing Tool).

97272-60 NEEDLE BEARING TOOL

Used to assemble camshaft needle bearings.

# TRANSMISSION 4

TABLE OF CONTENTS

# GENERAL

## TRANSMISSION SPECIFICATIONS

### CLUTCH (4B)

| | |
|---|---|
| Type | Dry-multiple disc |
| Capacity | 248 lb.-ft. torque |
| Spring pressure (total) | 475 lbs. |
| Roller bearing fit | .002 - .003 in. loose |
| Spring adjustment | |
| 1967 & earlier | 31/32 in. from spring collar edge to outer disc surface. |
| 1968 | 1-1/32 in. from spring collar edge to outer disc surface. |

### CHAIN

| | |
|---|---|
| Type (primary) | 1/2 in. pitch, double |
| Looseness | 5/8 to 7/8 in. slack (cold engine) 3/8 to 5/8 in. slack (hot engine) |

### MAINSHAFT MAIN DRIVE GEAR (4D)

| | |
|---|---|
| Roller bearing | .0005 - .002 in. loose |
| Inner bearing | .002 - .003 in. |
| Drive gear end play | .003 - .013 in. |

### MAINSHAFT (4D)

| | |
|---|---|
| Low gear end bearing | |
| In housing | Snug fit |
| On shaft | Light press |
| Housing in case | Light press |
| Third gear | |
| End play | .000 to .017 in. |
| Bushing on shaft | .001 - .002 in. loose |
| Bushing in gear | Press fit |

### COUNTERSHAFT (4D)

| | |
|---|---|
| Drive gear end bearing | .0005 - .002 in. loose |
| Low gear end bearing | .0005 - .002 in. loose |
| Gear end play | .008 - .012 in. |
| Second gear | |
| End play | .003 - .002 in. |
| Bushing on shaft | .000 - .0015 in. loose |
| Bushing in gear | .0005 - .0025 in. loose |
| Low gear | |
| Bushing on shaft | .000 - .0015 in. loose |
| Bushing in gear | .0005 - .0025 in. loose |
| Shifter clutch clearance | |
| Low and second | .075 in. |
| Third and high | .100 in. |
| Sliding reverse gear | approx. .055 in. |
| Gear backlash | .003 - .006 in. |

### SHIFTER CAM (4D)

| | |
|---|---|
| End play | .0005 - .0065 in. |

## FUNCTION OF TRANSMISSION

The transmission is comprised of four major assemblies, the clutch, gear box, gear shifter and starter. Each is a part of power transmission from engine to rear wheel or a means of power control.

### CLUTCH

The clutch is made up of a drum or shell which is integral with the rear primary drive chain sprocket and which has inside a series of alternately positioned lined and unlined discs. The lined discs are doweled to the clutch hub which is keyed to the transmission shaft while the steel (unlined) discs are keyed to the clutch shell. When the clutch pressure plate is seated, a group of springs press the steel and lined discs together making a non-slipping connection between the engine and transmission.

### GEAR BOX

The gear box contains a series of gears on a mainshaft and countershaft which may be powered in a selection of ratios according to speed and load requirements.

### GEAR SHIFTER

The gear shifter is a unit mounted to the gear box which shifts the gear box components into desired ratios by means of shifting forks that slide shifter clutches into and out of mesh along shafts.

### STARTER

The kick starter provides a means of starting an engine by manual power. When pedal is moved in downward stroke, ratchet teeth in starter are engaged, transmitting the force through gear box and clutch and front chain to sprocket on engine crankshaft.

On 1965 and later models an electric starter motor and Bendix type drive unit engages a ring gear on the clutch to crank the engine.

### TRANSMISSION REPAIR PROCEDURE

When operating troubles develop in a transmission component, it is recommended procedure to first check following adjustments. If adjustments do not remedy the trouble, then proceed to disassembly and repair procedures.

1. Adjusting Clutch Control (4B)
2. Adjusting Clutch (4B)
3. Adjusting Shifting Linkage (4D)
4. Adjusting Foot Shifter Cover (4D)

If above adjustments do not correct trouble, disassemble and repair as described in repair sections. See "Locating Operating Troubles," Section 1C, for aids to diagnosing trouble. It is not necessary to remove transmission from chassis to disassemble clutch, starter, main drive gear oil seal or clutch release mechanism. However, extensive repairs are often easier and more quickly made if transmission unit is removed to bench as described in following section, "Stripping Motorcycle for Transmission Repair." The transmission can be removed as a unit (including clutch), or each component individually.

STRIPPING MOTORCYCLE FOR TRANSMISSION REPAIR

1. Remove battery ground wire. Remove footrest and chain housing cover. If motorcycle is equipped with compensating sprocket, use Compensating Sprocket Shaft Nut Wrench, Part No. 94557-55, to remove compensating sprocket shaft nut. If not equipped with compensating sprocket, use 1-3/8 inch socket or box wrench to remove nut. Loosen nut by striking wrench handle several sharp blows with hammer.

2. On 1965 models, remove chain adjuster mounting bolt and large brass starter shaft thrust washer.

3. Remove push rod adjusting screw lock nut (nut on center screw on clutch sprocket), slip washer (any metal washer about 1-3/4 in. in diameter with 3/8 in. hole) over push rod adjusting screw and replace lock nut. Remove three spring tension adjusting nuts and pull clutch outer disc and spring collar assembly off clutch drive hub pins. Move clutch sprocket and motor sprocket out with chain, and remove from shafts.

4. On 1964 and earlier models, remove cotter pin, nut, flat washer and spring from each of the two inner chain guard rear mounting bolts. Bend back the ears of screw lock away from the three cap screws around the engine sprocket shaft that secure the front end of inner chain guard to engine crankcase, and remove cap screws and lock. Remove oil drain pipe from inner chain guard.

5. On 1965 and later models, remove clutch hub using Clutch Hub Nut Wrench, Part No. 94645-41 and Clutch Hub Puller, Part No. 95960-41A. Remove mainshaft key. Loosen the five transmission base mounting bolts. Remove the three bolts attaching chain housing to engine crankcase and four bolts attaching housing to transmission. Remove the two chain housing stud nuts attaching starter housing to chain guard. Remove wires connected to starter solenoid terminals. Pull inner chain housing loose from mainshaft using Puller, Part No. 95960-41A which has four screws to fit tapped holes in chain housing. Care must be taken to be sure housing moves out squarely as front end is snug fit on shoulder of crankcase. As housing is pulled out shake starter assembly shaft to free it from gear in starter motor housing. Remove chain oiler hose at oil pump. Remove chain housing oil return hose at rear of chain guard and vent hose at T-connection and move housing away. Remove battery carrier bracket and regulator ground strap from right side of transmission. Remove right Buddy Seat footrest bracket. Remove starter motor bracket and pull starter motor out left side. Remove kick starter crank.

6. On all models, remove clutch control rod from clutch release lever by loosening lock nut at pedal (foot control clutch) or at booster connection (hand control clutch) and turning rod out until length has been increased enough to slide flat portion out of slot in clutch release lever.

7. Disconnect shifter rod from transmission cover by removing nut and bolt or cotter pin and clevis pin.

8. Disconnect speedometer drive cable and housing from transmission. Disconnect neutral indicator switch wire clip.

9. Remove rear chain connecting link and chain. Remove bolt which secures transmission to support bracket on right side of frame.

10. Remove bolts and cap screws which secure transmission mounting plate to chassis.

11. Remove complete transmission with mounting plate.

Reassembly is made in reverse order excepting as follows:

On 1965 models, when installing chain housing, "Grade A" Loc-Tite must be used on main shaft to secure inner race of ball bearing in case to shaft.

The four nuts securing the transmission to mounting plate as well as the bolt which secures transmission to frame support bracket should be left loose to facilitate easy alignment of the chain housing with engine crankcase and transmission bolts.

Case bolts on engine and transmission should be tightened evenly so housing does not bind on transmission mainshaft or shoulder on engine crankcase. Final tightening should start at three bolts at engine crankcase, then four bolts at transmission, then four base mounting nuts and bolts securing transmission to chassis bracket.

NOTE

It is not necessary to remove transmission from chassis to adjust or repair the clutch or starter mechanism.

# CLUTCH

GENERAL

The clutch or clutch control mechanism need attention when the clutch slips under load, or drags in released position. For causes of slipping clutch see "Locating Operating Troubles," Section 1C. Before disassembling clutch when repair is indicated, readjust gear shifter control and clutch spring tension. It is not necessary to remove transmission from chassis to adjust or repair clutch.

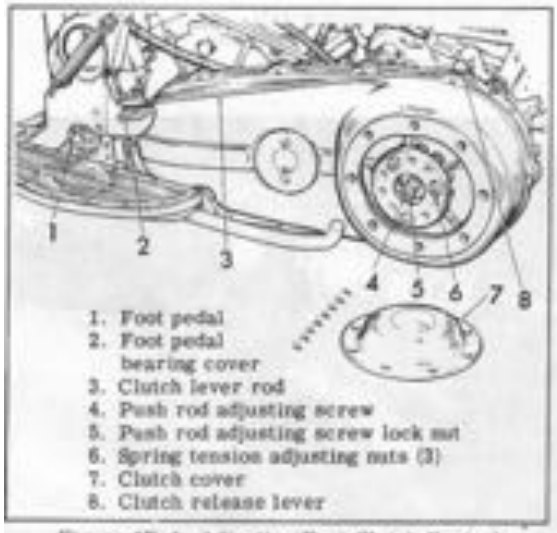
ADJUSTING FOOT CLUTCH CONTROL (Fig. 4B-1)

With foot pedal (1) in fully disengaged position (heel down), the clutch lever (8) should strike the transmission case cover. Adjust length of the foot pedal rod (3) to just clear the foot pedal bearing cover (2) so the rod is not bent down by the bearing cover.

On 1964 and earlier models, remove the chain guard clutch cover (7). On 1965 models, remove the chain housing cover. Move the foot pedal (1) to a toe down or fully engaged position, loosen the lock nut (5) and readjust the push rod adjusting screw (4) with a screwdriver so that the end of the clutch lever (8) has about 1/8 in. free movement before clutch disengages. On 1964 models, clutch lever should strike the transmission case cover. On 1965 models, clutch lever should be 1/4 in. away from starter drive housing. Turn screw (4) right for less movement and left, for more.

ADJUSTING HAND CLUTCH CONTROL (1968 AND LATER MODELS) FIG. 4B-1A

Adjust control cable sleeve (1) as required to maintain approximately 1/4 inch free hand lever movement before clutch starts to disengage. To adjust, loosen adjusting sleeve lock nut (2) turn threaded sleeve out for less hand lever free play or into bracket (3) for more hand lever free play and retighten lock nut.




1. Foot pedal
2. Foot pedal bearing cover
3. Clutch lever rod
4. Push rod adjusting screw
5. Push rod adjusting screw lock nut
6. Spring tension adjusting nuts (3)
7. Clutch cover
8. Clutch release lever

Figure 4B-1. Adjusting Foot Clutch Control (1964 model shown)

If sleeve adjustment has been all taken up or there are other indications of incorrect clutch operation such as slipping clutch, gear clash due to dragging clutch when shifting, the following adjustments should be made in the order shown.

Move end of lever on transmission forward until it becomes firm indicating that all slack in the actuating mechanism has been taken up.

Measure clearance between starter motor (7) and clutch release lever (8) which should be 3/8 to 5/8 inch. If not within this range, adjust as follows:

Loosen control coil adjusting sleeve lock nut (2) (Fig. 4B-1A) and turn control coil adjusting sleeve (1) all the way into bracket. Remove chain housing cover, loosen clutch push rod screw lock nut (4) and turn screw (5) in (clockwise) to move lever (8) to the rear, or outward (counterclockwise) to move end of lever forward. When 1/2 inch clearance between lever and starter motor has been attained, tighten lock nut (4) and reinstall chain housing cover.

IMPORTANT

Chain housing must be airtight with cover reinstalled — use new cover gasket and gasket sealer.

Adjust clutch hand lever for 1/4 inch free movement before clutch starts to release by turning adjusting sleeve (1) outward and retighten lock nut (2).

Adjust clutch hand lever for 1/4 inch free movement before clutch starts to release by turning adjusting sleeve (1) outward and retighten lock nut (2). To disassemble cable from hand lever at anchor pin, turn sleeve into bracket (3) and remove cable from side slot as shown in figure 4B-1A. When reassembling cable ferrule in hand lever anchor pin with side slot, be sure slot is toward inside as shown. Earlier type pin with slotted end should have open end facing downward.

ADJUSTING HAND CLUTCH BOOSTER CONTROL (Fig. 4B-2)

The booster type clutch hand control requires occasional adjustment of control coil adjusting sleeve (1) and the clutch lever rod (5) to maintain the correct amount of free movement for hand lever on handlebar and clutch actuating lever.

If major readjustment is indicated by hand lever becoming hard to operate, clutch control booster bellcrank failing to return to forward position when hand lever is released, slipping clutch, or dragging clutch manifested by gear clash when shifting, the following

adjustments should be made:

Loosen clutch lever rod lock nut (7) and adjust clutch lever rod (5) far enough so clutch actuating lever (1, Fig. 4B-3) has about 1/2 in. free movement. Move end of actuating lever forward to a position where it becomes firm indicating that all slack in the actuating mechanism has been taken up. On 1964 and earlier models: The distance from the foot shifter housing on transmission to the outer edge of chamfered slot in lever (1) should be 4-1/4 in. as shown in Fig. 4B-3. 1965 and later models: The distance between the chain housing and clutch lever rod should be 1/4 in. If necessary, readjust to obtain this measurement as follows:

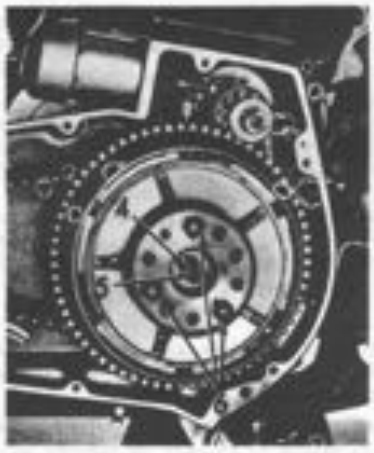
Remove clutch cover or chain housing cover, loosen push rod adjusting screw lock nut (4) and turn push rod adjusting screw (3) in (clockwise) to move lever to rear; out (counterclockwise) to move lever forward. When correct position of lever has been attained, tighten lock nut.

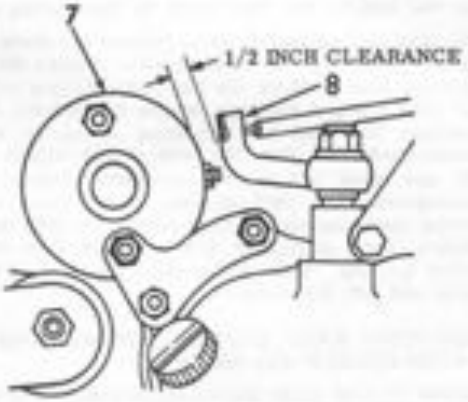
Refer to Fig. 4B-2. Loosen control coil adjusting sleeve lock nut (2) and turn in adjusting sleeve until clutch hand grip has an inch or more free play.

Loosen bell crank adjusting screw lock nut (4) and tighten bell crank adjusting screw (3) until bell crank (8) fails to go across top dead center, as shown, when moved back and forth by hand.

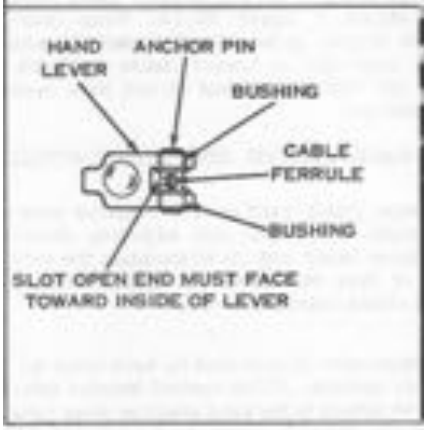
Loosen clutch booster spring tension upper adjusting nut (13) as far as it will go.

Turn out bell crank adjusting screw a little at a time until bell crank moves over top dead center and remains in that position when released. Move bell




1. Clutch cable adjusting sleeve
2. Sleeve lock nut
3. Bracket
4. Clutch push rod adjusting screw lock
5. Clutch adjusting screw
6. Clutch spring adjusting nuts
7. Starter motor
8. Clutch release lever



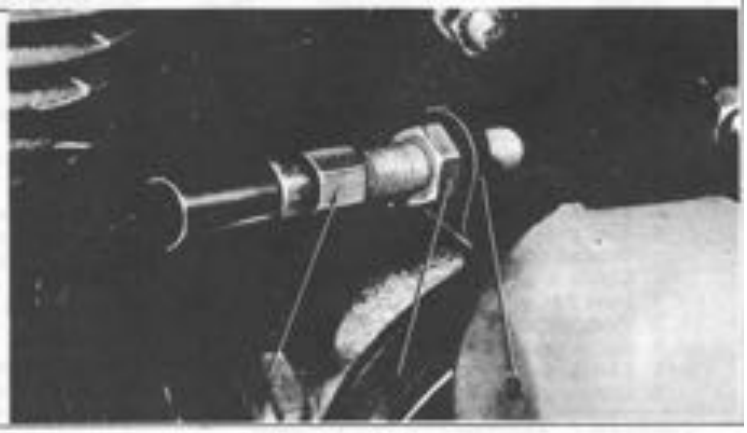
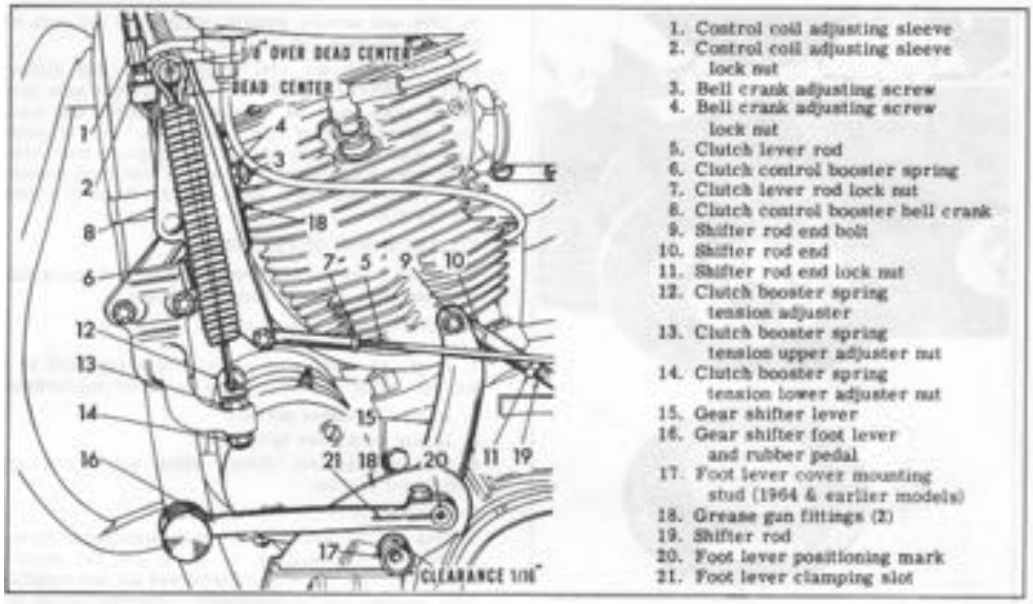



Figure 4B-1A. Adjusting Hand Clutch (1968 Model)




1. Control coil adjusting sleeve
2. Control coil adjusting sleeve lock nut
3. Bell crank adjusting screw
4. Bell crank adjusting screw lock nut
5. Clutch lever rod
6. Clutch control booster spring
7. Clutch lever rod lock nut
8. Clutch control booster bell crank
9. Shifter rod end bolt
10. Shifter rod end
11. Shifter rod end lock nut
12. Clutch booster spring tension adjuster
13. Clutch booster spring tension upper adjuster nut
14. Clutch booster spring tension lower adjuster nut
15. Gear shifter lever
16. Gear shifter foot lever and rubber pedal
17. Foot lever cover mounting stud (1964 & earlier models)
18. Grease gun fittings (2)
19. Shifter rod
20. Foot lever positioning mark
21. Foot lever clamping slot

Figure 4B-2. Adjusting Hand Clutch Booster (1967 & Earlier)

crank by hand, not with control hand lever. Bell crank should find locked position at about 1/8 in. over dead center. Tighten adjusting screw lock nut (4).

Adjust clutch lever rod (5) so clutch actuating lever has 1/16 in. free movement. Tighten clutch lever rod lock nut (7).

Turn adjusting sleeve (1) upward until end of clutch hand lever has 1/2 in. free movement before releasing pressure is applied to clutch. Tighten lock nut (2).

Depress clutch hand lever fully. Tighten clutch booster spring tension lower adjusting nut (14) until hand lever remains depressed. Slowly loosen lower adjusting nut enough to allow hand lever to return to fully extended position. Tighten upper adjusting nut (13).

## ADJUSTING CLUTCH

If the clutch slips after adjusting clutch controls, increase spring tension on the three clutch spring guide stud nuts (6, Fig. 4B-1) or (6, Fig. 4B-1A). Remove chain housing cover and tighten all three nuts one-half turn at a time until clutch holds. Test after each half turn by cranking the engine. Usually a clutch that holds without noticeable slipping when cranking the engine will hold under normal road conditions. Do not increase spring tension any more than is necessary to make clutch hold.

A new clutch is assembled so the distance from inner edge of spring collar (2, Fig. 4B-4) to the surface of the outer disc (9) is exactly 31/32 in. for 1967 and earlier models or 1-1/32 in. for 1968 and later models. If springs are compressed so this distance is 7/8 in. or less, the clutch probably cannot be fully disengaged.

When clutch will not hold without tightening beyond this limit, disassemble the clutch for inspection of the clutch discs. Discs may be worn or oil soaked and in need of replacement or washing.

## DISASSEMBLING CLUTCH (Fig. 4B-5)

Remove outer chain guard or chain housing cover.

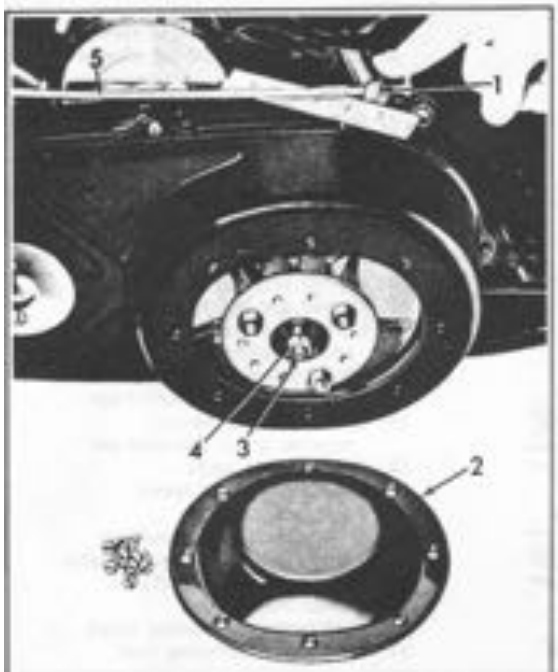
Remove push rod adjusting screw lock nut (1). Place a flat washer about 1/8 in. thick with 1-3/4 in. outside diameter and 3/8 in. hole over the adjusting screw (2). Replace lock nut and turn down until three spring tension adjusting nuts (3) are free. The nuts may then be removed and the spring collar-springs-outer disc assembly (4, 5 and 6) may be slipped off clutch hub dowels and studs as shown in Fig. 4B-4. Do not disassemble these parts unless necessary for spring, spring collar or outer disc replacement.

Remove spring disc (7, if used). Remove steel discs (8) and lined friction discs (9).

Remove engine sprocket or compensating sprocket as described in "Stripping Motorcycle for Transmission Repair."

Remove clutch shell (10) and primary chain from clutch hub.

Pry back ear on clutch hub nut lock washer. Remove clutch hub nut (11) using Clutch Hub Nut Wrench, Part No. 94645-41. Thread is left hand. Loosen nut by striking wrench handle several sharp blows with a mallet. Remove clutch hub nut lock washer (12) and




1. Clutch actuating lever
2. Clutch cover
3. Push rod adjusting screw
4. Push rod adjusting screw lock nut
5. Clutch lever rod

Figure 4B-3. Positioning Clutch Release Lever (1964 model shown)

on 1964 and earlier models, strip push rod cork oil seal (13) off push rod.

Remove clutch hub (14) using Clutch Hub Puller, Part No. 95960-41A. Turn tool center bolt back until puller plate may be slipped over clutch hub studs and against ends of clutch hub pins. Secure puller plate with the three clutch spring guide stud nuts. Turn down tool center screw until clutch hub breaks free from gear box shaft taper. Remove clutch hub key (15).

## CLEANING AND INSPECTION

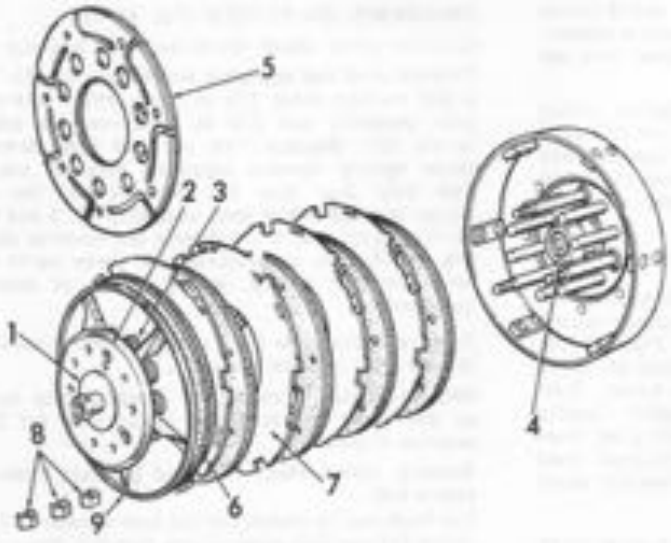
Wash all parts except friction discs in cleaning solvent and blow dry with compressed air.

Examine friction discs for:

1. A glazed surface which may be recognized by a smooth, shiny and sometimes darkened appearance.
2. Worn or grooved surface.
3. Lining worn down to rivets.
4. Oil impregnated linings which will sometimes accompany glazing.
5. Cracked or chipped linings.

Glazed and oil soaked discs may sometimes be reconditioned by soaking in white gas for several hours, blowing dry with compressed air and roughing with medium coarse sandpaper. Grooved linings and linings worn down near the rivets must be replaced. Chipped or cracked linings must also be replaced. Badly glazed and burned linings are probably beyond reconditioning and should be replaced.

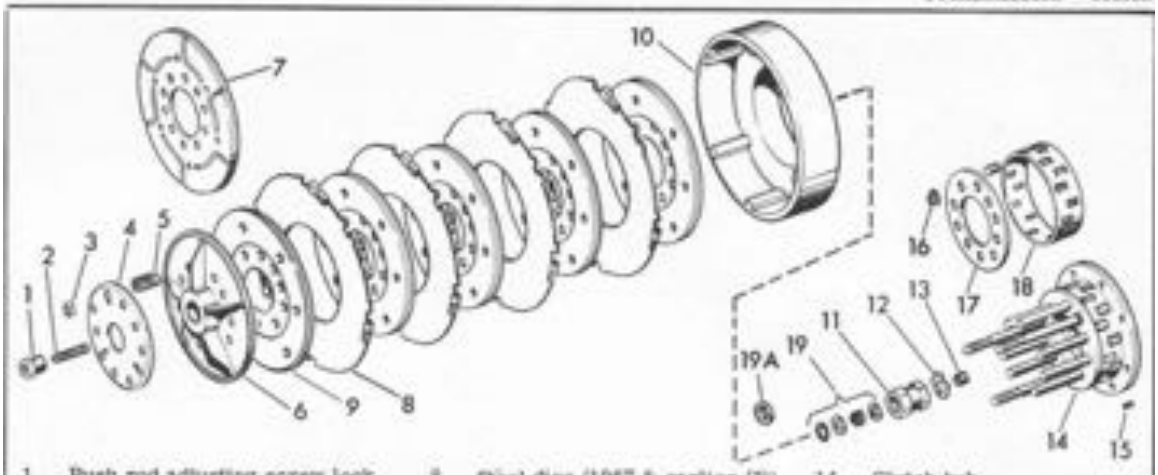
Steel discs that are grooved or warped should be replaced. Depress steel disc buffer balls with fingertip. If they do not snap back in place, spring is worn and buffer assembly must be replaced.




1. Flat washer
2. Spring collar
3. Spring
4. Clutch hub nut
5. Spring disc (1967 & earlier)
6. Friction discs (1967 & earlier (3)) (1968 & later (5))
7. Steel discs (1967 & earlier (3)) (1968 & later (4))
8. Spring tension adjusting nuts (3)
9. Outer disc

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4B-4. Removing Clutch




| | | |
|---|---|---|
| 1. Push rod adjusting screw lock nut | 8. Steel disc (1967 & earlier (3)) (1968 & later (4)) | 14. Clutch hub |
| 2. Adjusting screw | 9. Friction disc (1967 & earlier (3)) (1968 & later (5)) | 15. Clutch hub key |
| 3. Spring tension adjusting nut (3) | 10. Clutch shell | 16. Bearing plate spring (3) |
| 4. Spring collar | 11. Clutch hub nut | 17. Bearing plate |
| 5. Springs (10) | 12. Hub nut lock washer | 18. Bearing retainer |
| 6. Outer disc (pressure plate) | 13. Push rod cork oil seal (1964 & earlier) | 19. Hub nut seal parts (1964 & earlier) |
| 7. Spring disc (1967 & earlier) | | 19A. Hub nut seal (1965 & later) |

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4B-5. Clutch Assembly - Exploded View

Check bearing race inside clutch shell. If it appears grooved or pitted, the shell should be replaced.

Revolve clutch hub roller bearing. If it sticks or feels rough, inner bearing race is probably pitted and should be replaced. Disassemble clutch hub as follows:

Remove three bearing plate springs (16), slip bearing plate (17) off hub pins and remove bearing retainer (18). If inner race thus exposed proves to be worn, replace hub.

Clutch springs occasionally set or become fatigued, especially when excessive heat has been produced by operating motorcycle with a slipping clutch. If this has been the case, or if clutch discs are in good condition but it was not possible to obtain a suitable clutch adjustment, check clutch spring free length. Also check spring compression using the Valve Spring Tester, Part No. 96797-47. 1967 and earlier spring free length should be 1-31/64 in., and compression test should be from 42 to 52 pounds at 1-1/8 in. 1968 and later spring free length should be 1-45/64 in. and compression test should be from 30 to 38 lbs. at 1-1/4 in. Replace springs not meeting compression specifications and those with a free length below specified figure, compression testing to near low tolerance range figure.

On 1964 and earlier models, check push rod oil seal spring located inside clutch hub nut with fingertip. If the spring returns both washers to position against shoulder or spring ring, parts (19) are serviceable.

On 1965 models, lip type seal (19A) should be inspected and replaced if worn or damaged.

ASSEMBLING CLUTCH (Fig. 4B-5)

Assemble clutch in approximate order of disassembly.

If parts 1, 2, 4, 5 and 6, have been disassembled, preassemble them on clutch hub as follows: Place clutch releasing disc (6) on hub. Position springs (5) on pins and studs. Place spring collar (4) over springs. Note that stud holes are arranged so it fits in only one position. Turn adjusting screw lock nut on adjusting screw until head is flush, then turn into pressure plate with 1-3/4 in. washer under nut. Remove this assembly from hub.

Place key in slot in mainshaft. Slip clutch hub onto shaft. Install new cork oil seal on clutch push rod. Position washer followed by hub nut. Tighten nut with the special wrench. Strike wrench handle several sharp blows with mallet. Bend over the ear on washer matching hub nut flat. Grease clutch shell bearing and install clutch shell.

Install lined and steel discs in clutch shell, staggering position of steel disc buffers in key slots in shell. Make sure steel discs are installed with side stamped "OUT" facing outward.

Install pressure plate assembly. Draw down adjusting nut until stud nuts may be started. Turn down stud nut until 1-3/4 in. washer is loose. Remove washer and replace adjusting nut.

Draw down stud nuts evenly until distance from back of pressure plate to front of clutch releasing disc is 31/32 in. for 1967 and earlier models or 1-1/32 in. for 1968 and later models.

Make final adjustments to clutch as described in "Adjusting Clutch Foot Control," or "Adjusting Clutch Hand Control," and "Adjusting Clutch."

# KICK STARTER

DISASSEMBLING KICK STARTER (Fig. 4C-1)

Remove kick starter assembly from gear box as follows:

Place oil drain pan under transmission. Remove starter cover nuts (1) and plain washers (2). If transmission is in chassis, remove clutch lever rod from left end of clutch release lever. Cover assembly with clutch release lever assembly is then free to be pulled off mounting studs. Clutch release bearing (3) will come off with cover. If starter cover binds, release bearing is binding on starter clutch. Pry bearing off starter clutch. Do not pry cover for it will damage bearing. With starter cover removed, push rod (4) is free to be pulled out of mainshaft.

Clamp crank (8) in vise, bend ear of lock washer (6) away from flat of starter crank nut (5) and remove nut and lock washer (6). Remove starter gear (7) using the Harley-Davidson All Purpose Claw Puller, Part No. 95635-46. If puller is not available, remove starter crank from vise, and drive starter crank out of starter gear with rawhide mallet. Be sure to hold starter crank and cover from swinging when shaft is free from gear.

With starter gear removed, crank (8) can be pulled out of cover. Thrust washer (9) is installed between starter crank spring (10) and cover (11) with chamfered side of washer facing spring.

Remove nut (12) and lock washer (13), and pull release lever (14) from end of clutch release lever shaft (15) using All Purpose Claw Puller.

Remove cotter pin (16) and plain washer (17) from lower end of release lever shaft, which can then be pulled out of cover, freeing release finger (18) and thrust washer (19).

CLEANING, INSPECTION AND REPAIR (Fig. 4C-1)

Wash all parts in a grease solvent and blow dry.

Insert starter crankshaft in starter cover and check play. If play is appreciable, press out bushings (20) and install new parts. If transmission was leaking oil out starter crank, install new oil seal (21). Bushings are pressed in with outside ends just flush with bushing boss and outer surface of cover.

Bushings (22 and 23) rarely need replacement. However, check fit of release lever shaft and press out old bushings and install replacement parts if shake is considerable.

Check clutch push rod bearing for wear. Replace unit that grinds, feels rough or loose when rotated.

Check starter crank gear cam plate and gear pin to be sure they are in good condition, especially if starter crank bushings were replaced.

ASSEMBLING STARTER (Fig. 4C-1)

Install release lever shaft (15) and release finger (18) in cover with thrust washer (19) located between finger and bushing (23), and plain washer (17) and cotter pin (16) on end of shaft.

Install starter crank spring (10) and thrust washer (9) on starter crank with chamfer side facing spring, and apply a film of light grease on oil seal (21) and on end of starter crank shaft before installing crank (8). Hold crank in vise and wind spring by turning cover clockwise. Install starter crank gear (7) so dowel pin holds crank in normal, upward position. Install lock washer (6) and nut (5) and tighten nut securely. Bend over one ear of lock washer against one flat of nut. Install gasket (24) over studs on case.

Before starter cover is installed, clutch release bearing (3) is inserted into cover, with slot in outer bearing race engaging clutch release finger (18). Insert push rod (4) small diameter end into clutch release bearing and place the other end into mainshaft. With push rod serving as pilot, move cover assembly into place. Groove in clutch release bearing inner race and ball plunger in starter clutch must align so they will be engaged when assembly is completed. Turn on and draw up all cover nuts and washers.

Refill unit with 1-1/2 pints of same grade oil used in engine.

DISASSEMBLING STARTER CLUTCH (Fig. 4C-1)

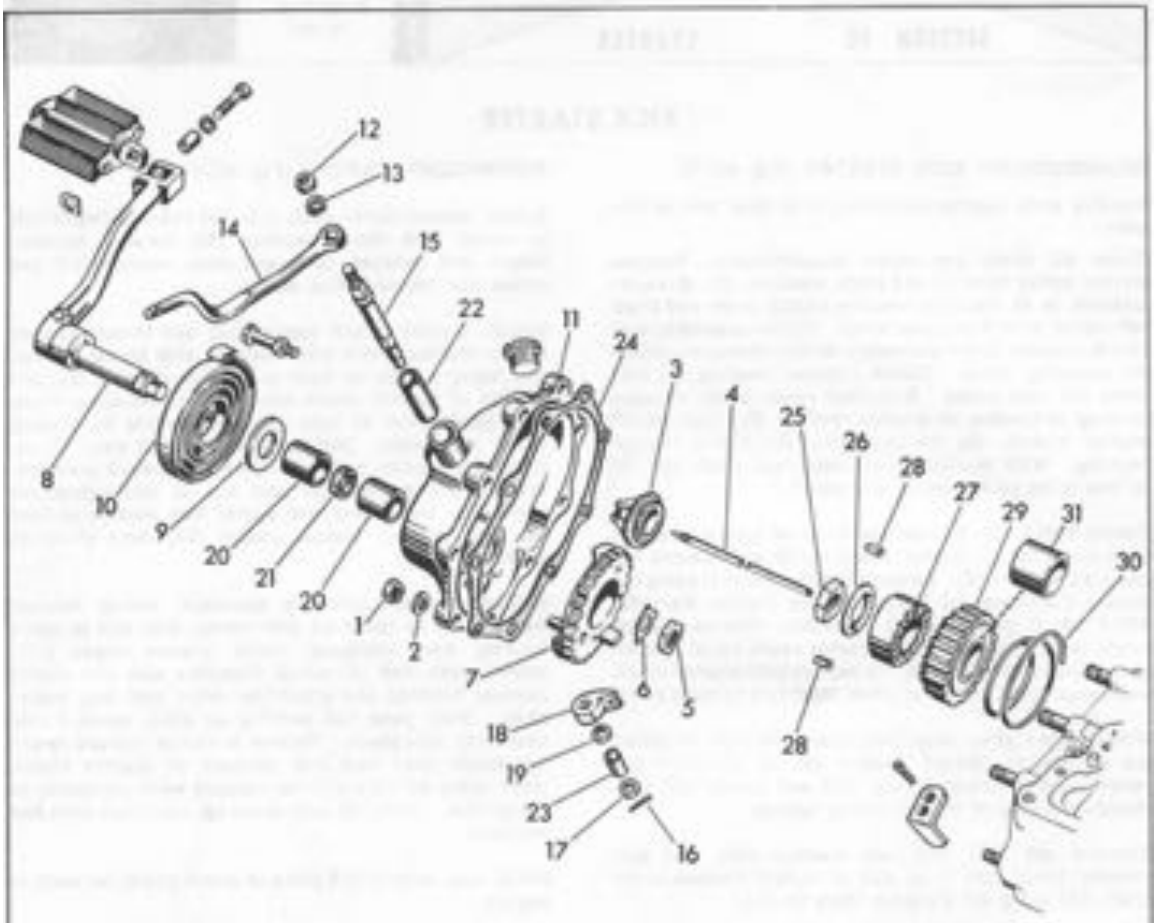
Remove starter cover assembly as described in "Disassembling Starter," and proceed as follows:

Bend ear of lock washer away from flat of starter clutch nut (25) and remove nut and washer (26). Pull starter clutch (27) from mainshaft taper with Starter Clutch Puller, Part No. 95650-42. With starter clutch removed, starter clutch keys (28), starter mainshaft gear (29) and starter clutch spring (30) are free to be removed from mainshaft.

CLEANING, INSPECTION AND REPAIR (Fig. 4C-1)

Wash all parts except gasket (24) in grease solvent and blow dry with compressed air.

Examine teeth on starter clutch and starter gear (29), ratchet teeth on mainshaft gear and starter clutch. Teeth should be sharp edged. If teeth are rounded or mushroomed and rider has experienced ratchet slip, replace worn parts. If starter clutch nut has previously been drawn down too tight, starter clutch may be cracked. If cracked, it is usually difficult to get the starter clutch out of clutch release bearing when disassembling starter cover.




| | | | |
|---|---|---|---|
| 1. Starter cover nut (9) | 9. Thrust washer | 17. Plain washer | 25. Starter clutch nut |
| 2. Plain washer (9) | 10. Starter crank spring | 18. Release finger | 26. Starter clutch washer |
| 3. Clutch release bearing | 11. Starter cover | 19. Thrust washer | 27. Starter clutch |
| 4. Push rod | 12. Release lever nut | 20. Starter crank bushing (2) | 28. Starter clutch key (2) |
| 5. Starter crank nut | 13. Lock washer | 21. Oil seal | 29. Starter mainshaft gear |
| 6. Eared lock washer | 14. Release lever | 22. Release lever bushing | 30. Starter clutch spring |
| 7. Starter gear | 15. Release lever shaft | 23. Release lever bushing | 31. Mainshaft gear bushing |
| 8. Crank | 16. Cotter pin | 24. Starter cover gasket | |

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4C-1. Kick Starter Assembly - Exploded View

Position mainshaft gear (29) on shaft and check play. If obviously loose, replace bushing (31).

ASSEMBLING STARTER CLUTCH (Fig. 4C-1)

Coat gasket (24) with Perfect Seal No. 4 and position on gear box. Lubricate mainshaft with engine oil and slip spring (30) and mainshaft gear over shaft. Bushing should be loose enough on mainshaft to allow gear to slide under force of compressed starter clutch spring. If necessary, line ream bushing to achieve free fit.

Position starter clutch, drive in starter clutch keys and assemble remainder of parts in reverse order of disassembly.

Be careful not to draw down nut (25) too tight. Don't go beyond a point where top of starter clutch is less than 5/8 in. above edge of gear box.

# ELECTRIC STARTER

STARTER DRIVE (Fig. 4C-1C)

The Bendix type drive shaft and gear assembly, located in starter housing between starting motor and clutch ring gear, provides automatic means of engaging the starter shaft drive pinion with the ring gear on the clutch sprocket for cranking the engine, and for disengaging the drive pinion from the ring gear after the engine starts.

When the starter motor is not operating, the drive shaft worm pinion is disengaged from the ring gear.

When the starter switch button closes starting circuit, the solenoid armature shaft (1) pulls shifter lever (2). Fingers on lever engage groove in shifting collar (3) which forces pinion gear (4) into engagement with clutch ring gear (5). At the same time, solenoid also closes starter motor circuit thus turning the ring gear and cranking the engine. After the engine starts and switch button is released spring return on solenoid shaft returns lever so that pinion gear disengages from ring gear and starter motor shuts off. There are matching spiral threads on starter shaft (6) and pinion gear (4) so pinion will shift if mating teeth do not line up for going into mesh. If starter button is not released after engine starts, pinion gear will turn freely by means of overrunning clutch (7) to prevent damage to starter.

DISASSEMBLING STARTER AND SOLENOID (Fig. 4C-1D)

DISASSEMBLING SOLENOID:

Remove solenoid as follows:

Disconnect battery ground wire from battery terminal post. Remove cover (1) and disconnect wires from starter solenoid terminals held by nuts and lockwashers (2) and (3).

Remove chain housing cover.

Depress retainer cup (4), remove pin (5) from hole in plunger (11) shaft. Remove spring (6).

Remove solenoid attaching bolts and lockwashers (7) and spacer bar (8). Remove solenoid (13) with boot (9), gasket (10), plunger (11), plunger spring (12).

DISASSEMBLING STARTER DRIVE SHAFT AND HOUSING

Remove starter drive shaft and parts as follows:

Remove solenoid as described in previous paragraph.

Rotate starter pinion lever (25) end forward and disengage lever fingers from pinion gear shifting collar (20). Pull pinion gear and shaft assembly (14) from housing. Note drive gear (27) will remain in drive shaft housing (28).

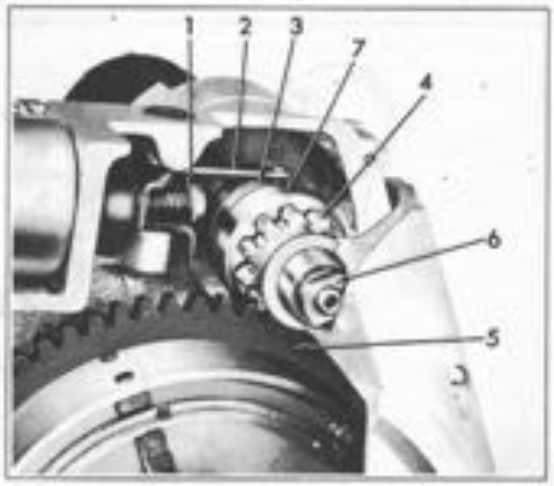



Figure 4C-1C. Starter Drive

To disassemble pinion gear and shaft assembly (14) remove thrust washer (15). Place nut (16) between copper jaws in a vise and unscrew from shaft which has a left hand thread. Remove pinion gear assembly (17). Remove lock ring (18) to separate gear (19) and shifter collar (20). Remove snap ring (21) or spacer (21A) from shaft (22).

To remove starter shifter lever (25), it is necessary to either remove inner chain housing (See Stripping Motorcycle for Transmission Repair, Section 4A) or remove oil tank.

Remove screw (24) and lever (25) from chain housing.

Remove starter shaft housing from chain housing studs as follows:

Remove starter motor and housing as an assembly by removing nuts and lockwashers (23) from chain housing studs. (See Starter Motor, Section 5L-5.)

Remove oil deflector (26) and gear (27) from starter shaft housing (28). Washer (29) is staked in place in housing recess. Needle bearings (30) and (31) are pressed into housings at shaft ends. Washer (29) presses out with needle bearing (30).

Replace deflector O-ring (26A) if worn or damaged. To service starter motor see Section 5L.

ASSEMBLING STARTER AND SOLENOID (Fig. 4C-1D)

Assembly is essentially the reverse of disassembly except as follows:

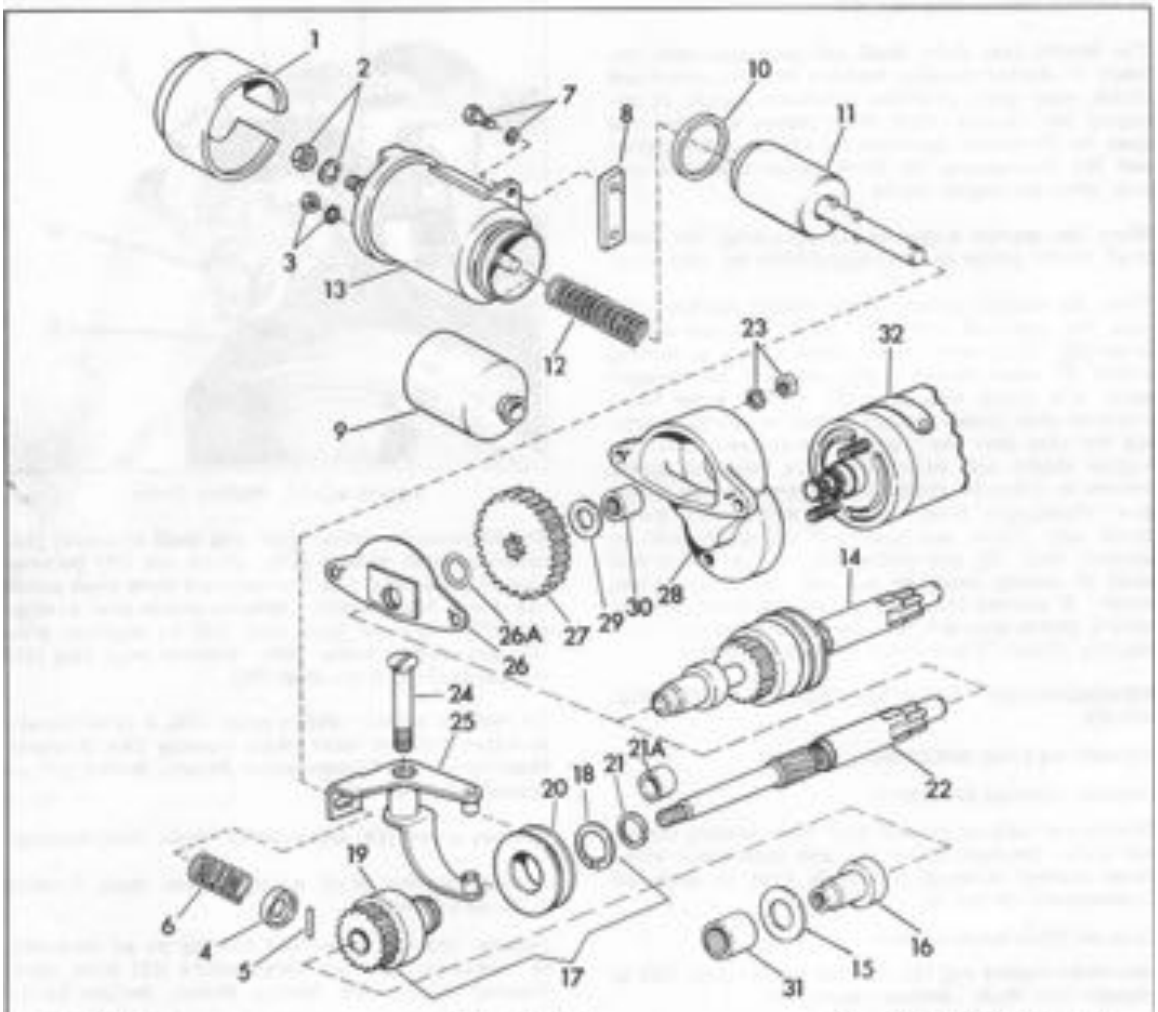
Clean needle bearings (30 and 31) and repack with grease. If replaced, needle bearing (30) should be pressed in flush with outside of housing. Stake washer (29). Pinion (19) and shaft (22) should be assembled with no lubrication on worm threads.

Shaft nut (16) should be secured to shaft with Loc-Tite "grade A". Wash parts in white gas or cleaning fluid before applying Loc-Tite to threads.

Connect battery cable to longest solenoid terminal stud.

**CAUTION**

If cables are reversed, the solenoid will remain in battery circuit.




1. Cover
2. Terminal nut and lockwasher (2)
3. Terminal nut and lockwasher
4. Retainer cap
5. Pin
6. Spring
7. Bolt and lockwasher (2)
8. Spacer bar
9. Boot
10. Gasket
11. Plunger
12. Plunger spring
13. Solenoid
14. Pinion gear and shaft assembly
15. Thrust washer
16. Pinion shaft nut
17. Pinion and shifter collar assembly
18. Lock ring
19. Pinion gear
20. Shifter collar
21. Lock ring (early 1965)
21A. Spacer (late 1965)
22. Shaft
23. Nut and lockwasher (2)
24. Shifter lever screw
25. Shifter lever
26. Oil deflector
26A. Oil deflector O-ring (late 1965)
27. Drive gear
28. Starter shaft housing
29. Washer
30. Needle bearing
31. Needle bearing
32. Starter motor

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4C-1D. Starter Shaft, Housing and Solenoid,- Exploded View

# GEAR BOX

## ADJUSTING SHIFTING LINKAGE

HAND SHIFT. The hand shift normally requires adjustment only to compensate for wear or when transmission has been moved. Only the shifter rod needs adjustment to maintain correct hand shift lever position. On 1964 and earlier models this will be necessary whenever front chain adjustment is made.

To adjust hand shift move the shifting lever to third position on four-speed transmissions and to second position on three-speed transmissions.

Disconnect shifter rod from shifter lever; with slight backward and forward movement carefully "feel" the transmission lever into exact position where the shifter spring plunger (inside transmission) seats fully in its retaining notch.

By turning the clevis in or out, carefully refit the shifter rod to the shifting lever, without disturbing the shifting lever's exact positioning.

FOOT SHIFT. The foot shift normally requires adjustment only to compensate for wear or when transmission has been moved. Only the shifter rod needs adjustment to maintain correct foot lever pedal position. On 1964 and earlier models this will be necessary whenever front chain adjustment is made.

Check to make sure that clamping slot in shifter lever is in alignment with notch or mark in end of foot shift lever shaft, see section 4B.

Note: For 1964 and earlier models only, adjust length of shifter rod so that the foot lever, when fully depressed, has about 1/16 in. clearance from foot lever cover mounting stud. Length of rod is adjusted by removing shifter rod end bolt, loosening shifter rod end lock nut, and turning rod end farther on or off rod. This rod adjustment is important, as any interference between foot lever and cover mounting stud will prevent full movement of foot lever and full engagement of shifting parts inside transmission.

ADJUSTING FOOT SHIFTER COVER. When it is impossible to shift foot shifting mechanism into all gears, adjust as follows:

Disassemble shifter cover parts 1 through 12 as described in "Disassembling Shifter Cover (Foot Shift)," see Fig. 4D-5. Time shifter notches as illustrated in Fig. 4D-8. Loosen screw (14, Fig. 4D-6) and rotate adapter plate (16) until timing notch (Fig. 4D-8) in adapter plate, located at bottom of shifter gear hole, lines up with notch between two shifter gear teeth. Make alignment exact, then tighten adapter plate bracket screw to lock in position. This adjustment can be made with shifter in any gear (not neutral).

Assemble shifter cover in reverse order of disassembly.

## REPLACING MAIN DRIVE GEAR OIL SEAL

MAIN DRIVE GEAR OIL SEAL TOOL. Main Drive Gear Oil Seal Tool, Part No. 95660-42, (Fig. 4D-1) enables removing worn or damaged oil seal and installing new seal without removing or disassembling transmission. It may be used on transmission removed from chassis as well. To use, transmission must be assembled with the exception of clutch and countershaft sprocket.

REMOVING OIL SEAL. Shift transmission into low gear and lock rear wheel brake to prevent parts from turning while disassembling.

Remove outer front chain guard, engine sprocket, front chain, clutch assembly, inner chain guard, countershaft sprocket and rear chain.

Place sleeve (C, Fig. 4D-1) on end of main drive gear. Note: 1965 and later Electra-Glide requires 15/16 inch long Sleeve, Part No. 95666-42A. Slide body (B) over sleeve with body stop rod downward. Turn body clockwise until stop bears against transmission case or mounting plate. Hold body in this position and insert center punch (E) through each of the three holes in body and center punch oil seal as shown in Fig. 4D-2.

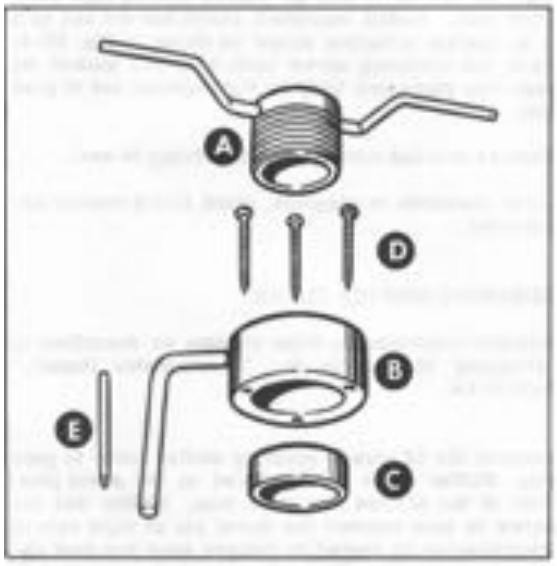



Figure 4D-1. Main Drive Gear Oil Seal Tool

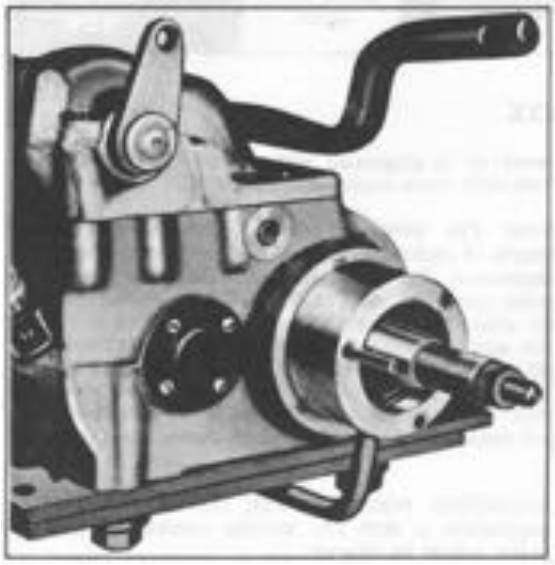


Figure 4D-2. Centerpunching Screw Hole Locations

Remove body and drill a 3/32 in. hole through metal face of oil seal at each punch mark. Replace body and insert the three self-tapping screws (D) through body and into oil seal. Tighten screws until body is against oil seal.

Turn actuating screw (A) into body and continue turning as shown in Fig. 4D-3 until oil seal is free. Discard oil seal and oil seal cork washer found behind seal.

INSTALLING OIL SEAL. Remove burrs with scraper from outer edge of oil seal recess in transmission

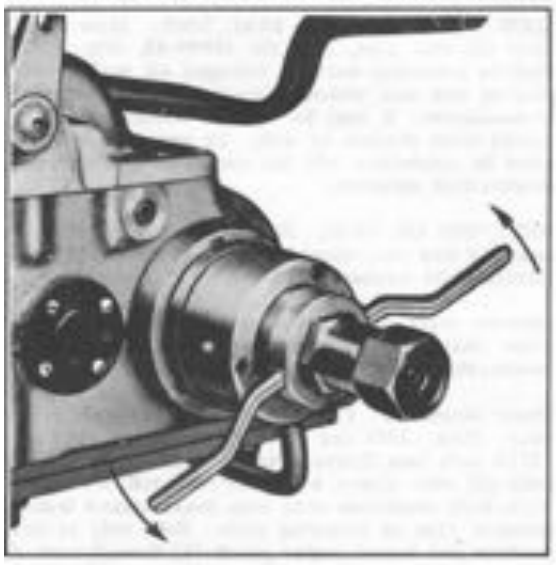


Figure 4D-4. Installing Oil Seal

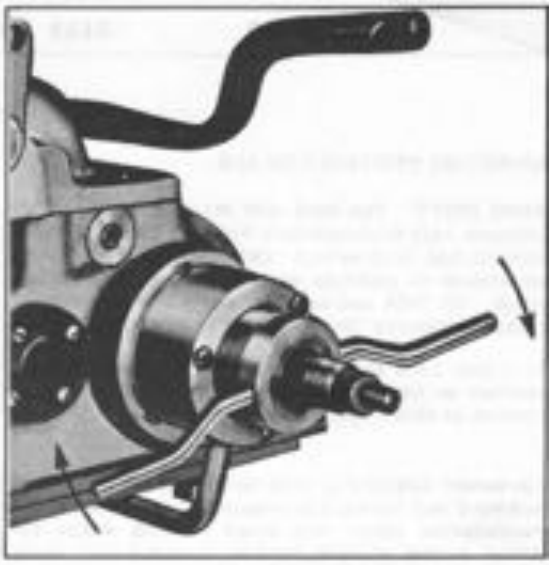


Figure 4D-3. Pulling Oil Seal

where metal was staked to secure seal. Position new cork gasket.

Coat lip of oil seal with oil or grease to prevent damage to new seal.

Insert sleeve (C, Fig. 4D-1) into oil seal. Place sleeve and seal on main drive gear with lip side of seal toward transmission case. Turn seal so it will not stake at same points old seal was staked.

Place body on sleeve and turn actuating screw into body as far as it will go without pulling body away from seal. Install mainshaft clutch hub nut and turn it in against actuating screw as shown in Fig. 4D-4. Back out actuating screw until body has pushed oil seal into place and body is tight against end of gear box.

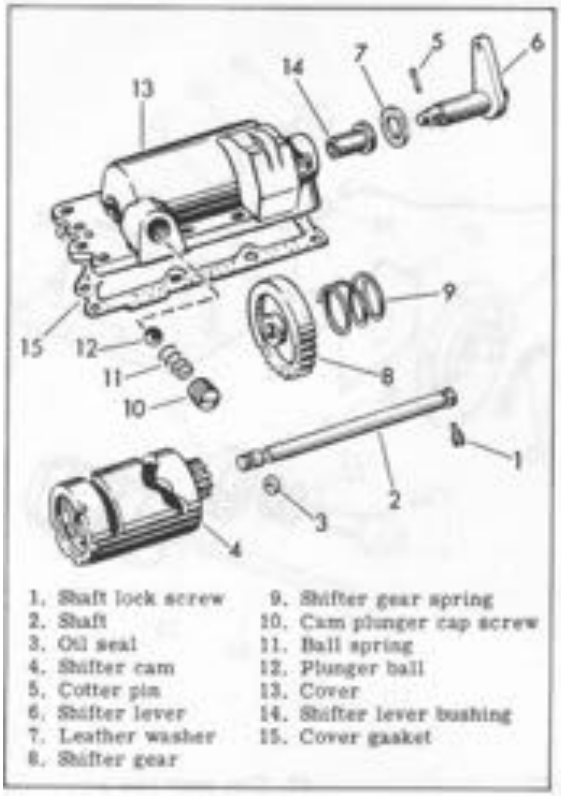
Remove tool and stake case into notches in seal.

After assembly is complete, check clutch control adjustment.

REMOVING SHIFTER COVER

Remove transmission from chassis as described in "Stripping Motorcycle for Transmission Repair," Section 4A.

Remove the 12 screws securing shifter cover to gear box. Shifter cover is registered on two dowel pins. Two of the screws are extra long. Notice that the screw in hole nearest the dowel pin on right side of transmission is vented to relieve gear box heat expansion pressure. This screw must be installed in the same hole when assembling shifter cover or transmission oil may be forced out into clutch.




1. Shaft lock screw
2. Shaft
3. Oil seal
4. Shifter cam
5. Cotter pin
6. Shifter lever
7. Leather washer
8. Shifter gear
9. Shifter gear spring
10. Cam plunger cap screw
11. Ball spring
12. Plunger ball
13. Cover
14. Shifter lever bushing
15. Cover gasket

Figure 4D-5. Hand Shifter Cover - Exploded View

DISASSEMBLING SHIFTER COVER (HAND SHIFT) (FIG. 4D-5)

Remove shaft lock screw (1). Shaft (2) may then be driven out, using the edge of a discarded valve as a drift. Drive on stem end with light hammer taps, with valve head in groove at end of shaft. With shaft removed, shifter cam (4) is free to come out of cover.

Remove cotter pin (5) from shifter lever shaft. Wedge screwdriver between shifter gear and inside of cover. Tap screwdriver in to force gear off shaft. Shifter lever (6) and leather washer (7) can then be pulled out of cover.

Remove cam plunger cap screw (10) and ball spring (11). Plunger ball (12) is then free to drop out of cover (13).

CLEANING, INSPECTION AND REPAIR (FIG. 4D-5)

Clean all parts except cam shaft oil seal (3), and shifter lever leather washer in grease solvent and blow dry with compressed air.

Inspect shifter lever fit in bronze bushing (14). Remove worn bushing as follows: Thread a 5/8 in. tap into bushing about 1/2 in. deep. Remove tap and heat case around bushing to about 300 degrees. Replace tap and clamp in vise. Tap cover with rawhide mallet or block of wood and hammer until cover is driven off bushing.

Inspect gear teeth on shifter cam and shifter gear. If wear is deep, replace parts. Slightly worn parts may be used safely with no impairment to proper function.

Inspect shifter cam slots and plunger ball seats for excessive wear. Cam track and ball seats must be sharp edged. Compare with new part if possible. Replace cam if slots are worn.

Inspect oil seal (3) and cover gasket (15) and replace if broken or in questionable condition.

ASSEMBLING SHIFTER COVER (HAND SHIFT)

It is necessary to time shifter lever gear to gear on shifter cam. Install shifter gear spring (9) and shifter gear (8) in cover with spring located over gear hub and timing mark between gear teeth to outside (facing cover bushing). Install shifter cam (4) so notch in gear tooth is aligned with timing mark on shifter gear. Install shifter lever and shaft assembly (6), with square end of shaft in hole in gear with shifting lever pointed toward left, front screw hole in cover, and leather washer (7) between lever and cover bushing.

Insert cotter pin in shaft hole.

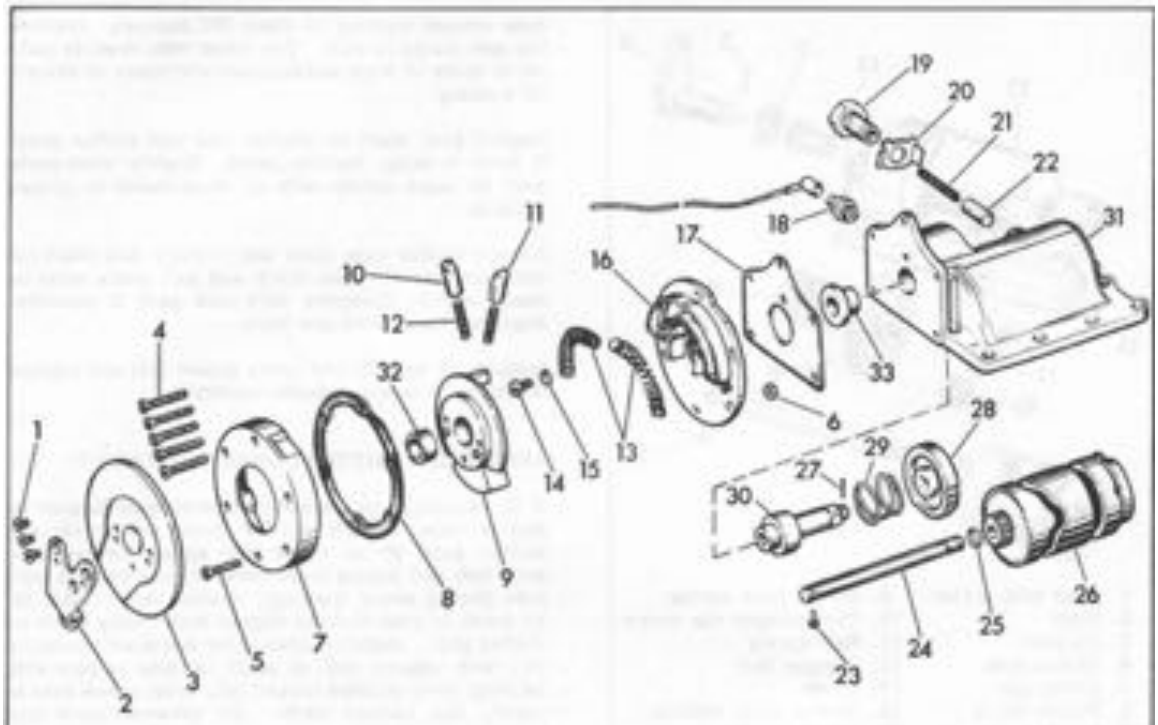
Place shifter cam in cover with timing mark on teeth registered with timing mark between teeth on side of shifter lever gear.

Install shifter cam shaft (2) and secure with lock screw. Be sure oil seal is in place in widest groove in right end of shaft. Shifter cam end play should be .0005 in. to .0065 in. If greater, install shim washer of desired thickness. If less than desired amount, file boss in case until recommended play has been achieved.

DISASSEMBLING SHIFTER COVER (FOOT SHIFT) (FIG. 4D-6)

Remove three shifter lever screws (1), and remove lever (2) and dust shield (3). Remove five long shifter cover screws (4) and one short screw (5) by removing nut (6) located on rear of adapter plate (16). The pawl carrier cover (7), gasket (8), and pawl carrier (9) are then free to be removed. The pawls (10 and 11), pawl spring (12), and pawl carrier springs (13) are under compression and will pop out when pawl carrier is removed. Remove adapter plate bracket screw (14) and washer (15) to free adapter plate (16) and gasket (17).

Remove neutral indicator switch (18) from cover. Bend back ear on cam follower retainer washer (20) and remove retainer (19), washer (20), spring (21) and cam follower (22).




1. Shifter lever screw (3)
2. Shifter lever
3. Dust shield
4. Shifter cover screw (5)
5. Shifter cover screw (short)
6. Cover screw nut
7. Pawl carrier cover
8. Cover gasket
9. Pawl carrier
10. Pawl (right)
11. Pawl (left)
12. Pawl spring (2)
13. Pawl carrier spring (2)
14. Adapter plate bracket screw
15. Adapter plate bracket screw washer
16. Adapter plate
17. Adapter plate gasket
18. Neutral indicator switch
19. Cam follower retainer
20. Cam follower retainer washer
21. Spring
22. Cam follower
23. Cam shaft lock screw
24. Cam shaft
25. Oil seal
26. Shifter cam
27. Cotter pin
28. Shifter gear
29. Shifter gear spring
30. Shifter shaft
31. Shifter cover
32. Pawl carrier bushing
33. Shifter shaft bushing

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4D-6. Foot Shifter Cover - Exploded View

Remove cam shaft lock screw (23) from left side of shifter cover joint face. Engage head of old valve in notch in cam shaft and tap end of valve stem to pull cam shaft (24) from cover. Shifter cam (26) may be lifted out of cover.

Remove cotter pin (27) from end of shifter shaft. Remove shifter gear (28) and spring (29) from shaft and pull shaft (30) out of cover (31).

CLEANING, INSPECTION AND REPAIR (FIG. 4D-6)

Clean all parts except gaskets (8 and 17), and neutral indicator switch (18) in grease solvent. Clean switch with "Gunk" or gasoline.

Inspect fit of shaft (30) in bushings (32 and 33). If there is considerable side play, replace bushings. Pawl carrier bushing (32) may be pressed out of carrier on arbor press. Shifter shaft bushing (33) is removed as follows: Thread 5/8 in. tap into bushing about 1/2 in. deep. Remove tap and heat shifter cover around bushing to about 300 degrees. Quickly replace tap and clamp tap handle in vise. With rawhide mallet, tap cover near bushing until cover is driven off bushing. Insert new bushing with arbor press or soft metal hammer and wood block. Be sure bushing shoulder is seated against cover.

Inspect teeth on shifter gear and cam. Replace badly worn parts.

Inspect neutral indicator switch. Depress plunger in base of body. It should spring back without a bind. If panel light fails to light in neutral position, plunger is sticking. Switch cannot be repaired, it must be replaced. Do not test switch by passing current through it without having a neutral indicator panel light bulb in the circuit in series.

Inspect all springs. Inspect tips of cam follower (22) and shift pawls (10 and 11). If tips are rounded and worn, replace parts. To function properly these parts must have reasonably sharp tips.

Inspect all parts generally for cracks, bent parts and any wear that would impair intended functions. If hole in pawl carrier is elongated, bushing (32) must be replaced or mechanism will not shift properly.

ASSEMBLING SHIFTER COVER (FOOT SHIFT) (FIG. 4D-6)

It is necessary to time the shifter shaft (30) to the shifter gear (28), and the shifter gear to the cam gear on the shifter cam (26). If this is not done correctly, it will be impossible to shift into all gears.

Notice that the timing mark (Fig. 4D-7) cut between the center teeth on one side of shifter gear is in line with the corner of the squared shaft end and just a little to the left of the last ratchet tooth on the shifter shaft. This is the proper timing alignment.

Refer to Fig. 4D-6. Position shifter gear (28) and spring (29) in case, so side of gear with timing mark is toward case. Insert shifter shaft (30) so parts are timed as described above and tap parts together. Insert cotter pin (27).

Install shifter cam (26) in cover so ground timing mark on top of a tooth registers with timing mark on shifter gear. Slip oil seal (25) on widest of two grooves on end of cam shaft (24) and insert in cover, passing it through shifter cam. Secure shaft with lock screw (23).

Install cam follower (22), spring (21), retaining washer (20) and retainer (19). Install neutral indicator switch (18) and check to make sure button on shifter gear contacts plunger in base of switch.

Position cover (31) in vise with shifter mechanism end upward. Place gasket (17) and adapter plate (16) over cover. Insert adapter plate bracket screw (14) and washer (15) in hole directly above end of shifter gear but do not tighten. Shift gear shift cam to any position but neutral. Rock cam back and forth to make sure spring loaded cam follower is seating exactly in one of the indexing notches, or "V's," that determine cam position for one of the four gears.

Rotate adapter plate until timing notch (Fig. 4D-8) in adapter plate, located at bottom of shifter gear hole, lines up with notch between two bottom shifter gear teeth. Make alignment exact, then tighten adapter plate bracket screw to lock in position.

Apply a light coat of "Grease-All" grease to curved springs (13) and insert them in slots on adapter plate. Grease ratchet end of shifter shaft. Lubricate pawls (10 and 11) with light oil after checking to see if they are free in holes in pawl carrier (9). Install pawl springs (12) and pawls in pawl carrier so notches in ends of pawls face inward or toward each other.

Install pawl carrier with pawls over end of shifter shaft with lug on pawl carrier inserted between ends of pawl carrier springs.


Figure 4D-7. Timing Shifter Gear

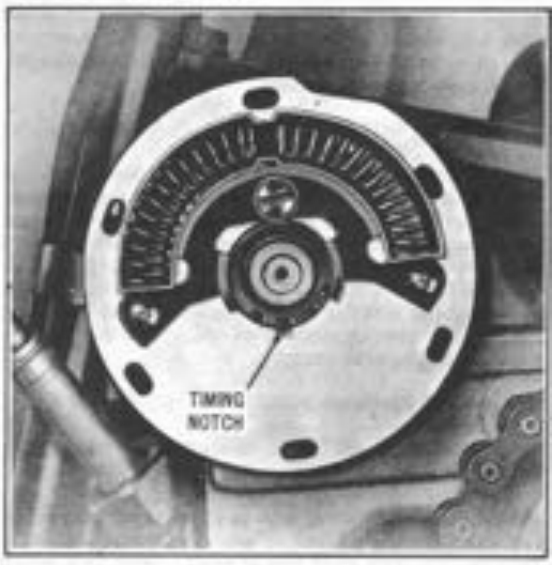
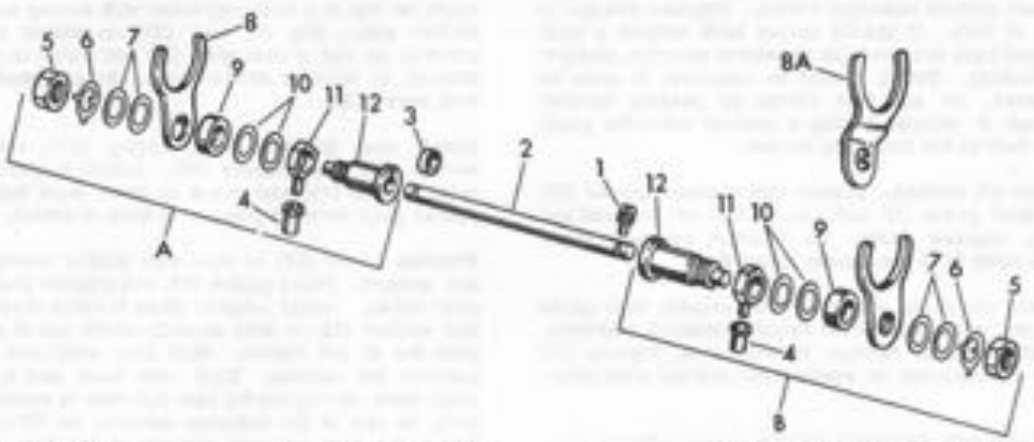



Figure 4D-8. Timing Shifter Notches




1. Lock screw
2. Shifter fork shaft
3. Rubber oil seal
4. Shifter finger rollers (2)
5. Nut (2)
6. Lock washer (2)
7. Spacing shim (variable number) (.007") (.014")
8. Shifter fork (1 or 2)
8A. Shifter fork (3-speed, reverse only)
9. Standard spacing shim (2)
10. Spacing shim (variable number) (.007") (.014")
11. Shifting finger (2)
12. Shifting fork bushing (2)

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4D-9. Shifter Fork - Exploded View

Lubricate back of pawl carrier with "Grease-All" grease and install cover gasket (8) and cover (7) so notches at top line up with corresponding notch on adapter plate. Apply Loctite sealant, Part No. 99619-60, to threads of shorter screw (5) and insert through bottom hole. Secure with nut (6) on back of adapter plate. Apply Loctite sealant to threads of five long screws (4) and tighten all screws.

Position cover dust shield (3) over dowel pins on pawl carrier. Position shifter shaft lever (2) over dowel pins and secure with three shifter shaft lever screws (1). Also treat the threads of these screws with Loctite sealant before inserting.

REPLACING SHIFTER COVER

Coat shifter cover gasket with Perfect Seal No. 4 and position on gear box. Install assembled shifter cover over gear box opening and secure with twelve screws. Note that two screws are longer. They are inserted in holes adjacent to bulge in cover over shifter gear. The short cover screw with vent hole is inserted in hole nearest locating dowel pin on right side of gear case. Use Loctite sealant on all screw threads except the single vent screw.

REMOVING SHIFTER FORKS (FIG. 4D-9)

Remove shifter cover as described in "Removing Shifter Cover."

Shifter fork shaft (2) is held in position by lock screw (1) which may be found in gear box cover joint surface in line with right end of shaft. With lock screw (1) removed, shaft may be driven out by means of a drift inserted in hole in starter cover joint face of gear box. Notice that a rubber oil seal (3) is assembled in groove on left end of shifter fork shaft.

Shifter fork assemblies (A and B) are not interchangeable. Note exactly the arrangement of parts and components in each. Keep parts separate to avoid needless adjusting when reassembling. If inspection shows fork assemblies are not damaged, worn or bent, it may not be necessary to disassemble them unless shifter clutches are replaced. Adjustments are described in "Assembling Shifter Forks."

DISASSEMBLING SHIFTER FORKS (FIG. 4D-9)

If it is necessary to disassemble shifter forks, lift off shifter finger rollers (4), pry back ear on lock washer (6) and turn off nut (5). Lift washer (6), a number of .014 in. or .007 in. spacing shim washers (7) which varies from one fork assembly to another, shift forks (8), 5/64 in. thick standard spacing shim (9), more .007 in. or .014 in. spacing shims (10), shifting fingers (11) and shifting fork bushings (12).

CLEANING, INSPECTION AND REPAIR

Clean all parts in cleaning solvent and blow dry with compressed air.

If shifter forks are bent or worn, replace them. Straightened forks are weak. They may break and cause extensive damage to gear box parts.

Check fit of shifter fork bushings on shaft. If bushings are loose enough to give fork action lash, replace them. Check replacement part fit on shaft.

Lap out bushings if they bind. Shifting will be difficult unless bushings work freely on shaft.

ASSEMBLING SHIFTER FORKS

Assemble shifter forks in reverse of disassembly order making sure parts are not transposed.

Check adjustment of shifter forks with Fork Shifter Gauge, Part No. 96384-39, by placing shifter gauge on shifter cover as shown in Fig. 4D-10. With the 3/8 in. gauge rod furnished, set tool gauge blocks in exact alignment with straight sections of cam slots in shifter cam. Lock gauge blocks in place with thumb screws.

Remove tool from cover, turn it over, and place it on transmission case with shifter fingers engaged in slots on gauge blocks as shown in Fig. 4D-11. Be sure shifter finger rollers are in place on shifter fingers.

With thickness gauges, check clearance on both sides of shifting clutches. All shifting clutches must be centered.

When clearances are not equal and correct, shifting fork assemblies must be corrected by increasing or decreasing the number of shims between shifter fork and shifter finger. To make this adjustment, remove shifter fork assemblies from transmission. Shims are available .007 in. and .014 in. thick.

After taking out or adding shims, be sure fork assembly lock nut is tight. However, excessive tightening may close up hole in bushing so it is no longer a free, sliding fit on shaft.

Clearances between shifter clutch and gear are as follows:

Low and second gear: When centered between gears to have .075 in. clearance on both sides.

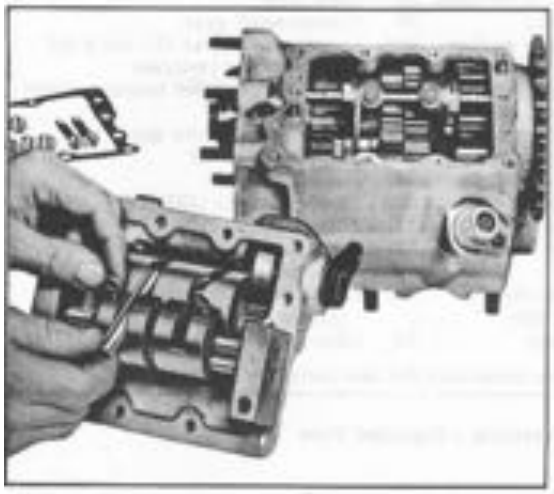


Figure 4D-10. Adjusting Shifter Gauge

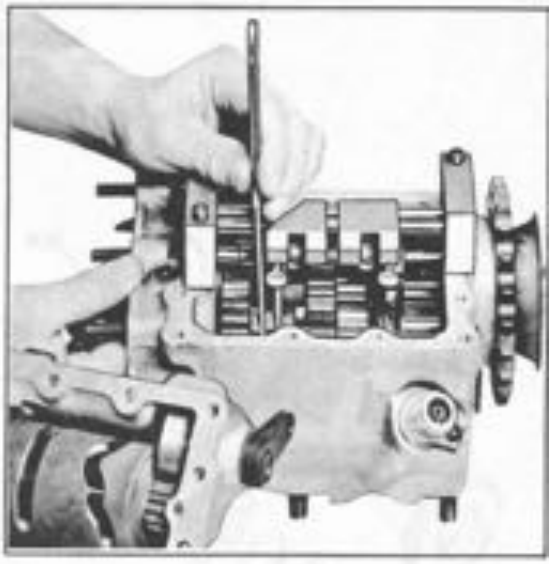


Figure 4D-11. Checking Shifter Clutch Clearance

Third and high gear: When centered between gears to have .100 in. clearance on both sides.

Sliding reverse gear: When centered between gears to have approximately .055 in. clearance between gear teeth.

Where shifter clutch engagement is with dogs protruding from face of gear, turn gear so dogs on shifter clutch and dogs on gear are overlapping each other about 1/8 in. before checking clearance.

Place shifter forks in gear box and install shifter fork shaft. Fork with narrow opening is for high gear shifter clutch. Install shifter shaft lock screw.

Assemble shifter cover to gear box as described in "Replacing Shifter Cover."

DISASSEMBLING GEAR BOX (FOUR SPEED)

Remove transmission from chassis as described in "Stripping Motorcycle for Transmission Repair," Section 4A.

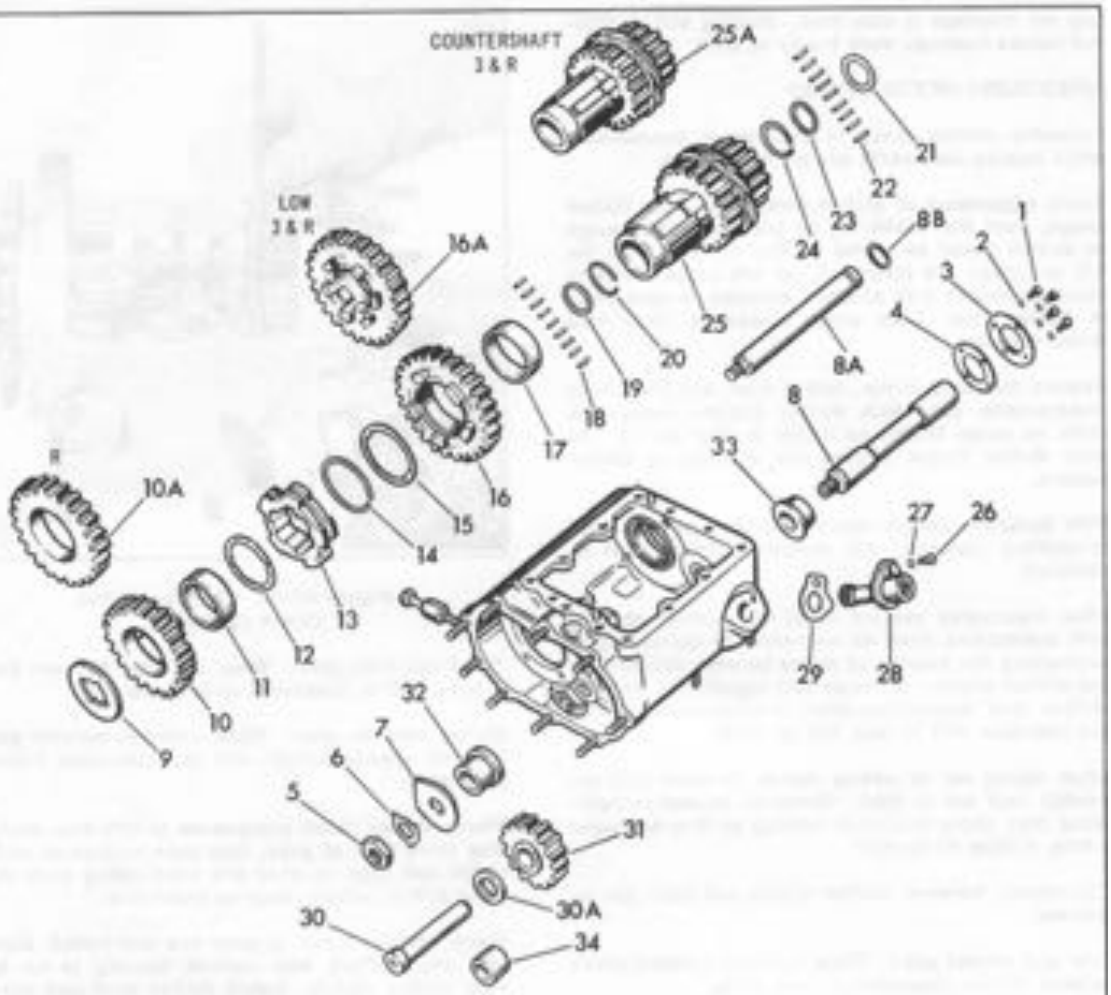
Remove clutch as described in "Disassembling Clutch," Section 4B.

Remove starter assembly and starter clutch as described in "Disassembling Starter," Section 4C.

Remove shifter cover and shifting forks as described in "Removing Shifter Cover" and "Removing Shifter Forks."

DISASSEMBLING COUNTERSHAFT (Fig. 4D-12)

On 1964 and earlier models, remove four screws (1) and washers (2) holding countershaft end cap (3) and gasket (4) to left (clutch)




| | | |
|---|---|---|
| 1. End cap screw (4) (1964 & earlier) | 10A. Countershaft reverse gear | 24. Lock ring |
| 2. End cap screw washer (4) (1964 & earlier) | 11. Low gear bushing | 25. Countershaft gear |
| 3. End cap (1964 & earlier) | 12. Low gear bearing washer | 25A. Countershaft gear (19-tooth for 3-speed and reverse) |
| 4. End cap gasket (1964 & earlier) | 13. Shifter clutch | 26. Speedometer drive housing screw |
| 5. Countershaft nut | 14. Spring lock ring | 27. Washer |
| 6. Lock washer | 15. Gear retaining washer | 28. Speedometer drive unit |
| 7. Lock plate | 16. Countershaft second gear | 29. Drive unit gasket |
| 8. Countershaft (1964 & earlier) | 16A. Countershaft low gear (3-speed and reverse) | 30. Idler gear shaft |
| 8A. Countershaft (1965) | 17. Second gear bushing | 30A. Spacer washer (1964) |
| 8B. O-Ring (1965) | 18. Bearing rollers (22) | 31. Idler gear |
| 9. Countershaft gear end washer | 19. Roller retainer washer | 32. Countershaft mounting collar (starter side) |
| 10. Low gear | 20. Lock ring | 33. Countershaft mounting collar (clutch side) |
| | 21. Roller thrust washer | 34. Idler gear bushing |
| | 22. Roller bearing (22) | |
| | 23. Retaining washer | |

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4D-12. Countershaft Assembly - Exploded View

side of gearcase. Bend ear of lock washer (6) away from flat of nut and remove countershaft nut (5), lock washer (6) and countershaft lock plate (7). Countershaft (8 or 8A) may then be driven out of case toward left side with appropriate-size drift pin, freeing countershaft gear assembly consisting of parts 9 through 25. When countershaft gear assembly needs no repair, it should not be disassembled. With shaft out, countershaft gear end washer (9) will drop into case unless some provision for catching it is made before extracting countershaft.

Disassemble countershaft gear assembly as follows:

Lift low gear (10), low gear bushing (11), low gear bearing washer (12) and shifter clutch (13) off splined countershaft.

Remove spring lock ring (14), gear retaining washer (15), countershaft second gear (16) and second gear bushing (17).

Remove the 22 bearing rollers (18) and roller retainer washer (19) from shaft hole in countershaft gear. Use knife blade or thin screwdriver to remove lock ring (20).

Remove roller thrust washer (21), 22 rollers (22), retaining washer (23) and lock ring (24) from opposite end of countershaft gear (25).

When disassembling countershaft gear assembly, be sure all rollers are accounted for and roller set from each end of gear is wrapped separately in paper or cloth, marked for end of gear from which it was removed.

**CAUTION**

If any of the rollers are lost or if sets become mixed, both sets will have to be replaced with new parts even though in serviceable condition.

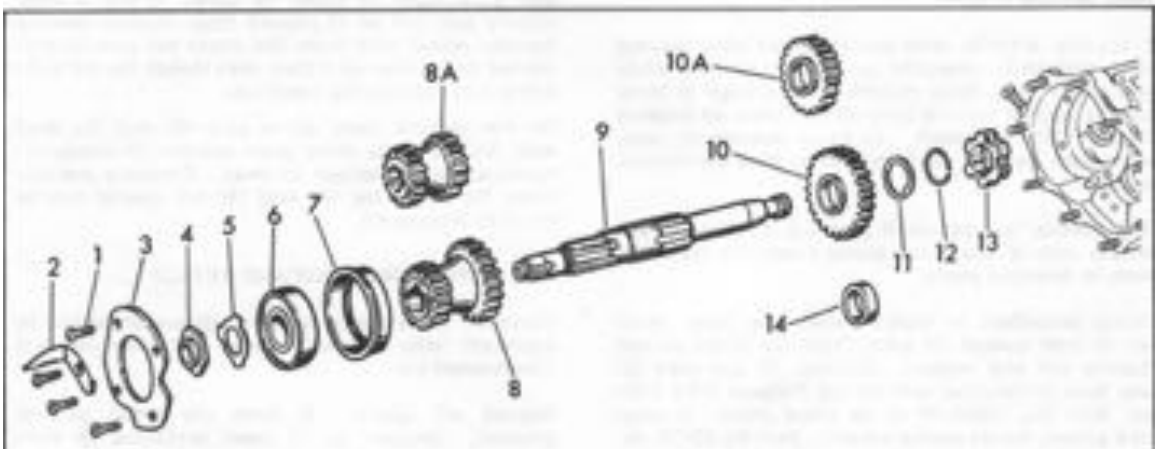
Remove speedometer drive housing screw (26) and washer (27) and lift out speedometer drive unit (28) and gasket (29) from gear case.

If a three-speed and reverse transmission, remove idler gear shaft (30), spacer washer (30A) and idler gear (31). Thread a 1/4-20 tap screw into end of shaft, grasp screw head in pliers and pull shaft out of case. It may be necessary to heat the case to facilitate pulling the shaft.

DISASSEMBLING MAINSHAFT (Fig. 4D-13)

Remove the four bearing housing retaining plate screws (1), oil deflector (2) and retaining plate (3).

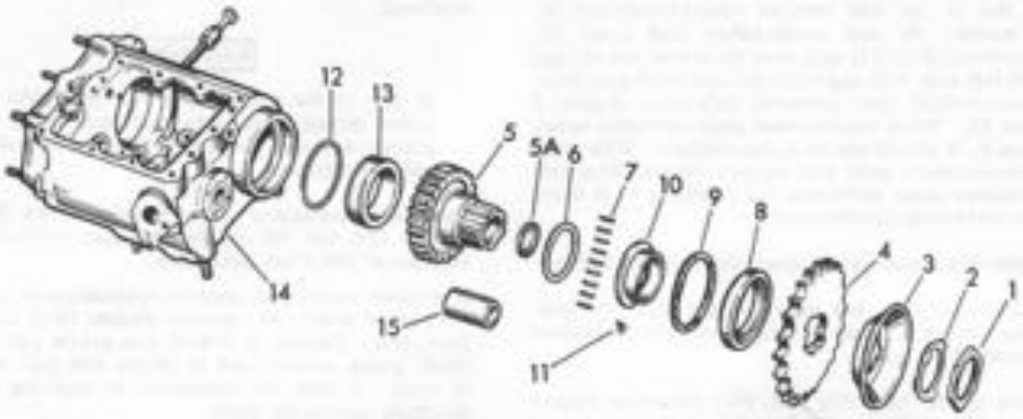
Drive mainshaft assembly toward right side of case with rawhide mallet or block of wood and hammer until mainshaft bearing (6) or bearing housing (7) with bearing are just free of opening in case. With screwdriver or other suitable tool, pry lock ring (12) out of groove in mainshaft and slide it onto mainshaft splines. Pull ball bearing nut (4), ball bearing washer (5), ball bearing (6), bearing housing (7), low and second gear assembly (8) and mainshaft (9) out




1. Bearing housing retaining plate screw (4)
2. Oil deflector
3. Retaining plate
4. Ball bearing nut
5. Ball bearing washer
6. Mainshaft bearing
7. Mainshaft bearing housing
8. Low and second gear
8A. Low and reverse gear (handshift)
9. Mainshaft
10. Third gear
10A. Mainshaft second gear (handshift)
11. Retaining washer
12. Lock ring
13. Shifter clutch
14. Third gear bushing

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4D-13. Mainshaft Assembly - Exploded View




1. Sprocket lock nut
2. sprocket lock washer
3. Oil deflector
4. Chain sprocket
5. Main drive gear
5A. Main drive gear shaft seal (1965)
6. Thrust washer
7. Roller bearings (44)
8. Main drive gear oil seal
9. Oil seal cork washer
10. Main drive gear spacer
11. Main drive gear spacer key
12. Bearing race retaining ring
13. Bearing race
14. Gear box
15. Main drive gear bushing

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 4D-14. Main Drive Gear - Exploded View

right side of case, slipping third gear (10), retaining washer (11), spring lock ring (12) and shifter clutch (13) off left end of mainshaft and out through shifter cover opening in case.

If bearing housing does not come out with bearing when mainshaft assembly is being removed, slide gear (8 or 8A) along mainshaft until edge of large gear is against bearing housing and drive out housing together with mainshaft. To avoid damage to case, make sure gear is positioned so it does not overlap housing.

Disassemble the mainshaft gear and ball bearing assembly only if inspection shows a need for replacing worn or damaged parts.

Clamp mainshaft in copper-faced vise jaws. Bend ear of lock washer (5) away from flat of nut (4) and remove nut and washer. Bearing (6) and gear (8) may then be removed with the All Purpose Claw Puller, Part No. 95635-46 or an arbor press. If using claw puller, insert center adapter, Part No. 95636-46, into end of shaft to prevent damage to shaft. Bearing and gear are removed separately.

DISASSEMBLING MAIN DRIVE GEAR (FIG. 4D-14)

Position gear box in vise and nail or bolt length of rear chain to bench. Engage chain on sprocket teeth to keep sprocket from turning.

Bend ear of lock washer away from flat of nut and remove sprocket lock nut (1) and washer (2). Nut has left hand thread. Lift oil deflector (3) and chain sprocket (4) off gear. Push main drive gear (5) into case and withdraw it from top. Thrust washer (6) usually comes out with gear. Remove the 44 roller bearings (7). Be sure all rollers are accounted for and wrap them in paper or cloth. If any of these rollers are lost or if rollers from another bearing become mixed with them, the entire set must be discarded and a new set fitted, even though the old rollers are in serviceable condition.

Do not remove main drive gear oil seal (8), shaft seal (5A) or main drive gear spacer (10) unless inspection shows damage or wear. Complete instructions for removing oil seal (8) and spacer may be found in Section 4D.

CLEANING, INSPECTION AND REPAIR

Clean all parts except gaskets (all gaskets should be replaced) with cleaning solvent and blow dry with compressed air.

Inspect all gears. If teeth are pitted, scored, cracked, chipped or if case hardening is worn through, replace with new gears.

Inspect all bushings, bearing races and shafts. If bent or worn, install new parts. If mainshaft ball bearing (6, Fig. 4D-13) is worn to point where play is obviously too great, install new bearing.

To install main drive gear bearing race (13, Fig. 4D-14), heat case to about 300 degrees and press out old race with arbor press after removing bearing race retaining ring (12). Reheat case and press in new race until flange is seated against case. Install new bearing race retaining ring.

Oil seal cork washer (9) and oil seal (8 or 5A) should not be reinstalled if they have been removed. An oil leak will probably develop. Use new parts. Shaft seal (5A) should be installed with Seal-All in gear end recess.

Carefully check shifter clutches (13, Fig. 4D-12 and 4D-13) and engaging dogs on gears. If they are rounded or battered appearing, they must be replaced.

Worn shifter clutch and gear dogs result from shifting abuses or from out-of-adjustment clutch that does not release fully. Damaged engaging dogs try to creep out of engagement under a steady load. This creeping action develops great side pressure that results in damage to shifting mechanism and all thrust points along shaft assemblies.

Check bearings (7, Fig. 4D-14 and 18, 22, Fig. 4D-12) for proper fit in races according to tolerances shown in "Transmission Specifications," Section 4A. Replacement rollers are available standard, .0004 in. and .0008 in. oversize.

ASSEMBLING GEAR BOX (FOUR SPEED)

ASSEMBLING MAIN DRIVE GEAR (FIG. 4D-14)

Assuming that main drive gear oil seal (8), oil seal cork washer (9) and gear spacer (10) are assembled in case (replacing these parts must be done before gear box is disassembled or after it is repaired and assembled as described in Section 4A), install rollers (7) in bearing outer race (13), holding rollers in place with a light coat of grease.

Install main drive gear thrust washer (6) on main drive gear. Insert main drive gear (5) into gear box. Be sure rollers stay in place as gear is inserted.

Install main drive gear spacer key (11), registering longer section of key in any splineway on main drive gear and shorter section of key in slot in outer edge of main drive gear spacer.

Install sprocket (4) with flat side outward. Install oil deflector (3), lock washer (2) and sprocket lock nut (1). Hold sprocket as outlined in disassembly procedure and tighten nut securely. Check main drive gear assembly end play. See "Transmission Specifications," Section 4A, for proper tolerances. Bend one ear of lock washer against flat of nut.

ASSEMBLING MAINSHAFT (FIG. 4D-13)

Assemble parts 4 through 8 to mainshaft before installing mainshaft in gear case. Position gear (8) on shaft splines. Press or fit ball bearing housing (7) over ball bearing (6) and press onto shaft. Assemble lock washer (5) and nut (4) to shaft and tighten securely. Bend over one ear of lock washer against flat of nut.

Insert mainshaft assembly into gear box far enough to install gear (10), thrust washer (11) lock ring (12) and shifter clutch (13) over shaft. Always install new lock rings and make sure they are properly seated in lock ring groove. One side of mainshaft shifter clutch is stamped "HIGH." Make sure this side faces main drive gear.

With a screwdriver or other suitable tool, work lock ring onto shaft splines. Use screwdriver wedged against shifter clutch to force lock ring into seat in shaft.

With a soft-metal hammer or brass drift, tap mainshaft assembly into case until flange on ball bearing housing is shouldered against case. Install retaining plate (3), oil deflector (2) and four screws (1).

If working on three-speed transmission, install reverse idler gear (31, Fig. 4D-12) and shaft before installing retaining plate.

ASSEMBLING COUNTERSHAFT (FIG. 4D-12)

Before installing countershaft gear train to shaft and case, it is necessary to check bearing fit and shaft end play.

If countershaft mounting collars (32 and 33) were removed for replacement, press or drive old parts out and new parts in after gear case has been heated to approximately 300 degrees to expand case and facilitate pressing.

Install roller sets (18 and 22) in countershaft gear (25), holding them in place with a coat of grease. Be sure lock rings (20 and 24) and bearing retaining washers (19 and 23) are in place before installing bearings. Install bearing thrust washer (21) in its recess in left end of countershaft gear. Install countershaft temporarily to check bearing fit. See "Transmission Specifications," Section 4A, for tolerances.

Install countershaft gear in case holding end play adjusting washer (9) in place with daub of heavy grease. Install countershaft.

Check end play with feeler gauge between end play adjusting washer and end of countershaft gear. Consult transmission specifications for tolerances. Increase or decrease end play as necessary by fitting end play adjusting washer of required thickness. Washers are available in thicknesses of .074, .078, .082, .085, .090, .095 and .100 in. When correct gear end play has been established, remove countershaft and gear from case. Set aside adjusting washer until needed for assembly.

Install gear bushing (17), gear (16), thrust washer (15) and gear lock ring (14) on countershaft gear (25).

Install shifter clutch (13), thrust washer (12), gear bushing (11) and gear (10) on countershaft gear. Check to make sure all rollers are in place in gear.

Place end play adjusting washer (9) on end of countershaft gear, holding in position with daub of grease. Position assembly in case and insert countershaft (8 or 8A) and lock plate (7). Straight edge of lock plate fits against edge of bearing retaining plate (3, Fig. 4D-13). Install lock washer (6) and nut (5). Tighten

nut securely and bend over one ear of lock washer against flat of nut.

On 1964 and earlier models, install gasket (4) and end cap (3) with washers (2) and screws (1).

Install gasket (29), drive unit (28), washer (27) and screw (26).

Install shifter cover, starter clutch, starter cover and clutch as described in pertinent sections.

Assemble transmission to motorcycle and connect controls in reverse order of stripping procedure described in "Stripping Motorcycle for Transmission Repair," Section 4A.

DISASSEMBLING GEAR BOX (THREE-SPEED AND REVERSE)

A three forward speed and reverse transmission cannot be installed on a foot shift model motorcycle, and a three-speed transmission cannot be assembled in a four-speed gear case.

The disassembly, repair and assembly procedures for a three-speed and reverse transmission are the same as for a four-speed transmission except for the procedures described in operations to four-speed model and following differences:

Refer to Fig. 4D-12. In three-speed and reverse countershaft assembly, omit shifter clutch (13), lock ring (14), thrust washer (15) and gear bushing (17).

Substitute gear 10A for 10, 16A for 16, and 25A for 25.

Refer to Fig. 4D-13. Substitute 8A for 8 and 10A for 10.

Refer to Fig. 4D-9. Substitute 8A for 8.

94557-55 COMPENSATING SPROCKET SHAFT NUT WRENCH

94635-41 MAINSHAFT BALL BEARING LOCK NUT WRENCH

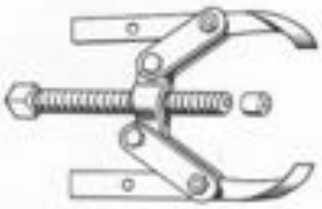
94645-41 CLUTCH HUB NUT WRENCH

94660-25 COUNTERSHAFT SPROCKET LOCK NUT WRENCH

94825-31 TRANSMISSION MAIN DRIVE GEAR BUSHING REAMER

Used to size new main drive gear bushing.

95635-46 ALL PURPOSE CLAW PULLER



95637-46 WEDGE ATTACHMENT FOR CLAW PULLER

Used in combination with claw puller for pulling close fitting gears or bearings.

95650-42 TRANSMISSION MAINSHAFT STARTER CLUTCH AND BEARING PULLER

One end used to remove mainshaft starter clutch, the other end for pulling worn mainshaft ball bearing with transmission in or out of chassis.

95660-42 MAIN DRIVE GEAR OIL SEAL TOOL

Used to remove and install main drive gear oil seal with transmission in or out of chassis.

Used with clutch gear oil seal tool to remove and install clutch gear oil seal on Electra-Glide Model having longer transmission mainshaft.

95960-41A CLUTCH HUB AND CHAIN HOUSING PULLER

Four holes fit clutch hub studs. Four bolts fit tapped holes in chain housing.

96216-49 INTERNAL LOCK RING PLIERS LARGE

Special pliers for removing and replacing lock ring.

96384-39 FORK SHIFTER GAGE

Used to accurately set and align transmission shifter forks.

# ELECTRICAL 5

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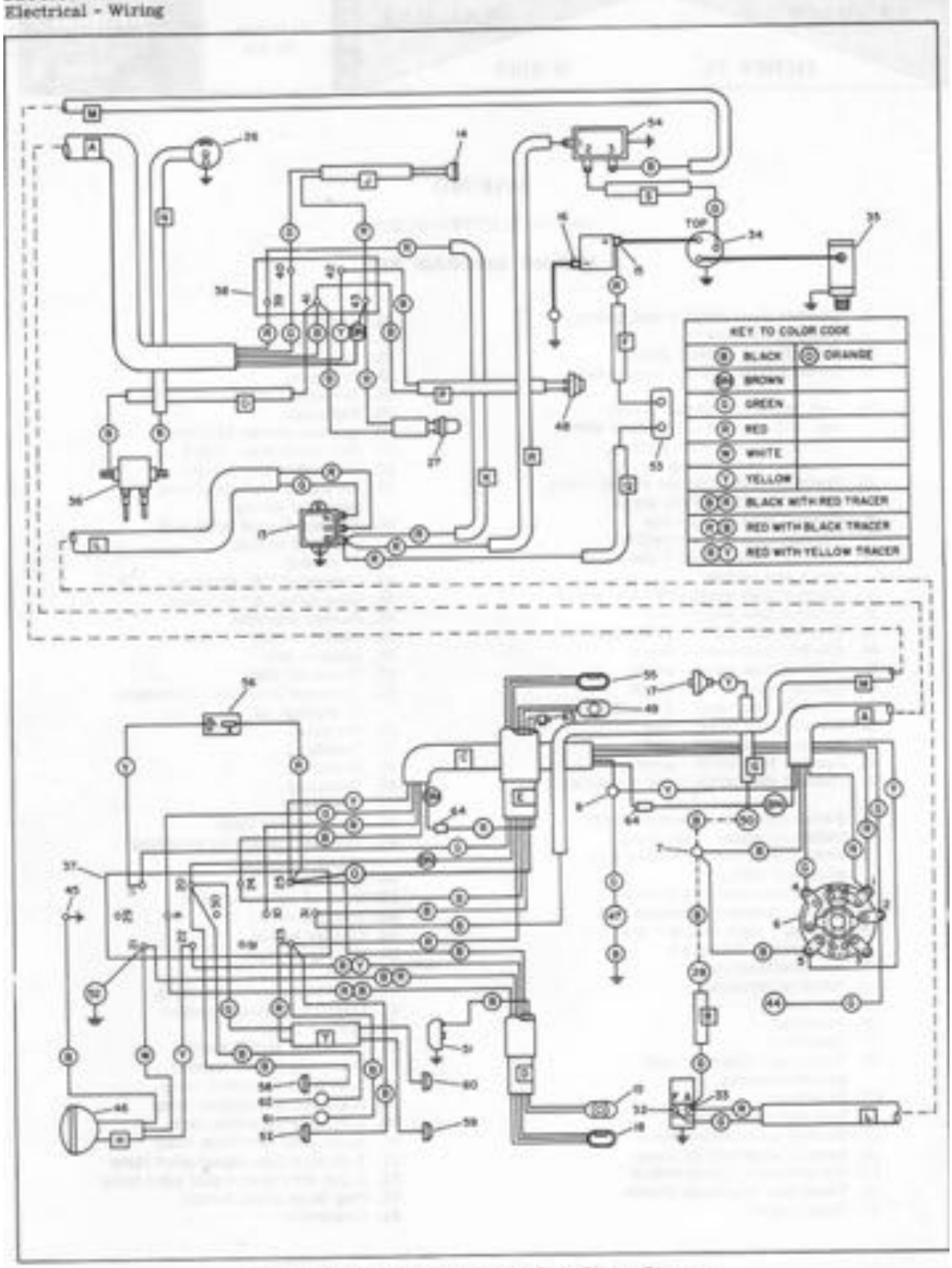



Figure 5B-22A. 1968-69 Electra-Glide Wiring Diagram

# WIRING

## 1959 DUO-GLIDE WIRING DIAGRAM KEY

A. Conduit (four wire) - Red, green, black and yellow
B. Conduit (one wire) - Green
C. Conduit (four wire) - Red, green, yellow and black
D. Handlebar (loose wires) - Red with black tracer, black with red tracer, red with yellow tracer, black and green
E. Conduit (two wire) - Red and green
F. Conduit (three wire) - Black, green and red
G. Conduit (three wire) - Red, green and red
H. Conduit (two wire) - Black with red tracer and red
J. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Conduit (two wire) - Green and red
N. Conduit (one wire) - Green

1. Switch terminal - 3 Red wires
2. Switch terminal - 2 Green wires
3. Switch terminal - Not used with standard wiring
4. Switch terminal - Green wire
5. Switch terminal - Black and yellow wires
6. Junction terminal - 5 Black wires
7. Junction terminal - Green, yellow wires
8. Speedometer light - Green wire
9. Terminal - Red with black tracer, green wire
10. Terminal - Red wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Regulator - 3 Red, green wires
14. Tail and stop lamp - Green, red wires
15. Battery positive terminal - Red wire
16. Battery negative terminal - Black wire
17. Oil pressure signal switch - Green wire
18. Handlebar headlamp switch - Red with black tracer, black with red tracer, red with yellow tracer
19. Horn switch - Black, green wires
20. Terminal - Not used with standard wiring
21. Terminal - 2 Black wires with red tracer
22. Terminal - Red wire, red with yellow tracer
23. Terminal - Not used with standard wiring
24. Terminal - 2 Black wires
25. Terminal - Yellow wire
26. Ignition circuit breaker - Black wire
27. Stop lamp switch - Black, red wires
28. Generator signal light - Green, black wires
29. Terminal - Not used with standard wiring
30. Terminal - Not used with standard wiring
31. Terminal - Not used with standard wiring
32. Generator "F" terminal - Green wire
33. Generator "A" terminal - Red and green wires
34. Ignition - Light switch-See terminals 1 thru 5
35. Ignition coil - 2 Black wires
36. Terminal place - See 10 and terminals 20 thru 24
38. Terminal box - See terminals 39 thru 43
39. Terminal - 3 Red wires
40. Terminal - 2 Green wires
41. Terminal - 3 Black wires
42. Terminal - Yellow, green wires
43. Terminal - 2 Red wires
45. Headlamp bracket - Black wire
46. Junction terminal - Black, green wires
47. Neutral indicator light - Black, green wires
48. Neutral indicator switch - Green wire
50. Oil signal light - Black and green wires
51. Horn - Red and green wires
52. Headlamp - Red wire black with red tracer

## KEY TO WIRING DIAGRAM (RADIO-SPECIAL)

Wiring with radio equipment is unchanged except for regulator, generator and battery connections.

B. Conduit (one wire) - Green
G. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Cable (two wire) - Red and green
M. Conduit (one wire) - Red (not shown)

13. Regulator - Green and red wires
32. Generator "F" Terminal - Green wire
33. Generator "A" Terminal - Red wire
39. Terminal - Red wire
49. Fuse

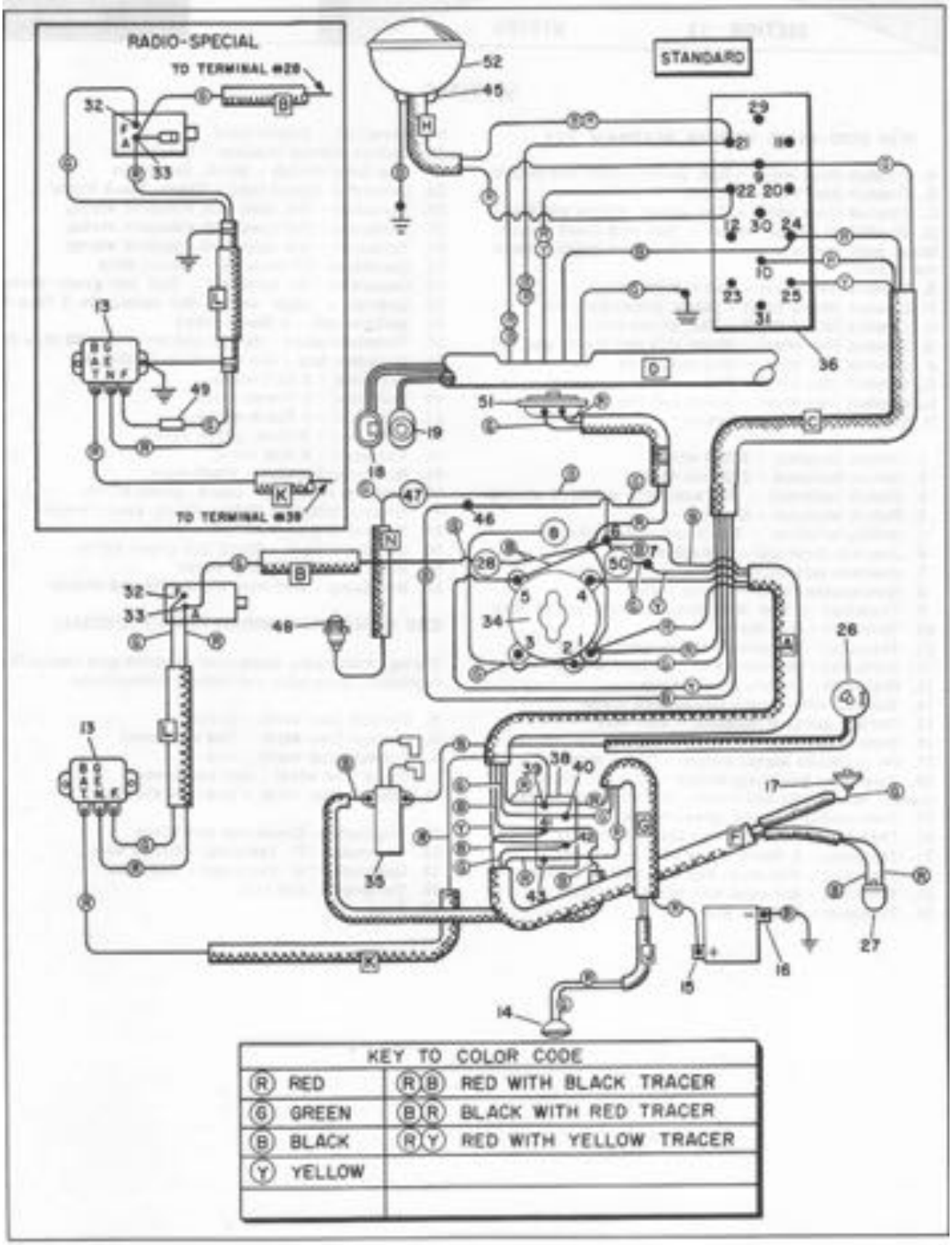



Figure 5B-1. 1959 DUO GLIDE Wiring Diagram

# WIRING

1960 DUO-GLIDE

## WIRING DIAGRAM KEY

A. Conduit (four wire) - Red, green, black and yellow
B. Conduit (one wire) - Green
C. Conduit (four wire) - Red, green, yellow and black
D. Handlebar (loose wires) - Red with black tracer, black with red tracer, red with yellow tracer, black and green
E. Conduit (two wire) - Red and green
F. Conduit (three wire) - Black, green and red
G. Conduit (three wire) - Red, green and red
H. Conduit (three wire) - Black, white and yellow
J. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Conduit (two wire) - Green and red
N. Conduit (one wire) - Green

1. Switch terminal - 3 Red wires
2. Switch terminal - 2 Green wires
3. Switch terminal - Not used with standard wiring
4. Switch terminal - Green wire
5. Switch terminal - Black and yellow wires
6. Junction terminal - 5 Black wires
7. Junction terminal - Green, yellow wires
8. Speedometer light - Green wire
9. Terminal - Red with black tracer, green wire
10. Terminal - Red wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Regulator - 2 Red, green wires
14. Tail and stop lamp - Green, red wires
15. Battery positive terminal - Red wire
16. Battery negative terminal - Black wire
17. Oil pressure signal switch - Green wire
18. Handlebar headlamp switch - Red with black tracer, black with red tracer, red with yellow tracer
19. Horn switch - Black, green wires
20. Terminal - Not used with standard wiring
21. Terminal - 2 Black wires with red tracer
22. Terminal - Red wire, red with yellow tracer
23. Terminal - Not used with standard wiring
24. Terminal - 2 Black wires
25. Terminal - Yellow wire
26. Ignition circuit breaker - Black wire
27. Stop lamp switch - Black, red wires
28. Generator signal light - Green, black wires
29. Terminal - Not used with standard wiring
30. Terminal - Not used with standard wiring
31. Terminal - Not used with standard wiring
32. Generator "F" terminal - Green wire
33. Generator "A" terminal - Red and green wires
34. Ignition - Light switch - See terminals 1 through 5
35. Ignition coil - 2 Black wires
36. Terminal plate - See 10 and terminals 20 through 24
38. Terminal box - See terminals 39 through 43
39. Terminal - 3 Red wires
40. Terminal - 2 Green wires
41. Terminal - 3 Black wires
42. Terminal - Yellow, green wires
43. Terminal - 2 Red wires
45. Terminal plate top mounting screw (ground)
46. Junction terminal - Black, green wires
47. Neutral indicator light - Black, green wires
48. Neutral indicator switch - Green wire
50. Oil signal light - Black and green wires
51. Horn - Red and green wires
52. Headlamp - Black, white and yellow wires

## KEY TO WIRING DIAGRAM (RADIO-SPECIAL)

Wiring with radio equipment is unchanged except for regulator, generator and battery connections.

B. Conduit (one wire) - Green
G. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Cable (two wire) - Red and green
M. Conduit (one wire) - Red (not shown)

13. Regulator - Green and red wires
32. Generator "F" terminal - Green wire
33. Generator "A" terminal - Red wire
39. Terminal - Red wire
49. Fuse

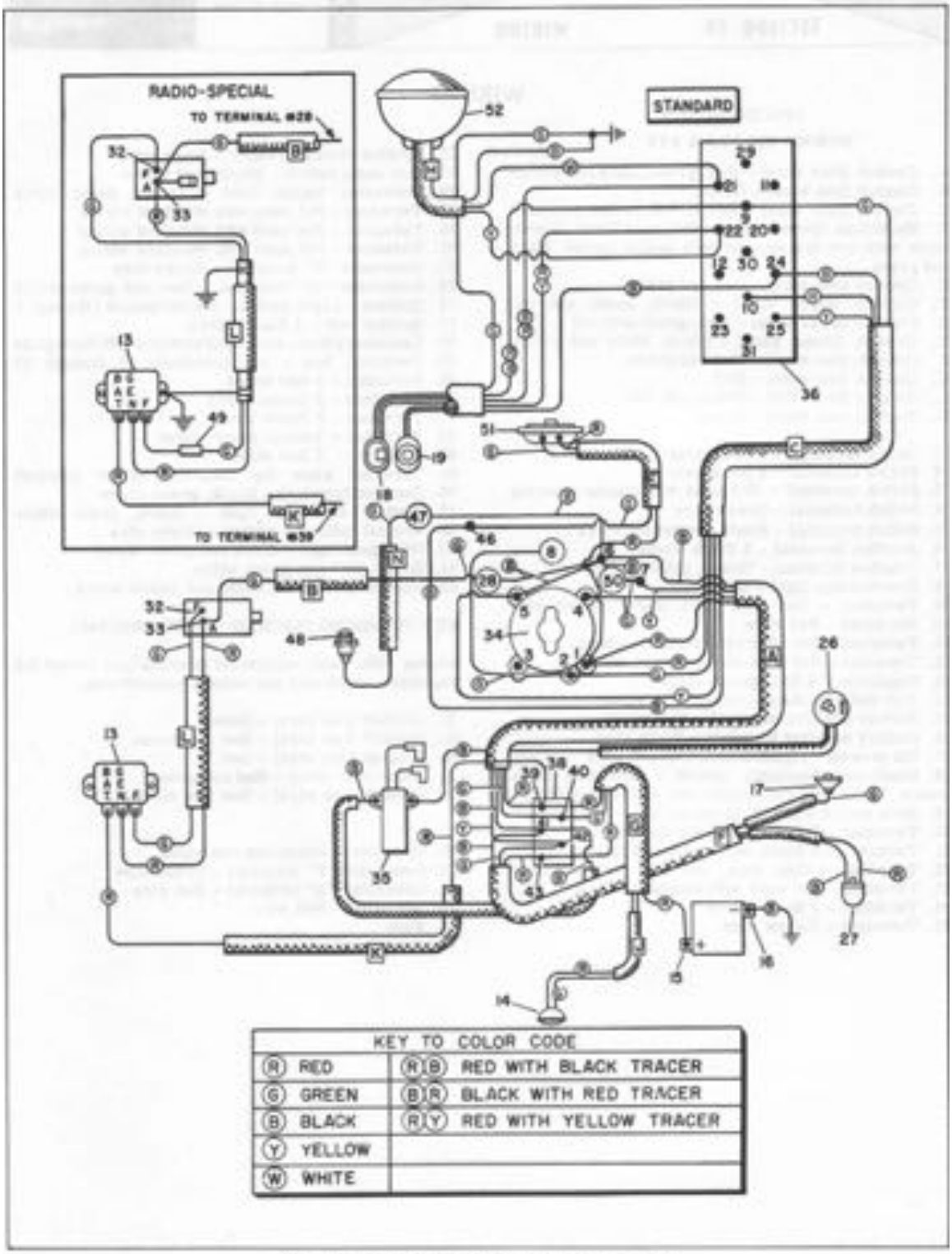



Figure 5B-1A. 1960 Duo-Glide Wiring Diagram

# WIRING

1961-64 DUO-GLIDE

## WIRING DIAGRAM KEY

A. Conduit (four wires) - Red, green, black and yellow
B. Conduit (one wire) - Green
C. Conduit (four wire) - Red, green, yellow and black
D. Handlebar (loose wires) - Red with black tracer, black with red tracer, red with yellow tracer, black and green
E. Conduit (two wire) - Red and green
F. Conduit (three wire) - Black, green and red
G. Conduit (three wire) - Red, green and red
H. Conduit (three wire) - Black, white and yellow
J. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Conduit (two wire) - Green and red
N. Conduit (one wire) - Green

1. Switch terminal - 3 Red wires
2. Switch terminal - 2 Green wires
3. Switch terminal - Not used with standard wiring
4. Switch terminal - Green wire
5. Switch terminal - Black and yellow wires
6. Junction terminal - 5 Black wires
7. Junction terminal - Green, yellow wires
8. Speedometer light - Green wire
9. Terminal - Red with black tracer, green wire
10. Terminal - Red wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Regulator - 2 Red, green wires
14. Tail and stop lamp - Green, red wires
15. Battery positive terminal - Red wire
16. Battery negative terminal - Black wire
17. Oil pressure signal switch - Green wire
18. Handlebar headlamp switch - Red with black tracer, black with red tracer, red with yellow tracer
19. Horn switch - Black, green wires
20. Terminal - Not used with standard wiring
21. Terminal - 2 Black wires with red tracer
22. Terminal - Red wire, red with yellow tracer
23. Terminal - Not used with standard wiring
24. Terminal - 2 Black wires
25. Terminal - Yellow wire
26. Ignition circuit breaker - Black, yellow wires
27. Stop lamp switch - Black, red wires
28. Generator signal light - Green, black wires
29. Terminal - Not used with standard wiring
30. Terminal - Not used with standard wiring
31. Terminal - Not used with standard wiring
32. Generator "F" terminal - Green wire
33. Generator "A" terminal - Red and green wires
34. Ignition light switch - See terminals 1 through 5
35. Ignition Coil Front Cylinder - Yellow wire
36. Ignition Coil Rear Cylinder - 2 Black wires
37. Terminal plate - See 10 and 20 through 24
38. Terminal box - See terminals 39 through 43
39. Terminal - 3 Red wires
40. Terminal - 2 Green wires
41. Terminal - 3 Black wires
42. Terminal - Yellow, green wires
43. Terminal - 2 Red wires
45. Terminal plate top mounting screw (ground)
46. Junction terminal - Black, green wires
47. Neutral indicator light - Black, green wires
48. Neutral indicator switch - Green wire
50. Oil signal light - Black and green wires
51. Horn - Red and green wires
52. Headlamp - Black, white and yellow wires

## 7. KEY FOR WIRING DIAGRAM (RADIO - SPECIAL)

Wiring with radio equipment is unchanged except for regulator, generator and battery connections.

B. Conduit (one wire) - Green
G. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Cable (two wire) - Red and green
M. Conduit (one wire) - Red (not shown)

13. Regulator - Green and red wires
32. Generator "F" Terminal - Green wire
33. Generator "A" Terminal - Red wire
39. Terminal - Red wire
49. Fuse

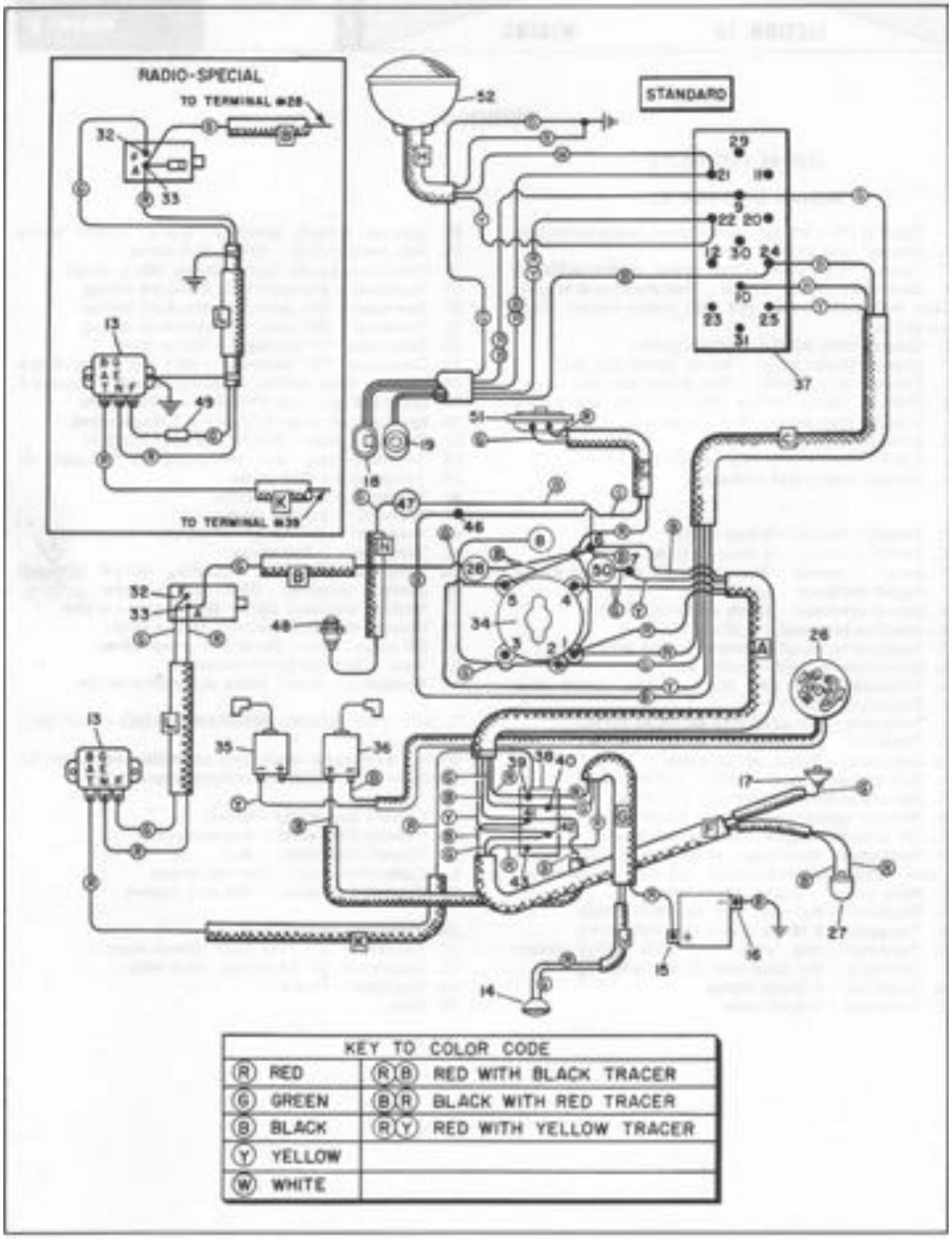



Figure 5B-10. 1961-64 Duo-Glide Wiring Diagram

# WIRING

1965-67 ELECTRA-GLIDE

## WIRING DIAGRAM KEY

A. Conduit (four wire) - Red, green, black and yellow
B. Conduit (one wire) - Green
C. Conduit (four wire) - Red, green, yellow and black
D. Left handlebar (loose wires) - Red with black tracer, black with red tracer, red with yellow tracer, 2 black wires
E. Right handlebar (loose wires) - 2 black wires
F. Conduit (two wire) - 2 red wires
G. Conduit (one wire) - Yellow
H. Conduit (three wire) - Black, white and yellow
J. Conduit (two wire) - Red and green
K. Conduit (one wire) - Red
L. Conduit (two wire) - Green and red
M. Conduit (one wire) - Black
N. Conduit (one wire) - Black
O. Conduit (one wire) - Black
P. Conduit (two wires) - 2 black wires
Q. Conduit (one wire) - Red

1. Switch terminal - Switch supply
2. Switch terminal - Headlamp
3. Switch terminal - Not used with standard wiring
4. Switch terminal - Tail lamp
5. Switch terminal - Ignition coil
6. Ignition - Light switch - See terminals 1 through 5
7. Junction terminal
8. Junction terminal
9. Terminal
10. Terminal
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Regulator
14. Tail and stop lamp
15. Battery positive terminal
16. Battery negative terminal
17. Oil pressure signal switch
18. Handlebar headlamp switch
19. Horn switch
20. Terminal - Not used with standard wiring
21. Terminal
22. Terminal
23. Terminal - Not used with standard wiring
24. Terminal
25. Terminal
26. Ignition circuit breaker
27. Stop lamp switch
28. Generator signal light
29. Terminal - Not used with standard wiring
30. Terminal - Not used with standard wiring
31. Terminal
32. Generator "F" terminal
33. Generator "A" terminal
34. Starter solenoid
35. Starter motor
36. Ignition Coil
37. Terminal plate
38. Terminal box - See terminals 39 through 43
39. Terminal
40. Terminal
41. Terminal
42. Terminal
43. Terminal
44. Speedometer light
45. Terminal plate top mounting screw (ground)
46. Headlamp
47. Neutral indicator light
48. Neutral switch
49. Starter button
50. Oil signal light
51. Horn
52. Circuit breaker

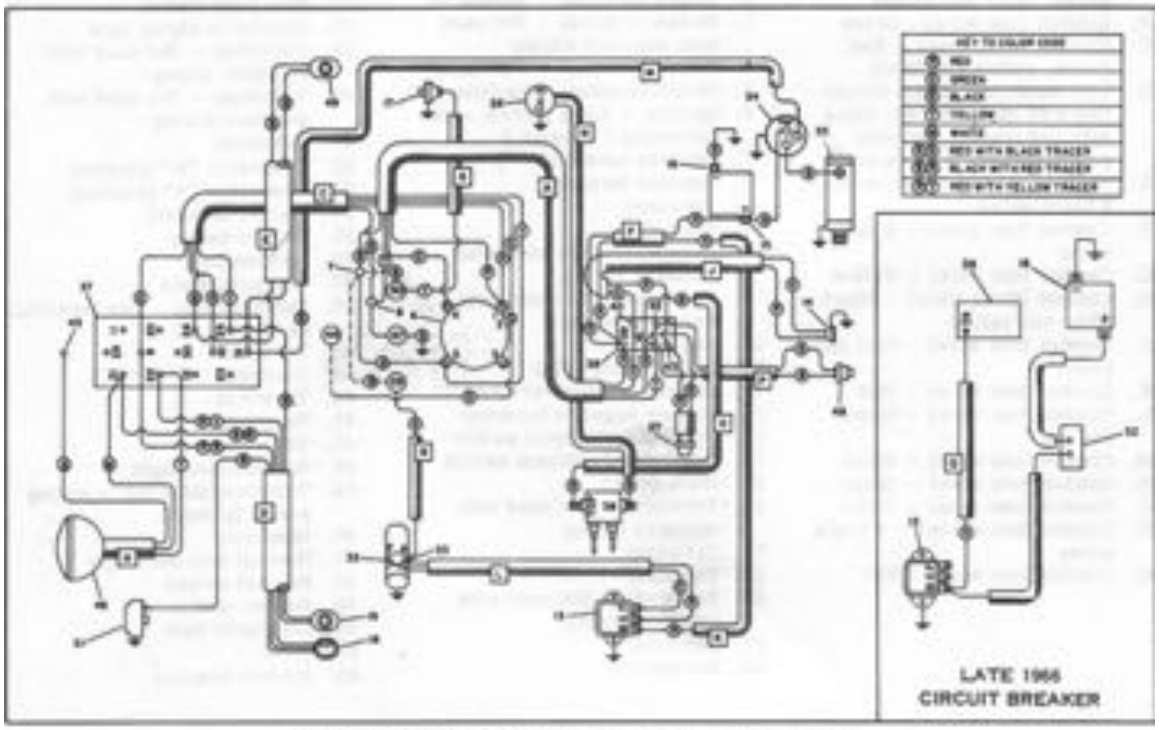



Figure 5B-22. 1965-67 Electra-Glide Wiring Diagram

# WIRING

1968-69 ELECTRA-GLIDE

## WIRING DIAGRAM KEY

A. Conduit (four wire) - red, green, black and yellow
B. Conduit (one wire) - green
C. Conduit (four wire) - red, green, yellow and black
D. Left handlebar (loose wires) - red with black tracer, black with red tracer, red with yellow tracer, 2 black wires
E. Right handlebar (loose wires) - red, green, brown, 2 black wires
F. Conduit (one wire) - red
G. Conduit (one wire) - yellow
H. Conduit (three wire) - black, white and yellow
J. Conduit (two wire) - red and green
K. Conduit (one wire) - red
L. Conduit (two wire) - green and red
M. Conduit (one wire) - black
N. Conduit (one wire) - black
O. Conduit (one wire) - black
P. Conduit (two wire) - 2 black wires
Q. Conduit (one wire) - red
R. Conduit (one wire) - red
S. Conduit (one wire) - green
T. Conduit (two wire) - red and green

1. Switch terminal - switch supply
2. Switch terminal - headlamp
3. Switch terminal - not used with standard wiring
4. Switch terminal - tail lamp
5. Switch terminal - ignition coil
6. Ignition - light switch - see terminals 1 through 5
7. Junction terminal
8. Junction terminal
9. Terminal
10. Terminal
11. Terminal
12. Terminal - not used with standard wiring
13. Regulator
14. Tail and stop lamp
15. Battery positive terminal
16. Battery negative terminal
17. Oil pressure signal switch
18. Handlebar headlamp switch
19. Horn switch
20. Terminal
21. Terminal
22. Terminal
23. Terminal
24. Terminal
25. Terminal
26. Ignition circuit breaker
27. Stop lamp rear switch
28. Generator signal light
29. Terminal - not used with standard wiring
30. Terminal - not used with standard wiring
31. Terminal
32. Generator "F" terminal
33. Generator "A" terminal
34. Starter solenoid
35. Starter motor
36. Ignition coil
37. Terminal plate
38. Terminal box - see terminals 39 through 43
39. Terminal
40. Terminal
41. Terminal
42. Terminal
43. Terminal
44. Speedometer light
45. Terminal plate top mounting screw (ground)
46. Headlamp
47. Neutral indicator light
48. Neutral switch
49. Starter button
50. Oil signal light
51. Horn
52. High beam indicator lamp
53. Overload circuit breaker
54. Starter relay
55. Direction signal switch
56. Direction signal flasher
57. Left front direction lamp
58. Right front direction lamp
59. Left rear direction lamp
60. Right rear direction lamp
61. Left direction signal pilot lamp
62. Right direction signal pilot lamp
63. Stop lamp front switch
64. Connector

# SWITCHES

## IGNITION-LIGHT SWITCH

The switch located in the center of the instrument panel below the "GEN" and "OIL" indicator lamps is a combination ignition-light switch. It has three positions plus a center-off position. One notch counterclockwise illuminates parking lights only. The first notch or click clockwise from the center-off position is ignition only while the second click is running lights and ignition.

It is not necessary to keep the key inserted in the lock to operate the switch after it has been unlocked. The switch can be locked only in the "off" and "parking lights" position.

### DISASSEMBLING IGNITION LIGHT SWITCH

On Duo-Glide and Servi-Car Models remove instrument panel cover by prying out side-cover clip located at trip mileage set knob and turning out mounting base center screw located in the center of instrument panel below speedometer. On Model 165 remove switch bezel to expose switch.

Disconnect all wires connected to switch terminals and remove four switch mounting screws.

See Fig. 5C-1. All directions for disassembly apply with switch in an inverted position. Switch must be in "off" position and unlocked.

Grasp end of roller contact retainer with pliers and simultaneously move it upward and away from roller contact (1). Lift off roller contact and switch mounting plate assembly (2). Notice that this plate is positioned with the three-terminal side away from lock cover hinge.

Reinforcing plate (3) with contact bar holder (4) and roller contact retainer (5) can be removed from switch cover by slipping part assembly sideways until one set of tabs clears slot in switch cover, then lifting and sliding assembly the opposite direction to clear other tab.

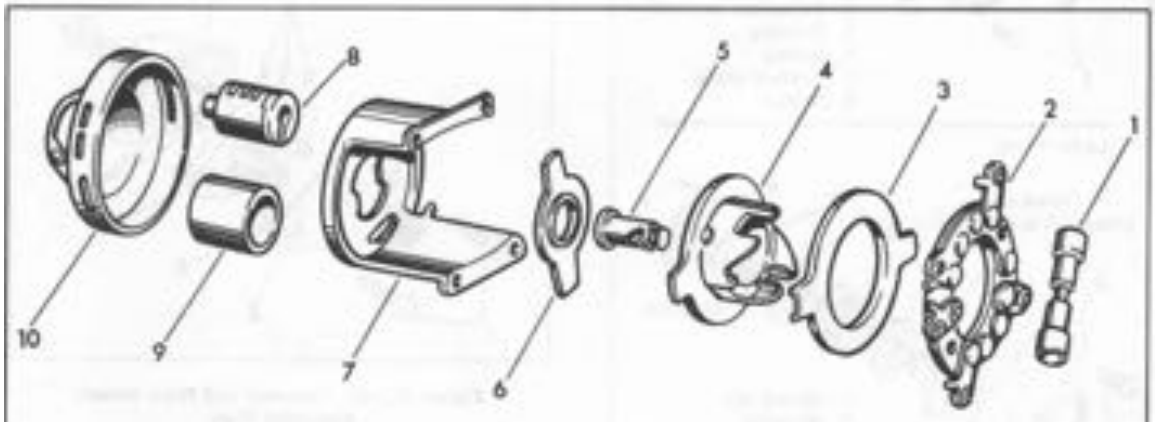
Switch base (7) and lock plate (6) can be removed from switch cover. Note that narrow end of elongated hole in lock, and lug on switch lock (8) which fits into hole in lock plate, are toward lock cover hinge.

Lock assembly (8 and 9) can now be lifted out of switch cover (10). Avoid separating switch cylinder from its case unless lock is faulty. On some models the lock cylinder and case are a single unit.

### CLEANING, INSPECTION AND REPAIR

Wash all parts in cleaning solvent and dry with compressed air.

Inspect all parts, particularly roller contact and plate assembly for excessive wear of contacting brass buttons and roller surfaces. Extreme wear of these parts may allow head of roller contact retainer to short against switch lock plate. Loosened terminals on switch mounting plate may also cause a short




1. Roller contact
2. Switch mounting plate assembly
3. Reinforcing plate
4. Contact bar holder
5. Roller contact retainer
6. Switch lock plate
7. Switch base
8. Ignition switch cylinder
9. Ignition switch cylinder case
10. Switch cover

Figure 5C-1. Ignition Light Switch

or an inconsistent positive contact. Replace all worn or rusted parts.

ASSEMBLING IGNITION LIGHT SWITCH

Apply a light coat of grease to head of roller contact retainer, lock plate, roller contact and contact buttons on switch mounting plate.

Assemble parts in reverse order of disassembly. If lock cylinder had to be removed from case for repair or replacement, it must be replaced in correct position or switch cannot be locked. To reassemble correctly, insert lock cylinder into housing with tumblers in any one of the four registers. While pressing cylinder into housing with fingertip, insert key and turn clockwise as far as possible. Remove key and complete assembly.

## BUTTON SWITCH

This type switch is used for momentary closing of circuits to horn, magneto or starting motor and is located on handlebar. Terminal has either one or two wires. Two types of switches are in use (early and late type). See Figure 5C-1A.

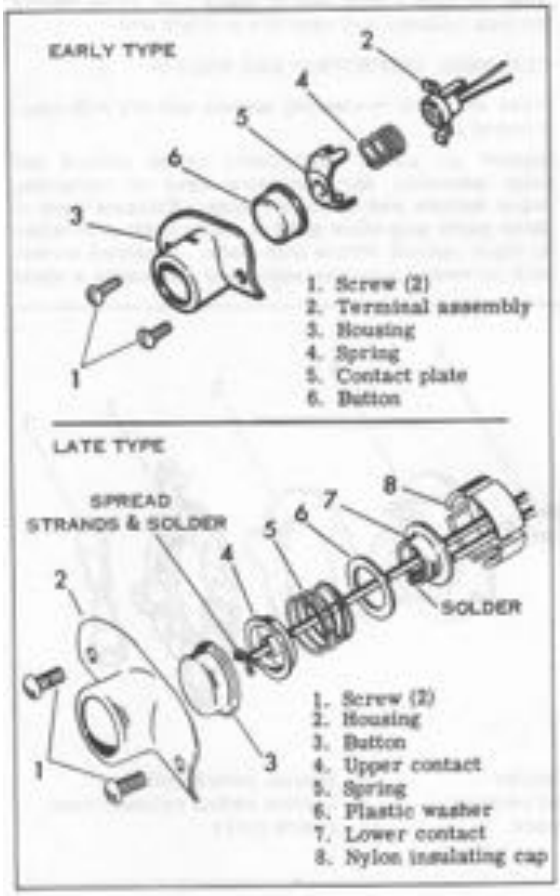



Figure 5C-1A. Button Switches - Exploded View

To disassemble the early type switch, remove screws (1) to free housing. Remove terminal assembly (2) from housing (3) with a screwdriver. Remove spring (4), contact plate (5), and button (6) from the housing.

To replace the early type switch wires, unsolder the old wires and solder new wires onto the terminal assembly. Assemble in reverse order of disassembly.

To disassemble late type switch, remove screws (1) from housing. Pull remaining parts from housing as an assembly.

To replace the switch wires, unsolder or cut wires from contacts. The wire ends should have about 1/4 inch of insulation stripped off.

Lead one wire through cup, lower contact, plastic washer and spring to upper contact. Be sure parts are arranged as shown. Insert one wire end through center of upper contact, spread strands out flat over contact and solder. Lead second wire through cup and solder to lower contact.

Insert button and assembled parts in housing and reinstall switch on handlebar.

## HEADLAMP DIMMER AND HORN SWITCH

This type switch has the headlamp dimmer switch and horn button combined in one unit located on the handlebar. High and low beams are operated with flip switch. Button operates horn. See Figure 5C-1B.

To disassemble switch, remove clamping screws (1) and separate parts of switch: cover (2), switch (3), and base (4). Remove wires (5) from switch by loosening terminal screws (6).

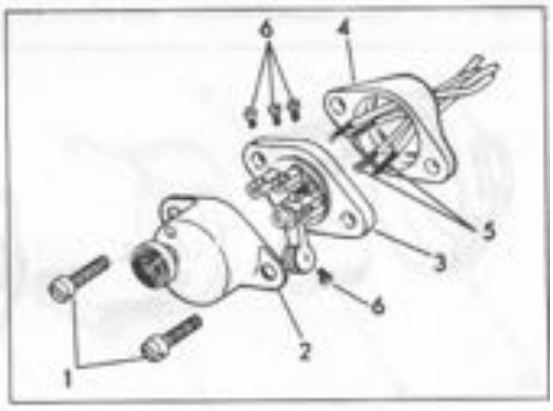


Figure 5C-1B. Dimmer and Horn Switch Exploded View

Check switch for wear, and replace switch if it will not stay in high or low beam position. Check spring tension on horn button.

Replace worn or broken parts with a new switch or base. Clean terminals and reassemble in reverse order. Be careful not to over-tighten clamp screws or plastic body may crack.

## TRANSMISSION NEUTRAL SWITCH

This switch is threaded into the transmission top cover. Switch plunger is depressed by a nub on the shifter drum or shifter gear only when the transmission is in neutral to complete the circuit. A variable number of spacing washers are used to close the circuit only when transmission is in neutral. Switch is permanently assembled and if it fails to close the circuit when operating plunger is depressed, it must be replaced.

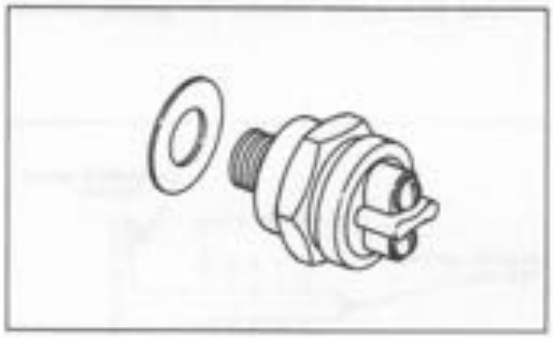


Figure 5C-1C. Neutral Switch

## SOLENOID SWITCH

Solenoid switches are designed to close and open electrical circuits electro-magnetically. Switches of this type consist basically of contacts and a winding around a hollow cylinder containing a movable plunger. When the winding is energized by the battery through an external control circuit, the magnetism produced pulls the plunger into the coil. The contact disc attached to the plunger moves against two main switch contacts closing the circuit.

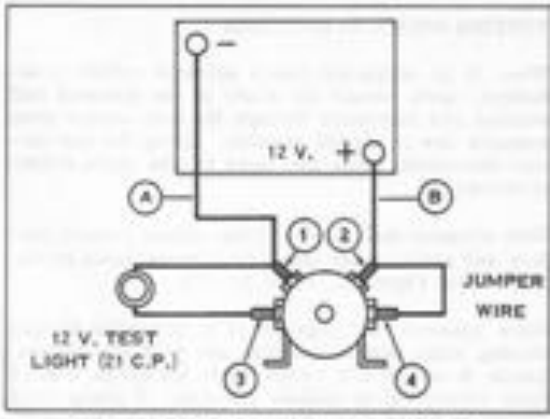
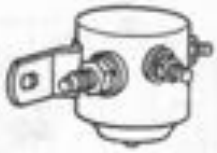



Figure 5C-1D. Test Circuit for 1964-65 Servi-car Solenoid

The 1964-65 Servi-car solenoid switch is permanently assembled. Repair parts are not sold. If this switch becomes defective, it must be replaced. The control circuit wires are connected to small terminals. The motor and battery circuit wires are connected to heavy terminals.



The Electra-Glide 1967 Sportster, and 1966 Servi-car solenoid switch individual parts are replaceable as shown in exploded view, Figure 5C-1E, below. The control circuit wire from handlebar starter button is connected to small terminal stud. Battery cable must be connected to the large, longest stud and starter motor cable is connected to the large, shorter stud. If cables are reversed, solenoid coils will remain in circuit and drain battery. See solenoid internal wiring diagram, Figure 5C-1G.

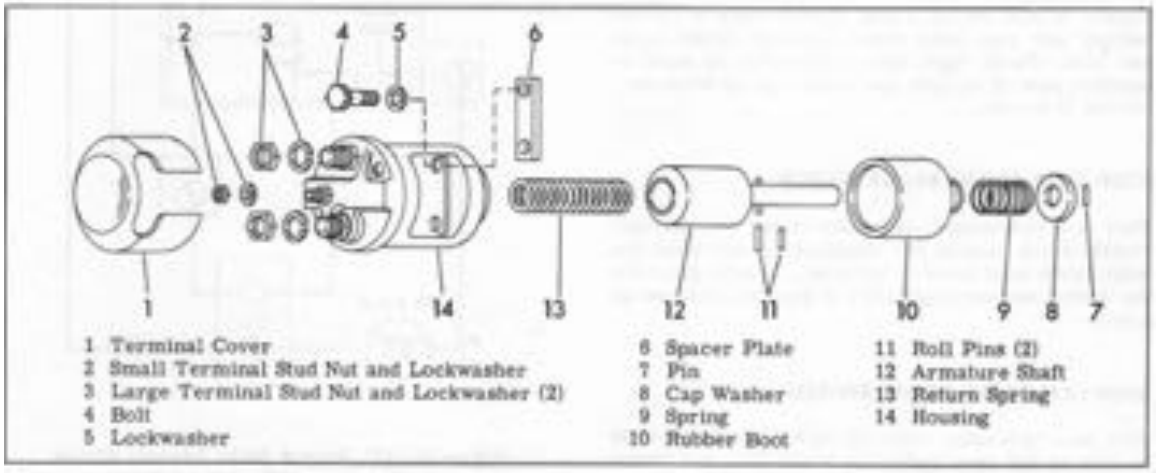



Figure 5C-1E. Electra-Glide 1967 Sportster and 1966 Servi-car Solenoid - Exploded View

TESTING SOLENOID SWITCHES

When it is suspected that a solenoid switch is defective, tests should be made of the solenoid coil winding and continuity through the main switch when contacts are in closed position. Using the test circuit described, these two tests can be made simultaneously.

With solenoid disconnected from control circuit, battery and motor, make test circuit connections as follows: (See Figure 5C-1D or 5C-1F).

Since solenoid coil requires 12 V. to actuate plunger closing main switch contacts, use a 12-volt battery. Leads A and B are connected to terminals 1 and 2 (coil terminals) to actuate solenoid. A sharp click should be heard from the solenoid switch when making this connection. No click or a heavy spark at the terminals when connecting wires would indicate either an open or short in the solenoid winding and solenoid switch must be replaced. If the solenoid winding checks good and plunger does close main switch contacts, there is still a possibility contacts are badly burned or eroded and will not pass heavy current.

To test continuity on the main contacts, leave 12 V. leads connected to terminals 1 and 2, connect a test bulb of a least 21 CP (12 V.) to terminals 1 and 3. (On servi-car solenoid connect terminals 2 and 4 with a jumper wire.) A bright glow of the test bulb indicates main switch contacts are passing current.

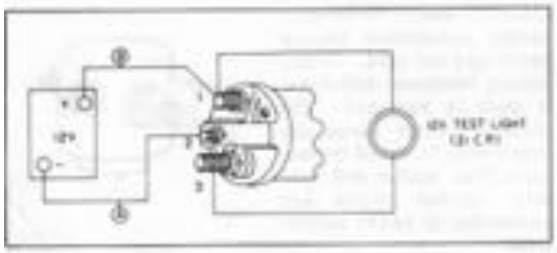


Figure 5C-1F. Test Circuit for Electra-Glide, 1967 Sportster and 1966 Servi-car Solenoid

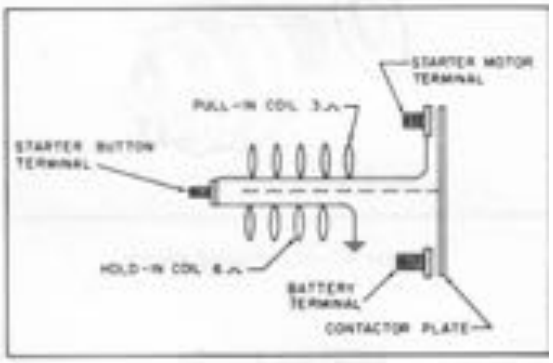



Figure 5C-1G. Solenoid Internal Wiring Diagram - Electra-Glide, 1967 Sportster and 1966 Servi-car

## STARTER RELAY SWITCH

Starter relay switch for late 1967 Electra-Glide models is a sealed unit and is not repairable. If test shows unit to be defective it must be replaced.

Figure 5C-1E shows a test circuit using a 12-volt battery and stop lamp bulb. Contacts should close and bulb should light when connection is made at positive post of battery and should go out when connection is broken.

## STOP LAMP FRONT BRAKE SWITCH

This is a mechanical, normally-closed plunger type switch which closes the stoplight circuit when the front brake hand lever is operated. Repair parts for the switch are not available - it must be replaced as a unit.

## STOP LAMP REAR BRAKE SWITCH

This is a hydraulic, normally-open switch, which is located in the rear hydraulic brake line, and closes the circuit when the rear brake is applied.

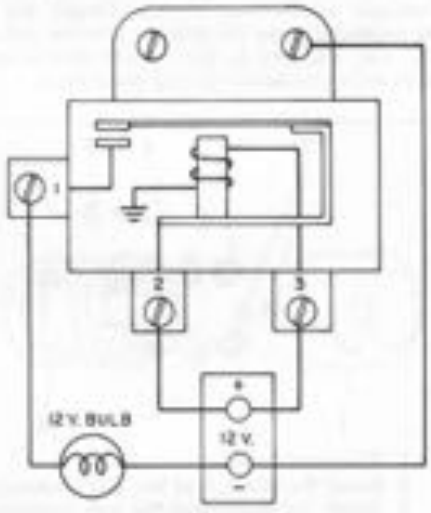



Figure 5C-1E. Starter Relay Internal Wiring Diagram and Test Circuit

# LAMPS

## HEADLAMP

DUO-GLIDE, SPORTSTER AND SERVI-CAR

The headlamp is a sealed-beam type, specially designed and made for Harley-Davidson motorcycles. When replacement is required, use only the prescribed sealed-beam unit. Do not attempt to use an automobile sealed-beam unit because the current requirements for a motorcycle are much less than for an automobile and damage to battery or generator will result. If either filament burns out, or the lens breaks, the entire unit must be replaced. Do not attempt to repair a defective sealed-beam unit because when the seal is broken the reflector tarnishes and poor light and road visibility result.

DUO-GLIDE AND SERVI-CAR

Loosen door screw enough to remove headlamp door. Remove three retaining ring screws and retaining ring.

> NOTE: Late models may have spring hooked into retaining ring hole - unhook spring to free retaining ring.

The sealed-beam unit is now free from the headlamp body, and connector block can be removed from the unit by pulling connector block from the unit prongs.

Assembly is the reverse order of disassembly. Make sure connector block contacts are clean to ensure good electrical contact.

To replace the entire headlamp on 1959 models remove a back panel and disconnect two lamp wires leading to terminal plate. Remove headlamp fastening nut and free lamp from motorcycle. On 1960 models remove 6 slotted screws holding headlamp body to housing.

SPORTSTER

1966 and Earlier XLH

Loosen headlamp mounting nut located beneath headlamp housing with socket wrench and move headlamp back so screw located on lower periphery of headlamp door is accessible with a screwdriver. Remove screw, simultaneously lift and swing unit up and free from headlamp body. Pull connector block from sealed-beam unit prongs. Pry retaining springs from headlamp door grooves to free sealed-beam unit from rim.

Assembly is the reverse order of disassembly. Be sure connector block contacts are clean to ensure a good electrical contact. After final assembly, readjust headlamp as described under "Beam Adjustment."

To replace entire headlamp assembly it is first necessary to remove handlebar clamp front cover and then the headlamp housing assembly. To free headlamp, disconnect lamp wires and remove nut securing lamp to the fork. Assembly is the reverse order of disassembly.

1967 and Later XLH and XLCH

To remove sealed beam unit, remove screw from door or clamping ring. Pry unit from rubber mounting and pull connector block from unit prongs. Headlamp mounting nut is located under snap plug on mounting bracket.

BEAM ADJUSTMENT

To get the greatest efficiency from the headlamp and to meet the requirements of the law, correctly adjust headlamp beam according to the following instructions.

Draw a horizontal line on a wall or screen exactly the same height as the center of the headlamp to be checked and adjusted. Then, position the motorcycle on a level surface with headlamp approximately 25 feet away from the test pattern. Have a rider sit on the motorcycle to simulate actual running conditions. Be sure tires are correctly inflated. Aim the headlamp directly at the screen and turn on the light switch. Set beam selector switch on the high beam position, and check beam for height and direction. The top of the main beam of light should register even with, but no higher than the horizontal line of the test pattern.

SPORTSTER

To aim beam, loosen the headlamp mounting nut and position the lamp to correctly adjust the beam of light in relation to the horizontal line. At the same time, turn the headlamp right or left to direct the beam of light straight ahead. Tighten the clamp nut after the lamp is correctly adjusted and install remaining fork parts.

ELECTRA GLIDE, DUO-GLIDE AND SERVI-CAR

The lamp can be tilted up or down to aim it in relation to the horizontal line by turning vertical adjusting screw in or out. The lamp can be aimed to the right or left in relation to the front wheel by turning the horizontal adjustment screw in or out.

BULB CHART

| Model | Lamp Description | Bulbs Rqd. | Candle Power or Wattage | | Harley-Davidson Part Number | |
|---|---|---|---|---|---|---|
| | | | 12 V. | 6 V. | 12 V. | 6 V. |
| DUO-GLIDE ELECTRA GLIDE | HEADLAMP | 1 | | | 67717-64 | 67717-48B |
| | Hi Beam | | 50 Watts | 45 Watts | | |
| | Lo Beam | | 45 Watts | 35 Watts | | |
| | TAIL AND STOP LAMP | 1 | | | 68165-64 | 68165-47 |
| | Tail Lamp | | 4 C.P. | 3 C.P. | | |
| | Stop Lamp | | 32 C.P. | 21 C.P. | | |
| | INSTRUMENT PANEL | | | | | |
| | Generator Signal Light | 1 | 2 C.P. | 2 C.P. | 68462-64 | 68462-49 |
| | Oil Pressure Signal Light | 1 | 2 C.P. | 2 C.P. | 68462-64 | 68462-49 |
| | Speedometer Light | 1 | | 1.5 C.P. | 71090-64 | 71090-47 |
| | Generator Signal Light (Special Radio) | 1 | | 2 C.P. | | 68462-49 |
| | Neutral Indicator Light | 1 | 2 C.P. | 2 C.P. | 68462-64 | 68462-49 |
| | High Beam Indicator | 1 | 2 C.P. | | 68462-64 | |
| | ACCESSORIES | | | | | |
| | Spot Lamp (Bulb Type) | 1 | 32 C.P. | 32 C.P. | 68715-64 | 68715-49 |
| | Spot Lamp (Sealed Beam Type) | 1 | 30 Watts | 30 Watts | 68726-64 | 68726-62 |
| | Parking Lamp | - | 3 C.P. | 3 C.P. | 68166-64 | 68165-15 |
| | Turn Indicator Lamps | 4 | 32 C.P. | 21 C.P. | 68572-64A | 68572-50 |
| | Turn Indicator Pilot Lamps | 2 | 1.5 C.P. | 1 C.P. | 71090-64 | 71090-47 |
| SPORTSTER | Headlamp Hi Beam / Lo Beam | 1 | 50 Watts / 45 Watts | 45 Watts / 35 Watts | 67717-64 | 67717-59 |
| | Tail Lamp Tail Lamp / Stop Light | 1 | 4 C.P. / 32 C.P. | 3 C.P. / 21 C.P. | 68165-64 | 68165-47 |
| | Generator Signal Light | 1 | 4 C.P. | 3 C.P. | 71090-65 | 71090-59 |
| | Oil Pressure Signal Light | 1 | 4 C.P. | 3 C.P. | 71090-65 | 71090-59 |
| | Speedometer Light | 1 | 2 C.P. | 1.5 C.P. | 68462-64 | 71090-47 |
| | High Beam Indicator | 1 | 2 C.P. | | 68462-64 | |
| | ACCESSORIES | | | | | |
| | Spot Lamp (Bulb Type) | 1 | 32 C.P. | 32 C.P. | 68715-64 | 68715-49 |
| | Spot Lamp (Sealed Beam Type) | 1 | 30 Watts | 30 Watts | 68726-64 | 68726-62 |
| | Parking Lamp | - | 3 C.P. | 3 C.P. | 68166-64 | 68165-15 |
| | Turn Indicator Lamps | 4 | 32 C.P. | 21 C.P. | 68572-64A | 68572-50 |
| | Turn Indicator Pilot Lamps | 2 | 1.5 C.P. | 1 C.P. | 71090-64 | 71090-47 |
| SERVI-CAR | Headlamp Hi Beam / Lo Beam | 1 | 50 Watts / 45 Watts | 45 Watts / 35 Watts | 67717-64 | 67717-48B |
| | Tail Lamp Tail Lamp / Stop Light | 1 | 4 C.P. / 32 C.P. | 3 C.P. / 21 C.P. | 68165-64 | 68165-47 |
| | Generator Signal Light | 1 | 2 C.P. | 2 C.P. | 68462-64 | 68462-49 |
| | Oil Pressure Signal Light | 1 | 2 C.P. | 2 C.P. | 68462-64 | 68462-49 |
| | Speedometer Light | 1 | 1.5 C.P. | 1.5 C.P. | 71090-64 | 71090-47 |
| | High Beam Indicator | 1 | 2 C.P. | | 68462-64 | |
| | ACCESSORIES | | | | | |
| | Spot Lamp (Bulb Type) | 1 | 32 C.P. | 32 C.P. | 68715-64 | 68715-49 |
| | Spot Lamp (Sealed Beam Type) | 1 | 30 Watts | 30 Watts | 68726-64 | 68726-62 |
| | Parking Lamp | - | 3 C.P. | 3 C.P. | 68166-64 | 68165-15 |
| | Turn Indicator Lamps | 4 | 32 C.P. | 21 C.P. | 68572-64A | 68572-50 |
| | Turn Indicator Pilot Lamps | 2 | 1.5 C.P. | 1 C.P. | 71090-64 | 71090-47 |

# GENERATOR

## STANDARD GENERATOR

The standard generator is a direct current two pole-, two-brush unit with charging rate governed entirely by a voltage regulator. The regulator functions to increase charging rate when the battery charge is low or current is used, and to decrease charging rate when no current is being used and the battery is nearing full charge.

### CHECKING GENERATOR

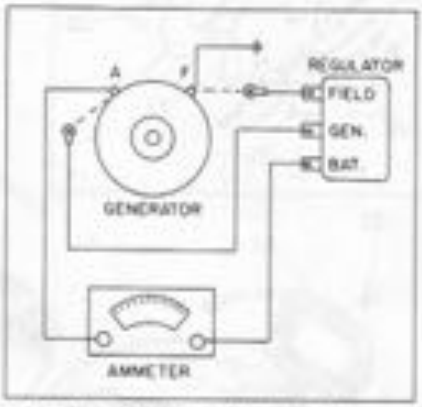
It is possible to trouble shoot faulty generator without removing the generator from the engine or, if necessary to remove it, without completely disassembling the generator. When a generator stops charging or not charging at a satisfactory rate as evidenced by a "dead" battery or signal light on switch panel remaining lighted, it is recommended that unless the trouble is known definitely, the following checking sequence be used:

On installations employing a fuse in the generator field circuit, remove fuse at regulator and examine it to see if it has blown. When replacing fuse be sure insulating sleeve is in good condition and covers fuse properly.

Make certain the generator signal light circuit is not grounded. Remove the wire or wires from the generator "A" terminal and position so contact is not made with motorcycle. Turn ignition on. If generator light on instrument panel goes on, light circuit is grounded and may be reason for the generator not charging. If this circuit is grounded this condition must be corrected. If the generator signal light circuit tested O.K. or if a grounded condition has been corrected, proceed to testing generator output.

### TESTING GENERATOR OUTPUT (See wiring diagram following)

Remove wire from "F" terminal of generator. Connect a short jumper wire from generator "F" terminal to ground on motorcycle. Remove wire or wires from generator "A" terminal and connect the positive lead of a 0-30 ampere ammeter. Start engine and run at a speed of 2000 RPM (approximately 40 MPH). Then momentarily connect negative lead of ammeter to motorcycle battery positive terminal. (Battery should be known to be good.) If the ammeter reads 15 amperes or more for a 6-volt generator or 10 amperes or more for a 12-volt generator, generator is not at fault. Therefore, the difficulty is in the regulator or wiring circuit. (See Voltage Regulator Section 5D). If generator shows no charge or charge below minimum rate, it must be removed for further checking.




Generator Output Test Wiring Diagram

### IMPORTANT

Avoid running with generator field grounded for extended periods. Disconnect ammeter lead from battery before stopping engine to avoid discharging battery through generator.

**CAUTION**

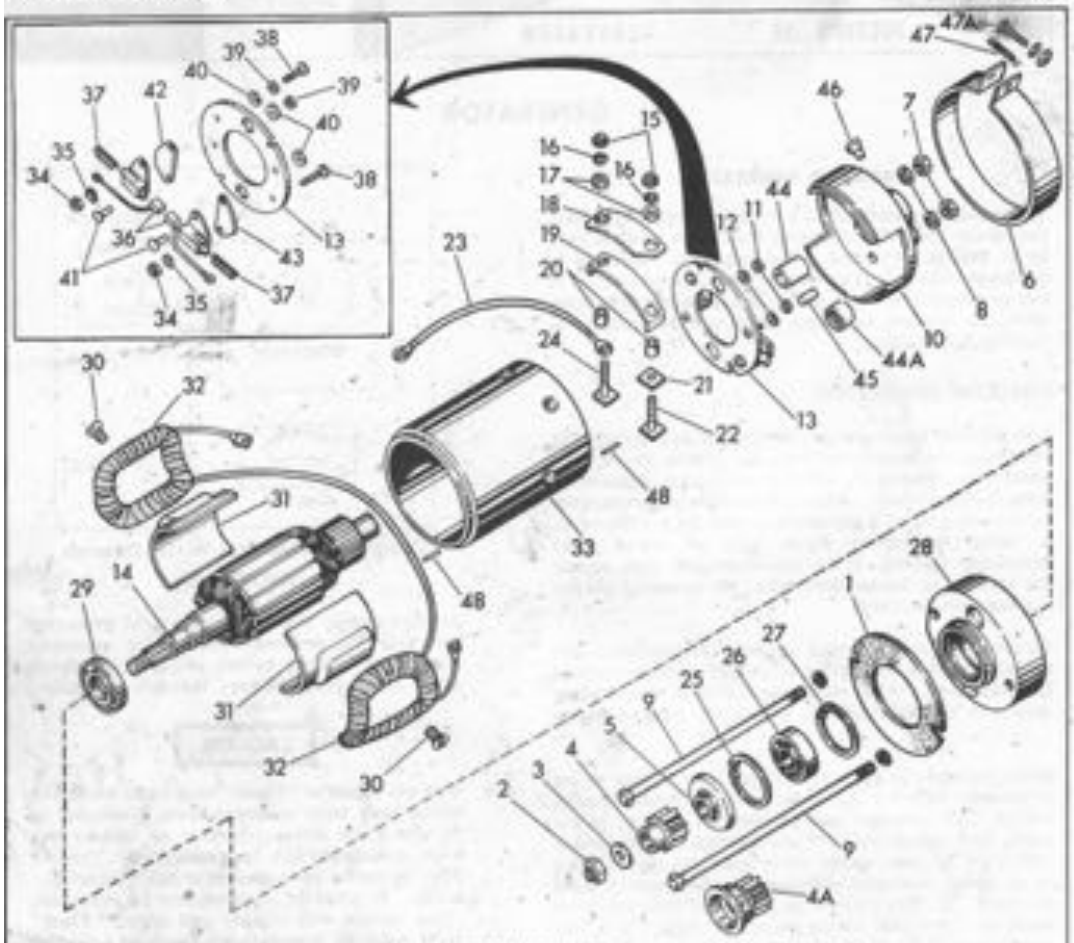
It is advisable to "Flash" field coils whenever wires have been removed from generator or regulator; or after generator or battery has been removed and is reinstalled. This is done to make sure generator has correct polarity. If polarity of generator is reversed, relay points will vibrate and burn. "Flash" field coils by momentarily touching a jumper wire between "BAT" terminal and "GEN" terminal on regulator, after all wires have been properly connected and before starting engine. The momentary surge of current from battery to generator will correctly polarize generator.

### REMOVING GENERATOR

DUO-GLIDE. Disconnect wires from generator "F" and "A" terminals. Remove two long screws through timing gearcase cover that secure generator to gearcase. Move generator to left side of motorcycle and remove, gear end first, between frame members.

SPORTSTER. Disconnect red wire from "BAT" terminal on voltage regulator. On standard Sportster, disconnect black wire from "GEN" terminal.

Remove two long screws through timing gearcase cover that secure generator to gearcase.



1. Mounting gasket
2. Gear shaft nut
3. Gear shaft washer
4. Drive gear
4A. Drive gear with oil slinger
5. Drive end oil deflector
6. Brush cover strap
7. Commutator end cover nut (2)
8. Commutator end cover washer (2)
9. Frame screw (2)
10. Commutator end cover
11. Brush cable nut (2)
12. Brush cable washer (2)
13. Brush holder mounting plate
14. Armature
15. Terminal screw nut (2)
16. Terminal screw lock washer (2)
17. Insulating washer (2)
18. Terminal insulator
19. Terminal bolt clip
20. Terminal screw bushing (2)
21. Bracket insulator
22. Terminal screw (2)
23. Positive brush cable
24. Terminal screw (see item 22)
25. Bearing retainer
26. Armature bearing
27. Bearing retainer
28. Drive end plate
29. Armature oil seal
30. Pole shoe screw (2)
31. Pole shoe (2)
32. Field coil (2)
33. Frame
34. Terminal screw nut (2)
35. Terminal screw lock washer (2)
36. Brush (2)
37. Brush spring (2)
38. Brush holder plate screw (2)
39. Brush holder plate screw washer (2)
40. Brush holder plate screw washer (3)
41. Brush holder plate rivet (2)
42. Brush holder insulation
43. Brush holder spacer
44. End cover bushing
44A. End cover bearing
45. Generator oil wick
46. Commutator end cover oil cup
47. Brush cover strap spring
47A. Brush cover screw, lock washer and nut (1966 model)
48. End locating pin (2)

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 5E-1. Standard Generator - Exploded View

Remove regulator from generator. Remove black or green wire from "F" terminal and red wire from "A" terminal on generator.

Remove generator from chassis out left side of motorcycle.

SERVI-CAR. Disconnect wires from generator "F" and "A" terminals. Remove two long screws through timing gearcase and remove generator to left side of chassis, depressing clutch pedal to allow generator to pass.

INSPECTING BRUSHES (Fig. 5E-1)

Inspect brushes to make certain they are not worn out, broken or gummy and sticking in brush holders.

Remove commutator end cover nuts (7), washers (8), and frame screws (9).

Pry or gently tap commutator end cover (10) off frame and armature shaft. Remove brush holder mounting plate (13) from frame. Disconnect both black brush wires and generator positive brush cable from brush holder terminals.

Remove brushes from brush holders and clean brush holders with cleaning solvent. Blow dry with compressed air. Replace brushes when longest side of brush measures 1/2 in. or less. Seat new brushes with a brush seating stone.

TESTING FIELD COILS

Internal connections of generator field coils to brushes and terminals are shown in Fig. 5E-2.

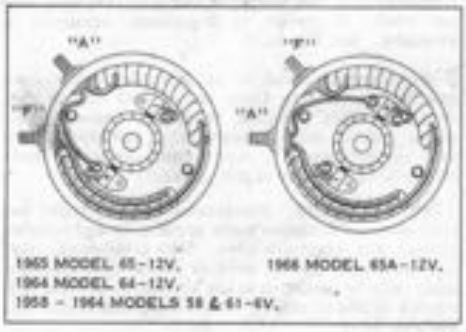



Figure 5E-2. Generator Wiring Diagrams

Arrange an ammeter and battery in series with test points connected to leads. NOTE: All 12-volt generators are stamped "12V" following model No. on frame. Use a 6 volt battery for testing 6-volt generators or a 12 volt battery for testing 12-volt generators. During all tests be particularly careful to avoid overloading or shorting ammeter. An overload is indicated by the needle going beyond range of calibrated scale. A direct short is indicated by needle swinging violently to extreme limit of its travel. In either case, contact must be broken instantaneously to avoid damaging the ammeter. In making the following tests, first make only a flicking, momentary contact to determine if a short is present. If ammeter needle does not go beyond calibrated scale, it is safe to make continuous contact. As added precaution, work on a bench with a nonconductive top. Never touch test points together.

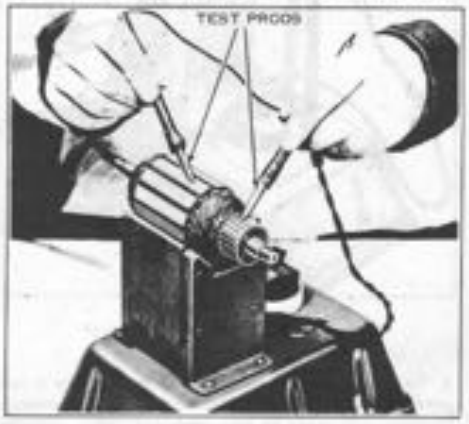



Figure 5E-3. Checking Armature for Grounded Winding

1. Remove brushes or insulate brushes from commutator. Touch one test lead to "F" terminal and the other to any part of the generator frame. There should be no reading. Move first terminal lead to "A" terminal. A reading at either contact indicates a terminal or field coil is grounded to frame. If no reading was obtained, follow further disassembly procedure and eliminate step 2.

Remove generator drive gear using Gear Puller, Part No. 95715-19A.

Press armature out of ball bearing with arbor press and remove. Disassemble terminals, remove field coil leads, inspect terminal components for cracked or worn through insulating materials and, if parts appear serviceable, reassemble terminal components eliminating field coil leads.

2. Recheck terminal to ground contacts as described in step 1. No reading indicates terminals are properly insulated. If reading was obtained in step 1, but not in step 2, field coils are probably grounded.

3. Touch one test lead to either field coil lead and the other to the generator frame. A reading indicates a field coil is grounded and it is necessary to clip the connection between the field coils. Touch test leads to one field coil lead and ground. Repeat process on other coil. A reading indicates a grounded coil which will have to be replaced. If terminals and field coils are in serviceable condition, proceed to step four.


Figure 5E-4. Testing Armature for Short

4. Test field coils, using 6 volt battery for 6 volt generator and 12 volt battery for 12 volt generator, touching test leads to coil lead terminals. Current values should be as follows for double coil: 2 amp. on 6 volt coils, .95 amp. on 1964 model 12 volt coils and 2.3 amp. on 1965 model 12 volt coils. No reading indicates an open coil, a higher reading indicates a shorted coil.

5. Strip back the insulation at point where two field coil leads are joined and file the insulating varnish off a spot on the splice. Connect one test lead at this point, the other at either coil lead. Without moving first test lead, move second test lead to opposite free lead. Current values should be as follows: 4 amperes for 6 volt coil, 1.9 amperes for 1964 model 12 volt coil, and 4.6 amperes for 1965 model 12 volt coil. No reading indicates an open coil, a higher reading indicates a shorted coil. Faulty parts must be replaced.

6. Touch one test lead to brush holder mounting plate, the other to positive (insulated) brush holder. A reading indicates a shorted holder. Clean thoroughly and recheck. If reading is obtained, replace brush holder mounting plate. Check negative brush holder to be sure it is tight and well grounded.

If field coils, brush holders and generator terminals are serviceable, the trouble is probably in the armature.

Do not remove pole shoes and field coils unless tests previously made proved one or both of the coils to be faulty. When a pole shoe must be removed to replace a field coil, follow the procedure described in "Disassembling Generator."


Figure 5E-5. Testing Armature for Open Circuit

TESTING ARMATURE

TEST FOR GROUND. If growler with test leads is available, test by touching armature core with one test lead and commutator segments, individually, with the other. If this means of testing is not available, test with battery, ammeter and leads as used for testing field coils. Contact commutator segments with one test point and armature core with the other. If circuit is completed, armature is grounded. See Fig. 5E-3.

If armature is found to be grounded, make sure commutator is free from carbon and copper dust deposits. After cleaning thoroughly between segments and at ends of commutator and blowing dry with compressed air, repeat test. Armature must be replaced if ground is still present.

TEST FOR SHORT. Place armature in growler and hold piece of hacksaw blade parallel to and in loose contact with armature core. Turn growler on. Rotate armature slowly several turns. The hacksaw blade will be attracted to the armature core and will vibrate at one or more points if armature is shorted. See Fig. 5E-4.

If short is found, clean commutator segments as described above under "Test for Ground." If short still exists, armature must be replaced.

TEST FOR "OPEN." Place armature in growler. Turn growler on. Insert tip of hacksaw blade between commutator segments that are in horizontal alignment with top of growler "V" shaped cradle. Make and break contact between segments with hacksaw blade. A strong flash should be seen as contact is broken. No flash or a weak flash indicates an open circuit. See Fig. 5E-5.

Repeat the test between all segments, turning the armature so each test is made in the same position relative to the growler. If an open circuit is found, check for loose or broken wires at commutator connections. If none are found that may be repaired, armature must be replaced. All soldering should be done with rosin flux.

## REPAIRING COMMUTATOR

A generator that has been in extended service may fail to deliver enough current to keep the battery in a charged condition although its field coil and armature windings are in serviceable condition. In such cases the commutator and/or brushes are usually at fault. If the commutator has been worn down until the mica separations between segments are no longer undercut or recessed, the commutator probably is grooved noticeably in path of brush travel and no slot between commutator segments exists, causing the brushes to ride high and make only intermittent contact with commutator.

The commutator may be turned down in a lathe and sanded with fine sandpaper until true and smooth. Mount armature in lathe on its bearing seats not on shaft centers. Never sand a commutator with emery cloth. Particles will imbed themselves in the copper surface, holding the brushes off the commutator far enough to cause heavy arcing and burning.

After commutator has been turned down, the mica insulation between segments must be recessed or undercut approximately .025 in. Undercutting is usually done with a special undercutting machine. If one is not available, satisfactory undercutting may be done with a piece of hacksaw blade. Carefully thin down blade width, if necessary, until offset saw teeth are the same width as slots in commutator. Slots must be square-bottomed for good results. See Fig. 5E-6.

Sand commutator surface on lathe and repeat growler test to be sure there are no copper particles between segments.

Open circuited armatures can often be repaired. The break or opening in the circuit usually occurs at the commutator riser bars, a result of overloading the generator which causes overheating and the melting of solder at the joint. Resolder the leads in the riser bars using rosin flux. Turn down commutator and sand to remove any burn spots as described in previous paragraph.

## POLARIZING GENERATOR

Assemble generator as described in "Assembling Generator." After a generator has been repaired, it must be repolarized to make sure that it has the correct polarity for charging in the right direction.

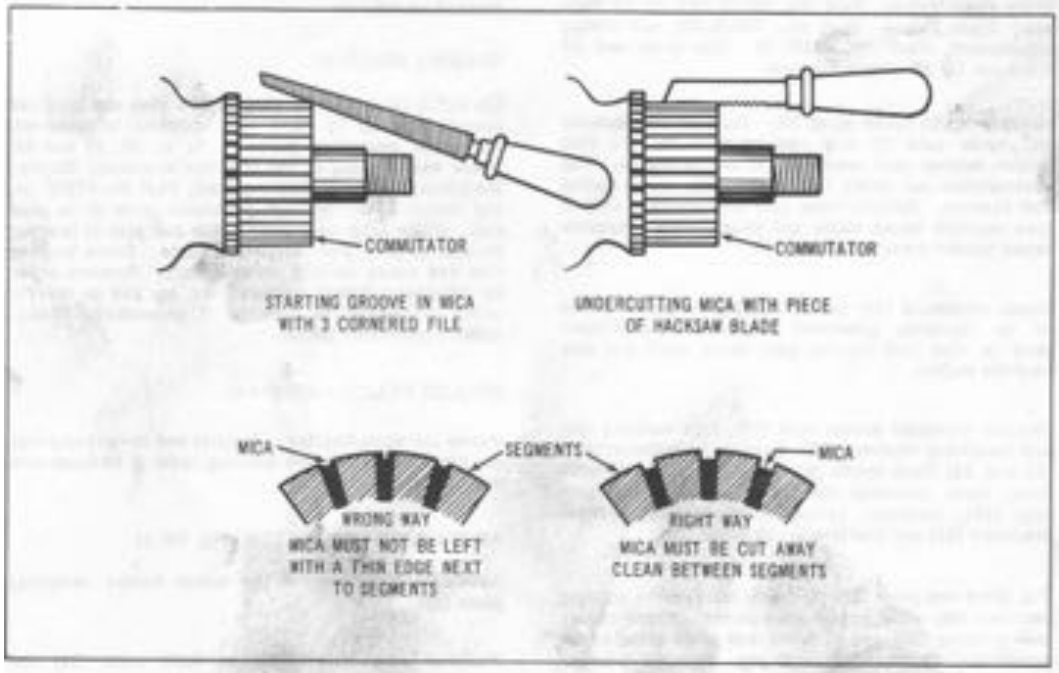



Figure 5E-6. Recessing Mica Separators

A generator that is put into service with the wrong polarity may result in burned relay points, a dead battery and damage to the generator.

Polarize the generator by momentarily connecting the "BAT" and "GEN" terminals with a jumper wire.

GENERATOR CHARGING RATE

After a generator has been repaired, assembled, installed on motorcycle, connected and polarized, it may be checked for maximum output. That is, the maximum, uncontrolled amperage output range may be checked to determine the success of the repair work. This test is described in previous paragraph "TESTING GENERATOR OUTPUT". This test will not, however, indicate if the battery and generator are being protected by proper regulator function. See "Voltage Regulator," Section 5I, for correct Delco Remy Bulletin giving checks that can be made to determine if the regulator is functioning normally.

DISASSEMBLING GENERATOR (Fig. 5E-1)

Remove generator from engine gearcase as described in "Removing Generator."

Remove gasket (1). Remove gear shaft nut (2) and washer (3). Remove generator drive gear (4 or 4A) using Gear Puller, Part No. 95715-19A or All Purpose Claw Puller, Part No. 95635-46, and Wedge Attachment, Part No. 95637-46. Slip drive end oil deflector (5) off armature shaft.

Remove brush cover strap (6). Turn off commutator end cover nuts (7) and remove washers (8). Pull frame screws and washers (9) out of frame. Tap commutator end cover (10) gently with small mallet and remove. Remove nuts (11) and washers (12) to free positive brush cable and brush leads. Remove brush holder mounting plate (13).

Press armature (14) out of bearing on arbor press or by clamping generator frame between copper jaws in vise and tapping gear drive shaft end with rawhide mallet.

Remove terminal screw nuts (15), lock washers (16) and insulating washers (17). Remove terminal screws (22 and 24) from inside generator frame and remove from them terminal insulator (18), terminal bolt clip (19), terminal screw bushings (20), bracket insulator (21) and positive brush cable (23).

Tap drive end plate (28) off frame and remove bearing retainer (25) using needle nose pliers. Press armature bearing (26) out of drive end plate using arbor press and appropriate drift pin. Remove bearing retainer (27). Press armature oil seal (29) out of drive end plate from drive gear side.

Remove two pole shoe screws (30). Use large, heavy, screwdriver. Screws are turned extremely tight. Remove pole shoes (31) and field coils (32) from frame (33). Do not remove pole shoe screws, pole shoes and field coils unless necessary to replace faulty parts.

CLEANING, INSPECTION AND REPAIR (Fig. 5E-1)

Clean all parts except gasket, armature, field coils and brushes in cleaning solvent and blow dry with compressed air. Wipe rest of parts clean with cloth dampened in white gas and blow dry with compressed air.

Examine all parts carefully for wear. Give close attention to condition of insulators, armature windings, field coil wrapping and surfaces of pole shoes nearest armature. If armature had oily appearance before cleaning, replace oil seal. Replace any part of brush holder mounting assembly that is bent. Disassemble parts as far as necessary in order of numbers shown in Fig. 5E-1, lowest number first.

Check play in armature ball bearing. If any play can be detected, replace part.

Check fit of armature shaft in end cover bushing or roller bearing (44, 44A). If fit is obviously too loose, replace as follows:

BUSHING REMOVAL

Clamp 9/16 in. - 24 plug tap in vise and turn end cover onto tap by hand until bushing is removed. Assemble generator parts 7, 8, 9, 10, 28 and 33. Place new bushing on end of arbor in special Harley-Davidson Generator Bushing Tool, Part No. 97250-58, and insert arbor through generator from drive gear end. Place pilot tool over arbor and seat in bearing recess in generator drive end plate. Drive bushing into end cover until it seats firmly. Remove arbor by twisting. Insert screwdriver or rod in hole in arbor to assist in twisting if necessary. Disassemble generator parts.

ROLLER BEARING REMOVAL

Press out worn bearing. Support end cover and press on closed end of new bearing until it is flush with surface of end cover.

ASSEMBLING GENERATOR (Fig. 5E-1)

Assemble all parts to the brush holder mounting plate (13).

Position pole shoes (31) in field coils (32) and insert in frame. Turn in pole shoe screws until snug. Place frame in vise and use very large

screwdriver to securely tighten screws. Use a wrench to turn screwdriver while bearing down with considerable force to keep screwdriver from slipping out of slots. Shoes will align themselves in frame.

Place bearing retainer (27) in inner groove in drive end plate (26). Press in bearing (26) to seat against retainer. Compress bearing retainer (25) with needle nose pliers and insert in outer groove.

Turn drive end plate back side up and press oil seal (29) in place. Insert armature (14) drive end shaft and press in until shoulder seats.

Slip "A" terminal field coil lead on positive terminal screw (24), followed by positive brush cable (23), a terminal screw bushing (20), bolt clip (19) and the terminal insulator (18). Insert the assembly through "A" terminal frame hole from inside. Assemble the insulating washer (17), lock washer (16) and nut (15) over terminal screw.

Slip "F" terminal screw (22) into "F" terminal field coil lead, bracket insulator (21) and screw bushing (20). The assembly is then slipped into "F" terminal frame hole through the bolt clip and terminal insulator. An insulating washer (17), lock washer (16) and nut (15) are assembled over terminal screw.

Slip frame assembly over armature, locating pin (48) in hole in drive end plate. Bend loose end of positive brush cable out commutator end of generator. Push brushes back in brush holders to clear commutator and assemble brush holder mounting plate over commutator so pin (48) registers in small slot and brush cable passes through large slot almost directly opposite.

Connect positive brush cable and positive brush lead to insulated brush holder terminal with washer (12) and nut (11). Connect grounded (negative) brush to its terminal in same manner.

Install commutator end cover (10) over armature shaft end so notch in edge registers over pin (48) in frame. Slip internal lock washers over frame screws (9) and feed them through generator from drive end. Assemble lock washers (8) and nuts (7) to frame screws and tighten securely. Turn armature shaft to see if it is bound or if armature core strikes pole shoes. Shaft should be reasonably difficult to turn but there should be no tight spots. If armature core strikes pole shoes, generator ends are not seated properly or pole shoes are not drawn up tightly.

Slip drive end oil deflector (5), drive gear (4 or 4A) and washer (3) over shaft and turn on nut (2) until gear is seated against oil deflector. Install brush cover strap (6) with connection at bottom as positioned on motorcycle. Position gasket (1) coated with Perfect Seal No. 4 to generator and install in reverse order of disassembly as described in "Removing Generator."

## FAN COOLED GENERATOR

The fan cooled generator is essentially the same as the standard, electrically, that is, it is a two-brush, shunt wound generator. Charge rate is governed by a current and voltage regulator. The difference is a larger physical size with higher current generating capacity, and it employs a fan to dissipate heat. Much of the technique used in testing the standard generator may be used in testing the fan cooled generator.

### CHECKING GENERATOR

Before checking a generator believed to be faulty, check generator signal light as described in "Checking Generator", standard generator.

If generator signal light circuit is not shorted proceed as follows:

Disconnect any condensers found connected to generator "A" terminal. A shorted condenser will prevent generator from charging.

See Fig. 5E-7. Remove the three screws (1) and washers (2) securing the fan housing (3) and remove it. Inspect brushes to make sure they are not worn out, broken or gummy and sticking in holders.

### TESTING GENERATOR OUTPUT

Test generator output as described in "Testing Generator Output," standard generator. Generator should generate 20 amperes or more. If it does not, trouble is in one or more of components listed.

### REMOVING GENERATOR

DUO-GLIDE. Disconnect wires from generator "F" and "A" terminals. Remove two long screws through timing gearcase cover securing generator. Remove footshifter assembly and jiffy stand (footshift model) or clutch assembly and jiffy stand (handshift model). Remove generator to left side of chassis.

SERVI-CAR. Disconnect wires from generator "F" and "A" terminals. Remove two long screws through timing gearcase cover securing generator and remove generator to left side of chassis, depressing clutch pedal to allow generator to pass.

### TESTING FIELD COILS

The field coils of the model fan cooled generator are not spliced together so there are four leads rather than two.

Testing procedures are the same as described in "Testing Field Coils" on the standard generator except for following differences:

After step one remove parts number 4 through 19. (See "Disassembling Fan Cooled Generator"). Assemble terminal components eliminating field coil leads.

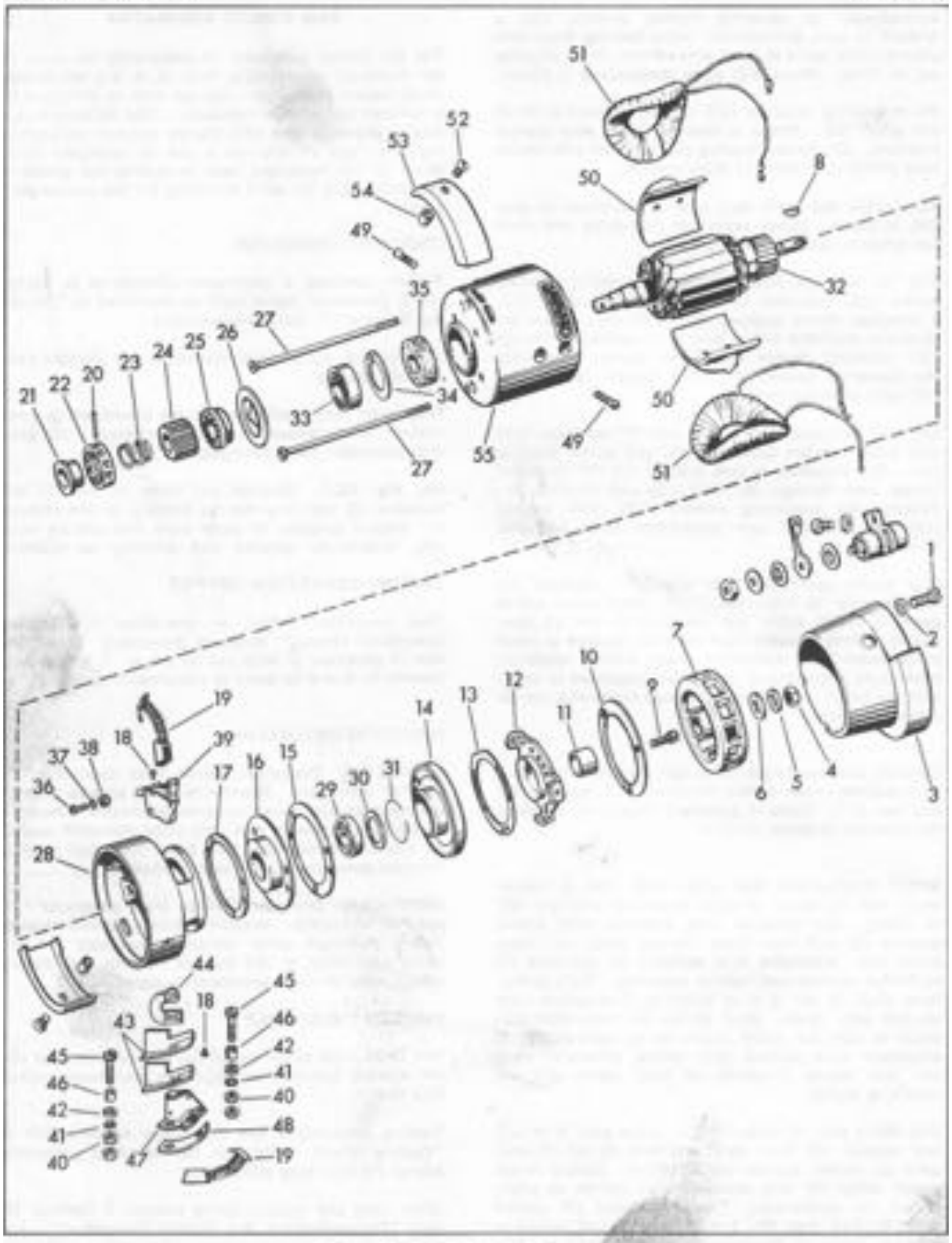



Figure 5E-7. Fan Cooled Generator

LEGEND FOR FIGURE 5E-7

1. Fan housing screw (3)
2. Internal lock washer (3)
3. Fan housing
4. Armature shaft nut
5. Armature shaft lock washer
6. Armature shaft plain washer
7. Fan
8. Armature shaft key (used 1961 and earlier)
9. Fan baffle plate screw (3)
10. Fan baffle plate
11. Fan spacer
12. Fan housing spider
13. End plate
14. Brush end bearing housing
15. Drive end cover gasket
16. Inner oil retainer
17. Commutator end bearing shim (0 to 3)
18. Terminal screw (3)
19. Brush and spring (2)
20. Clutch spring collar pin
21. Clutch spring collar
22. Oil slinger
23. Clutch spring
24. Drive gear
25. Clutch
26. Drive end oil deflector
27. Frame screw (2)
28. Frame end
29. Armature bearing
30. Armature spacing shim (.020 in.)
31. Bearing plate spring ring
32. Armature
33. Armature bearing
34. Drive end spring ring
35. Felt retainer
36. Negative brush holder screw (2)
37. Lock washer (2)
38. Brush holder screw nut (2)
39. Brush holder (negative)
40. Terminal screw nut (2)
41. Terminal screw lock washer (2)
42. Terminal screw insulating washer (2)
43. Field coil terminal insulator (2)
44. Field coil terminal
45. Terminal screw (2)
46. Terminal screw bushing (2)
47. Brush holder (positive)
48. Brush holder insulation
49. Pole shoe screw (4)
50. Pole shoe (2)
51. Field coil (2)
52. Air intake shield screw (2)
53. Air intake shield (2)
54. Spacing bushing (2)
55. Generator frame

Figure following name of part indicates quantity necessary for one complete assembly.

In step three, touch one test lead to generator frame, the other to either of two field coil leads, making sure other lead from same coil does not touch generator frame. Repeat process on other coil.

Omit step four.

In place of step five, touch ammeter leads to two field coil leads. Repeat process with opposite coil. Ammeter should read 1 ampere in both cases. No reading indicates an open coil, a higher reading indicates a shorted coil.

In step six, touch one test lead to generator frame, the other to positive (insulated) brush holder.

## TESTING ARMATURE

Test armature as described in "Testing Armature," standard generator.

## REPAIRING COMMUTATOR

Repair commutator as described in "Repairing Commutator," standard generator.

## POLARIZING GENERATOR

Polarize generator as described in "Polarizing Generator," standard generator.

## GENERATOR CHARGING RATE

Refer to directions in "Generator Charging Rate," standard generator, except minimum charging rate should be 20 amperes.

## DISASSEMBLING GENERATOR Fig. 5E-7

Remove three fan housing screws (1), washers (2) and fan housing (3). Turn off armature shaft nut (4) and remove lock washer (5) and plain washer (6).

Use All Purpose Claw Puller, Part No. 95635-46, to pull the fan (7). Remove key (8) (if used) from armature shaft.

Remove three fan baffle plate screws (9) and lift off baffle plate (10), fan spacer (11), fan housing spider (12) and end plate (13). Use Claw Puller to pull brush end bearing housing (14). Ball bearing (29) should come off with bearing housing and parts 30 and 31. However, the bearing sometimes stays on the shaft holding parts 15, 16, and 17, in place. In that event, do not remove bearing and go on to following procedure.

Remove terminal screws (18) and lift brush and spring assemblies (19) out of brush holders. At this point electrical checks to determine condition of field coils may be made (see "Testing Field Coils").

Drive clutch spring collar pin (20) out of clutch spring collar (21) on Duo-Glide, out of oil slinger (22) on Servi-Car. Slip clutch spring (23) and drive gear off armature shaft. Pull clutch (25) from shaft using All Purpose Claw Puller. Lift oil deflector (26) off shaft.

Loosen frame screws (27) about 1/4 in. and tap on ends to unseat frame end (28). Remove frame screws and pull frame end with bearing (29), gasket (15), oil retainer (16) and bearing shims (17) if there are any. In factory assembly, these shims are supplied as needed to center brushes on commutator. The usual assembly includes up to three spacing shims.

The armature (32) may be pressed out of the frame to release drive end ball bearing (33). If necessary spring ring (34) and felt grease retainer (35) can be removed.

There is no need to disassemble brush holders (39 and 47) from frame end unless test proves the positive holder is shorted, or unless they are badly bent or broken. If removal is necessary, turn out negative brush holder screws (36) and terminal screw nuts (40) to free all parts.

Do not remove pole shoe screws unless necessary to replace pole shoes or field coils. If necessary, turn out pole shoe screws (49) several turns, then tap on heads to loosen pole shoes (50) from keyed slots in frame before turning screws completely out.

Air intake shields (53) may be removed at any time convenient during the disassembly procedure.

## CLEANING, INSPECTION AND REPAIR

Clean all parts except gaskets, felt grease retainer, armature field coils and brushes in cleaning solvent and blow dry with compressed air. Wipe armature, field coil and brushes clean with cloth dampened in white gas and blow dry with compressed air.

Examine all parts carefully for wear. Give close attention to condition of insulators, armature windings, field coil wrapping and surfaces of pole shoes nearest armature.

If play can be detected in ball bearings, replace them. Pack bearings, liberally with "Grease-All" grease before assembly of parts.

## ASSEMBLING GENERATOR

Assemble generator in approximate order of disassembly. Install field coils in frame. Insert armature and assemble the felt retainer, spring ring and bearing. Use arbor press to push bearing in place.

Assemble brush holders to frame end and slip frame end in place over frame. If frame end is a tight fit, it may be drawn into place by tightening frame screws. Bring field coil leads (1, 2 and 3 Fig. 5E-7A) through smaller opening in frame end and lead 4 through larger opening. Select lead ends 1 and 3. Run lead 1 behind field coil terminal, make loop and place it over field coil terminal. Twist leads 2 and 3 as in first half of shoe tying operation and secure to field terminal with terminal screw (18, Fig. 5E-7). Twist leads 2 and 4 in similar manner and attach to positive brush terminal with brush in place. Be sure lead 3 is behind frame screw. Assemble negative brush.

Assemble commutator end of generator in reverse of order disassembled, replacing same number of shims (17, Fig. 5E-7) that were removed.

Install generator in reverse order of removal as described in "Removing Generator," standard generator. Test generator as described in "Testing Generator Output," standard generator.

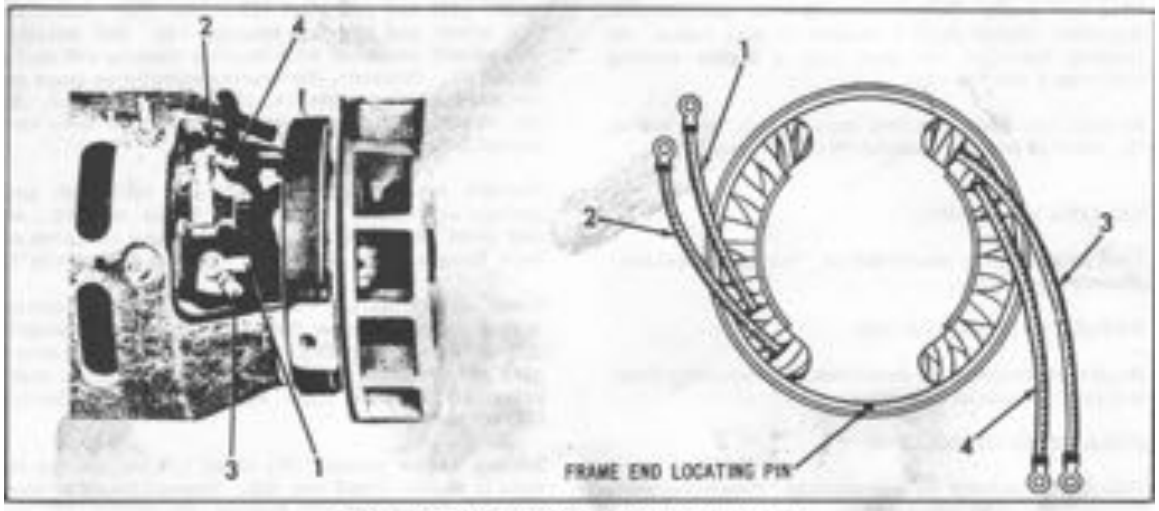



Figure 5E-7A. Fan Cooled Generator Wiring

# CIRCUIT BREAKER

## DESCRIPTION

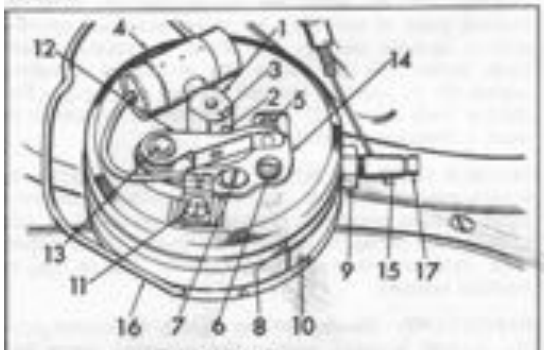
The ignition system has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, switch, primary coil, breaker points, condenser and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The circuit breaker has two functions. First, the breaker cam and contact points open and close the low tension circuit between the battery and ignition coil causing the coil to produce high voltage discharge to the spark plugs. Second, the circuit breaker times discharge for proper engine firing.

The following three types of circuit breakers are in use:

SINGLE CONTACT POINT CIRCUIT BREAKER WITH MANUAL ADVANCE (Fig. 5F-1).

The breaker points are operated by a cam with a narrow and wide lobe. The narrow lobe times the front cylinder and the wide lobe times the rear cylinder. A single ignition coil fires both spark plugs at the same time, but one spark occurs in the exhaust stroke of one cylinder and the other spark fires the combustible gases in the other cylinder to produce the power stroke. Timing is advanced or retarded by manual rotation of circuit breaker base in relation to cam.




1. Breaker cam
2. Fiber cam follower
3. Cam timing mark
4. Condenser
5. Contact points
6. Lock screw
7. Eccentric adjusting screw
8. Timing mark
9. Adjusting stud lock nut
10. Timing adjusting stud plate
11. Wire stud screw
12. Circuit breaker lever
13. Pivot stud
14. Contact point and support
15. Timing adjusting stud
16. Cover retainer
17. Control wire lock screw

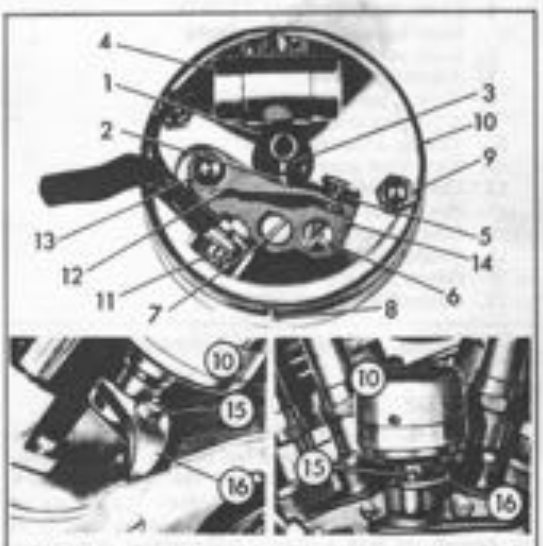
Figure 5F-1. Single Contact Point Circuit Breaker - Manual Advance

SINGLE CONTACT POINT CIRCUIT BREAKER WITH AUTOMATIC ADVANCE (Fig. 5F-1A).

Automatic advance circuit breaker functions the same way as the manual advance circuit breaker except that the spark timing cam is advanced automatically as engine speed increases through action of the flyweights in the circuit breaker base. This insures correct spark timing to suit both starting and running requirements.

DOUBLE CONTACT POINT CIRCUIT BREAKER (Fig. 5F-1B).

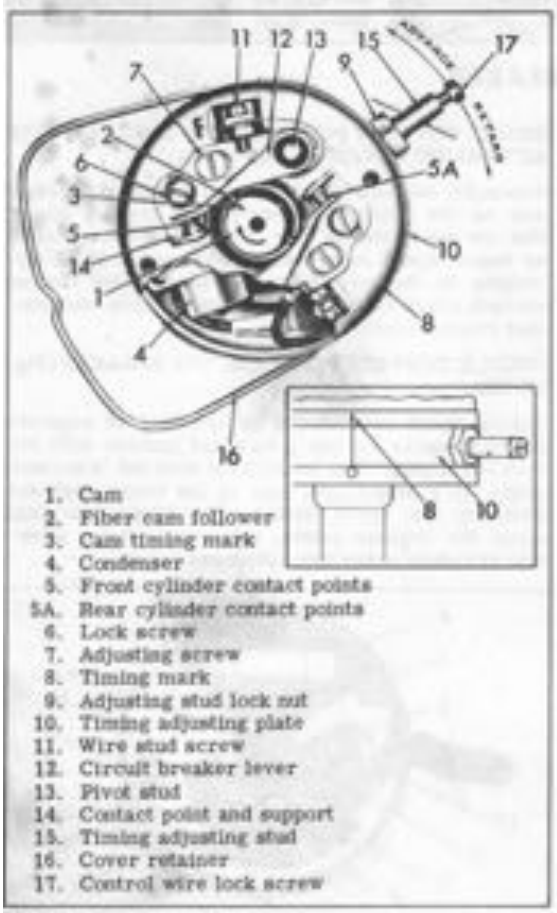
Ignition spark is produced by operation of separate circuit breaker contact points and ignition coils for each spark plug. The breaking of each set of breaker points by a single-lobe cam on the timer shaft determines the spark timing. The single-lobe cam opens the breaker points, individually firing alternate cylinders every crankshaft revolution.




1966 Electra-Glide 1966 Sportster and Servi-car

1. Breaker cam
2. Fiber cam follower
3. Cam timing mark
4. Condenser
5. Contact points
6. Adjustable point lock screw
7. Eccentric adjusting screw
8. Timing marks (1965 model)
9. Circuit breaker head nut (2)
10. Circuit breaker head
11. Wire stud screw
12. Circuit breaker lever
13. Pivot stud
14. Contact point and support
15. Stem clamp nut
16. Stem clamp

Figure 5F-1A. Single Contact Point Circuit Breaker - Automatic Advance




1. Cam
2. Fiber cam follower
3. Cam timing mark
4. Condenser
5. Front cylinder contact points
5A. Rear cylinder contact points
6. Lock screw
7. Adjusting screw
8. Timing mark
9. Adjusting stud lock nut
10. Timing adjusting plate
11. Wire stud screw
12. Circuit breaker lever
13. Pivot stud
14. Contact point and support
15. Timing adjusting stud
16. Cover retainer
17. Control wire lock screw

Figure 5F-1B. Double Contact Point Circuit Breaker

OPERATION

In tracing the current through the ignition system the initial current comes from the battery. The current flows from the battery through the primary coil to ground and back to the battery while the points are closed. When the cam opens the points, the circuit is broken so that a high voltage surge is produced from ignition coil primary to secondary. This voltage will cause a spark to jump the air gap of the plugs.

The condenser is connected to the circuit breaker points and functions to produce a quick collapse of the magnetic field in the coil so that high voltage will be produced. In doing this, the condenser acts to prevent current from continuing to flow across the contact points after points open.

The engine must be timed to fire at the proper point before top dead center on the compression stroke of each cylinder. This procedure is covered under subsequent headings.

TROUBLE SHOOTING

Disengage spark plug cable and insert a metal rod, screw or nail into each spark plug cable. Arrange cable end so tip of inserted metal object is 1/4" away from cylinder head. Turn on the ignition, break the points by hand. See if a "hot" or "blue" spark is obtained. If not, it is an indication of a weak coil, dead battery, broken or loose wires, etc. Arcing of the points and hard starting indicates a faulty condenser.

## ADJUSTING CIRCUIT BREAKER POINTS

NOTE

Refer to either Fig. 5F-1, 5F-1A or 5F-1B corresponding to circuit breaker used.

Circuit breaker point contacts should be checked for gap and surface condition initially at 500 and 1,000 miles, and every 2,000 miles thereafter. Point contacts that have undergone considerable use, may not appear bright and smooth. However, this should not be interpreted as meaning points are worn out. Circuit breaker points that are burned or pitted should be dressed or renewed as described in "Inspection and Replacement of Parts."

SINGLE CONTACT POINT CIRCUIT BREAKER. Check the gap between the contact points with a feeler gage (wire preferred). Point gap should be exactly .020 in. when the lever fiber (2) is on the highest point of cam (1). Incorrect point gap spacing affects ignition timing. To adjust the points, loosen lock screw (6) and move the eccentric adjusting screw (7) to provide correct contact point gap. Retighten lock screw (6) and again check the gap to be sure it remains correct.

DOUBLE CONTACT POINT CIRCUIT BREAKER. On double circuit breaker (Fig 5F-1B) adjust front cylinder contact points (5) (marked "F" on base) to .022 in. gap according to above procedure. Then adjust rear cylinder contact points (5A) to .022 in. gap in similar manner.

IMPORTANT: Check ignition timing whenever double circuit breaker points are adjusted since any change in rear contact point gap affects ignition timing.

## CHECKING AND ADJUSTING IGNITION TIMING

MANUAL ADVANCE CIRCUIT BREAKERS

NOTE

Refer to either Fig. 5F-1 or 5F-1B corresponding to single or double circuit breaker.

Remove spark plugs to permit engine to turn easily. Remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be ob-

served. Remove circuit breaker cover and set circuit breaker point gap as described in "Adjusting Circuit Breaker Points."

Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes), and continue turning engine very slowly (less than 1/2 revolution) until timing mark for front cylinder on flywheel is aligned in inspection hole, as shown in Fig. 5F-3. Make sure timing mark (8) on circuit breaker base aligns with end of timing adjusting plate (10).

Rotate circuit breaker head counterclockwise against stop (fully advanced position).

Timing mark (3) on cam lobe should now align with circuit breaker arm fiber cam follower (2). If it does not, but is only slightly out of alignment, loosen timing adjusting stud lock nut (9) and shift circuit breaker head to attain alignment. Timing mark (8) will no longer line up exactly with edge of plate (10). Be sure to securely retighten lock nut. Remember that circuit breaker must be fully advanced when checking alignment of timing mark with fiber cam follower.

1. SINGLE CONTACT POINT CIRCUIT BREAKER.

Use a test lamp to determine when point contacts open as follows: Connect one test lamp wire to coil wire (12, Fig. 5F-2) at spark coil terminal. Connect the other test lamp wire to the battery positive terminal. Ground battery negative terminal to engine. With points closed, lamp will light, and points open, lamp will be out.

With circuit breaker fully advanced against its stop and flywheel marks correctly positioned as shown in Fig. 5F-3, contact points should just begin to open, "light off." The instant direction is reversed (spark retarded) from full advance stop position, points should begin to close, "light on."

If the contact points remain closed, "light on", in the fully advanced position, timing is late. Loosen adjusting stud lock nut (9, Fig. 5F-1) and shift circuit breaker base counterclockwise until contact points just begin to open (timing light just flickers or goes off) in fully advanced position.

If the contact points begin to open, "light off", before circuit breaker is in fully advanced position, timing is early. Loosen adjusting stud lock nut (9, Fig. 5F-1) and shift circuit breaker base clockwise until contact points just begin to open, "light off", in fully advanced position.

Retighten lock nut (9) then move circuit breaker from retard to advance to see that points will just open when the circuit breaker reaches the advance stop. Be sure to keep flywheel mark correctly positioned during the entire procedure.

NOTE: Timing ignition for front cylinder automatically times ignition for rear cylinder.

CHECKING TIMING. Install circuit breaker cover (1, Fig. 5F-2), turn engine in direction in which it runs until front piston is on compression stroke. Continue to turn engine very slowly until points just begin to open, "light off." Flywheel mark should be correctly located in inspection hole as shown in Fig. 5F-3.

If timing mark is forward of correct position as shown in Fig. 5F-3, timing is late. If timing mark is to the rear of correct position as shown in Fig. 5F-3, timing is early. In either case, re-adjust timing as previously described.

2. DOUBLE CONTACT POINT CIRCUIT BREAKER

TIMING FRONT CYLINDER. Connect one test lamp wire to circuit breaker yellow wire (12A, Fig. 5F-2) (front spark coil terminal), and the other wire to the battery positive terminal. Ground battery negative terminal to engine. Time front cylinder breaker points (marked "F" on circuit breaker base) with flywheel timing mark for front cylinder aligned in inspection hole as shown in Fig. 5F-3. Same as for single contact point manual advance circuit breaker.

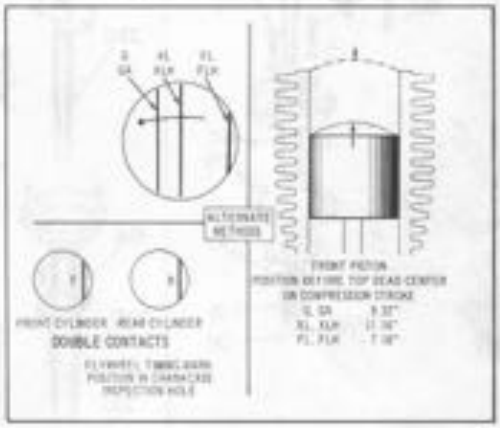


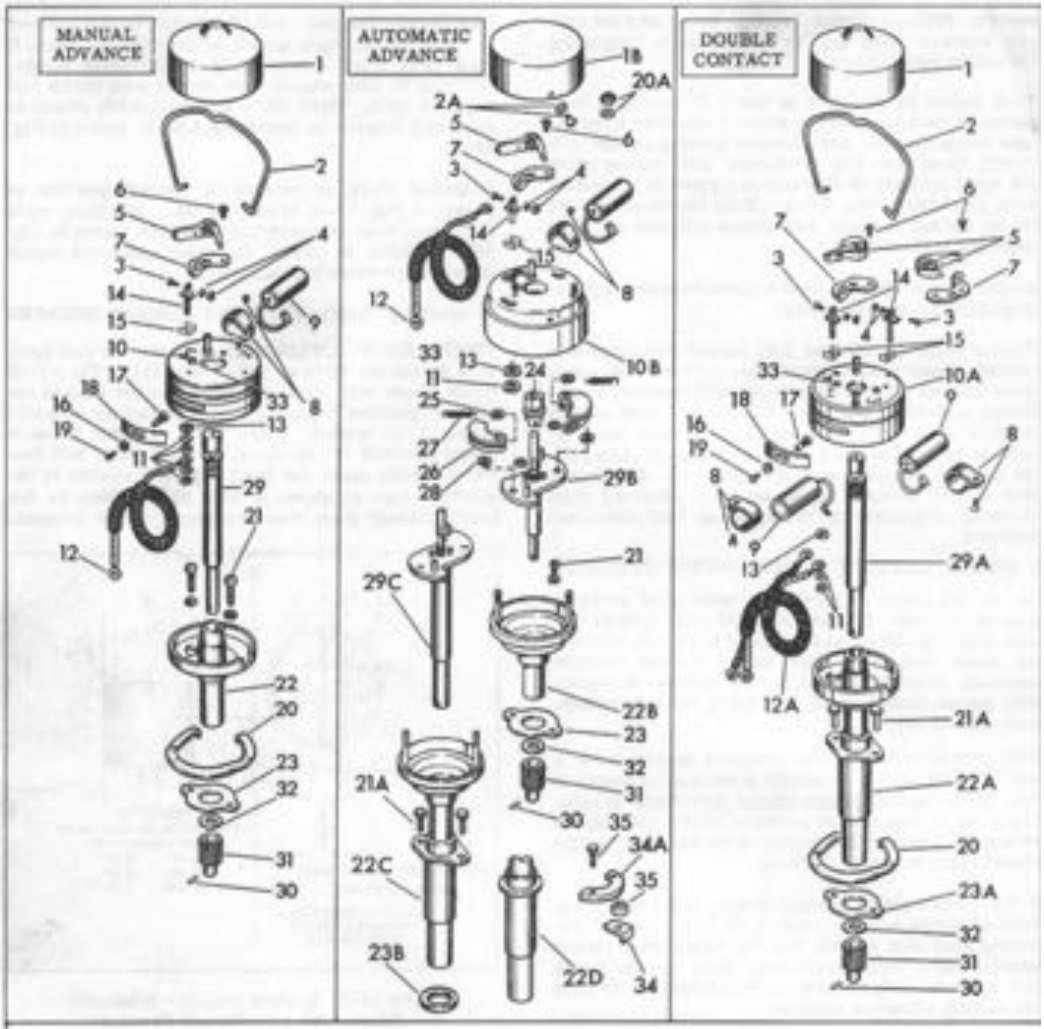

Figure 5F-3. Ignition Timing - Schematic - Manual Advance Circuit Breaker

TIMING REAR CYLINDER. Connect one test lamp wire to circuit breaker black wire (12A, Fig. 5F-2) (rear spark coil terminal) and the other wire to the battery positive terminal. Ground battery negative terminal to engine.

Fully advance circuit breaker.

Turn engine flywheel shaft in direction in which it runs until the mark on the cam approaches the cam follower fiber on the rear cylinder breaker points.

Continue rotating engine very carefully in same direction until timing mark for rear cylinder (marked "R" on flywheel) is aligned in inspection hole as shown in Fig. 5F-3.




1. Cover
1B. Cover
2. Cover retainer
2A. Cover screw and lock washer
3. Wire stud screw
4. Wire stud nut and lock washer
5. Lever, contact point
6. Adjustable point locking screw
7. Contact point and support
8. Condenser bracket and screw
9. Condenser
10, 10A, 10B. Base
11. Stud nuts and washers
12, 12A. Cable
13. Wire stud fiber washer
14. Wire stud
15. Wire stud insulator
16. Adjusting stud lock nut
17. Adjusting stud
18. Adjusting stud plate
19. Control wire lock screw
20. Base retainer
20A. Base nut and washer (2)
21, 21A. Crankcase screw (2)
22, 22A, 22B, 22C. Stem
23, 23A, 23B. Gasket or O-ring
24. Cam
25. Clip (2)
26. Flyweight (2)
27. Flyweight spring (2)
28. Washer (4)
29, 29A, 29B, 29C. Camshaft
30. Gear pin
31. Gear
32. Shaft washer
33. Eccentric screw
34, 34A. Stem clamp
35. Clamp nut or bolts

Figure 5F-2. Circuit Breakers - Exploded View

NOTE: Flywheel is not marked for rear cylinder timing on 1961 Duo-Glide engines made prior to Engine No. 61FLH 7987 and piston position must be used as an alternative to flywheel timing marks as follows:

Piston position can be determined by using spark timing gage Part No. 95885-61 which screws into spark plug hole. Gage rod contacts piston top to indicate piston position. Gage rod has two marks. When engine is turned over so gage rod has moved to highest point, (rear cylinder piston at top dead center) set gage collar exactly at lower mark on gage rod. Piston position before top center is indicated when engine is turned over and piston moves so rod upper mark comes even with gage collar. If timing gage is not available, rear cylinder head can be removed and piston position measured with a scale or dial indicator.

With circuit breaker fully advanced against its stop and flywheel timing mark for rear cylinder correctly positioned as shown in Fig. 5F-3, contact points should just begin to open, "light off." The instant direction is reversed (spark retarded from full advance position), points should begin to close, "light on."

If contact points remain closed "light on" in the fully advanced position, timing is late - point contacts set too close together.

If contact points begin to open "light off" before circuit breaker is in fully advanced position, timing is early - point contacts set too far apart.

To correct rear cylinder timing, the breaker points must be readjusted so contact points just begin to open (timing light just flickers or goes off) when circuit breaker is fully advanced.

NOTE: This will result in a different point contact opening than original setting of .022 in.

Check the rear cylinder timing with timer cover installed, using same procedure as given in preceding paragraph heading, "Checking Timing," but using rear cylinder breaker points and rear cylinder flywheel timing mark.

NOTE: If engine is in chassis, test lamp can be connected to circuit breaker wire and engine (ground). With ignition turned on, lamp will light with points open and go off with points closed, exactly opposite from battery hookup previously described.

## CHECKING AND ADJUSTING IGNITION TIMING AUTOMATIC ADVANCE CIRCUIT BREAKER

NOTE

Refer to Fig. 5F-1A - Automatic Advance Circuit Breaker.

Follow same procedures as for manual advance circuit breaker, aligning advance timing mark (Fig. 5F-3A) in center of inspection hole according to model being worked on as shown. *Note that cam must be turned clockwise with flyweights against stops, and held in this position while checking timing.*

Timing mark (3) on top edge of circuit breaker cam (1) should align perfectly with breaker arm fiber cam follower (2). If it does not, shift circuit breaker head to attain alignment as follows:

1966 and later models have clamp (16) on circuit breaker stem to allow 360° adjustment range. Loosen clamp nut or bolts (15) and shift circuit breaker head (10) clockwise (retard) or counterclockwise (advance) to attain alignment. 1965 models have slotted holes in timer plate for base studs to allow limited adjustment. Loosen circuit breaker head nuts (9) and shift base on stem to attain alignment. Timing marks (8) will no longer exactly line up. Retighten nuts (9) securely, but care must be taken not to over tighten or breaker head base plate will distort and affect timing.

Circuit breaker cam must be fully advanced clockwise against stop when checking alignment of mark (3) with fiber cam follower (2).

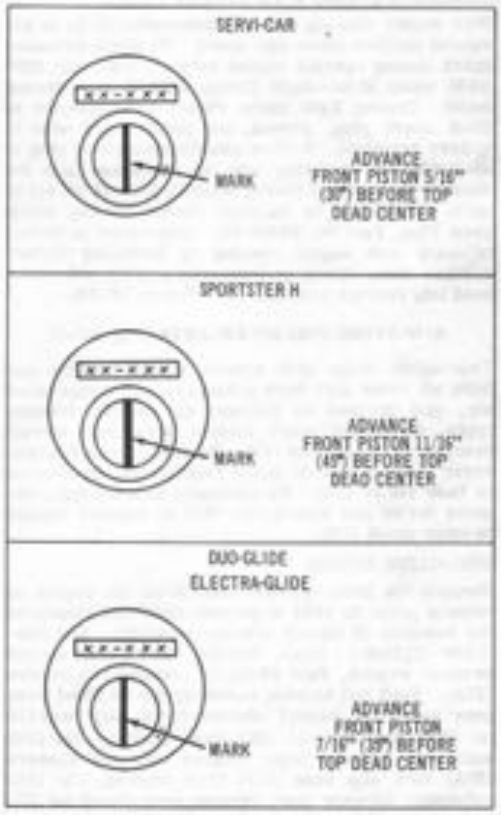



Figure 5F-3A. Ignition Timing Schematic, Automatic Advance Circuit Breaker

NOTE

Cam (1) engages flyweights on cam shaft in either of two positions 180° apart, but only one of these positions will give correct ignition timing. If cam (1) is removed for any reason and engagement with flyweight is lost, see subsequent paragraph, "Installing Circuit Breaker."

Use a test lamp to determine when contact points open following the same procedure as for the MANUAL ADVANCE SINGLE CONTACT POINT CIRCUIT BREAKER and adjust circuit breaker head by shifting as necessary to obtain approximate timing.

*NOTE*

*The above timing will be approximate (slightly retarded) because of circuit breaker drive gear lash and endplay which exist when engine is not operating. To set ignition timing accurately, it must be checked with a strobe light timing gun with the engine running according to the procedure in the following paragraph.*

CHECKING TIMING WITH STROBE LIGHT

With engine running cam will automatically be in advanced position above idle speed. To check advanced spark timing operate engine between 1500 and 2000 RPM using Strobe-light timing light to view timing mark. Timing light leads should be connected to front spark plug, ground, and positive red wire to battery terminal. A clear plastic timing hole plug is available for screwing into the crankcase hole for viewing the flywheel timing mark to prevent oil spray while the engine is running. Order Timing Mark View Plug, Part No. 96295-65. Adjustment in timing is made with engine running by loosening circuit breaker stem clamp or head nuts slightly and rotate head into correct position. See Figure 5F-3B.

**REMOVING CIRCUIT BREAKER** (Fig. 5F-2)

Thoroughly clean area around circuit breaker and blow all loose dirt from crankcase with compressed air, and proceed as follows: On manual advance types, disconnect spark control wire from circuit breaker adjusting stud (17). Remove circuit breaker cover (1) and unlatch cover retainer (2) from holes in base (10 or 10A). On automatic advance type, remove screw and lockwasher (2A) to remove circuit breaker cover (1B).

DUO-GLIDE MODEL

Remove the front cylinder head from the engine on models prior to 1962 to provide sufficient clearance for removal of circuit breaker assembly. See Duo-Glide Cylinder Head, Section 3B. Using circuit breaker wrench, Part 94501-56, remove two screws (21A). Shaft and housing assembly can be lifted from gear case. On manual advance types, slip base (10 or 10A) and retainer (20) from housing. On 1965 automatic advance type, remove nuts and washers (20A) then slip base (10B) from housing. On 1966 automatic advance type, remove stem clamp nut (35) and clamp (34) to free entire circuit breaker from crankcase.

1964 AND EARLIER SPORTSTER AND 1963 AND EARLIER SERVI-CAR MODELS

Remove base (10) and retainer (20) exposing two screws (21) securing shaft and housing assembly to gear case cover. Remove screws (21) and lift shaft and housing from gear case cover.

Figure 5F-3B. Checking Timing with Strobe-Lite

1965 AND LATER SPORTSTER AND 1964 AND LATER SERVI-CAR

On earlier models, remove nuts and washer (20A) which secure base to stem. Remove base (10B) exposing two screws and washers (21) securing shaft and housing assembly to gear case cover. Remove screws (21) and lift shaft and housing from gear case cover. On 1966 automatic advance type, remove stem clamp bolts (35) and clamp (34A) to free entire circuit breaker from crankcase.

**INSPECTION AND REPLACEMENT OF PARTS** (Fig. 5F-1, 5F-1A, 5F-1B and 5F-2)

Using cloth with clean white gasoline, wipe circuit breaker clean and inspect parts.

Inspect circuit breaker contact points (5 and 5A). If lever fiber (2) is badly worn, replace points. Points that are burned or pitted should be replaced or dressed with a clean, fine-cut contact point file. Do not attempt to remove all roughness nor dress point surfaces down smooth; merely remove scale or dirt. Contact point file should not be used on other metal and should not be allowed to become greasy or dirty. Never use emery cloth or sandpaper to clean points, since particles will embed themselves and cause arcing and rapid burning of points.

Circuit breaker points should be replaced, if contact point pressure is not within prescribed limits of 14 to 18 oz. Check pressure with a spring gauge. The scale should be hooked to the breaker lever at an angle of 90 degrees with the point surface and reading taken just as points break. Excessive pressure causes rapid wear of fiber block, cam, and contact point. Insufficient pressure will permit high speed point bounce which will, in turn, cause arcing and burning of the points and missing of the engine.

Point faces must seat squarely against each other. If bent, square up by bending contact plate.

To replace a set of circuit breaker points, loosen screw (11) and slip condenser wire and connection from screw. Lift circuit breaker lever (12) from

screw (11) and pivot stud (13). Remove screw (6) and circuit breaker contact point and support (14). Install new points in reverse order of disassembly. Position circuit breaker lever (12), lever notch registered with screw (11), between brass washer and condenser wire end. Be sure point faces seat squarely against each other. Adjust point gap as previously described in "Adjusting Circuit Breaker Points."

Lubricate breaker cam with a trace of grease when points are replaced or every 5000 miles. Also remove cam and lubricate shaft with very light grease Delco Remy No. 1960954 or equivalent. Replace cam in correct position.

Check circuit breaker advance flyweight action by moving cam in direction required to advance weights to their fully extended position. Then release the cam and see if springs return to the fully retarded position. Correct causes for faulty action by cleaning and lubricating shaft, cam and flyweights and replacing weak springs.

Be extremely careful to avoid excessive lubrication. If too much grease is used, the excess is apt to get on the contact points and cause them to burn.

For maximum operating efficiency it is recommended practice to replace circuit breaker points when pitted, burned or worn excessively.

The condenser (4) is a relatively long life part and will not require frequent replacement. However, if the condenser is suspected of being defective simply replace with a proven new condenser and note whether engine performance is improved. A condenser that is defective will have either an open or short circuit. An open circuit will be evident by excessive arcing at breaker contact points and a shorted circuit will have no noticeable spark at the contact points.

Examine the circuit breaker base pivot stud (13) for wear or damaged condition. Try circuit breaker base (10, 10A or 10B) Fig. 5F-2 on stem, (22, 22A, 22B or 22C) for free turning, but not loose fit. If base has too much clearance on stem, the circuit breaker point gap will vary as the base is shifted for spark control. If base is found excessively worn or damaged in any way, renew it.

Examine the coil to circuit breaker low tension wire (12 or 12A, Fig. 5F-2) for brittle or cracked insulation and broken strands and replace if defective. Inspect circuit breaker wire stud insulator (15) and fiber washer (13) for brittle or cracked condition. Unless inspection shows insulation defective, it is not necessary to remove stud, insulator and washers.

Examine cam advance mechanism on automatic advance circuit breakers to see that flyweights (26) move outward freely and springs (27) return them inward against stops. Check for looseness of cam (24) on spindle (29B or 29C) and wear on sides of flyweight (26) ears which engage slots in cam. Check springs (27) and replace if stretched or distorted.

To disassemble mechanism pry clips (25) from grooves in pivot pins on stem plate (29B or 29C). Inspect teeth or worm gear (31) for excessive wear and damage. Check the amount of end play and side play of shaft (29, 29A, 29B or 29C) in stem. End play in excess of .008 in. or excessive side play of shaft in stem bushings will affect ignition timing and also allow oil from cam gear base to enter breaker assembly base to contaminate ignition points.

If renewal of shaft or stem parts is necessary remove pin (30) from gear and lift or press circuit breaker cam shaft from gear. Withdraw cam shaft from base. If bushings have excessive wear, timer stem assembly can be replaced or stem assembly can be rebushed by drifting out old bushings and installing new bushings. New bushings should require no reaming. When reassembling gear and breaker cam shaft use spacer washer (.062 thick), (.066 thick), (.072 thick) or (.076 thick) to obtain a .001 to .007 in. shaft end play.

When assembling circuit breaker shaft in breaker stem, always secure gear and spacer washer to shaft with new steel pin riveted in place. Rotate shaft to be sure it is free in stem.

## INSTALLING CIRCUIT BREAKER

### INSTALLING CIRCUIT BREAKER 1964 AND EARLIER DUO-GLIDE MANUAL CIRCUIT BREAKERS

Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes) and continue turning engine very slowly (less than 1/2 revolution) until advance timing mark on flywheel is aligned in the inspection hole as shown in Fig. 5F-3.

Assemble circuit breaker as follows (See Fig. 5F-2):

Position circuit breaker base assembly (10 or 10A) on shaft and stem assembly (22 or 22A), wrapping wire (12 or 12A) clockwise around shaft. Install base retainer (20) over wire, retainer ends facing down and toward front cylinder. Engage cover retainer (1) with holes in base and register retainer ends in locating notches of base retainer (20).

Make sure timing mark (8, Fig. 5F-1 or 5F-1B) on circuit breaker base aligns with end of adjusting stud plate (10).

Install a new circuit breaker gasket (23 or 23A, Fig. 5F-2) using gasket sealer. Turn circuit breaker shaft counterclockwise approximately 60 degrees from position where mark on cam lobe lines up with breaker lever fiber.

Temporarily insert circuit breaker assembly into gear case, with adjusting stud pointing toward the front of motorcycle and screw holes of stem housing lined up with mounting holes in crankcase. Move circuit

breaker base (10 or 10A) to fully advanced position (counterclockwise) and observe how close timing mark on cam lobe lines up with breaker lever fiber

NOTE

On double contact breakers, mark on cam lobe must align with breaker lever fiber on contact points for front cylinder. This set of contact points is identified on breaker base by (F).

If fiber does not line up with cam lobe timing mark, lift circuit breaker assembly and turn shaft gear so engagement with driving gear is changed one tooth. Again check cam lobe timing mark for alignment with lever fiber. Repeat this procedure until gear engagement is attained which closely aligns cam lobe mark and lever fiber, then secure circuit breaker assembly to crankcase.

Adjust ignition timing. See previous paragraph "Checking and Adjusting Ignition Timing" in this section.

1963 & EARLIER SERVI-CAR
1964 & EARLIER SPORTSTER
MANUAL CIRCUIT BREAKERS

Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes) and continue turning engine very slowly (less than 1/2 revolution) until advance timing mark on flywheel is aligned in the inspection hole, as shown in Figure 5F-3

Install a new circuit breaker gasket (23) using gasket sealer. Insert circuit breaker shaft and stem assembly into gear case cover with wire (12, Fig. 5F-2) inserted in hole of stem flange. Before engaging circuit breaker driving gear, turn shaft counterclockwise, approximately 60 degrees from position where mark (3, Fig. 5F-1) on cam lobe lines up with breaker lever fiber block. Insert screws (21, Fig. 5F-2) snug, but not tight. Temporarily position base on shaft and stem assembly in fully advanced position.

Observe how closely mark on cam lobe lines up with lever fiber. If it does not line up, remove screws (21, Fig. 5F-2), lift circuit breaker shaft and stem assembly from gear case. Turn shaft gear so its engagement with its driving gear is changed on tooth. Check again according to breaker cam mark. Repeat this procedure until gear engagement is attained which closely aligns mark on cam with breaker lever fiber. Then tighten screws (21, Fig. 5F-2).

Wrap wire (12) clockwise around shaft (29) and install base retainer (20) over wire, retainer end facing down and towards front cylinder (as positioned on motorcycle). Engage cover retainer with holes in base and register retainer ends in locating notches of base retainer (20) An easy way to engage retainer end with retainer notch is to insert cover retainer (2) under flats of base retainer (20). Then, with a screwdriver, move base retainer (20) until its notches register with ends of retainer (2).

Adjust ignition timing. See previous paragraph "Checking and Adjusting Ignition Timing" in this section.

1965 ELECTRA-GLIDE AUTOMATIC ADVANCE CIRCUIT BREAKER

Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes) and continue turning engine very slowly (less than 1/2 revolution) until timing mark (Fig. 5F-3A) on flywheel is aligned in the inspection hole.

Assemble circuit breaker as follows: (See Fig. 5F-2). Lubricate camshaft end of shaft and stem assembly (22C) and install breaker cam (24) on camshaft so that notches in cam engage with flyweights (26). Place breaker base (10B) on stem and shaft assembly. Put on nuts and washers (20A) but do not tighten.

Stem mounting stud slots in breaker base are offset, and base can be installed only in one position to allow full range of circuit breaker adjustment. Be sure to align timing marks (8, Fig. 5F-1A) on Stem and breaker base.

Install a new circuit breaker rubber seal (23B). Turn circuit breaker shaft counterclockwise approximately 60 degrees from position where mark on cam lobe lines up with breaker lever fiber. Temporarily insert stem (22C) into crankcase with timing marks (8, Fig. 5F-1A) toward outside of engine with screw holes in stem housing aligned with screw holes in crankcase. With flywheel retarded ignition timing mark in center of timing hole in crankcase, observe how close timing marks on cam lobe lines up with breaker lever fiber.

If fiber does not line up with cam lobe timing mark, lift circuit breaker assembly and turn shaft gear so engagement with driving gear is changed one tooth. Again check cam lobe timing mark for alignment with lever fiber. Repeat this procedure until gear engagement is attained which closely aligns cam lobe mark and lever fiber, then secure circuit breaker assembly to crankcase.

Adjust ignition timing. See previous paragraph "Checking and Adjusting Ignition Timing" in this section.

1964 & LATER SERVI-CAR AND 1965 SPORTSTER AUTOMATIC CIRCUIT BREAKERS

Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in

left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes) and continue turning engine very slowly (less than 1/2 revolution) until timing mark (Fig. 5F-3A) on flywheel is aligned in the inspection hole.

Assemble circuit breaker as follows (see Fig. 5F-2): On automatic advance circuit breakers, lubricate camshaft end of shaft and stem assembly (22B) and install breaker cam (24) on camshaft so that notches in cam engage with flyweights (26). Place breaker base (10B) on shaft and stem assembly. Put on nuts and washers (20A) but do not tighten. Stem mounting stud slots in breaker base are offset and base can be installed only in one position to allow full range of circuit breaker adjustment. Be sure to align timing marks (8, Fig. 5F-1A) on stem and breaker base.

Install a new circuit breaker gasket (23) using gasket sealer. Insert circuit breaker shaft and stem assembly into gear case cover with wire (12, Fig. 5F-2) inserted in hole of stem flange. On automatic advance circuit breakers, stem (22B) should be positioned so that timing marks on base (8, Fig. 5F-1A) face toward outside of engine. Before engaging circuit breaker driving gear, turn shaft counterclockwise, approximately 60 degrees from position where mark on cam lobe lines up with breaker lever fiber block. Insert screws (21, Fig. 5F-2) snug, but not tight. Temporarily position base on shaft and stem assembly with timing marks aligned.

With flywheel ignition timing mark in center of hole in crankcase, observe how closely mark on cam lobe lines up with lever fiber. If it does not line up, remove screws (21, Fig. 5F-2), lift circuit breaker shaft and stem assembly from gear case. Turn shaft gear so its engagement with its driving gear is changed one tooth. Check again according to breaker cam mark. Repeat this procedure until gear engagement is attained which closely aligns mark on cam with breaker lever fiber. Then tighten screws.

Position base assembly on shaft (29B) with timing marks on base (8, Fig. 5F-1A) in alignment and tighten hold down nuts and washers (20A, Fig. 5F-2) snugly, but do not overtighten.

Adjust ignition timing. See previous paragraph "Checking and Adjusting Ignition Timing" in this section.

1966 AND LATER ELECTRA-GLIDE, SPORTSTER AND SERVI-CAR AUTOMATIC ADVANCE CIRCUIT BREAKER

Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just after front intake valve closes) and continue turning engine very slowly (less than 1/2 revolution) until timing mark (Fig. 5F-3A) on flywheel is aligned in the inspection hole.

Assemble circuit breaker as follows: (See Fig. 5F-2). Lubricate camshaft end of shaft and stem assembly (22D) and install breaker cam (24) on camshaft so that notches in cam engage with flyweights (26). Place breaker base (10B) on stem and shaft assembly. Install nuts and washers (20A). Do not over-tighten. Install new seal (23B). Before installing circuit breaker, turn shaft gear to approximately align cam mark (3) with cam follower (2) as shown in Fig. 5F-1A. Insert circuit breaker into gearcase with wire toward rear of engine. This will position circuit breaker points to outside of engine permitting access to adjusting screws when cover is removed.

With flywheel ignition timing mark in center of timing hole in crankcase, observe how close timing marks on cam lobe lines up with breaker lever fiber.

If fiber is not close to cam lobe timing mark, lift circuit breaker assembly and turn shaft gear in correct direction so engagement with driving gear is changed one tooth and reinstall circuit breaker in gearcase to get approximately close alignment of fiber and cam mark. Reinstall stem clamp (34 or 34A, Fig. 5F-2) and tighten clamp nut (or bolts) (35) being sure cam mark and fiber are still in alignment.

Adjust ignition timing. See previous paragraph "Checking and Adjusting Ignition Timing" in this section.

# IGNITION COIL

DESCRIPTION

The ignition coil is a pulse transformer that transforms or steps up low battery or generator voltage to high voltage necessary to jump the electrode at the spark plug in the engine cylinder head. Internally, coil consists of primary and secondary windings with laminated iron core and sealed in waterproof insulating compound. Case cannot be taken apart or coil repaired.

TROUBLE SHOOTING ALL MODELS

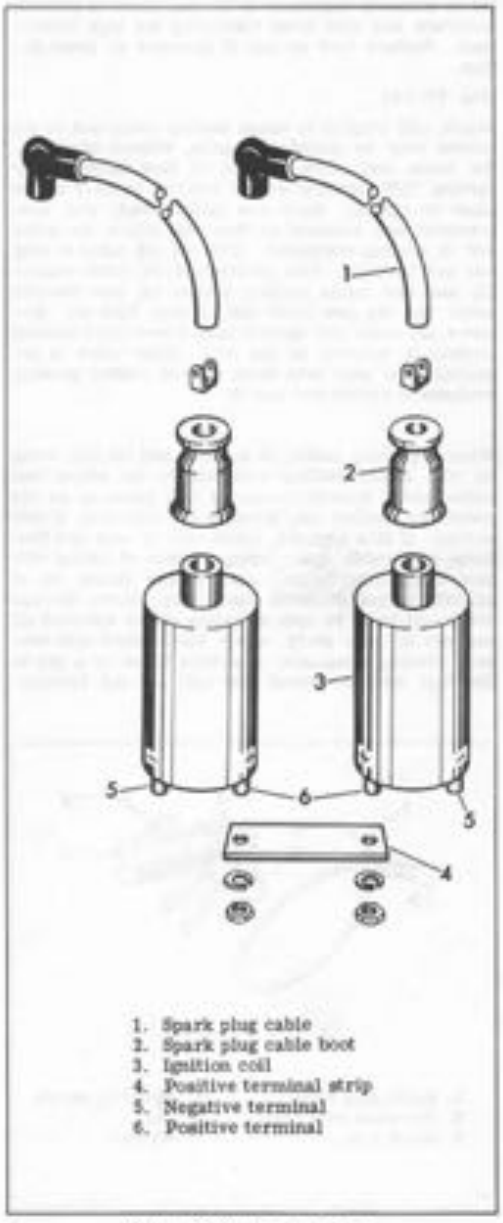
NOTE

Interpret references to "plug," "cable," "condenser" etc., as "plugs," "cables," "condensers" when more than one are used.

When hard starting or missing indicates a faulty ignition system, first, check condition of source of current (battery or magneto depending on model of motorcycle). If lamps light with full brilliancy and horn blows, indicating current source is in at least fair condition check, clean or replace spark plug. If this does not correct performance, inspect circuit breaker points and install new condenser. If condition persists, try a new ignition coil. (In the case where two separate coils are installed determine which is believed to be faulty.)

Temporarily substitute a new ignition coil by attaching it at any convenient point near old coil (coil will function without being securely grounded). Transfer terminal wires to new coil according to the information given in the wiring diagrams pertaining to the model being worked on. Attach new coil cable to the spark plug. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil for damaged cables and insulation. The insulation on cables (and on some models the coil itself) may be cracked or otherwise damaged allowing high tension current to short to metal parts. This is most noticeable in wet weather or when motorcycle has been washed.

Replacing plug cable is the only repair that can be made to an ignition coil. If this does not correct faulty coil performance, coil is defective.




1. Spark plug cable
2. Spark plug cable boot
3. Ignition coil
4. Positive terminal strip
5. Negative terminal
6. Positive terminal

Figure 5G-2. Ignition Coils - 1961 to 1964 Duo-Glide

REPLACING SPARK PLUG CABLE

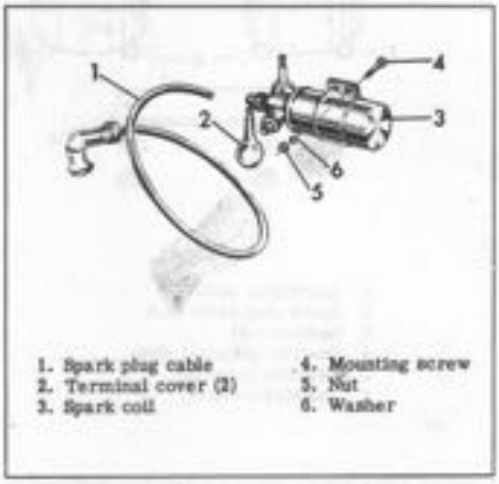
(Fig. 5G-2 and 5G-2B)

Remove old cable (1) from coil terminal and install new cable. Always be certain that cable boot or cap (2) is securely tightened to the coil tower to prevent moisture and dirt from contacting the high tension lead. Replace boot or cap if damaged or loose fitting.

(Fig. 5G-2A)

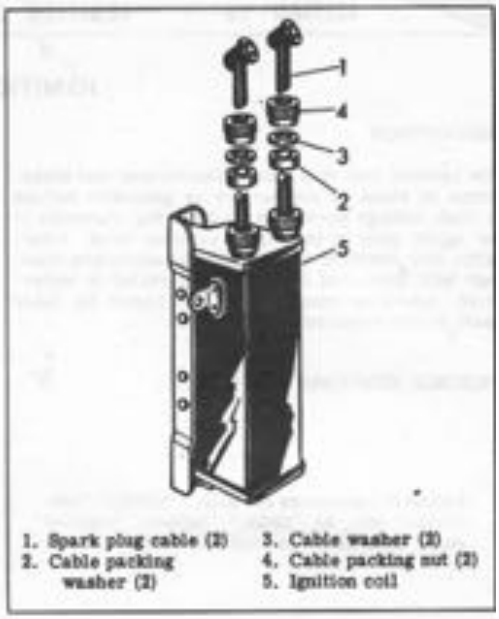
Warm coil slightly to soften sealing compound so old cables may be pulled out easily, without breakage. To warm coil allow current to flow through it by turning "ON" ignition switch (circuit breaker points must be closed). Have new cables ready with ends trimmed and rounded so they will follow the holes left in sealing compound. Clip off old cable at plug end and transfer cable packing nut, (4) cable washer (3) and new cable packing washer (2) onto the new cable and dip new cable end in very light oil. Remove old cable and quickly install new cable making certain it bottoms in the coil. After cable is installed turn seal nuts down against rubber packing washers to secure and seal it.

When replacing cables do not heat coil too hot, doing so will soften sealing compound to the extent that cable holes through compound will close up as old cables are pulled out, blocking the insertion of new cables. If this happens, allow coil to cool and then form new cable holes using a piece of tubing with saw teeth filed in one end. Tubing should be of slightly larger diameter than cable. Holes through compound must be open so cables can be inserted all the way to their seats, where they contact high tension winding terminals; otherwise there is a gap in the high tension circuit and coil will not function.



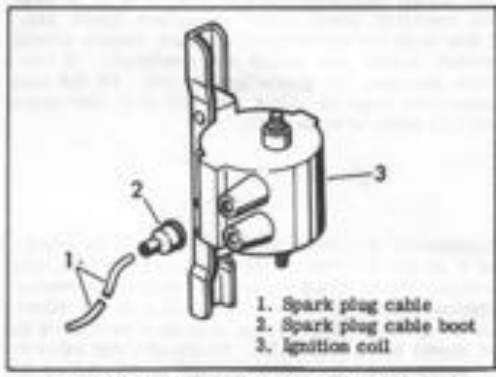

1. Spark plug cable
2. Terminal cover (2)
3. Spark coil
4. Mounting screw
5. Nut
6. Washer

Figure 5G-2C. Ignition Coil - Sprint




1. Spark plug cable (2)
2. Cable packing washer (2)
3. Cable washer (2)
4. Cable packing nut (2)
5. Ignition coil

Figure 5G-2A. Ignition Coil - 1960 & Earlier Duo-Glide, 1963 & Earlier Servi-Car, & Sportster




1. Spark plug cable
2. Spark plug cable boot
3. Ignition coil

Figure 5G-2B. Ignition Coil - 1964 and Later Servi-Car, 1965 and Later Electra-Glide, & Sportster

(Fig. 5G-2C)

Unscrew spark coil cap and pull spark cable from spark coil. Remove rubber seal, seal cover and cap from end of old cable and install on new cable with cap going on first, cover second and seal last. Place rubber seal far enough up on cable so that when installing new cable in spark coil, brass pin inside of coil will pierce cable. Slide cover on seal and secure assembly with cap.

# SPARK PLUGS

## GENERAL

Harley-Davidson spark plugs (Figure 5H-1) have been designed to give maximum life and efficient combustion of fuel. They are available in various "heat ranges," each for a particular service application. Plugs are labeled with numbers 2, 3, 4, or 5 the lowest number indicating the "hottest" plug. Designations 3-4 and 7 are special-purpose plugs.

For normal service, the spark plug as recommended in motorcycle specifications, Section 1-A, should be used on a particular model. However, for special service conditions, a "colder" or "hotter" plug may be desired. If, for instance, the number 4 plug is used on original equipment for normal service, the number 3 plug could be used for slow speed or short run operation while the number 5 plug could be used for the higher speeds of highway travel or maximum throttle operation. It is not uncommon for best results to be obtained with plugs of different heat ranges in front and rear cylinders, with the front usually the colder.

## REMOVING SPARK PLUGS

Disconnect wires from plugs, connection is simple snap-on type. Use a deep socket wrench or special spark plug wrench to loosen plugs. Blow away all dirt from plug base with compressed air before removing plug.

## CLEANING, INSPECTION AND REPAIR (Figure 5H-2)

Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the correctness of the plug heat range and efficiency, as well as a guide to the general condition of rings, valves, carburetor and ignition system.

A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip (A) indicates an oil fouled plug. The condition is caused by worn rings and pistons, loose valves, weak battery, faulty ignition wires, circuit breaker trouble, weak coil or a cold plug.

A dry, fluffy or sooty black deposit (B) indicates plug is gas fouling, a result of a too rich carburetor air-fuel mixture, long periods of engine idling or a cold plug.

An overheated plug (C) can be identified by a light brown, dry, glassy looking deposit. This condition may be accompanied by cracks in the insulator tip and is caused by too lean an air-fuel mixture, a hot running engine, valves not seating, improper ignition timing or too hot a plug for the service. The oxide deposit on the spark plug is a conductor when hot. It will cause plug to misfire, especially at high speed.

A plug with a rusty brown to tan powdery deposit (D) indicates a balanced ignition and combustion condi-

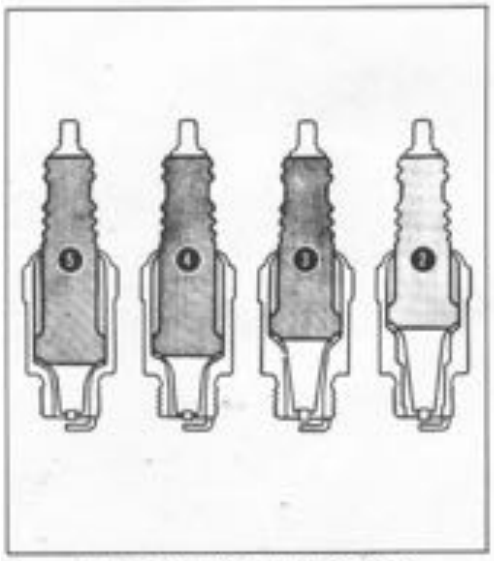



Figure 5H-1. Spark Plug Heat Range

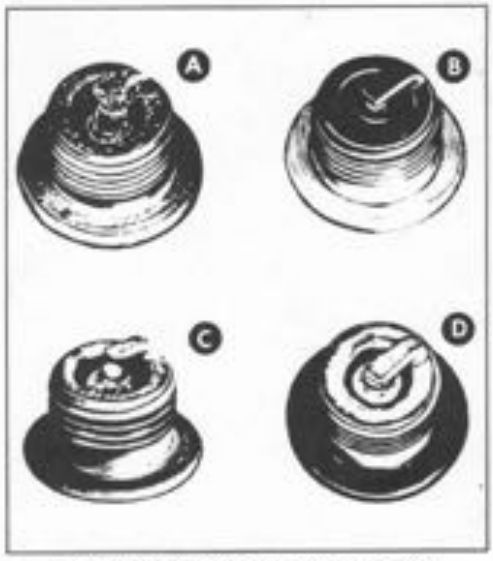



Figure 5H-2. Type of Plug Base Deposits

tion. With leaded gasolines the deposits may be white or yellow. In either case, ignition functions through the deposits if only light and the deposits should be cleaned off at regular intervals to keep them from building up.

When spark plug electrodes have become eroded away (C) to the point where gap setting is difficult or impossible, the plug should be replaced. Plugs with cracked insulator should also be discarded.

Clean plugs with a sand blast cleaner. Rotate plug top while applying sand blast to clean insulator and electrodes. Cleaning time should be carefully limited to just what is necessary to clean deposits from insulator nose. Prolonged use of abrasive blast will wear away insulator. Normally three to five seconds of sand blasting is sufficient. Never use metal instruments to remove deposits from plugs.

SETTING SPARK GAP

Before setting spark gap on used plugs, pass a thin point file (or nail file) between electrodes to produce flat, parallel surfaces to facilitate accurate gauging.

Use only a wire type gauge. Bend the outside or grounded electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs as shown under Engine Specifications Section 3A.

TESTING SPARK PLUGS

Check the sparking ability of a cleaned and regapped plug on a sparking comparator if possible. An inability to withstand rapid firing under cylinder compression conditions can be discovered.

INSTALLING SPARK PLUGS

Before turning spark plugs into cylinder heads, check condition of threads in head and on plug. Soften deposits in cylinder head with penetrating oil and clean out with tap or old plug.

Install new spark plug gasket and turn plug down finger tight. Tighten to 15 pounds with torque wrench or 3/4 of a turn.

Check and adjust engine idle speed and mixture setting after installing new set of plugs if necessary.

# REGULATOR

GENERAL INFORMATION

This section covers testing and servicing of regulators for all Harley-Davidson motorcycle models, except Sprint.

Two unit voltage regulators and three unit current and voltage regulators are used to control generator output to the electrical system.

Normally the regulator does not require attention at regular service intervals; however, point cleaning, point setting and air gap adjustments may be necessary if regulator is not functioning correctly.

Four basic tests are required:

1. Test the generating system to determine whether the generator or regulator is at fault.

2. Test the cutout unit closing voltage.

3. Test the voltage control unit setting.

4. Test the current control unit setting.

Voltage and current settings for all regulators are are listed in following table of specifications, Figure 5I-1.

Before making any checks or adjustments, the charging circuit must be operated approximately 15 minutes to bring regulator to normal operating temperature. Regulator cover and gasket must be in place.

Two methods are used for making regulator tests, the method used depending upon the type of equipment available.

METHOD I employs separate voltmeter, ammeter, fixed resistances of 1/4 ohm and 1-1/2 ohm, and 25 watt variable field resistor. This is the method outlined in detail in the Delco-Remy Service Bulletins.

METHOD II employs single test instrument incorporating the same components as Method I, and in addition has a variable load resistance. The equipment used is a VAT 26 voltage-ampere tester manufactured by the Sun Equipment Corporation.

## METHOD I
## TESTING DELCO - REMY REGULATORS

GENERATOR-BATTERY SYSTEM (6 or 12 VOLT)

*Covers all models except Sportster XLCH*

A. TESTING THE GENERATING SYSTEM (SEE FIGURE 5I-2)

1. Disconnect battery wire from regulator "BAT" terminal and connect this wire to the negative lead of an ammeter (0-30 amperes). Connect positive ammeter lead to regulator "BAT" terminal.

2. Connect the positive lead of a voltmeter (0-20 volts) to the regulator "GEN" terminal. Connect voltmeter negative lead to ground on motorcycle.

3. Disconnect the wire from the regulator "F" terminal and connect this wire to a lead of a field control variable resistor. Connect other lead of field control variable resistor to ground on motorcycle. Set field control knob to open position.

4. Operate engine at 2000 RPM (approximately 40 MPH).

5. Slowly turn field control knob toward direct position until the ammeter reads:

15 amperes for 6 volt systems using standard equipment generators (Models 58 and 61 generators)

20 amperes for heavy duty fan-cooled generators (Models 51 and 58R generators)

10 amperes for 12 volt generators (Models 64 and 65 generators)

If ammeter reading is as specified, generator is not faulty and difficulty is in regulator. Make regulator tests B, C and D.

6. If there is no ammeter reading or reading is low, observe voltmeter reading. If voltmeter reading is below 6 volts on 6 volt systems, or below 12 volts on 12 volt systems, generator requires service.

## Figure 5I-1. Regulator Test Specifications

**DELCO REMY REGULATORS**

| REGULATOR PART NUMBER | | FOR TESTING PROCEDURE SEE DELCO-REMY SERVICE BULLETIN NUMBER | REGULATOR TYPE | ADJUSTMENT AND RANGE AMPS | ADJUSTMENT AND RANGE (VOLTS) | | USED WITH HARLEY-DAVIDSON GENERATOR AND MOTORCYCLE MODELS | |
|---|---|---|---|---|---|---|---|---|
| HARLEY-DAVIDSON | MANUFACTURER'S NUMBER | | | CURRENT REGULATOR SETTING | CUTOUT RELAY CLOSING VOLTAGE | VOLTAGE REGULATOR SETTING | | |
| 74511-51 | 1118 388 | 1R 116 | 3 Unit Current & Voltage | 18 | 6.6 | 7.5 | 1950-1951 model 48, 2-brush fan-cooled generator. (Superseded by 74511-51A for parts order.) | |
| 74511-51A | 1118 707<br>1118 707B<br>1118 707C<br>1118 707D | 1R 116<br>1R 118<br>1R 118<br>1R 118A | 3 Unit Current & Voltage | 20<br>(17.5 - 20.5) | 6.6<br>(5.9 - 6.7) | 7.5<br>(7.2 - 7.5) | Model 51, 2-brush fan-cooled generator. | |
| 74511-58 | 1119 185C<br>1119 185D | 1R 118<br>1R 118A | 3 Unit Current & Voltage | 15<br>(13.5 - 16.5) | 6.6<br>(5.9 - 6.7) | 7.4<br>(7.2 - 7.5) | Model 58 Generator | |
| 74510-47 | 1118 307 | 1R 116 | 2 Unit Voltage | | 6.4 | 7.0 | Models 125-165 Generators | Regulator superseded by 74510-47A for parts order |
| | | | | | | 7.4 | Model 52K Generator | |
| | 1118 794 | 1R 116 | 2 Unit Voltage | | 6.4 | 7.0 | Models 125-165 Generators | Regulator superseded by 74510-47A for parts order |
| | | | | | | 7.4 | Model 52K Generator<br>Model 58 and 61 Generator | |
| 74510-47A | 116 995 | 1R 116 | 2 Unit Voltage | | 6.4<br>(5.9 - 6.7) | 7.2<br>(7.0 - 7.3) | Model 52K, 58 and 61 Generators. Model 125-165 Generators | |
| 74510-59 | 1118 989 | 1R 116 | 2 Unit Voltage | | 5.5<br>(5.0 - 6.0) | 6.7<br>(6.5 - 6.8) | Model 58 and 61 Generators | |
| 74510-64 | 1119 614 | 1R 119A | 3 Unit Current & Voltage | 10<br>(9.0 - 11.0) | 12.4<br>(11.8 - 13.0) | 14.3*<br>(13.9 - 14.5)* | Model 64 and later 12V. generator. (*Upper contact operation. Operation on lower contacts must be .1 to .3 volt lower.) | |
| 74511-65 | 1100 687 | 1R 202 | 2 Unit Voltage | | 12.5<br>(11.5 - 13.5) | 14.4*<br>(13.5 - 14.9)* | Delcotron Alternator | |
| ALL 6-VOLT REGULATORS | CURRENT REGULATOR AIR GAP .075 IN.<br>VOLTAGE REGULATOR AIR GAP .075 IN. | | | | CUTOUT RELAY POINT OPENING .020 IN.<br>CUTOUT RELAY AIR GAP .020 IN. | | | |
| ALL 12-VOLT REGULATORS | CURRENT REGULATOR AIR GAP .075 IN.<br>VOLTAGE REGULATOR AIR GAP VARIES WITH SETTING. | | | | CUTOUT RELAY AIR GAP AND POINT OPENING .020 IN.<br>VOLTAGE REGULATOR POINT OPENING .016 IN. | | | |

**BOSCH REGULATORS**

| HARLEY-DAVIDSON | MANUFACTURER'S NUMBER | RELAY CUT-IN VOLTAGE | REGULATOR VOLTAGE | | Used with Harley-Davidson Generator and Motorcycle Models |
|---|---|---|---|---|---|
| | | | NO LOAD | LOAD | |
| 74511-65 | TBA 130 - 150/12/2 | 12.4 - 13.1 | 13.8 - 15.4 | 12.7 - 14.5 @ 10 Amp. | 1965 Model 65 Generator for 1965-66 Sportster XLH and 1965 and Later XLCH |

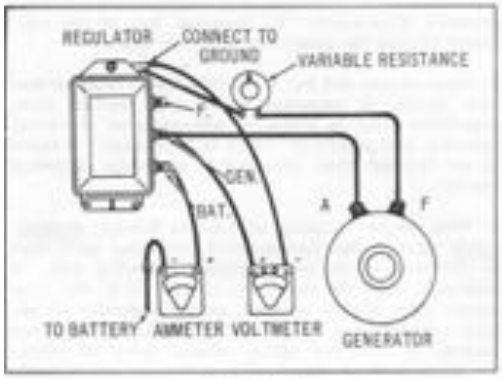



Figure 5I-2.

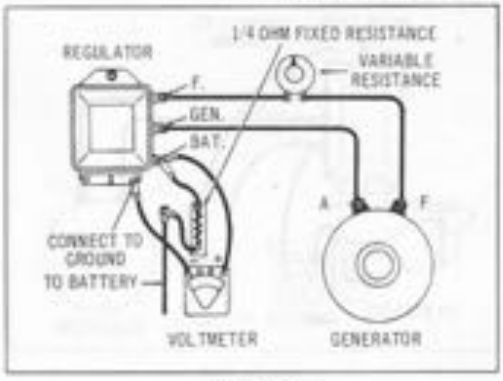



Figure 5I-3.

7. If voltmeter reading is high, over 7.5 volts on 6 volt systems or over 15 volts on 12 volt systems, the cutout relay is not closing. Make tests B, C and D.

NOTE

Before making adjustments or servicing regulator, identify regulator by number stamped on regulator base, or mounting bracket, then refer to table Fig. 5I-1 which contains service information for desired regulator. Delco Remy Bulletins listed in table may be obtained from a Delco Remy service station or the Harley-Davidson Motor Co.

B. TESTING CUTOUT RELAY UNIT CLOSING VOLTAGE (THE SAME CONNECTIONS ARE USED AS IN TEST A (FIG. 5I-2.)

1. Turn field control variable resistor to open position.

2. Operate engine at 1500 RPM (approximately 30 MPH).

3. Slowly turn Field Control knob toward direct position to decrease resistance in field circuit. Voltmeter reading will increase slowly until cutout points close. Closing voltage will be highest voltmeter reading before meter pointer "kicks" to read battery voltage. After cutout points close, ammeter will indicate a current flow.

If closing voltage is not within specifications (See Fig. 5I-1) adjust setting according to manufacturer's service bulletin. (See Fig. 5I-1.)

C. TESTING VOLTAGE CONTROL UNIT SETTING (FIG. 5I-3)

1. Remove battery wire from regulator battery "BAT" terminal. Connect a 1/4 ohm resistor (not less than 25 watts) in series with the removed battery wire and the regulator battery "BAT" terminal.

2. Connect the positive lead of a voltmeter (0-15 volts) to the regulator "BAT" terminal, connect the negative lead to ground.

3. Remove wire from regulator field "F" terminal and connect a 25 watt variable resistance Field Control in series with the removed wire and the regulator field "F" terminal, turn control knob to direct position (no resistance).

6 Volt Regulator - Operate engine at 2000 RPM (approximately 40 MPH). Turn field control resistor knob to "Open" position then to "Direct" position to cycle regulator. Check voltmeter reading. Reading indicated on voltmeter is voltage regulator setting.

12 Volt Double Contact Regulator - Operate engine at 2000 RPM (approximately 40 MPH). Turn field control resistor knob to "Open" position then to "Direct" position to cycle regulator. Check voltmeter reading. Reading indicated on voltmeter is the voltage regulator setting of the upper contacts (shorting contacts). Voltmeter reading should be within manufacturer's specifications (See Fig. 5I-1). Maintain engine speed, slowly rotate field control resistor toward "Open" position to increase resistance until voltmeter reading drops slightly and then remains steady. This indicates the voltage setting of the lower contacts (series contacts). The voltage difference between the settings of the two sets of contacts should be within specifications (See Fig. 5I-1).

If voltage readings are not within specifications, replace regulator or service and adjust settings (See "Servicing Regulator").

**CAUTION**

Never ground the 12 volt generator or regulator field terminal while these two units are connected and operating. This will burn up the upper set (shorting set) of contacts of the voltage control unit.

D. TESTING CURRENT CONTROL UNIT SETTING ON 3 UNIT REGULATORS (FIG. 5I-4)

1. Remove battery wire from regulator "BAT" terminal and connect to negative lead of ammeter (0-30 amps). Connect positive lead of ammeter to regulator "BAT" terminal.

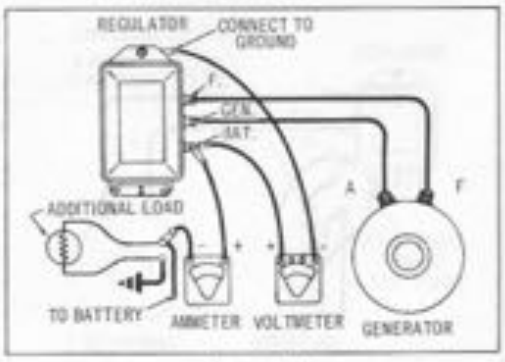



Figure 5I-4.

2. Connect positive lead of voltmeter to regulator battery "BAT" terminal and negative voltmeter lead to ground.

3. Turn on light and connect additional load to the battery to drop the voltmeter reading to one volt below voltage regulator setting.

4. Operate engine at 2000 RPM (approximately 40 MPH) and note reading on ammeter. If reading is not within regulator specifications (See Fig. 5I-1) replace regulator or adjust according to manufacturer's Service Bulletin.

GENERATOR SYSTEM - WITHOUT BATTERY
(6 Volt)
*Covers 1964 and earlier Sportster Model XLCH.*

A. TESTING THE GENERATING SYSTEM (FIG. 5I-5)

NOTE

Make all tests with light switch in off position to prevent possible light burnout.

1. Connect an ammeter and 1-1/2 ohm resistor in series between regulator terminal marked "GEN" and ground. (Use regulator mounting bolt for ground.) Disconnect "F" terminal lead at the regulator to open the generator field circuit.

2. Start engine and run at slightly faster than normal idle speed. If ammeter shows any current flow, generator field is grounded internally or in wiring harness, and generator repair is necessary. If there is no current flow, proceed to make the following checks.

3. With engine running at idle as before, momentarily ground the disconnected generator field lead by touching it on the regulator mounting bolt. If ammeter does not show any current flow, the generator field circuit is open, or the generator armature circuit is at fault, and generator must be repaired. If ammeter shows sudden jump in output, the generator is functioning normally, and trouble is located elsewhere.

4. Reconnect "F" terminal lead to regulator. Regulator can now be checked to determine if it is functioning properly. Make regulator Tests B, C and D.

NOTE

Before making adjustments or servicing regulator, identify regulator by number stamped on regulator base or mounting bracket, then refer to table Fig. 5I-1 which contains service information for desired regulator. Delco-Remy bulletins listed in table may be obtained from Delco Remy service station or the Harley-Davidson Motor Co.

B. TESTING CUTOUT UNIT SETTING AND VOLTAGE CONTROL UNIT SETTING (FIG. 5I-6)

1. Remove the red wire from regulator terminal marked "BAT". Connect a 1-1/2 ohm resistor between the regulator terminal marked "BAT" and one of the regulator mounting bolts (ground). Connect a voltmeter to the same terminals with negative lead of voltmeter to the regulator mounting bolt.

2. Run engine at fast idle. A reading of 5 volts or more indicates that the relay is functioning properly.

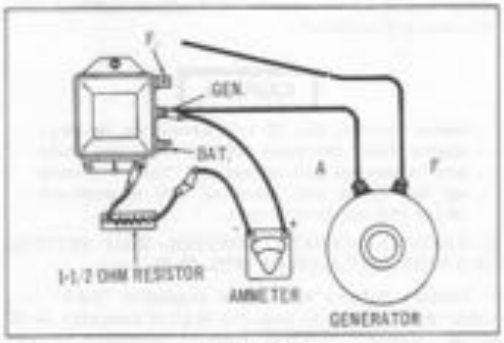



Figure 5I-5.

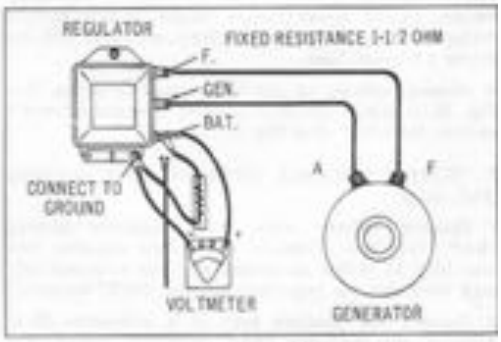



Figure 5I-6.

The cutout relay setting is not critical. The only requirement is that the relay close at a low engine speed.

At a very slow engine idle the voltage may fluctuate between zero and 5 volts. This is a normal condition.

3. With the regulator cover in place and the regulator at operating temperature, increase the engine speed to approximately 2700 RPM (45 MPH road speed) and read the voltmeter. If the voltmeter reading falls within the limits given in Fig. 5I-1, it indicates that the voltage regulator is operating properly.

If the voltmeter reading does not fall within the limits given in Fig. 5I-1, the voltage regulator must be replaced or adjusted according to manufacturer's Service Bulletin.

## METHOD I
## TESTING BOSCH REGULATORS

12 VOLT SYSTEM WITH OR WITHOUT BATTERY
*Covers 1965 Sportster Models XLH and XLCH*

NOTE

This regulator is a sealed unit and no servicing or adjusting is necessary or recommended. When some difficulty arises, checks can be made to determine if the regulator is controlling generator output within specifications. If voltage readings are not within specifications, regulator should be replaced.

A. TESTING GENERATING SYSTEM (FIG. 5I-7)

1. Disconnect wire or wires from regulator battery terminal "B+". On XLH models, connect these wires together.

2. Connect one lead from 1-1/2 ohm resistor (not less than 100 watt rating) to the regulator "B+" terminal. Connect the other lead from the resistor to the Positive terminal of an ammeter (0-15 amp). Connect the negative ammeter lead to ground on motorcycle.

3. Connect the Positive lead of a voltmeter (0-15 volts) to regulator "D+" terminal, connect the negative lead to ground on chassis.

4. Disconnect wire from regulator field "DF" terminal and connect this wire to one lead of a field control variable resistor, connect other lead of the field control to ground on motorcycle chassis. Turn field control to "Open" position.

5. Operate engine at 2700 RPM - (approximately 45 MPH).

6. Slowly rotate field control resistor knob toward the "Direct" position until ammeter reads 10 amperes, then immediately turn the control knob to "Open" position. If a reading of 10 amperes is obtained, generator is O.K. and any difficulty in the

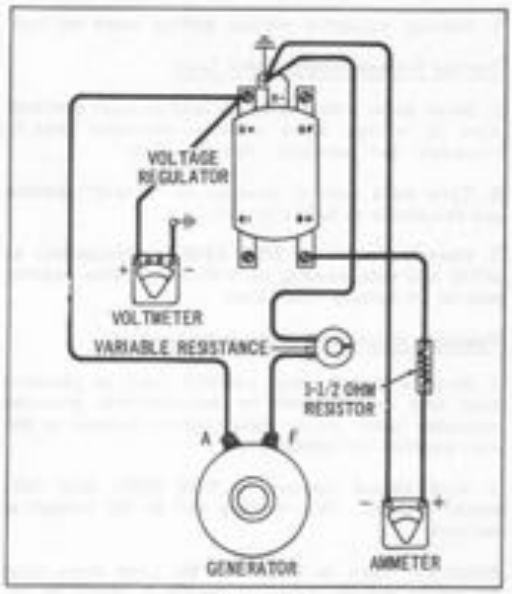



Figure 5I-7.

charging circuit is caused by a faulty regulator or defective wiring. Inspect wiring and make regulator tests B and C. If a reading of 10 amperes cannot be obtained and voltmeter reading is below 12 volts, generator is in need of service.

If no reading is obtained on ammeter but voltmeter reading is 15 volts or higher, cutout relay is defective and regulator should be replaced.

B. TESTING CUTOUT RELAY UNIT CLOSING VOLTAGE - SAME CONNECTIONS ARE USED AS IN TEST A (FIG. 5I-7)

1. Turn field control resistor knob to "Open" position.

2. Operate engine at 2000 RPM (approximately 35 MPH).

3. Slowly turn field control toward "Direct" position. As the resistance is decreased, the voltmeter reading will increase. Note the highest reading on the voltmeter before the pointer "kicks". This will be the relay closing voltage. Repeat operation a few times, each time returning the field control resistor to "Open" position. If the closing voltage is not within specifications, (see Fig. 5I-1) replace regulator.

C. TESTING VOLTAGE CONTROL UNIT SETTING. (FIG. 5I-8)

Two tests are required:

1. Testing regulator voltage setting under load.

2. Testing regulator voltage setting under no load.

Testing Voltage Setting Under Load

1. Make same connections as used to make previous Test B, except move positive voltmeter lead to regulator "B+" terminal. See Fig. 5I-8.

2. Turn field control resistor to "Direct" position (no resistance in field circuit).

3. Operate engine at 2700 RPM (approximately 45 MPH) and note reading on voltmeter. This reading will be the voltage under load.

Testing Voltage Setting Under No Load

1. Remove 1-1/2 ohm resistor used in previous load test from circuit by disconnecting grounded ammeter lead. Place field control resistor in Direct position (no resistance).

2. With engine running at 2700 RPM, note voltmeter reading. This reading will be the voltage at no load.

Readings taken in Load and No Load tests must be within specifications or regulator should be replaced. See Fig. 5I-1 for specifications.

**METHOD II**
**TESTING DELCO - REMY REGULATORS**
**(VAT 26 TESTER)**

GENERATOR-BATTERY SYSTEM (6 OR 12 VOLT)
*Covers all models except Sportster XLCH*

A. TESTER CONTROLS

Turn ground polarity selector to negative; Load Control knob to Direct; Ammeter selector to 100A position; and voltage selector to 16V position for 12 volt system, or 8V position for 6 volt system.

B. TESTER CONNECTIONS (See Fig. 5I-9)

1. Remove "BAT" lead from voltage regulator.

2. Connect Regulator lead "R" of tester to "BAT" terminal of regulator.

3. Connect Battery lead "B" of tester to battery wire removed from regulator.

4. Connect Ground lead "G" of tester to ground of motorcycle.

5. Connect Positive voltmeter lead to "GEN" terminal of regulator.

6. Connect Negative voltmeter lead to ground of motorcycle.

7. Remove wire connected to regulator field "F" terminal and connect this wire to a lead of the field control variable resistor, the other lead of the field control resistor is connected to ground on motorcycle. Turn field control to "Open" position.

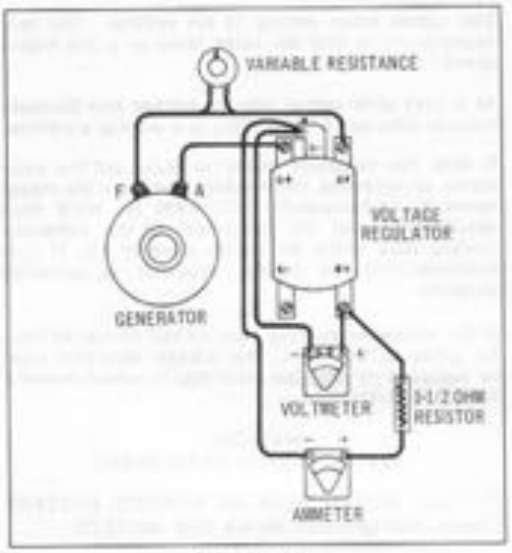



Figure 5I-8.

C. TESTING GENERATING SYSTEM.

1. Operate engine at 2000 RPM (approximately 35 MPH).

2. Slowly turn field control resistor knob to "Direct" position until ammeter reads:

15 amperes for 6 volt systems using standard equipment generators.

20 amperes for heavy duty fan-cooled generators (6 volt)

10 amperes for 12 volt generators.

If ammeter reading is as specified, generator is not at fault and difficulty is in voltage regulator or wiring. Make regulator Tests D, E, and F.

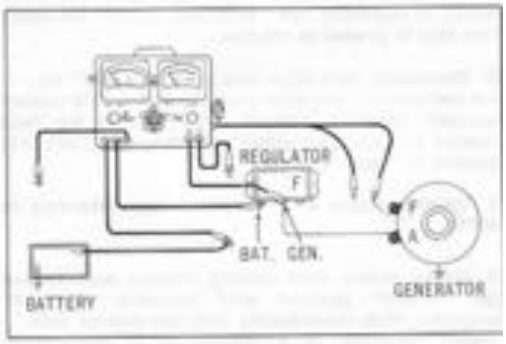



Figure 5I-9.

3. If there is no ammeter reading or reading is low, observe voltmeter reading. If voltmeter reading is below 6 volts on 6 volt systems or below 12 volts on 12 volt systems, generator requires service.

4. If voltmeter reading is over 7.5 volts on 6 volt systems or over 15 volts on 12 volt systems, the cutout relay is not closing. Make following Test D.

NOTE

Before making adjustment or servicing regulator, identify regulator by Delco Remy number stamped on regulator base or mounting bracket. Then, see table, Fig. 5I-1, which contains service information for the desired regulator. Delco Remy Bulletins listed in table may be obtained from a Delco Remy service station or the Harley-Davidson Motor Co.

D. TESTING CUTOUT RELAY UNIT CLOSING VOLTAGE

Use same tester connections as previous Test C. (Fig. 5I-9)

1. Turn field control variable resistor to "Open" position.

2. Turn load control knob to "Direct" position.

3. Operate engine at 1500 RPM (approximately 30 MPH).

4. Slowly turn field control resistor knob toward "Direct" position observing voltmeter.

As resistance is decreased in field circuit, voltage will rise. Note highest reading before meter pointer "kicks" to read battery voltage. Repeat operation several times, each time turning field control to "Open" position. Highest reading observed is the cutout relay closing voltage.

If closing voltage is not within specifications (see Fig. 5I-1), replace regulator or adjust according to manufacturer's Service Bulletin.

E. TESTING VOLTAGE CONTROL UNIT SETTING (FIG. 5I-10)

Same connections are used as in previous Test D except move Positive voltmeter lead to regulator battery "BAT" terminal and remove grounded lead of the field control variable resistor and connect to regulator field "F" terminal. (See Fig. 5I-10)

1. Turn field control knob to "Direct" position.

2. Turn load control to the 1/4 ohm position.

6 Volt Regulator - Operate engine at 2000 RPM (approximately 40 MPH). Turn field control resistor knob to "Open" position then to "Direct" position to cycle regulator. Check voltmeter reading. Reading indicated on voltmeter is voltage regulator setting.

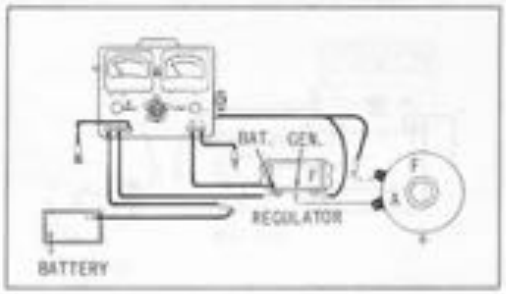



Figure 5I-10.

12 Volt Double Contact Regulator - Operate engine at 2000 RPM (approximately 40 MPH). Turn field control resistor knob to "Open" position then to "Direct" position to cycle regulator. Check voltmeter reading. Reading indicated on voltmeter is the voltage regulator setting of the upper contacts (shorting contacts). Voltmeter reading should be within manufacturer's specifications (See Fig. 5I-1). Maintain engine speed, slowly rotate field control resistor toward "Open" position to increase resistance until voltmeter reading drops slightly and then remains steady. This indicates the voltage setting of the lower contacts (series contacts). The voltage difference between the settings of the two sets of contacts should be within specifications (See Fig. 5I-1).

If voltage readings are not within specifications, replace regulator or service and adjust settings (See "Servicing Regulator").

**CAUTION**

Never ground the 12 volt generator or regulator field terminal while these two units are connected and operating. This will burn up the upper set (shorting set) of contacts of the voltage control unit.

F. TESTING CURRENT CONTROL UNIT SETTING ON 3 UNIT REGULATORS

Use same connections as previous Test E, Voltage Control Test. (See Fig. 5I-10).

1. Turn field control to "Direct" position.

2. Operate engine at 2000 RPM.

3. Turn load control clockwise until maximum reading is obtained on ammeter.

This reading will be equal to the current limiter setting. If not within specifications (see Fig. 5I-1), replace or adjust according to manufacturer's Service Bulletin and retest. Take final reading with regulator cover in place.

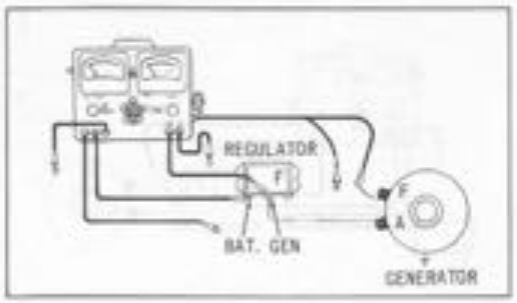



Figure 5I-11.

GENERATOR SYSTEM WITHOUT BATTERY (6 VOLT)

*Covers 1964 and earlier Sportster Model XLCH*

A. TESTER CONTROLS

Turn ground polarity selector to Negative; load control knob to Direct; ammeter selector to 100A position; and voltage selector to 6 volt position.

B. TESTER CONNECTIONS (See Fig. 5I-11)

1. Remove wires from regulator "BAT" terminal.

2. Connect Regulator lead "R" of tester to regular "BAT" terminal.

3. Connect Ground lead "G" of tester to ground on motorcycle.

4. Connect Positive lead of voltmeter to regulator "GEN" terminal.

5. Connect Negative lead of voltmeter to ground on motorcycle.

6. Remove wire connected to regulator "F" terminal and connect this wire to a lead of the field control variable resistor. Connect other lead of field control to ground on motorcycle. Turn field control variable resistor to "Direct" position.

Battery lead "B" of tester is not connected.

C. TESTING GENERATING SYSTEM

1. Operate engine at 2700 RPM (approximately 45 MPH).

2. Turn load control clockwise until a 15 ampere reading is observed.

If reading is 15 amperes or more, generator is not at fault and difficulty is in voltage regulator. Make Tests D, E and F.

If no ammeter reading is obtained or reading is low, observe voltmeter reading. If reading is below 6 volts, generator requires service. If voltmeter reading is high (over 7.5 volts), the cutout relay is not closing. Make Test D following.

D. TESTING CUTOUT RELAY UNIT CLOSING VOLTAGE (Fig. 5I-11)

1. Connect battery lead "B" of tester to 1-1/2 ohm connection on side of tester.

2. Turn field control variable resistor to "Open" position.

3. Turn load control knob to "Direct" position.

4. Operate engine at approximately 2000 RPM (35 MPH).

5. Slowly turn field control knob toward the "Direct" position to decrease resistance in generator field circuit. As the resistance is decreased, voltmeter reading will increase until a kickback of the voltmeter needle is observed. The highest voltage noted will be the cutout relay closing voltage. Repeat operation several times, each time turning the field control to "Open" position. If the closing voltage is not within specifications (see Fig. 5I-1), adjust according to manufacturer's Service Bulletin and retest.

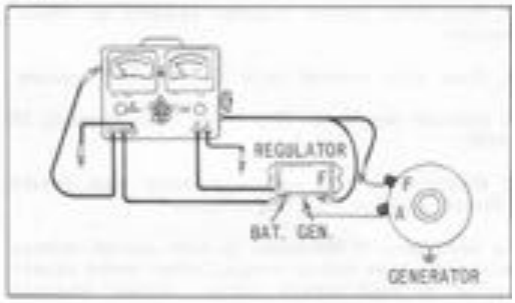



Figure 5I-12.

E. TESTING VOLTAGE CONTROL UNIT SETTING (FIG. 5I-12)

1. Move positive voltmeter lead to regulator "BAT" terminal.

2. Move field control lead from ground on motorcycle to regulator field terminal.

3. Turn field control variable resistor to "Direct" position.

4. Operate engine at 2700 RPM, (approximately 45 MPH).

5. Turn field control variable resistor to "Open" position, then to "Direct" to cycle regulator. Observe voltmeter reading.

6. If voltmeter reading is not within specifications (see 5I-1), replace or adjust regulator according to manufacturer's Service Bulletin.

## METHOD II
## TESTING BOSCH REGULATORS
## (VAT 26 TESTER)

12 VOLT SYSTEM WITH OR WITHOUT BATTERY
*Covers 1968 Sportster Models XLH and XLCH*

A. TESTER CONTROLS

Turn ground polarity selector to Negative; load control knob to Direct; ammeter selector to 100A position; and voltage selector to 12 volt position.

B. TESTER CONNECTIONS (SEE FIG. 5I-13)

1. Remove wires from regulator "B+" terminal. On XLH models, connect these wires together.

2. Connect Regulator lead "R" of tester to regulator terminal "B+"

3. Connect Ground lead "G" of tester to ground on motorcycle.

4. Connect Positive voltmeter lead to regulator terminal "D+" and connect Negative lead to ground on motorcycle.

5. Remove wire from regulator terminal "DF" and connect this wire to a lead of the field control variable resistor. Connect the other lead of the field control to ground on motorcycle. Turn field control to "Direct" position. Turn load control to "Direct" position.

Battery lead "B" of tester is not connected for this test.

C. TESTING GENERATING SYSTEM

1. Operate engine at 2700 RPM (approximately 45 MPH).

2. Slowly rotate load control clockwise until a reading of 10 amperes is observed.

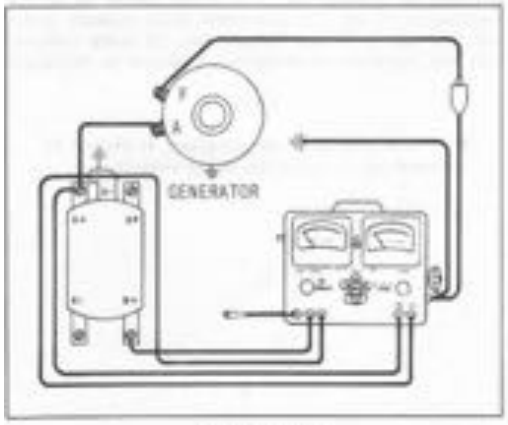



Figure 5I-13.

3. If a reading of 10 amperes is obtained, generator is not at fault and difficulty is due to a faulty regulator or defective wiring. Inspect wiring and make Tests D and E.

4. If a reading of 10 amperes cannot be obtained and voltmeter reading is below 12 volts, generator is defective.

5. If no reading is obtained on ammeter but voltmeter reading is 15 volts or higher, cutout relay is defective. Regulator should be replaced and circuit retested.

D. TESTING CUTOUT RELAY UNIT CLOSING VOLTAGE

Make same connections as in previous Test C, except connect battery lead "B" of tester to 1-1/2 ohm connection on side of tester.

1. Turn load control to "Direct" position.

2. Turn field control variable resistor to "Open" position.

3. Operate engine at 2000 RPM (approximately 35 MPH).

4. Slowly turn field control variable resistor toward "Direct" position while observing the voltmeter. As resistance is decreased in field circuit, voltage will rise.

Observe highest voltmeter reading before voltmeter pointer kicks back. Repeat operation several times, each time returning field control to "Open" position. Highest reading observed is the cutout relay closing voltage.

If closing voltage is not within specifications (see 5I-1), replace regulator.

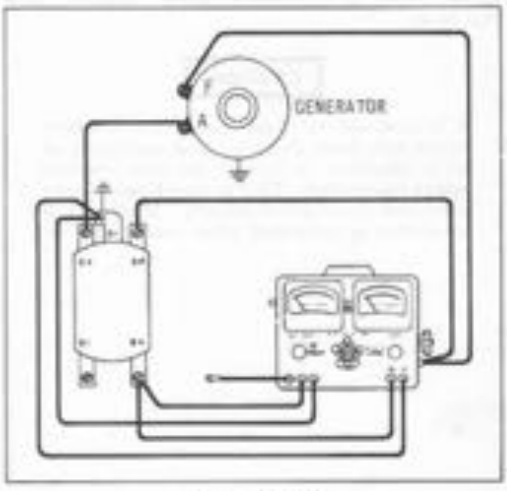



Figure 5I-14.

E. TESTING VOLTAGE CONTROL UNIT SETTING. (FIG. 5I-14)

Two tests are required:

1. Testing regualtor voltage setting under load.

2. Testing regulator voltage setting under no load.

Testing Voltage Setting Under Load

1. Make connections as in previous Test D, except switch positive voltmeter lead to regulator "B+" terminal, disconnect tester battery lead "B" from 1-1/2 ohm connector on tester, disconnect field control lead from ground connection on motorcycle and connect this lead to regulator "DF" terminal.

2. Turn field control resistor to "Direct" position (no resistance in field circuit).

3. Operate engine at 2700 RPM (approximately 45 MPH).

4. Turn load control knob clockwise to load circuit until ammeter reads 10 amperes.

5. Voltmeter reading will be voltage setting under load.

Testing Voltage Setting Under No Load

1. Return load control knob to "Direct" position.

2. Turn field control resistor to "Direct" position.

3. Operate engine at 2700 RPM.

4. Voltmeter reading will be voltage setting at no load.

Both load and no-load voltage readings must be within specifications or regulator should be replaced. (See Fig. 5I-1)

**CAUTION**

It is advisable to "flash" field coils whenever wires have been removed from regulator; or after generator or battery has been removed and is reinstalled. This is done to make sure generator has correct polarity. If polarity of generator is reversed, relay points will vibrate and burn. On battery systems, "flash" field coils by momentarily touching a jumper wire between "BAT" terminal and "GEN" terminal on regulator, after all wires have been properly connected and before starting engine.

On systems without battery, connect negative lead of outside battery to generator frame and flash positive lead to generator "A" terminal. The momentary surge of current from battery to generator will correctly polarize generator.

SERVICING REGULATORS

Delco Remy Regulator

Faulty operation of Delco Remy regulators may be due to one or more of the following conditions:

1. Contact points dirty, oxidized or pitted — To clean contacts, refer to manufacturer's Service Bulletin, (See Fig. 5I-1)

After cleaning contacts, the air gaps and contact spacing must be adjusted. See Fig. 5I-1 for information on the voltage regulator and cutout relay air gap and contact opening setting.

2. Ground wire broken (short braided wire between regulator base and mounting bracket).

3. Defective fuse (in holder near regulator).

4. Corrosion contamination on regulator internal parts.

After any faults have been corrected, regulating units must be adjusted according to manufacturer's Service Bulletin. (See Fig. 5I-1).

Bosch regulator

Service or adjustment to internal parts of Bosch regulators is not recommended since contact spacing and air gaps are factory set. If tests indicate that the regulator is defective, it should be replaced.

NOTE

If a new regulator is installed, it should be checked out in operation of the vehicle.

# BATTERY

## GENERAL

The battery serves as a storage place for current used in starting the motorcycle; to operate accessories when the engine is not running and to provide additonal current, when necessary, over the amount being generated. For a battery to remain in good condition, the current draw must be balanced by a current input. All Harley-Davidson batteries have lead plates and sulphuric acid electrolyte units of capacities suitable for load requirements under intended use.

## BATTERY CARE

Prompt and correct battery care determines the life span of the unit. Therefore, for a longer useful life, the battery solution level must be checked at weekly intervals. Add only pure distilled or approved water to recommended level above plates and separators. Be careful not to overfill. Overfilling will result in some of the electrolyte being forced out through cap vent holes, diluting or weakening the solution strength. An overflow of battery solution will cause cables to corrode and motorcycle parts near the battery to be damaged.

Clean battery and terminals when necessary with a baking soda-water solution. Be careful to avoid getting any of the solution into the cap vent holes. When solution stops bubbling, flush off battery with clean water.

Coat terminals with grease or oil felt terminal post washers after wires have been attached to retard corroding.

## CHARGING BATTERY

Never allow a battery to stand in a discharged condition. Start charging it at once at the recommended continuous charge rate.

To determine the amount or condition of a battery charge, check solution in each cell with a battery hydrometer. When hydrometer reading is 1.200 or less, battery is considered discharged and should be removed from motorcycle and charged at the following maximum continuous charge rate; using appropriate 6 or 12 volt charger.

12 volt 53 Ampere hour battery - 10 amperes
12 volt 32 Ampere hour battery - 4 amperes
6 volt 51 Ampere hour battery - 3-1/2 amperes
6 volt 22 Ampere hour battery - 1-1/2 amperes
6 volt 10 Ampere hour battery - 1/2 ampere
2-6 volt 8 Ampere hour batteries
(Series connected - 12 volts ) - 1/2 Ampere

A higher battery charge rate will heat and damage the battery. For this reason, do not allow the small motorcycle battery to be charged in the same line with large batteries. Hydrometer reading of a fully charged battery in good condition, with full strength electrolyte will be 1.270 or higher.

**WARNING**

Hydrogen gas, formed when charging, is explosive. Avoid open flame or electrical spark near battery.

Allowing a battery to remain in a discharged condition will shorten its life. It is important that a battery be kept well charged during below freezing weather.

## RECLAIMING SULPHATED BATTERY

If a battery has been allowed to stand in a discharged condition for a period of time, the lead sulphate in the plates will crystalize and not take a charge at normal rates. Such batteries should be charged at half the specified continuous rate for twice the computed time. A longer charging time at a slower rate will many times break down the crystalline structure into active materials and restore the battery.

## CHANGING ELECTROLYTE

In normal service with average care, it is never necessary to change electrolyte for the lifetime of the battery. However, if the battery solution is spilled, diluted as a result of careless water addition, or neutralized by the addition of an alkaline substance, the battery solution may be changed and in some cases near full capacity restored.

A weak acid solution may be detected by charging the battery until all cells gas freely and the gravity has not shown a rise for three successive readings taken at hourly intervals. "Gassing" is evidenced by a bubbling action in the electrolyte that may be detected by sight or sound. Do not change electrolyte in a battery with one or more cells that fail to gas. Such a condition indicates a structural failure.

Pour solution out of charged battery and fill with water. Charge battery again until maximum specific gravity is reached. Pour out this solution and add prepared battery electrolyte to specified level and charge again for a short length of time for full capacity.

Check specific gravity and add a little water if necessary to bring solution down to desired maximum limits.

The value of changing electrolyte in a fairly old battery is questionable. By tipping over such a battery to drain the solution, the sloughed-off waste materials accumulated by repeated charging and discharging actions might be dislodged from the sediment chambers in the bottom of the battery and deposited in the separators. This material is an electrical conductor and thus may "tree" or catch in the separators and cause a short circuit.

# HORN

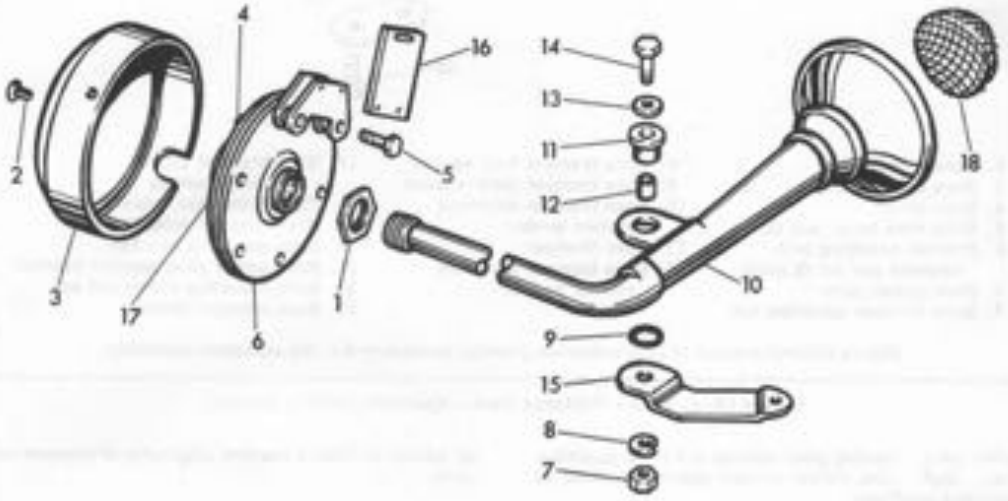
## TRUMPET HORN - 1964 AND EARLIER DUO-GLIDE AND SPORTSTER

If the horn does not blow satisfactorily, the trouble may be caused by a constricted diaphragm, loose terminal wires, or a discharged battery. Before attempting to correct horn performance by moving the adjusting screw, it is recommended procedure to trouble shoot as follows: (Fig. 5K-1 and 5K-2).

1. Check the battery for adequate current. Examine the horn trumpet (10 or 11, depending on model being worked on) and power pack (6) for misalignment with each other causing constriction of power pack diaphragm. To correct horn misalignment, loosen horn power pack support bracket (16) or (17) and horn support bracket nut (7), and correctly align (10 or 11) and (6) with each other. Be sure the horn trumpet does not contact any part of the engine. If horn trumpet and power pack cannot be realigned, check the power pack support bracket (16) or (17) for bent condition.

2. Check to make sure horn power pack has not been tightened more than 2 to 2-1/2 turns on trumpet stem. If tightened further, trumpet stem end will obstruct operation of pack diaphragm.

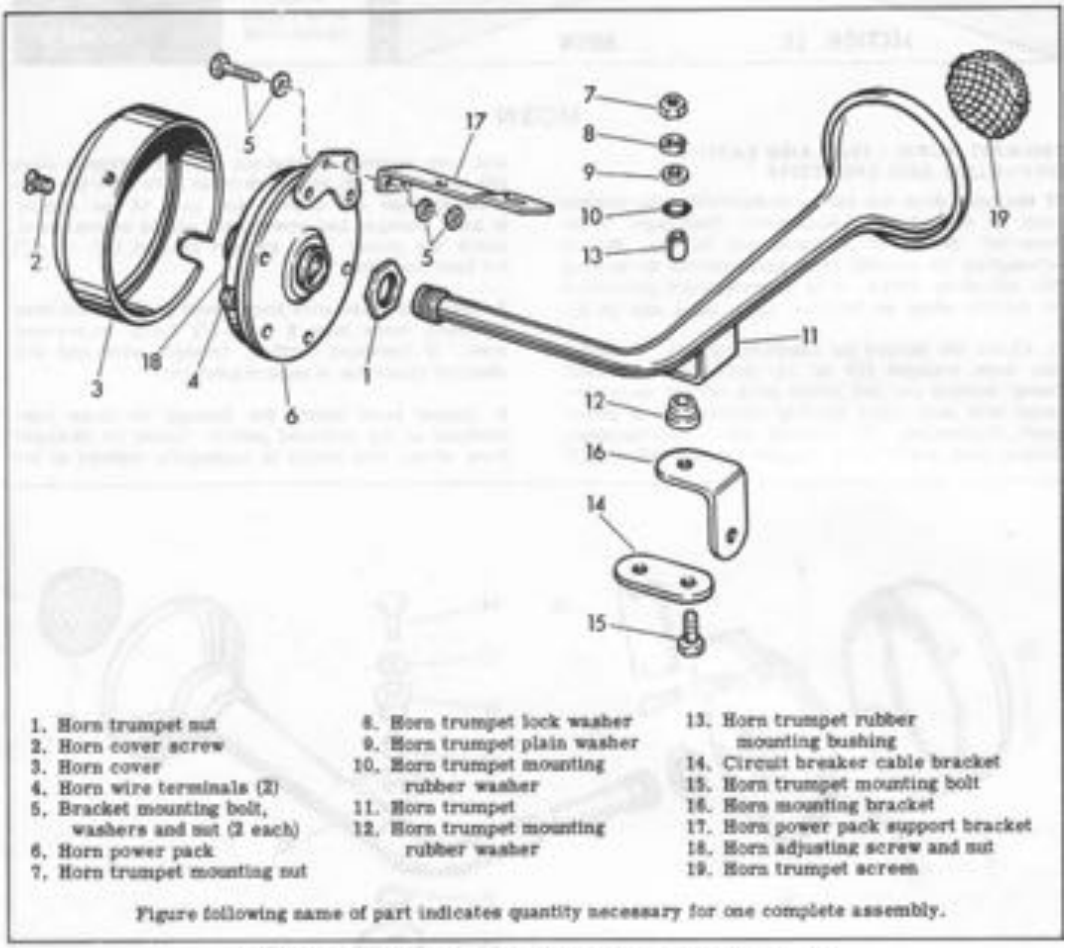
3. Inspect horn wiring for damage or loose connections at the terminal points. Loose or damaged horn wires will result in inadequate voltage at the




1. Horn trumpet nut
2. Horn cover screw
3. Horn cover
4. Horn wire terminals (2)
5. Horn power pack bracket mounting bolt (2)
6. Horn power pack
7. Horn trumpet mounting nut
8. Horn trumpet lock washer
9. Horn trumpet mounting rubber washer
10. Horn trumpet
11. Horn trumpet mounting rubber washer
12. Horn trumpet mounting rubber bushing
13. Horn trumpet plain washer
14. Horn trumpet mounting bolt
15. Circuit breaker control coil clamp and horn bracket
16. Horn power pack support bracket
17. Horn adjusting screw and nut
18. Horn trumpet screen

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 5K-1. Horn - Exploded View - Duo-Glide (1964 & Earlier)




1. Horn trumpet nut
2. Horn cover screw
3. Horn cover
4. Horn wire terminals (2)
5. Bracket mounting bolt, washers and nut (2 each)
6. Horn power pack
7. Horn trumpet mounting nut
8. Horn trumpet lock washer
9. Horn trumpet plain washer
10. Horn trumpet mounting rubber washer
11. Horn trumpet
12. Horn trumpet mounting rubber washer
13. Horn trumpet rubber mounting bushing
14. Circuit breaker cable bracket
15. Horn trumpet mounting bolt
16. Horn mounting bracket
17. Horn power pack support bracket
18. Horn adjusting screw and nut
19. Horn trumpet screen

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 5K-2. Horn - Exploded View - Sportster (1964 & Earlier)

power pack causing poor volume and tonal qualities. Also, check horn button contact points for dirty or corroded condition.

4. Horn performance will be affected if dirt or water accumulates in the trumpet or horn pack diaphragm compartment. This condition will dampen action of the horn diaphragm affecting volume and tonal quality of the horn. Remove trumpet and power pack and clean out all scale and dirt. Shake out any accumulated debris from the power pack and reassemble.

DISASSEMBLY AND REASSEMBLY (Fig. 5K-1 and 5K-2)

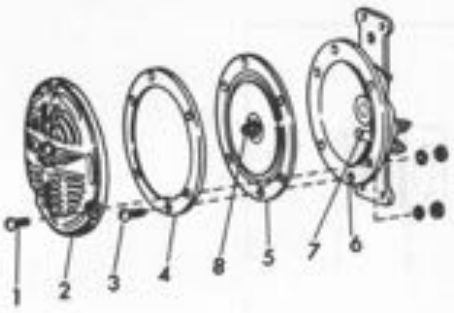
To disassemble the horn, simply follow the order of disassembly as illustrated. When installing the horn power pack to the trumpet, tighten the power pack 2 - 2-1/2 turns on the trumpet stem before tightening nut (1). Be careful to correctly position all parts as shown to insure correct alignment of trumpet and pack.

ADJUSTMENT

Loosen the center core jam nut with a wrench, and turn the slotted center core screw 1/2 turn counterclockwise with a screwdriver. Then adjust the Phillips head tone adjusting screw until the horn blows. Turn the center core screw clockwise until the horn rattles, and then back off screw (counterclockwise) 1/4 turn. While holding core screw in this position, tighten core screw lock nut with wrench. Readjust the Phillips head tone adjusting screw for desired tone.

**1961 AND EARLIER SERVI-CAR (Fig. 5K-3)**

The horn operating (ground) button is on the handlebar.




1. Horn front bolt, lock washer and nut (3)
2. Horn front
3. Horn diaphragm bolt, lock washer and nut (3)
4. Horn diaphragm retainer
5. Horn diaphragm
6. Horn back
7. Horn contact points
8. Horn diaphragm air gap adjusting screw

Figure following name of part indicates quantity necessary for one complete assembly.

Figure 5K-3. Horn - Exploded View - 1961 and Earlier Servi-Car

If the horn fails to blow or does not blow satisfactorily, check for loose, frayed or damaged wiring leading to horn terminals, discharged battery, etc. If these steps do not correct the trouble, turn the contact point adjuster screw located back of horn until horn just gives a single click - then retard screw until best tone is obtained. If horn fails to operate after moving adjusting screw it is necessary to disassemble horn for inspection and cleaning of parts.

DISASSEMBLY (Fig. 5K-3)

Disconnect horn wires and remove horn from motorcycle. Remove three horn front bolts, lock washers and nuts (1) and remove horn front (2). Remove three horn diaphragm bolts, lock washers and nuts (3), loosen retainer (4) and horn diaphragm (5) from horn back (6).

INSPECTION AND REPAIR

Brush all scale, rust and dirt from horn parts and blow clean with compressed air. Examine interior of horn for damaged or broken wires and cracked or damaged terminal screw bushing. Make sure contact points are clean.

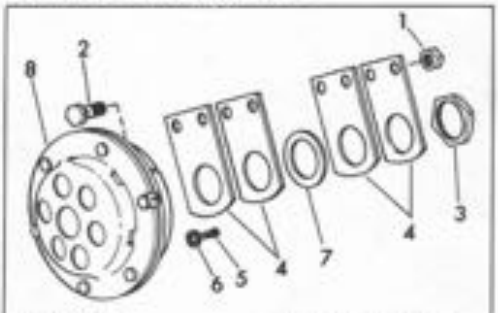
Air gap adjusting screw (8) should be left as originally set by the manufacturer. However, in the event horn does not appear to operate correctly after all other possible disorders have been eliminated (includes cleaning of contact points), the air gap adjusting screw can be turned to correct tone and output of horn.

ASSEMBLY

Assembly is the reverse order of disassembly. Be sure to correctly align the diaphragm assembly on the horn back and to readjust the contact points after the horn is assembled.

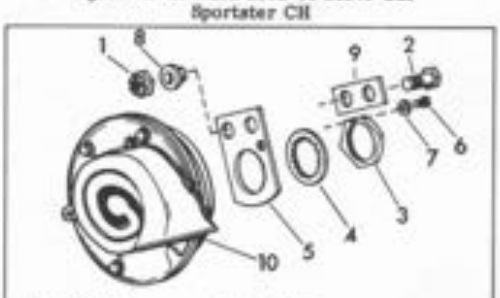
## 1962 AND LATER SERVI-CAR, SPORTSTER CH 1965 AND LATER DUO-GLIDE/ELECTRA-GLIDE

Horns are shown in Figures 5K-4, 5K-5, and 5K-6. If the horn fails to blow or does not blow satisfactorily, check for loose, frayed or damaged wiring leading to horn terminals, discharged battery, etc. If these steps do not correct the trouble, turn in contact point adjusting screw, located back of horn, until horn just gives a single click - then retard screw until best tone is obtained. If horn fails to operate after moving adjusting screw, entire horn must be replaced because it is permanently riveted together. Mounting parts are replaceable.



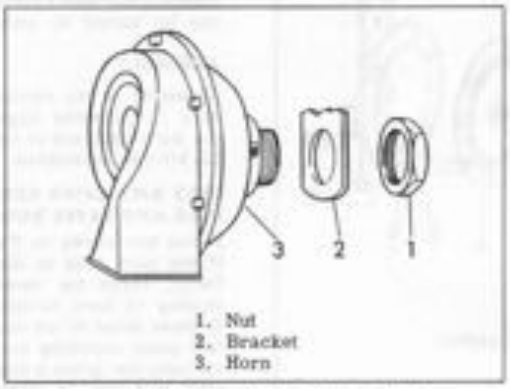

1. Nut (2)
2. Bolt (2)
3. Core nut
4. Bracket lamination (4)
5. Adjusting screw
6. Lock washer
7. Washer
8. Horn

Figure 5K-4. Horn 1962-63 Servi-Car Sportster CH




1. Nut (2)
2. Bolt (2)
3. Core nut
4. Lockwasher
5. Bracket
6. Screw
7. Lock washer
8. Insulator (2) (Early 64)
9. Plate (Early 64)
10. Horn

Figure 5K-5. Horn 1964 Servi-Car




1. Nut
2. Bracket
3. Horn

Figure 5K-6. Horn 1965 Electra-Glide, Sportster & Servi-Car

# STARTER MOTOR

## STARTER MOTOR

The starter motor is a 12-volt, series field 2-pole or 4-pole drive motor which engages the clutch ring gear through a Bendix type drive and a reduction gear unit. The two pole 2-brush type was used on early Servi-cars. The four pole 4-brush type is used on the Electra-Glide, Servi-car and Sportster models. A solenoid relay provides battery current directly to the motor. The solenoid is controlled by a button switch on the handle bar. On some models control circuit has a cut-out switch in the transmission cover. Switch plunger contacts a sub on the shifter can only when transmission is in neutral to complete the starting circuit. This prevents starter operation when transmission is in gear.

NOTE

Starter motor should never be operated continuously for more than 30 seconds without pausing to let it cool for at least two minutes. The motor is not designed for continuous operation and serious damage may result.

## LOCATING TROUBLES

The starter motor is designed to be corrosion resistant and requires very little maintenance. However, to insure satisfactory operation, periodic inspection of brushes and commutator should be made. In the event starter motor fails to operate satisfactorily, the following checks should be made before removing motor for inspection:

1. Wiring

Make sure the mounting and wiring connections are tight and in good condition. The solenoid switch should be firmly mounted and all wiring connections should be clean and tight. Also inspect the connections to the battery and return circuit, as loose or dirty connections anywhere in the circuit will cause high resistance and reduced motor efficiency.

2. Battery

If the connections and wiring are found to be satisfactory, the battery should be checked to determine its state of charge (See Section 5J, "Charging Battery"). If the battery is charged and battery voltage is reaching the motor without any excessive losses in wiring or connections, the trouble may be attributed to either the engine or the starter motor itself.

3. Switches

If the battery is charged but there is no current flow to motor at all, trouble is probably in handlebar button switch, transmission cutout switch or the solenoid switch. This can be determined by by-passing each switch with a heavy jumper (Refer to wiring diagram, Section 5B).

4. Engine

Excessive friction in the engine from tight bearings or pistons or from heavy oil obviously makes engine harder to crank. However, if engine is known to be in normal condition and the rest of the starting system is satisfactory, the starter motor should be removed for further checking.

NOTE: Electrical tests to locate cause of starting system failures can be made using the Sun VAT-26 Tester and applicable Service Bulletins.

## REMOVING STARTER MOTOR AND DRIVE

SERVI-CAR (Fig. 5L-5)

Disconnect solenoid and battery cables from starter motor. On 1964-65 model, remove motor thru bolt nuts and lockwashers (1), securing motor (2), until it can be removed as an assembly from starter shaft housing and transmission top cover flange (3). Remove starter motor end support bracket (not shown). On 1966 and later models, unscrew motor thru bolts (4) from transmission cover (3A).

NOTE: Late 1966 mounting flange has 2 sets of holes for Delco Remy or Prestolite motor.

ELECTRA-GLIDE (Fig. 5L-6)

Disconnect solenoid cable from starter motor terminal. Remove attaching nuts and lockwashers (1) which fasten starter motor housing (3) to studs on chain housing. Remove starter motor end support plate (not shown) from transmission. It may be necessary to loosen and raise battery carrier to provide clearance. Remove starter motor (2) and starter shaft housing (3) from motorcycle as an assembly.

SPORTSTER (Fig. 5L-7)

Disconnect solenoid cable from starter motor terminal. Remove starter motor clamp bolt and lockwasher (1) from crankcase. Unscrew motor thru bolts (4) from starter shaft housing (3). Remove starter motor and clamp (2) as an assembly.

## DELCO-REMY STARTER MOTOR SERVICE

DISASSEMBLING STARTER MOTOR

Delco-Remy 2-pole and 4-pole (Fig. 5L-8 and 5L-9)

Remove thru-bolts (1). Note that the bolt which passes near field coil connection has insulating sleeve (2). Remove commutator end frame (3) and drive end frame (4). Remove armature (5) from drive end of frame and field assembly (6).

## CHECKING FRAME AND FIELD ASSEMBLY

The frame, field and brush assembly can be checked for open or grounded circuit using a test lamp. To test for open circuit, place one prod of test lamp on terminal screw (9) and other prod on insulated brush (20). If test lamp fails to light, an open circuit is indicated. A grounded field circuit is located by placing one test prod on each insulated brush (20) or on the terminal (9) and the other test prod on the frame (6), making certain contact is made with the metal surface. The lamp will light if the circuit is grounded. Each insulated brush holder should be checked with the test lamp to make certain it is insulated from the frame.

There is no satisfactory field test for shorted field coils, and if this condition is suspected, the field coil assembly should be replaced and the motor retested to see if performance improves.

## REPLACING FIELD COILS AND BRUSHES

Remove pole shoe screws (7), terminals nuts, lockwashers and insulating washers (8) and terminal screw (9). Remove set of field coils with brush (10) and pole shoes (11). It is unnecessary to remove brush holders (12) except when defective or when replacing grounded brushes (13). Remove by cutting off or drilling out rivets. Replacement brushes are complete with screws (14), washers, and nuts (15) for attaching to frame. To remove brush springs (16), compress one side of spring with a small screw driver until it flips out of its seat. Then turn spring clockwise until it comes out of holder.
Replacement insulated brush holder set (17) is available with insulator (18) and attaching hardware. Grounded replacement brush holder set (19) includes grounded brushes (13) and insulated brushes (20) with necessary attaching hardware.

## INSULATED BRUSH

To replace insulated brush (20), first cut off old brush lead where it is attached to field coil wire. Coil wire must then be prepared for soldering on new lead. Lead should be soldered to back side of coils so that excessive solder will not rub on armature. Thoroughly clean coil lead end by filing or grinding off old connection. Varnish should be removed only as far back as necessary to make new solder connection. Using rosin flux, solder brush lead to field coil lead, making certain brush is in the right position to reach brush holders (See Figure 5L-10).

Do not over-heat brush lead or solder will run on wire strands and lead will no longer be flexible.

## GROUNDED BRUSH

To replace grounded brush, remove brush holder as described in "Disassembling Starter Motor". Attach new brush holder and brush assembly (Items 12 & 13, Fig. 5L-8 or 5L-9), with hardware included in package.

After tightening nuts on both brush holders, peen the screws with a hammer so nuts cannot vibrate loose.

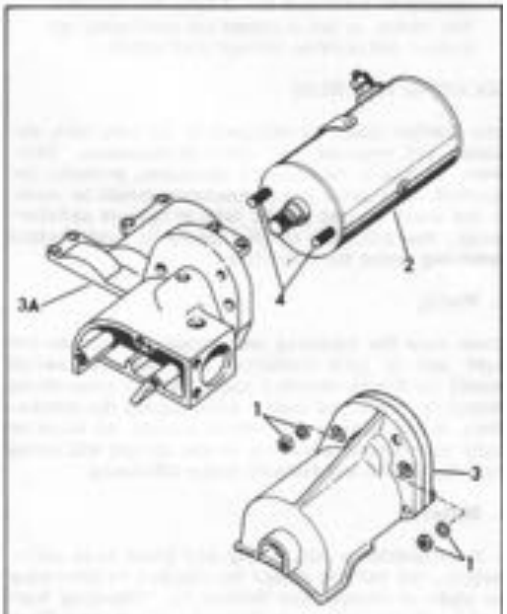
## REPAIRING ARMATURE

If armature commutator is worn, dirty, out of round or has high mica insulation between segments, commutator can be turned down in a lathe. Mica should then be undercut 1/32 in. deep with an undercutting machine and slots cleaned out to remove dirt or copper dust. If undercutting machine is not available, undercutting can be accomplished satisfactorily using a hacksaw blade. (See Fig. 5E-6, page 5E-5 for recessing mica separators.) Commutator should then be sanded lightly with No. 00 sandpaper to remove any burrs left from undercutting procedure.

Armature test procedure is described in Section 5E, or see Delco-Remy service bulletin No. 1M-152.

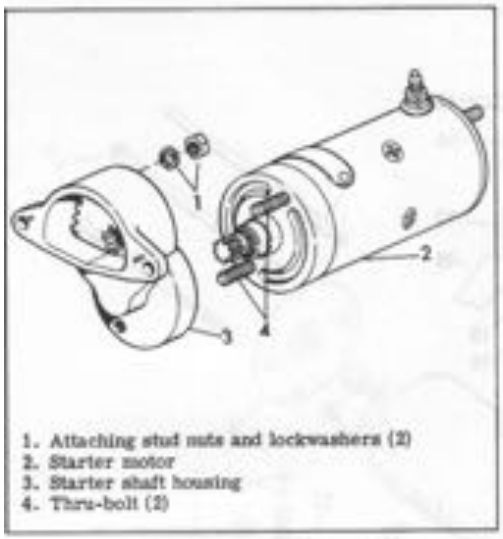
Inspect bushings (Item 21, Fig. 5L-8 and 5L-9) in drive end and commutator end frames, and commutator end thrust washer (22). Replace any excessively worn parts. Inspect bearing (23) in 4-pole type and replace if worn to excessive looseness.

For additional service and testing procedures, see Delco-Remy service bulletin No. 1M-152.



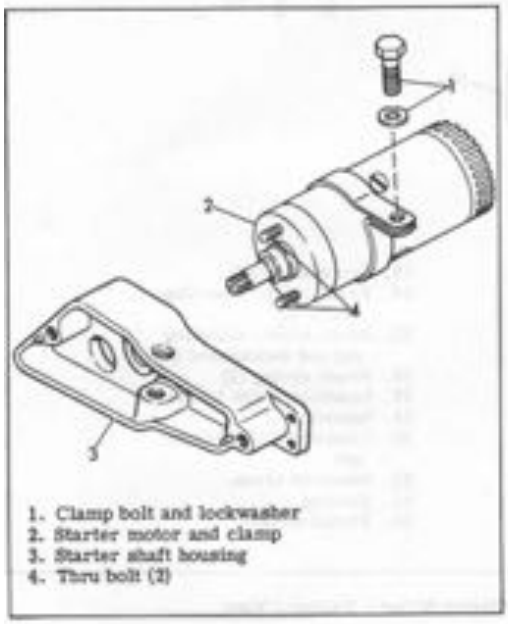

1. Thru-bolt nuts and lockwashers (1964-65) (2)
2. Starter motor
3. Transmission cover (1964-65 Servi-car)
3A. Transmission cover (1966 Servi-car)
4. Thru-bolt (2)

Figure 5L-5. Removing Starter Motor - Servi-car




1. Attaching stud nuts and lockwashers (2)
2. Starter motor
3. Starter shaft housing
4. Thru-bolt (2)

Figure 5L-6. Removing Starter Motor - Electra-Glide




1. Clamp bolt and lockwasher
2. Starter motor and clamp
3. Starter shaft housing
4. Thru bolt (2)

Figure 5L-7. Removing Starter Motor - Sportster

REASSEMBLING STARTER MOTOR (Fig. 5L-8 and 5L-9)

Reassembly is essentially the reverse of the disassembly procedure. The frame and field assembly should be completed first and checked with test lamp to make sure no grounds or open circuits have been caused by disassembly. Note that pole shoes (11) are notched on one end to accomodate connections at field coils. It is important that notched ends be placed at the lead ends of the coils so the pole shoes can be tightened properly and not drag on the armature.

Reassemble remaining parts in reverse order of assembly. Note that end frames (3 and 4) are notched to fit field frame ends. Also note correct location of thru-bolt insulator sleeve (2) next to field coil connection. Reconnect cables to solenoid switch and battery.

## PRESTOLITE STARTER MOTOR SERVICE

DISASSEMBLING STARTER MOTOR (Fig. 5L-11)

Remove thru bolts (1) with washers and lockwashers (2). Remove commutator end cover (3) holding brush plate (4) in place if necessary.

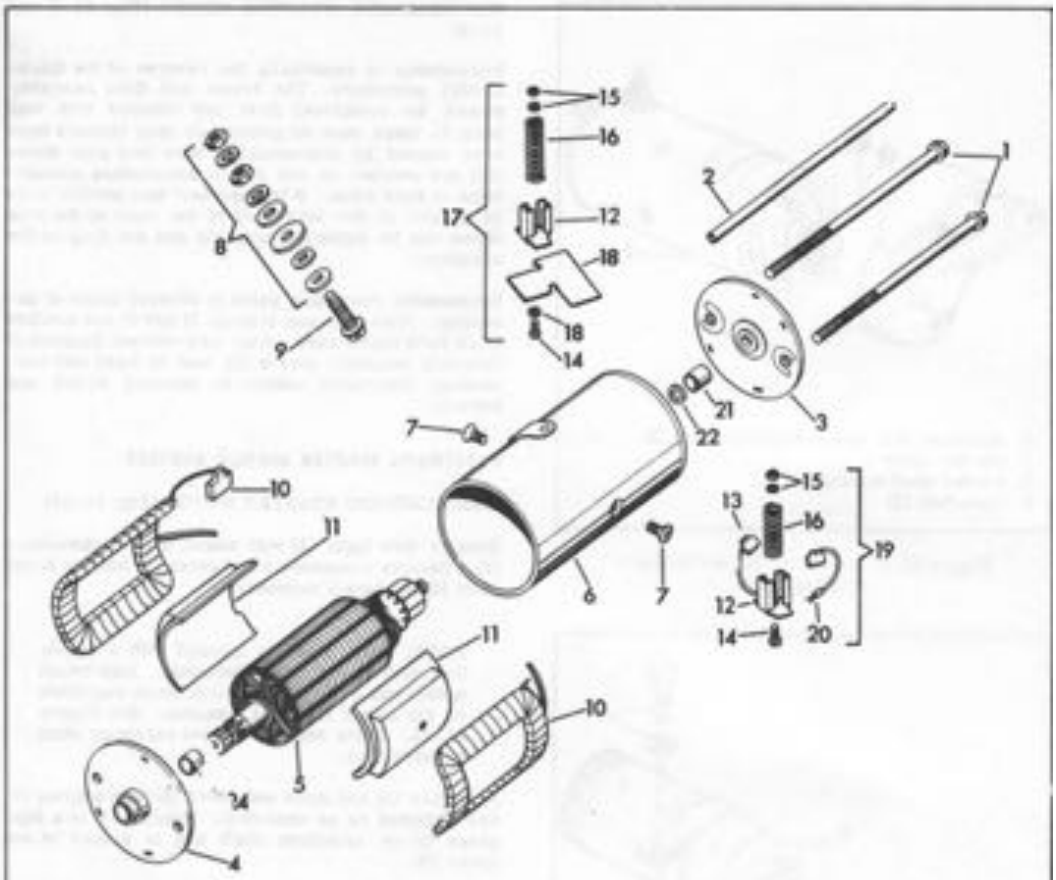
NOTE: End cover is marked with a double line next to the motor terminal. Also brush holder has a positioning notch which registers on the motor terminal insulator. See Figure 5L-12. Parts must be located correctly when reassembled.

Armature (5) and drive end cover (6) with bearing (7) are removed as an assembly. Bearing (7) is a light press fit on armature shaft and is staked in end cover (6).

NOTE: To prevent brushes from escaping holders, insert a spool of slightly larger diameter than the commutator underneath brushes when brushes are half exposed as armature is withdrawn from frame. In this way armature can be reinstalled without removing brushes from holders.

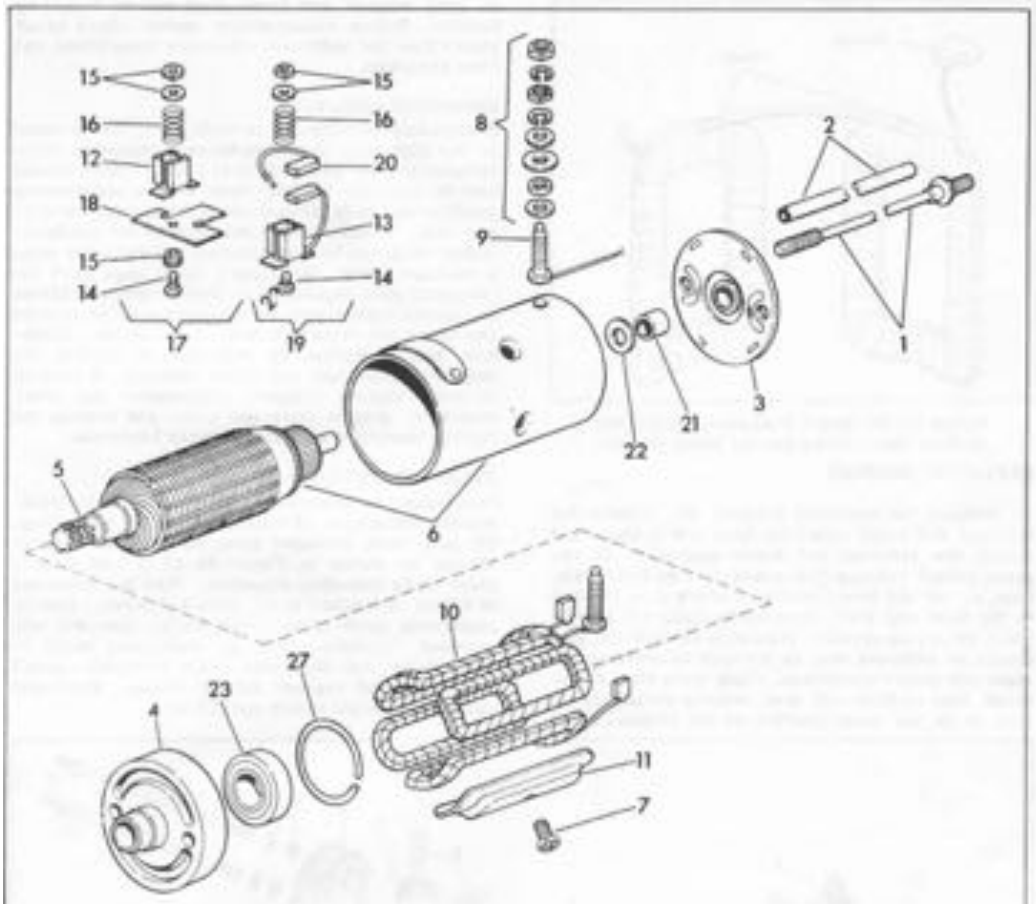
CHECKING FRAME AND FIELD ASSEMBLY

Due to the internal wiring and connections of the frame and field assembly, there is no satisfactory field test to determine grounded or shorted field coils. If field coils are required, it is necessary, due to the method of installing field coils in this assembly, to replace the frame and field assembly. To test for open field coils, using a test lamp, place one probe of test light against the frame. Place the other probe against each of the brushes attached to the field coils. If test lamp fails to light on one or both of the brushes, an open circuit is indicated.




1. Thru-bolt (2)
2. Insulating sleeve
3. Commutator end frame
4. Drive end frame
5. Armature
6. Frame and field assembly
7. Pole shoe screw (2)
8. Terminal nuts, lockwashers and insulating washers
9. Terminal screw
10. Set of field coils with insulated brush
11. Pole shoe (2)
12. Brush holder (2)
13. Grounded brush
14. Brush holder mounting screw (2)
15. Brush holder mounting nut and lockwasher (2)
16. Brush spring (2)
17. Insulated brush holder set
18. Insulator
19. Grounded brush holder set
20. Insulated brush
21. Bushing
22. Thrust washer

Figure 5L-8. Delco-Remy 2 Pole Starter Motor - Exploded View




1. Thru bolt (2)
2. Insulating sleeve
3. Commutator end frame
4. Drive end frame
5. Armature
6. Frame and field assembly
7. Pole shoe screw (2 or 4)
8. Terminal nuts, lockwashers and insulating washers
9. Terminal screw
10. Set of field coils
11. Pole shoe (2 or 4)
12. Brush holder (2 or 4)
13. Grounded brush and holder (1 or 2)
14. Brush holder mounting screw (2 or 4)
15. Brush holder mounting nut and lockwasher (2 or 4)
16. Brush spring (2 or 4)
17. Insulated brush holder set
18. Insulator
19. Grounded brush holder set
20. Insulated brush (1 or 2)
21. Bushing
22. Thrust washer
23. Ball bearing
24. Bearing retainer

Figure 5L-9. Delco Remy 4 Pole Starter Motor - Exploded View

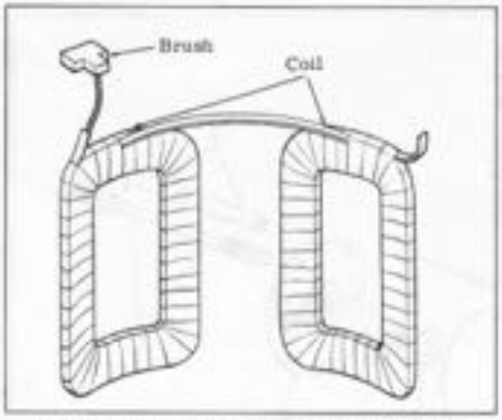



Figure 5L-10. Brush Position on Field Coil
(2-Pole Delco-Remy Starter Motor Shown)

REPLACING BRUSHES

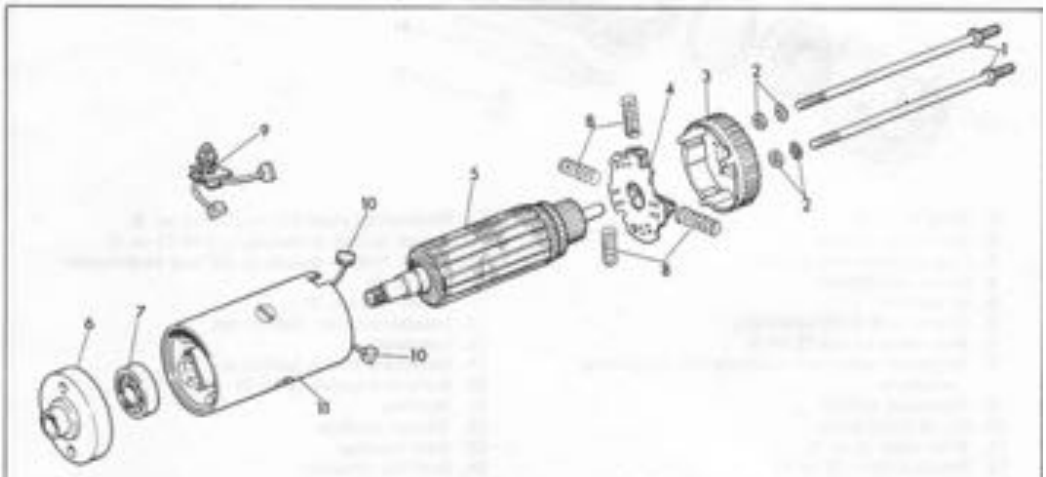
To replace the insulated brushes (9), remove the terminal and brush assembly from slot in frame and install new terminal and brush assembly. To replace ground brushes (10) attached to the field coils, first cut off old brush lead wire where it is attached to the field coil lead. Thoroughly clean coil lead by filing off old connection. Insulation on field coil lead should be removed only as far back as necessary to make new solder connection. Using rosin flux, solder brush lead to field coil lead, making certain brush lead is in the same position as the original brush lead. Do not overheat brush lead or solder will run on wire strands and brush lead will no longer be flexible. Before reassembling motor, check brush connections for sufficient clearance from frame and from armature.

REPAIRING ARMATURE

If armature commutator is worn, dirty, out of round or has high mica insulation between segments, commutator can be turned down in a lathe. Mica should then be undercut 1/32 in. deep with an undercutting machine and slots cleaned out to remove dirt or copper dust. If undercutting machine is not available, undercutting can be accomplished satisfactorily using a hacksaw blade. See Figure 5E-6, page 5E-5 for recessing mica separators.) Commutator should then be sanded lightly with No. 00 sandpaper to remove any burrs left from undercutting procedure. Armature test procedure is described in Section 5E. Inspect commutator end cover bushing. If bushing is worn, replace complete commutator end cover assembly. Inspect drive end cover and bearing and replace bearing if worn to excessive looseness.

REASSEMBLING STARTER MOTOR

Reassembly is essentially the reverse of the disassembly procedure. If brushes (9 and 10) and springs (8) have been released from holder, use clips or clamps as shown in Figure 5L-13 to hold them in place while installing armature. Note that drive end of frame is notched to fit drive end cover. Line up positioning notch in the brush holder assembly with terminal insulator. Line up positioning mark on commutator end head with motor terminal. Install thru bolts and replace unit on engine. Reconnect cables to solenoid switch and battery.




1. Thru bolt
2. Washer and lockwasher (2)
3. Commutator end cover
4. Brush plate and holder assembly
5. Armature
6. Drive end cover
7. Drive end ball bearing
8. Brush spring (4)
9. Terminal and brush assembly
10. Ground brush (2)
11. Frame and field coil assembly

Figure 5L-11. Prestolite 4-Pole Starter Motor - Exploded View

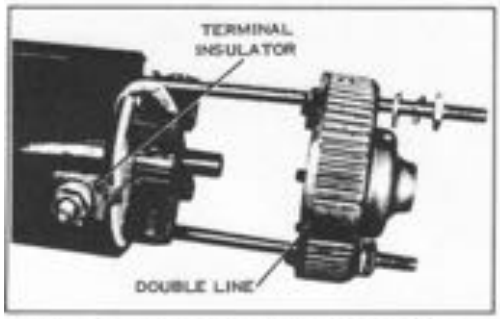



Figure 5L-12. Positioning Prestolite Starter Motor Cover

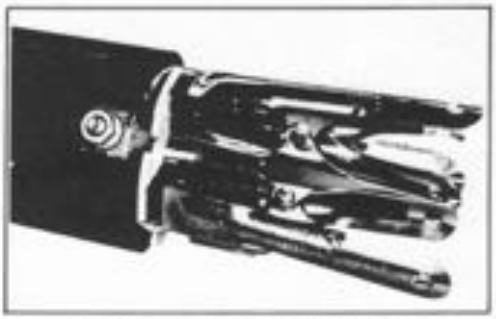


Figure 5L-13. Using Clamps to Hold Brushes in Place

SUN POWER TIMING LIGHT MODEL PTL-45

Order from Sun Electric Corp., Chicago, Ill.

94501-56 CIRCUIT BREAKER WRENCH

Used to tighten circuit breaker attaching bolts.

94575-58A SPARK PLUG WRENCH

Fits 14 mm spark plugs.

95715-19A GEAR PULLER

Removes generator drive gear.

96295-65 TIMING MARK VIEW PLUG

Clear plastic plug threads into crankcase timing hole for accurate ignition timing with strobe timing light.

96802-63 BATTERY HYDROMETER — WITH TEMPERATURE CORRECTION FEATURE

For testing state of charge of storage batteries. Specific gravity of electrolyte can be corrected for temperature extremes by means of built-in thermometer.

# MISCELLANEOUS 6

TABLE OF CONTENTS

# INSTRUMENTS

## SERVICING SPEEDOMETER

GENERAL

Lubricate cable core every 5,000 miles with graphite grease.

To lubricate the speedometer drive core or replace a damaged or broken core, proceed as follows:

DUO-GLIDE AND SERVI-CAR MODEL

Remove instrument panel cover. Remove two screws that secure speedometer head to instrument panel base. Lift speedometer head as far as casing will permit, and with pliers, loosen case coupling nut from speedometer head. Withdraw core from casing. To free a broken core from casing, disconnect lower case coupling nut from speedometer drive unit located at transmission on Duo-Glide and right axle on Servi-Car Model. Withdraw core from lower case end.

SPORTSTER MODEL

Remove headlamp housing (if necessary). With a pliers remove speedometer case coupling nut from speedometer head and withdraw core from casing. To free a broken core from casing, disconnect lower case coupling nut from speedometer drive unit located under transmission sprocket cover. Withdraw core from lower case end.

To free the speedometer head, remove headlamp housing from fork (if necessary), disconnect speedometer cable casing as described above. Disconnect trip odometer adjuster knob from its stem and remove nut securing odometer adjuster to panel. Remove two nuts securing speedometer head, and lift head from its mounting bracket.

To install a speedometer head and drive case, reverse the order of disassembly.

Install core in upper end of casing, applying a light coat of graphite grease to the core as it is inserted into position. Engage squared lower end of core in speedometer drive shaft. Connect case coupling upper end to the speedometer head, engaging squared end of core in speedometer shaft. Be sure to tighten both case coupling nuts securely.

## SERVICING TACHOMETER

GENERAL

Lubricate cable core every 5,000 miles with graphite grease.

To lubricate the tachometer drive core or replace a damaged or broken core proceed as follows:

ELECTRA GLIDE AND SPORTSTER

With a pliers remove case coupling nut from tachometer and withdraw core from casing. To free a broken core from casing, disconnect lower case coupling nut from drive unit located on circuit breaker cover or magneto. Withdraw core from lower case end.

To free tachometer head, disconnect tachometer cable casing as described above. Remove two nuts securing tachometer head, and lift head from its mounting bracket.

To install a tachometer head and drive case, reverse the order of disassembly.

Install core in upper end of casing, applying a light coat of graphite grease to the core as it is inserted into position. Engage squared lower end of core in drive shaft. Connect case coupling upper end to the head, engaging squared end of core in shaft. Be sure to tighten both case coupling nuts securely.