Harley-Davidson

SERVICE MANUAL

Sportster

1959 to 1969

Part No. 99484-69

1959 to 1969 SPORTSTER SERVICE MANUAL

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The maintenance and repair information in this manual applies to the 1959 to 1969 Harley–Davidson Sportster and K–KH models

Printed in U.S.A.

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. Sections are then divided into 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. Page number consists of section number and page number.

3. Information is presented in a definite order as follows:

   Adjustments
   Disassembly
   Cleaning, Inspection and Repair
   Assembly

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

NOTE

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

PREPARATION FOR SERVICE

Proper preparation is very important for efficient service work. A clean work area at the start of each job will allow you to perform the repair as easily and quickly as possible, and reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover trouble sources. Tools, instruments and parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a needless delay. Special tools required for a job are listed at the end of each section.

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Always stop engine, and do not smoke or allow open flame or sparks when refueling or servicing the fuel system.

SERVICE BULLETINS

In addition to the information given in this Service Manual, Service Bulletins are issued to Harley-Davidson Dealers from time to time, which cover interim engineering changes and supplementary information. Service Bulletins should be consulted for complete information on the models covered by this manual.

USE GENUINE REPLACEMENT PARTS

WARNING

When replacement parts are required, use only genuine Harley-Davidson parts or parts with equivalent characteristics including type, strength and material. Failure to do so may result in product malfunction and possible injury to the operator and/or passenger.

To ensure a satisfactory and lasting repair job, follow the manual instructions carefully and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON is more than half a century of designing, research, manufacturing, testing and inspecting experience.

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.

PRODUCT REFERENCES

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be used in place of the one mentioned.

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All photographs and illustrations may not necessarily depict the most current model or component, but are based on the latest production information available at the time of publication.

Harley-Davidson Motor Co., Inc., reserves the right to change specifications, equipment, or designs at any time without notice and without incurring obligation.

WARNINGS AND CAUTIONS

Statements in this manual preceded by the words WARNING or CAUTION and printed in bold face are very important.

WARNING

Means there is the possibility of personal injury to your self or others.

CAUTION

Means there is the possibility of damage to the vehicle.

We recommend you take special notice of these items.

WARNING

Proper service and repair is important for the safe, reliable operation of all mechanical products. The service procedures recommended and described in this service manual are effective methods for performing service operations. Some of these service operations require the use of tools specially designed for the purpose. These special tools should be used when and as recommended.

It is important to note that some warnings against the use of specific service methods which could damage the motorcycle or render it unsafe are stated in this service manual. However, please remember that these warnings are not all inclusive. Since Harley-Davidson could not possibly know, evaluate and advise the service trade of all possible ways in which service might be done or of the possible hazardous consequences of each way, we have not undertaken any such broad evaluation. Accordingly, anyone who uses a service procedure or tool which is not recommended by Harley-Davidson must first thoroughly satisfy himself that neither his nor the operator's safety will be jeopardized by the service methods selected.

Harley-Davidson products are manufactured under one or more of the following patents: U.S. Patents — 2986162, 2987934, 2998809, 3116089, 3144631, 3144860, 3226994, 3229792, 3434887, 3559773, 3673359, 3709317, Des. 225 626.

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PRODUCT 1

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GENERAL

SPECIFICATIONS

DIMENSIONS

	XL, XLH	XLCH
Wheel Base		
(to 1966)	56-1/2 in.	57 in.
(1967)	58-1/2 in.	
Overall Length		
(to 1966)	87 in.	83-1/4 in.
(1967)	89 in.	
Overall Width	34 in.	(to 1966) 29-1/2 in.
		(1967) 34 in.
Overall Height	40-1/2 in.	42 in.
Road Clearance		
(1966 & earlier)	2-1/2 in. Min.	4-1/8 in. Min.
(1967)	5-1/2 in.	6-7/8 in.
	6-3/4 in.	6-1/2 in.

CAPACITIES

	XL, XLH	XLCH
Gasoline Tank (U.S. Gallons)	4.0	2.2
Oil Tank (Quarts)	3	3
Transmission (Pints)	1-1/2	1-1/2

ENGINE

Model Designation Letters	XL, XLH, XLCH
Type of Engine	4 Cycle OHV
Number of Cylinders	2
Placement of Cylinders	45 Degree, V Type
Horsepower	XL 42 HP at 5,500 R.P.M.
	XLCH, XLH 55 HP at 6,300 R.P.M.
Taxable Horsepower	7.2
Weight	XLCH .188 lbs.
	XL, XLH .204 lbs.
Bore	(76.2 mm) 3.000 in.
Stroke	(96.8 mm) 3.8125 in.
Piston Displacement	(883 c.c.) 53.9 cu. in.
Torque	XL 48 lb-ft at 3,600 R.P.M.
	XLCH, XLH 52 lb-ft at 3,800 R.P.M.
Compression Ratio	XL 7.5 to 1
	XLCH, XLH 9.0 to 1
Spark Plugs (Heat Range for Average Use)	No. 4

NOTE

After break-in period, No. 5 plug is recommended for hard service - XLCH and XLH Models.

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 - Foot Shift
Speeds	4 Forward

Number of Sprocket Teeth	1966 & Earlier XL-XLH 1967 XLH-XLCH (Optional)	1966 & Earlier XLCH 1967 & Later XLH-XLCH (Standard)
Engine	34	34
Clutch	59	59
Transmission	21	20
Rear Wheel	51	51
Gear Ratios	**1966 & Earlier XL-XLH 1967 XLH-XLCH (Optional)**	**1966 & Earlier XLCH 1967 & Later XLH-XLCH (Standard)**
First (Low) Gear	10.63 to 1	11.16:1
Second Gear	7.69 to 1	8.08:1
Third Gear	5.82 to 1	6.11:1
Fourth (High) Gear	4.21 to 1	4.42:1

TIRE DATA

Tire Size	
XLCH, 1967 & Later XLH	Front - 3.25/3.50 x 19
	Rear - 4.00 x 18
1966 & Earlier XL, XLH	3.50 x 18
Tire Pressure	
XLCH, 1966 & Earlier XLH	Front - 14 lbs.
	Rear - 18 lbs.
1967 & Later XLH	Front - 16 lbs.
	Rear - 20 lbs.

NOTE

The tire inflation pressures given are based on a rider weighing approximately 150 lbs. or more, increase tire pressure as follows: For each 50 lbs. of overload, increase pressure of rear tire 2 lbs., front tire 1 lb.

SERVICE

SERVICING A NEW MOTORCYCLE

RECOMMENDED OPERATIONS AT FIRST 500 AND 1000 MILES

AT 500 MILES

1. Drain oil tank through drain plug, flush with kerosene and refill with fresh oil.

2. If motorcycle is equipped with oil filter, service the filter.

3. Drain transmission and front chain compartments, clean transmission magnetic drain plug, and refill with fresh oil. Use same grade oil used in engine.

4. Lubricate all points indicated for 2000 mile servicing as described in the Regular Service Intervals Chart.

5. Inspect and service air cleaner if needed.

6. Check and adjust chains.

7. Check lubrication of rear chain and adjust rear chain oiler if necessary.

8. Check all nuts, bolts and screws, and tighten any found loose.

9. Check wheel mounting bolts which secure rear wheel to brake assembly. These bolts must be kept very tight.

10. Check XLH battery solution level and add distilled water if needed. Make sure terminals are clean and connections tight.

11. Check tightness of all cylinder head bolts and all cylinder base nuts.

12. Check tappet adjustment and readjust if necessary.

13. Check spark plug electrodes, clean and regap if necessary.

14. Check ignition timing and circuit breaker point gap.

15. Check wheel spokes and tighten if necessary.

16. Check front fork and rear fork bearing adjustment.

17. Lubricate tachometer drive (XLCH).

18. Check clutch adjustment.

19. Check brake adjustment.

20. Aim headlight.

21. Check tire pressure and inspect tread.

22. Road test.

AT 1000 MILES

1. Drain oil tank through drain plug and refill with fresh oil.

2. Clean oil filter (if applicable).

3. Check level of oil in transmission and front chain compartments and add oil if needed. Use same grade of oil used in engine.

4. Service air cleaner.

5. Check and adjust chains.

6. Check lubrication of rear chain and adjust rear chain oiler if necessary.

7. Check XLH battery solution level and add distilled water if needed. Make sure terminals are clean and connections tight.

8. Check tappet adjustment and readjust if necessary.

9. Check circuit breaker points and adjust if needed.

10. Check clutch adjustment.

11. Check brake adjustment.

12. Check tire pressure and inspect tread.

13. Road test

All operations are fully described in subsequent sections.

REGULAR SERVICE INTERVALS
SUGGESTED OPERATIONS FOLLOWING THE INITIAL BREAK-IN PERIOD

REGULAR SERVICE INTERVAL	FIG. 1B-2 INDEX NO.	GREASE	FIG. 1B-2 INDEX NO.	OIL	FIG. 1B-2 INDEX NO.	SERVICE
EVERY 1000 MILES			7	Rear Chain	4 25 7	Air Cleaner Battery Rear Chain Adjustment
EVERY 2000 MILES	19 8 31 15 14 6 16 32	Rear Brake Shaft Front Brake Shaft Rear Brake Cross-over Shaft Clutch Release Worm Foot Shift Lever Seat Bar Roller and Bolt (Seat post saddle only) Kick Starter Shaft Rear Wheel Hub Tachometer drive gear (special equip.)	17 9 21 1 22 2 28 11 26 29	Rear Brake Rod Clevis Front Brake Cable Clevis Clutch Hand Lever Brake Hand Lever Clutch Control Cable Front Brake Cable Throttle Control Cable Spark Control Cable (if used) Seat post (saddle only) Generator Bearing (1960 & earlier)	13 5 30 20 12	Tappet Adjustment Clutch Adjustment Brake Adjustment Oil Filter Front Chain Adjustment Rear Chain Oiler Circuit Breaker Points
EVERY 5000 MILES OR 1 YEAR (whichever comes first)	3 23 12 27 34	Throttle Control Spiral Spark Control Spiral (if used) Circuit Breaker Camshaft Front Wheel Hub (1964 & earlier) Speedometer and Tachometer Cables			10 24 5 12 29 33	Check Front and Rear Fork Bearing Adjustment Replace: Spark Plugs Oil Filter Element Inspect and Switch Tires Time Ignition Clean Gas Tank Strainer Check Generator Brushes Check Shock Rubber Bushings
EVERY 10,000 MILES	18 29	Repack Rear Fork Pivot Bearings Generator Bearing (1961 and later)				
EVERY 50,000 MILES	10	Repack Steering Head Bearings				
WEEKLY						Check Tires Check Battery

SERVICE INTERVAL ENGINE AND TRANSMISSION

	300 MILES	1000 MILES	2000 MILES	5000 MILES or 1 YEAR	SPRING AND FALL
ENGINE OIL	Check	Check	Change		Change
TRANSMISSION OIL		Check		Change	Change

LUBRICANTS TO USE

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.

HARLEY-DAVIDSON CHAIN GREASE, CHAIN SAVER AND CHAIN SPRAY

Designed especially as chain lubricants. Penetrates inner bearings for long chain life.

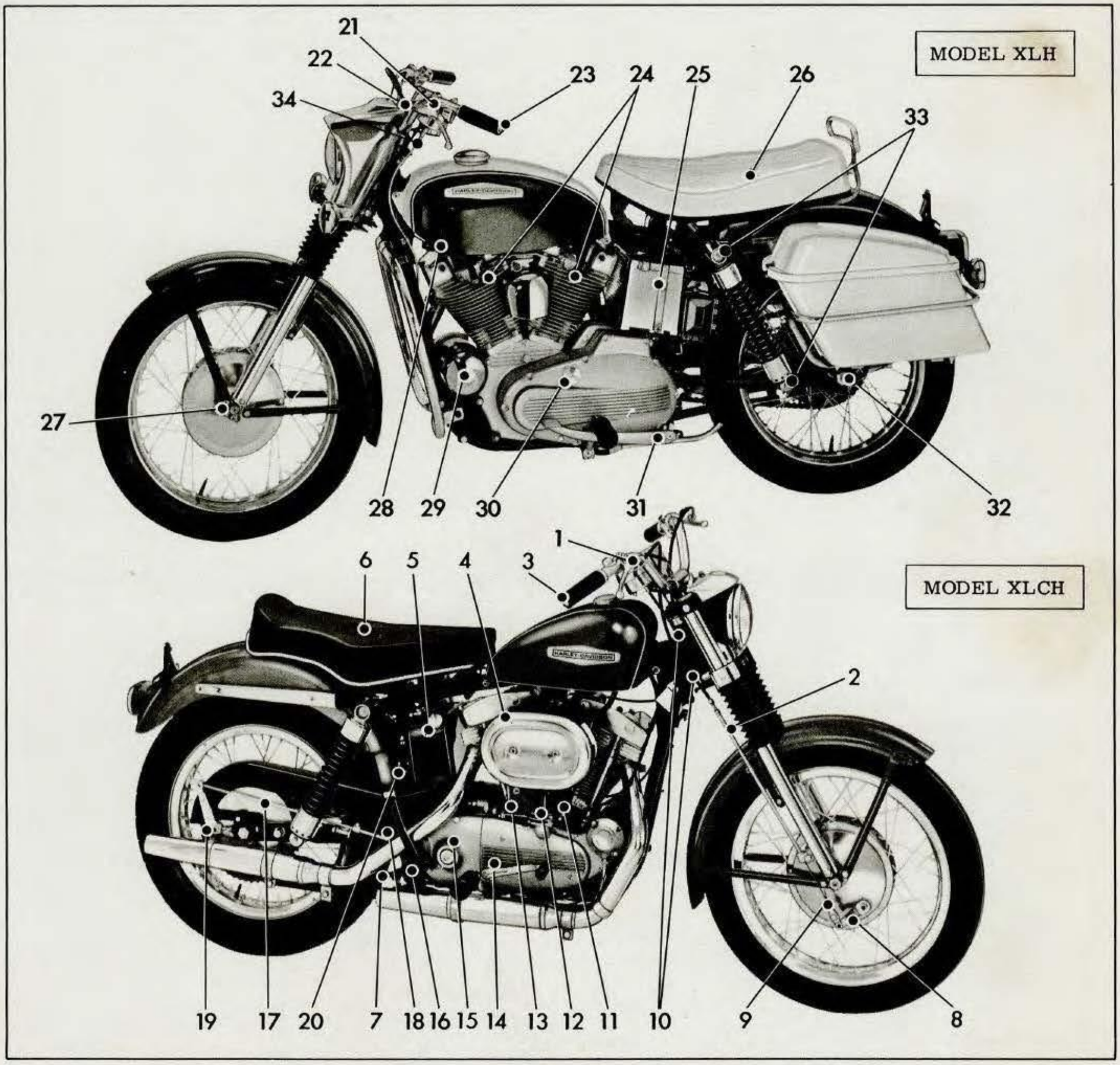


Figure 1B-2. Service Chart

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. Discharged battery, or loose or corroded connections.
3. Starter control circuit or solenoid defective.
4. Clutch slipping.
5. 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 and/or ignition timing points 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. Carburetor 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.

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 coii).
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 and 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 (1965 and earlier).
6. Carburetor inlet lever not set correctly (1966).
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 sprocket keys badly worn.
5. Clutch discs warped.

IF BRAKE DOES NOT HOLD NORMALLY

1. Brake shoe 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.

CHASSIS 2

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DRIVE

CHAINS

FRONT CHAIN ADJUSTMENT (Fig. 2B-3)

The front chain should be checked every 2000 miles for correct adjustment. Check chain adjustment through oil filler opening located near the top of the chain cover. A correctly adjusted front chain should have free up-and-down movement in the upper stand midway between engine and clutch sprockets as follows: 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. To adjust chain, disconnect battery cable from starter motor, remove left footrest, and rear brake foot lever. Place an oil drain pan under clutch and remove front chain cover screws, chain cover and gasket.

The front chain is adjusted by means of a shoe underneath the chain which can be raised to tighten or lowered to loosen the chain. The chain adjuster is secured to the inner surface of the chain compartment by 3 bolts (XLH) or two bolts (XLCH). Simply loosen bolts and raise or lower chain adjuster. When chain is correctly adjusted tighten bolts securely and reassemble remaining parts.

FRONT CHAIN LUBRICATION

There is an opening between the front chain and transmission compartments, and the same oil supply automatically lubricates moving parts in both compartments. For complete lubrication service on the front chain see "Gear Box," Section 4D.

REPLACING A WORN FRONT CHAIN

Since the front chain is automatically lubricated by running in oil, little service will be required other than checking chain adjustment every 2000 miles. However, if through hard usage the front chain does become worn, it is essential to replace chain rather than trying to repair it. This will avert chain breakage and possible damage to the crankcases. To remove front chain, see "Disassembling Clutch," Section 4B.

REAR CHAIN ADJUSTMENT (Fig. 2B-3A)

The rear chain should be checked every 1000 miles for correct adjustment. A correctly adjusted rear chain should have 1/2 in. free up-and-down movement midway between mainshaft and rear wheel sprocket. As chains stretch and wear in service, they will run tighter at one point on the sprockets than another; therefore always rotate rear wheel and check adjustment at tightest point of chain.

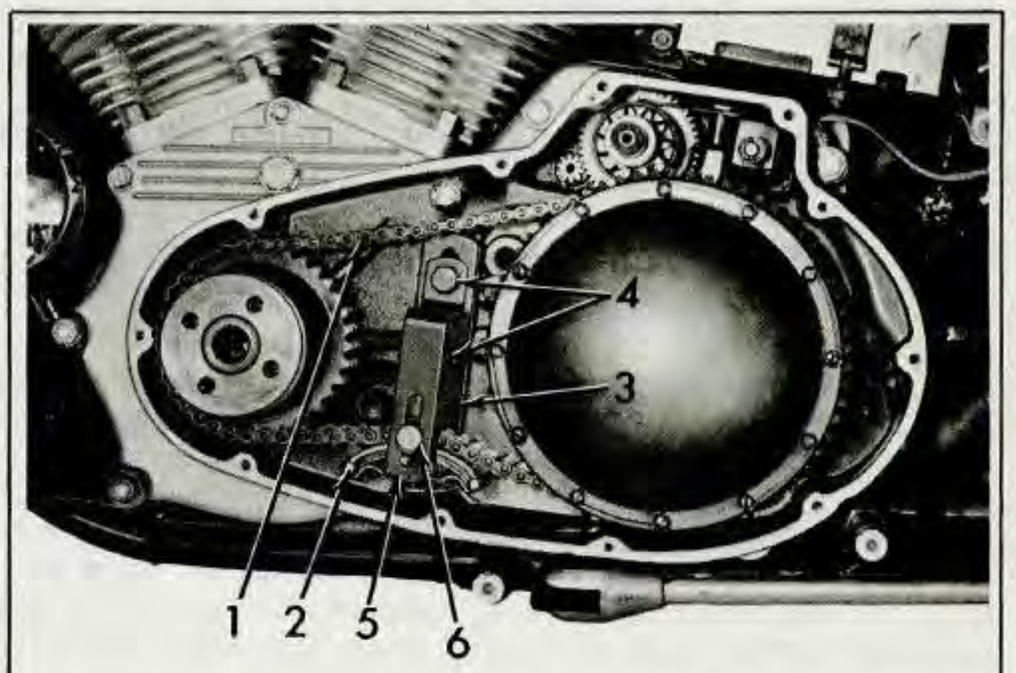
To adjust rear chain, loosen axle nut (1) on right side of motorcycle. Loosen lock nut (2) from adjusting nut (3), on both sides of motorcycle. Turn adjusting nut (3) clockwise to move rear wheel back, tightening chain; turn adjusting nut (3) counterclockwise, and at the same time, tap each end of the axle to move the wheel forward, loosening the chain. Turn adjusting nut (3) on either side exactly the same number of turns to maintain alignment of wheel. With lock nut (2) tight against adjusting nut (3), the distance from lock nut to outer end of adjusting stud (4) should be the same on both sides. Check correct alignment of wheel by observing that tire runs about midway between rear frame tubes and rear wheel sprocket runs centrally in the chain. When readjustment is completed, be sure to securely retighten rear axle nut (1) and rear wheel adjusting stud lock nut (2).

After adjusting rear chain, the rear brake may be too tight. Readjust brake rod, if necessary, as described in "Adjusting Rear Wheel Brake," Section 2G.

REAR CHAIN OILER (Fig. 2B-4)

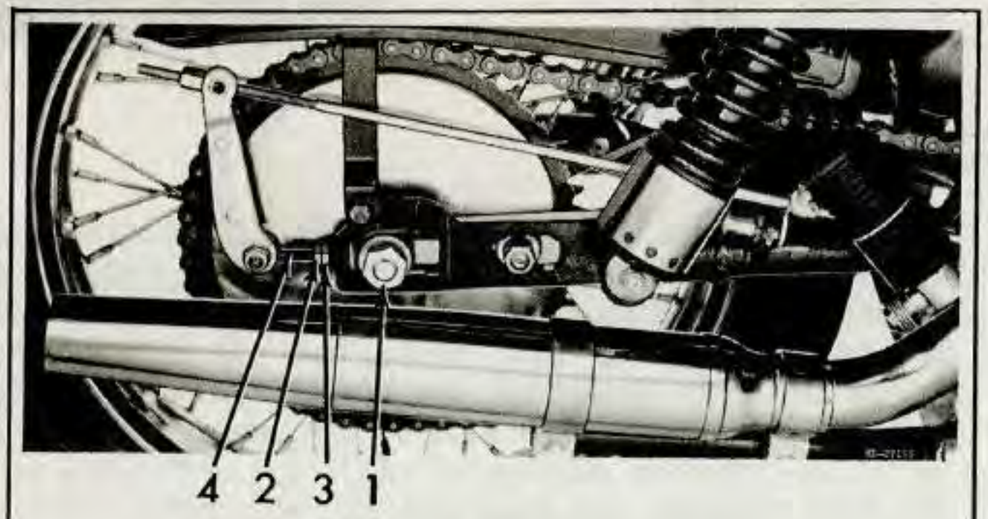
At regular service intervals (1000 miles) make a close inspection of rear chain. If it does not appear to be getting sufficient lubrication, or if there is evidence of an over-supply of oil, adjust rear chain oiler.

To adjust rear chain oiler, proceed as follows. Loosen lock nut (2) and turn screw (1) outward for more oil, and inward for less oil. Turn screw only a fraction of a turn at a time; lock adjusting screw in place with lock nut.



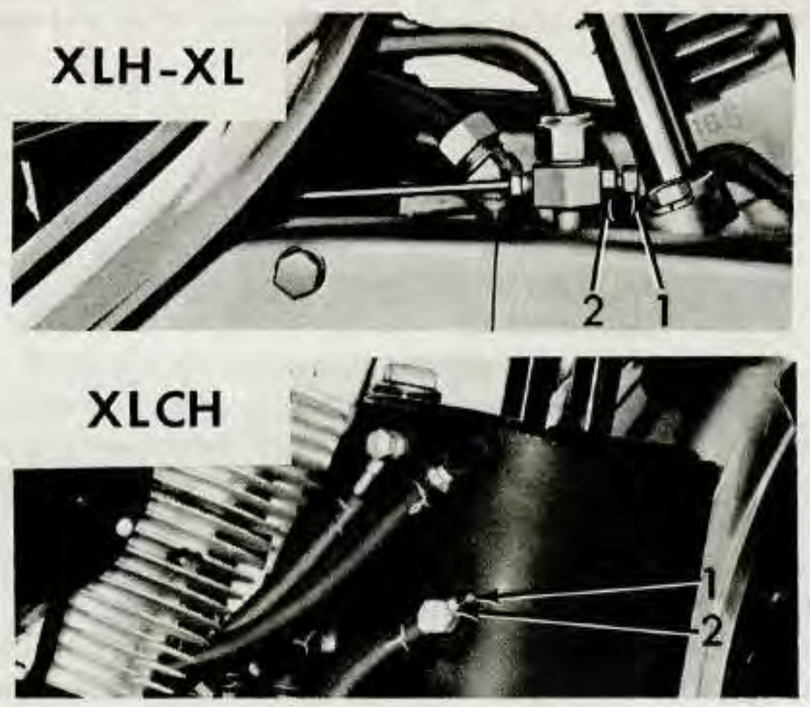
1. Drive chain
2. Chain adjuster shoe
3. Support bracket
4. Support bracket bolts (2)
5. Support bracket brace (XLH)
6. Brace bolt (XLH)

Figure 2B-3. Front Chain Tensioner Adjustment



1. Rear axle nut
2. Adjusting stud lock nut
3. Adjusting stud nut
4. Adjusting stud

Figure 2B-3A Right Side Rear Wheel (XLH)



1. Adjusting screw
2. Adjusting screw lock nut

Figure 2B-4. Rear Chain Oiler (1966 Models Shown)

The quantity of oil needed to lubricate the rear chain is very small. The size of the opening (orifice) through which oil bleeds to the chain is regulated by the adjusting screw. Sediment and gummy matter, accumulating in the oil supply, deposit in and around this orifice and gradually decrease the oil supply 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 blow away accumulated sediment and restore the orifice to its original size at intervals of approximately 2000 miles.

To clean rear chain oiler, proceed as follows:

1. Back out adjusting screw lock nut as far as possible.

2. Turn adjusting screw in until it bottoms on its seat. Count the number of turns needed to turn the screw in.

3. Remove adjusting screw and blow out orifice with compressed air.

4. Reinstall adjusting screw and turn it in until it bottoms on its seat.

5. Turn adjusting screw out the number of turns counted in Step 2 above, and lock in place with locking nut. This is the original setting.

The rear chain oiler should be set to permit oil to flow at a rate of 2 to 3 drops per minute. This setting is approximately 1/4 turn open for 1968 and earlier models and 3/4 turn open for 1969 models.

SERVICING REAR CHAIN

At regular service intervals of 1000 miles, examine the rear chain for adequate lubrication and worn chain links. If additional chain lubrication is needed, adjust chain oiler according to the procedure described in "Rear Chain Oiler."

Occasionally the chain should be removed from the motorcycle, inspected for worn condition and receive additional lubrication. Free chain from motorcycle by removing spring-locked connecting link. Connecting link pins which have press fitted side plates can be pressed apart with Chain Repair Tool, Part No. 95020-38 which is supplied in accessory rider tool kit. A shop tool is available for this purpose under Part No. 95021-29. Lay clean chain out flat and contract chain by taking up all slack in its links. Measure the chain length. Then stretch chain out to its full length and again measure chain length. If the difference between the two measurements exceeds 1 in., the chain should be replaced. In addition, if the chain has any stiff links, is visibly worn or damaged, it should be replaced. If a new chain is not available and it is necessary to repair the old chain, remove damaged links by pressing out riveted link pins with Chain Repair Tool.

Before installing chain on motorcycle proceed as follows: Soak and wash thoroughly in a pan of kerosene. Remove chain from kerosene and hang to allow kerosene to drain off. Immerse for a short time in a pan of grease heated to the consistency of light engine oil. If grease or facilities for heating are not available, substitute light engine oil. While immersed, move chain around to be sure that hot grease or oil works through inner chain bearings. Remove from lubricant and allow chain to drain. Wipe all surplus grease or oil from chain surface.

Install chain on motorcycle. Inspect connecting link and spring clip closely for bad condition. Replace if at all questionable. To install new press fitted connecting link, use Rear Chain Assembling Tool, Part No. 95020-66. Be sure spring clip is securely locked on pin ends, open end of clip on outside, trailing direction of chain travel, as positioned on motorcycle.

WHEELS

WHEELS AND TIRES

Maximum tire mileage and good handling qualities are directly related to care given wheels and tires. A front tire kept in continuous service will wear irregularly and peaked and may affect handling, especially if over-inflated. Therefore, it is extremely important that front and rear tires be interchanged at recommended service intervals and correct tire pressure be maintained at all times.

At regular intervals of 5000 miles, or at any time handling irregularities are experienced, see the chart below for recommended service.

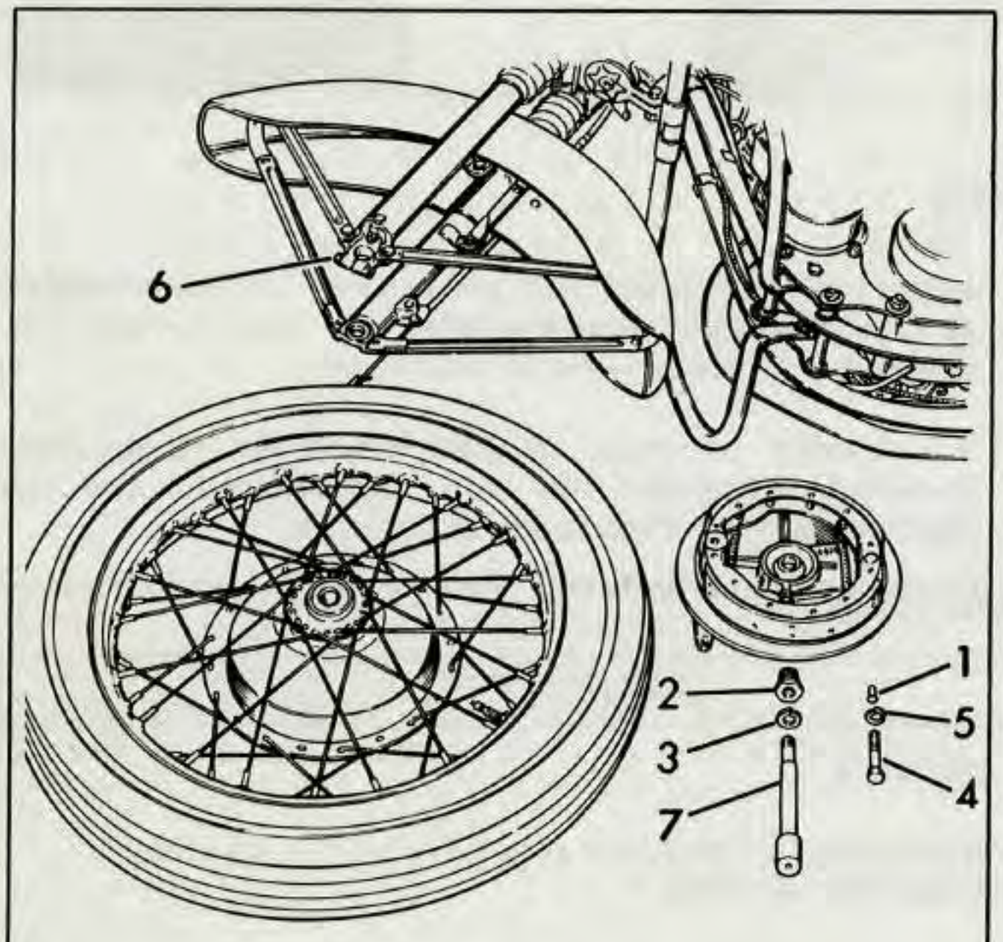
WHEEL SERVICE CHART

CHECK FOR	REMEDY
1. Loose axle nuts.	Tighten axle nuts.
2. Excessive side-play or radial (up and down) play in wheel hubs.	Replace wheel hub bearings as described in "Inspecting and Repairing Wheel Hubs."
3. Loose spokes.	Tighten or replace spokes as described under "Truing Wheels" and "Spoking Wheels."
4. Alignment of rear wheel in frame and with front wheel.	Check wheel alignment as described in this section, or, inspect and straighten frame as described in "Frame," Section 2E or repair rear fork as described in "Rear Fork," Section 2F.
5. Rims and tires out-of-true sidways, (should not be more than 3/64 in.).	True wheels, replace rims or replace spokes as described under, "Spoking Wheels" and "Truing Wheels."
6. Rims and tires out-of-round or eccentric with hub (should not be more than 3/32 in.).	See Item 5, above.
7. Irregular or peaked front tire wear.	Transpose tires as described in "Removing and Installing Front and Rear Wheel," and "Removing and Installing Tire and Tube."
8. Correct tire inflation.	Inflate tires as described in "Specifications", General (1A).
9. Correct tire and wheel balance.	Static balance may be satisfactory if dynamic balancing facilities are not available, however, dynamic balancing is also recommended.
10. Steering head bearings	Correct adjustment and replace pitted or worn bearings. See Section 2F.
11. Shock absorbers.	Check damping action and mounting stud rubbers. See Section 2F.
12. Rear fork bearings.	Check for looseness. See Section 2F.

REMOVING AND INSTALLING FRONT WHEEL (Fig. 2C-9)

Raise front end of motorcycle high enough to permit removing wheel; support motorcycle by suitable blocking underneath frame. Disconnect brake control by removing brake clevis pin (1). Remove axle nut (2), and axle nut lock washer (3). Remove brake anchor and shoe centering bolt (4), and lock washer (5). Loosen axle pinch bolt (6). With a soft hammer loosen axle (7) and remove from hub and fork assembly. Remove front wheel and brake assembly complete.

To reinstall front wheel and brake assembly, reverse the disassembly procedure. Center brake shoes as described in "Adjusting Front Wheel Brake," Section 2G. Inject one ounce of "Grease-All" grease into the wheel hub and spin wheel, to make sure it has free movement.



1. Brake clevis pin
2. Axle nut
3. Axle nut lock washer
4. Brake anchor and centering bolt
5. Lock washer
6. Front axle pinch bolt
7. Front wheel axle

Figure 2C-9. Front Wheel Removal

REMOVING AND INSTALLING REAR WHEEL (Fig. 2C-10)

Raise rear end of motorcycle high enough to permit removing wheel; support motorcycle by suitable blocking underneath frame. Locate and remove chain connecting link (1) and disengage chain from rear sprocket. Remove brake adjusting nut (2) from brake rod. Remove axle nut (3), axle nut lock washer (4) and centering collar (5). With a soft hammer tap right end of axle (6) to loosen from left side of frame. Remove axle from hub and frame assembly. Remove axle spacer (7) from left side. Slide wheel and brake assembly to extreme rear end of frame. Lift wheel up to pass brake drum over brake shoes. Remove wheel from motorcycle.

To reinstall rear wheel, reverse the disassembly procedure. Center brake shoes as described in "Adjusting Rear Wheel Brake," Section 2G. Inject one ounce of "Grease-All" grease into the wheel hub and spin wheel to make sure it turns free

DISASSEMBLING FRONT WHEEL HUB
1963 AND EARLIER (Fig. 2C-11)

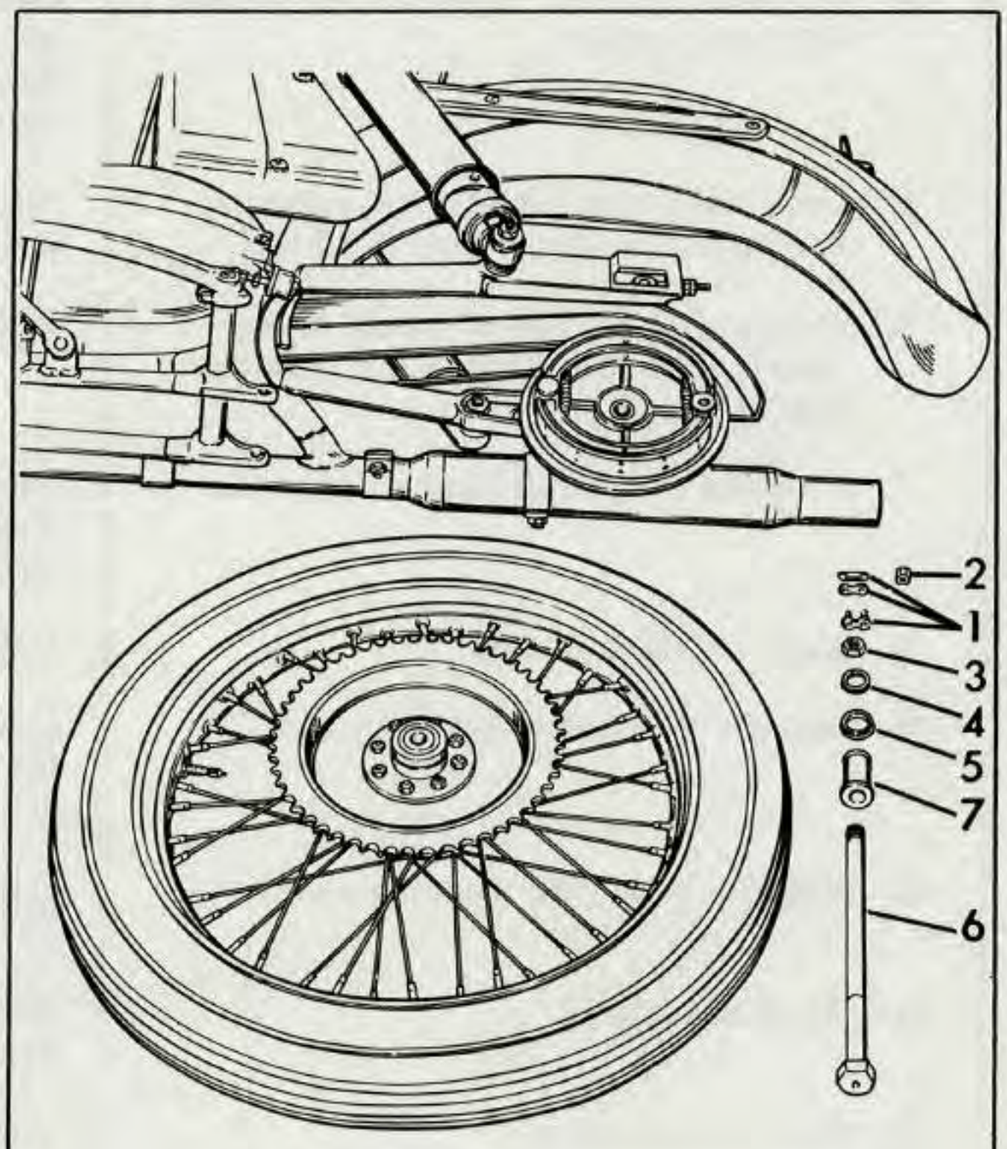
Remove front wheel from motorcycle as described in "Removing and Installing Front Wheel." Turn threaded bearing lock nut (1) from hub, breaking stake locks as it is being removed. Drift out ball bearing (2) from opposite side of hub. Free bearing washer (3) and spacer (4). Drift out ball bearing (5) and grease retainer (6) from opposite side of hub.

1964 and Later (Fig. 2C-11A)

Pry grease seal (1) from wheel hub. Remove retaining ring (2) with Tru-arc lock ring pliers. Tap ball bearing (3) inward all the way against its seat in hub. This will move bearing (4) out far enough so that spacer (5) can be moved away from bearing (4). Then use a drift to tap out bearing (4) from opposite end of hub. Bearing (3) can now be tapped out from opposite end.

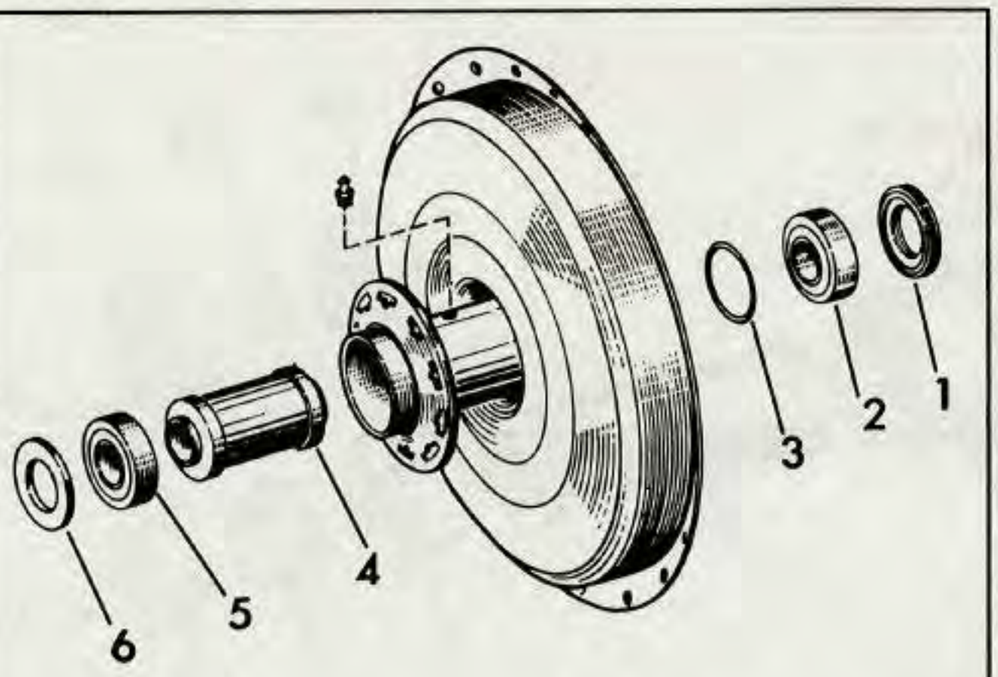
DISASSEMBLING REAR WHEEL HUB (Fig. 2C-12)

Remove rear wheel from motorcycle as described in "Removing and Installing Rear Wheel." Using tool, Part No. 94630-67, turn threaded bearing lock nut (1) from hub, breaking stake locks as it is being removed. Drift out bearing oil seal (2) and outer spacer (3) from opposite side of hub. Repeat operation for ball bearing (4) and washer (5). Free bearing spacer (6). Drift out ball bearing (7 or 7A), spacer (8 or 8A) and grease retainer (9 or 9A) from opposite side of hub.



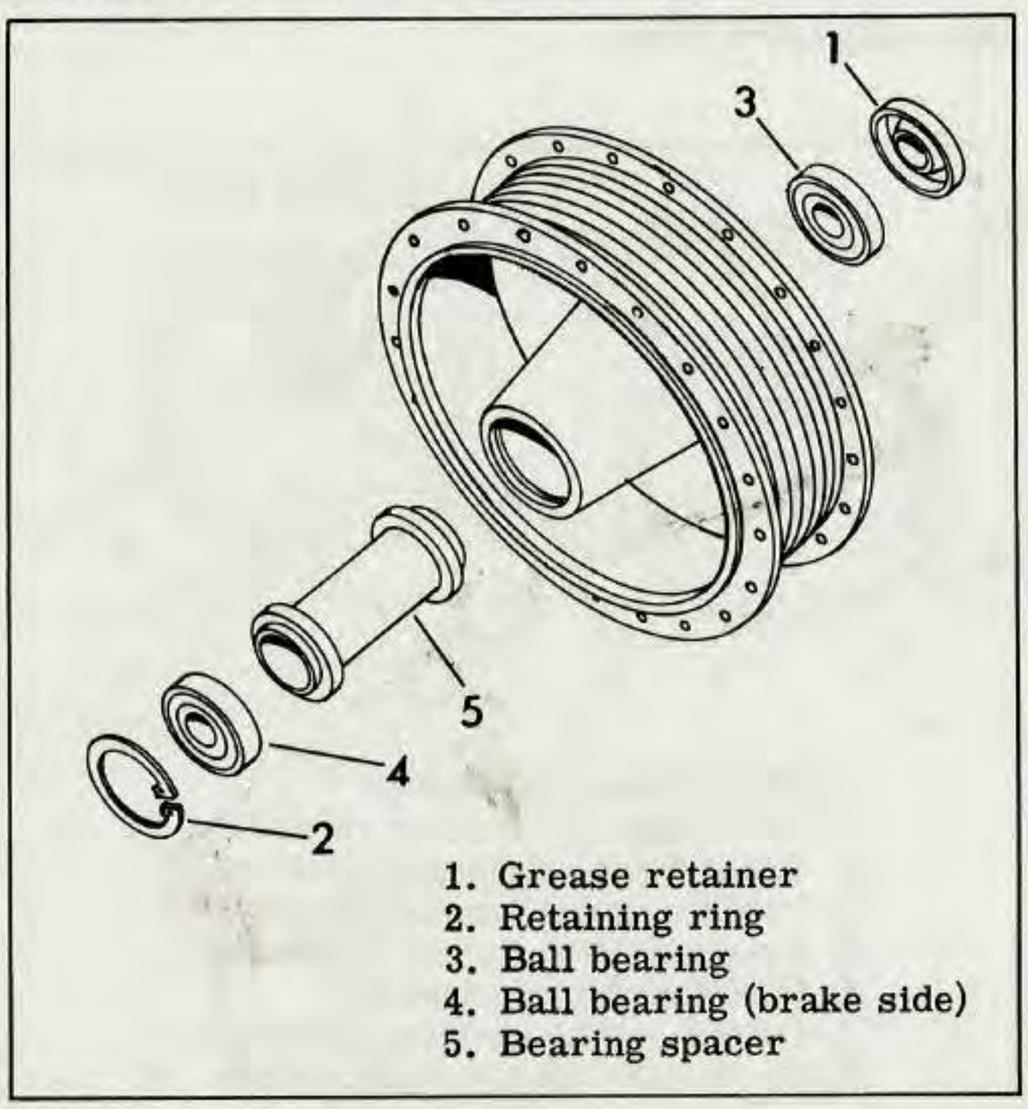
1. Chain connecting link
2. Rear brake rod adjusting nut
3. Axle nut
4. Axle nut lock washer
5. Axle centering collar, right side
6. Rear axle
7. Axle spacer, left side

Figure 2C-10. Rear Wheel Removal



1. Bearing lock nut
2. Ball bearing
3. Bearing washer
4. Bearing spacer
5. Ball bearing
6. Grease retainer

Figure 2C-11. Front Wheel Hub (1963 and Earlier)



1. Grease retainer
2. Retaining ring
3. Ball bearing
4. Ball bearing (brake side)
5. Bearing spacer

Figure 2C-11A. Front Wheel Hub (1964 And Later)

INSPECTING AND REPAIRING WHEEL HUBS (Fig. 2C-11, 2C-11A and 2C-12)

Clean and inspect all parts, paying particular attention to the wheel hub bearings. If bearings have excessive side play or radial (up and down) play in the wheel hubs, they should be replaced. If ball bearings have been removed from the hubs, carefully examine for visible wear, heat discoloration or damage to inner and outer races. Inspect brake shells for scoring, grooving and worn running surfaces. Check spoke flanges for bent or damaged condition. Recommended hub repair is replacement of worn or damaged parts.

ASSEMBLING FRONT WHEEL HUB

1963 and Earlier (Fig. 2C-11)

Assemble washer (3) open end ball bearing (2) bearing lock nut (1). Peen lock nut to hub in two places. Insert front wheel bearing spacer (4) and press closed end ball bearing (5) into hub against bearing spacer (4), closed end facing out. Insert retainer (6). Install front wheel in motorcycle as described in "Removing and Installing Front Wheel."

1964 and Later (Fig. 2C-11A)

Clean and pack both ball bearings with fresh Grease-All grease. Press brake side ball bearing (4) against shoulder in hub, shielded side out. Install retaining ring (2) using Tru-arc lock ring pliers. Install bearing spacer (5). Press ball bearing (3) against shoulder in hub and tap grease retainer (1) in place.

ASSEMBLING REAR WHEEL HUB (Fig. 2C-12)

Press oil seal (2) into lock nut (1) and insert outer spacer (3) in oil seal (2) and lock nut (1). Install washer (5) and ball bearing (4). Assemble lock nut (1), oil seal (2), and outer spacer (3) into hub as one unit. Peen lock nut to hub in two places and insert bearing spacer (6).

1962 and Earlier

Press ball bearing (7) into hub against bearing spacer (6). Insert bearing spacer (8) and grease retainer (9). Install rear wheel in motorcycle as described in "Removing and Installing Rear Wheel."

1963 and Later

Press unshielded bearing (7A) against bearing spacer (6). Install bearing spacer (8A), and shielded bearing (9A) with oil seal (9) on outside.

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 by removing 8 bolts. 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.

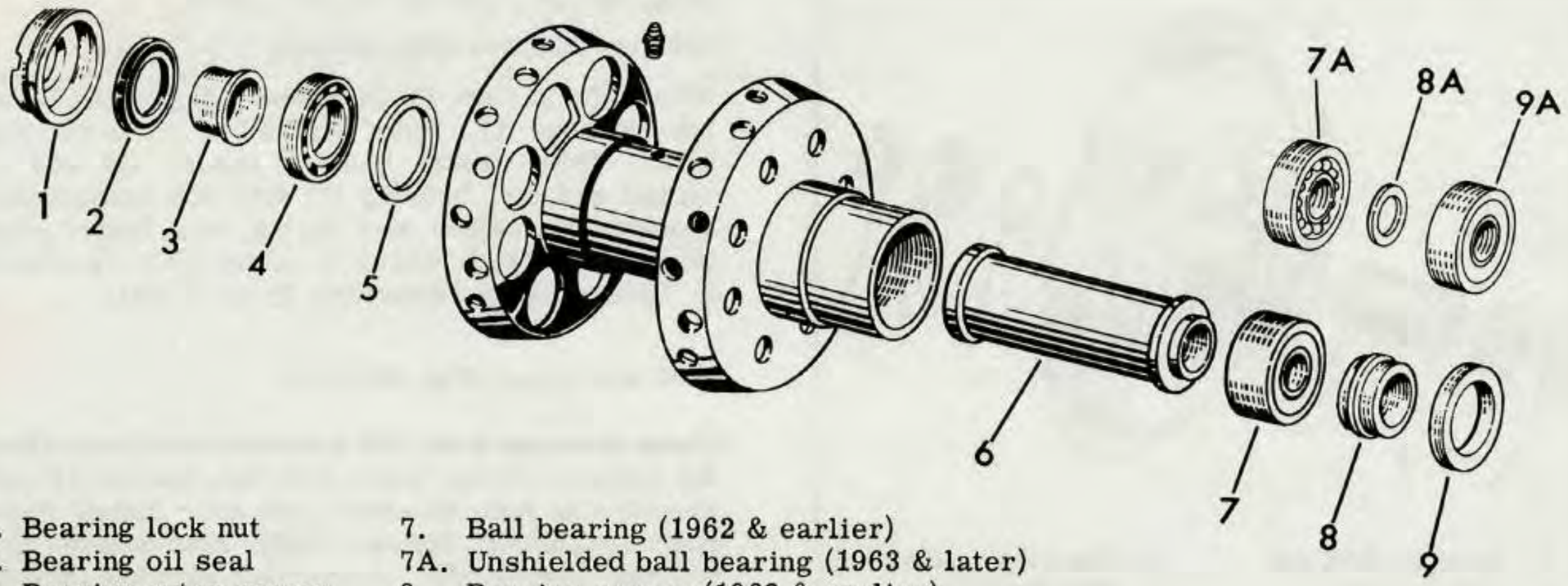
To drill new rivet holes, proceed as follows using new sprocket as a template for locating holes.

1. Drill a 9/64 in. hole from the brake shell side.

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.



1. Bearing lock nut
2. Bearing oil seal
3. Bearing outer spacer
4. Ball bearing
5. Bearing washer
6. Bearing spacer
7. Ball bearing (1962 & earlier)
7A. Unshielded ball bearing (1963 & later)
8. Bearing spacer (1962 & earlier)
8A. Bearing spacer washer (1963 & later)
9. Grease retainer (1962 & earlier)
9A. Shielded ball bearing (1963 & later)

Figure 2C-12. Rear Wheel Hub - Exploded View

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. 95600-33A. Proceed as follows, inserting and seating dowel pins first, and then rivets.

1. Insert dowel pin and rivet from brake shell side.

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

3. Use concave punch and flare dowel pin end. Head rivet end until head extends 3/64 in. above sprocket face.

4. Repeat steps 1, 2 and 3 seating opposite dowel pins and rivets until all are in place.

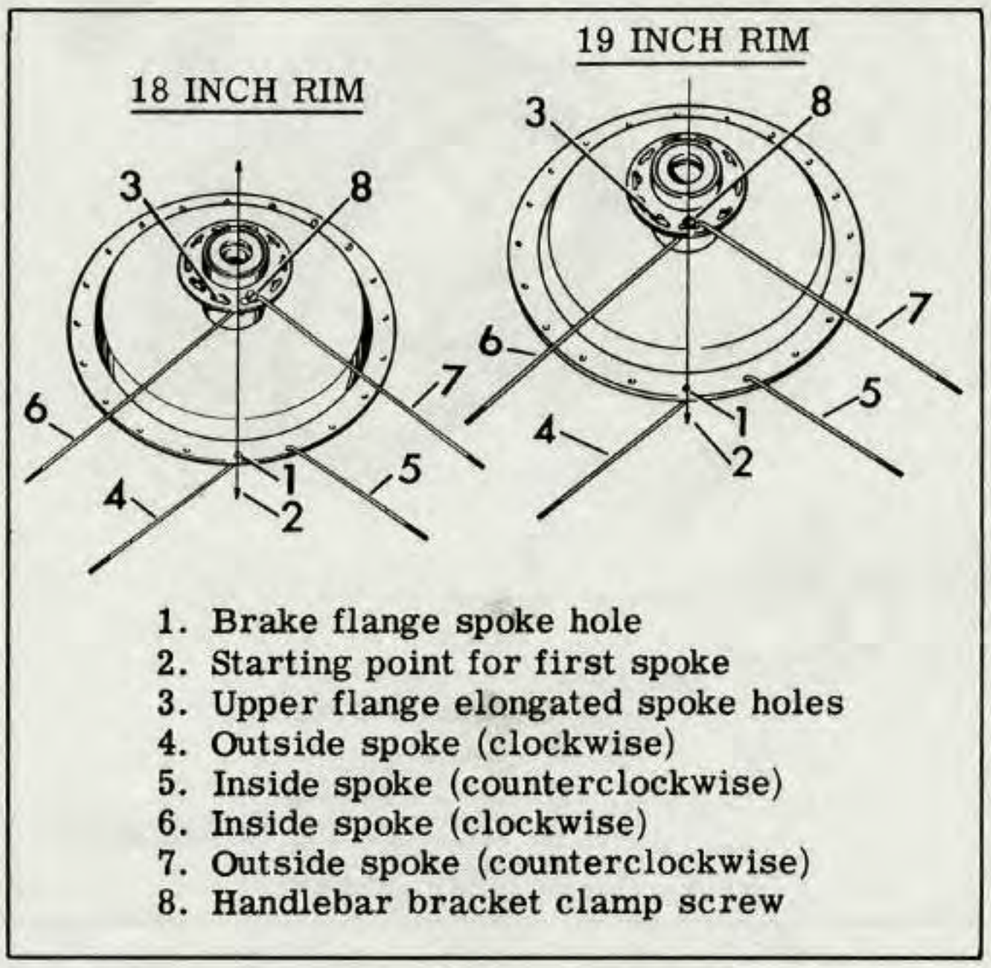
This procedure will prevent distortion of sprocket.

Install brake drum on wheel and wheel in motorcycle as described in "Removing and Installing Rear Wheel."

SPOKING FRONT WHEEL

1963 AND EARLIER (Fig. 2C-13 AND 2C-14)

Front wheel rim is identified by Part No. stamped in rim-well as follows: 18" steel 43002-30, 18" aluminum 43009-60, 19" steel 43003-53 and 19" aluminum



1. Brake flange spoke hole
2. Starting point for first spoke
3. Upper flange elongated spoke holes
4. Outside spoke (clockwise)
5. Inside spoke (counterclockwise)
6. Inside spoke (clockwise)
7. Outside spoke (counterclockwise)
8. Handlebar bracket clamp screw

Figure 2C-13. Inserting Spokes in Front Wheel (1963 And Earlier)

43010-60. Spoke holes in hub flanges are in one row around each flange - 20 holes in the brake side flange and 10 elongated holes (2 spokes to a hole) in the small flange. (See Fig. 2C-13.)

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

2A. 18" Wheel: Select a brake flange spoke hole (1) that is located midway (2) between two elongated spoke holes (3) of the small flange (upper flange as positioned on workbench), and insert spoke (4) from

inside of hub. Follow through, and insert spokes in every other brake flange hole until 10 spokes are in place.

2B. 19" Wheel: Select a brake flange hole (1) that is located through the center of the elongated spoke hole in the small flange (upper flange as positioned on workbench), and insert spoke (4) from inside of hub. Follow through, and insert spokes in every other brake flange hole until 10 spokes are in place.

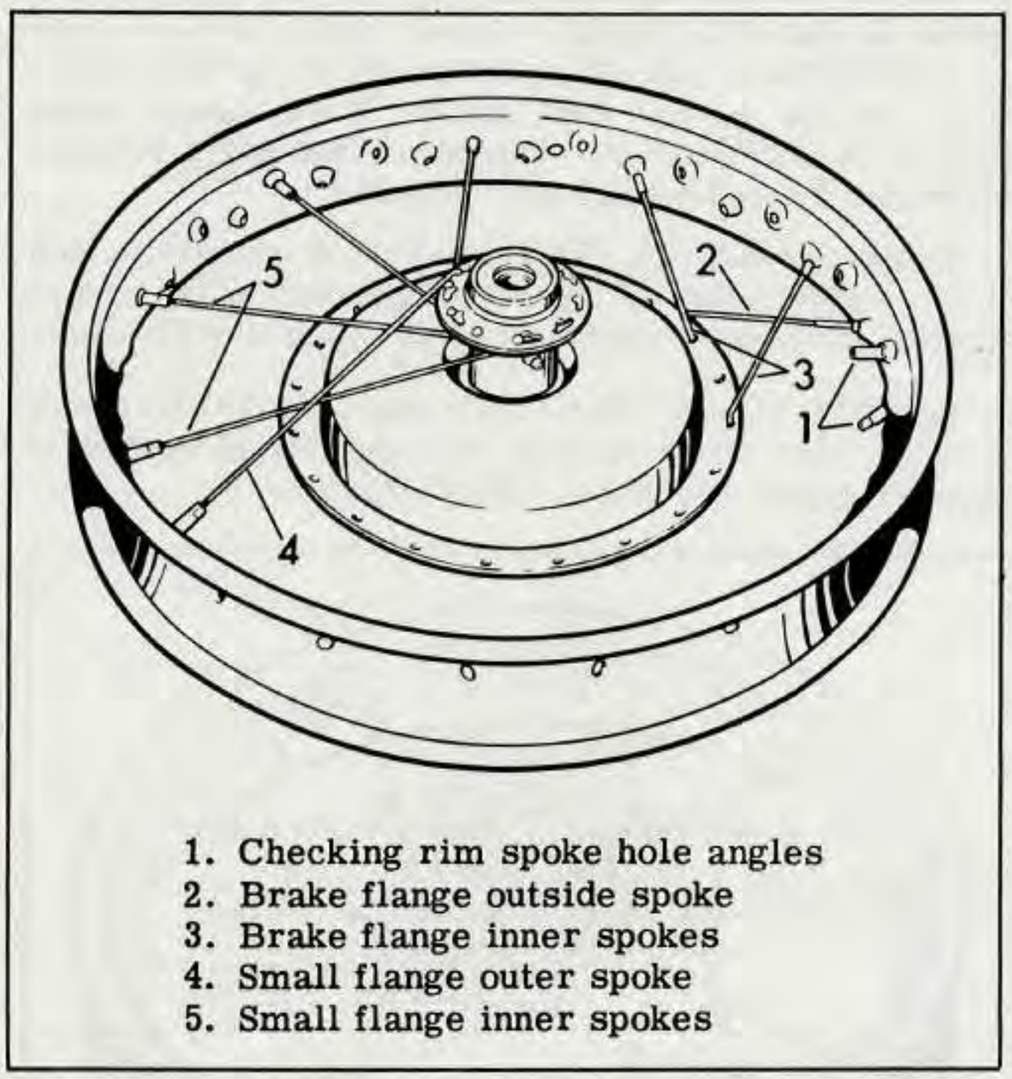
3. Turn hub over. Insert spokes (5) from the outside of hub, filling the remaining 10 spoke holes of the brake flange.

4. Again, place hub on bench with brake drum end of hub down.

5. Swing the 10 outside spokes (4) clockwise.

6. Swing the 10 inside spokes (5) counterclockwise.

7. Place the rim over the hub with the spoke holes having the most acute angle facing down. Check by inserting nipples in spoke holes as shown in (1, Fig. 2C-14).



1. Checking rim spoke hole angles
2. Brake flange outside spoke
3. Brake flange inner spokes
4. Small flange outer spoke
5. Small flange inner spokes

Figure 2C-14. Lacing Front Wheel (1963 and Earlier)

8. Cross a brake flange outside spoke (2), under two inner spokes (3) and insert in lower row of holes in rim that angle in same direction as spokes. Start nipples on spokes as they are inserted in rim.

9. Follow around hub repeating the operation described in step 8, until all spokes are secured to rim.

10. With hub in same position, insert ten spokes (6, Fig. 2C-13) in small flange (upper flange as positioned on workbench) elongated holes, with head of spoke up and to the left in the elongated hole. Swing spokes clockwise and insert in nearest upper row of rim holes that angle in same direction as spokes. Just start nipples on spokes as they are inserted in rim.

11. Insert the 10 remaining spokes (7, Fig. 2C-13) in the elongated holes - head of spoke down and to the right in the hole. Swing spokes counterclockwise.

12. See Fig. 2C-14. Select any small flange outer spoke (4), cross it over four inner spokes (5) on 18 in. wheel, and three on 19 in. wheel. Insert spoke in nearest upper row of rim holes that angle in same direction as spokes. Just start nipples on spokes as they are inserted in rim.

13. Insert 10 handlebar bracket clamp screws Part No. 1214, (8, Fig. 2C-13), in the elongated holes between the spoke heads to prevent the spokes from falling out when truing up the wheel.

SPOKING FRONT WHEEL

1964 AND LATER (Fig. 2C-14A)

Front wheel rim is identified by part No. stamped in rim well as follows: 18" steel 43001-64, 18" aluminum 43009-64, 19" steel 43003-64, and 19" aluminum 43010-64. 20 spoke holes are equally spaced around each side flange of hub. 20 spoke holes are arranged in pairs on each side of rim well. Holes are spaced the same on each side of both rim and hub.

Note that there are two types of spokes, long and short at bent end as shown in Figure 2C-14A. One long and one short spoke are used in each pair. The long spoke (L) of each pair on rim crosses over to opposite side of hub while the short spoke (S) of each pair on rim connects to same side of hub. Spoke arrangement is shown in figure 2C-14A.

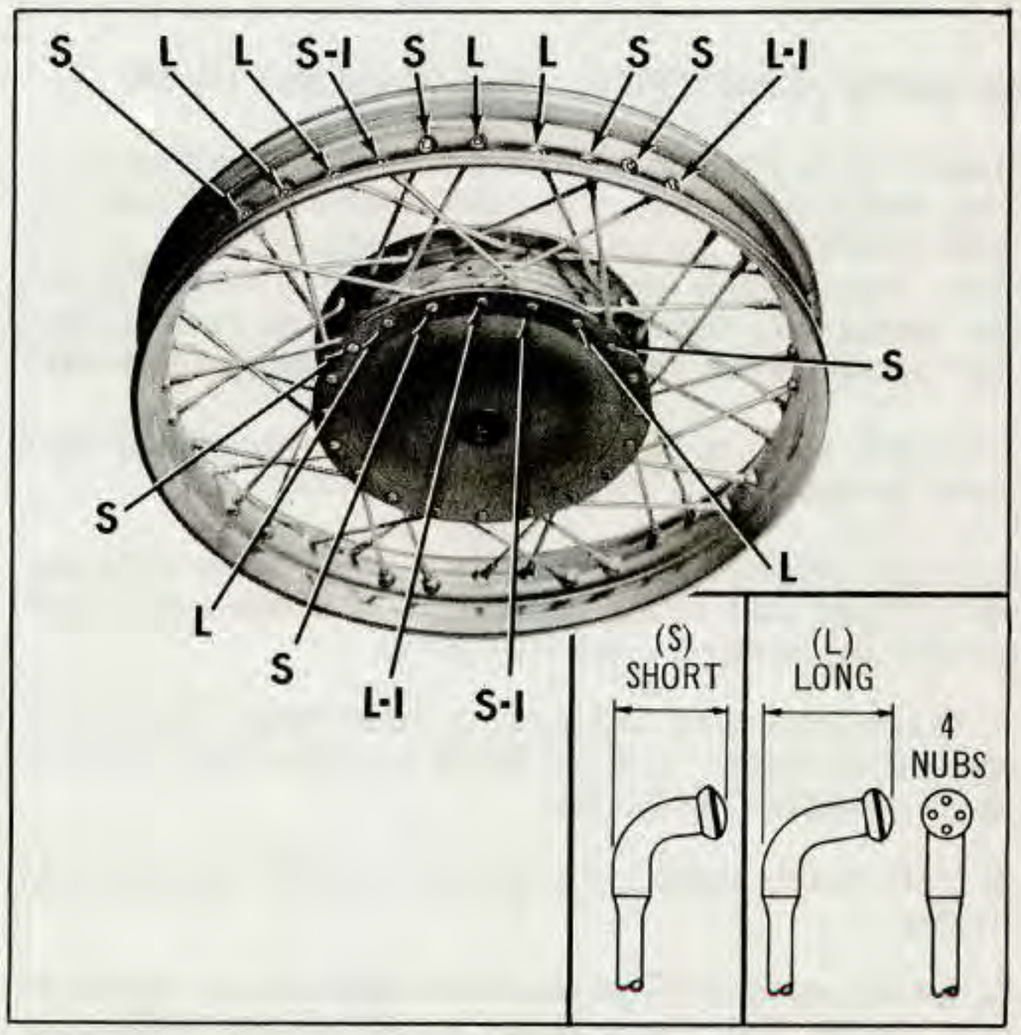


Figure 2C-14A. Lacing Front Wheel (1964 And Later)

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

2. Insert 10 short spokes in every other hole from outside of brake side flange.

3. Insert 10 long spokes in remaining holes.

4. Turn hub over on bench with brake drum side of hub down.

5. Insert 10 short spokes in next holes to right (clockwise) from long spoke holes in opposite flange.

6. Insert 10 long spokes in remaining holes.

7. Swing short spokes counterclockwise and long spokes clockwise crossing underneath short spokes and forming pairs.

8. Place rim over hub (either side down).

9. Cross long spokes clockwise underneath short spokes and insert into right (clockwise hole) of each pair of holes that angles in same direction as spoke on opposite side of rim well. See L-1 in figure 2C-14A.

10. Cross short spokes counterclockwise above long spokes and insert into right (clockwise hole) of each pair on near side of rim well that angles in same direction as spoke. See S-1 in Figure 2C-14A.

Spoke will enter 6th hole to left of clockwise long spoke hole in rim. Repeat for remaining spokes. Start nipples on spokes as they are inserted in rim until all spokes are secured.

11. Turn wheel over and repeat procedure for spokes on brake side.

SPOKING REAR WHEEL (Fig. 2C-15 and 2C-16)

Rear wheel rim is identified by Part No. stamped in rim-well as follows: 18" steel 43004-60, 18" aluminum 43008-60. Spoke holes in hub flanges are in two rows around each flange - ten inner row holes (1) and ten outer row holes (2, Fig. 2C-15) in each flange. All spokes must be inserted from inside of flange.

1. Place hub on bench with brake drum end of hub down as shown in Fig. 2C-15.

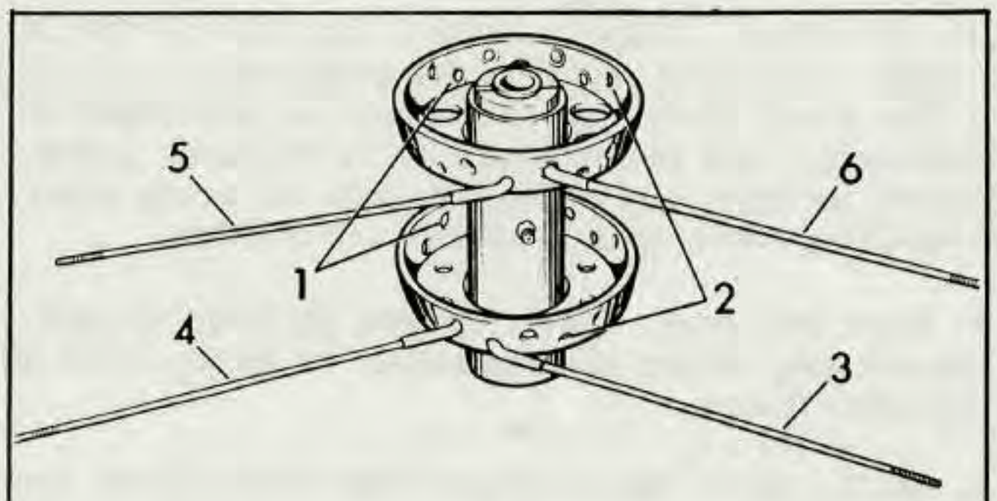
2. Insert spokes (3) in ten outer spoke holes of brake side flange and swing loose end of spokes counterclockwise, as far as hub will allow.

3. Place rim over hub (either side down) and insert spokes in lower row of holes in rim, that angle in same direction as spokes.

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

5. Insert spokes (4) in ten inner spoke holes of brake side flange and swing loose end of spokes clockwise as far as hub will allow.

6. See Fig. 2C-16. Select any inner spoke (1), cross it over four outer spokes (2), and insert spokes in nearest lower rim holes. Start nipples.



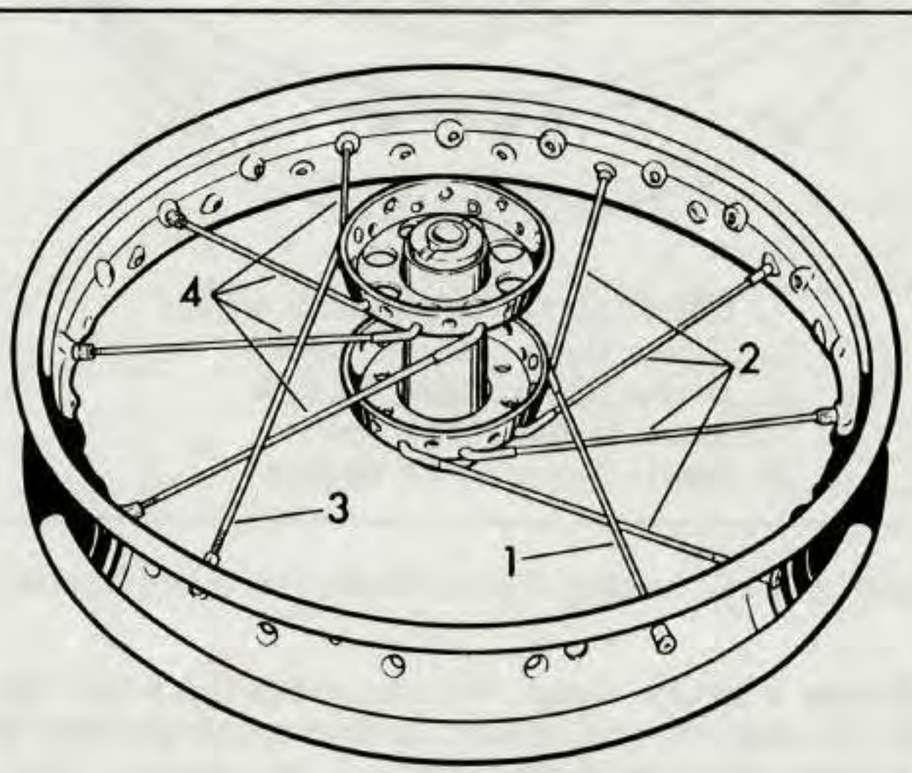
1. Inner row spoke holes
2. Outer row spoke holes
3. Outside spoke (counterclockwise)
4. Inner spoke (clockwise)
5. Inner spoke (clockwise)
6. Outside spoke (counterclockwise)

Figure 2C-15. Inserting Spokes in Rear Wheel Hub

7. Insert spokes (5, Fig. 2C-15) in ten inner spoke holes of opposite flange, (upper flange as positioned on workbench), and swing loose end of spokes clockwise as far as hub will allow. Then, insert inner spokes in nearest upper rim holes that angle in same direction as spokes and start nipples.

8. Insert spokes (6, Fig. 2C-15) in remaining ten outer spoke holes of upper flange and swing end of spokes counterclockwise as far as hub will allow.

9. See Fig. 2C-16. Select any outer spoke (3), cross it over four inner spokes (4), and insert spokes in nearest upper rim holes. Start nipples.



1. Brake side flange inner spoke
2. Brake side flange outer spokes
3. Upper flange outer spoke
4. Upper flange inner spokes

Figure 2C-16. Lacing Rear Wheel

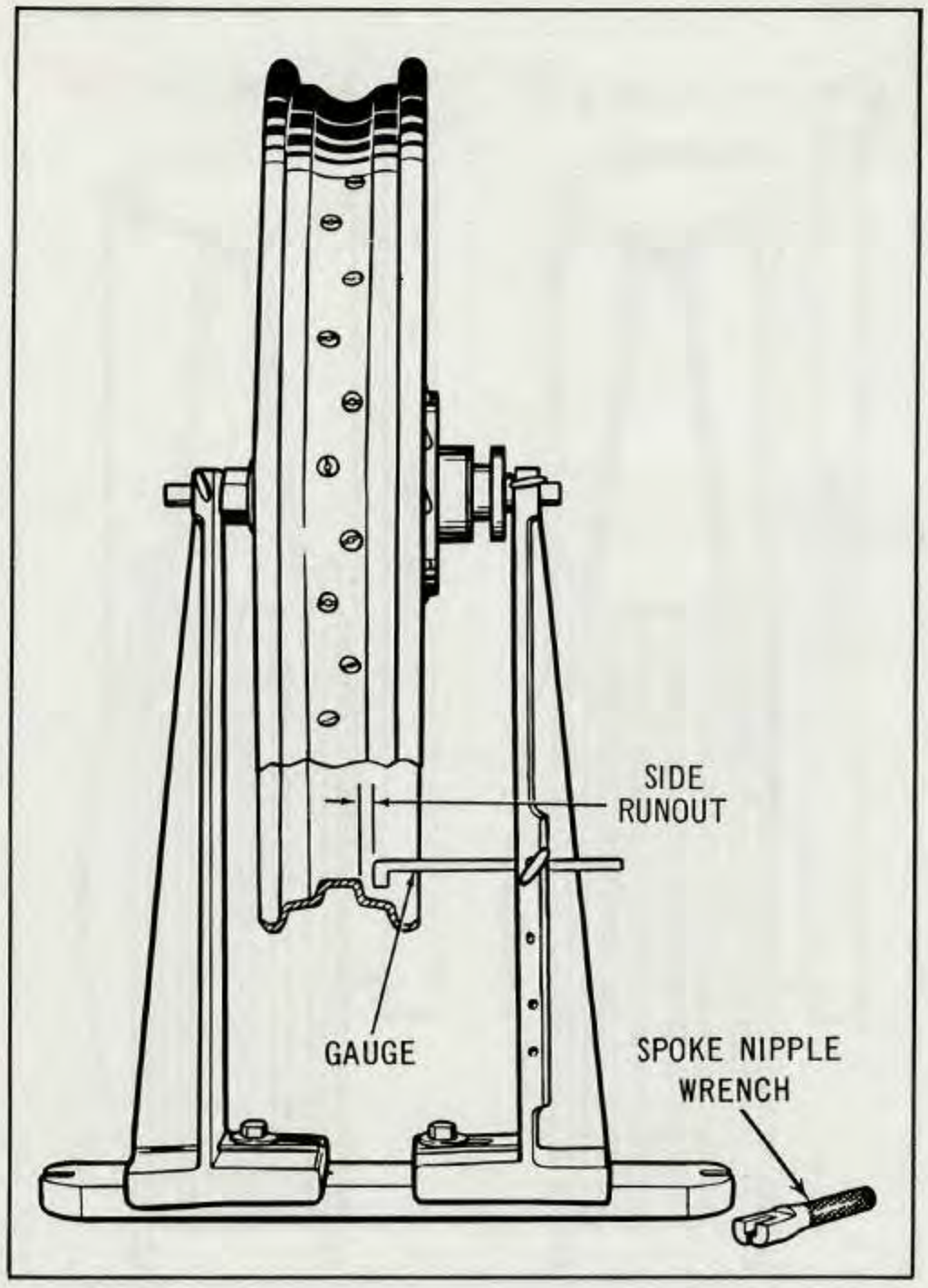


Figure 2C-17. Truing Rim Sideways

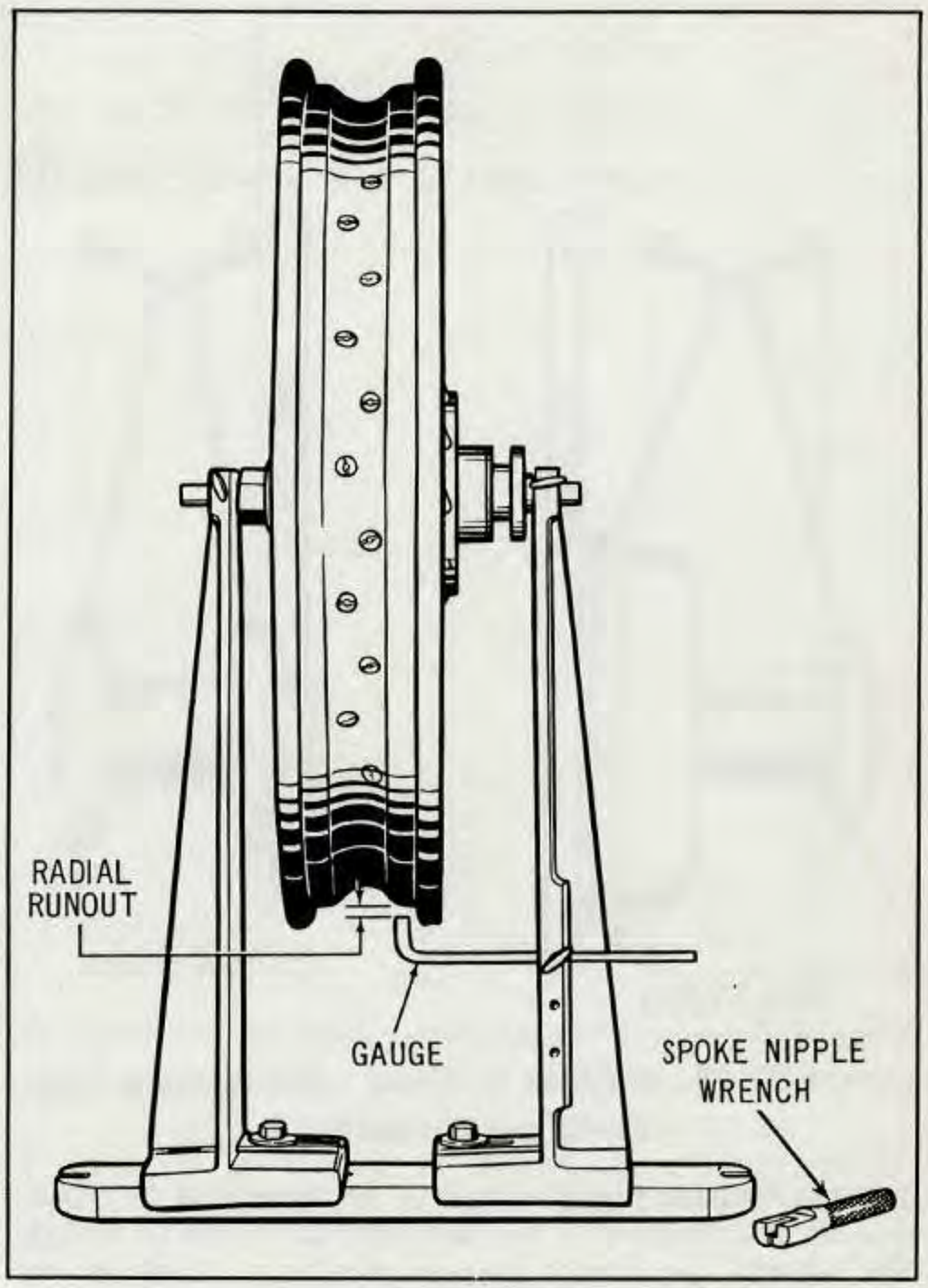


Figure 2C-18. Truing Rim Concentric with Hub

NOTE

Outer spokes on both sides should point in same direction.

TRUING WHEELS

1. See Fig. 2C-17 and proceed as follows. Use wheel axle as a truing arbor; insert in wheel hub and place wheel in Truing Stand, Part No. 95500-29.

2. Front Wheel: Starting at valve hole, tighten all nipples opposite brake flange side until end of spokes are approximately 1/16 in. from being flush with head of nipple. Use Nipple Wrench, Part No. 94681-39.

3. Rear Wheel: Turn each nipple on just far enough to cover spoke threads. Start at valve hole and tighten all nipples three full turns each. Then, proceed to tighten all nipples one full turn at a time until spokes are snug in wheel.

4. Front and Rear Wheel: Check rim for concentricity, centering sideways with hub and for running true sideways (Fig. 2C-17 and 2C-18). Centering rim sideways must be done as one operation. Rim must be properly centered sideways in relation to hub for correct alignment and "tracking" of wheels.

Figure 2C-19 and 2C-19A show method of using a straight edge to determine correct sideways centering of wheel rim. If rim is too close to straight edge, loosen all nipples on brake side and tighten all nipples on opposite side same amount. If rim is too far from straight edge, reverse operations. Lay straight edge across brake side as shown and measure distance from straight edge of rim. When rim is correctly centered, this distance will be as shown for each wheel listed.

Adjust truing stand gauge (Fig. 2C-17), to side of rim well 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 number of turns. 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 shown in Fig. 2C-19. Rim should be trued sideways to within 1/32 in.

After rim has been centered sideways with wheel hub and runs true sideways, check for concentricity. Adjust truing stand gauge (Fig. 2C-18) to rim tire bead seat. If rim runs eccentric (radial runout) nipples must be loosened at points rim does not contact gauge, and nipples tightened at points rim contacts

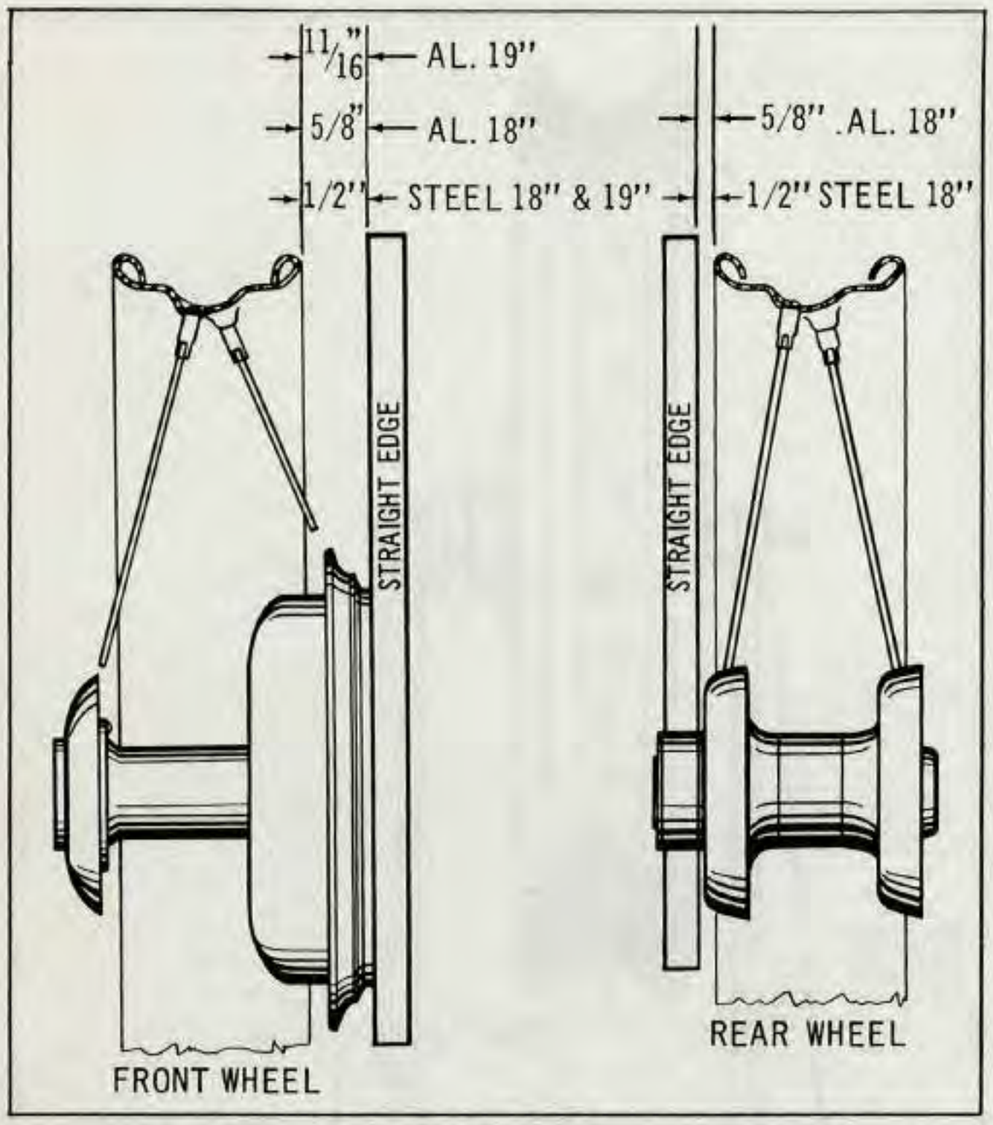


Figure 2C-19. Aligning of Wheel with Straight Edge (1963 and Earlier)

gauge. Amount nipples are to be loosened or tightened is determined by the amount rim is out of round. Rim should be trued concentrically to 1/32 in. or less radial runout.

5. After wheels have been checked and corrected as described in paragraph 4, start at valve hole and tighten nipples one turn at a time all the way around rim until spokes are normally tight. If possible compare with a new wheel. While tightening nipples, repeatedly check rim with gauge according to instructions under paragraph 4.

6. After all nipples have been pulled up, until spokes are normally tight and wheel is true, seat 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 after wheel is put into service as the result of spoke heads seating into the flange.

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.

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

REMOVING TIRE AND TUBE FROM RIM

Remove valve cap and valve core to free all air from tube. Remove valve stem nut. If four bead anchor screws are present on each side of rear wheel rim, remove screws. Loosen both beads from rim flanges by stepping on sides of tire or by using a tire tool.

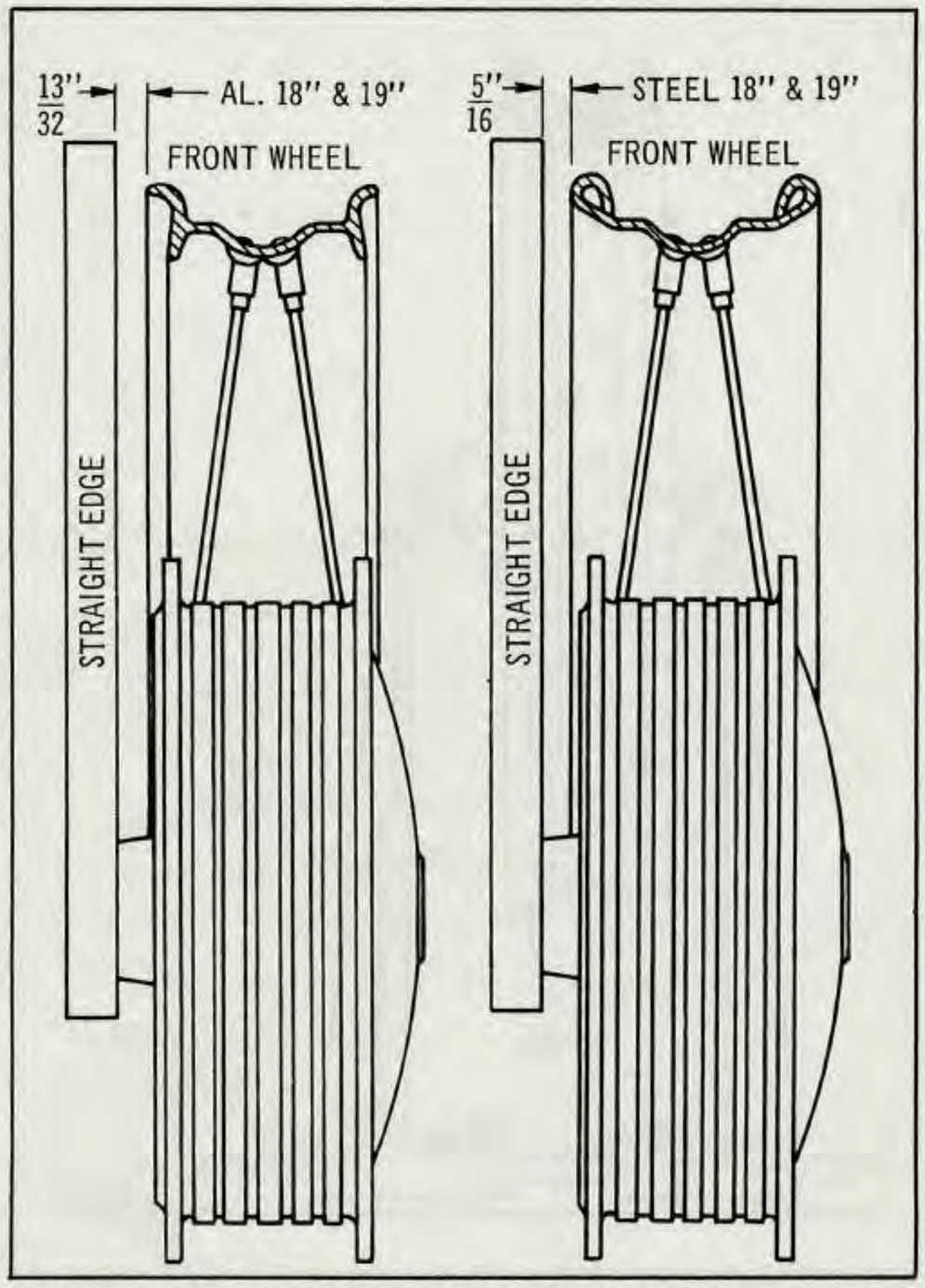


Figure 2C-19A. Aligning Wheel With Straight Edge (1964 and Later)

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 the tire ruined. Carefully remove inner 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 only allows inner tube to be removed and installed and also allows inside of casing to be inspected.

MOUNTING TIRE AND TUBE ON RIM

Steel rear wheel rims should be barbed. If not, add barbs to inner wall of bead using a cold chisel. Locate the barbs in three groups, one group symmetrical about valve stem hole, and two additional groups located approximately 120° either way from valve stem hole as shown in Fig. 2C-19B. Each group should include 16 barbs, 8 barbs to a side, with 4 barbs facing opposite the other four. Barbs should extend approximately 1/32 in. to 1/16 in. in height from surface of rim.

Carefully remove all dust and dirt, particularly hard particles from tire which might chafe an inflated tube. Wipe tube and inside of tire thoroughly with clean, dry cloth. If rim is dirty or rusty, clean it with a stiff wire brush. Be sure to examine a used tire carefully for fabric injuries which if neglected will damage tube.

Position rubber rim strip (for front wheel only) in rim-well with valve holes correctly registered. Swab thoroughly all around base of tube, between tube and side walls of tire with tire mounting compound. Place valve at tire balance mark, and inflate tube just enough to round it out. A tube flap (for rear wheel only) should be inserted between the tube and tire beads as shown in figure 2C-20. Install tube flap with hole over valve stem first. Tuck in remainder of flap carefully underneath tire beads all the way around both sides of tires. DO NOT ALLOW ANY FOLDS IN FLAP AND BE VERY CAREFUL TO SEE THAT POSITION OF FLAP IS NOT DISTURBED WHEN INSTALLING TIRE ON RIM AS FOLLOWS: 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 at this point to hold bead 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 reinstall bead anchor screws in rim sides (if used). Then, completely deflate tire 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. See "Specifications," Section 1A, for correct tire pressure.

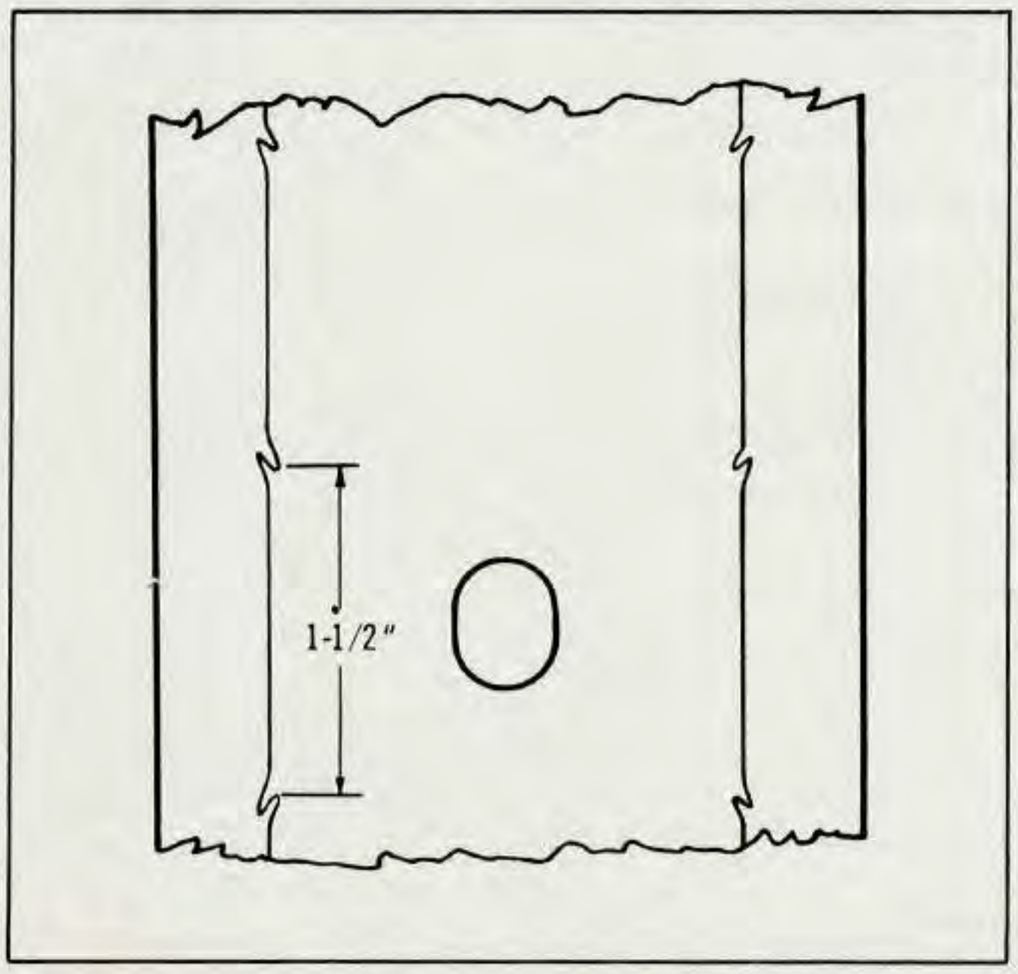


Figure 2C-19B. Rear (Steel) Wheel Barbs

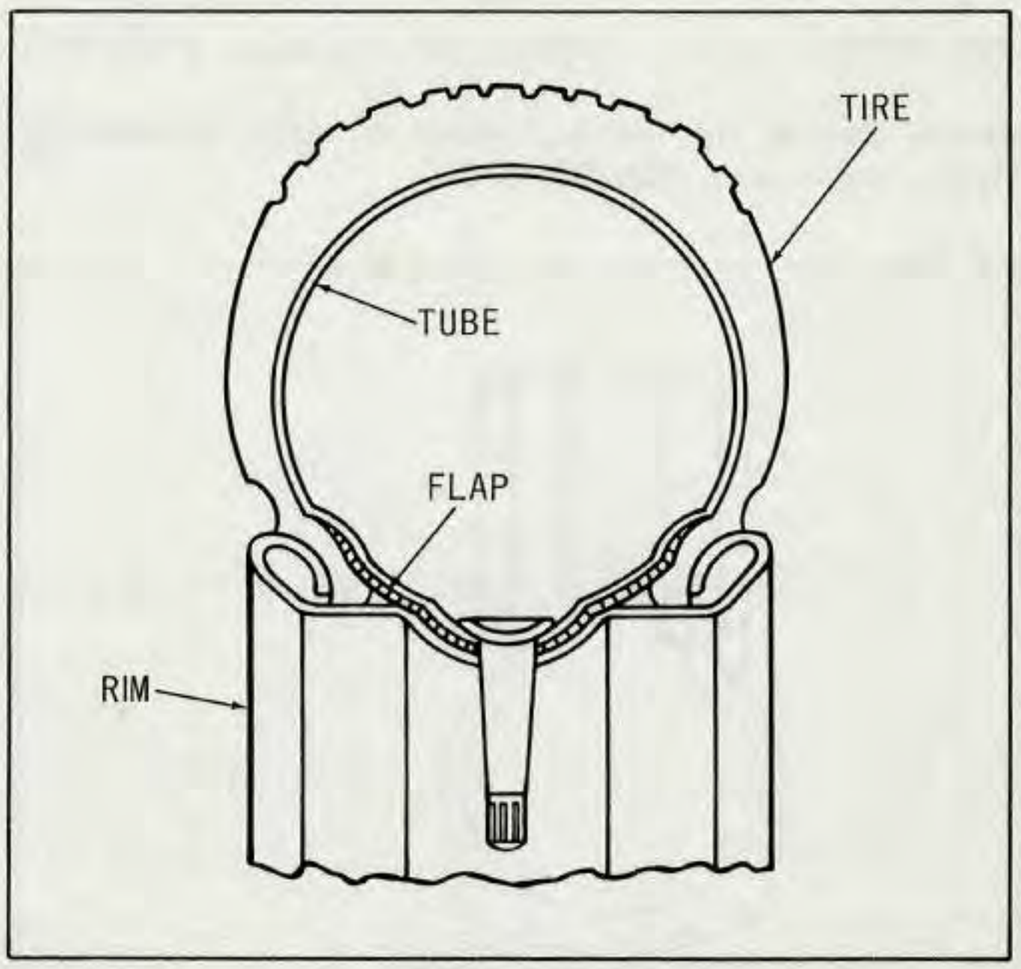


Figure 2C-20. Rear Wheel Tire Flap Installation

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-20A).

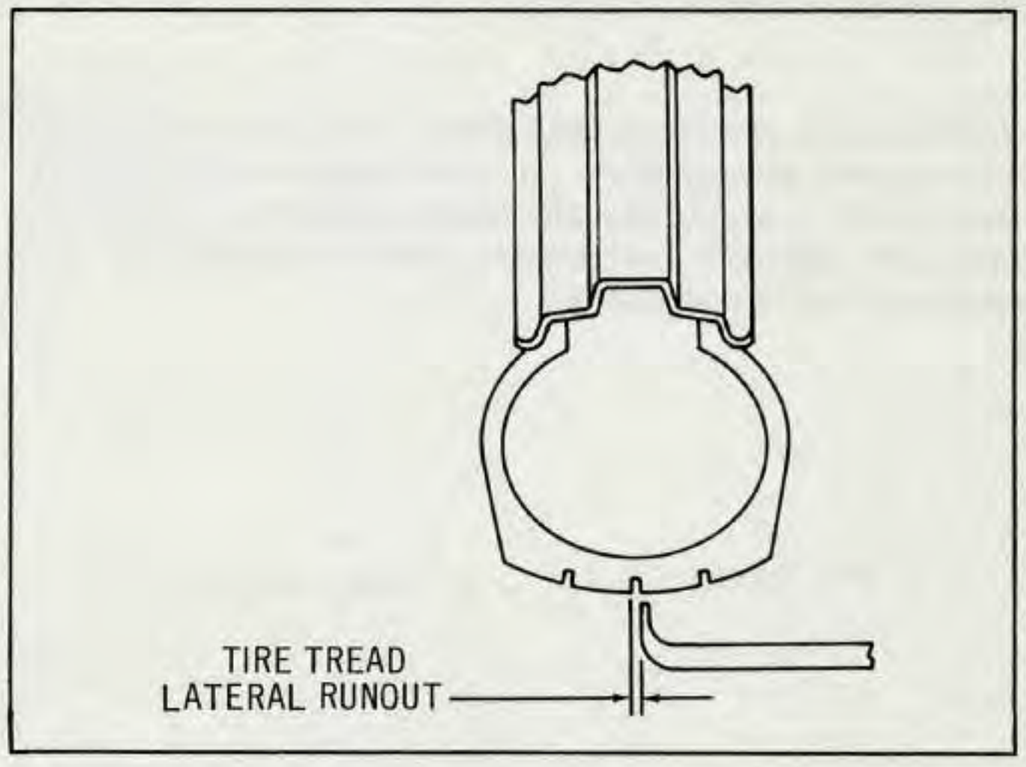


Figure 2C-20A. Checking Tire Lateral Runout

Tire tread runout should be no more than 3/64 in. If tire tread runout is more than 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.

CHECKING TIRE ROUNDNESS (RADIAL RUNOUT)

Check runout by turning wheel on axle, measuring tread runout (see Fig. 2C-20B).

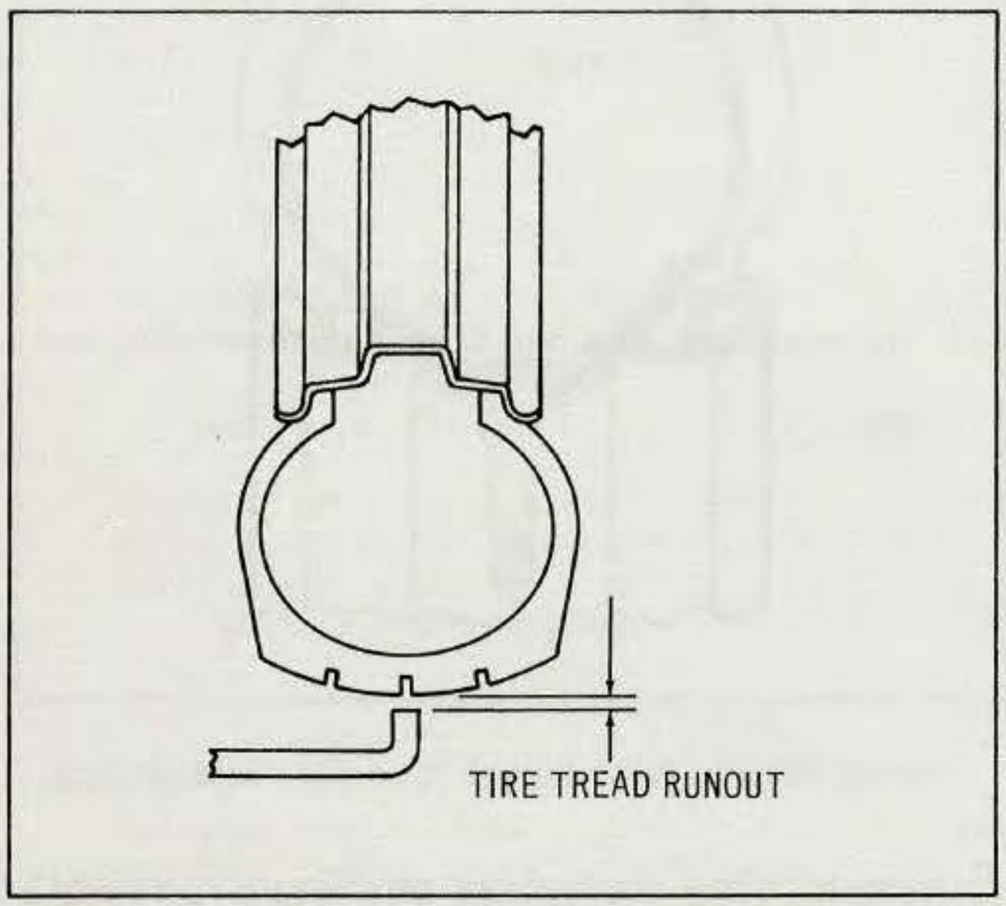


Figure 2C-20B. Checking Tire Radial Runout

Tire tread runout should be no more than 3/32". If tire tread runout is more than 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-20C). Adjust rear wheel in axle clips as necessary to correct misalignment.

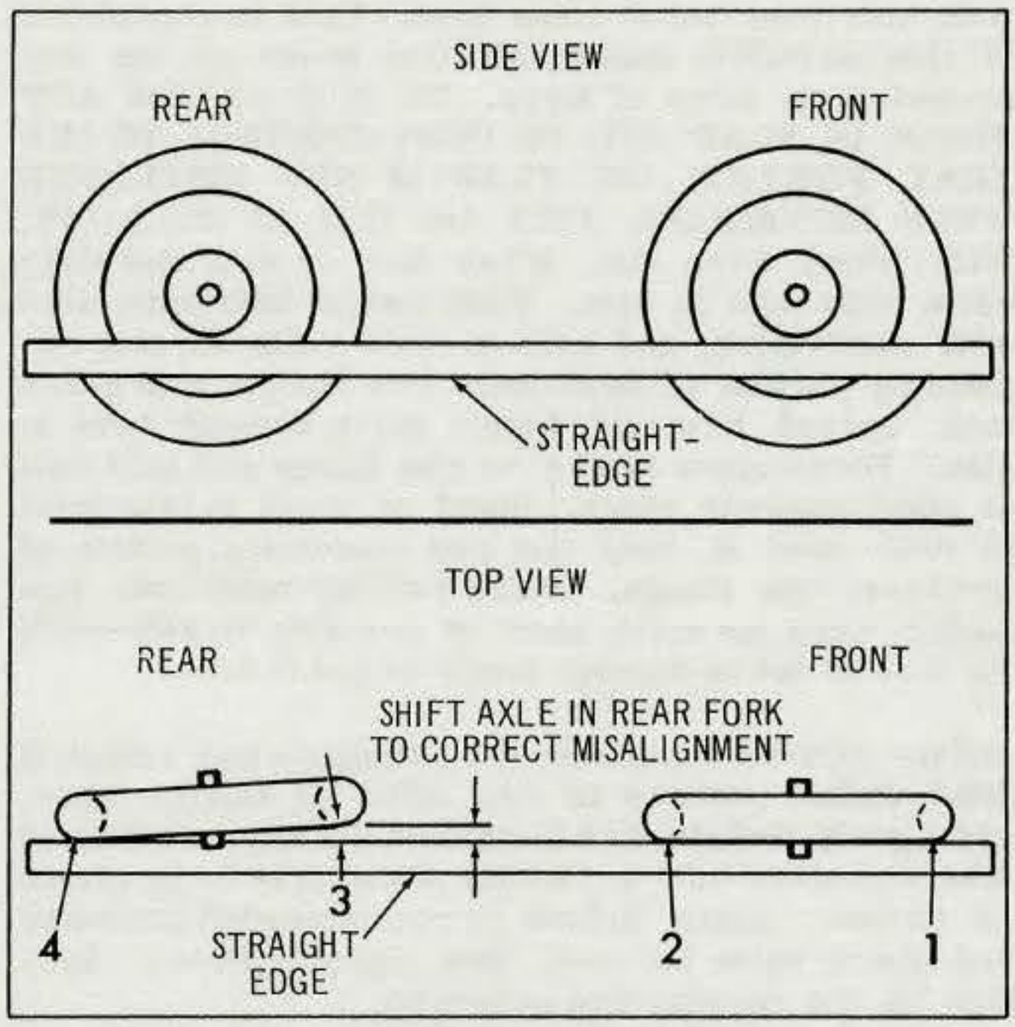


Figure 2C-20C. Wheel Alignment Diagram

HANDLEBAR

SERVICING HANDLEBAR CONTROLS

NOTE

Spark control information applies to models having manual spark advance.

To replace a damaged throttle or spark control coil and wire, proceed as follows:

DISASSEMBLY (Fig. 2D-4)

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

Remove handlebar end screw using a wrench and screwdriver as shown in Fig. 2D-3. Sometimes this screw is difficult to remove. In this case, insert a punch in screw slot and loosen screw by striking punch several sharp blows.

After removing grip sleeve assembly, (1, 2 and 3), working parts are accessible. Remove roller pin (4) and rollers (5). Pull plunger (6) with control wire (8) attached, from handlebar end. Wire is fastened into end of plunger by means of a set screw (7). If wire is broken, remove other half from coil at carburetor and circuit breaker connection end.



Figure 2D-3. Removing Handlebar Controls

To free control coil (housing) from motorcycle, remove grip control parts as explained above. Then, remove the small lock screws underneath each handlebar side to free coil end plugs (9). Lock screw on left handlebar side is located underneath horn button. Loosen rear fork panels and handlebar clamp cover from the motorcycle. Remove control coil and end plug as a unit from each handlebar end.

INSPECTION AND REPLACEMENT OF PARTS

Clean all parts thoroughly removing all rust, dirt and gummy grease deposits, especially from plunger inside of grip and handlebar end. Inspect all parts, if any are worn or damaged, replace them.

ASSEMBLY (Fig. 2D-4)

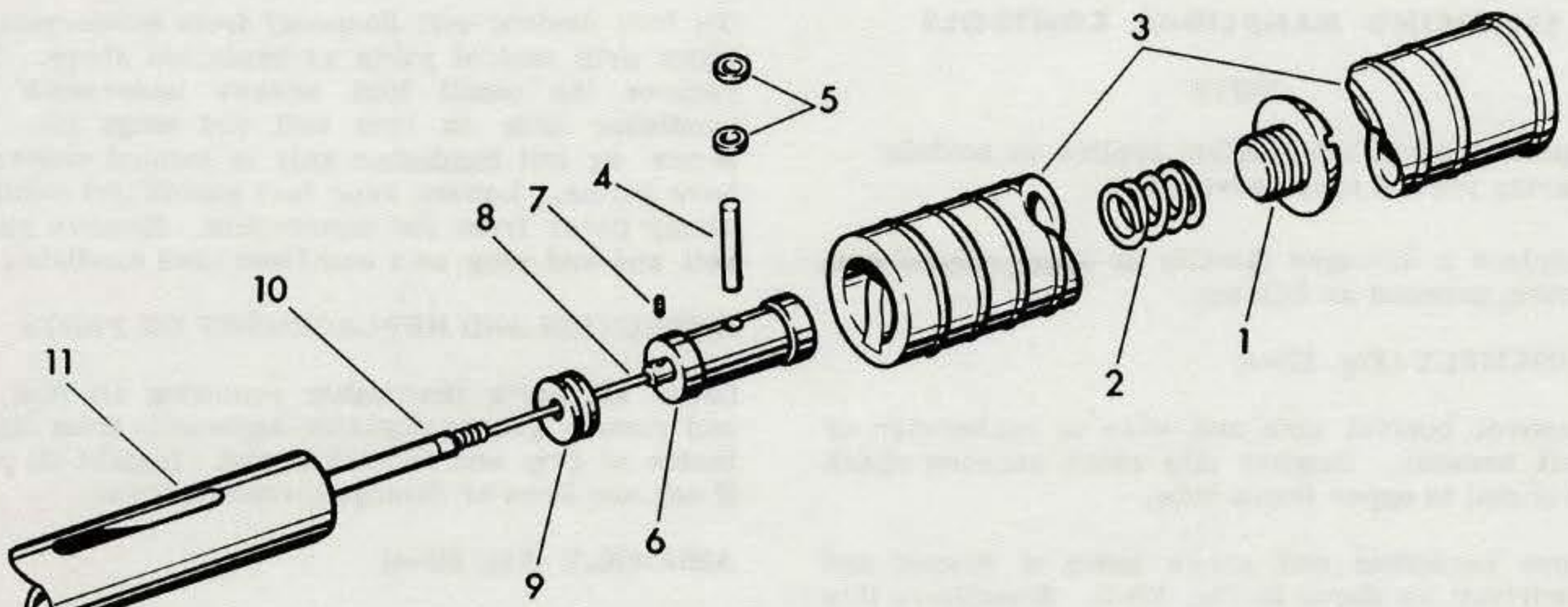
Assembly is essentially the reverse order of disassembly. If control coil has been removed from motorcycle make sure coil end plug (9) is correctly positioned in handlebar end with lock screw registered in groove of end plug.

Apply a light coat of grease or oil to control wire as it is inserted into coil. Insert two rollers (5) over roller pin (4), round side of roller up as positioned on motorcycle. Lubricate handlebar spirals with grease. See "Regular Service Intervals," Section 1B.

To start end screw (9) in handlebar, grasp grip sleeve assembly and apply slight pressure against screw as it is being started in handlebar end. This squares screw with end of grip sleeve, aligning threads. Tighten screw securely.

After throttle and spark controls are completely assembled, connect control coil and wire at carburetor and circuit breaker or magneto. Adjust throttle control so carburetor throttle lever closes and opens fully with grip movement. There should be about 1/4 in. between end of throttle control coil and carburetor control coil clip when throttle lever is in fully closed position against its stop.

With circuit breaker in fully advanced position, end of spark control wire should align directly with hole in circuit breaker or magneto connection. Allow about 1-1/2 in. of spark control coil to extend beyond clamp. Adjust spark control so circuit breaker or magneto advances and retards fully with spark control grip movement.



1. Handlebar end screw
2. Handlebar end screw spring
3. Handlebar grip sleeve
4. Control coil plunger roller pin
5. Control coil plunger roller (2)
6. Control coil plunger
7. Control coil set screw
8. Control wire
9. Control coil end plug
10. Control coil
11. Handlebar end

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

Figure 2D-4. Handlebar Controls - Exploded View

HANDLEBAR

SERVICING HANDLEBAR CONTROLS

NOTE

Spark control information applies to models having manual spark advance.

To replace a damaged throttle or spark control coil and wire, proceed as follows:

DISASSEMBLY (Fig. 2D-4)

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

Remove handlebar end screw using a wrench and screwdriver as shown in Fig. 2D-3. Sometimes this screw is difficult to remove. In this case, insert a punch in screw slot and loosen screw by striking punch several sharp blows.

After removing grip sleeve assembly, (1, 2 and 3), working parts are accessible. Remove roller pin (4) and rollers (5). Pull plunger (6) with control wire (8) attached, from handlebar end. Wire is fastened into end of plunger by means of a set screw (7). If wire is broken, remove other half from coil at carburetor and circuit breaker connection end.



Figure 2D-3. Removing Handlebar Controls

To free control coil (housing) from motorcycle, remove grip control parts as explained above. Then, remove the small lock screws underneath each handlebar side to free coil end plugs (9). Lock screw on left handlebar side is located underneath horn button. Loosen rear fork panels and handlebar clamp cover from the motorcycle. Remove control coil and end plug as a unit from each handlebar end.

INSPECTION AND REPLACEMENT OF PARTS

Clean all parts thoroughly removing all rust, dirt and gummy grease deposits, especially from plunger inside of grip and handlebar end. Inspect all parts, if any are worn or damaged, replace them.

ASSEMBLY (Fig. 2D-4)

Assembly is essentially the reverse order of disassembly. If control coil has been removed from motorcycle make sure coil end plug (9) is correctly positioned in handlebar end with lock screw registered in groove of end plug.

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To start end screw (9) in handlebar, grasp grip sleeve assembly and apply slight pressure against screw as it is being started in handlebar end. This squares screw with end of grip sleeve, aligning threads. Tighten screw securely.

After throttle and spark controls are completely assembled, connect control coil and wire at carburetor and circuit breaker or magneto. Adjust throttle control so carburetor throttle lever closes and opens fully with grip movement. There should be about 1/4 in. between end of throttle control coil and carburetor control coil clip when throttle lever is in fully closed position against its stop.

With circuit breaker in fully advanced position, end of spark control wire should align directly with hole in circuit breaker or magneto connection. Allow about 1-1/2 in. of spark control coil to extend beyond clamp. Adjust spark control so circuit breaker or magneto advances and retards fully with spark control grip movement.

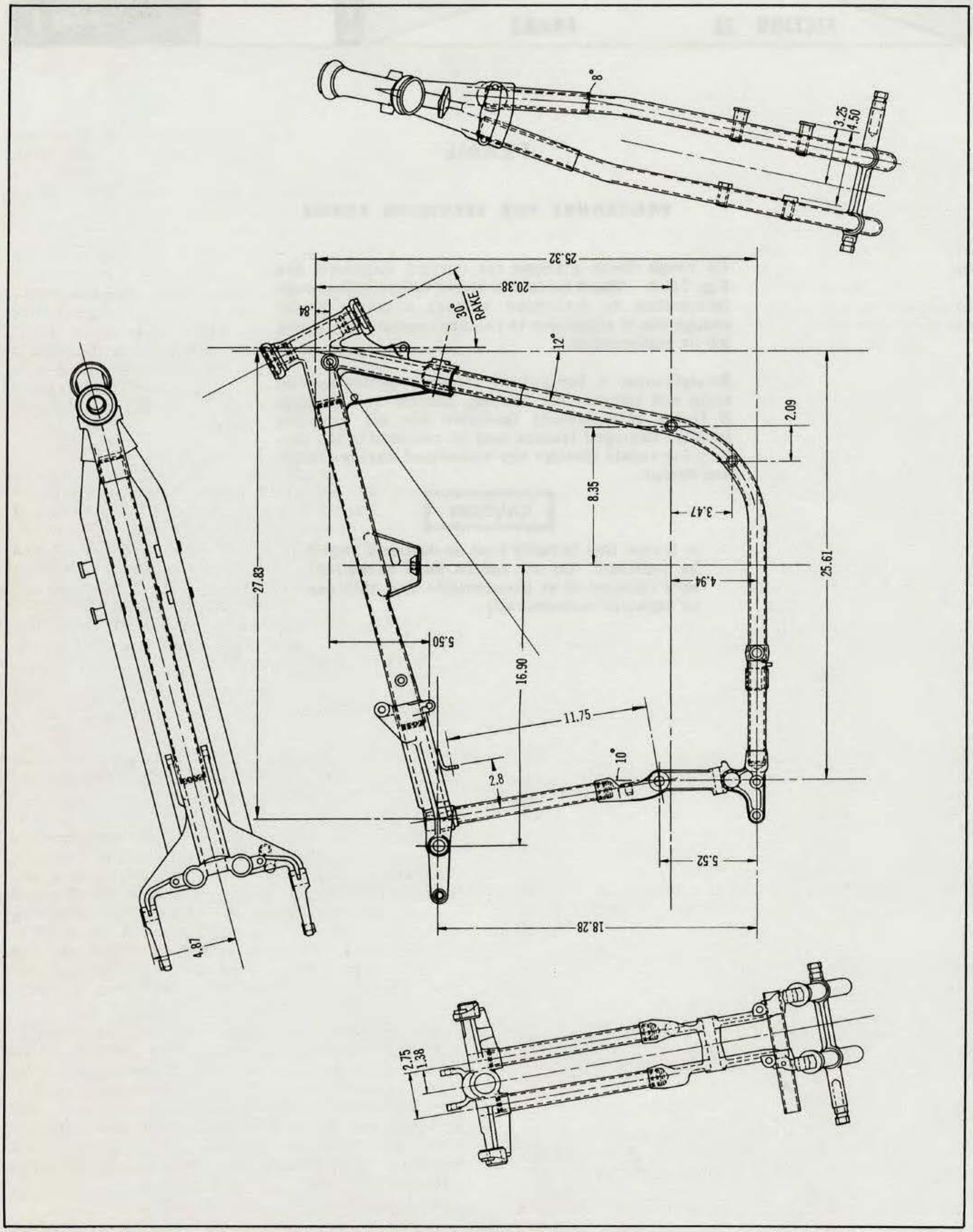


Figure 2E-2. Frame with Basic Dimensions

FRAME

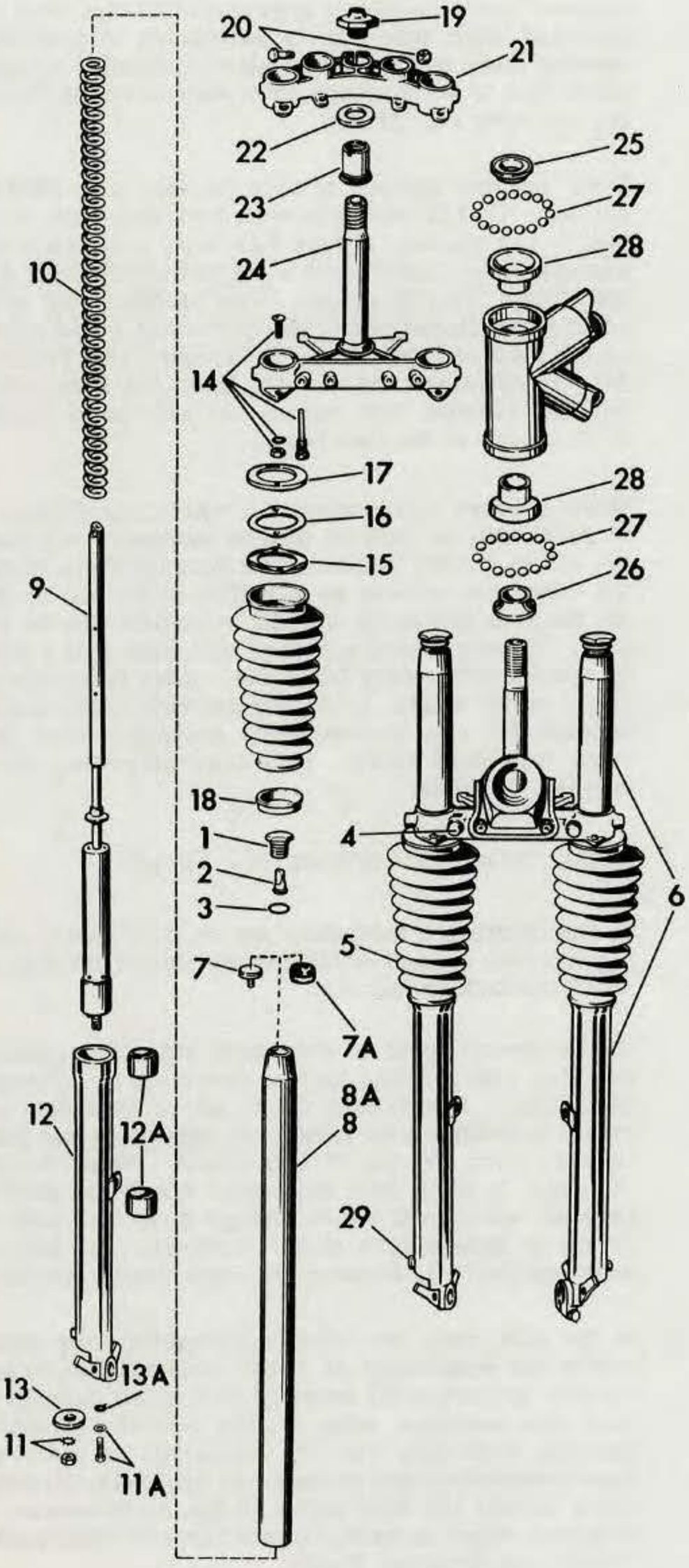
PROCEDURE FOR SERVICING FRAME

To rough check a frame for correct alignment see Fig. 2E-2. The dimensions shown will provide enough information to determine whether a frame is far enough out of alignment to require a major re-aligning 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 any authorized Harley-Davidson dealer.

CAUTION

A frame that is badly bent or damaged should be replaced. Do not return them to the factory because it is questionable that they can be repaired economically.



1. Tube cap
2. Tube breather valve
3. Tube cap seal
4. Pinch bolt
5. Fork boot
6. Fork side
7. Piston rod retainer (1967 & earlier)
7A. Spring retainer (1968)
8. Fork tube (1967 & earlier)
8A. Fork tube and shock absorber assembly (1968)
9. Shock absorber (1967 & earlier)
10. Fork spring
11. Tube end nut and shakeproof washer (1967 & earlier)
11A. Tube end bolt and washer (1968)
12. Fork slider
12A. Fork slider bushing (2)
13. Shock absorber gasket (1967 & earlier)
13A. O-Ring (1968)
14. Vent screw and plain screw
15. Boot retainer (upper)
16. Boot gasket
17. Boot retaining disc
18. Boot retainer (lower)
19. Stem sleeve end
20. Upper bracket pinch bolt and nut
21. Upper bracket
22. Upper bracket spacer
23. Stem sleeve
24. Stem and bracket assembly
25. Upper bearing cone
26. Lower bearing cone
27. Ball bearings (28)
28. Steering head cups (2)
29. Drain plug

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

Figure 2F-21. Front Fork and Steering Head - Exploded View

FORKS

SERVICING FRONT FORK

CHANGING FORK OIL

The hydraulic 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.

To drain fork sides, remove fork tube cap as described in "Disassembling Front Fork." Remove drain plug (29, Fig. 2F-21) from lower end of fork slider. Loosen tube end nut or bolt (11 or 11A, Fig. 2F-21) several turns. With a screwdriver move shock absorber up and down to loosen any sediment in bottom of fork slider, so oil will run free from drain.

After each fork side is drained and drain plugs have been installed, forks can be refilled by using an improvised filler can.

To make a filler can, see Fig. 2F-22, and proceed as follows. Drill a dozen 1/4 in. holes in the bottom of a one quart tin can (2), near the outside edge. Then, 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.

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 1-3/8 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 (6) 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). Make an adapter (8) from an old fork tube cap, Part No. 45757-49. Break three stake locks securing breather valve and remove valve from cap. Drill a 1/2 in. hole through cap and plug the vent hole. Assemble adapter (8) to top of fork and insert rubber plug (7) into the adapter hole. Attach filler can to stopper with transparent flexible tubing (5) about 2 feet long.

Suspend filler can above motorcycle so that when improvised fork tube cap is assembled in fork filler opening there will be ample slack in flexible tubing to allow fork to work up and down without tubing becoming taut (see Fig. 2F-23).

Pour correct amount of fork oil into can, 1967 and earlier: (3-1/2 ounces in each fork side after draining; 4-1/2 ounces, if fork has been completely disassembled or flushed with a solvent and is dry.) 1968 and later: (4-1/2 ounces after draining or 5-1/2 ounces assembled dry.) The difference in the amount of oil required between a (DRY) and a (WET) fork is due to oil cling. Do not use more oil than recommended because the excess oil will cause leakage from the top of the fork tubes.

Work the 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 filler can serves as a baffle, no oil will be lost. As the fork moves up, oil will be sucked into the fork side. Usually working fork up and down 3 or 4 times is sufficient to empty filler can. After filler can appears to be empty, it is good practice to allow a few seconds for can to completely drain into hose, then work fork once more. This assures getting all oil into the fork side.

INSPECTION PROCEDURE (Fig. 2F-21)

If the hydraulic fork does not work properly or an appreciable amount of oil leakage should develop, inspect the fork as follows:

Check the oil level in each fork side by completely draining and refilling fork as described in "Changing Fork Oil." Insufficient oil in either fork side will result in faulty recoil action and excess oil will cause leakage from the top of fork tubes. When checking oil level in each fork side, also check for water in fork oil which will cause leakage from fork tube cap or oil to bypass fork slider bushings. Oil will appear emulsified, aerated or light brown in color.

If the fork does not function correctly after eliminating the possibility of water contamination or fork oil and incorrect oil level in fork sides, inspect the fork tube breather valve (2) for defective condition. Remove fork tube cap (1), submerge in water and blow compressed air through cap vent hole. Breather valve should not leak below 15 lbs. air pressure. If breather valve is faulty, renew valve as described in "Replacing Breather Valve."

If snubbing action of the front fork remains unsatisfactory, bottoms on compression, stops suddenly on recoil and does not operate smoothly after eliminat-

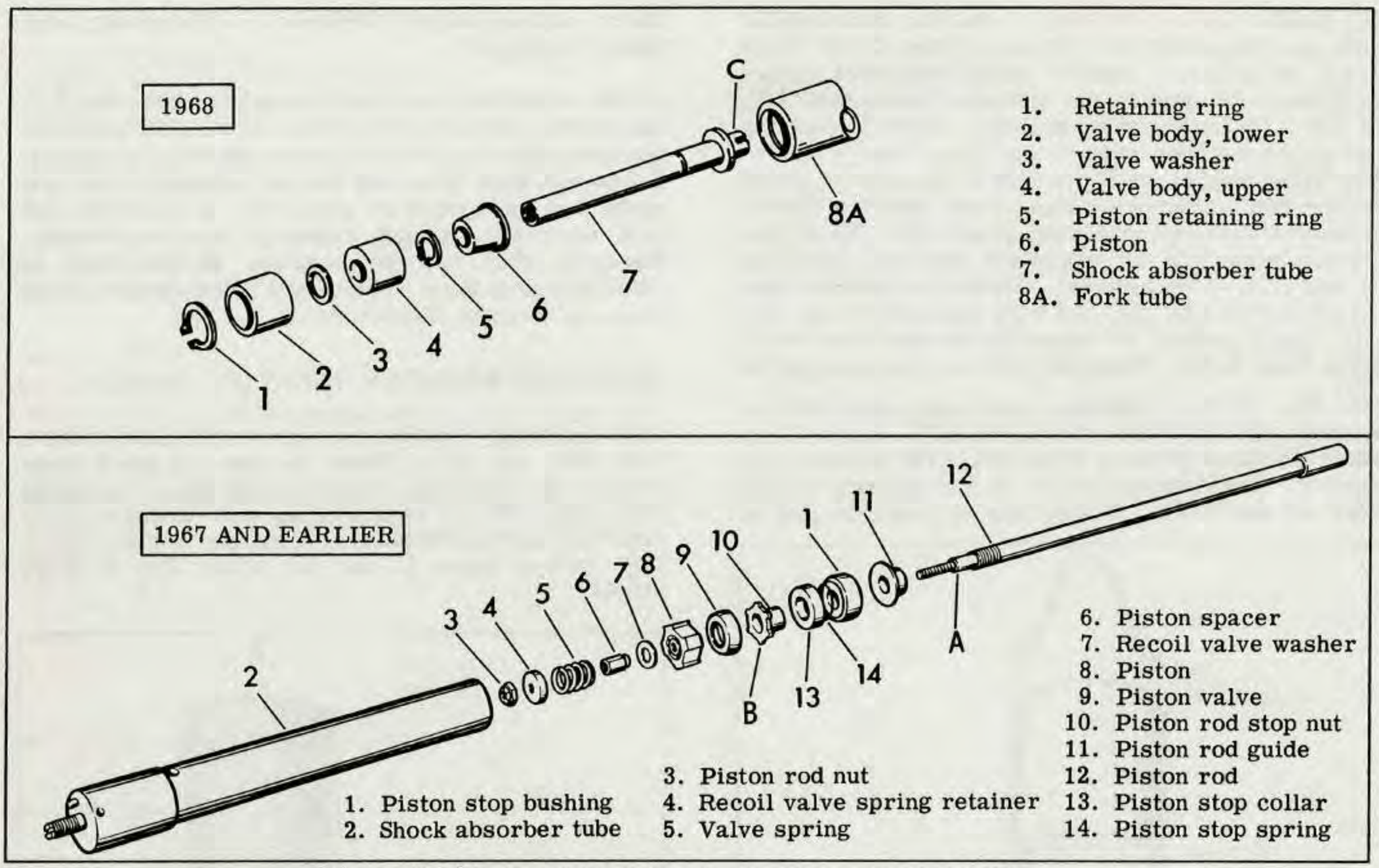


Figure 2F-24. Front Fork Shock Absorber - Exploded View

REPLACING FORK BOOT PARTS (Fig. 2F-21)

To replace fork boot parts that are damaged or worn, or to remove boot parts for straightening or replacement of fork stem and bracket assembly (24), proceed as follows: Free front fork sides from motorcycle as described in "Disassembling Front Fork." Remove fork boot plain screw and vent screw (14) and free retainer (15), gasket (16), and retaining disc (17). Lower retainer (18) is a light press fit in fork slider (12). Remove from slider by prying on retainer lip.

Assembly is the reverse order of disassembly. Start fork boot retainer by hand into the counterbore in upper end of fork slider. Insert the pilot end of oil seal driver, Part No. 96310-55, through fork boot retainer and into the upper fork slider bushing. With a soft hammer, use very light blows to drive fork boot retainer to bottom against the end of fork slider.

NOTE

If fork tube slider bushings (12A, Fig. 2F-21) are being replaced, install them before replacing lower fork boot retainer.

DISASSEMBLING FRONT FORK (Fig. 2F-21)

Remove front wheel and brake assembly as described in "Wheels," (2C), "Removing and Installing Front Wheel." Remove front fender and headlamp housing. Remove fork tube cap (1). Loosen fork tube pinch bolt (4) and stretch rubber fork boot (5) from upper retainer (15) lip. Remove fork side (6) complete. Use Wrench, Part No. 94694-52, and disassemble retainer (7 or 7A) from top of fork tube (8 or 8A). Note: On 1967 and earlier models, compress spring (10) and hold flat upper end of absorber (9) with vise grip pliers and turn piston rod retainer (7) from absorber (9). Remove spring (10) and drain hydraulic fork oil from fork tube. Turn assembly upside down and remove end nut and shakeproof washer (11) or bolt and washer (11A). On 1968 models it may be necessary to insert a long screwdriver or rod into 3/32 wide x 1/2 long slot C (Figure 2F-24) in upper end of shock absorber tube to keep it from turning while removing bolt (11A). Free slider (12) from tube (8 or 8A). On 1967 and earlier models, shock absorber (9) will come free.

DISASSEMBLING FRONT FORK SHOCK ABSORBER (Fig. 2F-24)

1967 and Earlier Models:
Disassemble front fork as described in "Disassembling Front Fork." Use Wrench, Part No. 94691-52, and remove fork piston stop bushing (1) from shock absorber tube (2). This bushing is a part of the shock absorber stop assembly consisting of fork piston rod bushing (1), spring (14), and stop (13). Each end of the spring is stake locked to the ends of stop (13) and rod bushing (1). Remove fork piston rod nut (3). Parts 4, 5, 6, 7, 8, 9, 10, 13, 14, 1 and 11 can now be removed from the fork piston rod (12).

1968 Models:
Shock absorber mechanism is part of fork tube (8A). To disassemble, remove retaining ring (1) with Tru-

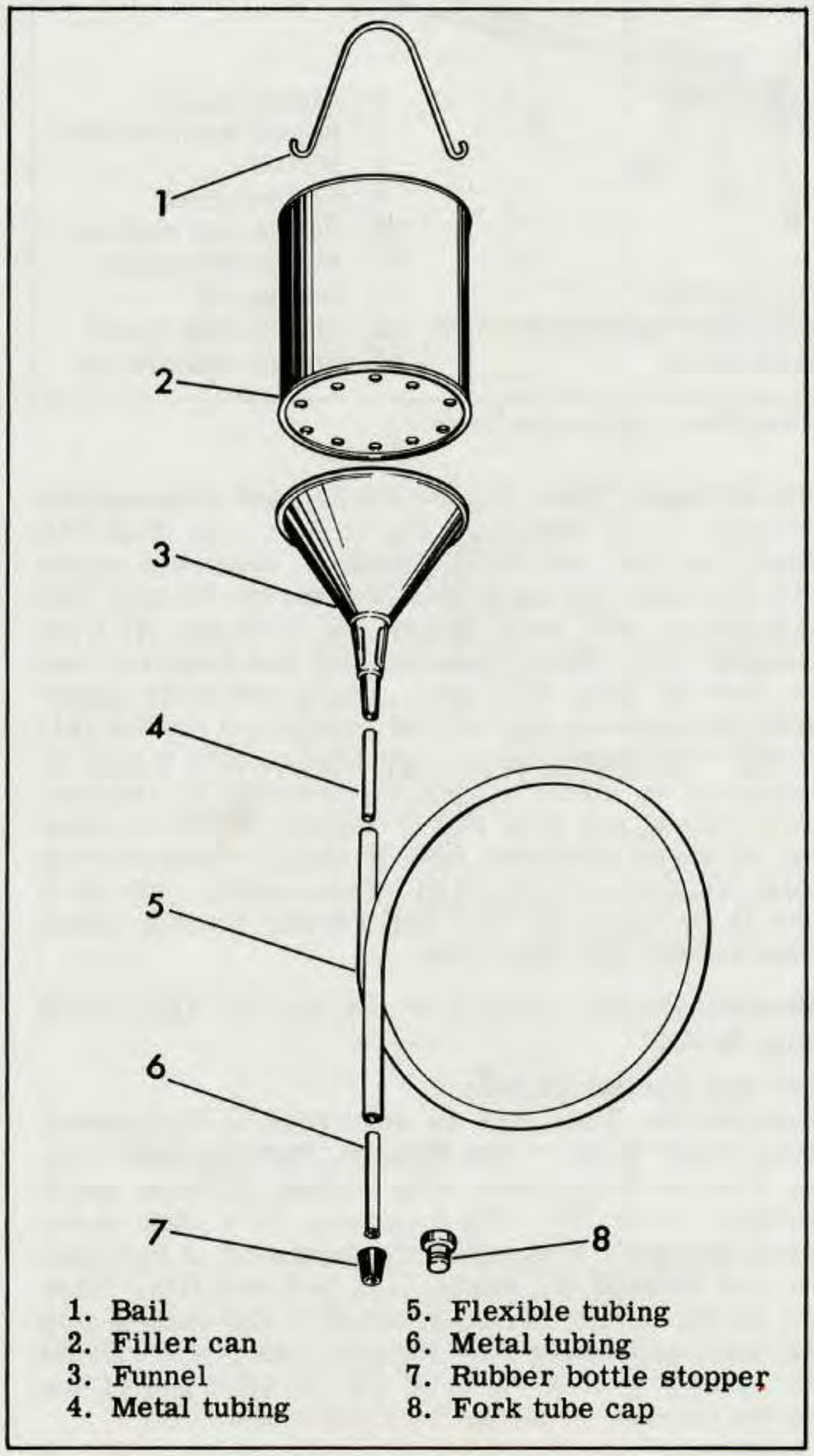
ing malfunctions previously covered, disassemble fork as described in "Disassembling Front Fork Shock Absorber." Inspect shock absorber giving particular attention to the following parts (see Fig. 2F-24): 1967 and earlier models: Check fork piston rod nut (3) for looseness on rod (12). Make sure recoil valve washer is not cocked in chamfer of piston spacer (6). Examine piston valve surface (9) for excessive wear and looseness in tube (2). Check piston rod guide (11) for excessive wear and looseness on rod (12). 1968 models: Check fit of damper piston (6) in fork tube (8A) and fit on shock absorber tube (7). Check seating of washer (3) on upper and lower valve body faces. Replace worn or damaged parts.

See Fig. 2F-21. Examine fork tube (8 or 8A) for scoring and badly worn sliding surface. Inspect fork slider bushings (12A) in fork slider (12) for wear and scoring. Insert tube (8 or 8A) in fork slider (12), and work up and down. If tube has appreciable play in slider, replace slider bushings. See "Removing Fork Slider Bushings."

If the front fork has been damaged, check the fork alignment. Inspect fork tubes and the fork stem and bracket assembly (24) for bent or damaged condition. Tubes and fork stem and bracket assembly, that are badly damaged, must be replaced. If fork tube and fork stem and bracket assembly are only slightly damaged, they can be repaired as described in "Straightening Fork Tubes," and "Straightening Fork Stem and Bracket Assembly."

REPLACING BREATHER VALVE (Fig. 2F-21)

Free headlamp housing from motorcycle and remove fork tube cap (1). Place in vise and break three stake locks securing breather valve (2). Free valve from cap. When reassembling, coat breather valve seat with DuPont Pliobond or a similar sealing agent. Seat rubber valve in cap and stake lock in three places.



1. Bail
2. Filler can
3. Funnel
4. Metal tubing
5. Flexible tubing
6. Metal tubing
7. Rubber bottle stopper
8. Fork tube cap

Figure 2F-22. Fork Filler Can Components - Exploded View

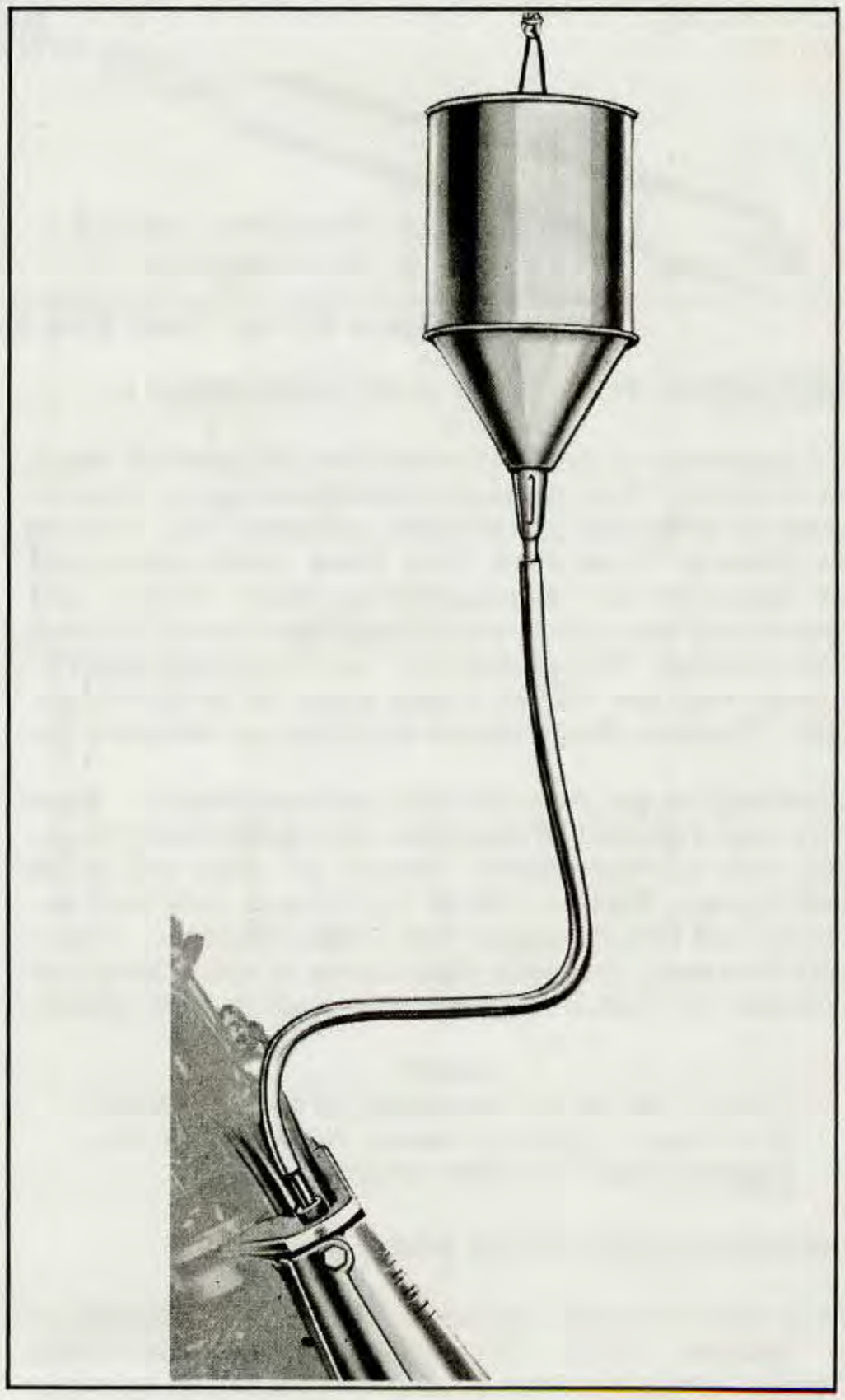


Figure 2F-23. Filling Hydraulic Fork with Oil

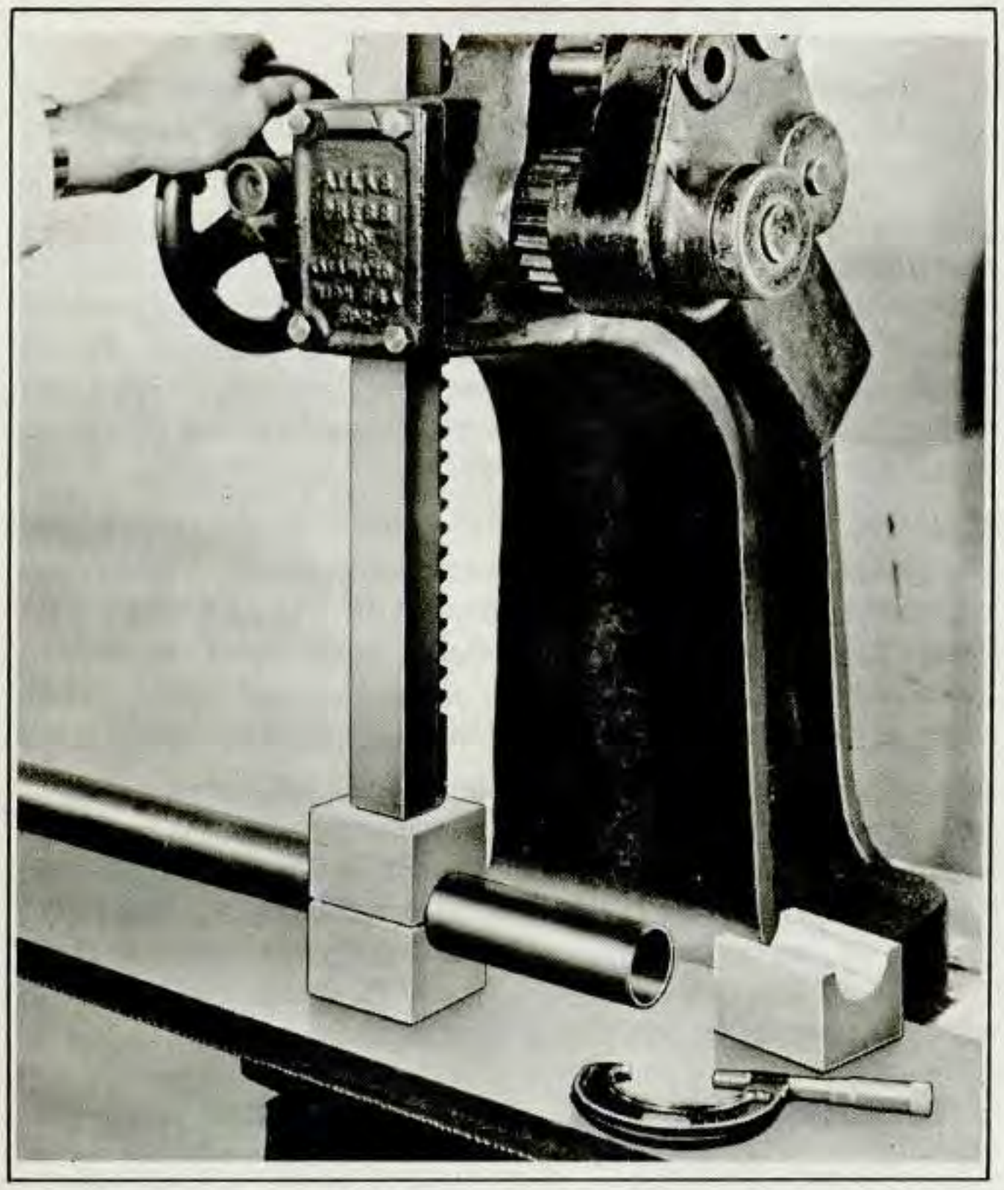


Figure 2F-27. Pressing Fork Tube Round

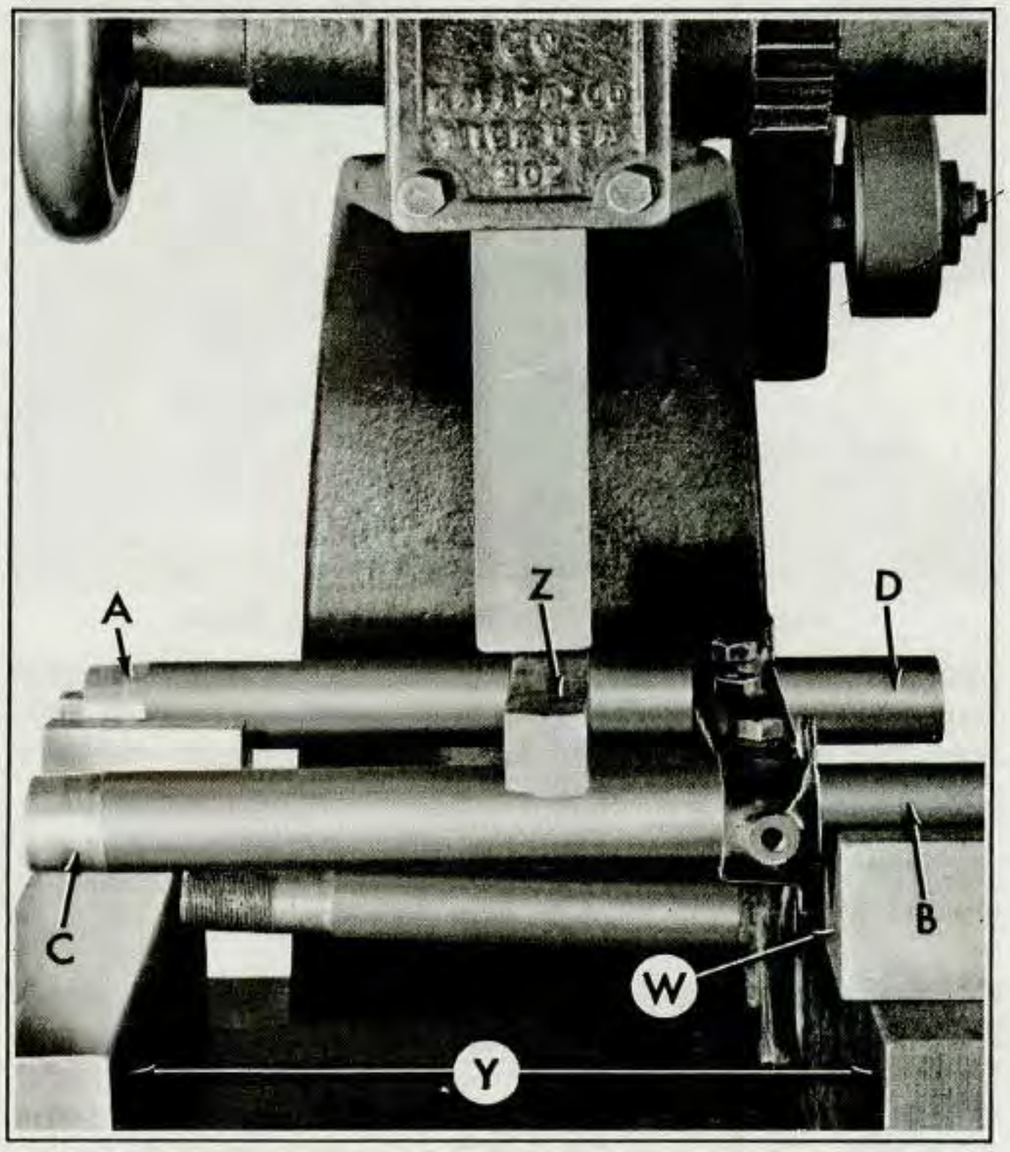


Figure 2F-28. Straightening Fork Stem and Bracket Assembly

to the factory through any authorized Harley-Davidson dealer. Do not attempt to repair fork stem and bracket assemblies that are badly bent or broken. These bracket assemblies should be scrapped.

Insert two steel gauging bars in the fork bracket and secure in place with two bracket pinch bolts as shown in Fig. 2F-28.

Sometimes the steel bars cannot be inserted into the bracket because the holes are distorted. In this case, press the bars into position using an arbor press. Then, press on the forward edge of bracket to correct "bow shaped" distortion (3) as shown in Fig. 2F-29. Repeat pressing operation until bar is loose in bracket. Secure in place with two pinch bolts.

A bracket assembly is usually out of alignment from a horizontal centerline (1) with both legs bent or just one leg bent. (See Fig. 2F-29.)

If both legs are twisted, place bracket assembly in position on arbor press as shown in Fig. 2F-28. Place two straightening blocks under low legs (A and B). With press block (Z) placed straight across bracket assembly, press until legs (C and D) are forced down and into alignment with legs (A and B).

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

Place the fork stem and bracket assembly on the four straightening blocks located on the surface plate, (Fig. 2F-30). If the legs rest squarely on straightening blocks, the bracket assembly is correctly trued.

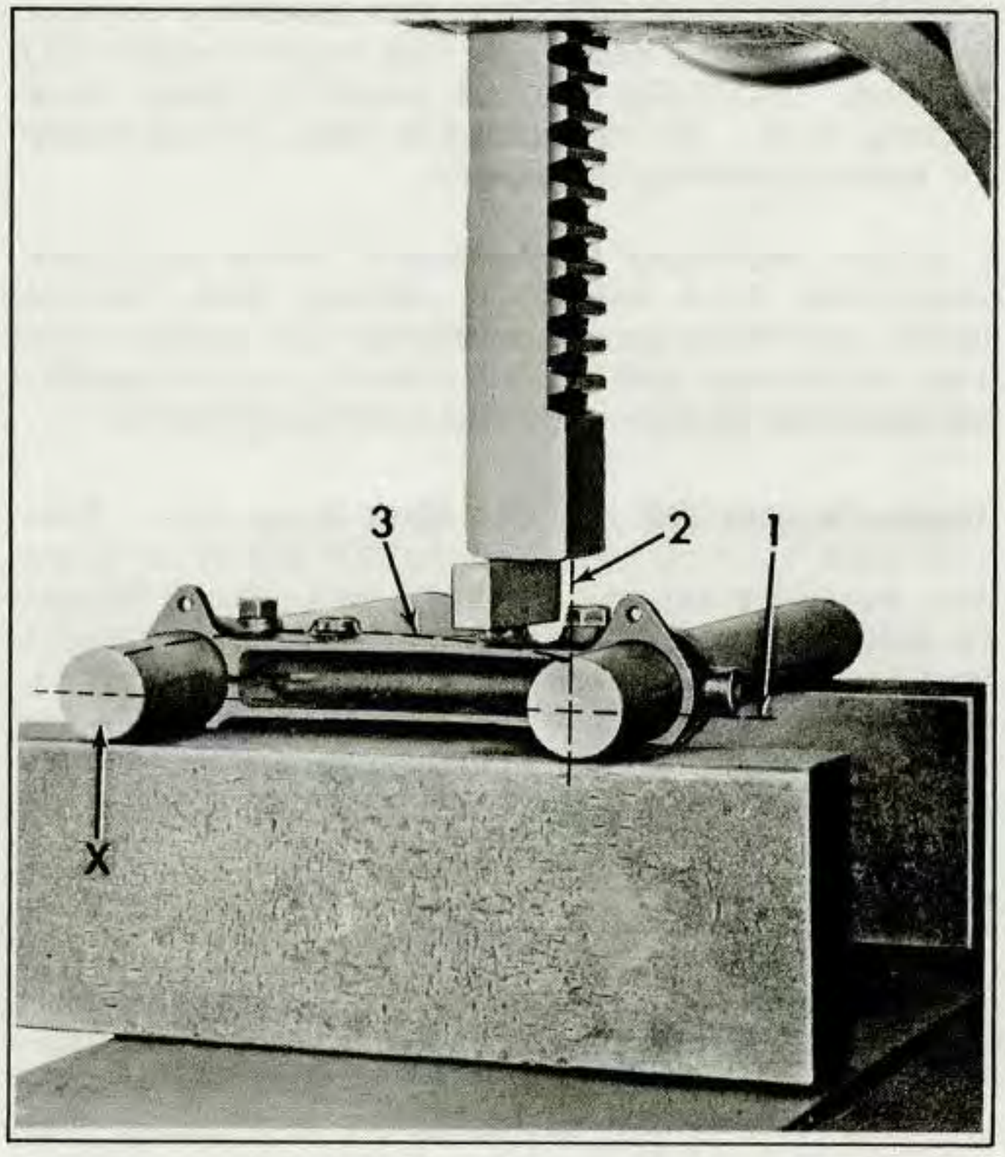


Figure 2F-29. Correcting Bracket Bow

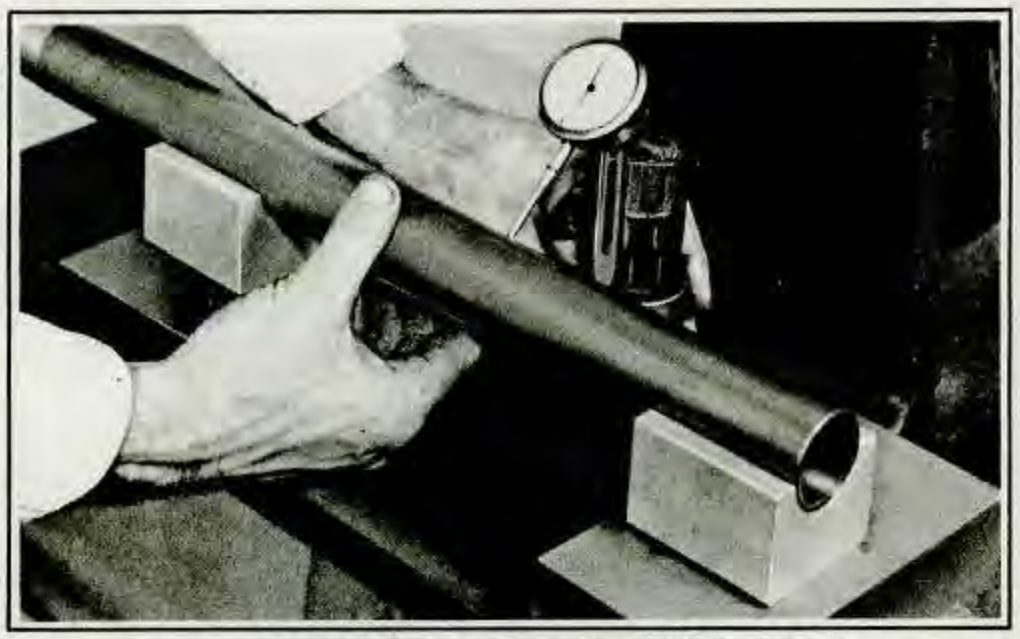


Figure 2F-25. Indicating High Point

arc pliers, Part No. 96215-49, and remove lower valve body (2), washer (3) and upper valve body (4). Remove shock absorber tube (7) and remove retaining ring (5) and piston (6).

REMOVING FORK STEM AND BRACKET ASSEMBLY FROM STEERING HEAD (Fig. 2F-21)

Disconnect wires from panel. Remove front wheel and brake assembly as described in "Removing and Installing Front Wheel." Remove front fender and headlamp housing. Remove fork tube cap (1). Loosen fork tube pinch bolt (4) and loosen fork boot (5) from upper retainer (15) lip. Remove fork side (6) complete. Remove handlebar clamp cover. Remove fork panels.

Remove headlamp and bracket as a unit. Disconnect speedometer cable from speedometer head.

Remove fork stem sleeve end (19) and loosen fork upper bracket pinch bolt (20). Lift handlebar assembly from steering head with fork upper bracket (21) attached. Carefully position assembly away from working area. Be careful not to bend control cables and wires more than necessary.

It is not necessary to disconnect clutch and brake handlevers from handlebar, wiring from ignition switch and wiring panel, or throttle and spark cables from carburetor and circuit breaker, unless handlebar assembly is to be removed from motorcycle.

Remove washer (22) and fork stem sleeve (23). Free fork stem and bracket assembly (24) and at the same time carefully remove bearing cones (25 and 26) and 28 ball bearings (27) from steering head. Inspect bearings, cones and cups for wear. If worn or pitted, replace. If necessary to remove head cups (28), insert a piece of bar stock through upper cup to drive against lower cup. Reverse operation to remove upper cup.

STRAIGHTENING FORK TUBES

Straightening fork tubes requires several special tools including a hydraulic or arbor press, dial indicator and straightening blocks. If facilities are not available locally for straightening fork tubes, they may be returned to the factory through any authorized Harley-Davidson dealer.

NOTE

Do not attempt to straighten a fork tube that has a sharp angle bend. These tubes should be scrapped because the metal is stretched.

Before beginning the straightening operation, clean the fork tube. Locate bends with a dial indicator as shown in Fig. 2F-25. (A fork tube is usually bent in two or three places - seldom one place.) Then, place fork tube on straightening blocks. Using an arbor or hydraulic press, straighten tube as much as possible as shown in Fig. 2F-26.

See Fig. 2F-25. With a dial indicator find the highest point out of round and mark with chalk. Press on high point of fork tube as shown in Fig. 2F-26. Repeat pressing operations until fork tube is within .003 to .004 in. of being straight. Always check with a dial indicator after each pressing operation.

Sometimes a fork tube is out of round, especially at the point it is clamped to the fork brackets. Place tube in straightening blocks as shown in Fig. 2F-27. Press until perfectly round and check with dial indicator or micrometer. Check fork tube by inserting into a new fork slider. Work tube up and down in slider, if it does not bind, it is straight.

STRAIGHTENING FORK STEM AND BRACKET ASSEMBLY (Fig. 2F-28)

Straightening a fork stem and bracket assembly not only requires a great deal of practice to become proficient, but also several special tools and fixtures, including an arbor press, surface plate or suitable heavy metal plate that is perfectly smooth, bending bar, four straightening blocks (W), two improvised steel gauging bars or legs 1-5/16 in. diameter x 12 in. length (X, Fig. 2F-29), two steel support blocks (Y), and several steel press blocks (Z).

If facilities are not available locally for straightening fork stem and bracket assemblies, they may be sent

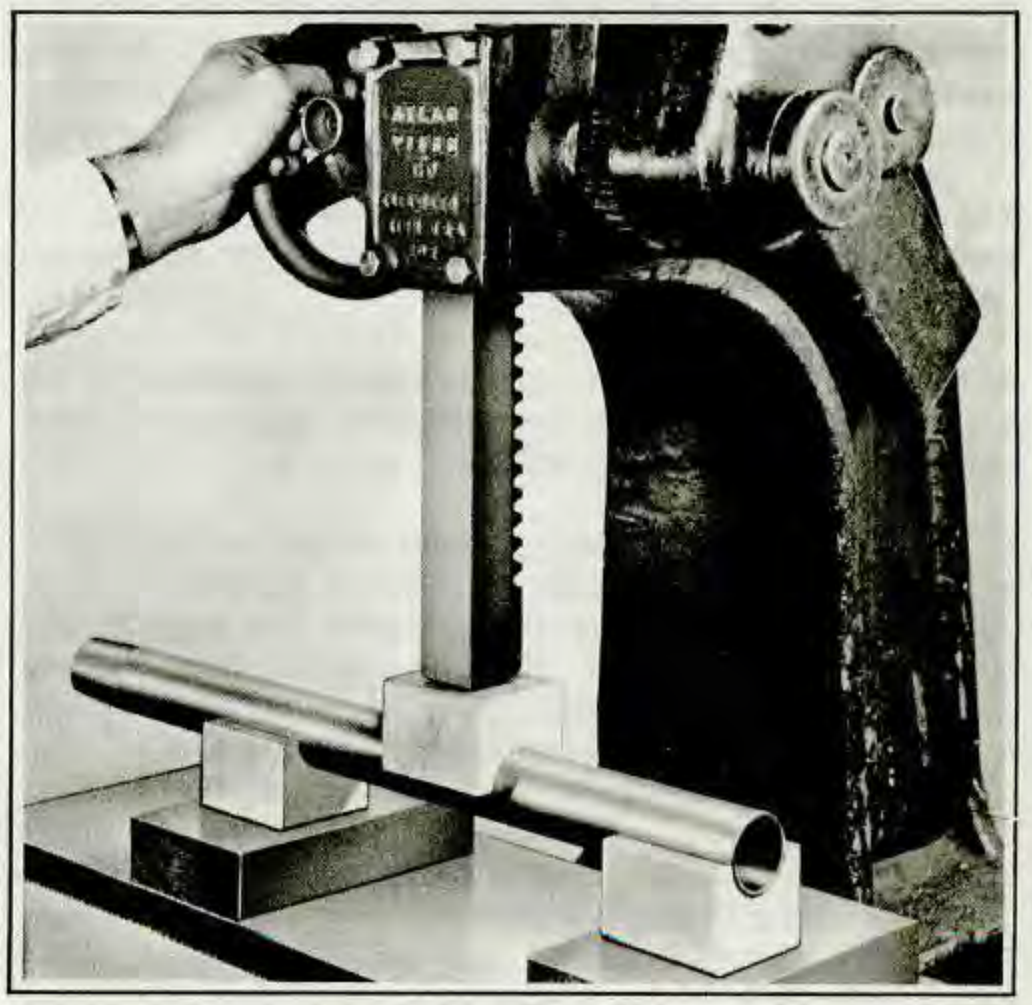


Figure 2F-26. Pressing High Point



1. Fork slider bushing puller and cap
2. Fork slider bushing driver and guide
3. Fork slider bushing reamer and pilots

Figure 2F-33. Fork Rebushing Tools

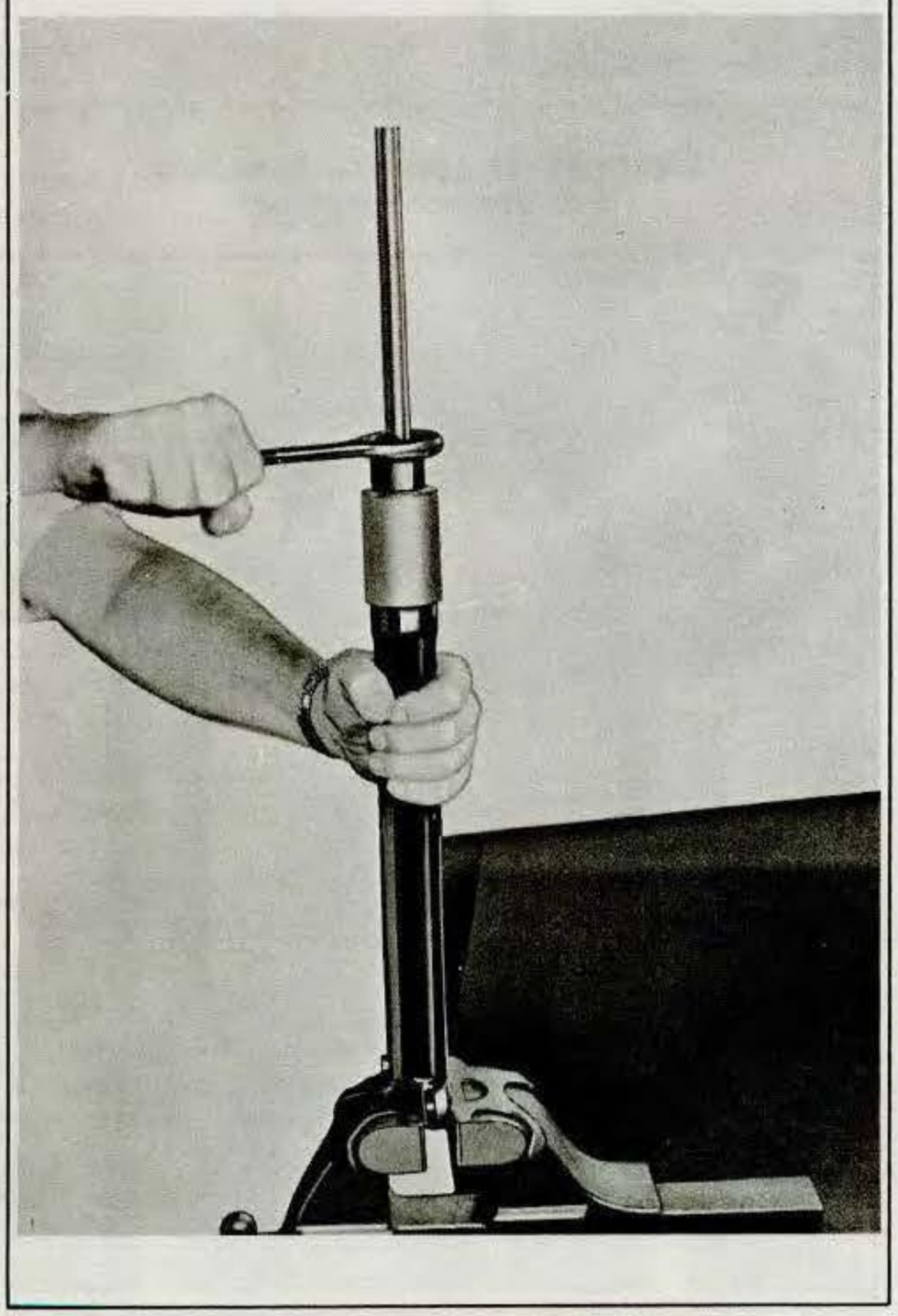


Figure 2F-34. Removing Fork Slider Bushing

NOTE

If the lower bushing is driven into the fork slider farther than specified, it will contact the bottom of the counterbore at lower end of fork bushing and bushing may be collapsed to the extent that it cannot be finish reamed.

When installing upper fork slider bushing, follow the same procedure used to install lower fork slider bushing. The upper fork slider bushing is driven into the fork slider the correct depth when the lower groove on the bushing driver is aligned with the top edge of the bushing guide.

REAMING FORK SLIDER BUSHINGS (Fig. 2F-36)

Fig. 2F-36 shows reamer with long pilot attached as required for reaming upper bushings to finish size. The long pilot is of correct size to fit into the unfinished lower bushing and guide the reamer through the upper bushing.

CAUTION

Do not drop cutting edges of the reamer into bushing.

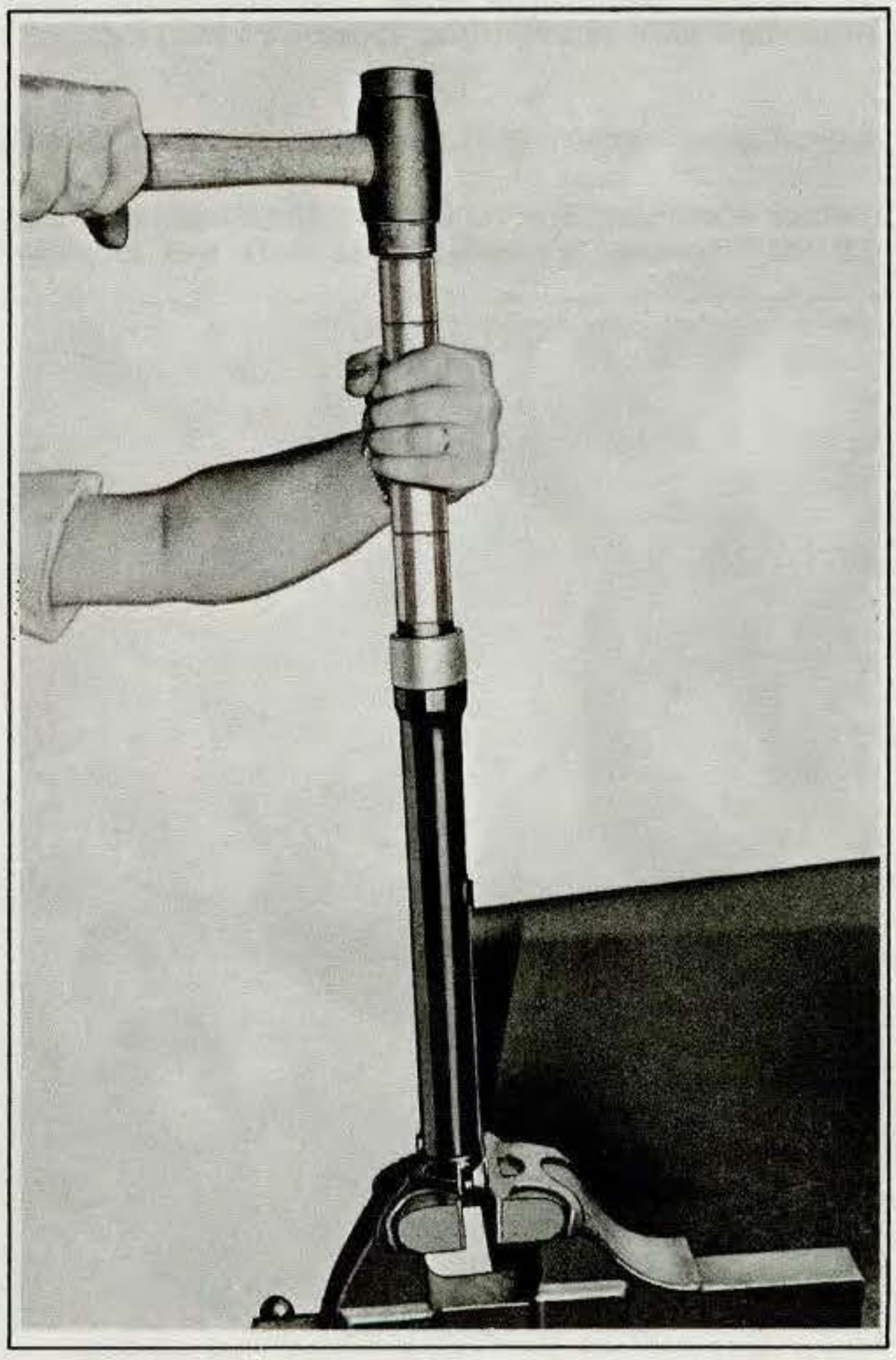


Figure 2F-35. Installing Fork Slider Bushing

If bracket is not true, press again, checking alignment after each operation.

Use a square and check to see if bracket assembly is bent or distorted (to either side) as shown in Fig. 2F-31. If so, place in vise and straighten, using Bending Bar, Part No. 96806-40, as shown in Fig. 2F-31.

Check to see if the fork stem is straight, [true on a vertical centerline (2, Fig. 2F-29)] by using a fork upper bracket as a gauge (Fig. 2F-32). If not, place in vise and use Bending Bar to bring into position.

REMOVING FORK SLIDER BUSHINGS

Insert the fork slider bushing puller and cap (1, Fig. 2F-33) into the fork slider a sufficient distance to allow the claws to extend below lower end of the upper fork slider bushing (12A, Fig. 2F-21). Place puller cap into oil seal counterbore. Apply oil to screw threads and steel thrust washer and turn nut down against puller cap to remove all slack from puller assembly. Use a Big Twin engine sprocket nut wrench and continue to turn nut against puller cap until bushing is removed (see Fig. 2F-34).

To remove lower fork slider bushing, follow same procedure used in removing upper fork bushing.

INSTALLING FORK SLIDER BUSHINGS (Fig. 2F-35)

Before installing new fork slider bushings (12A, Fig. 2F-21), thoroughly clean slider bore and lubricate with engine oil. Fork bushing driver and guide (2, Fig. 2F-33) is used to install fork slider bushings. Insert the bushing guide into the fork slider oil seal counterbore and insert the new lower fork slider bushing into the guide. The fork bushing driver has two grooves cut around its outside diameter which are used as depth gauges when driving in the bushings. The groove nearest the top of the driver is the depth gauge for the lower bushing, and the lower groove is the depth gauge for the upper bushing. The lower bushing is driven into the fork slider to the point where the upper groove on the bushing driver aligns with the top edge of the bushing guide.

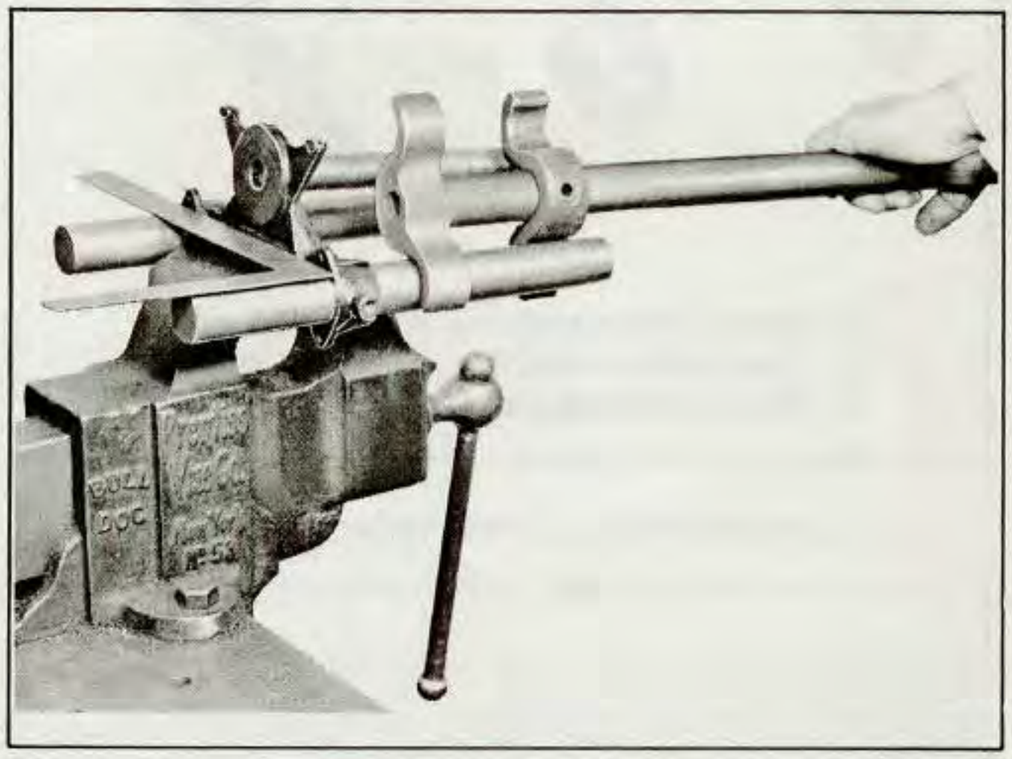


Figure 2F-31. Bending Fork Stem and Bracket Assembly

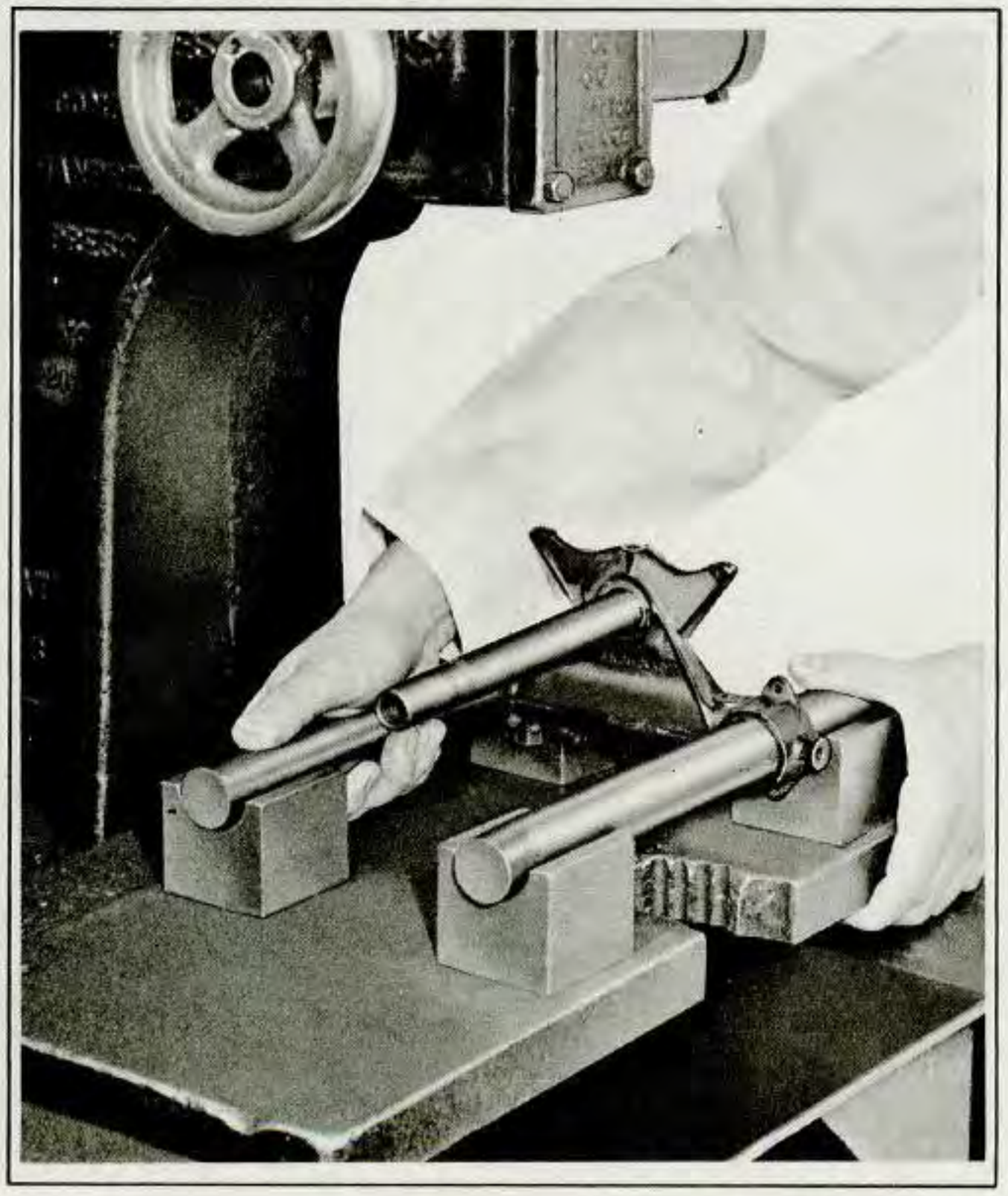


Figure 2F-30. Checking Bracket Alignment

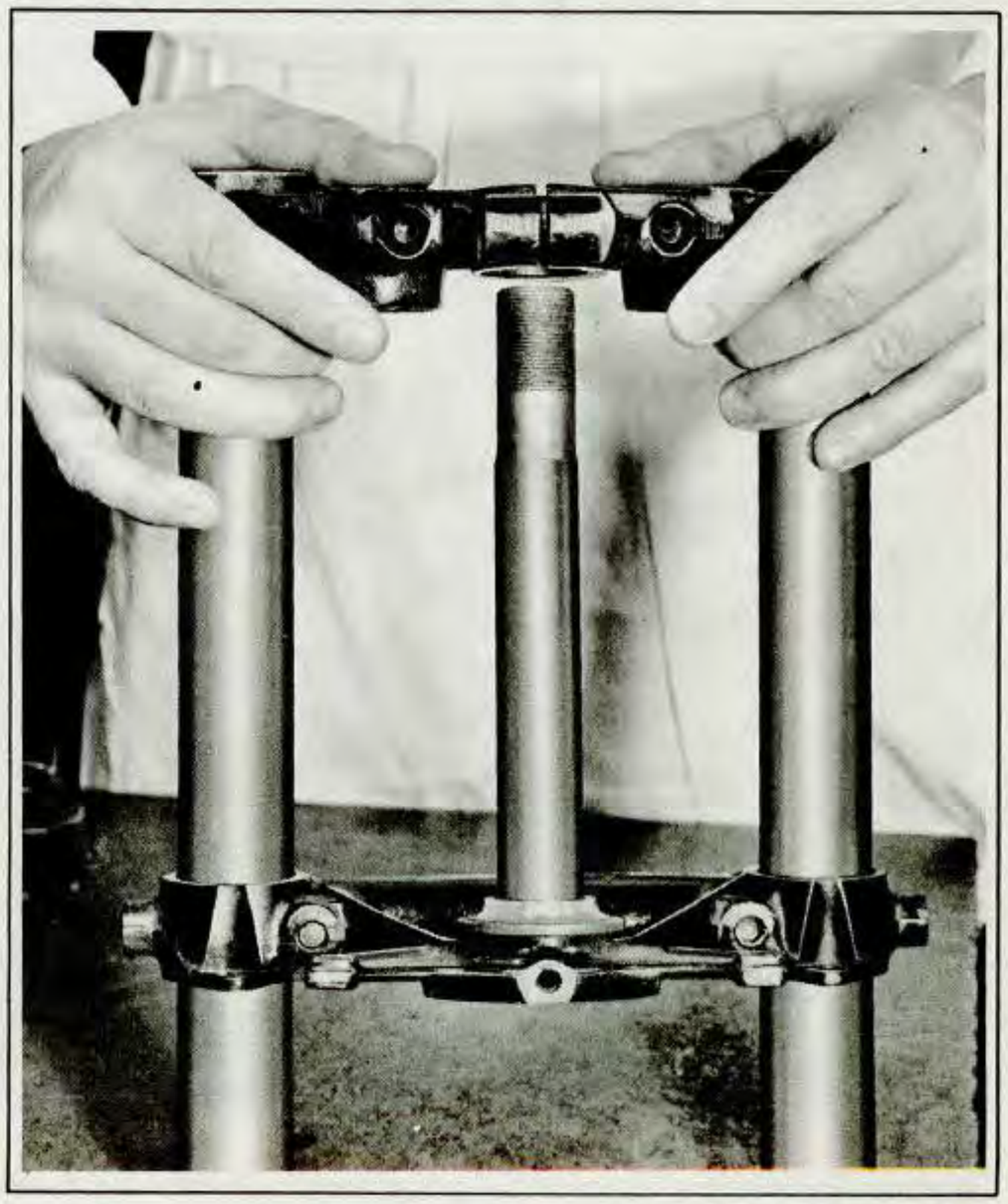
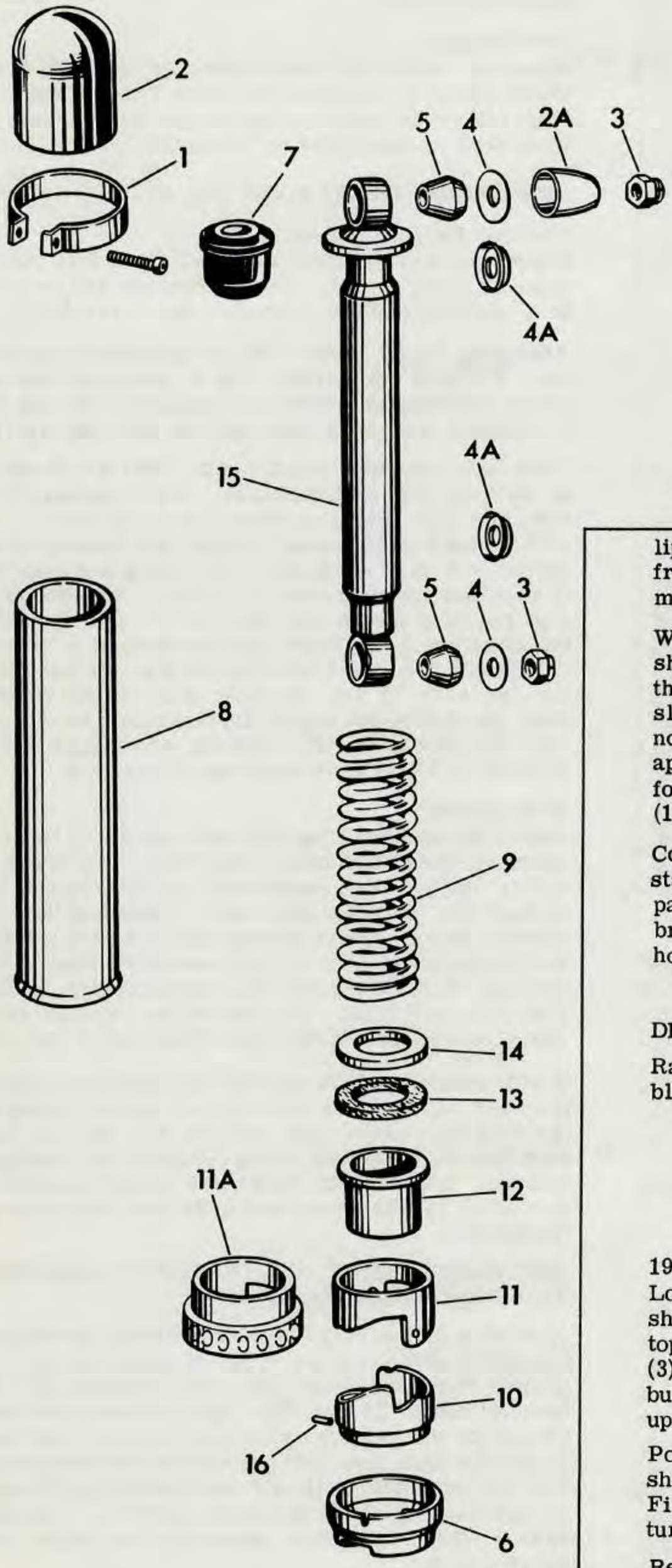


Figure 2F-32. Gauging Fork Stem



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 (2) (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. Dirt seal
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-37. 1966 & Earlier Rear Shock Absorber - Exploded View

lip of retainer (15). Install front fender. Install front wheel and brake assembly as described in "Removing and Installing Front Wheel," Section 2C.

With fork sides, wheel and fender reassembled, fork should have smooth free movement to either side. If there is any binding, slightly back off the fork stem sleeve (23) until it is correctly adjusted. Be sure not to back it off too much -- as there should be no appreciable shake or sideways movement of the front fork. Install and securely tighten the fork sleeve end (19) and the upper bracket pinch bolt and nut (20).

Connect speedometer cable to speedometer head. Install headlamp and wiring panel. Connect wires to panel terminals and ground wire to fork stem and bracket assembly. Install fork panels, headlamp housing, handlebar clamp cover and remaining parts.

REAR SHOCK ABSORBER AND REAR FORK

DISASSEMBLING REAR SHOCK ABSORBER

Raise rear end of motorcycle with stand or suitable blocking underneath frame.

NOTE

If blocking is not available work on only one shock absorber at a time, the other shock absorber will hold the rear fork and frame in place.

1966 and Earlier (Fig. 2F-37):
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.

Position shock absorber upside down in rear fork shock absorber tool, Part No. 97010-52A as shown in Fig. 2F-38. Compress absorber spring enough to turn lower stud eye 90° into the cam support slot.

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



Figure 2F-36. Reaming Fork Slider Bushing

Slowly start cut, turning reamer clockwise. When removing reamer after bushing is reamed, continue turning clockwise and apply a slight upward pressure to remove reamer from the finished bushing. Install the short reamer pilot, shown under 3, Fig. 2F-33, on reamer to ream the lower bushing. The Allen wrench provided with the tool set is used to tighten or loosen reamer pilots on the reamer body.

ASSEMBLING FRONT FORK SHOCK ABSORBER (Fig. 2F-24)

1967 and Earlier Models:

Assembly is essentially the reverse order of disassembly. Assemble parts on the fork piston rod (12) in the following order: Piston rod guide (11), piston collar (13), spring (14), bushing (1), and stop nut (10). Adjust stop nut (10) so that its face (B) measures .550 in. from point (A). Stake lock in four places around the center of the nut. Assemble piston valve (9), piston (8), recoil valve washer (7), piston spacer (6), valve spring (5), valve spring retainer (4) and piston rod nut (3). Using Wrench, Part No. 94691-52, turn the fork piston stop bushing (1) into the shock absorber tube (2) until the outer surface of the bushing is flush with the end of the shock absorber tube. Stake lock the threads of the bushing (1) through the small hole in the upper end of the shock absorber tube. Assemble front fork as described in "Assembling Front Fork."

1968 Models:

Assemble parts into shock absorber tube (8A) in reverse order of disassembly using Tru-arc retaining ring pliers to install rings in grooves. Assemble front fork as described in "Assembling Front Fork."

ASSEMBLING FRONT FORK (Fig. 2F-21)

1967 and Earlier Models:

Insert rod end of shock absorber (9) in fork tube (8) opposite tapered end. Place absorber and fork tube in a vertical position, absorber end screw facing up.

Assemble a new gasket (13) on end screw and dowel pin. Position fork slider (12) in place on tube end screw and turn until dowel pin registers with pin hole in slider. Assemble tube end nut and washer (11).

Turn tube assembly end for end. Pour 4-1/2 ounces of fork oil into each fork side. Insert spring (10) in fork tube (8). Using a brake rod or appropriate rod with a 5/16 x 24 thread, screw into threads of absorber rod end. Compress the spring and grip flats of absorber rod with vise grip pliers. Remove brake rod and turn piston rod retainer (7) into the end of the absorber rod. Stake lock the threads of retainer (7) through the small hole located near the top and on the flat side of the absorber rod. Using Wrench, Part No. 94694-52, install the piston rod retainer (7) into the fork tube (8). The top of retainer should measure 9/16 in. down from top of fork tube.

1968 Models:

Assemble slider (12) on fork tube and shock absorber assembly (8A). Use new o-ring (13A). Insert screwdriver or rod into upper end of fork tube to hold slotted end of tube (8A) while tightening bolt and washer (11A). Insert spring into fork side and pour 4-1/2 ounces of fork oil into each fork side. Using wrench, Part No. 94694-52, install spring retainer (7A) into fork tube. The top of the retainer should measure exactly 3/4 inch down from top of fork tube.

Install assembled fork side (6) into mounting brackets. Securely tighten fork tube cap (1) before tightening the fork tube pinch bolt. Secure fork boot in lip of retainer (15). Install front fender and headlamp housing. Install front wheel and brake assembly as described in "Removing and Installing Front Wheel," Section 2C.

INSTALLING STEM AND BRACKET ASSEMBLY, AND FORK SIDES (Fig. 2F-21)

Assembly of the fork stem and bracket assembly is essentially the reverse order of disassembly. Assemble the head cups (28), ball bearings (27) and bearing cones (25 and 26). Apply a heavy coating of grease to the bearings when positioned in head cups. Install the fork stem (24) and tighten fork stem sleeve (23) on fork stem until all appreciable play is taken up and bearing action is smooth and free. Assemble spacer (22), handlebar assembly and upper fork bracket (21).

Install fork sides (6) after assembly into mounting brackets. Securely tighten fork tube cap (1) before tightening fork tube pinch bolts. Secure fork boot in

(7) from retaining flange inside absorber cover (8). Remove shock absorber 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 shock absorber (15). Shock absorber bumper (7) is split and may be sprung and slipped off absorber piston shaft after it has been extended.

1967 and Later (Fig. 2F-37A):

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, 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-37A.

INSPECTION

Clean and inspect all parts for wear and damage, paying particular attention to the condition of the stud rubbers, the ride control adjustment cams, dirt seal, and spring. Examine absorber unit for traces of fluid leaking, especially at upper end. Unit should compress slightly easier than it extends. If possible, compare action with unused unit. Shock absorber cannot be repaired. Faulty units must be replaced.

ASSEMBLING REAR SHOCK ABSORBER

Assembly of the rear shock absorber is essentially the reverse order of disassembly.

1966 and Earlier (Fig. 2F-37):

Apply a thin coat of grease to the cam sleeve (12) and cam surface of spring rotating cam (11 and 11A), and slip cam over cam sleeve (12). Position cam support (6) over lower cam with 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 eye on surface to seat bumper in flange.

Place dirt seal washers (14) and dirt seal (13) into cover (8). Position assembly of cam support (6), lower cam (10), rotating cam (11 or 11A), and cam sleeve (12) over absorber. Compress spring in tool, as shown in Fig. 2F-38, and turn lower mounting stud eye 90° 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-37A):

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.

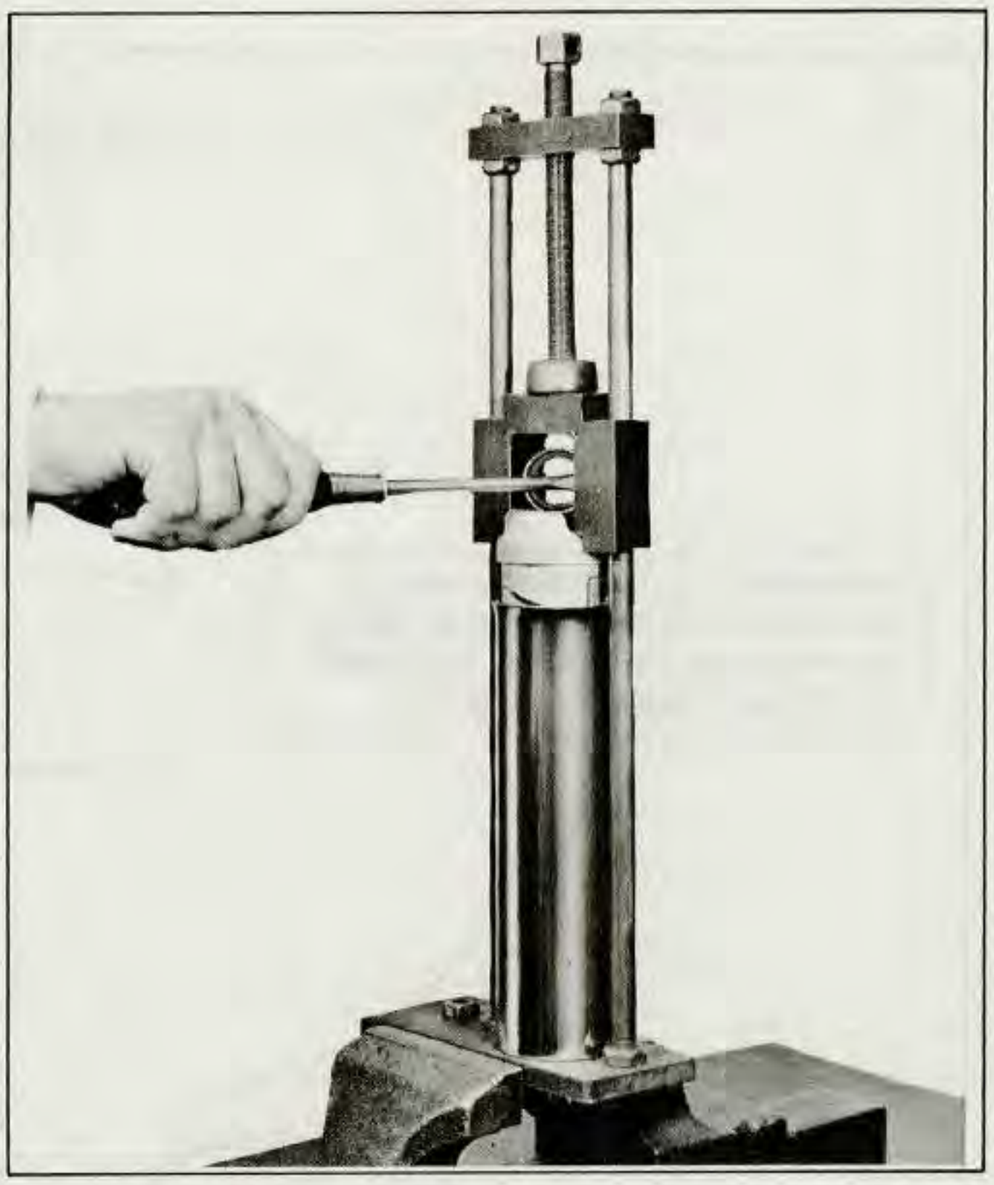


Figure 2F-38. Compressing Shock Absorber Spring (1966 & Earlier Shown)

2F-37A 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).

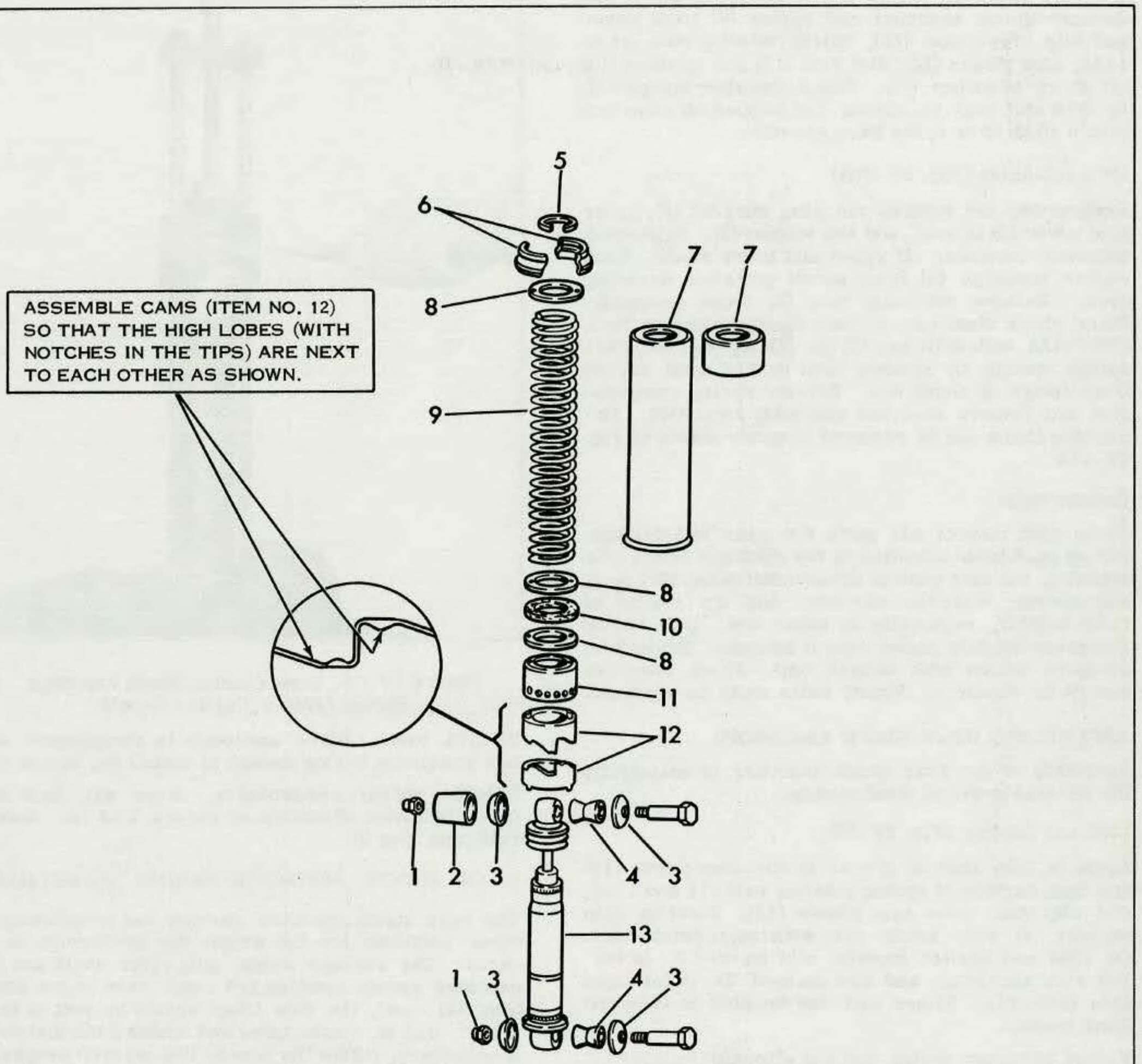
REAR SHOCK ABSORBER SPRING ADJUSTMENT

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 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 the other cam. To correct this condition, continue 180° in same direction until it falls off again and then adjust to desired position.



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

Figure 2F-37A. 1967 and Later Rear Shock Absorber - Exploded View

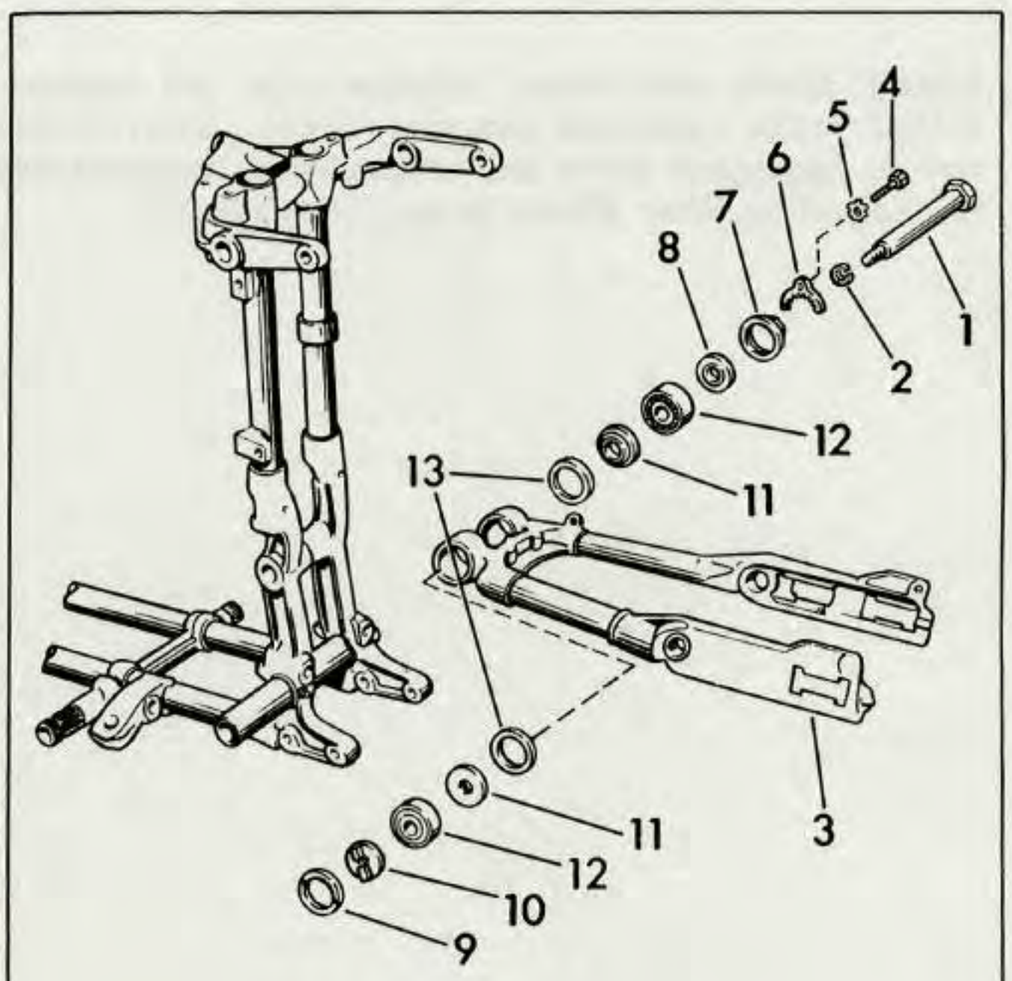
Insert bearing outer spacer (8), shoulder facing in. Assemble and tighten bearing lock nut - right (7), and then back off one full turn. Insert pivot bolt nut (10). With a punch, tighten bearing lock nut - left (9) until snug. Stake lock in three places. Position rear fork in place on motorcycle and at the same time position pivot bolt nut (10), shoulder in crankcase recess. With lock washer (2) in place, coat pivot bolt (1) with grease. Insert in rear fork assembly and tighten securely.

Weigh the extreme rear end of fork by attaching spring scale and raising fork to horizontal position with centerline of frame. Take scale reading and tighten lock nut - right (7) sufficient amount to provide from one to two pounds drag on the bearing. For example, if rear end of fork weighs three and one-half pounds with bearings free, bearings should be adjusted tight enough to increase weight of fork to four and one-half or five and one-half pounds as fork is lifted to horizontal position. Assemble screw (4), washer (5), and lock washer (6).

Install shock absorbers, exhaust pipe and muffler. Install brake assembly and rear wheel. Insert brake rod in operating lever and adjust brake as described in "Adjusting Rear Wheel Brake," Section 2G.

DISASSEMBLING REAR FORK (Fig. 2F-39)

Remove the rear wheel as described in "Removing and Installing Rear Wheel," Section 2C. Free brake rod from operating lever and remove brake assembly from motorcycle. Remove exhaust pipe and muffler. Disconnect shock absorbers from rear fork.



1. Pivot bolt
2. Bearing lock washer
3. Rear fork
4. Bearing screw
5. Shakeproof washer
6. Lock washer
7. Bearing lock nut - right
8. Outer spacer
9. Bearing lock nut - left
10. Pivot bolt nut
11. Bearing inner spacer (2)
12. Bearing (2)
13. Bearing shield (2)

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

Figure 2F-39. Rear Fork - Exploded View

See order of disassembly, Fig. 2F-39. Remove pivot bolt (1) and lock washer (2) from rear fork (3). Rear fork can now be disassembled from frame. Remove the following parts: Bearing screw (4), bearing shakeproof washer (5), bearing lock washer (6), bearing lock nut - right (7) and bearing outer spacer (8). With a punch turn out bearing lock nut - left (9) and remove pivot bolt nut (10). From inside of fork press or drive out bearing inner spacer (11) and bearing (12), by applying pressure against spacer (11). Press or drive out bearing shields (13) from fork inner side.

CLEANING AND INSPECTION

Before re-assembling, clean and inspect all parts. Rough check the rear fork for correct alignment. Dimensions shown in Fig. 2F-40 will provide enough information to determine if fork is far enough out of alignment to require re-aligning or replacement. Straightening a badly bent rear fork requires special tools and fixtures for holding, bending and gauging. If facilities are not available locally, damaged rear fork can be returned to the factory for repair through any authorized Harley-Davidson dealer.

Check the rear fork bearings. If the inner or outer bearing race is badly pitted, replace bearing assembly.

ASSEMBLING REAR FORK (Fig. 2F-39)

Assembly is essentially the reverse order of disassembly. Attention should also be given to the following instructions:

From outside of fork press or drive bearing shield (13) into position, flush with inner fork side. From outside of fork insert bearing spacer (11), shoulder facing in. Apply a heavy coating of grease to bearing (12).

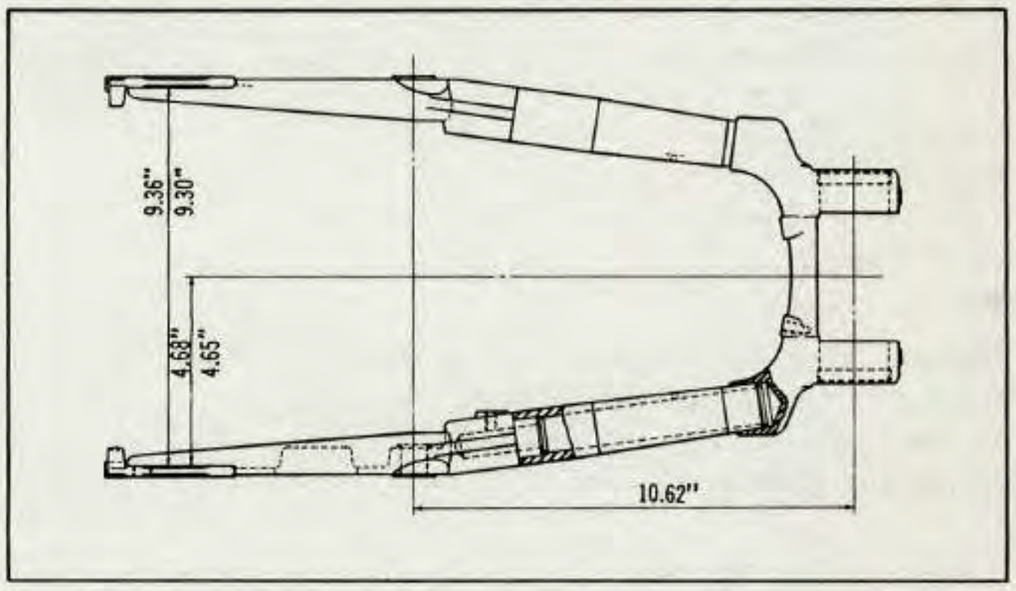
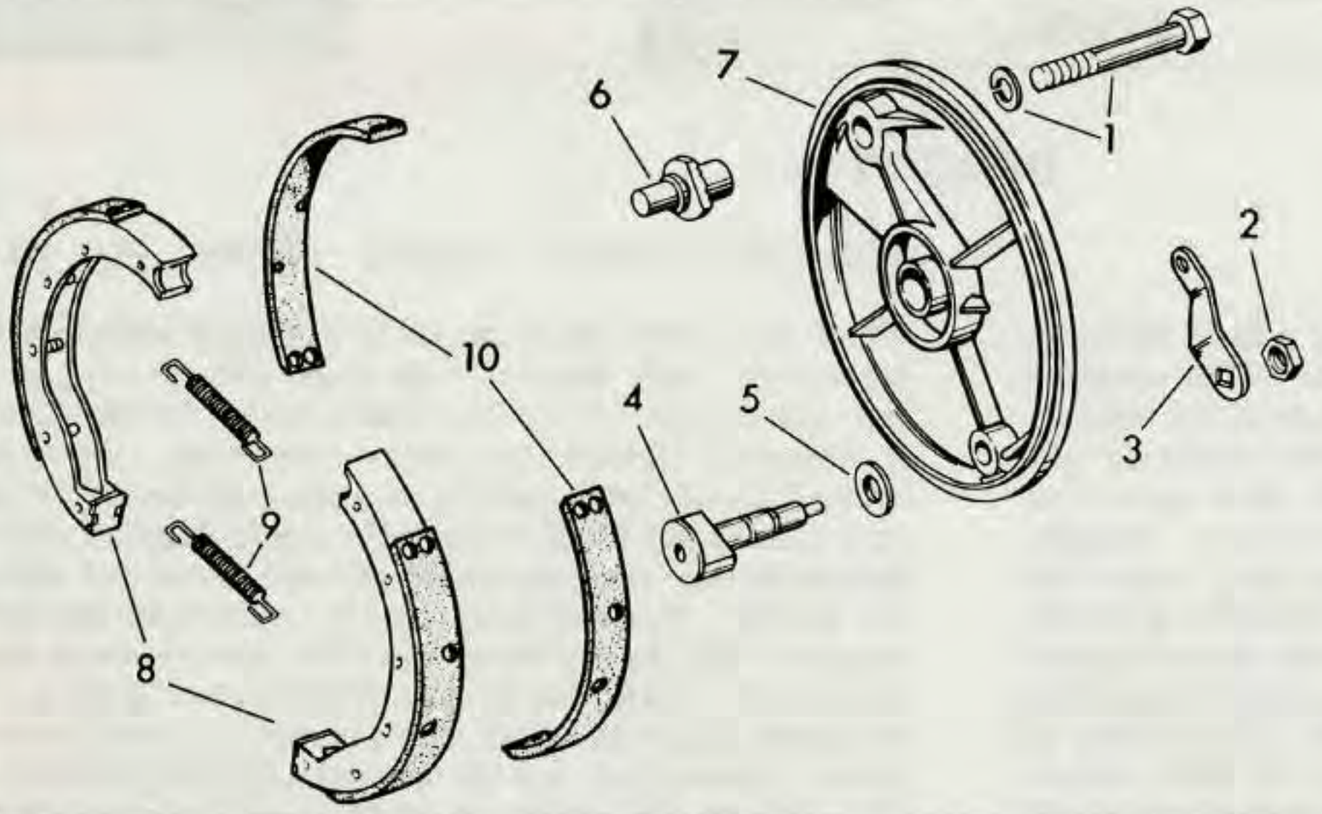


Figure 2F-40. Rear Fork Dimensions

NOTE

Pack the two rear fork pivot bearings with fresh grease at 10,000 mile intervals.

With wide side of bearing outer race facing out, tap bearing into fork until flush with inner fork side.



1. Pivot stud screw and washer
2. Operating shaft nut
3. Operating lever
4. Operating shaft
5. Operating shaft washer
6. Shoe pivot stud
7. Brake side plate
8. Brake shoe and lining (2)
9. Brake shoe spring (2)
10. Brake lining (2)

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

Figure 2G-10. Front Wheel Brake - Exploded View

the foot lever is pushed downward about 1-1/4 in. Turn the nut onto the rod to tighten the brake; back it off to loosen the brake. Turn the wheel to be sure the brake is not too tight and dragging. If brake should drag with correct free movement in foot pedal, re-center brake shoes in brake drum as follows:

Loosen but do not remove rear brake pivot stud nut (4) and axle nut (5). Spin rear wheel. While wheel is turning apply brake and tighten pivot stud nut (4) and then the axle nut (5). Re-check brake for correct adjustment, as previously described.

REPLACING FRONT WHEEL BRAKE CABLE (Fig. 2G-8)

If the front wheel brake cable (6) is not free in its housing, is frayed or broken, replace cable. Remove clevis clamp nut (7) and clamp (8). Free cable from clevis and pull from upper end of coil. Install new cable from upper end of housing as positioned on motorcycle, applying a light coat of grease as it is inserted into coil. 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.

To correctly adjust brake cable turn adjusting sleeve lock nut (1) and adjusting sleeve nut (3) to the top of brake adjusting sleeve (2). Make sure brake cable end is correctly positioned in brake lever slot, control coil ferrule is correctly positioned in hand lever bracket slot, and the brake cable support tube (9) is positioned in the fork slider bracket. Take all slack out of brake cable by pulling at the lower end of cable. With front brake lever (10) in lowest position (brake released), loop cable (6) around clevis and secure in place with clevis clamp (8) and nut (7). Adjust brake as described in "Adjusting Front Wheel Brake."

DISASSEMBLING FRONT WHEEL BRAKE (Fig. 2G-10)

Remove front wheel and brake assembly from motorcycle as described in "Removing and Installing Front Wheel," Section 2C. Remove operating shaft nut (2) and operating lever (3). Lightly tap operating shaft (4) to remove brake shoes (8), springs (9), operating shaft (4), washer (5) and pivot stud (6) as a unit from brake side plate (7). Remove shoes from operating shaft (4) and pivot stud (6).

DISASSEMBLING REAR WHEEL BRAKE (Fig. 2G-11)

Remove rear wheel from motorcycle as described in "Removing and Installing Rear Wheel," Section 2C. Remove rear brake rod adjusting nut (1) and free brake rod (2) from operating lever (3). Remove brake assembly from motorcycle. Remove operating shaft nut and washer (4), operating lever (3), pivot stud nut and lock washer (5) and locating block (6). Lightly tap operating shaft (7) to remove brake shoes (8), springs (9), pivot stud (10), operating shaft (7) and washer (11) as a unit from brake side plate (12). Remove shoes from operating shaft (7) and pivot stud (10).

INSPECTING AND REPAIRING BRAKE (Fig. 2G-10 and 2G-11)

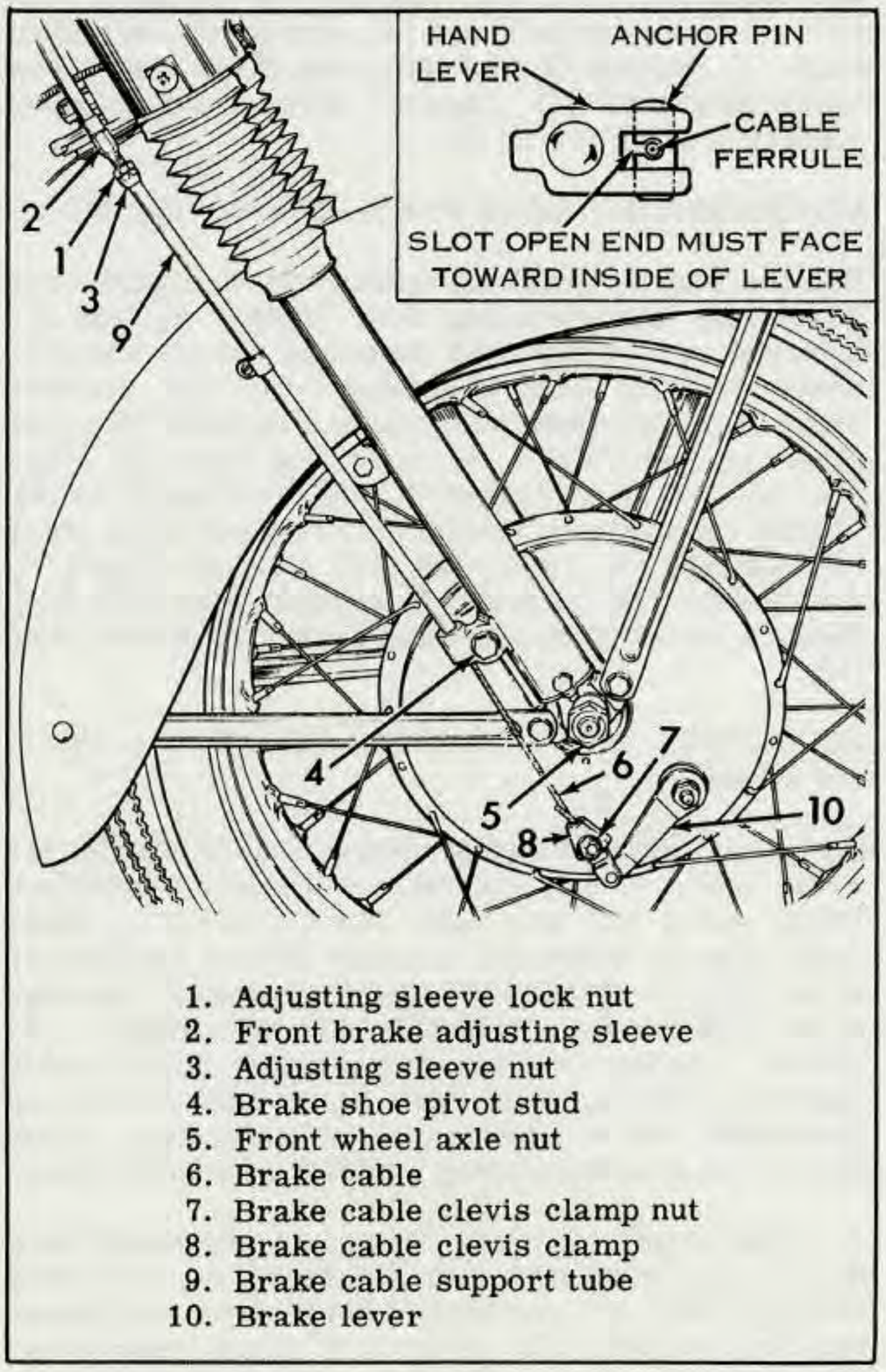
Clean and inspect brake shoes and linings (8) for wear, loose rivets, glazing, or imbedded particles. Brake shoes that are badly worn, cracked or damaged must be replaced. Linings (10 and 13) that are worn down to rivet heads, hard or glazed, impregnated with grease, cracked or damaged, must be replaced. Linings that are only slightly glazed and in apparent good condition may be re-used after being roughened with a medium grade of sandpaper. Also, be sure to roughen braking surface of the brake drum.

If replacement of brake linings is necessary, new linings can be riveted to the old shoes, or, if riveting facilities are not available, brake shoes and linings can be renewed. To reline old shoes remove and discard old rivets and linings. Position new lining on brake shoe and head rivets, working from one end

BRAKES

SERVICING BRAKES

The front wheel brake is operated by a hand lever on the right handlebar side, and the rear wheel brake is operated by a foot pedal on the left side of the motorcycle. Both hand lever and foot lever controls are connected to their respective brake shoe operating shafts independently through mechanical linkage. Compressing the front wheel brake hand lever and depressing the rear wheel brake foot lever actuates the operating shaft cam, moving brake shoes against the brake drum. To keep brakes in proper operating condition, it is essential to check adjustment of brakes at regular service intervals of 5000 miles, or sooner, depending on wear of brake linings and drums. See adjustment of brakes and centering brake shoes. If brakes do not operate satisfactorily after adjustment of linkage and re-centering brake shoes in drums, disassemble and service brakes and connecting linkage.



1. Adjusting sleeve lock nut
2. Front brake adjusting sleeve
3. Adjusting sleeve nut
4. Brake shoe pivot stud
5. Front wheel axle nut
6. Brake cable
7. Brake cable clevis clamp nut
8. Brake cable clevis clamp
9. Brake cable support tube
10. Brake lever

Figure 2G-8. Front Wheel Brake

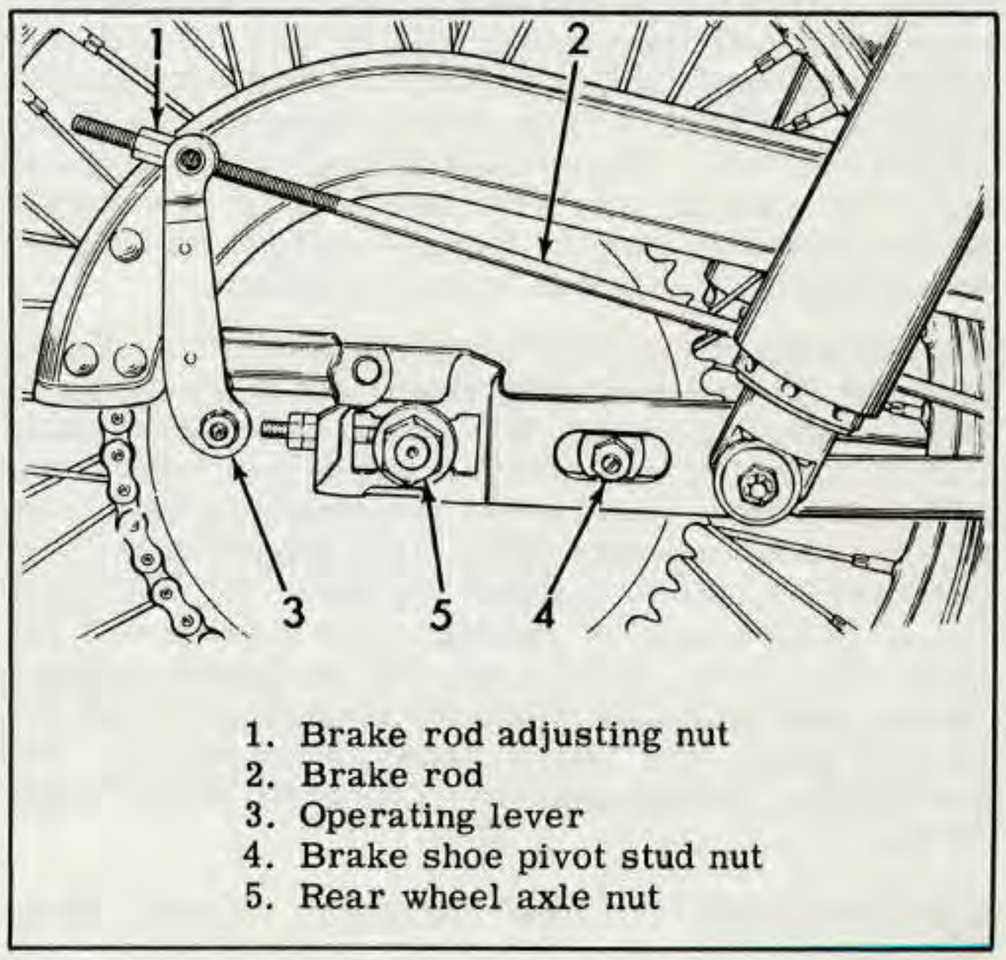
ADJUSTING FRONT WHEEL BRAKE (Fig. 2G-8)

When the front wheel brake is properly adjusted, the hand lever will move freely about one-quarter of its full movement before the brake starts to take effect. If adjusted tighter the brake may drag. To adjust brake, loosen lock nut (1) on adjusting sleeve (2) and turn sleeve nut (3) in toward the cable support tube to decrease the free movement of hand lever and tighten the brake. Turn sleeve nut (3) away from the cable support tube to increase the free movement of hand lever and loosen the brake. When free movement of the hand lever is about one-quarter of its full movement, tighten lock nut (1) against adjusting sleeve nut (3). Rotate the wheel to make sure brake is not too tight and dragging. If brake should drag with correct free movement in hand lever, re-center brake shoes in brake drum as follows:

Loosen, but do not remove, front brake shoe pivot stud (4) and axle nut (5). Spin front wheel. While wheel is turning apply brake and tighten pivot stud (4) and then axle nut (5). Recheck brake for correct adjustment as described above.

ADJUSTING REAR WHEEL BRAKE (Fig. 2G-9)

To adjust rear wheel brake turn adjusting nut (1) to change the effective length of the brake rod (2). The adjusting nut has a notch which fits against the clevis pin in the operating lever (3). Thus, it is locked in place on the rod, but may be turned down or backed off the rod by half turns as required. Set the adjusting nut so that the brake begins to take effect when



1. Brake rod adjusting nut
2. Brake rod
3. Operating lever
4. Brake shoe pivot stud nut
5. Rear wheel axle nut

Figure 2G-9. Rear Wheel Brake

DISASSEMBLING REAR BRAKE CROSS SHAFT (Fig. 2G-11)

If it is necessary to remove the brake cross shaft (14) from the motorcycle, proceed as follows:

Disconnect rear chain and remove exhaust pipe and muffler from motorcycle. Free brake rod (2) clevis from cross shaft (14) lever arm, by removing washer and cotter pin (15) and clevis pin (16). Discard pin (15). Loosen pinch bolt (17), slip foot lever (18) and spring (19) from shaft (14). Remove shaft (14) from frame tube.

INSPECTING AND REPAIRING CROSS SHAFT

Examine cross shaft (14) and lever (18) splines for wear and damage. If lever slips on shaft splines when pinch bolt (17) is tight, renew worn parts. Fit clevis pin (16) in rod (2) clevis, and check for worn condition. Replace clevis pin (16) if badly worn.

Check cross shaft (14) bearing surface and compare with shaft non-bearing surface. If bearing surface is not worn, but has excessive play in frame tube, replace bronze bushings (20). Thread tap (3/4-16 thd) into bushing and, from opposite side, drift bushing and tap from frame tube. Press new bushings (20) in place and install shaft (14). Rotate shaft to make sure it is free in bushings. If high spots develop when bushings are installed, ream to size.

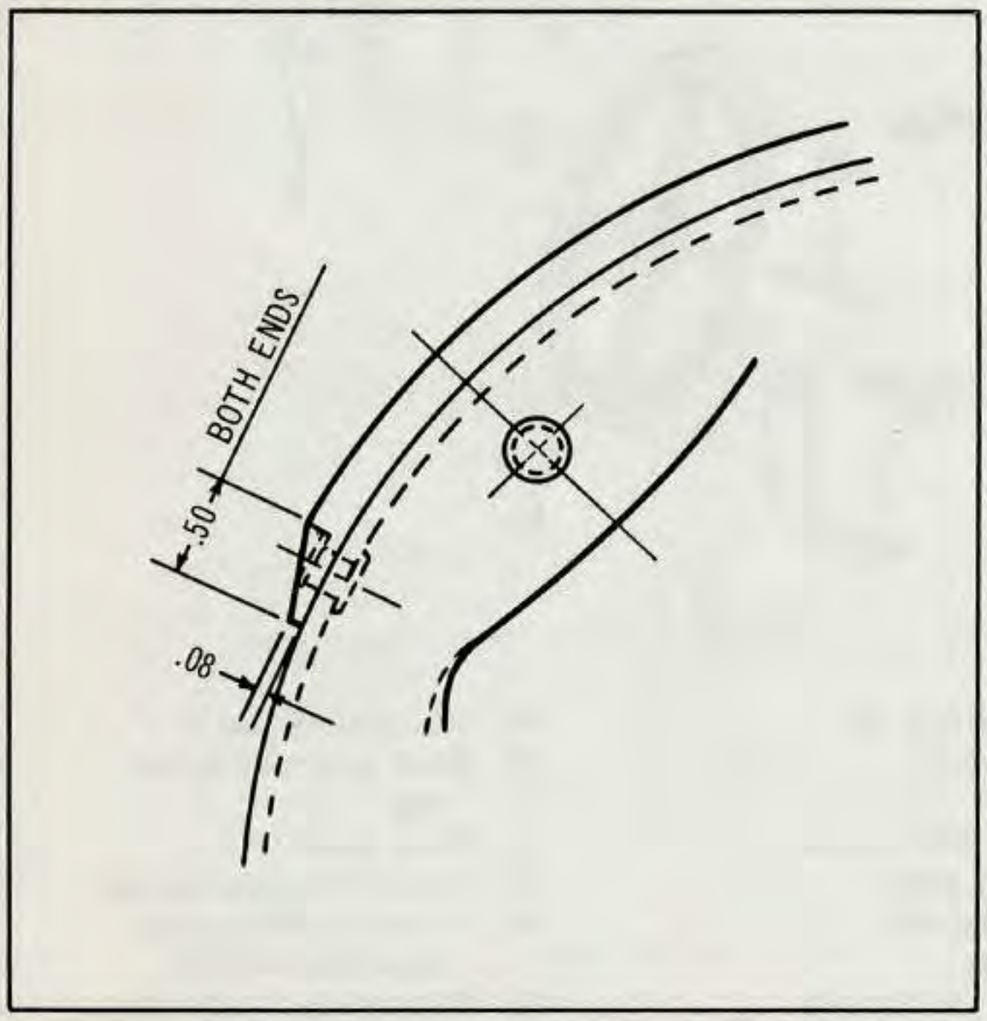
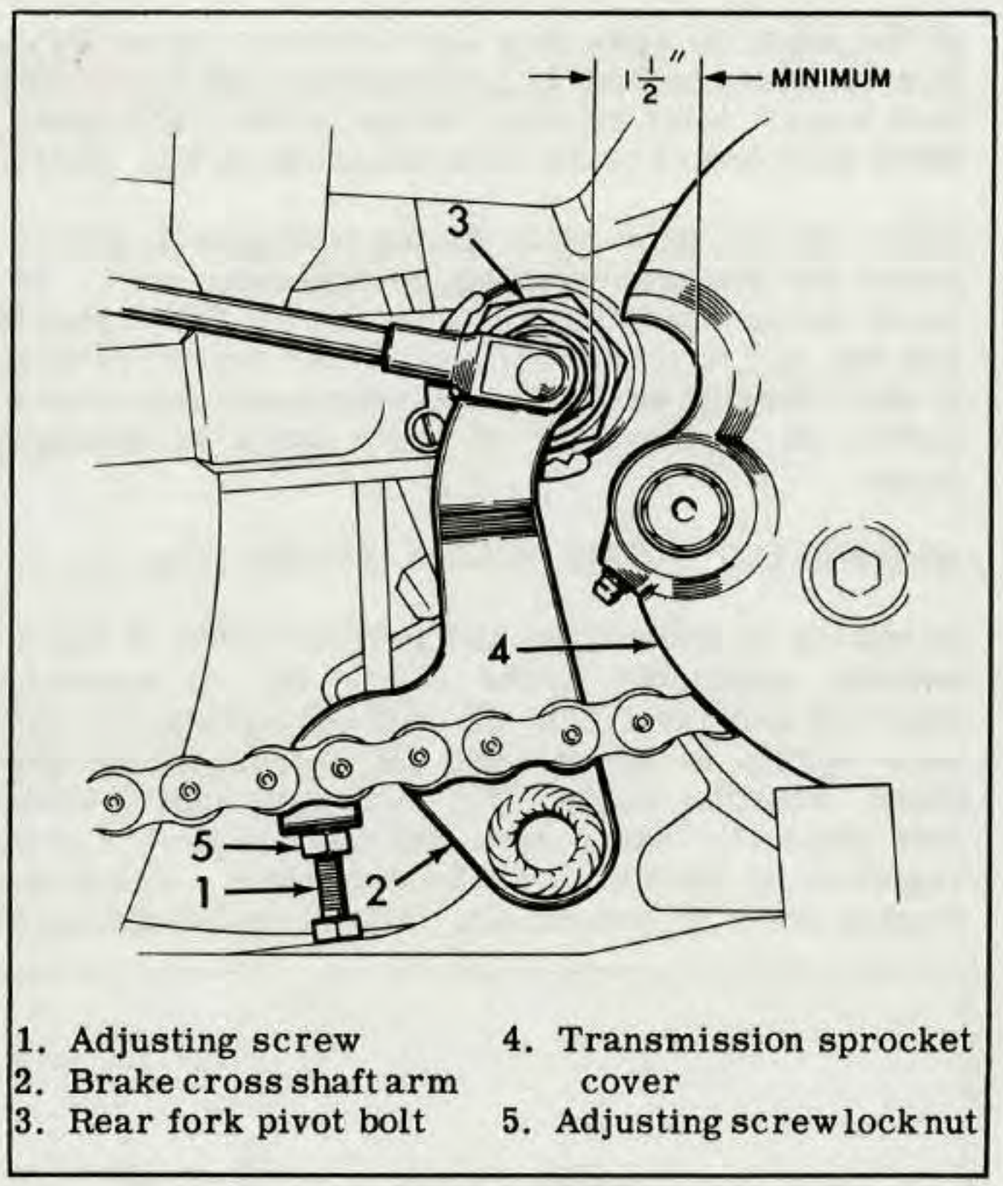


Figure 2G-12. Beveling Brake Lining



1. Adjusting screw
2. Brake cross shaft arm
3. Rear fork pivot bolt
4. Transmission sprocket cover
5. Adjusting screw lock nut

Figure 2G-13. Rear Brake Cross Shaft Adjustment

ASSEMBLING CROSS SHAFT

With cross shaft (14) correctly positioned in frame tube, insert shaft arm in brake rod clevis and install pin (16). Insert washer and new cotter pin (15) in pin (16). Connect chain and install exhaust system.

See Fig. 2G-13, and proceed as follows: Adjust cross shaft adjusting screw (1) so that with screw against its stop on frame, the top of the cross shaft arm (2) is slightly back of center of the rear fork pivot bolt (3). Under no conditions should the top front of the cross shaft arm (2) be closer than 1-1/2 in. to the rear of the relieved portion of the transmission sprocket cover (4). Assemble brake pedal on cross shaft. If pedal does not position correctly (almost touching footrest), re-adjust cross shaft adjusting screw (1) so that cross shaft splines and brake pedal are correctly positioned. However, adjustment should be made so that cross shaft arm (2) is always moved to the rear, never closer to the transmission sprocket cover (4). After final adjustment tighten cross shaft bolt lock nut (5).

LUBRICATION

Before operating motorcycle, lubricate brake system as indicated under "Regular Service Intervals," Section 1B.

to the other to achieve a tight fit and avoid buckling. If a riveting machine is not available, set rivets with hand tools. After riveting linings to the brake shoes, bevel each end of brake lining as shown in Fig. 2G-12.

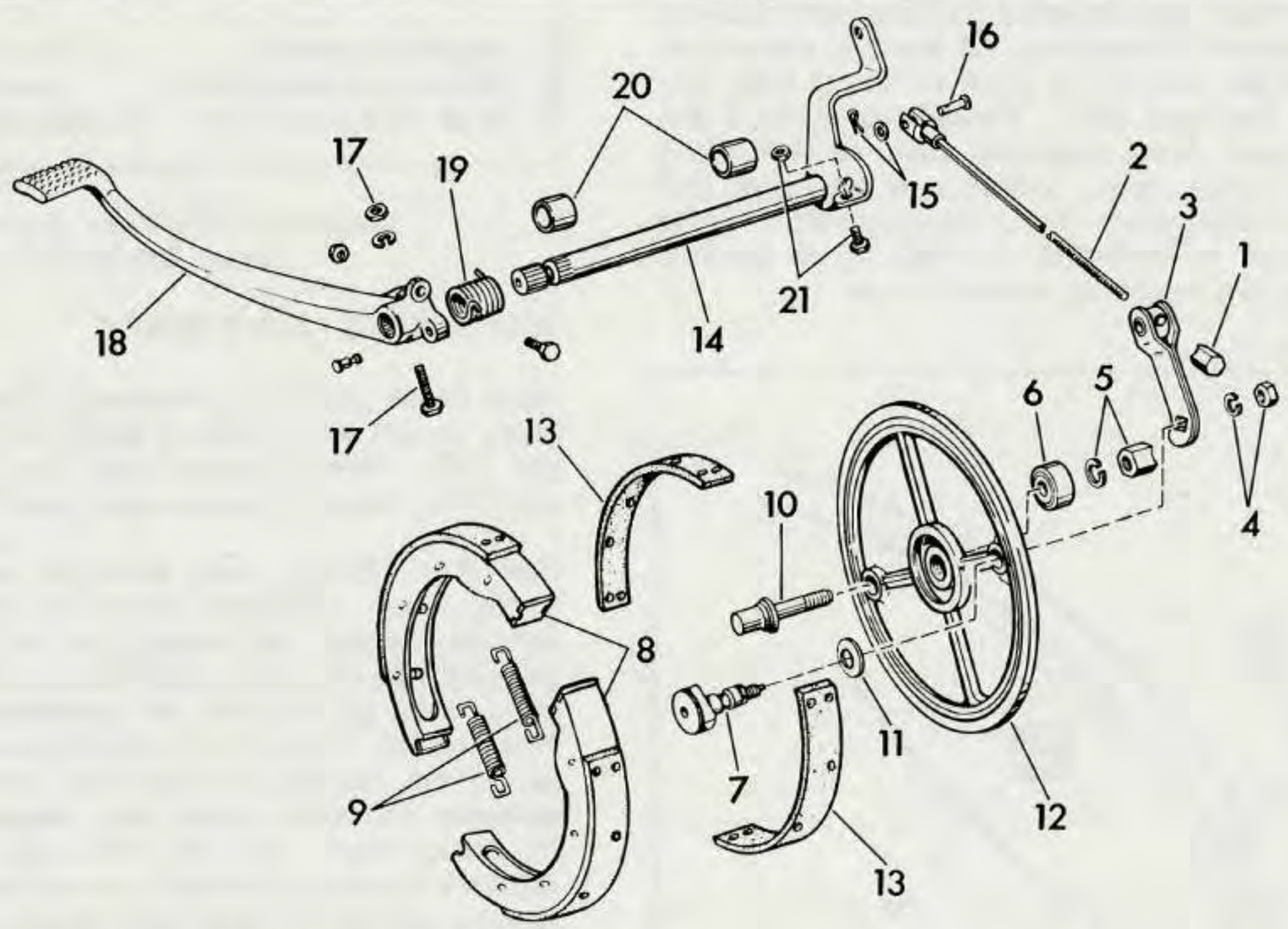
Clean all dirt from brake drums (not shown), and examine for scoring, grooving, or excessive wear. Inspect brake operating shaft (4 and 7), pivot stud (6 and 10), and brake side (7 and 12) for excessive wear of shaft bearing surfaces. Recommended repair procedure is replacement of badly worn or damaged parts.

ASSEMBLING FRONT WHEEL BRAKE (Fig. 2G-10)

Assembly is essentially the reverse order of disassembly. Assemble brake shoes (8) on operating shaft (4) and pivot stud (6) with one spring (9). Secure spring in groove that is nearest brake side plate. Position washer (5). Assemble unit to brake side plate (7). Make sure flat side of pivot stud (6) registers in recess of brake side plate. Install operating lever (3) and nut (2). Attach second spring in place with pliers. Install front wheel and brake assembly as described in "Removing and Installing Front Wheel," Section 2C. Adjust brakes and center brake shoes as described in "Adjusting Front Wheel Brake."

ASSEMBLING REAR WHEEL BRAKE (Fig. 2G-11)

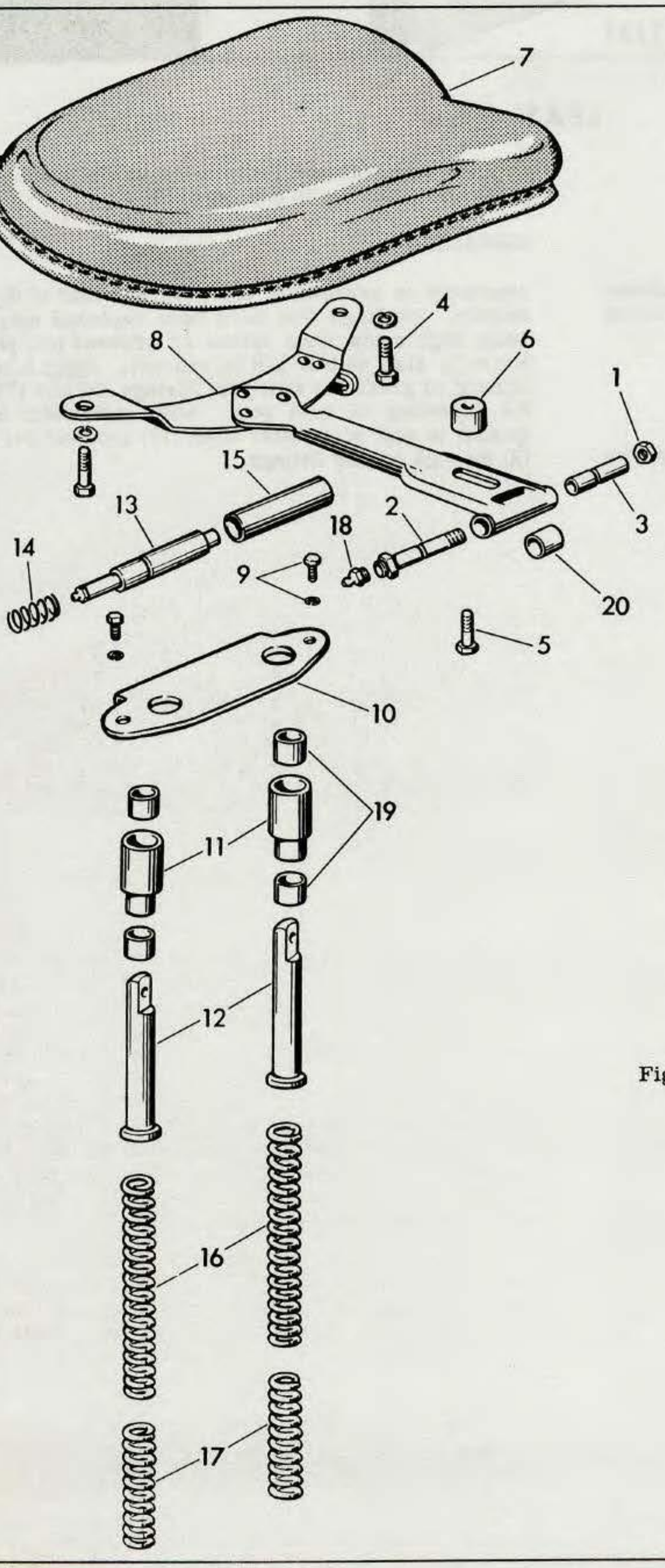
Assembly is essentially the reverse order of disassembly. Assemble brake shoes (8) on operating shaft (7) and pivot stud (10) with one spring (9). Secure spring in groove nearest brake side plate. Position washer (11) on shaft (7). Assemble unit on brake side plate (12). Install locating block (6), nut and lock washer (5), operating lever (3) and nut and lock washer (4). Attach second spring in place with pliers. Position brake assembly in rear wheel brake drum and install wheel assembly in frame as described in "Removing and Installing Rear Wheel," Section 2C. Insert brake rod (2) through lever (3). Assemble adjusting nut (1) loosely on rod (2). Adjust brakes and center brake shoes as described in "Adjusting Rear Wheel Brake."



1. Brake rod adjusting nut
2. Brake rod
3. Brake operating lever
4. Operating shaft nut and lock washer
5. Pivot stud nut and lock washer
6. Locating block
7. Operating shaft
8. Shoe and lining (2)
9. Shoe spring (2)
10. Pivot stud
11. Operating shaft washer
12. Brake side plate
13. Brake lining (2)
14. Cross shaft
15. Rod clevis cotter pin and washer
16. Rod clevis pin
17. Foot lever bolt and nut
18. Foot lever
19. Lever torsion spring
20. Frame brake shaft tube bushing (2)
21. Cross shaft adjusting screw and nut

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

Figure 2G-11. Rear Wheel Brake - Exploded View



1. Seat bar bolt nut
2. Seat bar bolt
3. Seat bar bolt spacer
4. Seat rear mounting bolt and lock washer (2 each)
5. Seat front mounting bolt
6. Seat front mounting bolt spacer
7. Seat
8. Seat bar
9. Seat post retaining plate bolt and lock washer (2 each)
10. Seat post retaining plate
11. Seat post bushing sleeve (2)
12. Seat post (2)
13. Seat post roller shaft
14. Seat post roller shaft spring
15. Seat post roller
16. Seat post upper spring (2)
17. Seat post lower spring (2)
18. Grease fitting
19. Seat post bushing (4)
20. Seat bar bushing (2)

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

Figure 2H-3. Seat Post and Seat - Exploded View

SEAT

SEAT POST AND SEAT

DISASSEMBLY

See Fig. 2H-3 for order of disassembly. Bushings (19 and 20) are a press fit in seat post bushing sleeve.

INSPECTION

Before re-assembling clean and inspect all parts. Replace any that are badly worn or damaged. Pay particular attention to bushings (19).

ASSEMBLY

Assembly is essentially the reverse order of disassembly. Bushings that have been replaced may develop high spots when driven or pressed into place. Ream to size with a 5/8 in. reamer. Apply a heavy coating of grease to seat post springs (16 and 17) befor inserting in seat post. After assembly, apply grease to seat post roller shaft (13) and seat bar bolt (2) through grease fittings.



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

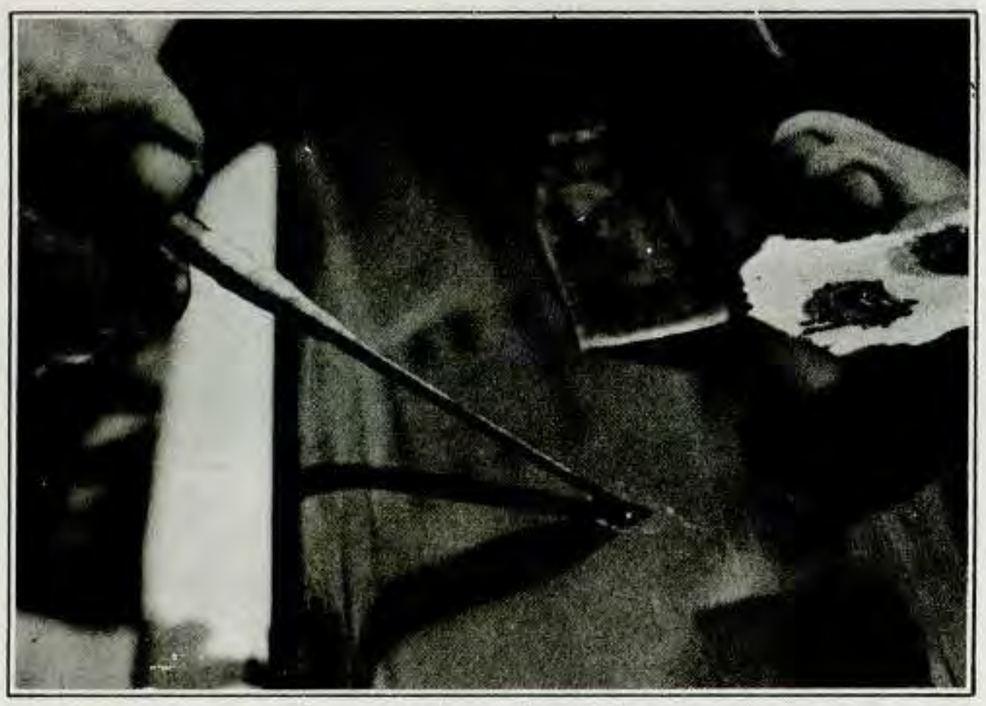


Figure 2J-3. Filling Hole or Scratch



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.

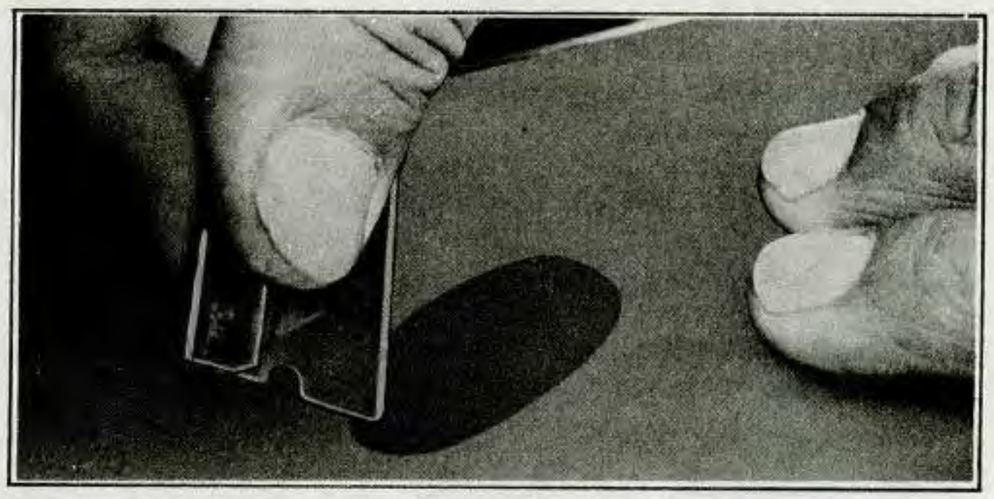


Figure 2J-5. Spreading Coat Evenly



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.

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.

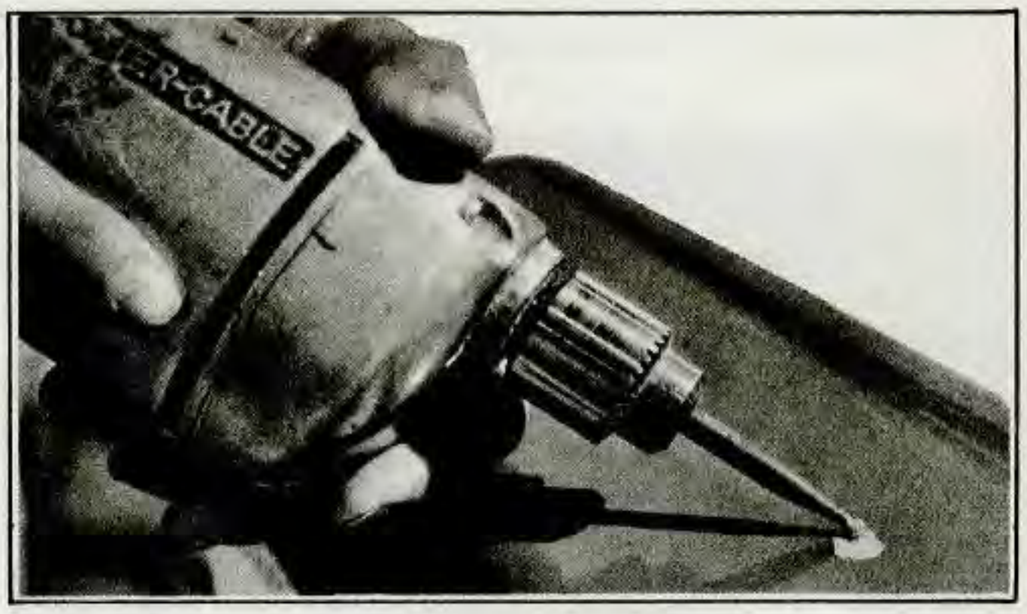


Figure 2J-1. Roughing Damaged Area

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.

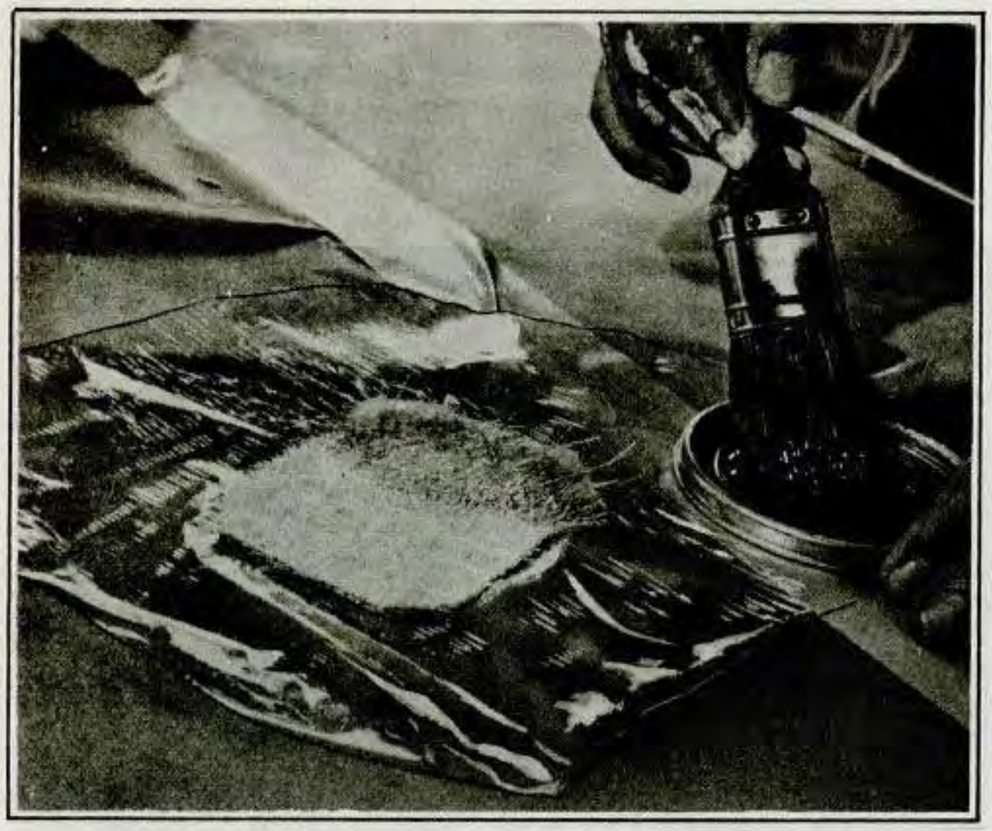


Figure 2J-10. Applying Resin to Mat

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.

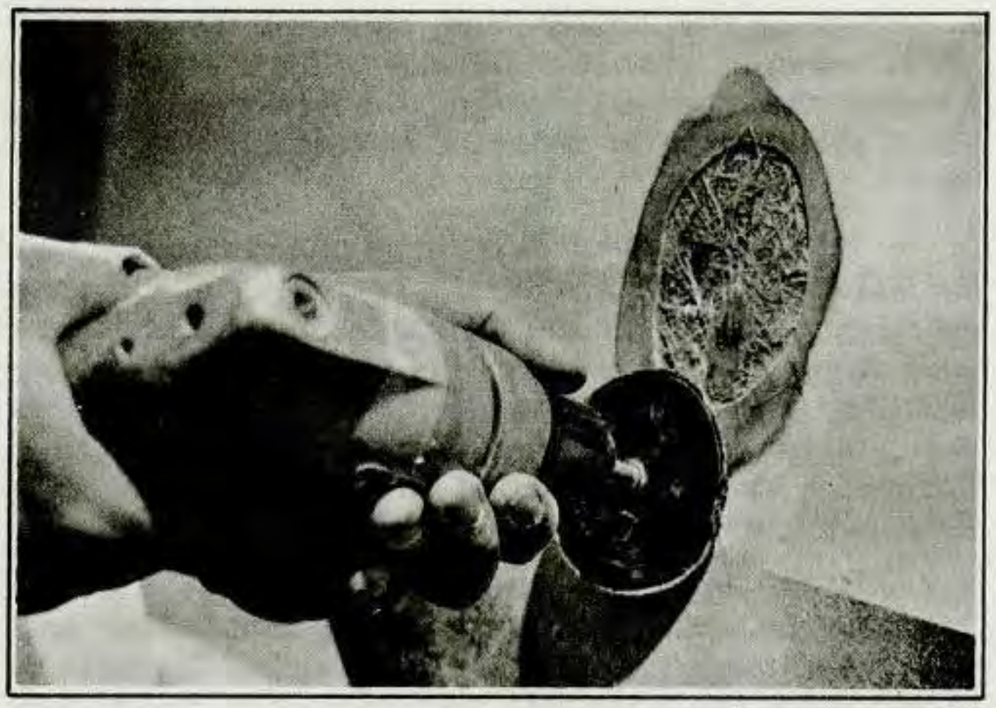


Figure 2J-12. Rough Sanding Outside Surface

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.

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.
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.

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.

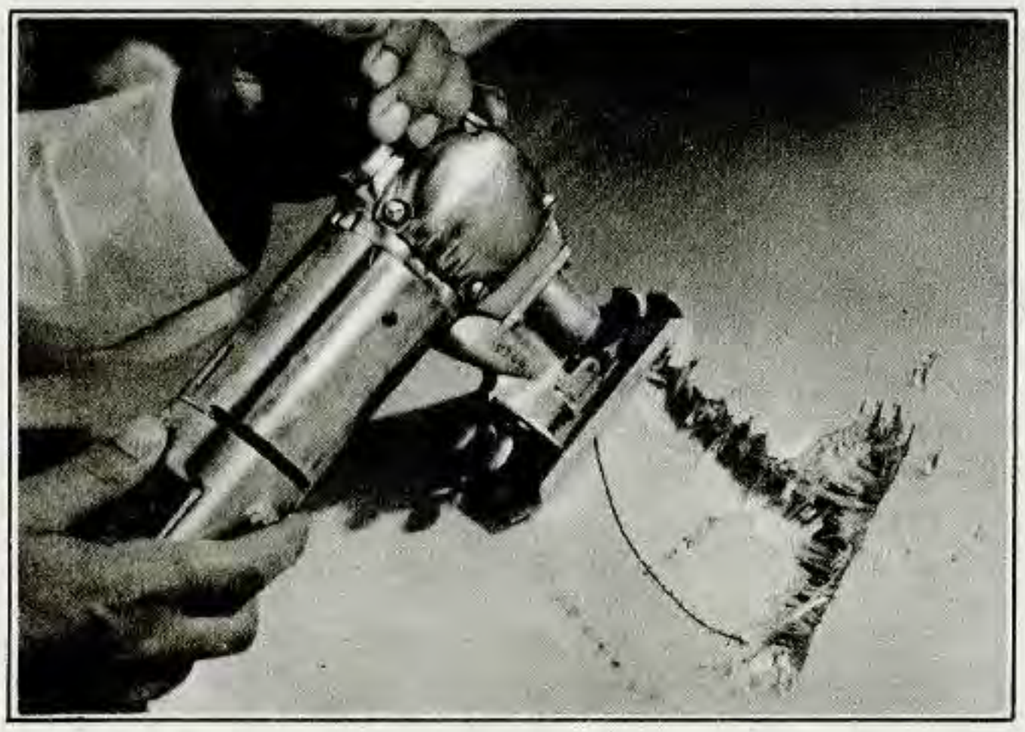


Figure 2J-7. Sawing Out Damaged Area

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.

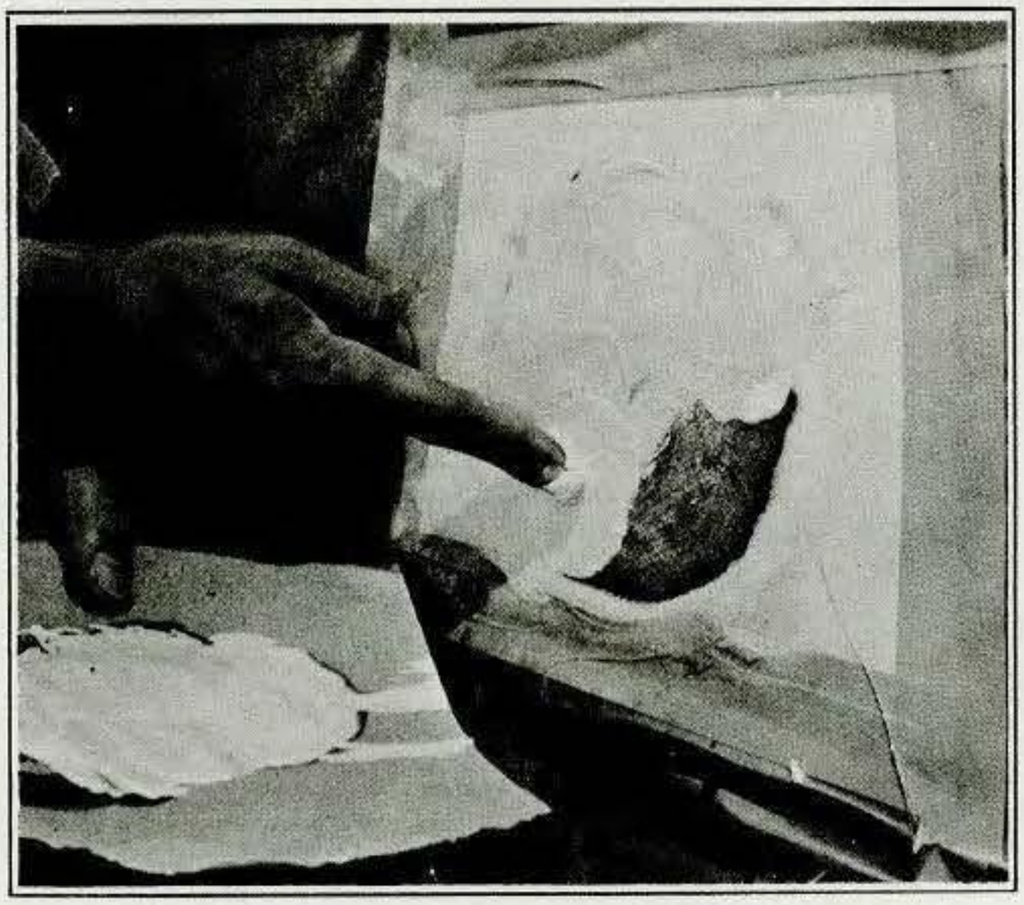


Figure 2J-14. Working Gel Coat into Patch

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. 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.

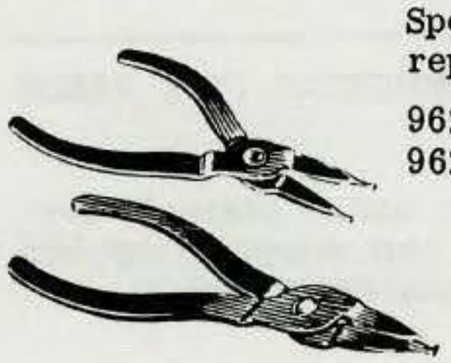
Thin Gel coat with acetone (1 to 1 ratio) and spray panel, blending sprayed area into a radius or corner on the part. Use a touch-up spray gun such as the Binks Model 15. After Gel coat is hard, buff and polish sprayed area.

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.



Figure 2J-15. Buffing Finish

INTERNAL LOCK RING PLIERS



Special pliers for removing and replacing retaining rings.

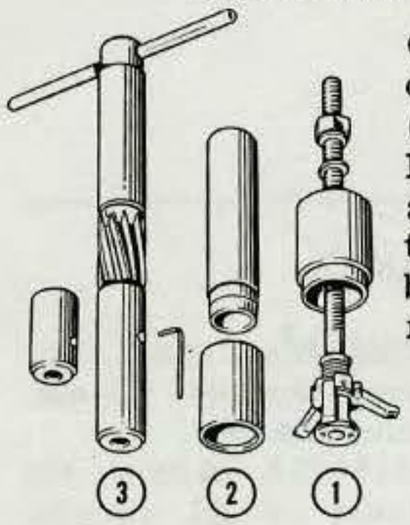
96215-49 Small.
96216-49 Large.

96247-54 FORK TUBE STRAIGHTENING BLOCK



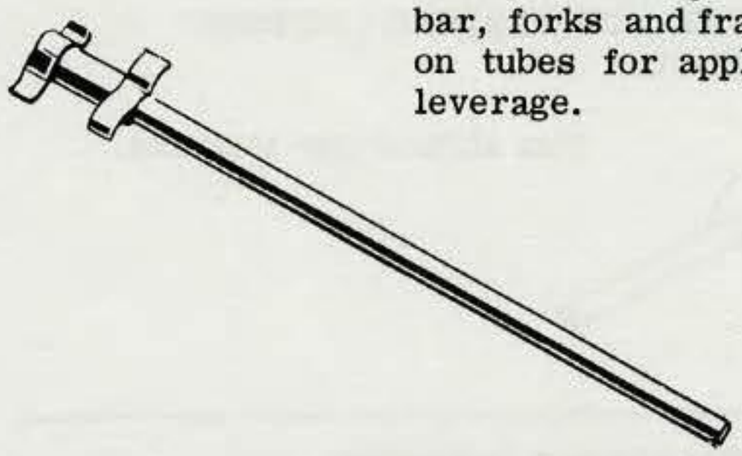
Three recommended for use to support fork tubes while straightening on an arbor press.

96254-54 FORK SLIDER BUSHING TOOLS FOR FRONT FORK



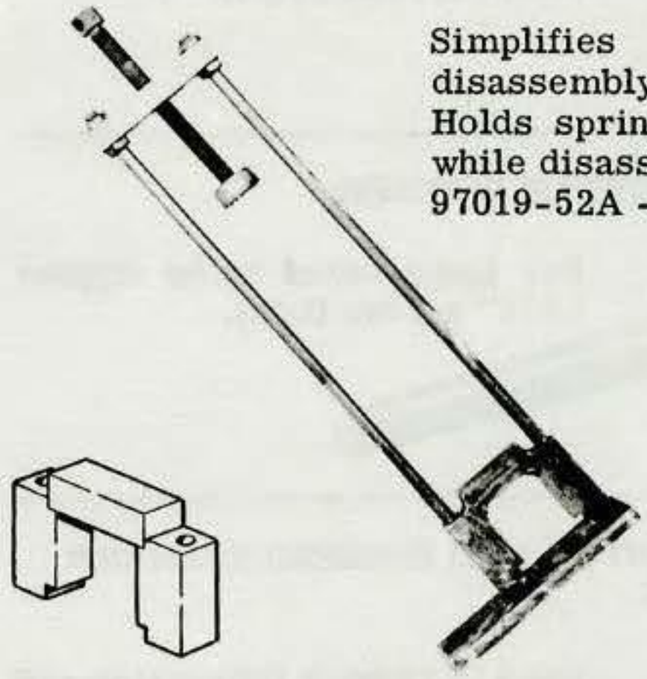
Complete set of tools consists of Fork Slider Bushing Puller (1), Bushing Driver (2) and Bushing Reamer (3) with long and short pilots. Tools used to remove worn fork slider bushings, install new parts and ream to size.

96806-40 BENDING BAR



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

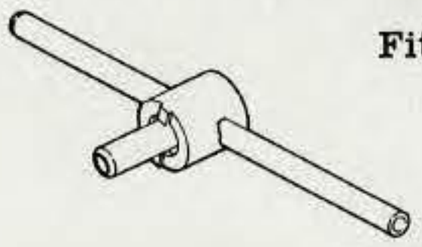
97010-52A SHOCK ABSORBER TOOL



Simplifies shock absorber disassembly or assembly. Holds spring in compression while disassembling parts.

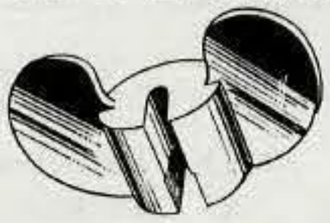
97019-52A - Block only for 1967 & later, FL, XL.

94630-67 WHEEL HUB BEARING LOCKNUT WRENCH



Fits slotted type locknuts.

94678-18 SPOKE NIPPLE WRENCH



For small wheel spoke nipples (.205" across flats).

94681-39 SPOKE NIPPLE WRENCH



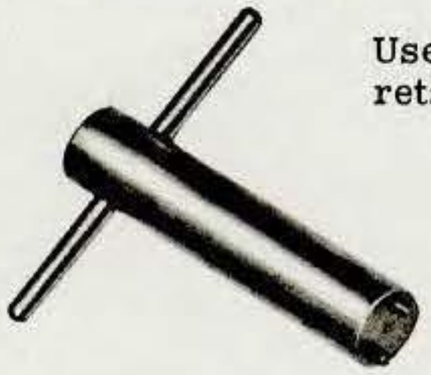
For large wheel spoke nipples (.234" across flats).

94691-52 FORK PISTON ROD BUSHING SPANNER WRENCH



Used to remove fork piston rod bushing from fork damper tube.

94694-52 FORK PISTON ROD RETAINER WRENCH



Used to remove fork piston rod retainer from fork tube.

94700-52B REAR SHOCK SPANNER WRENCH



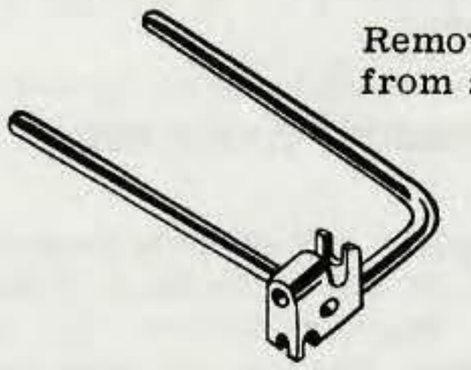
Used to adjust rear shock absorber units for more or less spring compression.

95020-66 REAR CHAIN CONNECTING LINK PRESS TOOL



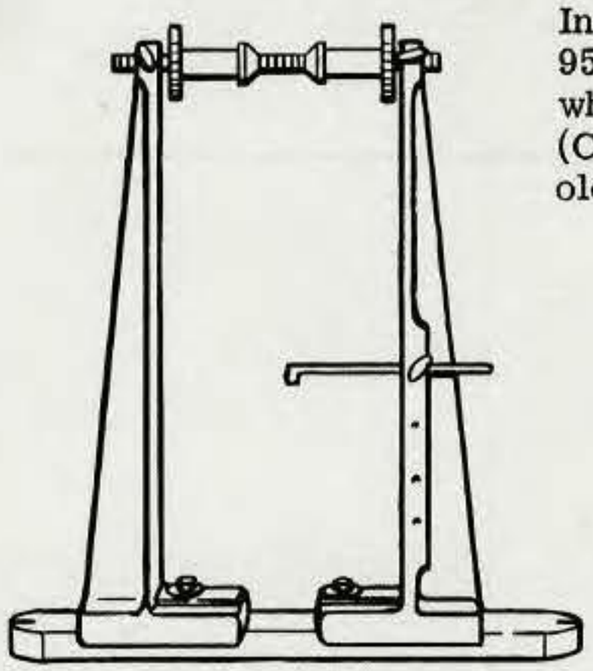
Used to install press-fit connecting link sideplate supplied with replacement chains.

95021-29 CHAIN DISASSEMBLING TOOL



Removes press fit roller pins from all chains.

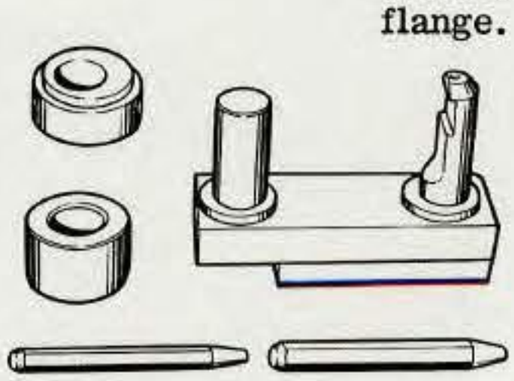
95500-29A WHEEL TRUING STAND



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).

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.



ENGINE 3

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tween 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 cam gear train consisting of four cam shafts with one cam lobe on each shaft 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. 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 a single set of breaker points by a double-lobe cam on the timer shaft determines the spark timing. The narrow lobe times the front cylinder. The wide lobe times the rear cylinder. Both spark plugs fire on each breaker point opening (twice per complete cycle of 720 degrees flywheel rotation since cam shaft operates at 1/2 engine speed). The valves are timed to produce combustion conditions in only one cylinder at a time so the spark in the other cylinder occurs ineffectually during its exhaust stroke.

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

LUBRICATION

GENERAL

The Sportster engine has a force-feed (pressure) type oiling system incorporating oil feed and return in one pump body, with one check valve on the oil feed side. The feed pump forces oil to the engine, lubricating lower connecting rod bearings, timing gears and bushings, generator drive gear, rocker arm bearings, valve stems, valve springs, push rods and tappets. Cylinder walls, pistons, piston pins and main bearings are lubricated by oil spray thrown off from connecting rods and crankshaft, and oil draining from rocker arm boxes through two holes in the base of each cylinder. The oil scavenging section of the pump returns oil to the tank from the engine and supplies lubrication to the rear chain through the chain oiler. An oil slinger on the generator drive gear, located in the gear case compartment, separates oil from air escaping through the breather tube.

CHECKING AND CHANGING OIL

Oil mileage normally varies from 250 to 500 miles per quart depending on the nature of service, fast or moderate driving, and how well the engine is kept tuned.

Remove tank cap and dip stick and check oil supply at least every 300 miles after each complete refill, or more often depending on condition of engine. Tank capacity is 3 quarts ("FULL" mark on dip stick). Do not fill above "FULL" mark, as the tank needs some air space. When oil is down to "REFILL" mark on dip stick, one quart can be added. Never allow oil level to go down to "DANGER" mark on dip stick. Tighten the cap securely to prevent leakage. Oil runs cooler and oil mileage is somewhat higher with oil level well up in the tank. Furthermore, unless oil tank is kept well filled, frequent checking of oil level will be necessary to avoid any chance of running dry.

Use proper grade of oil for the lowest air temperature expected before the 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.

After a new engine has run its first 500 and 1000 miles, and at 2000-mile intervals thereafter, completely drain oil tank of used oil and refill with fresh oil. If the engine is driven extremely hard, or used 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 as it does not accumulate used oil. At the time of the first 500 mile oil change, and 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.

CAUTION

Oil pump may lose prime because of air trapped in lines after system has been drained and refilled with oil. On models equipped with oil pressure signal light, be sure light goes out within 3 minutes with engine operating at fast idle. On models not having oil pressure signal light, start up the engine and loosen plug in fitting at front of oil pump to allow about 3 ounces of oil to drain into can. This will allow any air in the oil feed line and passages to bleed out through the oil pump. Retighten plug after air has been bled.

WINTER LUBRICATION

Combustion in any engine produces water vapor. When starting and warming up in cold weather, much of 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 driven enough to get the crankcase thoroughly warmed up, most of this water is again vaporized and blown out through the breather. However, a moderately driven engine making short runs, does not thoroughly warm up and is likely to accumulate water in the oil tank. In freezing weather, this water will become slush or ice, and if allowed to accumulate too long, may block the oil lines and cause damage to the engine. Water mixed with oil for some time also forms sludge that is harmful to the engine and causes undue wear of working parts.

In winter the oil change interval should be shorter

GENERAL

ENGINE SPECIFICATIONS

VALVES (3B)

Fit in guide (EX)	.0025 in. - .0045 in.
Fit in guide (IN)	.0015 in. - .0035 in.
Spring (outer)	52-62 lbs. at 1-9/32 in. (valve closed)
	155-165 lbs. at 15/16 in. (valve open)
Spring (inner)	30-35 lbs. at 1-3/32 in. (valve closed)
	75-85 lbs. at 3/4 in. (valve open)
Spring free length	1-1/2 in. (outer)
	1-23/64 in. (inner)

ROCKER ARM (3B)

Fit in bushing	.0005 in. - .002 in. loose

PISTON (3C)

Fit in cylinder	.0025 in. - .003 in. loose
Ring gap	.010 in. - .020 in.
Compression ring side clearance	.0025 in. - .004 in.
Oil ring side clearance	.003 in. - .005 in.
Piston pin fit	Light hand press fit at 70°F

CONNECTING ROD (3C)

Piston pin fit	.0008 in. - .001 in. loose
End play between flywheels	.006 in. - .010 in.
Fit on crank pin	.0008 in. - .001 in. loose

OIL PUMP PRESSURE (3D)

Minimum	6 lbs./sq. in. at 20 M.P.H.

TAPPETS (3D)

Guide fit	.0005 in. - .001 in. press
Fit in guide	.0005 in. - .001 in. loose
Roller fit	.0005 in. - .001 in.
Roller end clearance	.008 in. - .010 in.
Tappet clearance	Just free (no lash) --- Engine cold

GEARCASE (3D)

Intermediate gear shaft in bushing	.0005 in. - .001 in.
Cam gear shaft in bushing	.0005 in. - .002 in.
Cam gear shaft in needle bearing	.0005 in. - .0025 in.
Cam gear end play	.001 in. - .006 in.

FLYWHEEL ASSEMBLY (3E)

Gear shaft nut torque	100 FT-LBS
Sprocket shaft nut torque	100 FT-LBS
Crank pin nuts torque	150 FT-LBS
Runout (flywheels)	.002 in. maximum at rim
Runout (mainshafts)	.001 in. maximum

SPROCKET SHAFT BEARING (3E)

Cup fit in crankcase	.0005 in. - .0025 in. tight
Cone fit on shaft	.0002 in. - .0012 in. tight
End play	.001 in. - .010 in.

PINION SHAFT BEARING (3E)

Shaft fit in roller bearing	.0008 in. - .001 in.
Shaft fit in cover bushing	.0005 in. - .0012 in.

IGNITION TIMING (5F)

Breaker point gap setting (battery ignition	.020 in.
Dwell	90° @ 1000 R.P.M.)
Breaker point gap setting (magneto ignition)	.015 in.
Spark plug gap setting (battery ignition)	.025 in. - .030 in.
Spark plug gap setting (magneto ignition)	.020 in.
Ignition timing (Advanced) XLH-XLCH	45° (11/16 in. before piston top dead center)
Ignition timing (Retarded) XLH	15° (5/64 in. before piston top dead center)

ENGINE DESCRIPTION

GENERAL

The Sportster engine is a two-cylinder, four-cycle, air cooled, overhead-valve, V-type engine with 55 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 counter-weighted flywheels which rotate on two end shafts (pinion and sprocket shafts) supported by anti-friction roller bearings. The lower end of the rear cylinder connecting rod is forked to fit around the single-end front cylinder connecting rod, allowing a single connecting rod-crank pin 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 be-

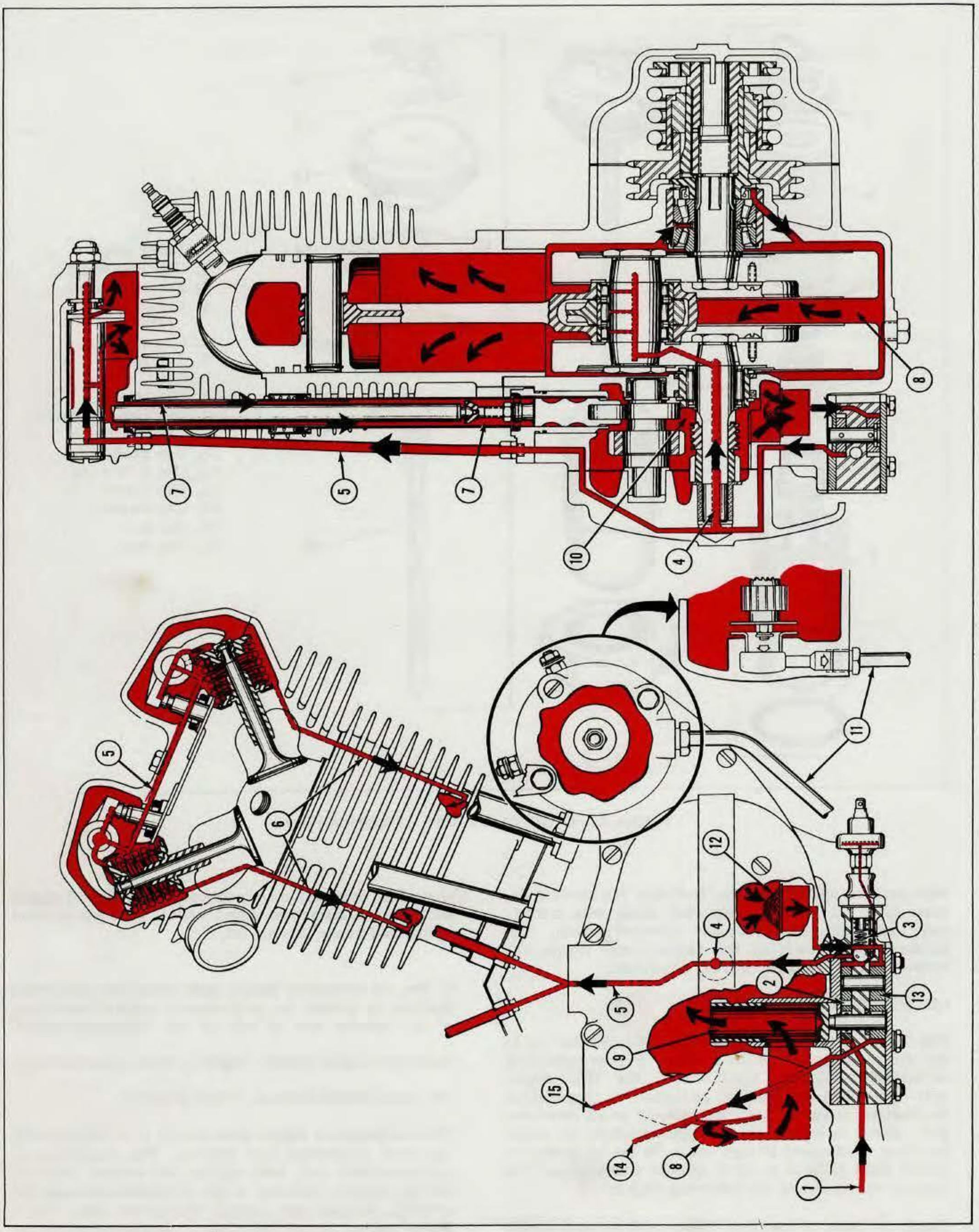


Figure 3A-6. Oiling System

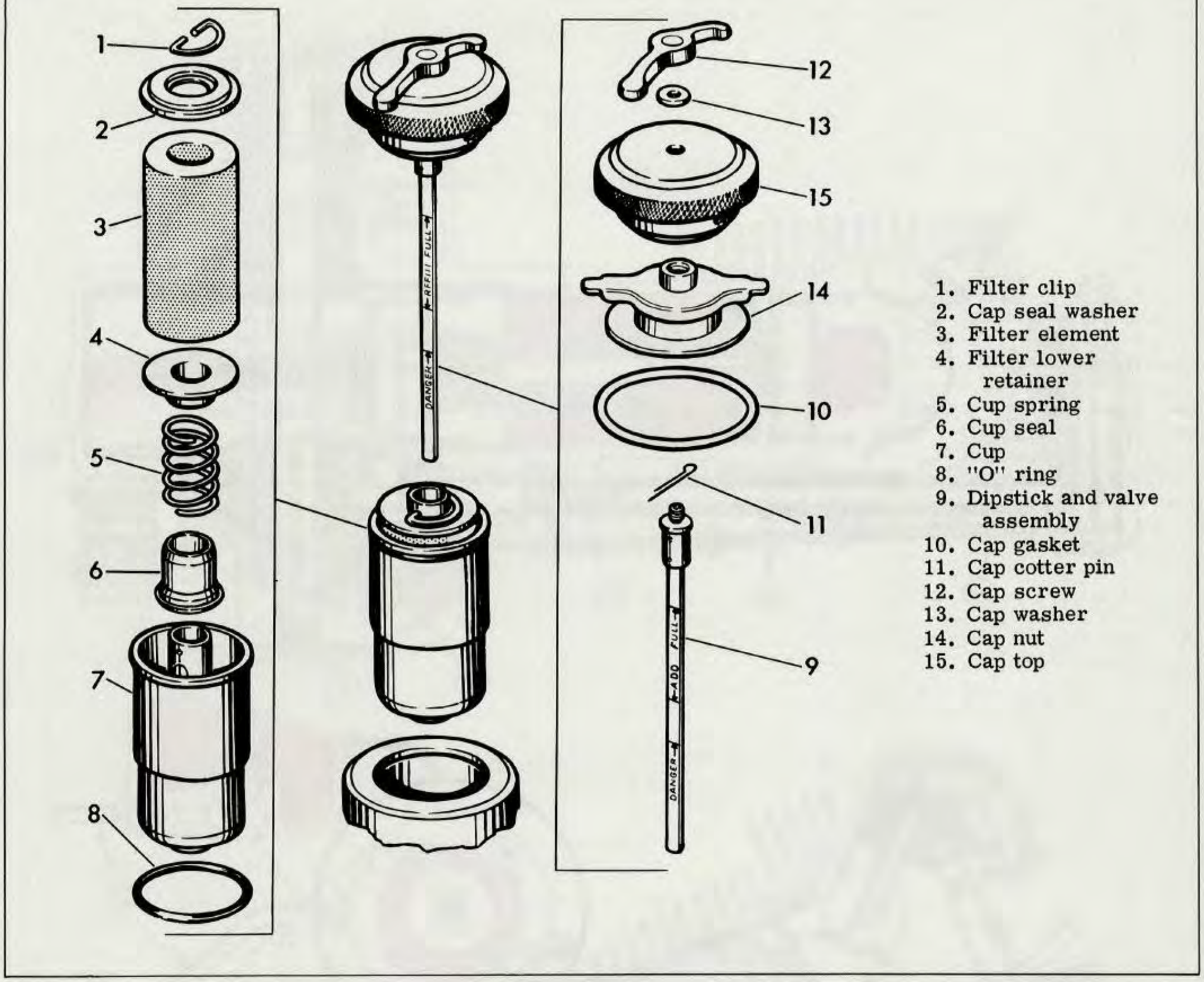


Figure 3A-5. Oil Tank Filter - Exploded View

than normal, and any engine used only for short runs, must have oil drained frequently along with a thorough tank flush-out, before new oil is put in tank. The farther below freezing the temperature drops, the shorter the oil change interval should be.

OIL PRESSURE SIGNAL LIGHT

The "OIL" signal light, when on, indicates that oil is not circulating through the engine. Proper operation is indicated when the light is off. The "OIL" signal will light when the ignition is turned on preparatory to starting engine. The light should be off when engine speed is equivalent to approximately 20 miles per hour road speed in high gear. If the oil pressure signal light fails to go off at speeds above idling it is usually due to one of the following causes:

Empty oil tank, oil feed line clogged with ice and sludge (freezing weather) or air bound, grounded oil signal switch wire, defective signal switch, gear pin sheared in oil feed pump, diluted oil.

If the oil pressure signal light does not work when ignition is turned on, preparatory to starting engine, it is usually due to one of the following causes:

Defective signal switch, defective wiring, dead battery.

OIL PRESSURE SIGNAL LIGHT SWITCH

The oil pressure signal light switch is an electrically operated diaphragm-type switch. The diaphragm is spring-loaded and held against its contact point by spring tension when oil is not circulating through the system, closing the circuit (indicator light "on"). When engine is started, and as engine speed is in-

Most commonly, only cylinder head and cylinder repair is needed (valves, rings, pistons, etc.) and it is recommended procedure to service these units first, allowing engine crankcase to remain in frame. Follow the procedure under "Stripping Motorcycle For Engine Repair," steps 1-5, 7, 24-28, to strip motorcycle for removal of cylinder head, cylinder and pistons.

After disassembling "upper end" only, it may be found that crankcase repair is necessary; this requires removal of engine crankcase from chassis outlined under "Stripping Motorcycle For Engine Repair," steps 6, 8-23, 29-39.

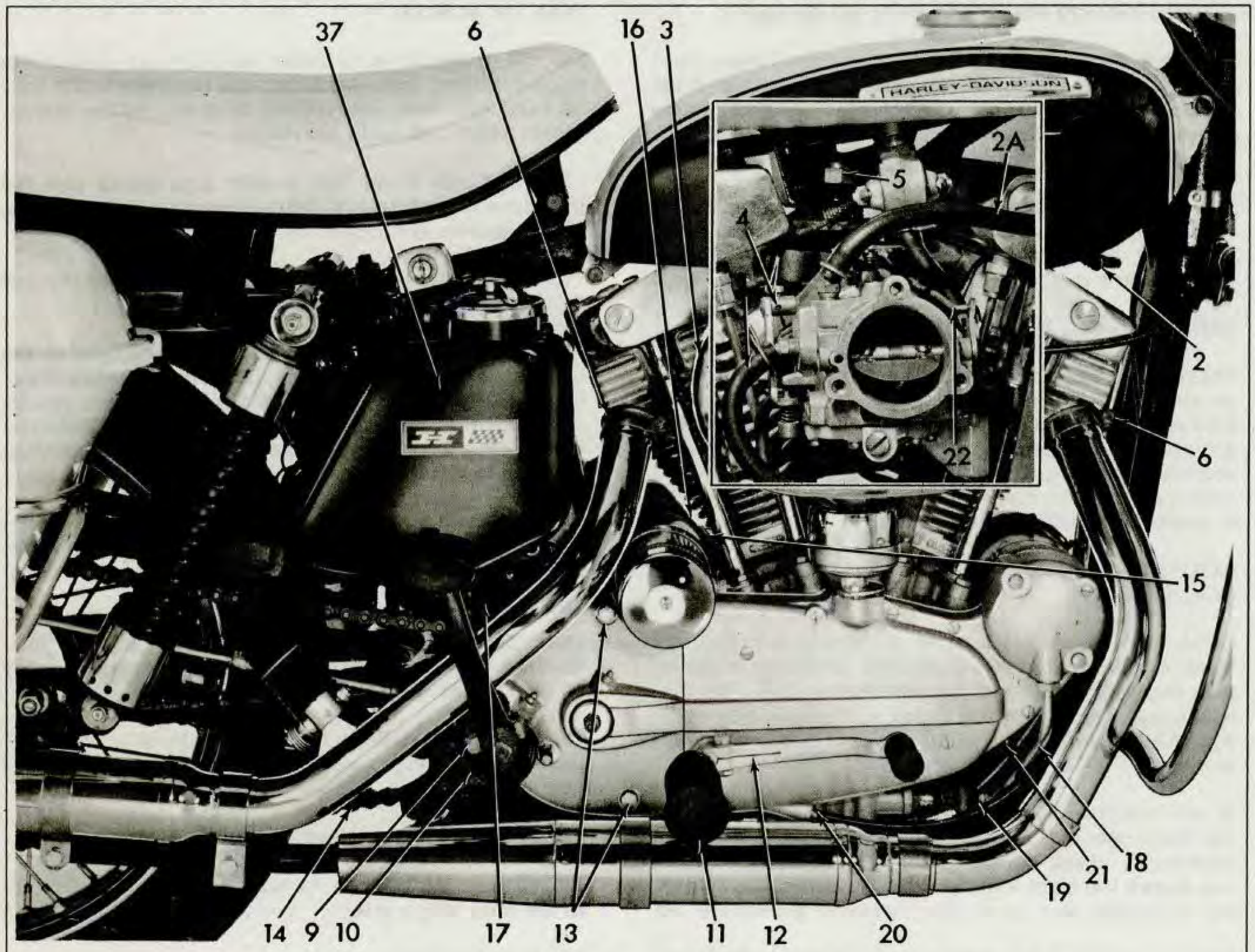
In cases where it has been definitely determined beforehand that crankcase repair is necessary, the engine, completely assembled, should be removed from chassis as outlined under "Stripping Motorcycle For Engine Repair," steps 1-39.

NOTE

The following stripping procedure applies to the standard XL and XLH Models. The same procedure may be used for the XLCH Model except for some changes in procedure due to differences in equipment.

STRIPPING MOTORCYCLE FOR ENGINE REPAIR (See Fig. 3A-7 or 3A-8)

1. Clean engine thoroughly with "Gunk" to remove all road dirt. Remove "Gunk" and dirt with water spray and blow engine dry with compressed air. Drain gasoline and oil. Remove seat. Disconnect



1.	Gasoline line	9.	Starter crank clamp bolt	16.	Oil vent line
2.	Gasoline tank interconnecting line	10.	Starter spring	17.	Oil feed line
2A.	Vent line (1966 & later)	11.	Footrest	18.	Breather pipe
3.	Cleaner assembly	12.	Foot shift lever	19.	Oil pressure switch wire
4.	Throttle cable connection	13.	Cover bolt (2)	20.	Clutch cable
5.	Engine support bolt location	14.	Rear chain	21.	Clip
6.	Exhaust pipe port clamp (2)	15.	Oil return line	22.	Choke connection

Figure 3A-7. Engine - Right Side View (1967 Model XLH Shown)

gasoline lines (1, 2 and 2A) and remove bolts securing gasoline tank. Tank can then be removed from motorcycle.

Remove the following parts from right side of motorcycle.

2. Remove air cleaner assembly (3) including back plate.

3. Disconnect throttle and choke control at carburetor (4 and 22).

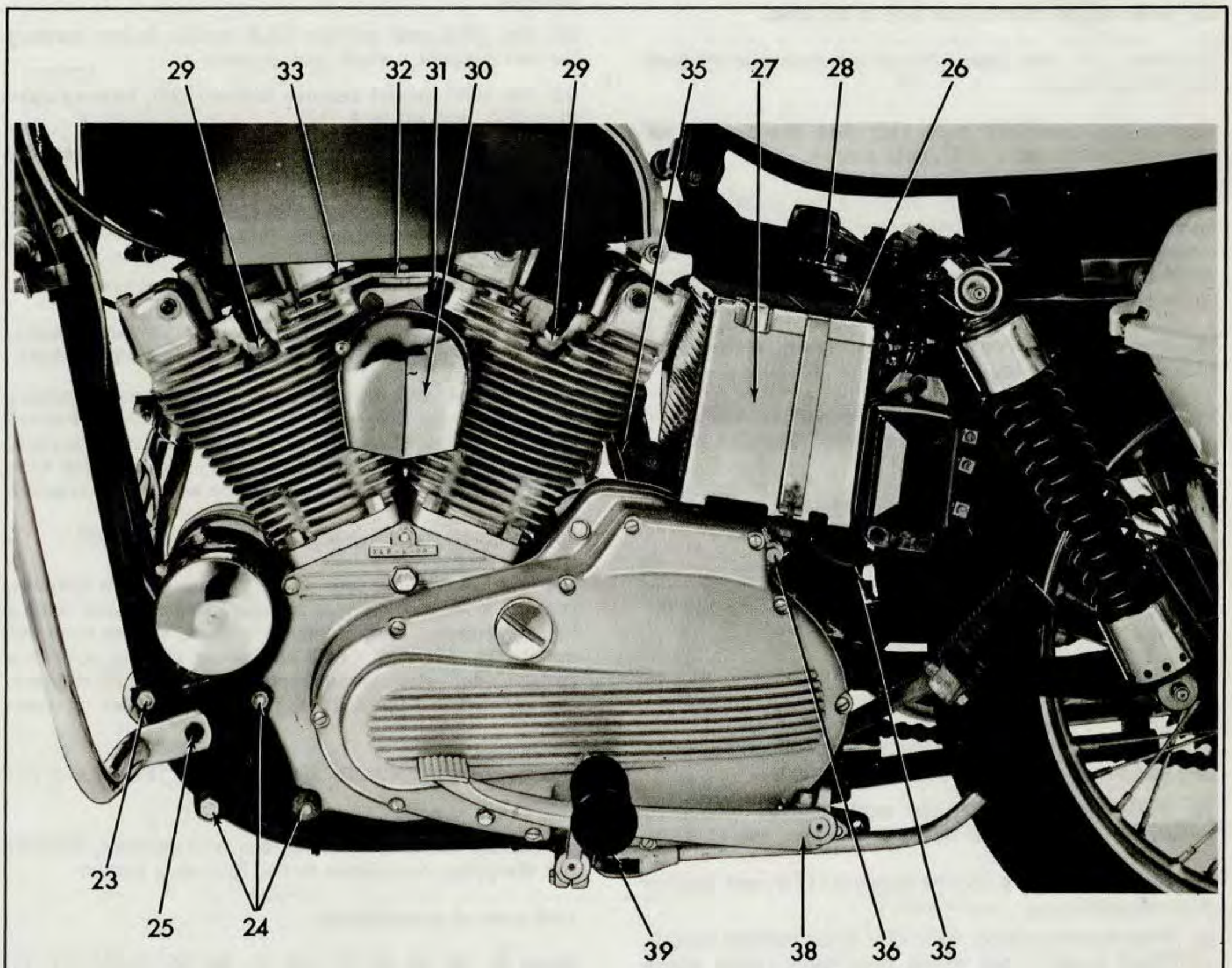
4. Remove top engine support bolt located at point (5). Be sure to note the number of shim washers between cylinder head bracket and frame lug; these will have to be refitted when installing the engine.

5. Loosen exhaust pipe port clamps (6). Remove two muffler clamps and free exhaust system from motorcycle.

6. Disconnect spark control wire from circuit breaker or magneto (1964 and earlier XLH and 1965 XLCH).

7. Remove generator and horn mounting screw (1964 and earlier XLH).

8. Remove starter crank clamp bolt (9) and with a screwdriver pry crank from shaft. Press down on



23. Top front end mounting bolt
24. Engine mounting bolts
25. Safety guard bolt hole
26. Battery (1967 XLH)
27. Battery carrier (1967 XLH)
28. Ground wire
29. Spark plugs
30. Horn cover
31. Wire
32. Support bracket and choke control (1966)
33. Support bracket bolt
35. Regulator ground strap
36. Engine mounting bolt
37. Oil tank
38. Foot lever and spring
39. Left footrest

Figure 3A-8. Engine - Left Side View (1967 Model XLH Shown)

end of starter spring (10), and at the same time pry spring off shaft.

9. Shift into high gear and remove footrest (11) and foot shift lever (12).

10. Remove transmission sprocket cover bolts (13). With a mallet, lightly tap cover at the same time pulling cover from shaft. Disengage clutch cable end from clutch release lever by moving lever forward, (as positioned on motorcycle) and disengage cable from lever.

11. Disconnect rear chain (14).

12. Remove oil return line (15) at oil tank.

13. Free oil vent line (16) at oil tank and oil feed line (17) at engine.

14. Remove breather pipe (18) and disconnect oil pressure switch wire (19) from switch.

15. Pull clutch cable (20) forward, (as positioned on motorcycle), until approximately 1 in. of cable remains in gearcase cover, at the same time press cable inward (towards oil pump), and down to free from gearcase cover.

16. Remove oil pressure switch from motorcycle with vise grip pliers.

17. With vise grip pliers, disconnect speedometer cable from speedometer drive unit (located under transmission sprocket cover).

18. Free speedometer cable from clip (21).

19. Remove lower front safety guard bolt.

Remove the following parts from left side of motorcycle.

20. Loosen, but do not remove, top front engine mounting bolt (23).

21. Remove three remaining engine mounting bolts (24) and lower front safety guard bolt (25).

22. Free tool box (1966 and earlier XLH model) by removing two phillips screws and one nut at base.

23. Remove battery tie rod support (1966 and earlier XLH model).

24. Disconnect ground wire (28) from battery terminal (XLH model), and spark plug cables from spark plugs (29).

25. On 1964 and earlier XLH models, remove horn cover (30) and disconnect three wires (31) from horn power pack. Free horn power pack from support bracket (32) and loosen nut securing power pack to horn trumpet (not shown). Remove power pack from threaded end of trumpet. Do not disconnect spark cable from trumpet bracket.

26. On 1964 and earlier XLCH and 1965 and later models disconnect horn wires and remove horn from engine mount bracket. Remove two engine support bracket bolts (33) and free bracket assembly from engine.

27. Free throttle cable and support bracket from carburetor. Remove cable from between the cylinders and position cable out of working area (to front of frame).

28. On XLH model, remove battery cover, positive and negative wires from battery terminals.

29. On 1966 and earlier models, disconnect oil vent line (35) at crankcase and remove from motorcycle.

30. Disconnect circuit breaker to coil wire (not shown).

31. On 1964 and earlier XLH model loosen battery tie rod support - right (not shown).

32. On 1967 model remove battery (26), battery carrier (27), and oil tank (37).

33. Remove two top rear engine mounting bolts (36) and regulator ground strap (35).

34. Remove stop light switch (1966 and earlier), rear brake foot lever and spring (38).

35. Remove left footrest (39) from motorcycle.

36. Remove two lower rear engine mounting bolts, (located directly above rear brake crossover shaft).

37. On 1964 and earlier XLH model remove battery wire (red wire with white tracer) and generator wires (red wire with black tracer and black wire with white tracer) from voltage regulator. Free oil switch wire from behind generator (green wire with white tracer).

38. Remove front top engine mounting bolt (23).

39. Engine is now free to be removed from chassis. Install a spare engine support bracket and with a hoist centered directly over engine, attach hook securely to bracket. Lift engine up off the mounting pad. Then, slip engine from left side of chassis, top of engine tipped slightly towards center of chassis.

INSTALLING ENGINE IN CHASSIS, (Fig. 3A-7 and 3A-8)

To install an engine assembly into chassis, reverse the stripping procedure in the following order:

Left side of motorcycle:

Steps 39, 36, 33, 32, 31, 38, 21, 20, 34, 33, 30, 37, 29, 27, 26, 25, 28, 24, 23 and 22.

Right side of motorcycle:

Steps 17, 15, 18, 16, 14, 11, 10, 13, 12, 9, 5, 19, 6, 3, 4, 2 and 1.

IMPORTANT

Be sure to check engine and transmission oil level before starting engine.

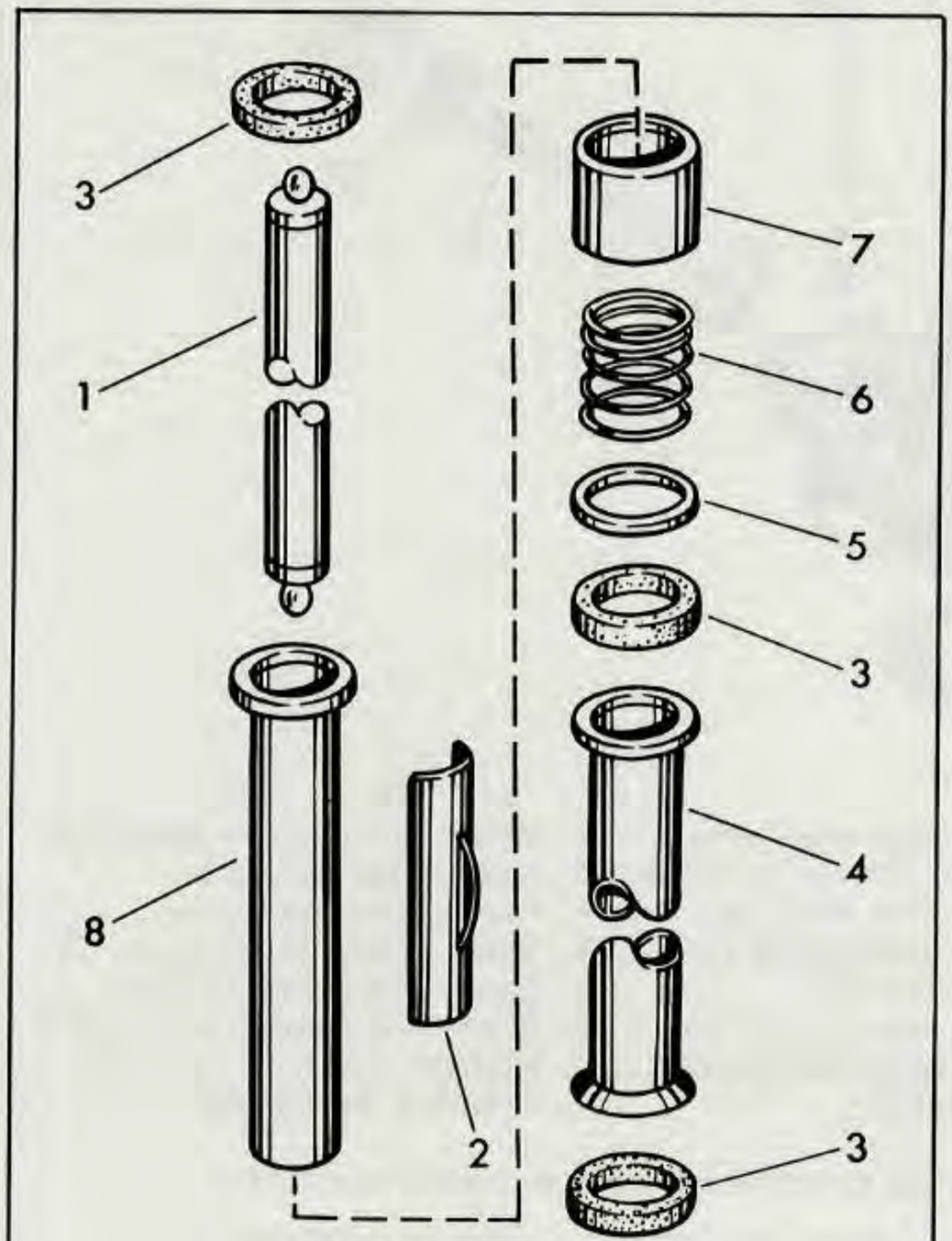
CYLINDER HEAD

CYLINDER HEAD ASSEMBLY

REMOVING CYLINDER HEAD ASSEMBLY

Before removing cylinder head assembly, strip motorcycle as described in "Stripping Motorcycle For Engine Repair," Section 3A, steps 1-5, 7, 24-27. Free carburetor and manifold assembly from motorcycle by removing two manifold clamps and carburetor support bracket nut at crankcase. Loosen two oil line nuts (2, Fig. 3B-7), and remove spark plugs.

See Fig. 3B-6, and proceed as follows. Open push rod covers. Press push rod cover spring retainers (7) down and remove push rod cover keepers (2). Telescope lower push rod cover (4) over upper cover (8).



1. Push rod
2. Cover spring keeper
3. Cover cork washer (3)
4. Lower cover
5. Cover screw washer
6. Cover spring
7. Spring retainer
8. Upper cover

Figure 3B-6. Push Rod Assembly - Exploded View

To remove cylinder head assembly, turn engine until both valves are closed in cylinder head. Remove cylinder head bolts (1, Fig. 3B-7). Free cylinder head and rocker arm cover assembly (from left side of motorcycle), valve push rods and push rod covers and oil lines in one operation. Mark push rods in some manner to identify them as to cylinder head and valve from which they were taken. If push rods are reinstalled in same locations from which they were removed, a minimum amount of valve adjusting should be necessary. If the cylinder head does not come loose on removal of head bolts, tap lightly with rawhide hammer. Never try to pry head off.

NOTE

With engine in chassis, the rear cylinder rocker arm cover and cylinder head must be removed from engine as an assembly. There is not enough clearance between rocker arm cover and frame to remove rocker arm cover only.

DISASSEMBLING CYLINDER HEAD (Fig. 3B-7)

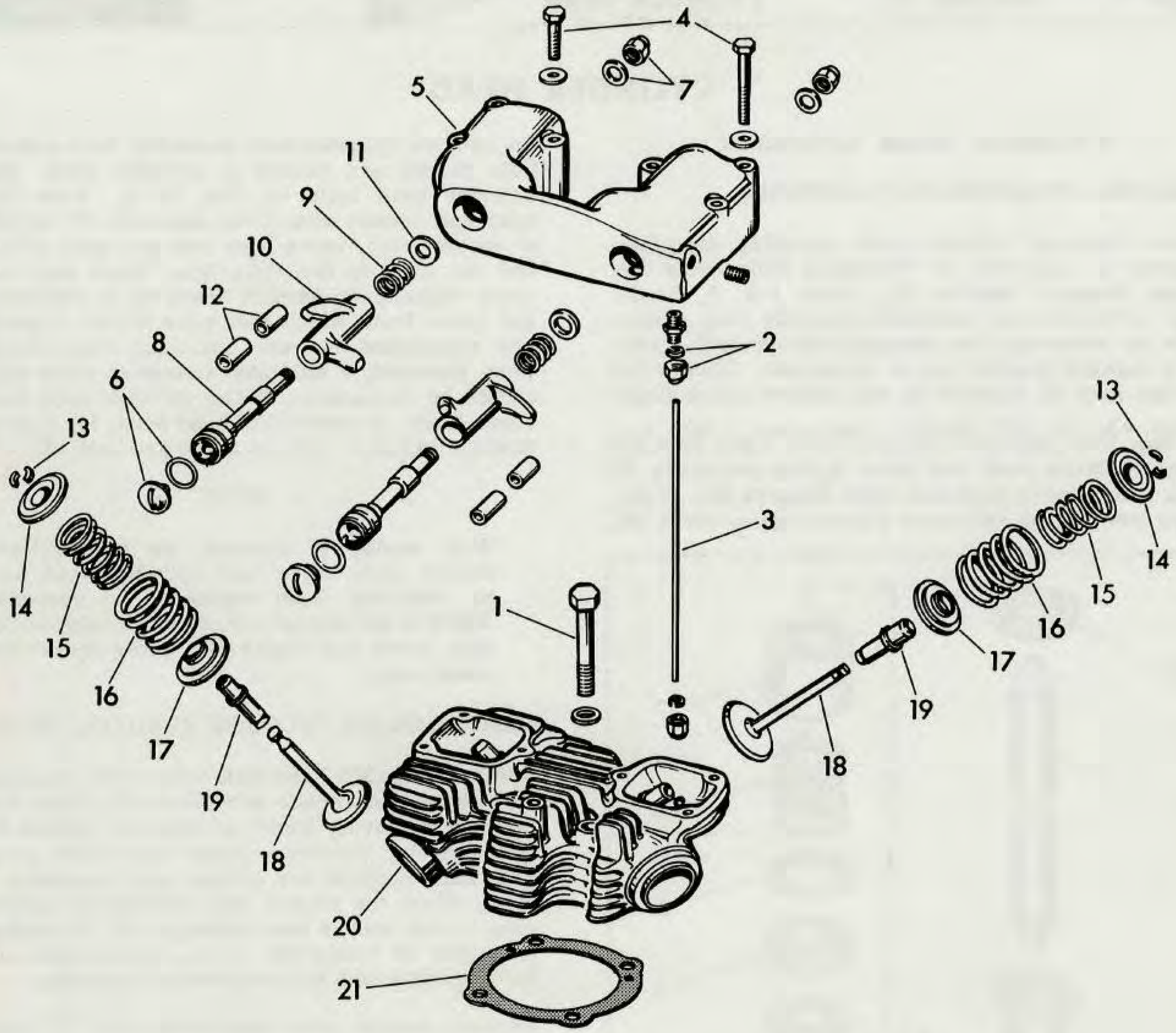
Refer to Fig. 3B-7 and follow the order of disassembly. Free the rocker arm cover (5) from cylinder head by removing cover screws (4). Before further disassembly, carefully check the rocker arm pads and ball sockets for pitting and excessive wear. Also, check the rocker arm shaft (8) for appreciable play in the rocker arm bushings (12). If rocker arm assembly is noticeably worn, disassemble unit for further inspection and replacement of parts.

Remove rocker arm shaft screw and "O" ring (6), acorn nut and washer (7). Discard shaft screw "O" ring. Tap rocker arm shaft (8) from cover and remove the following parts: Spring (9), rocker arm (10) 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. Exhaust rocker arms have extra oil hole to provide cooling on valve.

Compress valve springs using Valve Spring Compressor, Part No. 96600-36, and remove valve keys (13) from ends of valve stems as shown in Fig. 3B-8. Mark keys (13) to identify them with their respective valves. Remove valve spring collars (14 and 17), springs (15 and 16) and valves (18). 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.

CLEANING AND INSPECTING (Fig. 3B-7)

Thoroughly clean all parts and inspect them for wear and damage. Clean out oil passages with compressed air.



1. Cylinder head bolt and washer (4)
2. Oil line nut and rubber sleeve (2)
3. Rocker arm cover to crankcase oil line.
4. Rocker arm cover screw and washer (7)
5. Rocker arm cover
6. Rocker arm shaft screw and "O" ring (2 each)
7. Rocker arm shaft acorn nut and washer (2 each)
8. Rocker arm shaft (2)
9. Rocker arm spring (2)
10. Rocker arm (2)
11. Rocker arm spacer (2)
12. Rocker arm bushing (4)
13. Valve key (4)
14. Valve spring upper collar (2)
15. Inner valve spring (2)
16. Outer valve spring (2)
17. Valve spring lower collar (2)
18. Intake and exhaust valve
19. Intake and exhaust valve guide
20. Cylinder head
21. Cylinder head gasket

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

Figure 3B-7. Cylinder Head Assembly - Exploded View

Inspect oil line nut rubber sleeve (2), if damaged or worn, replace when reassembling.

Carefully check the rocker arm (10) and shaft (8) for wear. Replace rocker arm bushings if shaft is over .002 in. loose in bushings. Examine the rocker arm pads. If slightly worn, redress as described in "Repairing Rocker Arm and Bushings." If rocker arm and ball sockets are worn and elongated, the rocker arms must be replaced.

Place cylinder head in "Gunk Hydro-Seal" until deposits are soft. Then clean outside of cylinder head (20) with a wire brush. Scrape carbon from cylinder head combustion chamber, inlet and exhaust valve ports. When scraping carbon, be careful not to scratch or nick cylinder head face, as leakage will

result. Blow off loosened carbon and dirt particles and wash head in gasoline or solvent. Force air through all oil holes in cylinder head to make sure passages are clean.

If the valve seat is pitted, burned, corroded or has any indication of improper valve seating, recondition the seat as described in "Refacing Valves and Valve Seats." Replace any valve seat inserts that are cracked or loose in the cylinder head. See "Replacing Valve Seat Inserts."

Check length and tension of each valve spring (15 and 16) using Valve Spring Tester, Part No. 96797-47. Replace spring if 1/8 in. or more shorter than a new spring, or tension shows 5 lbs. below low limit tension of new spring. Refer to, "Engine Specifications," Section 3A, for free length, compressed length and poundage of new valve springs.

Remove carbon from valve head and stem using a knife and wire wheel - never a file or other hardened tool that will scratch or nick valve. Polish valve stem with fine emery cloth or steel wool. Replace valves that are badly scored, warped or in bent condition. Reface valves that are slightly pitted, burned or in corroded condition as described in "Refacing Valves and Valve Seats."

Clean intake valve guide with a 5/16 in. reamer and exhaust valve guide with a 11/32 in. reamer, and examine for wear and valve stem clearance. Check the valve fit in guide and guide fit in cylinder head. Replace guide, or possibly both valve and guide if either part is not within tolerances, described in "Engine Specifications," Section 3A.

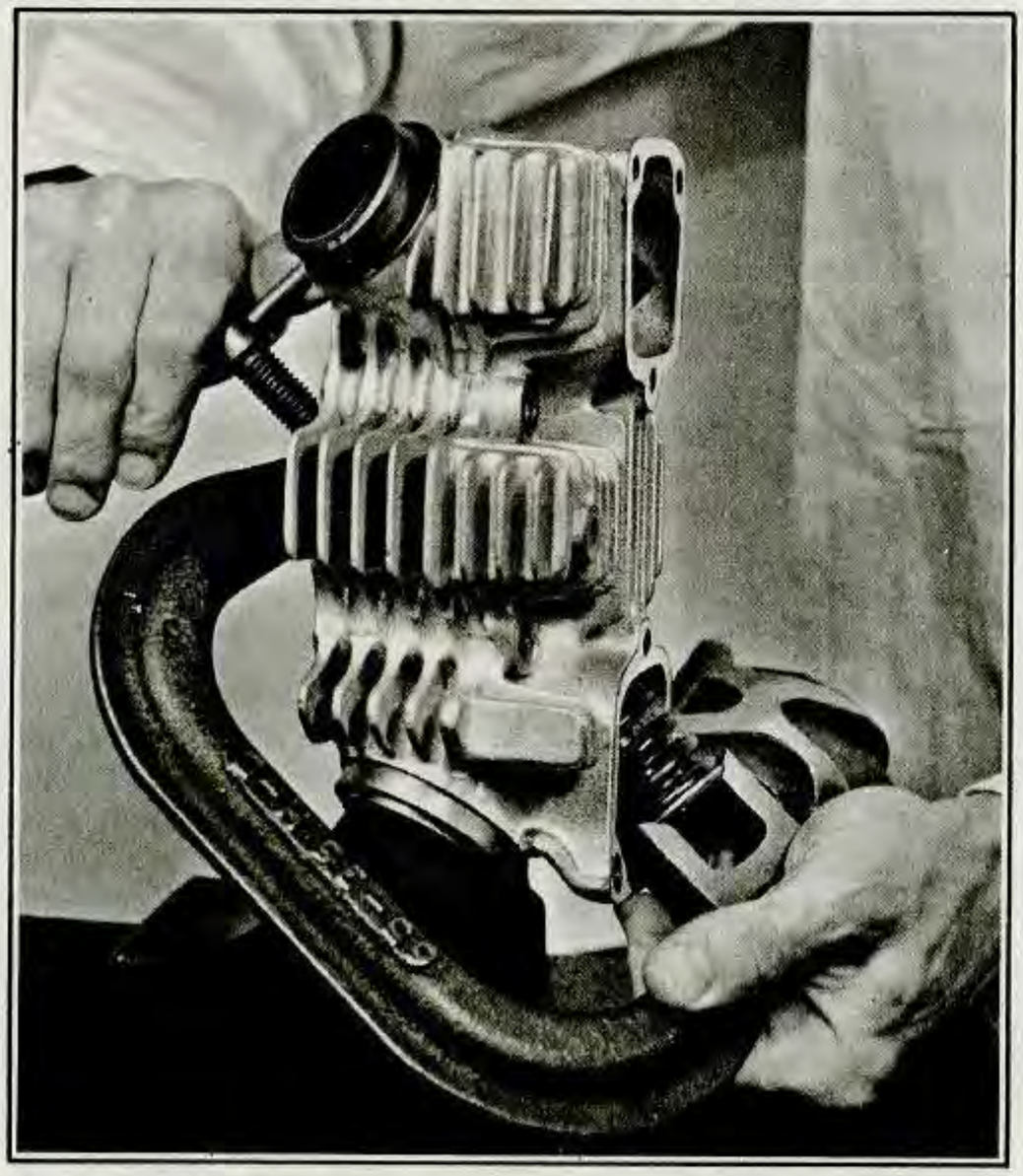
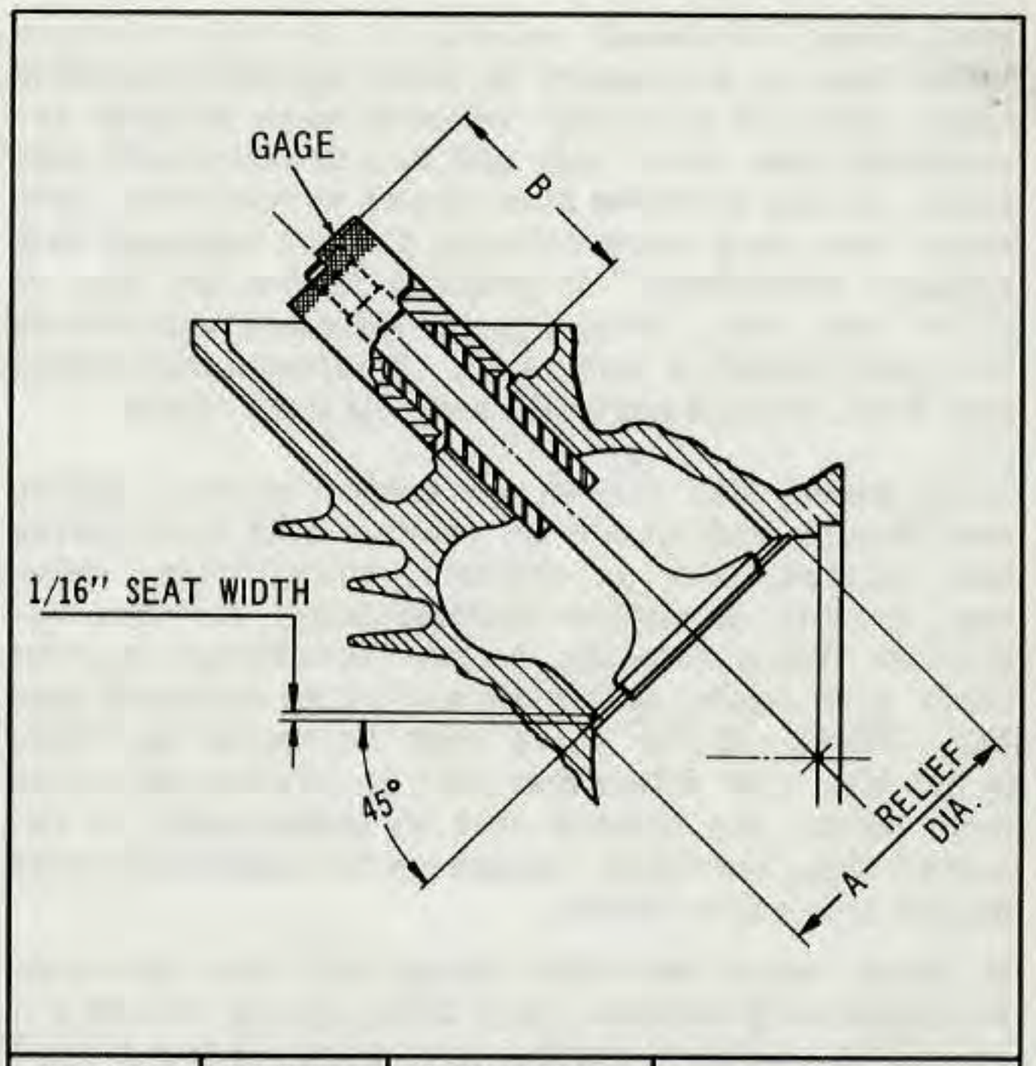


Figure 3B-8. Valve Spring Compressor



Model	Valve	Relief Dia. A	B	
			Max.	Min.
XL	Int. Exh.	1.75 1.62	1.420 (all)	1.375 (all)
XLH	Int. Exh.	1.87 1.62		

Figure 3B-9. Valve Seat Specifications

Inspect push rod (1, Fig. 3B-6) for damage and wear. Pay particular attention to the ball ends. If the ball ends are worn and flattened replace the push rod, otherwise satisfactory tappet and push rod adjustment cannot be made and "upper end" push rod trouble is likely to be experienced.

REPAIRING ROCKER ARM AND BUSHINGS (Fig. 3B-7)

To replace worn bushings (12), 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. New bushings should be line reamed using Reamer, Part No. 94804-57.

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.

REFACING VALVES AND VALVE SEATS

To recondition or reface valve use a valve-refacing machine (available commercially). Adjust grinder to exactly the same angle as valve face, which is 45° for both intake and exhaust valves. Make very light

cuts, being extremely careful to remove no more metal than is necessary to clean up and true valve face. Valve is correctly refaced when all pits are removed from valve face and face is concentric with stem. If end of valve stem shows uneven wear, true end of stem on a valve refacing grinder equipped with suitable attachment. If grinding leaves the edge of valve very thin or sharp, or indicates valve stem warpage, install a new valve. A valve in this condition does not seat normally and will burn easily.

Valve seats, like valves, are subject to wear, pitting and burning and should be refaced each time valves are refaced. Use an electric motor driven valve seat grinder (available commercially), for this operation. When refacing, be sure to maintain correct valve seat angle, seat width and relief diameter (see Fig. 3B-9). If the valve seat becomes too wide, grind the seat relief diameter to achieve specified seat width. Be careful that no more metal is removed than absolutely necessary to completely clean up and true valve seats.

If valve seats and valve faces have been smoothly and accurately refaced, very little lapping will be required to complete seating operation. Apply a touch of lapping compound to valve face, insert valve in guide, and using Lapping Tool, Part No. 96550-36, give valve a few oscillations - just enough to give face and seat a lapped finish (see Fig. 3B-10). Remove valve, wash valve face and seat thoroughly with clean gasoline and allow to dry, or blow dry with compressed air. When inspection shows an unbroken lapped finish around both valve face and seat, valve is well-seated. Apply a light coat of oil to valve face and seat when reconditioning job is finished.

REPLACING VALVE SEAT INSERTS

As valves and seats are refaced from time to time, valve seats widen and valves seat in lower position when fully closed. Passage around valve when fully open is restricted and the valve will tend to float as spring tension is reduced. To determine whether a valve seat requires grinding or a new valve seat insert, check the table in Fig. 3B-9. If measurement B exceeds maximum limit of 1.420 in., a valve seat insert should be installed. A special gage is available under Part No. 96489-63 which is used to measure this dimension. The tool consists of a gage valve and gage which is placed over the valve stem. If top end of gage valve stem is between steps on gage, the valve seat location is satisfactory.

Cylinder heads 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.

REPLACING VALVE GUIDES

Valve guides are a press fit in cylinder heads and should be removed and installed with an appropriate drift. When new valve guides are pressed into cylinder heads, they may close up slightly and the ends may become burred, therefore, after new guides are in place they should be checked and reamed, if necessary, to obtain a correct fit. Use a 5/16 in. reamer for the intake guide and a 11/32 in. reamer for the exhaust valve guide.

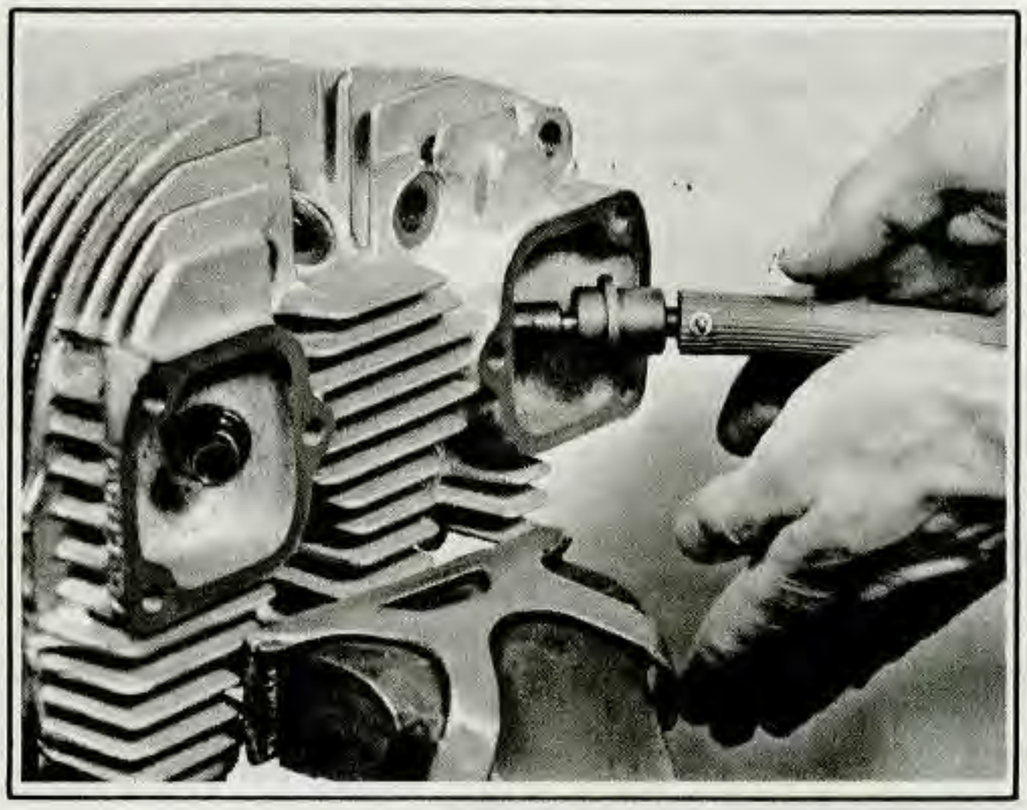


Figure 3B-10. Lapping Valve Face and Seat

It is of prime importance that valve guides fit tightly in cylinder heads. If original guide or new standard guide is not a tight press fit, an oversize guide must be installed. Valve guides are available .001 and .002 in. oversize. When a valve guide is removed and a new guide installed, it is not likely to be concentric with valve seat. If a valve guide is not concentric or true with seat, leakage and burning of valve may result, or valve may break due to cocked seating and deflection of valve stem. Therefore, it is especially important after installing new guides that seats be carefully refaced to make them concentric with guides and assure perfect alignment and matching of valve face and valve seat. See "Refacing Valves and Valve seats."

ASSEMBLING CYLINDER HEAD (Fig. 3B-7)

To install valve assemblies in cylinder head, reverse the disassembly procedure. Apply a light coat of oil to valve seats and stems. Be careful to insert marked valves (18) in their respective guides (19). Carefully seat lower valve spring collar (17) over valve guide. Install springs (16 and 15) and upper collar (14). Compress valve springs with Valve Spring Compressor, Part No. 96600-36. Position keys (13) in valve key groove using grease to hold them in place and slowly release compressor tool until keys are correctly locked in groove (see Fig. 3B-8).

Position spacer (11) in countersunk hole in rocker arm cover. Install marked rocker arms (10) in their respective cover location. Compress spring (9) and position spring between rocker arm and washer. Apply a light film of oil to rocker arm shaft (8) and insert in cover assembly. Examine spring ends to be sure they are square with washer and rocker arm. Install and securely tighten acorn nut and washer (7), shaft screw and new "O" ring (6). Check rocker arm action to make sure it is not binding.

Carefully clean top of cylinder head and rocker arm cover faces with a clean rag. Apply a thin coating

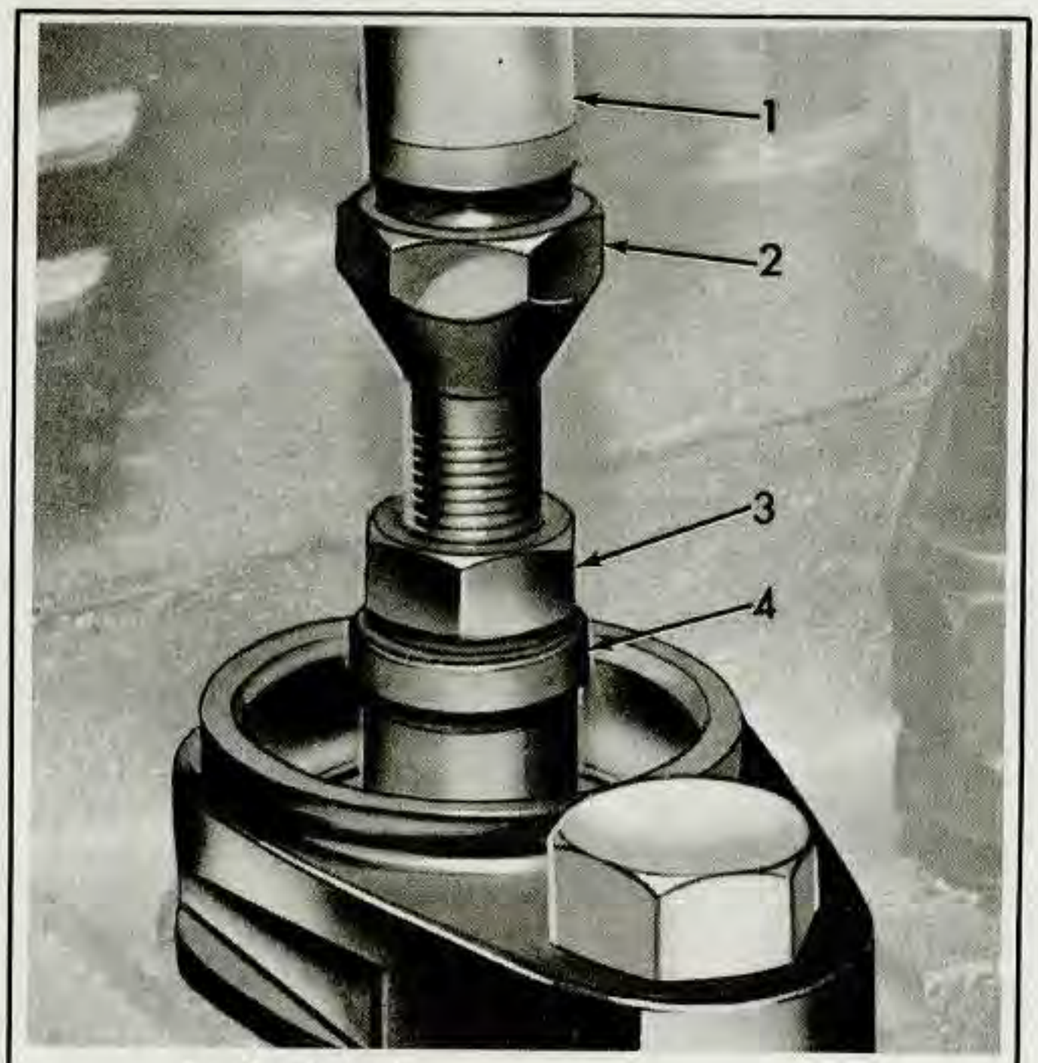
of aluminum paint to cylinder head face and position rocker arm cover on cylinder head. Install rocker arm cover screws (4) with flat washer under head of each screw. Screws must be tightened evenly to attain a tight joint. First turn them snug; then tighten each one, 1/8 or 1/4 turn at a time until all are securely tightened.

INSTALLING CYLINDER HEAD ASSEMBLY (Fig. 3B-7)

To install the cylinder head assembly, reverse the order of disassembly. Clean top of cylinder and cylinder head faces and wipe them off with a clean rag. Apply a light coat of engine oil or grease to both sides of a new gasket and position gasket on cylinder face.

Turn engine over so cylinder tappets are at their lowest position and install cylinder head, push rods and push rod covers in one operation. Install push rods in their original position in cylinder head. Be sure push rods register in tappet screw sockets at bottom end and in push rod sockets at upper end. Register oil line (3) in head and crankcase connection.

Install cylinder head bolts with flat washers under head of each bolt. Bolts must be tightened evenly to attain a tight joint. First turn bolts snug, then tighten each of them 1/8 or 1/4 turn at a time with a torque wrench until all are tightened to 65 ft-lbs. Follow same procedure for both cylinder heads. Make sure rubber sleeves are in place and tighten oil line nuts (2).



1. Push rod
2. Tappet adjusting screw
3. Tappet adjusting screw lock nut
4. Tappet body

Figure 3B-11. Adjusting Tappets

Before installing carburetor, replace intake manifold rubber "O" rings. Assemble "O" rings on manifold and then slip carburetor assembly into position aligning the hole in carburetor support bracket with top center crankcase stud. Just snug up stud nut. Carefully square manifold face with cylinder head intake port face and slip rubber "O" ring onto its seat. Insert and tighten two manifold clamps. Tighten crankcase stud nut securely.

NOTE

There are likely to be air leaks around manifold-cylinder head joints, unless manifold is perfectly aligned with cylinder head intake port face, rubber "O" rings are in good condition and manifold clamps securely tightened. Air leakage will affect carburetion, particularly at low speeds.

If all necessary steps have been taken and air continues to leak around manifold-cylinder head joints, it may be necessary to loosen the cylinder base nuts to allow final shifting and alignment of cylinders and manifold. Be sure to tighten base nuts after alignment.

Check tappet adjustment as described below and reassemble remaining parts.

ADJUSTING TAPPETS (Fig. 3B-11)

To get the maximum power and best all-around performance from an engine, keep valve tappets properly adjusted. They should be inspected and, if necessary, readjusted initially at 500 and 1000 miles and every 2000 miles thereafter.

Engine must be cold during tappet adjustment. As each tappet is readjusted, make sure it is at its lowest position, by turning engine ahead until the like tappet in the other cylinder is at its highest position (valve fully opened). The inlet valves are those nearest the carburetor.

To uncover tappets, press down on push rod cover spring retainer, and remove keeper at upper end. Cover then telescopes. Loosen tappet adjusting screw lock nut (3) and turn adjusting screw (2) downward (into tappet body) until push rod is just free and has noticeable shake. When checking for push rod shake, grasp push rod with finger tips just below cylinder head, and shake toward front and rear of engine. Slowly turn adjusting screw upward (toward push rod) until nearly all play is removed. At this point, lock tappet screw lock nut against tappet body (4) and recheck for correct tappet adjustment. A tappet is correctly readjusted when push rod has slight amount of play or shake, and can be turned freely with finger tips, completely around, without trace of bind.

When reassembling push rod covers, make sure that both ends of covers are properly seated against cork washers.

REMOVING AND INSTALLING PUSH RODS ONLY (Fig. 3B-11)

Before attempting to remove push rod and cover assembly, turn engine until tappet is at its lowest position. Turn adjusting screw lock nut (3) all the way up to end of thread on adjusting screw (2). Turn adjusting screw (2) all the way down into tappet body. Remove push rod and cover assembly by prying push rod upward and to one side, be careful not to bind push rod upper end in aluminum rocker arm housing. Doing so may result in a bent push rod. Install new cork washers (3, Fig. 3B-6) in aluminum rocker arm housing and in tappet guide, being careful not to damage them and making sure they are well seated. Replace cork washer (3, Fig. 3B-6) in push rod cover with a new one.

Reassemble push rod and push rod cover assembly in reverse order of disassembly. Check tappet adjustment as described in "Adjusting Tappets."

CYLINDER

CYLINDER AND PISTON

REMOVING CYLINDER AND PISTON (Fig. 3C-16)

See "Stripping Motorcycle For Engine Repair," Section 3A, steps 1-5, 7, 24-27 and "Removing Cylinder Head Assembly From Engine," Section 3B.

See Fig. 3C-16, and proceed as follows: Clean crankcase around cylinder base to prevent dirt from falling into crankcase when lifting cylinders. Remove cylinder base stud nuts (1). Raise cylinder and piston just high enough to permit placing a rag over crankcase opening; this will prevent dirt and possibly pieces of broken ring from falling into crankcase. With piston at bottom of stroke, remove cylinder (2), discard cylinder base gasket (3). Spring piston rings (4) outward until they clear grooves in piston (7) and lift off. Pry piston pin lock rings (5) from piston (7) groove using two sharp pointed instruments such as awls. Support piston and tap out piston pin (6) with a suitable drift.

Remove piston pin bushing (8) if necessary (see "Cleaning and Inspection") using Piston Pin Bushing Tool, Part No. 95970-32. Do not drive bushing out with a drift unless rod (9) is disconnected and well supported around piston pin hole.

CLEANING AND INSPECTION

Place piston and cylinder in "Gunk Hydro-Seal" or other carbon and gum dissolving agent until deposits are soft. Then thoroughly scrub piston and cylinder in gasoline or solvent to remove deposits. Where carbon deposit is thick or hard, it is advisable to scrape carbon before cleaning. Use a putty knife-type scraper or a ground tip from an old file. Use extreme care to avoid scraping into aluminum of pistons.

After parts are thoroughly washed, blow dry with compressed air. Force air through oil holes in cylinder. Clean piston ring grooves with a tool for cleaning ring grooves; if not available, sharpen end of a broken ring to a chisel edge. Avoid scratching or damaging sides of ring grooves.

Examine piston pin to see that it is not loose in connecting rod, grooved, pitted or scored. If necessary, remove bushing as described in "Disassembling Cylinder and Piston."

A piston pin, properly fitted, is a light hand press fit in piston and has .001 in. clearance in connecting rod upper bearing.

If difference in diameter of hole in piston pin bushing and diameter of piston pin exceeds a .002 in. fit, replace worn parts.

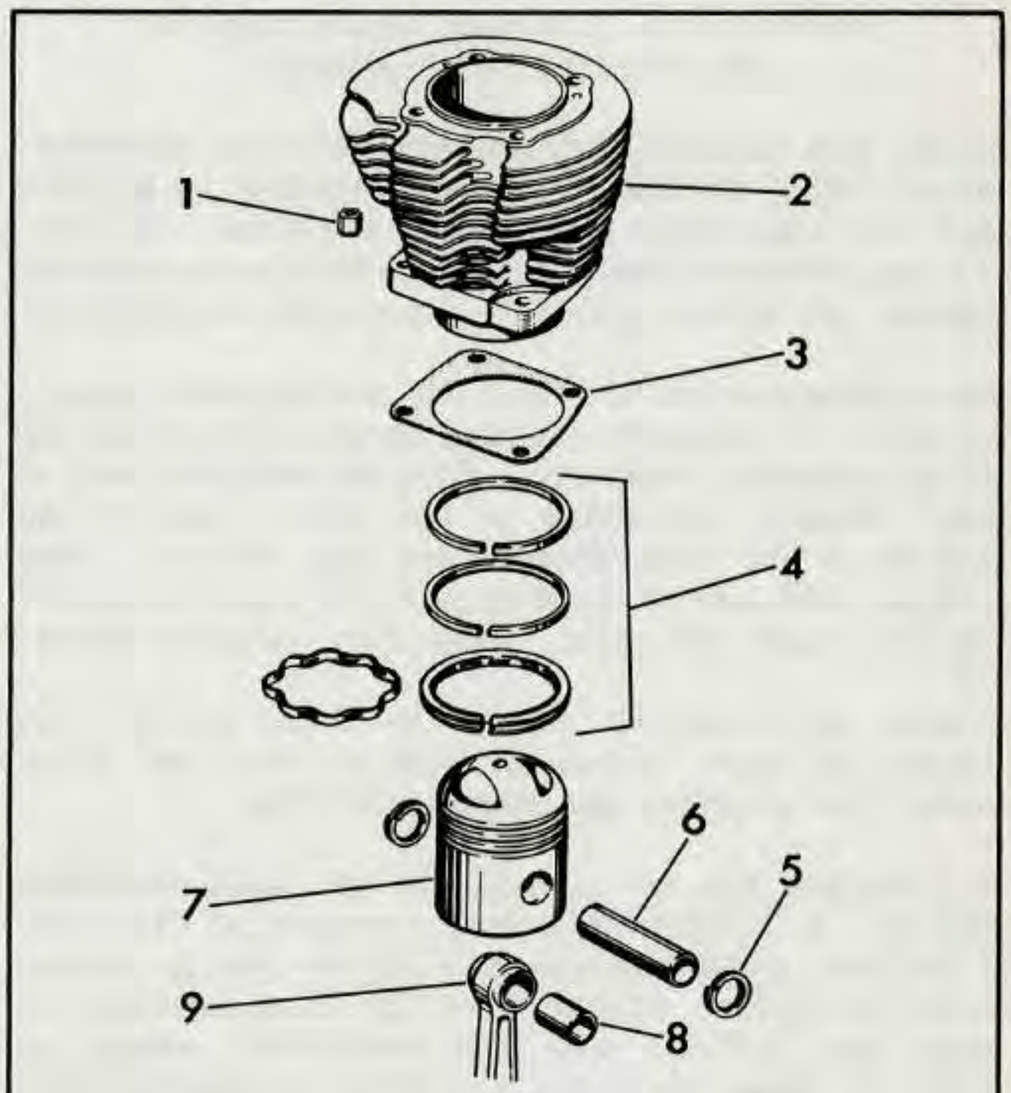
Replace piston pin lock ring whenever it is removed from piston groove. If opposite side ring has not been removed and is undamaged, it is not necessary to disturb it.

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

Check rods for up-and-down play and upper end side shake (see Fig. 3C-17). To make this check with accuracy, pistons should first be removed. When appreciable up-and-down play is found and side shake (rod tip) at extreme upper end is 11/64 in. or more for front rod or 3/64 in. or more for rear rod, lower bearing should be refitted. This requires removing and disassembling engine crankcase. See "Crankcase," Section 3E.

REFINISHING CYLINDERS

Pistons and cylinders must be gauged to see if they are worn to the point where cylinders must be refinished and oversize pistons installed.



1. Cylinder base nut (4)
2. Cylinder
3. Cylinder base gasket
4. Set piston rings
5. Piston pin lock ring (2)
6. Piston pin
7. Piston
8. Piston pin bushing
9. Connecting rod

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

Figure 3C-16. Cylinder and Piston - Exploded View

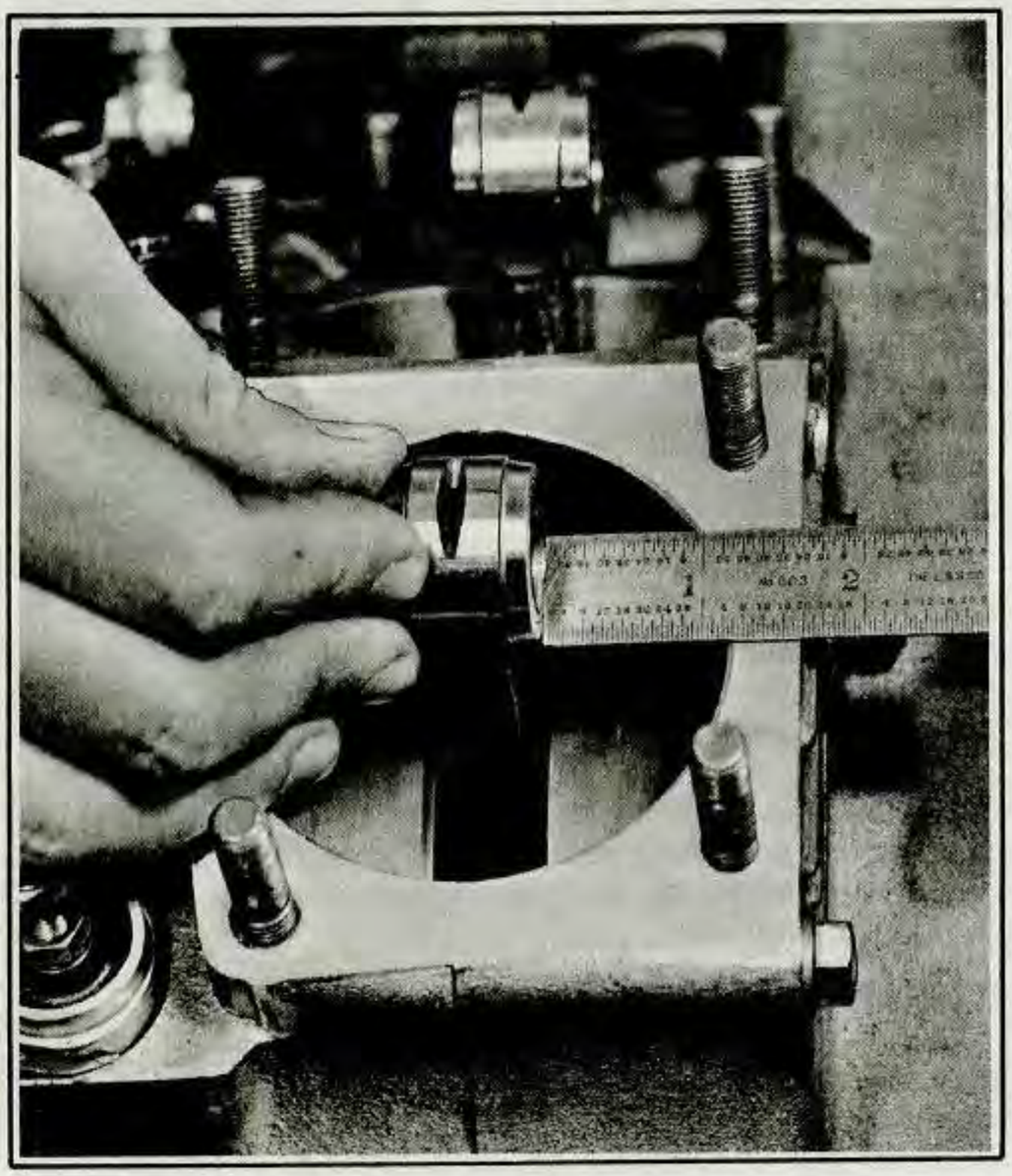


Figure 3C-17. Checking Connecting Rod for Crankpin Bearing Wear



Figure 3C-18. Measuring Cylinder

Inside and outside micrometers used for cylinder-piston fitting should be checked together to be sure they are adjusted to read exactly the same. By subtracting piston measurement from bore measurement, amount of piston-cylinder clearance is obtained.

Bore measurement of a used and worn 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 the ring travel (see Fig. 3C-18). This process will determine if cylinder is out-of-round or "egged" and will also show any cylinder taper.

Piston measurement should be taken at extreme bottom of skirt, measured front to rear, 90° from center line of piston pin (see Fig. 3C-19).

If cylinders are not scored and are worn less than .002 in., it is not usual practice to refinish oversize. If the total piston clearance is .002 to .006 in., a new standard piston, or piston of the same oversize to which the cylinder was last refinished, should be fitted to reduce clearance and effect reasonably quiet operation.

If cylinders show more than .002 in. wear, they should be refinished to the next oversize step and fitted with new corresponding pistons and rings.

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 inch oversize piston to be used measures 3.0190 inches, adding .0025 inch (desired clearance) equals 3.0215 inches (finish-honed size). When cylinders require reboring to beyond .070 inch oversize to clean up, cylinder oversize limit has been exceeded and the cylinder must be replaced.

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

Cylinders can be refinished oversize either with a hone, or a boring bar followed by a finishing hone. In general practice only cylinders not scored and not badly worn are refinished using only a hone. Cylinders badly worn or deeply scored are first rebored to nearly the required oversize and then are finish-honed to exact size. When cylinders must be rebored to beyond .070 in. oversize to clean up, their oversize limit has been exceeded and the cylinders must be replaced with new ones.

FITTING PISTON RINGS

If cylinders are worn less than the .002 in. maximum and refinishing is not necessary, (unless they are scuffed or grooved) the same pistons may be used with the replacement of rings. However, before reassembling it is a good practice to rough up the cylinder wall with No. 150 Carborundum emery paper or a No. 300 hone. This will remove any high spots, carbon or foreign material from the cylinder wall and at the same time provide a surface suitable for proper lubrication and ring seating.

Piston rings are of two types - Compression (plain face) and oil control. The two compression rings are positioned in the two upper piston ring grooves, chamfered side up. Rings are available in following oversizes to fit standard oversize pistons: .010, .020, .030, .040, .050, .060 and .070 in.

The rings must have proper side clearance in ring grooves. See "Specifications" Section 3A. Check with thickness gauge as shown in Fig. 3C-20. Gap between ends of rings when inserted squarely in cylinder bore must also be as specified in Section 3A.

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

To check ring gap place a piston in cylinder with top end of piston about 1/2 in. from top end of cylinder. Set the ring to be checked in cylinder bore squarely against piston. With a thickness gauge, check ring gap as shown in Fig. 3C-21.

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

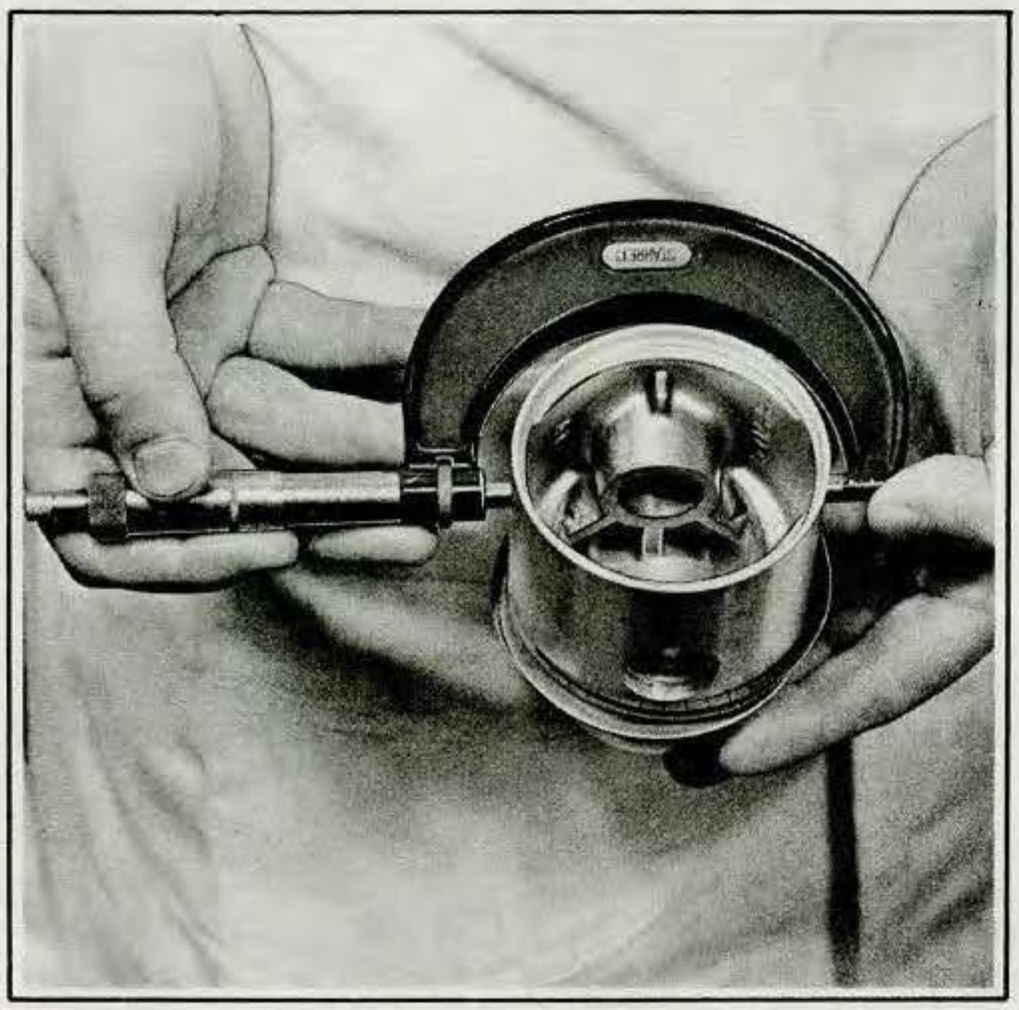


Figure 3C-19. Measuring Piston

If cylinder has been refinished oversize, use the correct oversize rings, fitting rings to give standard gap.

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

The two chrome plated compression rings, recognized by bright finish, are used in top and second ring grooves, with chamfer on one edge of the inside



Figure 3C-20. Measuring Ring Clearance in Grooves

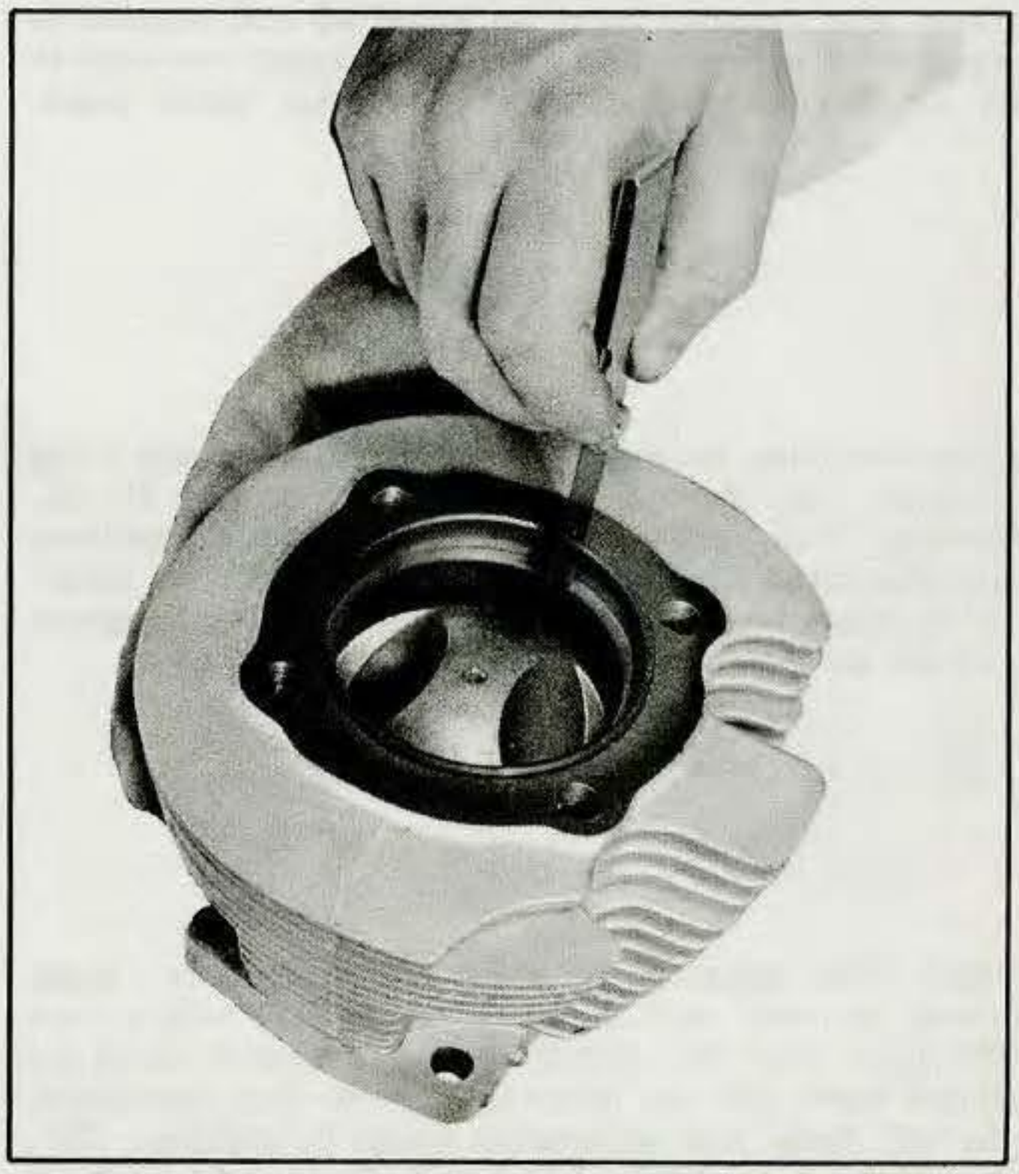


Figure 3C-21. Measuring Piston Compression Ring Gap

diameter facing top of piston when installed. Slotted oil control ring is used in bottom ring groove.

Use a piston ring expander tool to slip compression rings over piston into their respective grooves as shown in Fig. 3C-23. Be extremely careful not to overexpand, twist rings or damage the finely finished piston surface when slipping them in place. The piston ring expander tool can also be used to good advantage when removing piston rings.



Figure 3C-23. Installing Piston Rings

CONNECTING ROD BUSHING

When connecting rod bushing is found tight in rod but is worn to excessive pin clearance (.002 in. or more) it is, of course, possible to repair it by reaming oversize and fitting an oversize pin. However, it is better practice to install a new bushing and ream it 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 larger pin. The principal objection to fitting upper end oversize is that considerably more time is required for the job. New pistons obtained from factory are supplied correctly fitted with standard pin, and installing one is a short job if the rod bushing is already reamed to standard size. If bushing has been reamed oversize, either 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.

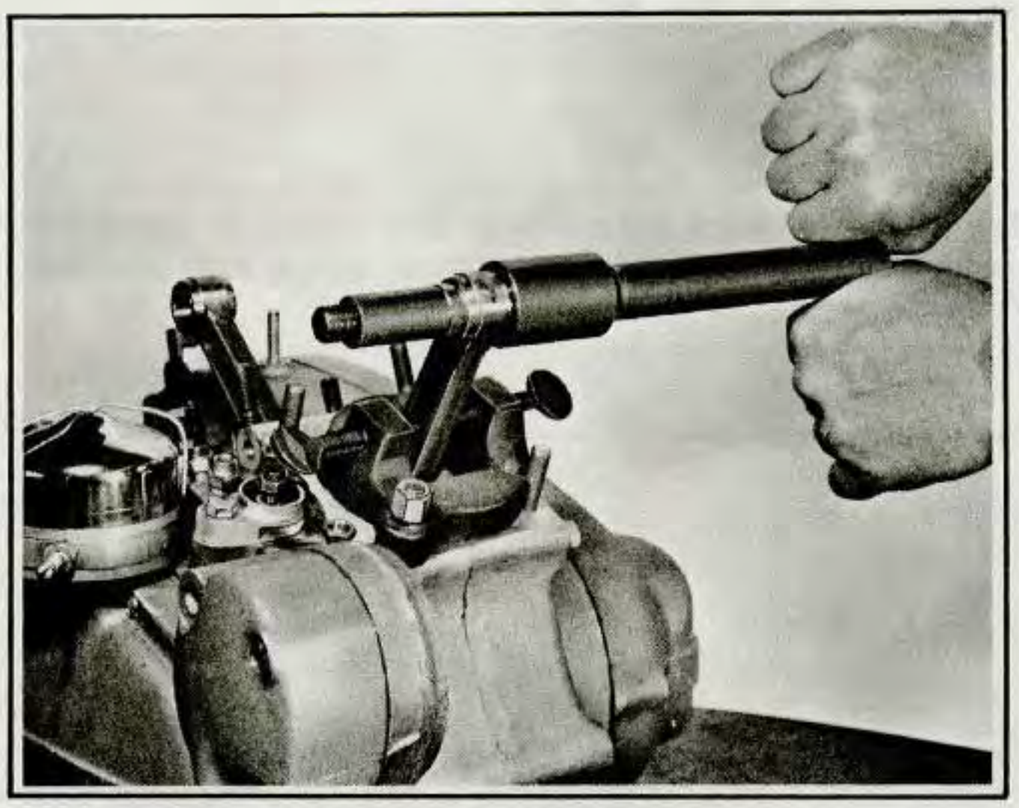


Figure 3C-24. Installing New Connecting Rod Bushing

When removing bushings in connection with only a top overhaul, use special tools as shown in Fig. 3C-24, Bushing Tool, Part No. 95970-32, and Connecting Rod Clamping Fixture, Part No. 95952-33. Be careful to start new bushings with oil slot in alignment with oil slot in rod.

Oversize piston pins are available .002, .004, .006, .008 and .010 in. oversize.

Ream new bushing to size, or preferably, ream nearly to size and finish to exact size with a hone (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.

After installing new connecting rod upper end bushings in connection with only a top overhaul, connecting rod alignment must be checked the same as when an engine is completely overhauled.



Figure 3C-25. Checking Connecting Rod Alignment

STRAIGHTENING CONNECTING RODS

In refitting and reassembling connecting rods, and finally fitting pistons, rods may possibly be bent or twisted, throwing upper bearing and lower bearing out of alignment with each other to some extent. Therefore, after pistons have been installed, rods must be checked and re-aligned as may be necessary. If a rod is left bent, or twisted, piston has a "cocked" relation to cylinder bore and the result is excessive noise and rapid wear.

Check rod alignment by means of Piston Squaring Plate, Part No. 96181-26, as shown in Fig. 3C-25. Be sure crankcase face is clean and free from burrs so that squaring plate seats fully.

If a rod is in perfect alignment, piston bottom will rest squarely on plate with flywheels turned so that crank pin is in either forward or rear position. Keep in mind that this check, to be accurate, depends upon checking with crank pin 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 very thin paper of equal thickness underneath piston, one on each side, below piston pin, as shown in Fig. 3C-25. Press piston down lightly with fingertips 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-26. 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 position; rod is bent.

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

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

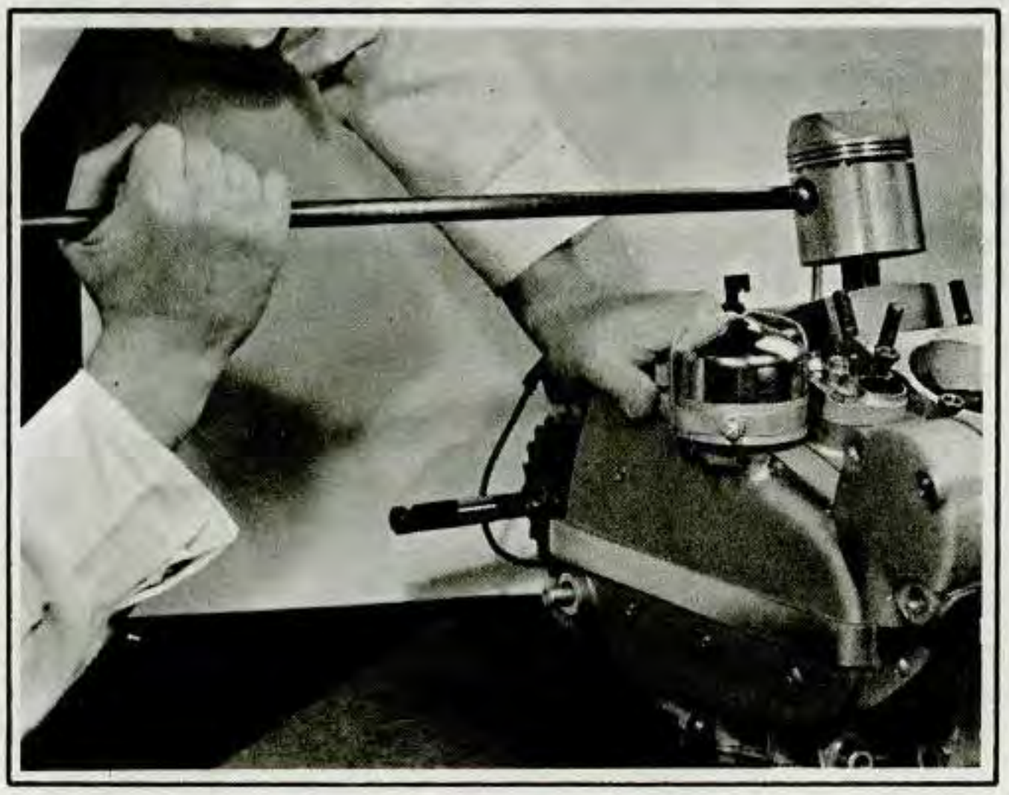


Figure 3C-26. Straightening Connecting Rod



Figure 3C-27. Inserting Piston Pin Lock Ring in Tool

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.

3. To straighten a bent and twisted rod (combination of a bend and twist), remove bend first and then remove twist. See above paragraphs, Nos. 4 and 5.

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.

ASSEMBLING CYLINDER AND PISTON (Fig. 3C-16)

When connecting rod is true, remove squaring plate and attach piston so web on piston pin boss inside piston skirt is to right side of engine. Be sure left side piston pin lock ring is in place. If the piston is heated the piston pin may be inserted into piston with a slip or light press fit.

After pin is in place, install new piston pin lock ring using special Lock Ring Tool, Part No. 96780-58A, as shown in Fig. 3C-27 and 3C-28. Make sure ring groove is clean and that ring seats firmly in groove. If it doesn't, discard the ring and install a new one. A lock

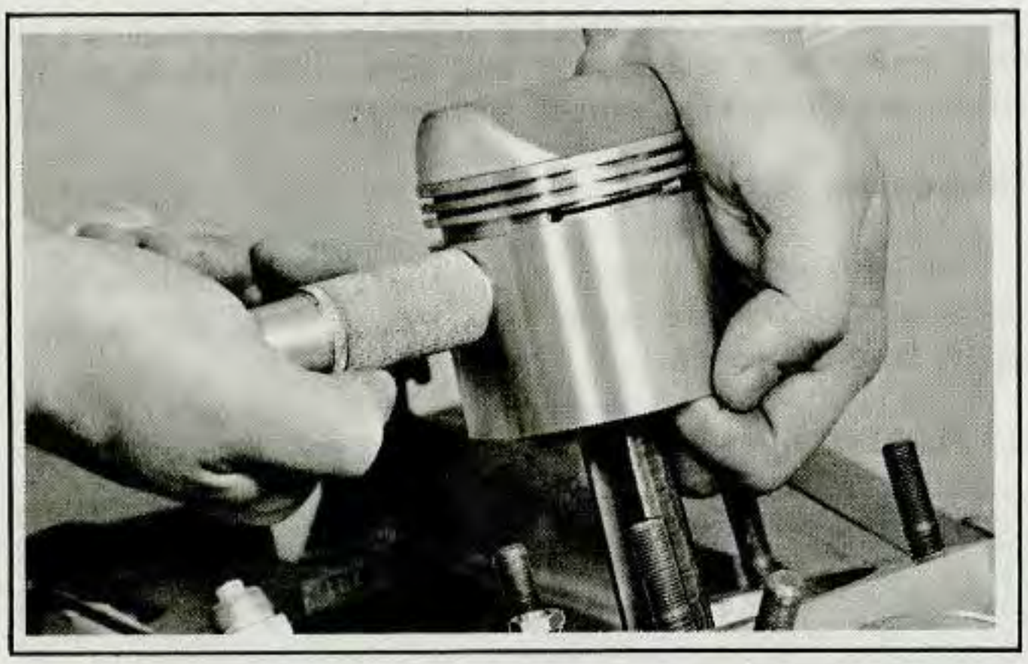


Figure 3C-28. Installing Piston Pin Lock Ring in Piston



Figure 3C-29. Installing Cylinder on Piston

ring loosely installed will rapidly loosen further in service and finally will come out of piston groove, resulting in both piston and cylinder soon being damaged beyond repair. Never install a used lock ring or a new one if it has been installed and then removed for any reason, always use a new lock ring.

Lubricate cylinder walls, pistons, pins and rod bushings with engine oil. Space ring gaps about 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. 96331-57, on rear piston and slip rear cylinder down over piston as shown in Fig. 3C-29. Install flat washers and nuts and pull them down tight. Repeat process to assemble front cylinder.

Assemble cylinder head and remaining parts of motorcycle as indicated in "Installing Cylinder Head Assembly," Section 3B.

GEARCASE

OIL PUMP

GENERAL

The oil feed and scavenger (oil return) pumps are gear-type pumps incorporated in one pump body with a check valve on the oil feed side. The feed section forces oil to the engine and the scavenging section returns oil to the tank.

The oil pump seldom needs servicing; therefore, before disassembling the pump for any repairs because of no oil pressure, be absolutely certain that all possible related malfunctions have been eliminated:

Check the level and condition of oil in the tank. If oil is diluted, pressure will be affected. In freezing weather, the oil feed line may clog with ice and sludge, preventing circulation of oil.

Check for a grounded oil pressure switch wire or a faulty switch if oil indicator light fails to go out with engine running. See "Engine Lubrication," Section 3A, for additional information.

Inspect the oil pump check valve. The check valve prevents the gravity flow of oil into the crankcase when the engine is not running and provides correct oil pressure for operation of the oil signal light switch. If the check valve is not seating correctly, oil will bypass the valve and drain oil from the tank into the crankcase and on starting the engine, a considerable amount of accumulated oil will be blown through the crankcase breather pipe. If this condition exists, disassemble and inspect the check valve. See "Disassembling Oil Pump Check Valve."

If no oil pressure or return oil is indicated at the oil tank (return line) when engine is running, or an excessive amount of oil is blown from the breather pipe, (after all other possible troubles have been eliminated, including inspection of the oil pump check valve), disassemble the oil pump for further inspection and repair. See "Disassembling Oil Pump."

When an oil pump has to be disassembled for repair, damage is usually caused by a foreign particle, such as a metal fragment, that has worked its way into the oil circulatory system. If this particle passes through the pump's protective screening, damage will result when it enters the pump. Primarily, the damage consists of a sheared oil pump drive lock pin (18, Fig. 3D-10), broken retaining ring (7) or subsequent damage to gears and other parts.

DISASSEMBLING OIL PUMP CHECK VALVE (Fig. 3D-10)

Thoroughly clean exterior of pump in gasoline or cleaning solvent before disassembly. Disconnect oil pressure switch wire and disassemble switch (1) from motorcycle. Remove oil pump nipple (2). Free check valve spring (3) and valve (4) from pump body.

CLEANING AND INSPECTING OIL PUMP CHECK VALVE (Fig. 3D-10)

Clean all parts in gasoline or cleaning solvent. Blow out pump nipple (2) oil passage and the nipple valve spring guide. Examine the nipple for any damage that would bind or hinder the free operation of spring (3). Carefully examine the nipple threads for wear; if badly worn replace nipple.

Inspect spring (3) for breakage and rusted condition. Replace if worn or damaged. Free length of new check valve spring (3) is approximately 1-15/64 in.

Carefully inspect the oil pump check valve ball (4) for wear and rusted condition. Valve may have rings formed by action on valve seat. Valves not perfectly smooth and round should be replaced.

Using a light, inspect valve seat in pump body (16) for pits and for dirty condition. A small particle of foreign matter lodged on valve seat will prevent check valve ball from seating. If seat is only slightly damaged place check valve ball on seat and with a drift lightly tap against its seat to remove slight striation marks or pits. Replace pump body if valve seat is badly damaged. See "Disassembling Oil Pump."

ASSEMBLING OIL PUMP CHECK VALVE (Fig. 3D-10)

Assembly is essentially the reverse order of disassembly. Apply a light coating of oil to all moving parts. Make sure that check valve ball (4) is correctly seated and valve action is free. Be extremely careful to prevent dust, dirt or other foreign particles from getting on the parts when reassembling.

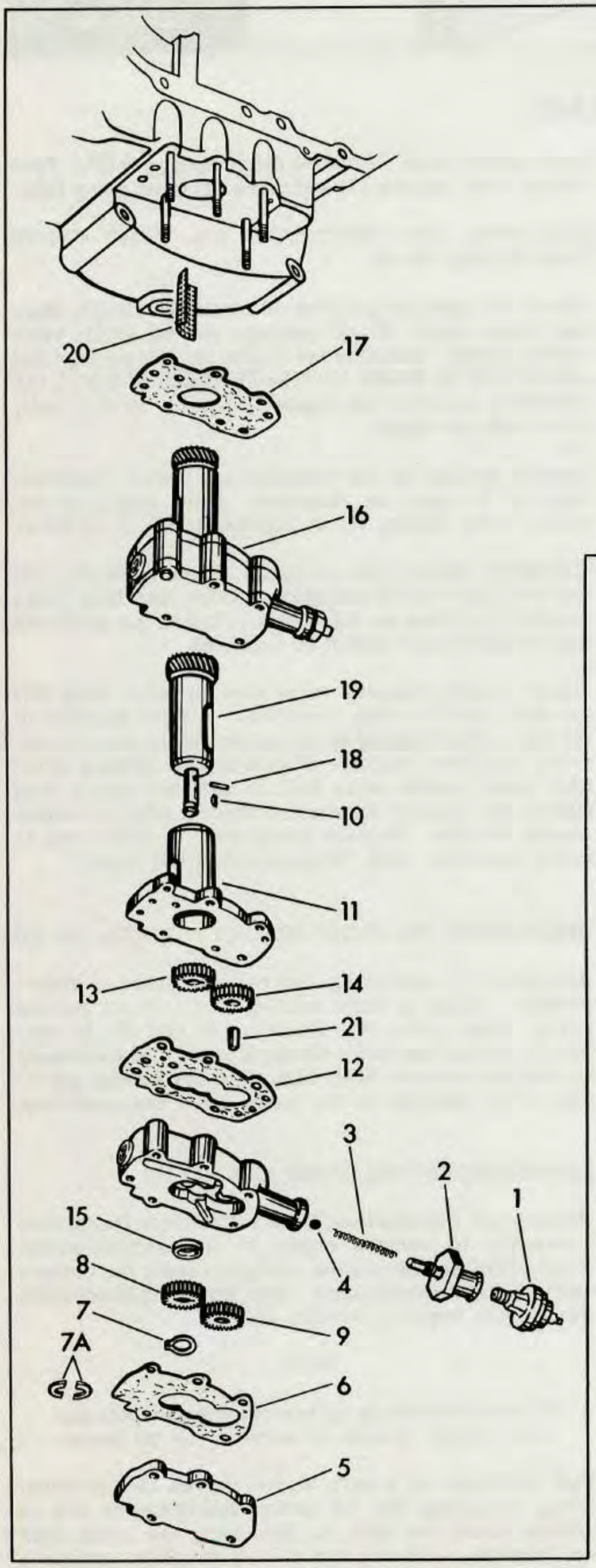
DISASSEMBLING OIL PUMP (Fig. 3D-10)

Because of interference from motorcycle frame it is necessary to remove engine to disassemble pump. First, remove the engine complete from the chassis and position on workbench. See "Stripping Motorcycle For Engine Repair," Section 3A.

NOTE

It is not necessary to remove valve tappets and valve tappet guides to service the oil pump.

The breather is a part of and drives the oil pump. When removing the oil pump, the breather will of course come out with it. Removing the pump does not require removing the circuit breaker, gearcase cover or removing timing gears. However, it must be remembered that in order to correctly time



1. Oil pressure switch
2. Oil pump nipple
3. Check valve spring
4. Ball valve
5. Body Plate
6. Body plate gasket
7. Retaining ring
7A. Retainer (2) (Half ring)
8. Scavenger pump gear
9. Scavenger pump idler gear
10. Breather valve key
11. Oil pump cover
12. Body cover gasket
13. Pump gear
14. Pump idler gear
15. Oil pump seal
16. Oil pump body
17. Body gasket
18. Drive lock pin
19. Breather valve gear and shaft
20. Crankcase breather valve screen
21. Idler gear shaft

Figure 3D-10. Oil Pump - Exploded View

breather and to check oil pump alignment, it is necessary to remove these parts.

See Fig. 3D-10. Thoroughly clean exterior of pump in gasoline or cleaning solvent before further disassembly. Remove the five crankcase stud nuts that secure the oil pump to the crankcase. Slip the pump off the studs as one unit. If difficult to remove, take a piece of brass and tap on breather sleeve that extends into gearcase compartment. To disassemble the check valve see "Disassembling Oil Pump Check Valve."

Free the oil pump body plate (5) from pump body. Discard gasket (6). Remove retaining ring (7) (with "Tru-Arc" pliers) or split key 7A. Remove scavenger gears 8 and 9). Remove key (10). Free oil feed pump cover (11) and breather valve (19) as one assembly from pump body. Discard gasket (12). Free gears (13 and 14) from pump body. Pry oil seal (15) from pump body (16) and discard seal. Discard gasket (17).

With a punch remove lock pin (18) and free oil pump breather valve gear and shaft (19) from oil pump cover (11).

NOTE

Remove lock pin (18) only if inspection or replacement of shaft (19) and cover (11) is necessary.

Remove breather valve screen (20) from crankcase. Remove idler gear shaft (21) only if replacement is necessary. Shaft is a press fit.

CLEANING AND INSPECTING OIL PUMP (Fig. 3D-10)

First clean all parts in gasoline or cleaning solvent. Blow out all oil holes and passages with compressed air. Replace any parts that are worn or damaged.

Replace all gaskets (6, 12 and 17), retaining ring (7), lock pin (18) and oil pump seal (15) when reassembling. Be sure to always install new "factory made" gaskets. Never use "homemade" gaskets because they are a specified thickness with holes especially located for oil passages.

Carefully examine the pump body (16) for any wear. See "Cleaning and Inspecting Oil Pump Check Valve."

Examine gears (8, 9, 13 and 14) and oil pump breather shaft (19) and idler gear shaft (21) for damage or wear. If the breather valve key (10) is excessively worn and loose on shaft or gear, replace with a new one. Inspect pump body plate (5) and cover (11). If they are worn or damaged, replace them. Examine breather valve (19) and oil pump cover for any wear or damage that might affect its operation. Insert breather valve (19) in oil pump cover (11). Make sure valve turns freely in cover and does not bind.

ASSEMBLING OIL PUMP (Fig. 3D-10)

Reassembly of the oil pump is essentially the reverse order of disassembly.

Apply a light coating of engine oil to all moving parts before assembling.

Reassemble check valve. See "Assembling Oil Pump Check Valve."

Position breather valve screen (20) in crankcase using grease to hold in place. Insert breather valve gear and shaft (19) in oil pump cover (11). Press a new drive lock pin (18) into breather valve shaft. Lock pins are often damaged when removed; therefore, install new ones when reassembling pump.

Press a new idler gear shaft (21) into pump body if the old one was removed. Place gears (13 and 14) in pump body and install a new gasket (12) being very careful to correctly align the oil holes of the gasket with the pump body. Use a non-hardening gasket sealer.

Install oil pump breather valve gear, shaft and cover assembly on pump body (16). Place a very thin strip of acetate (Scotch) tape over shaft lock ring groove to avoid damaging new oil seal (15). Install seal carefully over shaft with lip side facing pump body, then remove tape from shaft. Press seal into body counterbore flush with surface.

Install gear key (10) and gears (8 and 9). Install retaining ring (7 or 7A) in breather valve shaft groove. Assemble a new gasket (6) in place using a non-hardening gasket sealer. (If gasket is exceptionally dry and curled up, soak in water for a few minutes to soften before applying gasket sealer.) Position oil pump body plate (5) and install assembled pump in place on engine crankcase studs. Snug up the oil pump stud nuts evenly. Then, working opposite one another, tighten to ensure correct alignment of the oil pump.

Before installing gears on pinion shaft, make sure pump gears turn with little or no binding. While a very slight bind or drag is permissible, gears should turn freely as possible. Binding is caused by slight misalignment of pump. If there is more than just noticeable bind, loosen five mounting stud nuts and shift pump as needed by tapping lightly with a soft mallet. It will not be possible to determine before hand in which direction pump must be shifted and it may require several attempts from different angles before alignment is attained.

After the oil pump is completely assembled to the crankcase and correctly aligned, it is necessary to open gearcase in order to time the breather valve. Disassemble timing gears, gearcase cover, circuit breaker and push rods; and time breather as described subsequently under Heading "Gearcase and Timing Gears." Install engine in chassis as described in "Installing Engine in Chassis," Section 3A.

VALVE TAPPETS AND GUIDES

Tappets and tappet guides are normally long-life parts that seldom require replacement. Primarily, they are only removed for the purpose of checking end play of the cam gears, when reassembling an engine.

DISASSEMBLY (Fig. 3D-11)

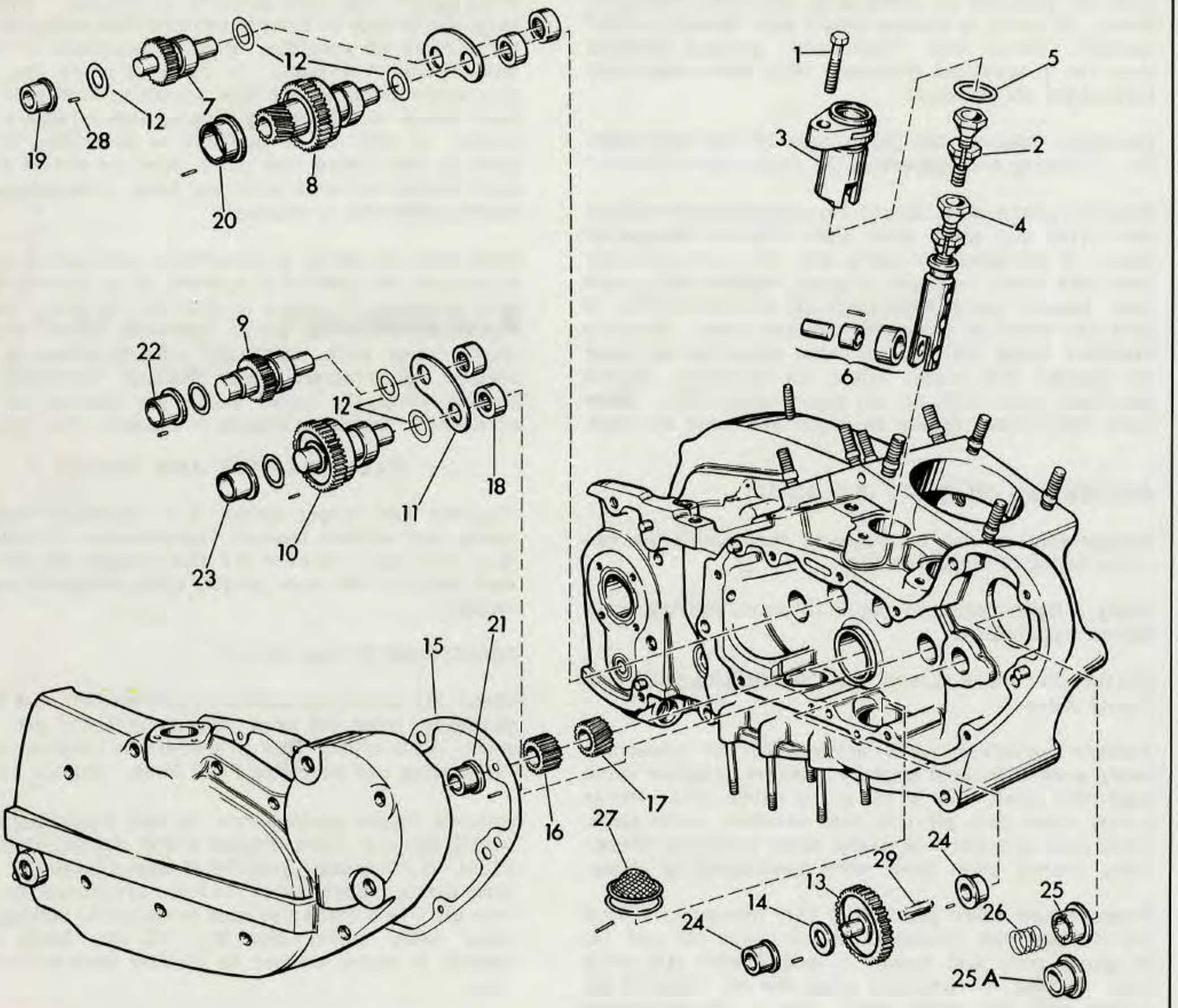
Clean all dirt from around crankcase and blow loose particles from the area with compressed air. Remove push rods. This procedure is covered under "Removing and Installing Push Rods," Section 3B.

Remove tappet guide screw (1) and tappet adjusting screw (2) and slide Tappet Guide Puller, Part No. 95724-57, in mating grooves of tappet guide (3). Before turning tappet guide (3) from crankcase, be sure cam gear is installed in case for tappet to butt against when using puller (see Fig. 3D-12). Mark valve tappets in some manner to identify them as to location.

It is good practice to reassemble valve tappets and valve tappet guides in the same place from which they were removed. This will ensure an even wear pattern between tappet, guide and cam surface.

CLEANING AND INSPECTION

Clean all parts thoroughly in gasoline or cleaning solvent and blow dry with compressed air. Inspect valve tappets for excessive clearance in guides. Valve tappets should be .0005 to .001 in. loose in tappet guides. Guides are .0005 to .001 in. press fit in crankcase. Excessive tappet-guide clearance is serviced by fitting new tappet, and/or new guide. It is recommended practice to replace complete tappet when only the roller is excessively loose or badly worn; however, it is possible to replace tappet roller kit (6) individual parts. If this is done, roller must turn freely (.0005 to .001 in. loose on needle bearings) and have about .008 in. sideplay after new roller pin is securely riveted to tappet.



1. Tappet guide screw
2. Tappet screw with nut
3. Tappet guide
4. Tappet and roller
5. Tappet guide "O" ring
6. Tappet roller kit
7. Rear cylinder exhaust cam gear
8. Rear cylinder intake cam gear
9. Front cylinder intake cam gear
10. Front cylinder exhaust cam gear
11. Cam gear plate (2)
12. Cam shaft washer - .005, .007 in.
13. Idler gear
14. Idler gear shaft fiber washer
15. Gearcase cover gasket
16. Flywheel shaft pinion gear
17. Oil pump drive gear
18. Cam gear needle roller bearing (4)
19. Rear exhaust cam gear shaft bushing
20. Cam gear and timer shaft bushing
21. Pinion gear shaft bushing
22. Front intake cam gear shaft bushing
23. Front exhaust cam gear shaft bushing
24. Idler gear shaft bushing (2)
25. Oil separator bushing assembly (1962 & earlier)
25A. Oil separator bushing (1963 & later)
26. Breather oil separator seal ring spring (1962 & earlier)
27. Crankcase oil strainer, retaining pin and gasket
28. Gearcase cover bushing pin (7)
29. Idler gear shaft

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

Figure 3D-11. Gearcase and Tappet - Exploded View

If end of valve tappet adjusting screw is worn hollow from action of push rod, it should be replaced to ensure accurate tappet-valve stem adjustment.

Inspect tappet guide rubber "O" ring (5, Fig. 3D-11) for wear or damage.

ASSEMBLY (Fig. 3D-11)

Assembly is essentially the reverse order of disassembly. Apply a light coat of oil to the tappet and in particular, the tappet roller assembly. If tappet is not located correctly in guide, tappet roller will be crosswise to guide and cam, and serious damage may result when pressed into crankcase.

Pull tappet out to limit of travel and hold in place with a clip or other means to prevent tappet from dropping into crankcase when installing the assembly.

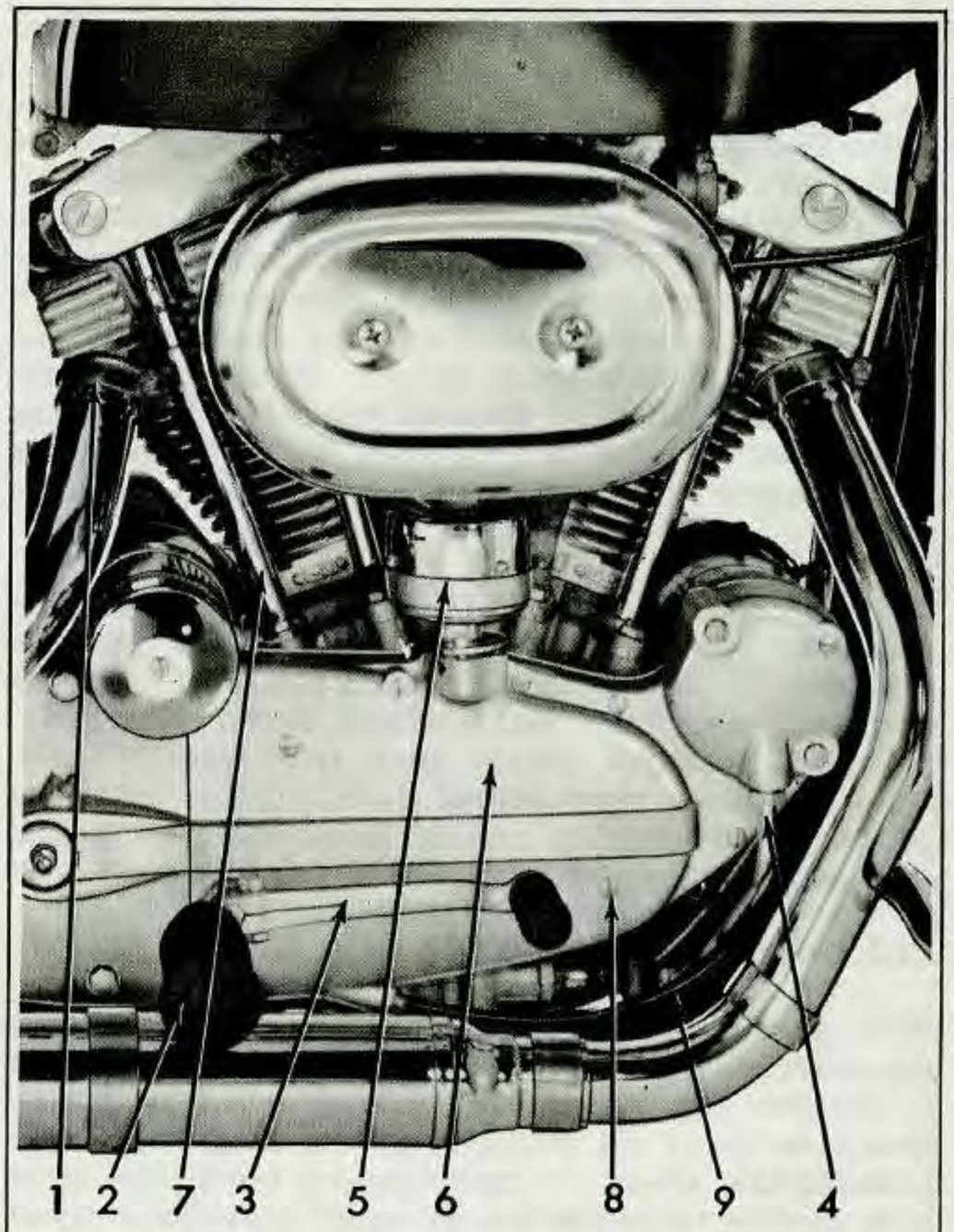
Insert "O" ring (5) on guide (3). Assemble adjusting screw and nut (2) in tappet (4) and then insert tappet into guide (3). Align screw holes in tappet guide with screw holes in crankcase and press assembly into position using a piece of tubing or a block of soft wood. Tappet guides are a soft malleable cast iron, therefore, be extremely careful not to damage the guide during the pressing operation. With screw (1) in place, recheck free movement of tappet in guide.

GEARCASE AND TIMING GEARS

DISASSEMBLY (Fig. 3D-13)

Thoroughly clean area around gearcase cover and tappets. Blow all loose dirt from crankcase with compressed air. Loosen exhaust pipe port clamps (1) and muffler clamps and lower exhaust pipe free of gearcase cover. Remove footrest (2), gear shift foot lever (3) and breather pipe (4).

Remove circuit breaker (5) or magneto (see Section 5F).



1. Exhaust pipe port clamp (2)
2. Footrest
3. Gear shift foot lever
4. Breather pipe
5. Circuit breaker
6. Gearcase cover
7. Push rod (4)
8. Gearcase cover screw (11)
9. Clutch cable

Figure 3D-13. Removing Gearcase Cover

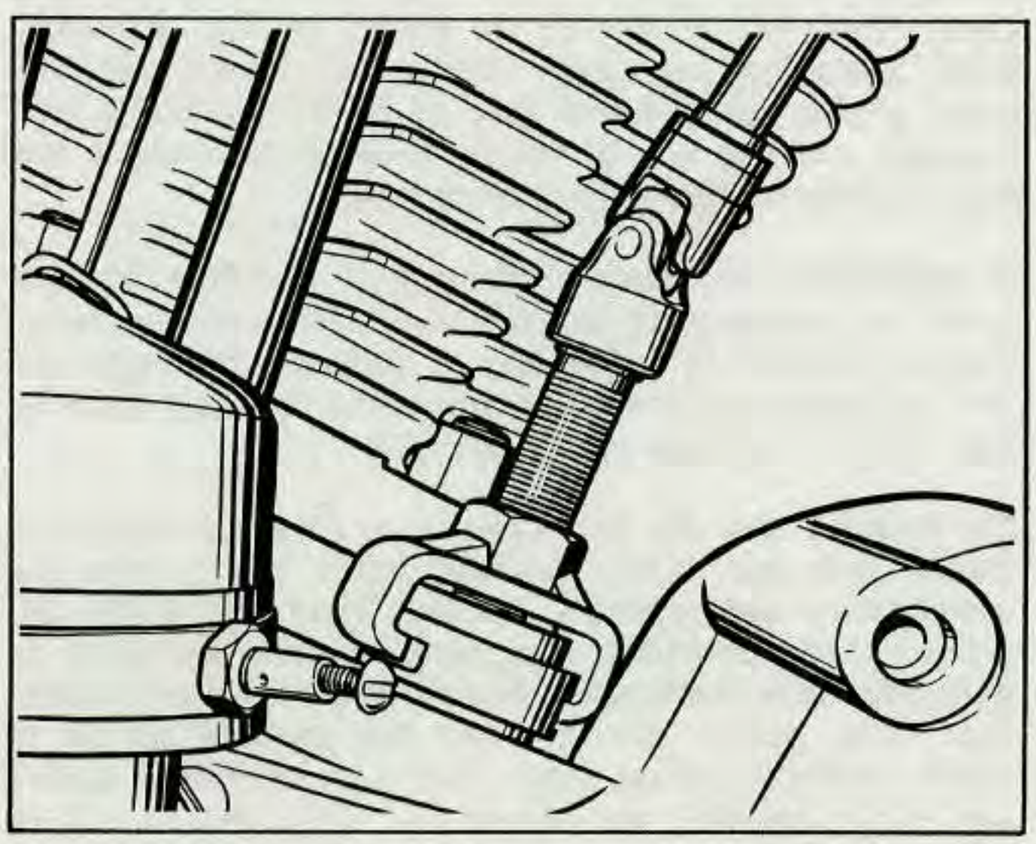


Figure 3D-12. Removing Tappet Guide

Remove push rods (7) as described in "Removing and Installing Push Rods," Section 3B.

Place a pan under gearcase to collect oil when cover is removed. Remove gearcase cover screws (8) and free cover from crankcase. Cover is located on dowel pins which fit rather snugly. The cover must be worked off these pins carefully to avoid damage to joint faces. Do not pry off with screwdriver inserted between joint faces. Use a hammer and a block of wood, and tap lightly at the end where the cover projects beyond the gearcase.

Remove valve tappets and valve tappet guides only to establish correct cam gear end play. See "Valve Tappets and Valve Tappet Guides." Pull clutch cable (9) forward (as positioned on motorcycle), at the

same time press cable inward and down to free from gearcase cover.

Refer to Fig. 3D-11 and proceed as follows. Remove cam gears (7, 8, 9 and 10) and cam gear plates (11). (Cam gears are numbered on cam lobe from one to four, from the rear exhaust valve cam forward.) When cam gears are removed, note whether or not cam gears have thin steel spacing washers (12) on either end of cam gear shafts. If any of the cam gears mentioned have spacing washers, be sure the same ones are used on each shaft when reassembling if the same cam gears and case cover are used again.

Free idler gear (13) with fiber washer (14) by lifting generator up and away from crankcase. Discard gasket (15). Pinion gear (16) is a press fit on pinion shaft splines. With Pinion Gear Puller, Part No. 96830-51, remove pinion gear from pinion shaft. Oil pump drive gear (spiral gear) (17) is located on splined shaft behind pinion gear. Remove spiral gear which is a slip fit on splines.

CLEANING AND INSPECTION (Fig. 3D-11)

With gasoline or cleaning solvent thoroughly scrub the gearcase compartment, gearcase cover and gears to remove any oil and carbon deposits. Blow out all gearcase cover oil passages and bushings with compressed air. Clean old gasket sealer from joint faces with carbon tetrachloride or other cleaning solvent. Carefully examine timing gears for excessive wear by inserting gears in case cover. Check for looseness in bushings and for amount of lash between gears. If teeth are pitted, scored, cracked, chipped or if faces of teeth are worn, replace gears. Check the gear shafts for damage and pitted surfaces and measure shafts with a micrometer for extent of wear. If any cams are found with rough or pitted surfaces, replace gear. The idler gear shaft (29) is a press fit in the gear and can be replaced, providing the gear is in good condition.

Check pinion gear (16) for press fit on pinion shaft. The slightest lash will usually result in noisy operation, often mistakenly attributed to the other timing gears.

Check cam gear needle roller bearings (18) and idler gear bushings (24) in right crankcase side and cam gear shaft and pinion gear shaft bushings (19, 20, 21, 22, 23 and 24) in gearcase cover for extent of wear. These bushings normally do not require replacement until an engine has run up extremely high mileage.

Specified clearance for cam gear shafts in cover bushings and for pinion gear shaft in cover bushing is .0005 to .001 in. Specified clearance for cam gear shafts in crankcase needle roller bearings is .0005 to .0025 in.

When bushings are worn to the extent of increasing clearance to .001 in. or more over specified limits, they should be replaced, as the cam gears are likely to become very noisy with excessive clearance in the bushings. Examine the face of each bronze bushing

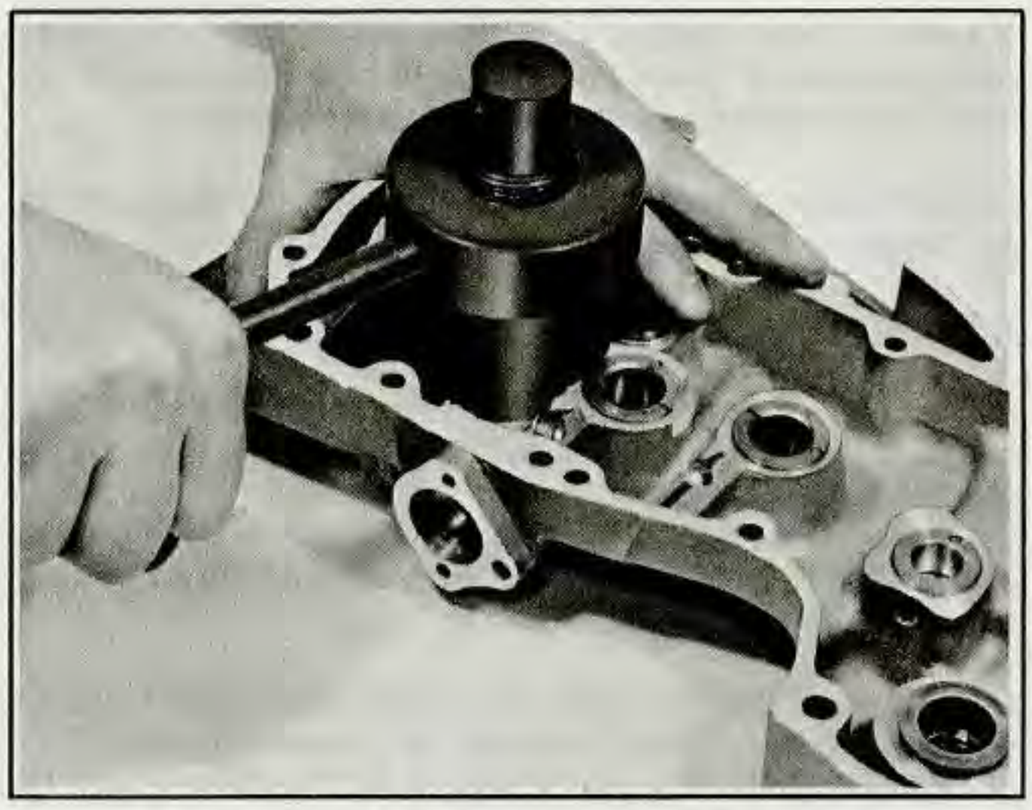


Figure 3D-14. Removing Bushing from Gearcase Cover

flange for wear. If bushing flanges are badly worn replace bushings.

Examine cam gear plate (11) for excessive wear or damage. Replace, if necessary. Check the operation of the oil separator bushing assembly (25 and 26) used on 1962 and earlier models. Bushing is spring-loaded and should have free action and be fully extended in gearcase cover.

Fixed type bushing (25A) should have 1/16 in. running clearance with generator oil slinger washer.

Inspect the crankcase oil strainer (27) to make sure it is not plugged with any foreign material.

REPLACING GEARCASE BEARINGS

The four cam gear needle roller bearings in the crankcase are a press fit and can be removed and installed without disassembling crankcase by using Tool, Part No. 97270-60 as shown in Fig. 3D-18A. When installing cam gear needle roller bearings, always press on printed side of bearings, being extremely careful not to tip or misalign bearing in the case during the installing operation.

If inspection warrants replacement of either the cam gear or pinion gear bronze bushings in the gearcase cover, it first is necessary to separate the right and left crankcase sides and remove the flywheel assembly. See "Crankcase," Section 3E.

To remove the six blind bushings from the gearcase cover and one blind bushing (idler gear) from the crankcase, use special Puller, Part No. 96760-36. Puller body provides four special pull-tap sizes to accommodate bushings. Screw puller-tap into bushing. Slip puller sleeve (use the stepped sleeve to clear bushing boss) over tap and assemble puller nut with handle as shown in Fig. 3D-14. Turn puller nut clockwise to pull bushing from gearcase cover.

Before pressing in new bushings, note location of original dowel pin holes for reference when drilling new holes. When drilling new holes, be sure to locate holes 1/8 in. or more from original dowel pin holes.

Use a smooth surfaced disc or plate slightly larger than flange when pressing bushing into position. Be sure bushing flanges are seated tight against gearcase cover and/or crankcase idler gear bushing.

After new bushings have been pressed in, they must be dowel pinned with cover bushing pins to prevent them from turning. Drill a hole with a number 31 drill, 9/32 in. deep, through bushing flange and into aluminum so when dowel pin (28, Fig. 3D-11) is driven in and bottomed, its end will be slightly below face of bushing flange. Peen bushing around dowel pin hole to prevent pin from coming out.

After all bronze bushings have been pressed in and dowel pinned, all but the idler gear bushings must be line-reamed.

Parts order bushings are furnished nearly to size so there is little stock to be removed when reaming bushing. When removing reamer, keep turning it to the right as it is being pulled out.

To ream idler gear bushings, use special Reamer, Part No. 94806-57. Carefully align and turn reamer into bushing until it bottoms.

To line-ream the circuit breaker shaft bushing in the gearcase cover, insert special Reamer Part No. 94803-37, through crankcase needle roller bearing. Reamer will be a close fit in needle roller bearing, providing alignment for reaming the gearcase cover bushing.

See Fig. 3D-15. Slip cover bushing reamer over end of smaller reamer and insert pin through reamers and install pin retainer. Install gearcase cover, at same time starting cover bushing reamer in cover bushing. Turn reamer into crankcase and gearcase cover bushings until it bottoms in gearcase cover. Remove gearcase cover and then remove cover bushing reamer from smaller reamer.

To line-ream the front exhaust, front intake and rear exhaust cam gear shaft bushings in the gearcase cover, assemble the cover to crankcase side. With cover bushing reamer removed, insert special Reamer, Part No. 94803-37, through needle roller bearing, into cover bushing and turn until it bottoms in case cover.

To line-ream the pinion gear shaft bushing, install gearcase cover. Insert steel pilot bushing into crankcase bearing race to guide reamer. Insert special Reamer, Part No. 94812-37A, through pilot bushing into pinion gear shaft bushing, and turn reamer until it bottoms in gearcase cover. Remove gearcase cover.

ORDER OF ASSEMBLY

1. Check end play of cam gears described below under "Determining Correct Cam Gear End Play."

2. Retime the breather valve according to the instructions under "Timing Breather Valve."

3. Install the timing gears and assemble the gearcase cover in place. See "Installing Timing Gears and Gearcase Cover."

4. Install valve tappets and valve tappet guides (if they have been removed). See "Valve Tappets and Valve Tappet Guides."

5. Reassemble circuit breaker or magneto. See "Circuit Breaker," Section 5F.

6. Install push rods and adjust tappets as described in "Cylinder Head," Section 3B and "Removing and Installing Push Rods," and "Adjusting Tappets."

7. Refer to Fig. 3D-13. Assemble breather pipe (4), gear shift foot lever (3), footrest (2), exhaust pipe port clamps (1) and muffler clamps.

DETERMINING CORRECT CAM GEAR END PLAY

Before final reassembly of the timing gears, correct cam gear end play must be established. Temporarily position the two cam gear plates (11, Fig. 3D-11), less shims, in the gearcase compartment. Position against crankcase with beveled side of holes for cam shaft facing outward toward cams. Install cam gears. Assemble the case cover with a dry gasket and securely tighten in place (less generator bolts).

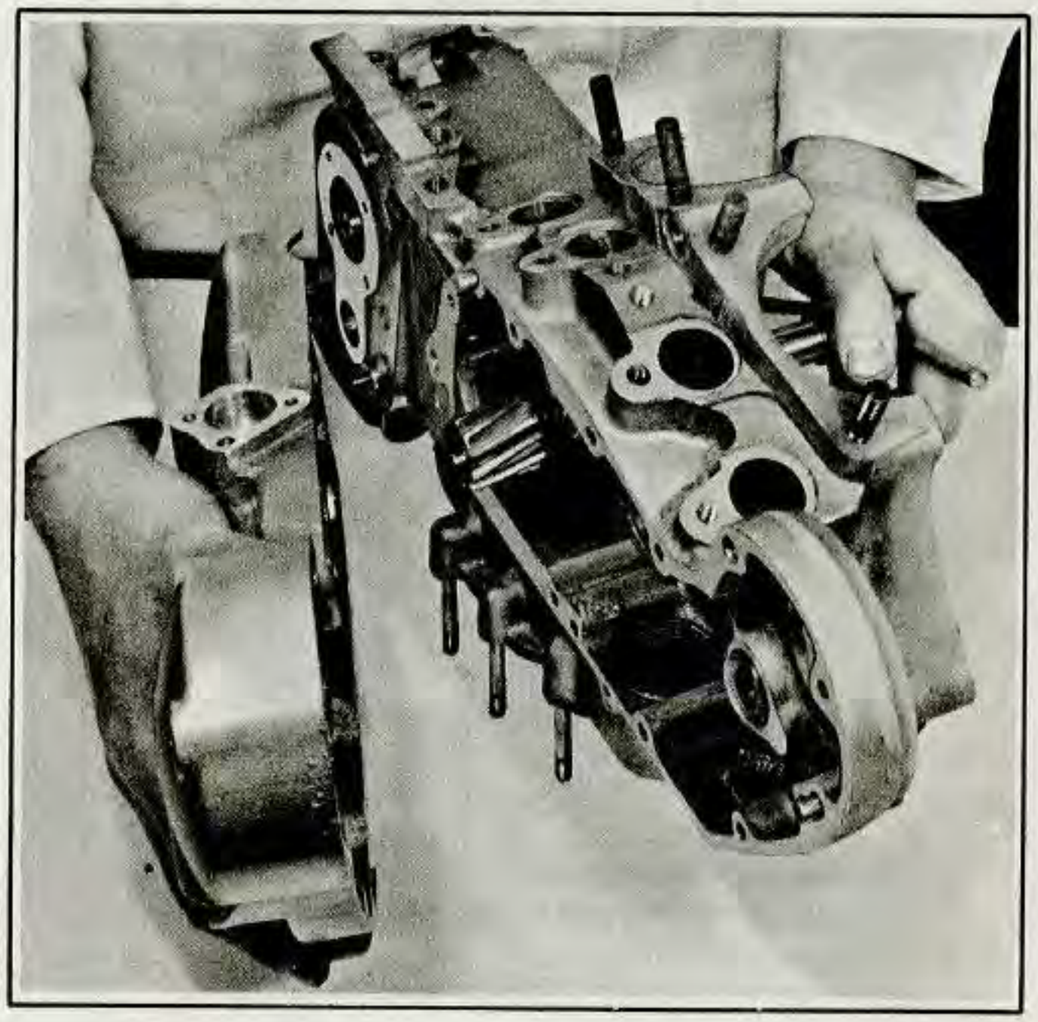


Figure 3D-15. Installing Tool for Line-Reaming Cam Gear Timer Shaft Bushing

Turn the engine over until the number one cam gear lobe is facing up as indicated through the tappet guide hole in the crankcase. Using a long shank screwdriver, pry the cam gear towards the case cover. With a feeler gauge, measure the clearance (end play) between the cam shaft shoulder and the gear plate. Repeat this operation for remainder of cam gears.

Correct cam gear end play is .001 to .006 in. If end play exceeds the maximum specification, add necessary number of .005 or .007 in. thickness steel shims to obtain recommended running clearance. After adding shims, turn engine over to be sure cam gears turn freely.

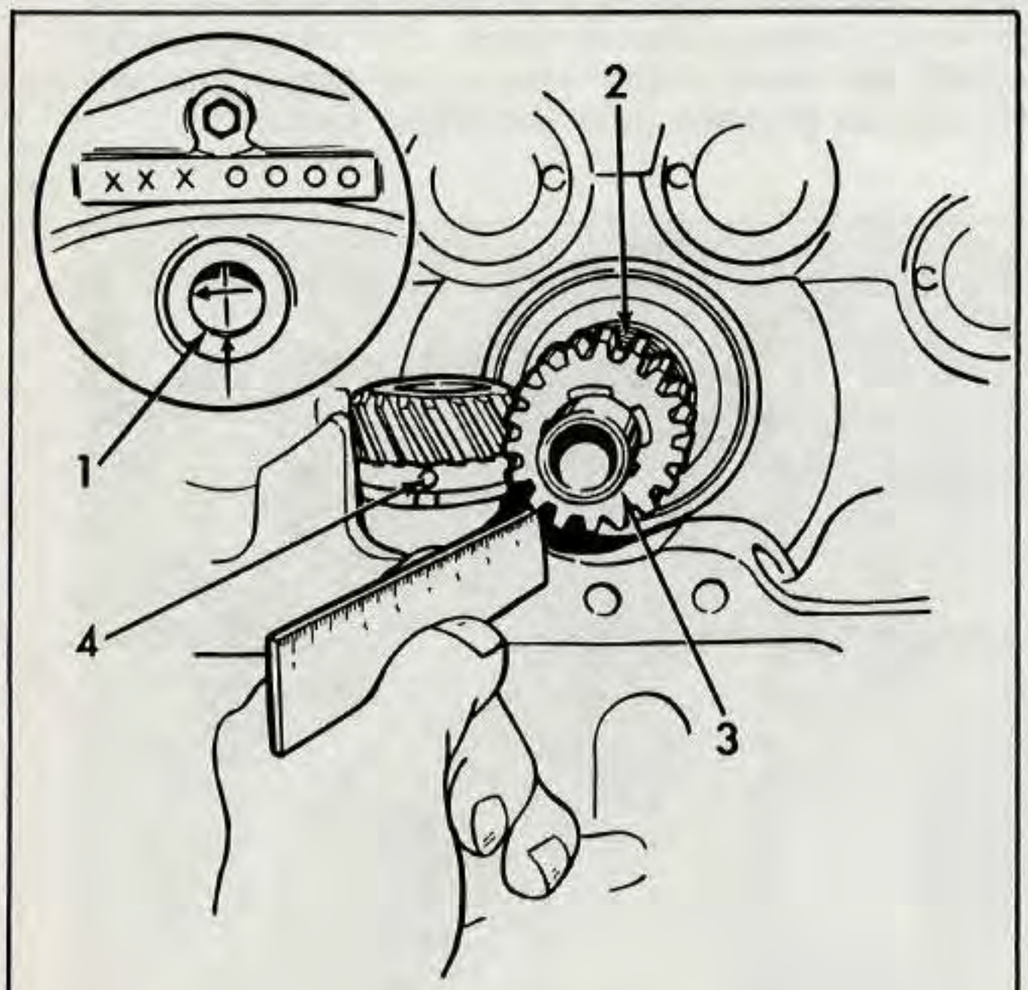
TIMING BREATHER VALVE (Fig. 3D-16)

The breather must be retimed if disengaged from mating oil pump drive gear (spiral gear) on pinion shaft. To check breather timing proceed as follows:

Flywheel timing mark (1) should be exactly in center of timing inspection hole in left side of crankcase.

Oil pump drive gear (spiral gear) (2) is located on splined shaft behind pinion gear (3). Spiral gear is a slip fit on splines. A mark is cut on one side of spiral gear, which should face outward against pinion gear when assembled to shaft.

Assemble spiral gear against shoulder on pinion shaft engaging breather sleeve gear tooth which will register timing hole in breather sleeve (4) in center of slot in breather bushing as shown.



1. Flywheel timing mark
2. Oil pump drive gear (spiral gear)
3. Pinion gear
4. Timing hole in breather sleeve gear

Figure 3D-16. Timing Crankcase Breather

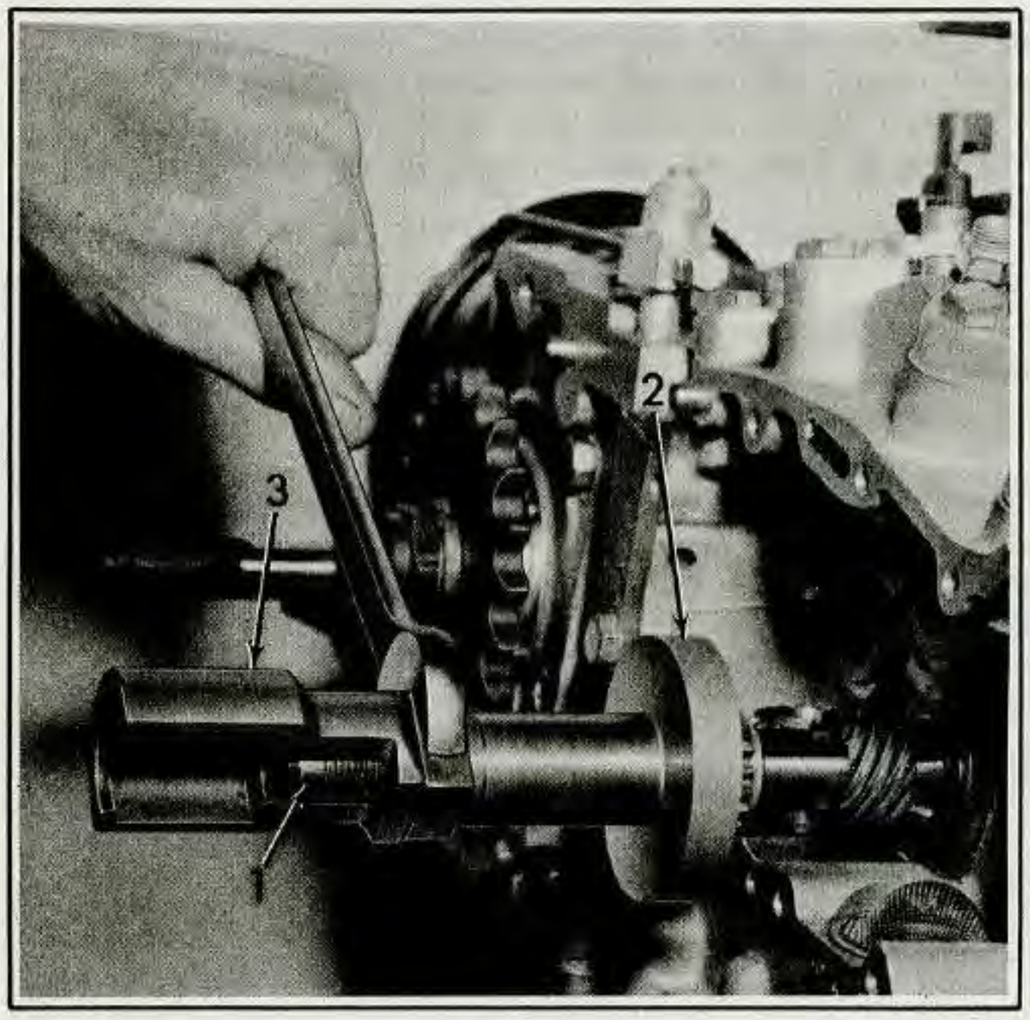


Figure 3D-17. Installing Pinion Gear

Install pinion gear using Gear Puller and Installer Tool as shown in Fig. 3D-17.

Turn screw (1) on end of pinion shaft and tighten securely. Position gear locating collar (2) and body (3) on screw (1). Turn tool body to press gear into position until locating collar firmly contacts joint face of crankcase. This positions pinion gear outer face exactly 5/16 in. from gearcase joint face, the running position for the gear when case cover is in place.

NOTE

Once breather valve is correctly timed, position of flywheel timing mark and breather valve timing mark, registered in slot of breather sleeve gear, can be disregarded when installing timing gears.

INSTALLING TIMING GEARS AND GEARCASE COVER (Fig. 3D-18)

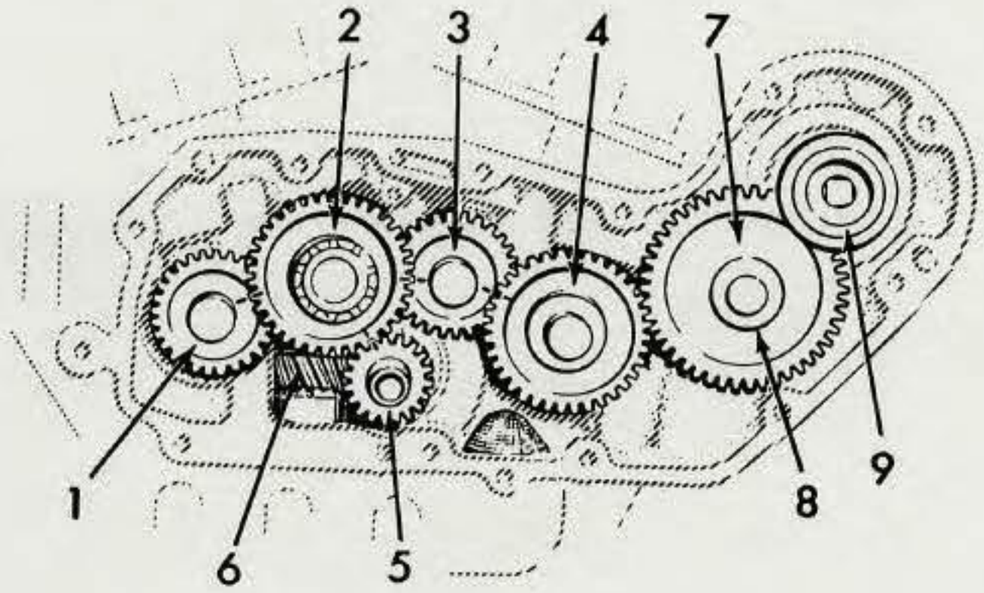
Install plates (11, Fig. 3D-11) in case recess with beveled side of holes for cam shaft facing outward toward cam.

Lubricate timing gear shafts and position in crankcase with marks on gears 1, 2, 3, 4 and 5 in alignment as shown under Fig. 3D-18. Install idler gear (7) in crankcase with fiber washer (8) toward the cover side.

Position gearcase cover gasket on crankcase using sealer to hold in place. Be sure to install a new "factory-made" gasket. Never use a "homemade" gasket as cover gasket has holes especially located for oil passages and if a hole is left out or put in wrong place, oiling system will not function normally.

Lubricate the timing gears with a liberal coating of

engine oil. Carefully align cover and tap into position. Cover should slip into place easily and should never be forced or driven into place. Tighten all screws evenly, working opposite from one another. Install generator and gasket in place. Tilt generator back end down as it is inserted in gearcase opening to lift oil slinger over intermediate gear, and then up to mesh generator and intermediate gears. Turn engine over to make sure gears turn freely.



1. Rear exhaust cam gear
2. Rear intake cam gear
3. Front intake cam gear
4. Front exhaust cam gear
5. Pinion gear
6. Crankcase breather sleeve gear
7. Intermediate gear (has no timing mark)
8. Intermediate gear fiber washer
9. Generator drive gear

Figure 3D-18. Timing Gears

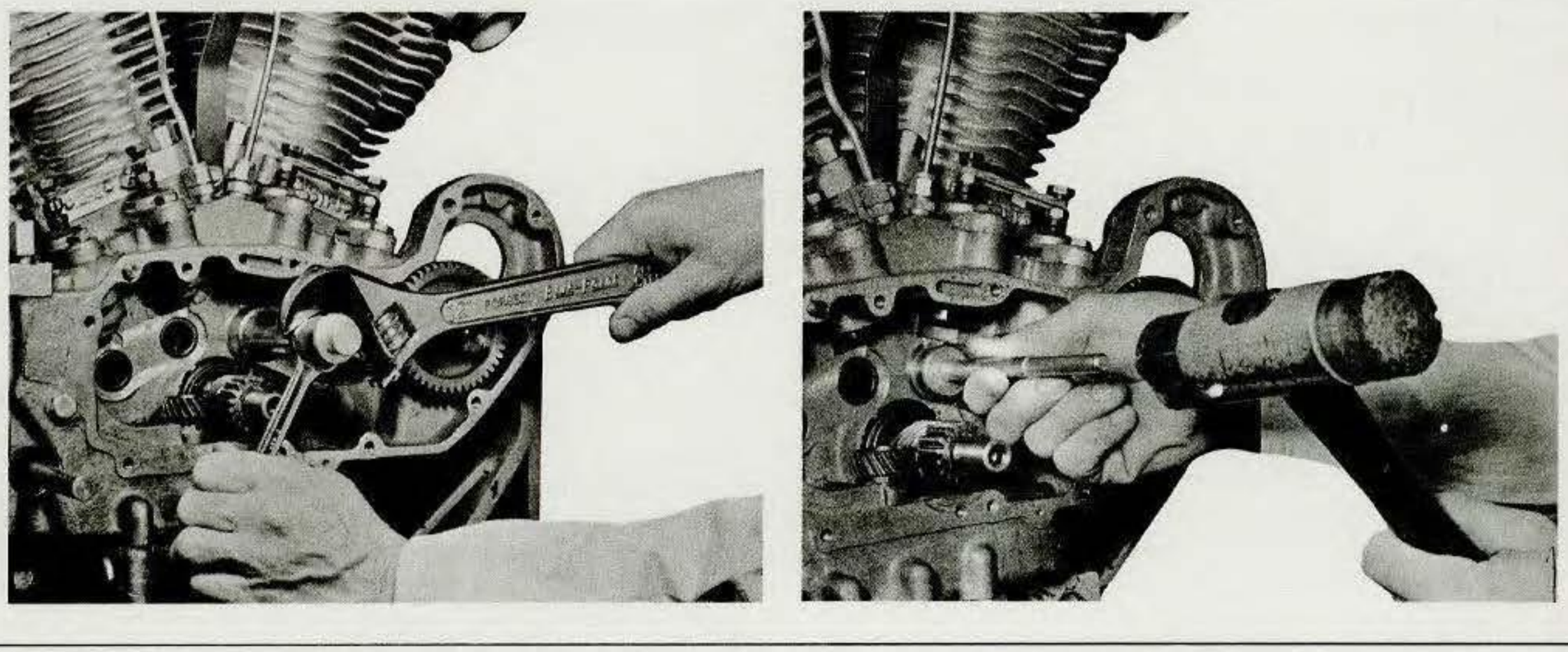


Figure 3D-18A. Removing and Installing Cam Gear Needle Bearings in Crankcase

CRANKCASE

GENERAL

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

CHECKING FLYWHEEL END PLAY

Before completely disassembling the crankcases, it is recommended procedure to check flywheel end play to determine amount of sprocket shaft bearing wear.

To check flywheel end play, remove cylinder heads, cylinders, clutch cover, gearcase cover and timing gears. Do not remove or loosen compensating sprocket assembly. See "Disassembling Crankcase."

Anchor dial indicator base firmly on right or left side of engine crankcase with indicator stem against end of pinion shaft or compensating sprocket shaft nut. Rotate flywheels and at the same time, push and pull on pinion shaft reading travel of dial indicator in thousandths of an inch. If end play exceeds maximum specification limit as shown under "Specifications," Section 3A, sprocket shaft Timken bearing must be replaced. Also, see "Cleaning and Inspection."



Figure 3E-18. Removing Sprocket Shaft Extension

DISASSEMBLING CRANKCASE

To completely disassemble the crankcase, follow steps 1 - 13.

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

2. Remove cylinders and pistons as described in "Cylinder," Section 3C.

3. Remove clutch and clutch release as described in "Clutch," Section 4B.

4. Remove the starter as described in "Starter," Section 4C.

5. Using Sprocket Shaft Extension Puller, Part No. 96015-56, remove sprocket shaft extension (1, Fig. 3E-20), as shown in Fig. 3E-18. For models equipped with a solid sprocket, use Claw Puller, Part No. 95635-46.

6. Remove tappets, tappet guides, circuit breaker or magneto, gearcase cover, timing gears and generator as described in "Gearcase," Section 3D.

7. Remove the oil pump as described in "Oil Pump," Section 3D.

8. See Fig. 3E-19. Free the speedometer drive unit from the right case and remove right crankcase bolts (1, 2, and 3) and stud nuts (4). Remove bolts (5), battery carrier (6) or oil tank bracket on magneto models, engine rear mount (7 or 7A), studs (8), and top center crankcase stud (9).

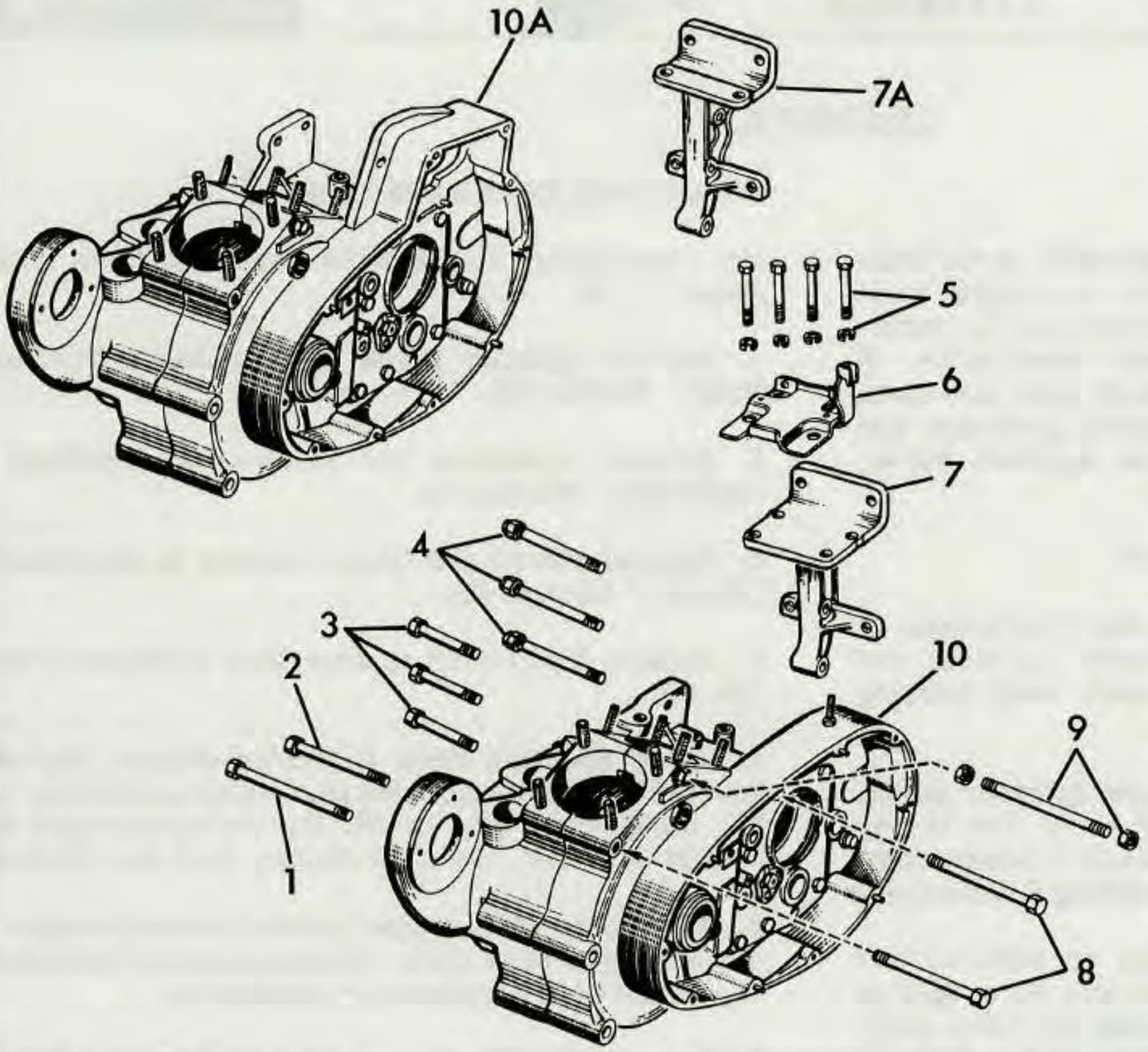
9. Position crankcase on work bench, gearcase side up. Tap crankcase with rawhide mallet to loosen top half. Separate right case from left case side.

10. See Fig. 3E-20. Remove snap ring (2) from pinion shaft with tip of screwdriver. Lift bearing washer (3) with bearings (4) and retainer (5) off pinion shaft.

11. Remove transmission as described in "Crankcase and Transmission Disassembly Procedure," Section 4D.

12. See Fig. 3E-20. Mount flywheel and left case assembly on press table supporting crankcase on parallel bars. Press on end of sprocket shaft with arbor press until flywheel assembly (6) is free from case. Do not drift or tap flywheel assembly from left case as flywheels may be knocked out of alignment.

13. See Fig. 3E-20. If it is necessary to disassemble flywheels or remove Timken bearing from crankcase, free right bearing half (7) from sprocket shaft, using Sprocket Shaft Bearing Puller, Part No. 96015-52, as shown in Fig. 3E-21. Secure pinion shaft between copper jaws in vise. Place hooked ends of puller



1. Crankcase mounting bolt 5/16 x 4-7/16"
2. Crankcase mounting bolt 5/16 x 4-1/16"
3. Crankcase mounting bolt 5/16 x 2-3/8" (3)
4. Crankcase rear mounting stud and lock nut (3)
5. Engine rear mounting bolt and lock washer (4) (1966 and earlier), (2) (1967)
6. Battery carrier (1966 and earlier)
7. Engine rear mount (1966 and earlier)

7A. Engine rear mount (1967)

8. Crankcase bolt (2)
9. Crankcase stud and lock nut (center)
10. Crankcase (1966 and earlier)

10A. Crankcase (1967)

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

Figure 3E-19. Crankcase - Exploded View

halves behind bearing, and slip round holding collar over outside diameter, down to bearing end. Engage puller screw handle in puller slots and pull bearing off by tightening puller screw against sprocket shaft center.

If left bearing half is to be removed, first pry oil seal (8) from crankcase. Use a pointed instrument such as an old spoke that has one end sharpened to a point. Remove crankcase outer spring ring (9) from groove in case, by prying end with screwdriver and inserting thin screwdriver or knife blade between spring ring and case.

Position left crankcase side on arbor press table, clutch side supported by parallel bars. Use right half of Timken bearing to press out sprocket shaft bearing spacer (10), bearing left half (11), spacer (12), and outer race (13).

DISASSEMBLING FLYWHEELS

See Fig. 3E-22 and proceed as follows: Grip pinion shaft in copper vise jaws so shafts are in vertical position. 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 right flywheel (10) to loosen and lift off pinion shaft (11). 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 flywheel to loosen and remove crank pin (16) and key (17).

Grip sprocket shaft in vise and remove lock plate screw (18), lock plate (19), and sprocket shaft lock nut (20). Tap flywheel to loosen and remove sprocket shaft (21). Remove key (22) from shaft.

CLEANING AND INSPECTION

Wash all parts in grease solvent and blow out oil holes in pinion shaft, right flywheel and crank pin 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, Fig. 3E-22). If either washer is worn and grooved, it should be replaced.

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 14, Fig. 3E-20) for pitting, grooving, and gouging. A shaft that is worn must be replaced. If bushing is worn beyond repair, replace as described in "Repairing Crankcase."

Examine sprocket shaft bearing outer races for wear, grooving, pitting and powdered metal fragments. Examine bearing rollers for wear, pitting, grooving and scoring. The sprocket shaft Timken tapered roller bearings are manufactured in selectively fitted sets. Each set has a serial number which appears on all parts. If any part is unusable, the entire set must be replaced. See "Checking Flywheel End Play."

REPAIRING CRANKCASE

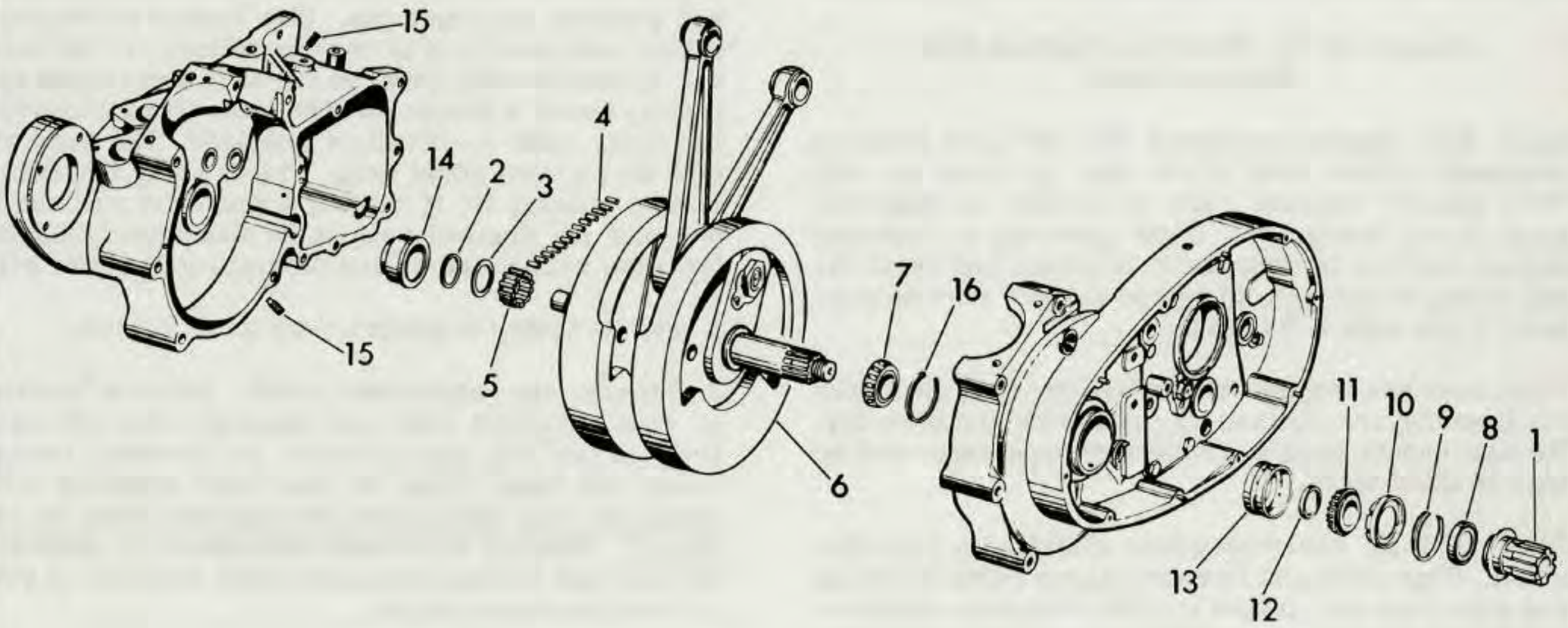
Replace worn flywheel washers as follows:

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 sideplay.

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.

See Fig. 3E-23. Turn lap in lathe at 150 to 200 rpm. Adjust lap by means of adjusting nut to a snug but free fit in rod race. Clean lap before using, then



1. Sprocket shaft extension
2. Pinion shaft bearing snap ring
3. Pinion shaft bearing washer
4. Pinion shaft roller bearing (13)
5. Pinion shaft roller bearing retainer
6. Connecting rod and flywheel assembly
7. Sprocket shaft Timken bearing right half
8. Sprocket shaft oil seal
9. Sprocket shaft bearing spring ring (outer)
10. Sprocket shaft bearing spacer
11. Sprocket shaft Timken bearing left half
12. Sprocket shaft Timken bearing spacer
13. Sprocket shaft Timken bearing outer race
14. Pinion shaft bushing
15. Pinion shaft bearing bushing screw (2)
16. Sprocket shaft bearing spring ring (inner)

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

Figure 3E-20. Crankcase and Flywheel Assembly - Exploded View



Figure 3E-21. Removing Bearing from Sprocket Shaft

apply fine lapping compound (No. 220 grit grinding compound mixed with oil) to lap. A loose lap will "bell mouth" bearing race so it must be kept just snug 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 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.

See Fig. 3E-22. Assemble pinion shaft (11) to right flywheel. Wipe shaft and flywheel tapers perfectly clean and free from oil. Insert key (12) in keyway and position flywheel over pinion shaft held in copper vise jaws. Tighten nut (9) very tight using Crank Pin and Flywheel Nut Wrench, Part No. 94546-41. If necessary, tighten nut a little more to make lock plate (8) 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. Handle length has been determined by strength of average man and is designed to give nut suitable tension with only this specific handle length used.

Repeat above operation to assemble crank pin nut with Flywheel Nut Wrench.

FITTING ROD BEARINGS

There are three ways to determine oversize rollers to use. Each 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 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 maximum 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. Secure right flywheel in vise with pinion shaft down. 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 a slip fit is achieved. 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:

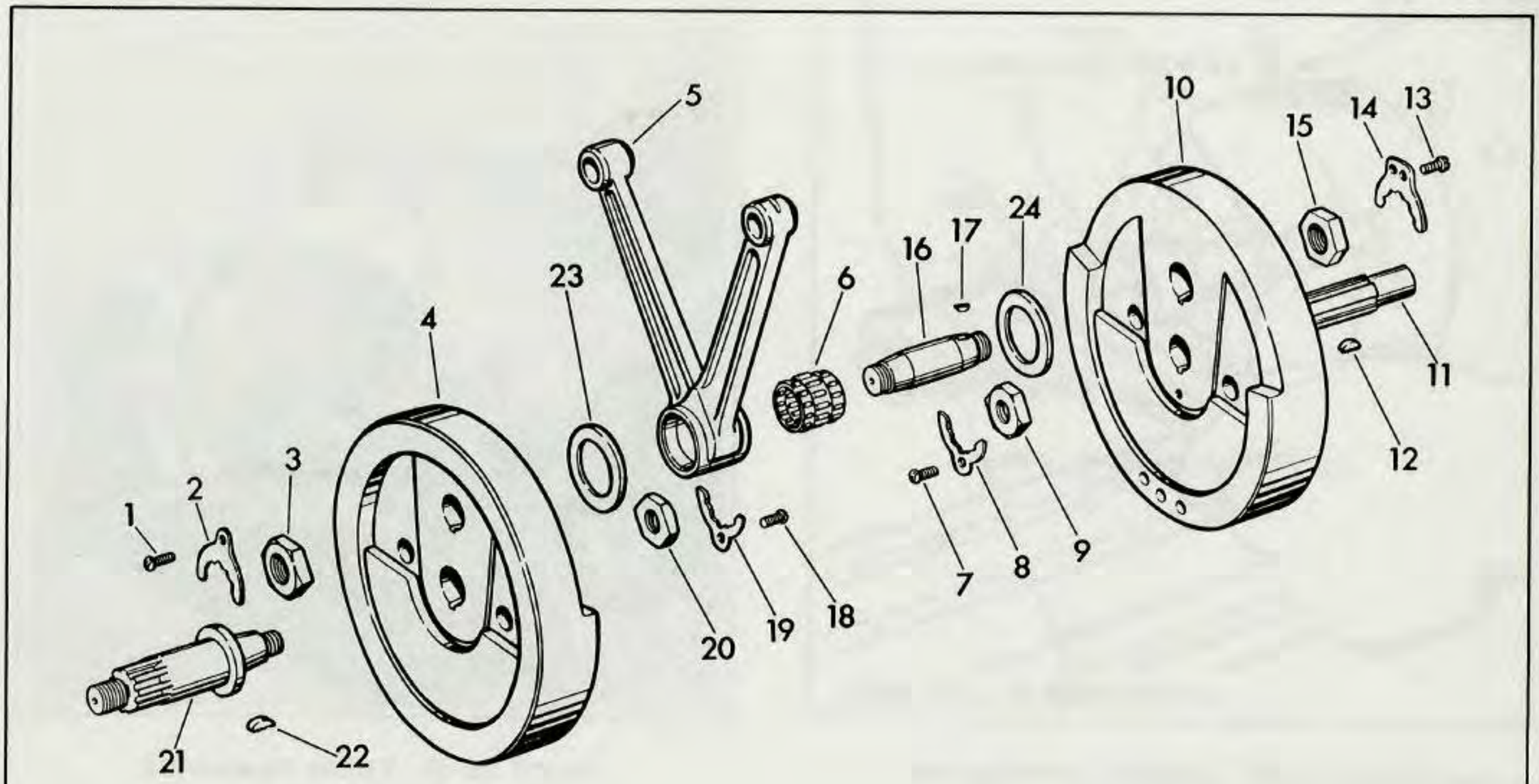
3. Fit any size rollers into races. Position bearings in rods. Support rods and bearings with left hand. Drop crank pin (not attached to flywheel) through crank pin hole. Plug fit has been achieved when crank pin will slide slowly through hole from its own weight. Running fit is then determined by subtracting 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.

NOTE

Roller bearings are not available in odd numbered sizes; therefore, when determining a plug fit, if the bearings are too loose with an even numbered roller bearing (example - .0008 in. oversize) and too tight with the next size even numbered roller bearing (.001 in. oversize), it must be assumed that an in-between odd size bearing (.0009 in. oversize) would achieve a plug fit. Running fit calculations are based on that assumption.



1. Crank pin lock plate screw
2. Crank pin nut lock plate
3. Crank pin nut
4. Flywheel (left)
5. Connecting rods
6. Crank pin roller and retainer set
7. Pinion shaft lock plate screw
8. Pinion shaft nut lock plate
9. Pinion shaft nut
10. Flywheel (right)
11. Pinion shaft
12. Pinion shaft key
13. Crank pin lock plate screw
14. Crank pin nut lock plate
15. Crank pin nut
16. Crank pin
17. Crank pin key
18. Sprocket shaft lock plate screw
19. Sprocket shaft nut lock plate
20. Sprocket shaft nut
21. Sprocket shaft
22. Sprocket shaft key
23. Crank pin boss washer (left)
24. Crank pin boss washer (right)

Figure 3E-22. Flywheel and Connecting Rod Assembly - Exploded View

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 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 free of oil and clean.

Fitting bearings tighter than described is likely to 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 all parts and lubricate bearings with engine oil. Install connecting rods on crank pin bearing so female rod is to rear cylinder. Assemble key and sprocket shaft to left flywheel with sprocket shaft nut, lock plate and lock plate screw.

Position right flywheel assembly in vise. Wipe crank pin taper and crank pin hole in left flywheel clean and dry. Install left flywheel and tighten nut lightly. Hold steel straight edge along outer face of wheel rim at 90 degrees from crank pin as shown in Fig. 3E-24. Tap outer rim of top wheel until rim faces of both wheels are in alignment. Tighten nut. Recheck with straight edge 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 as shown in Fig. 3E-25. Adjust so centers are just snug.

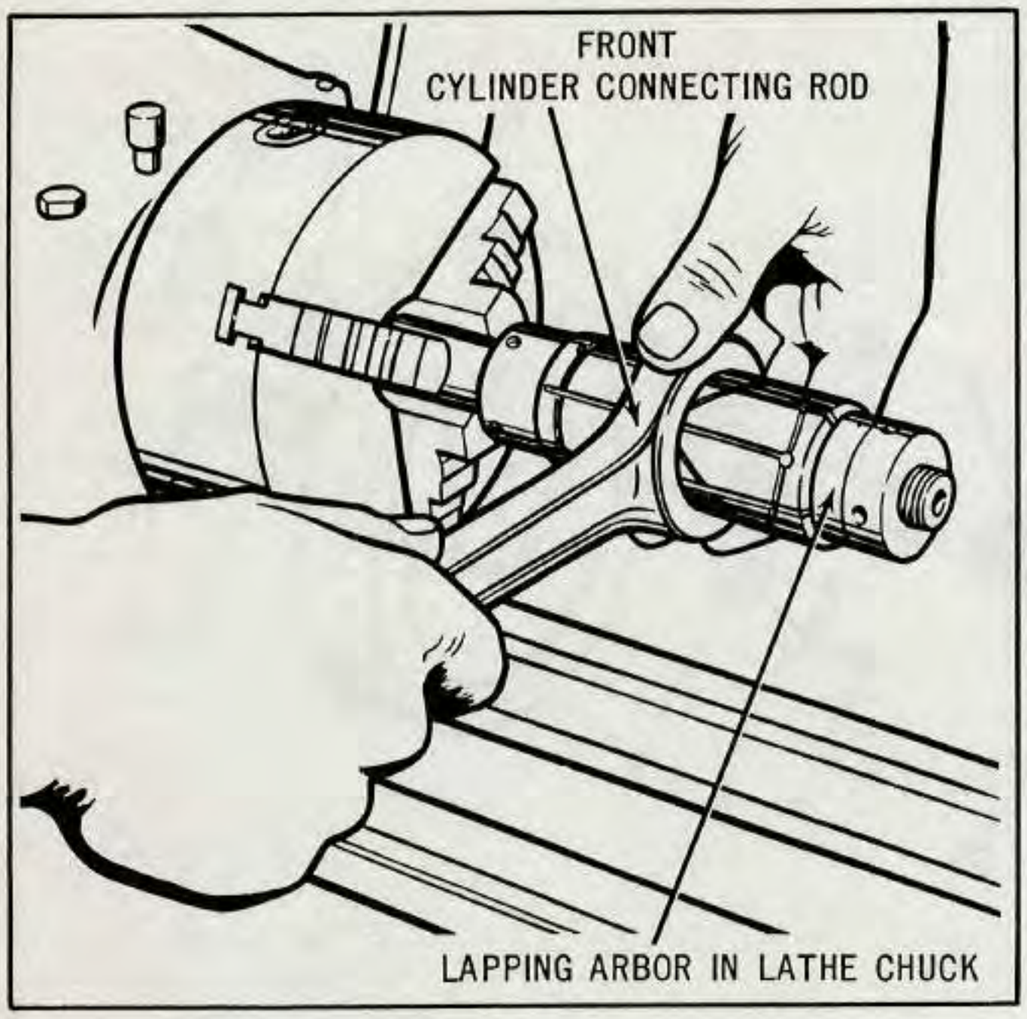


Figure 3E-23. Lapping Connecting Rod Bearing Race

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, and 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 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-26, or a combination of two of the three ways.

When wheels are both out of true as indicated in "A," a C-clamp is tightened on rims of wheels opposite

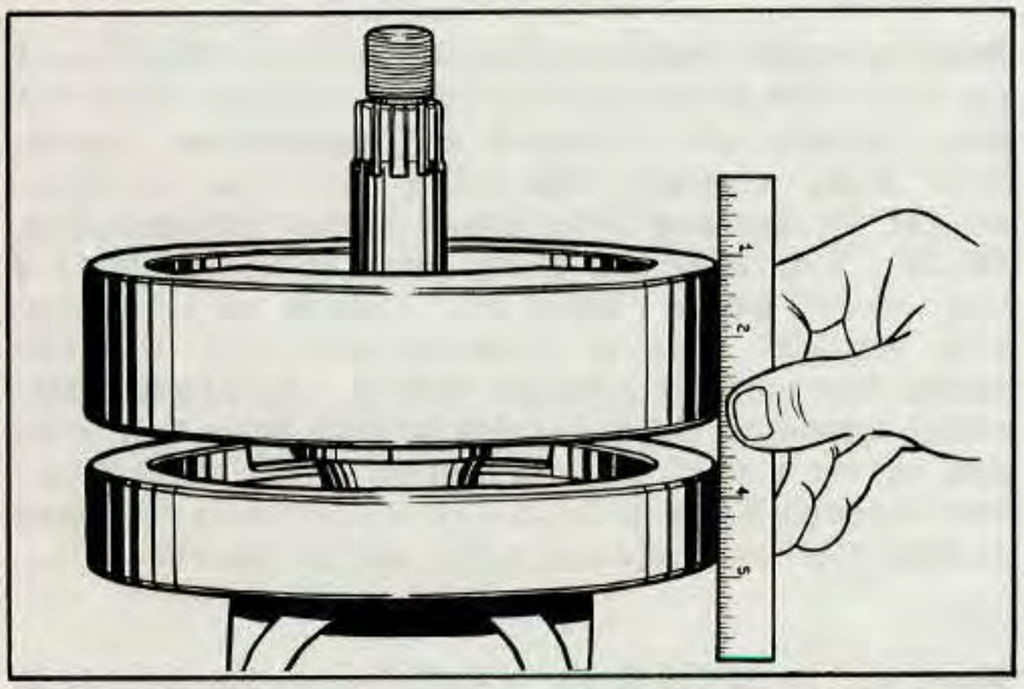


Figure 3E-24. Squaring Flywheel Faces

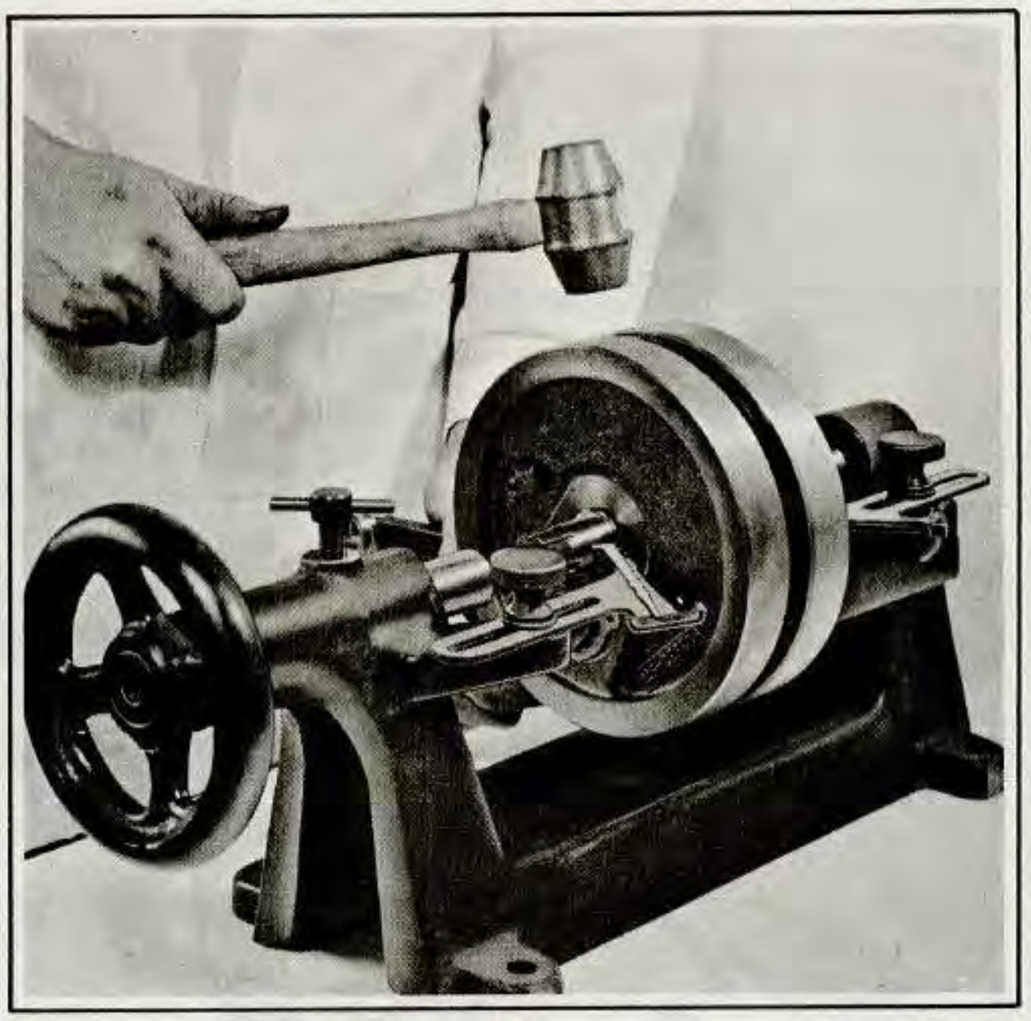


Figure 3E-25. Truing Flywheel on Truing Stand

crank pin and the rim at the crank pin is moderately tapped with lead or copper mallet.

When wheels are both out of true as indicated in "B," a hardwood wedge is driven between the wheels opposite the crank pin and the rims near the crank pins moderately tapped with a mallet.

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.

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.

Re-adjust centers, revolve wheels and take reading from indicator. Repeat truing operation until indicators show run-out to be no more than .001 in. (each graduation on indicator is .002 in.).

If it is impossible to true wheels, look 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. Check connecting rod sideplay with thickness gauge as shown in Fig. 3E-27. If it is greater than tolerance shown in "Engine Specifi-

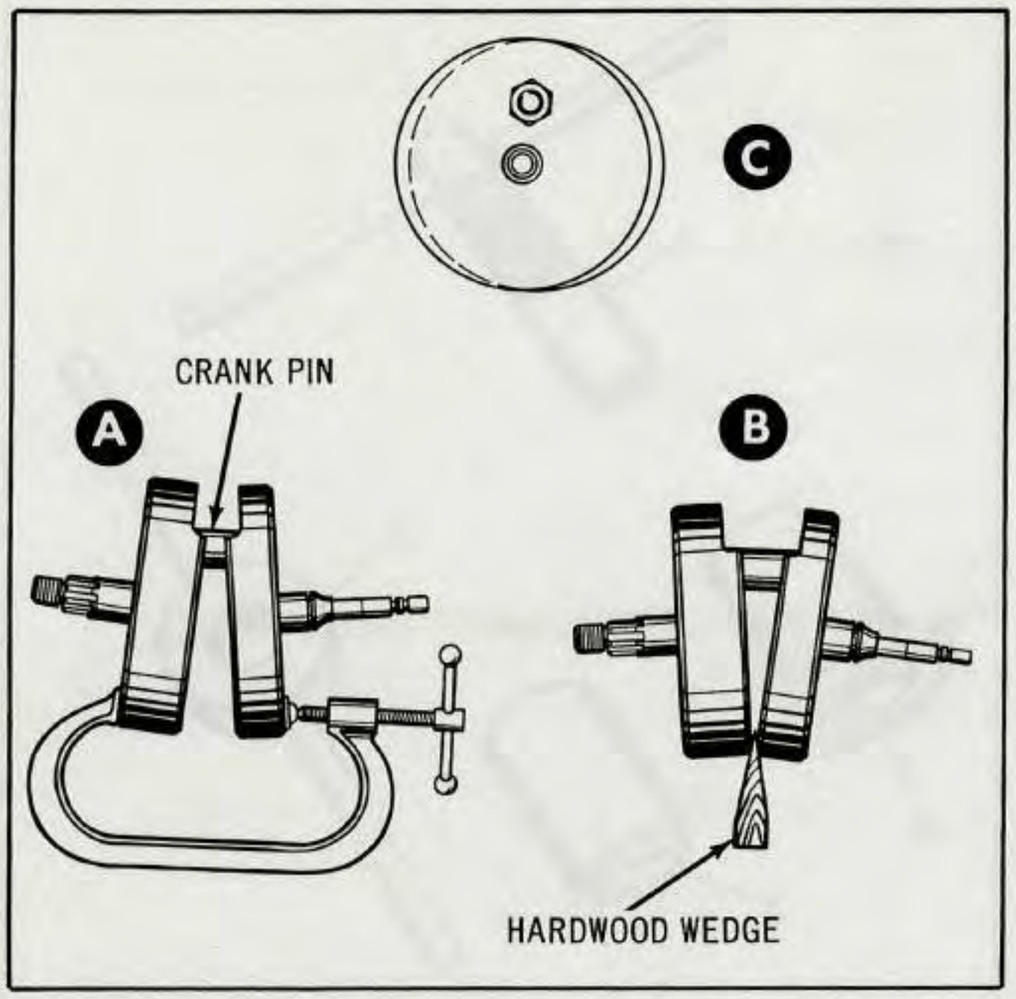


Figure 3E-26. Correcting Flywheel Alignment

cations," Section 3A, draw up crank pin nuts until within tolerance. Insufficient play between rods and flywheel face is caused by one of 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.

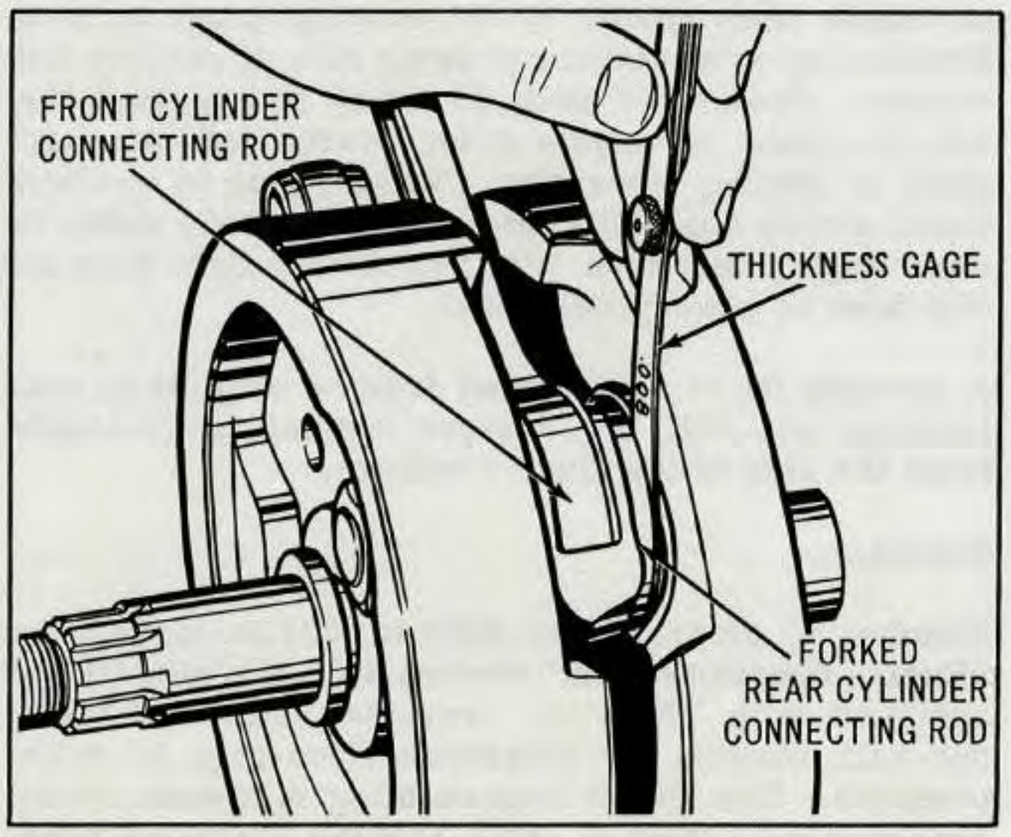
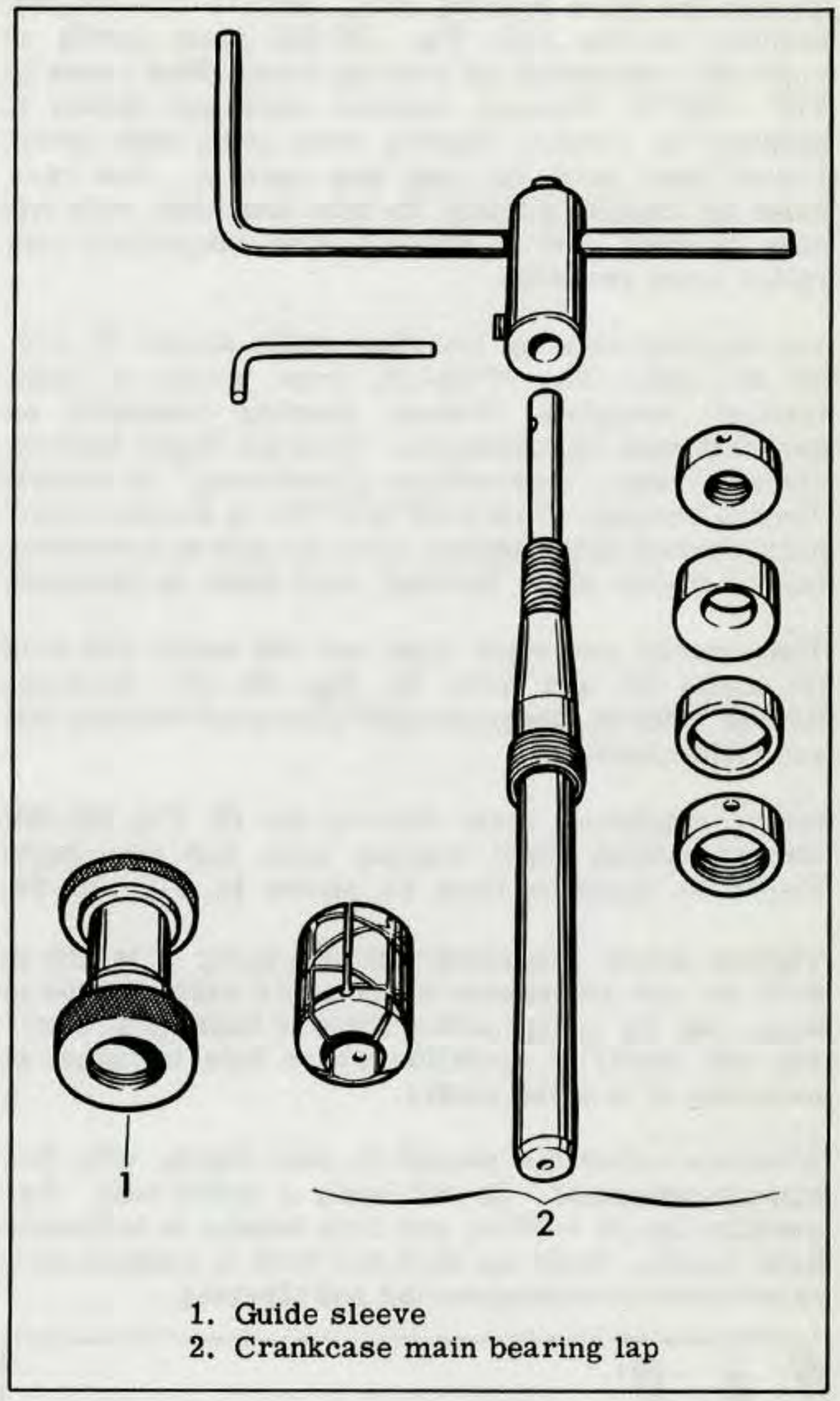


Figure 3E-27. Checking Connecting Rod Sideplay



1. Guide sleeve
2. Crankcase main bearing lap

Figure 3E-28. Main Bearing Lapping Tools

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, check wheel trueness on truing device. Correct any run-out as above.

TRUING AND SIZING PINION SHAFT BEARINGS RACE

Before fitting new pinion shaft bearings, lap bearing race in crankcase to true and remove traces of wear at sides of roller paths. A smooth velvety finish should result. A race that is worn beyond limits of oversize bearing rollers must be replaced. See "Engine Specifications," Section 3A, for shaft fit in roller bearing.

To remove worn bearing race, remove two bearing bushing screws (15, Fig. 3E-20) from inside of right case and press out bearing race. Heat cases to 275° - 300°F. Heating expands case and makes it possible to remove bearing race using less force. Press worn race 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.

Lap bearing race by inserting guide sleeve (1, Fig. 3E-28), Part No. 96728-56, from inside of case, through complete Timken bearing assembly on sprocket side of crankcase. Turn nut finger tight on sleeve. See "Assembling Crankcase," to install Timken bearing. This pilot will line up lapping arbor shaft through both bearing races so that an accurately lapped pinion shaft bearing race bore is obtained.

Temporarily assemble right and left cases with stud (9), bolts (3) and bolts (2, Fig. 3E-19). Securely tighten bolts to assure perfect alignment between left and right cases.

Insert crankcase main bearing lap (2, Fig. 3E-28) through pinion shaft bearing race and into guide sleeve in opposite race as shown in Fig. 3E-29.

Tighten arbor expansion collars using a length of 5/32 in. rod as spanner wrench until arbor begins to drag. Do not adjust arbor loose 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.

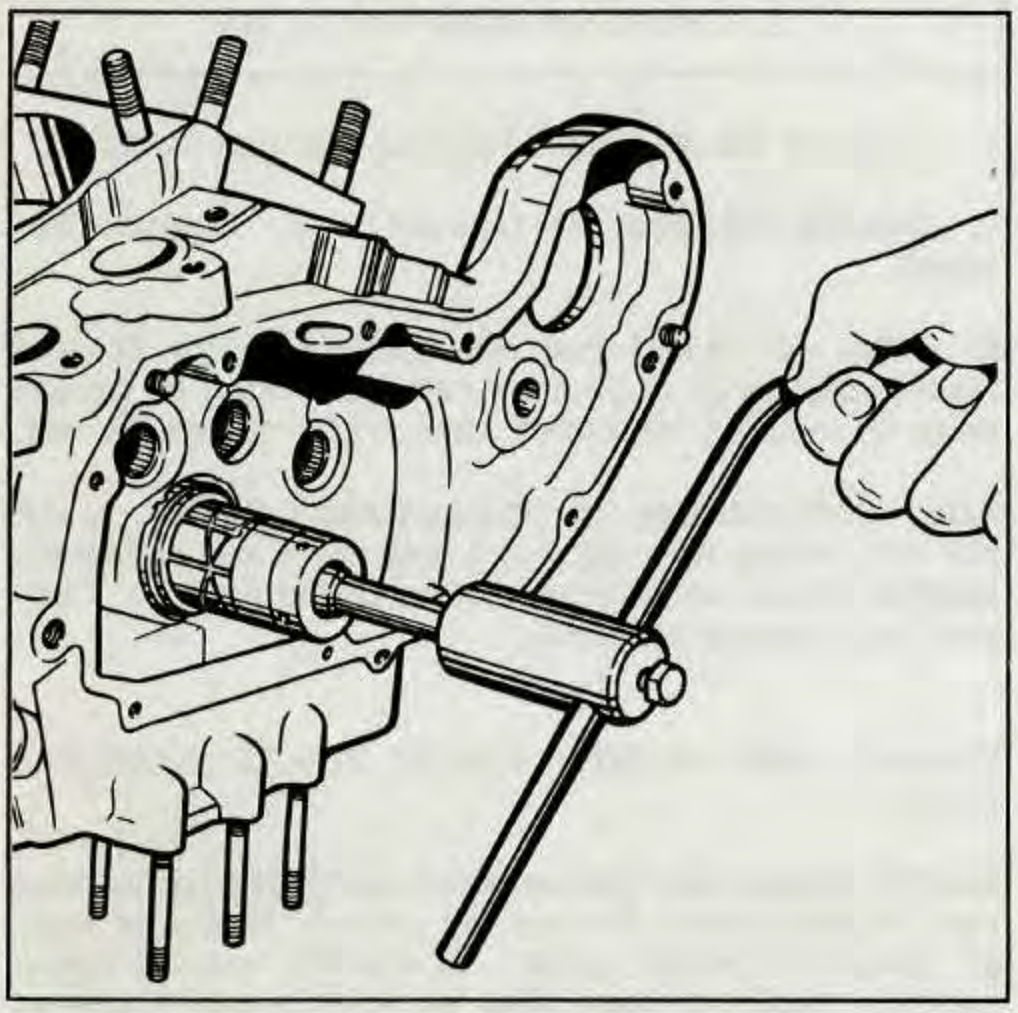
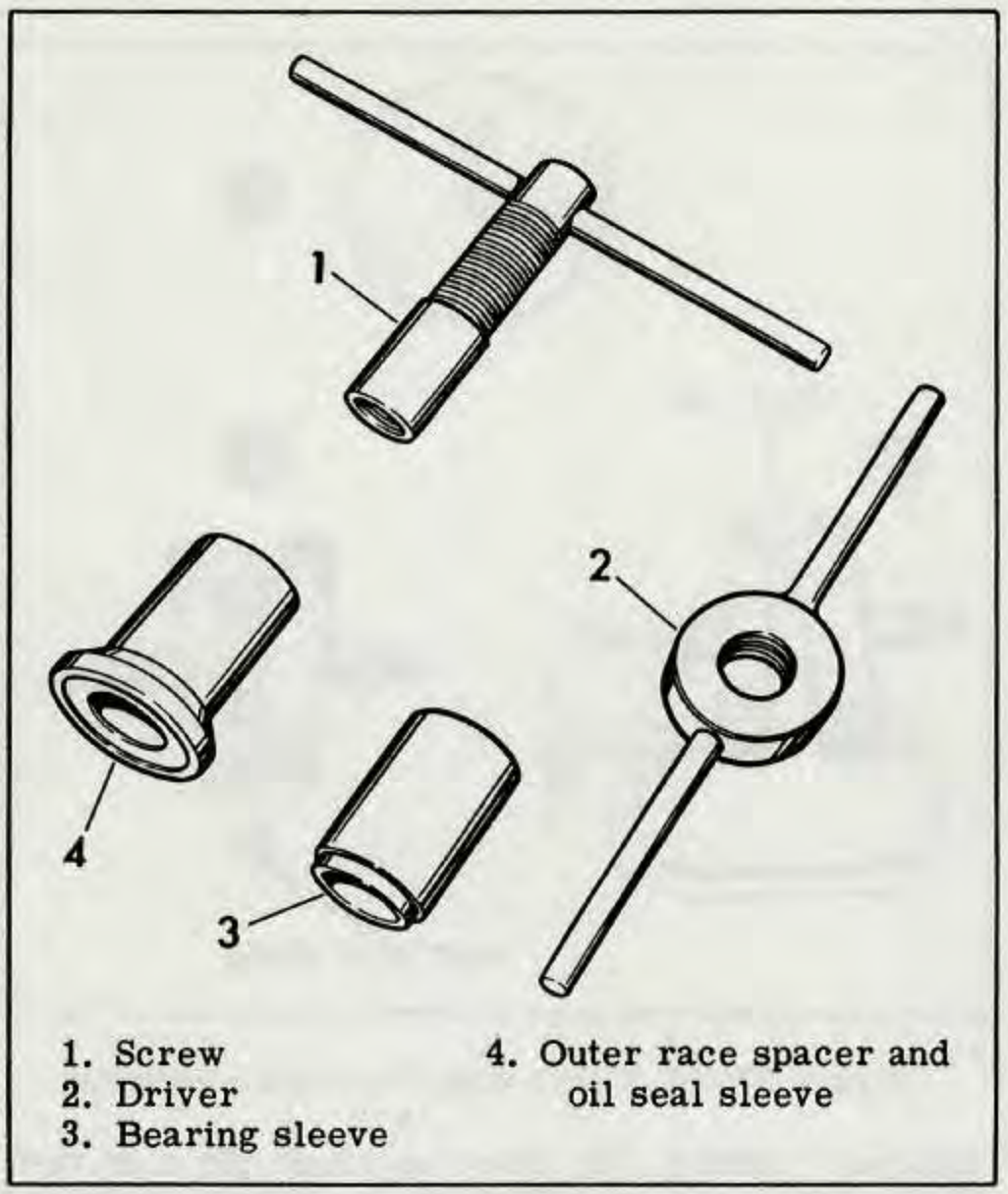


Figure 3E-29. Lapping Pinion Shaft Bearing Race



1. Screw
2. Driver
3. Bearing sleeve
4. Outer race spacer and oil seal sleeve

Figure 3E-30. Sprocket Shaft Timken Bearing Assembling Tool

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.

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 an inside micrometer or telescoping gauge or, preferably, by trial and error using sets of various size rollers. Determine plug fit using 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 .0008 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 minimum of tolerance span, .0008 in. One-half the minimum tolerance allowed (.0004 in.) subtracted from roller over-

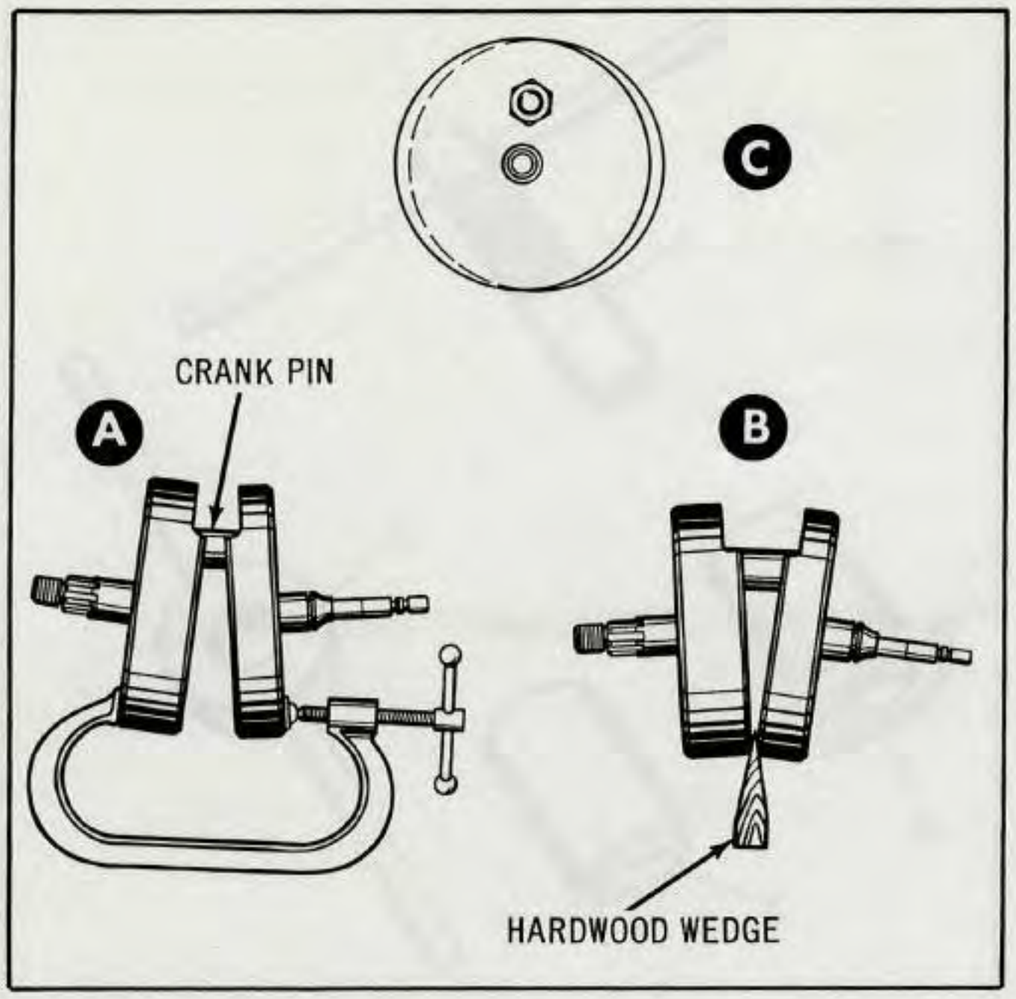


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3. Taper holes enlarged as a result of having been taken apart several times. Replace wheel seating deepest.

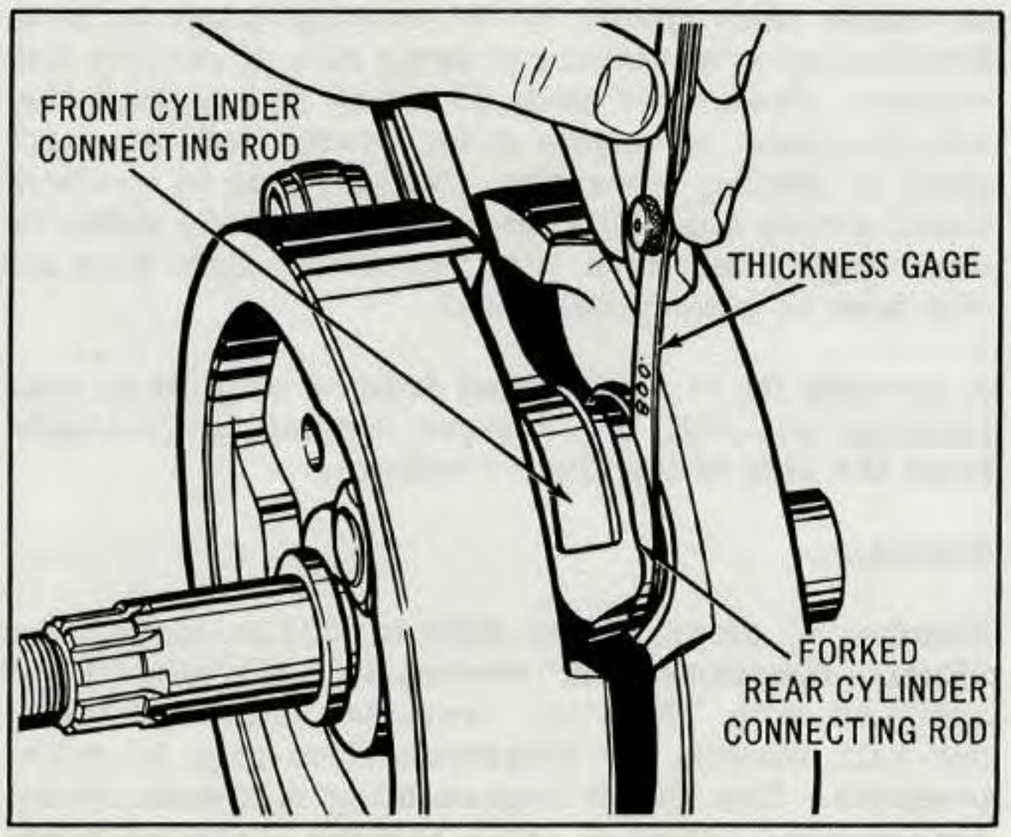
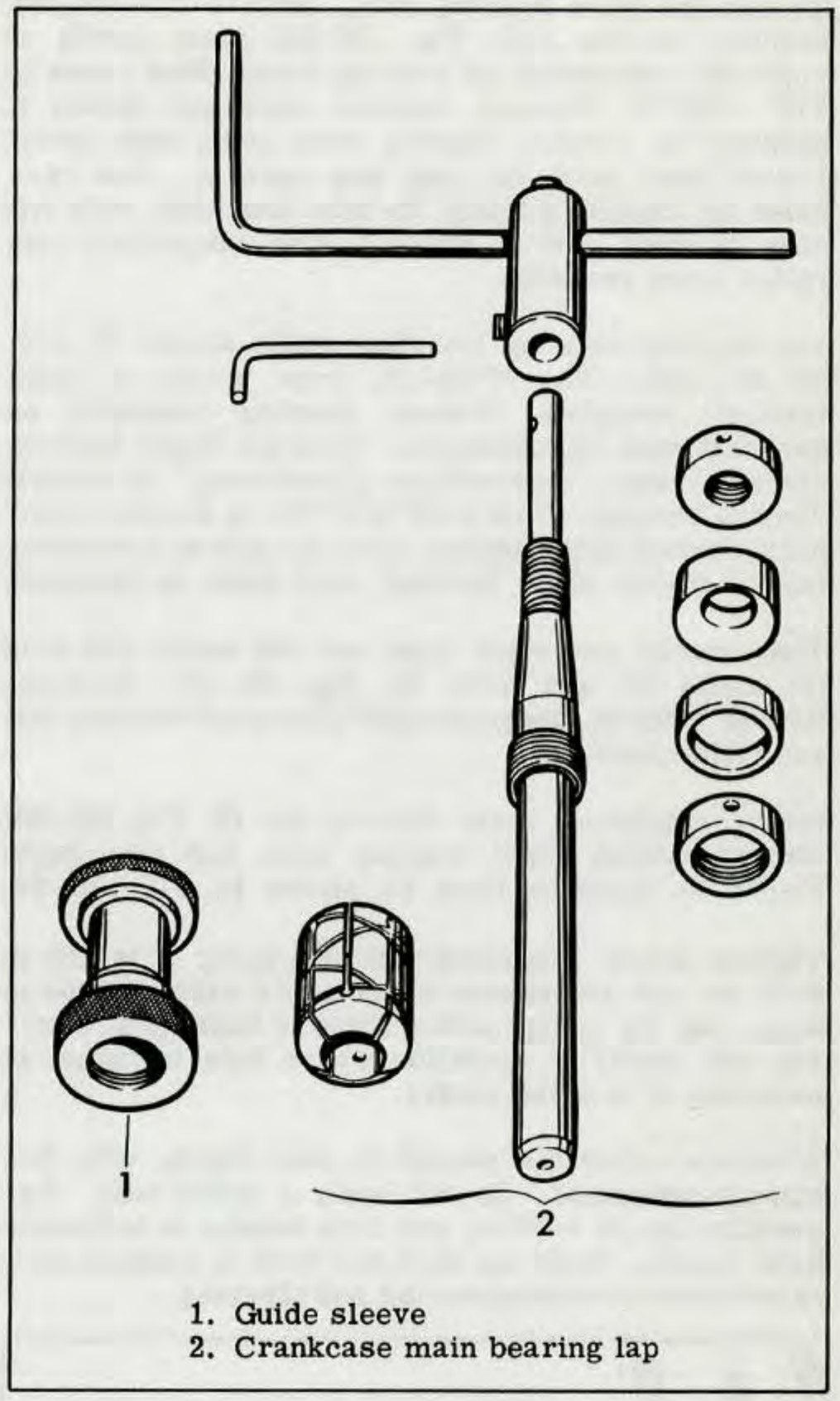


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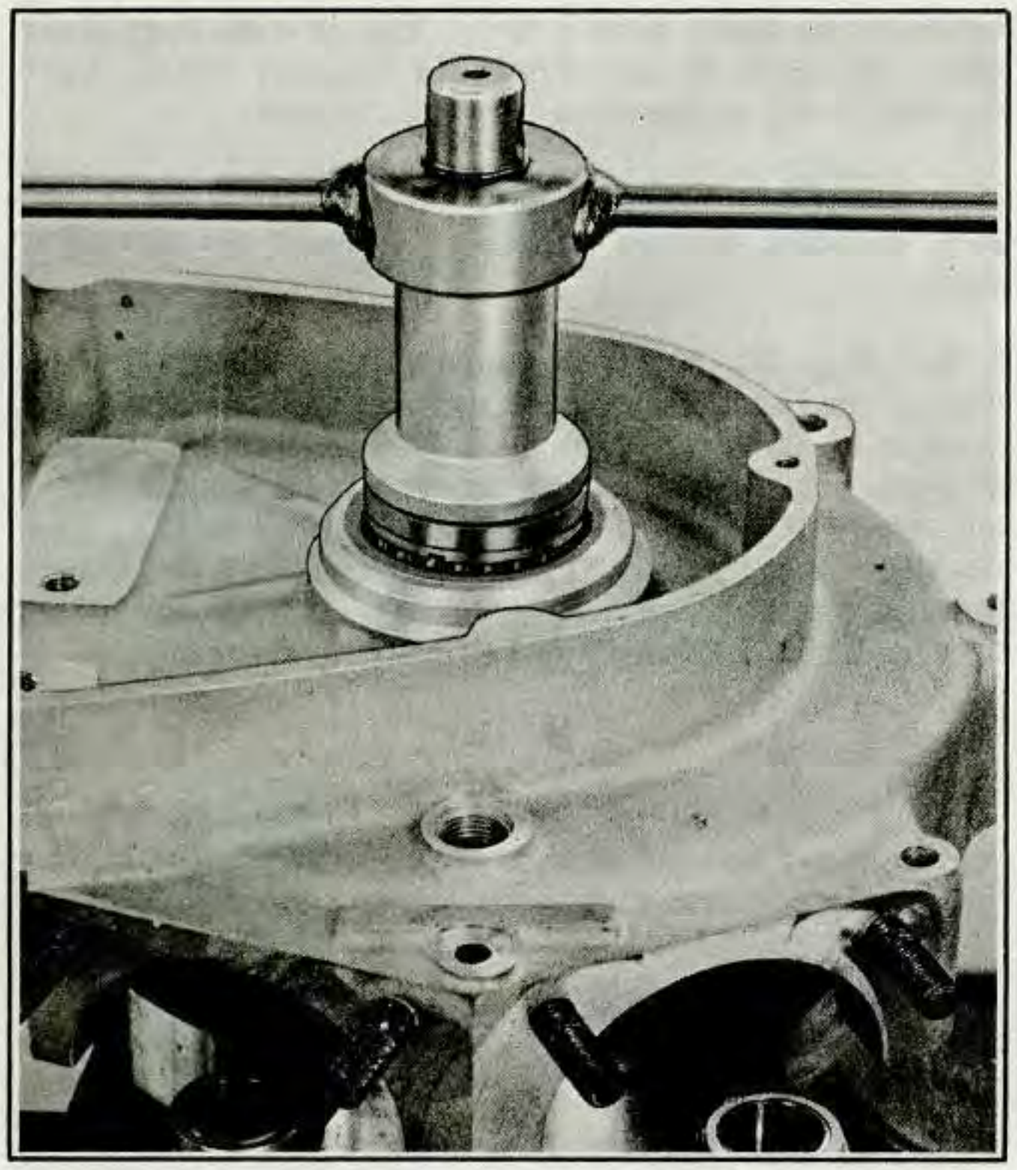


Figure 3E-33. Installing Sprocket Shaft Spacer

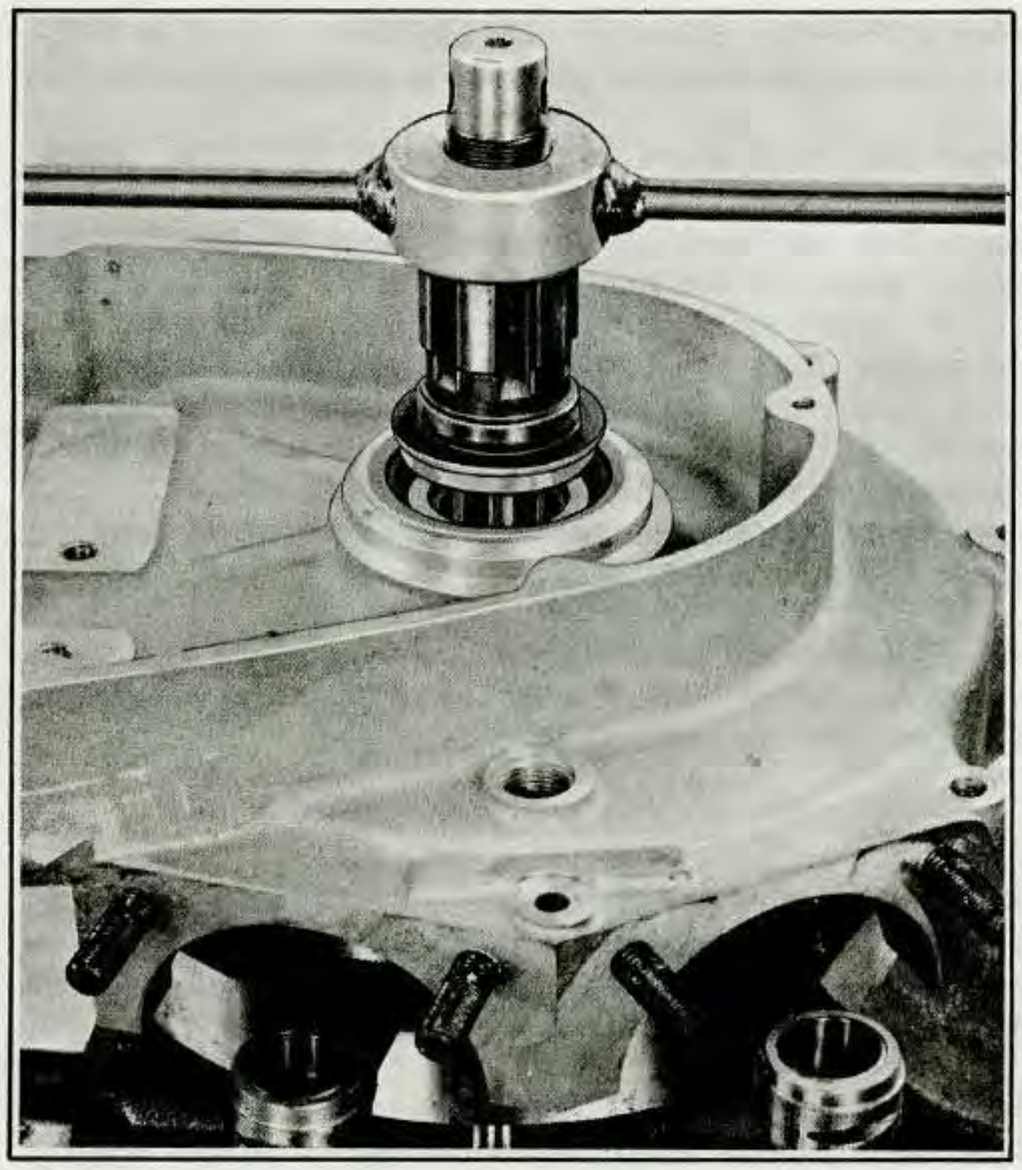


Figure 3E-34. Installing Sprocket Shaft Extension

4. Insert screw (1) with driver (2) in small end of spacer sleeve (4, Fig. 3E-30). Position sprocket shaft bearing spacer (10, Fig. 3E-20) on flanged end of spacer sleeve (4) with notched side of spacer away from spacer sleeve (4). Position this assembly with spacer against crankcase outer bearing race as shown in Fig. 3E-33. Assemble screw and driver on sprocket shaft. Turn driver clockwise until spacer is tight against bearing outer race. Remove tools and install sprocket shaft bearing spring ring (9).

5. Install oil seal (8), lip side of seal towards the spacer. Insert screw (1, Fig. 3E-30) through sleeve (4) and assemble on end of sprocket shaft. Install driver (2) and turn clockwise until seal is pressed into crankcase recess. Align splines and start sprocket shaft extension (1, Fig. 3E-20) on end of sprocket shaft. Insert screw (1) through shaft extension and tighten on end of sprocket shaft. Turn driver (2) clockwise until extension bottoms against bearing inner race (see Fig. 3E-34).

6. See Fig. 3E-20. Install bearing assembly (4 and 5) and washer (3) on pinion shaft. Install new snap ring (2) in groove of pinion shaft.

7. Reassemble transmission as described in "Crankcase and Transmission Assembly Procedure," Section 4D.

8. Apply a coat of non-hardening gasket sealer to crankcase joint faces. Lubricate pinion shaft bearing with engine oil and assemble crankcase sides together.

9. See Fig. 3E-19. Align case halves and assemble right crankcase bolts (1, 2, and 3), battery carrier (6), engine rear mount (7), stud nuts (4), bolts (5 and 8), stud (9), and speedometer drive unit.

10. Install transmission mainshaft sprocket as described in "Gear Box," Section 4D.

11. Install starter as described in "Starter," Section 4C.

12. Install clutch and clutch release as described in "Clutch," Section 4B.

IMPORTANT

Be sure to refill transmission with oil as described in "Lubrication," Section 4D.

13. Install oil pump as described in "Oil Pump," Section 3D.

14. Install timing gears, gearcase cover, tappet guides, tappets, and generator as described in "Gearcase," Section 3D.

15. Install cylinders and pistons as described in "Cylinder," Section 3C.

16. Install circuit breaker or magneto and time engine as described in Section 5F.

17. Install cylinder heads as described in "Cylinder Head," Section 3B.

18. Reassemble engine in chassis as described in "Installing Engine in Chassis," Section 3A.

size (.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 high speed 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.

ASSEMBLING CRANKCASE

1. See Fig. 3E-20. If spring ring (16) has been removed, install a new one in left case. Position left case on arbor press, clutch side up. Press outer race (13) in case until it bottoms against ring (16).

2. See Fig. 3E-31. Position flywheel assembly in vise and grip pinion shaft between copper jaws. Install screw (1, Fig. 3E-30) and with a 1 in. I.D. x 3-1/4 in. long steel tube under driver (2, Fig. 3E-30), install Timken bearing half (7, Fig. 3E-20) on sprocket shaft. Be sure bearing bottoms on shaft shoulder.

If an arbor press is available, bearing may also be pressed on shaft with a 1 in. I.D. x 6 in. long steel tube. Be sure to use Flywheel Support Plate, Part No. 96137-52, in between flywheel halves.

After pressing bearing tight against the flywheel, install bearing spacer (12, Fig. 3E-20) on sprocket shaft.

3. See Fig. 3E-32. With screw (1, Fig. 3E-30) installed on threaded end of sprocket shaft, place left crankcase (bearing race installed in case) over end of sprocket shaft, seating bearing race against Timken bearing half (7) and bearing spacer (12, Fig. 3E-20). Lubricate bearing with engine oil and insert Timken bearing left half (11, Fig. 3E-20) on screw (1, Fig. 3E-30) tapered end of bearing down.

NOTE

If Timken bearing left half (11, Fig. 3E-20) and outer spacer are already installed in case, simply position case over top of screw (1, Fig. 3E-30) until bearing is snug on sprocket shaft and proceed as follows.

Install bearing sleeve (3) over end of screw (1, Fig. 3E-30) with step-cut end of sleeve facing down as positioned on tool.

Start driver (2, Fig. 3E-30) on screw and turn driver down against bearing sleeve. Continue turning the driver clockwise until the two bearing halves are brought tight against spacer. Remove tools.

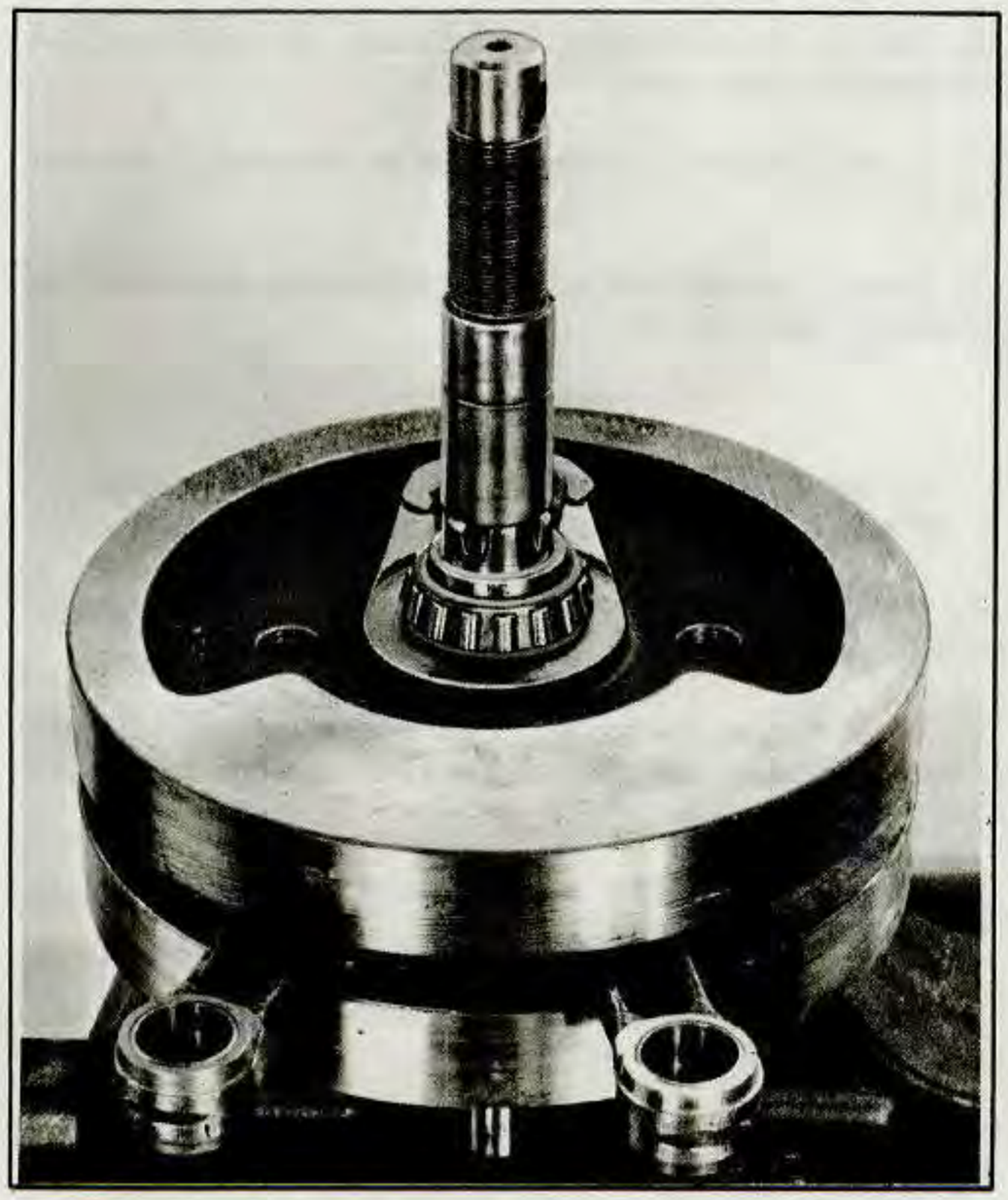


Figure 3E-31. Installing Bearing (Right Half) and Spacer

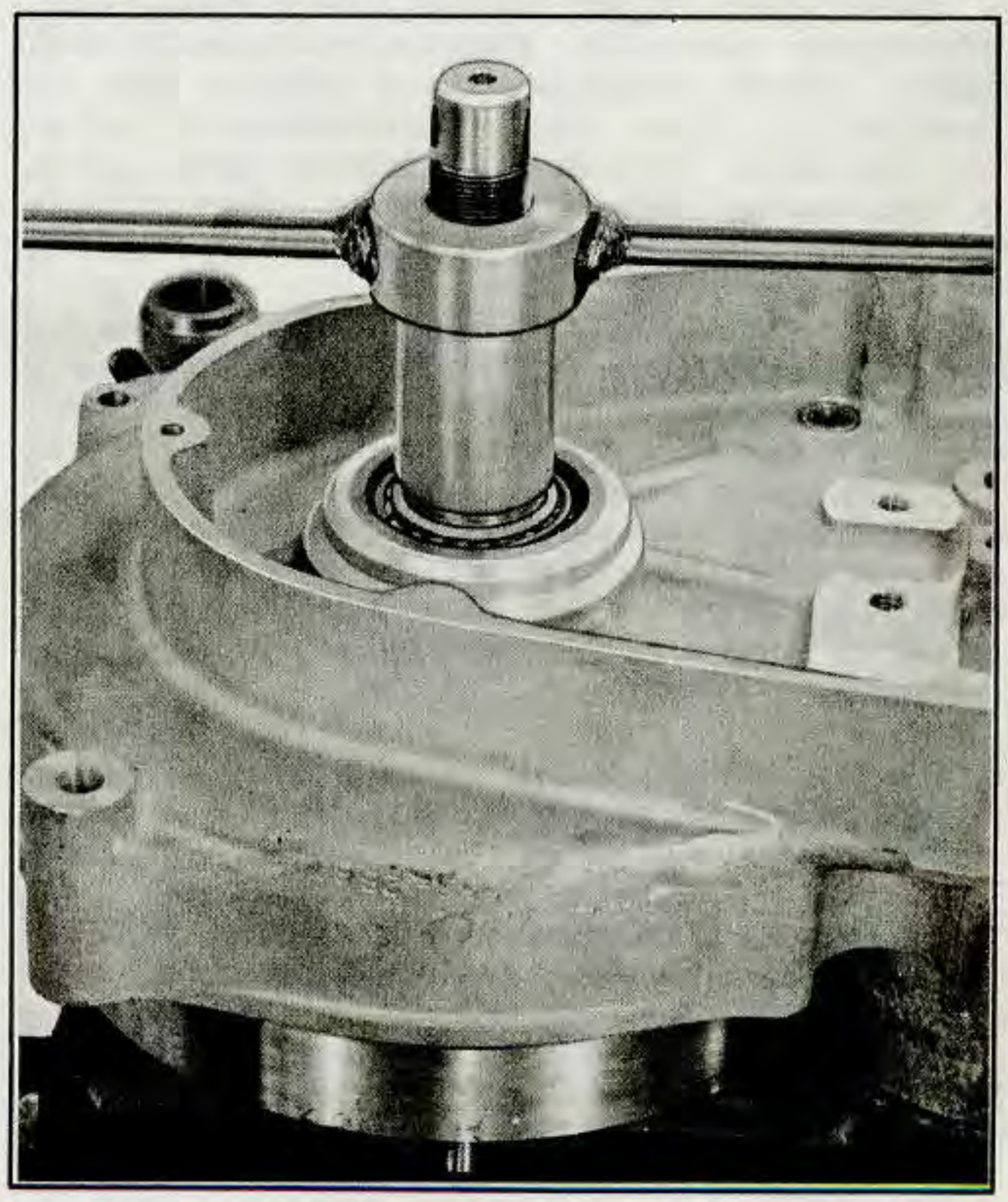


Figure 3E-32. Assembling Left Crankcase to Flywheel Assembly

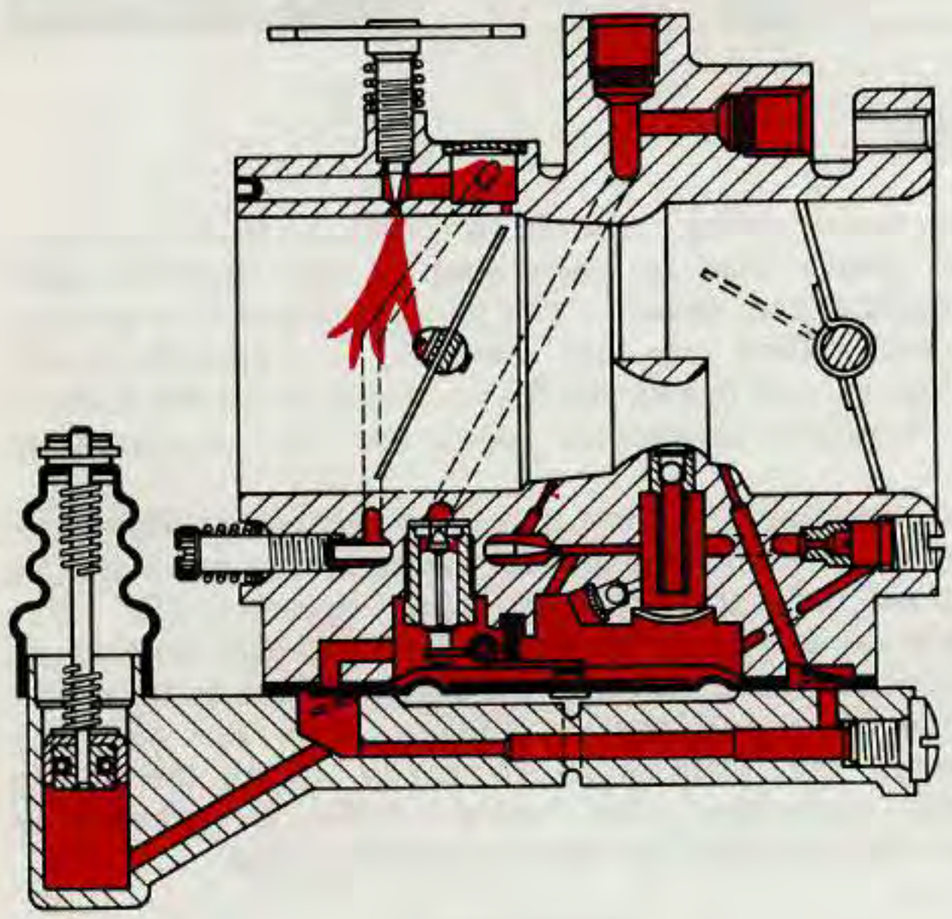


Figure 3F-2. Starting

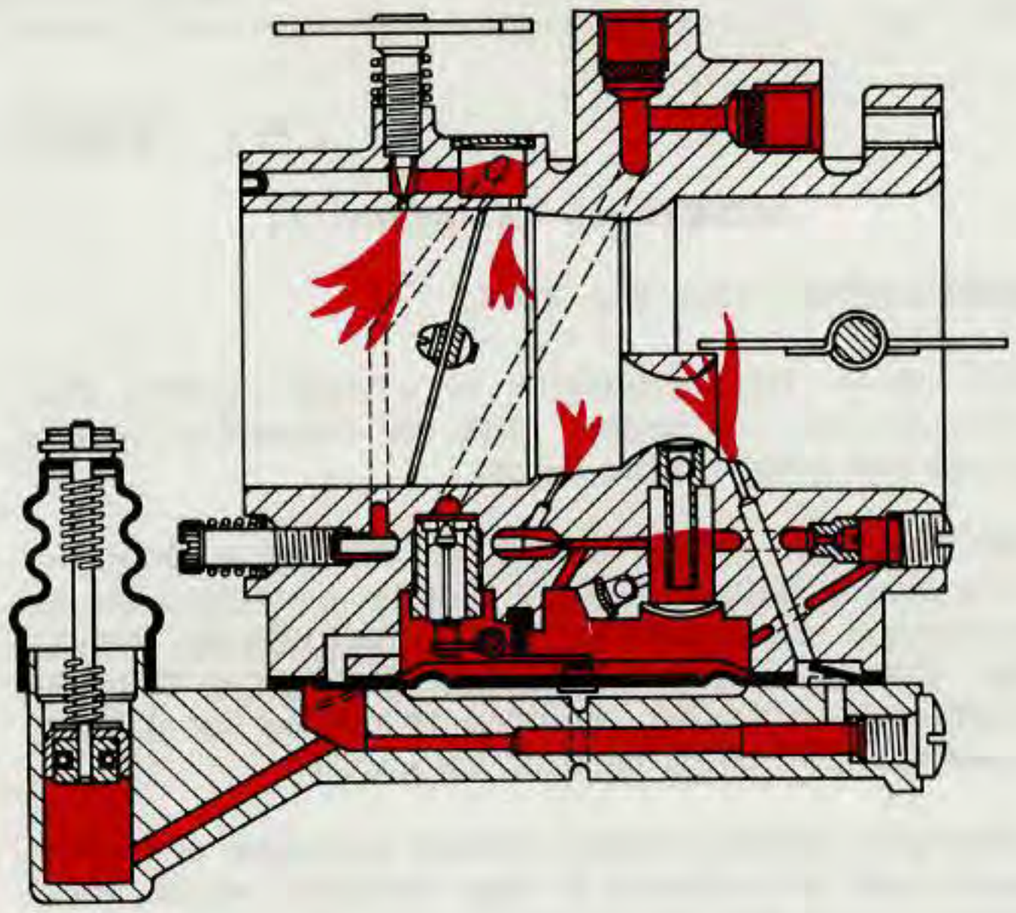


Figure 3F-3. Idle

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

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 in 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

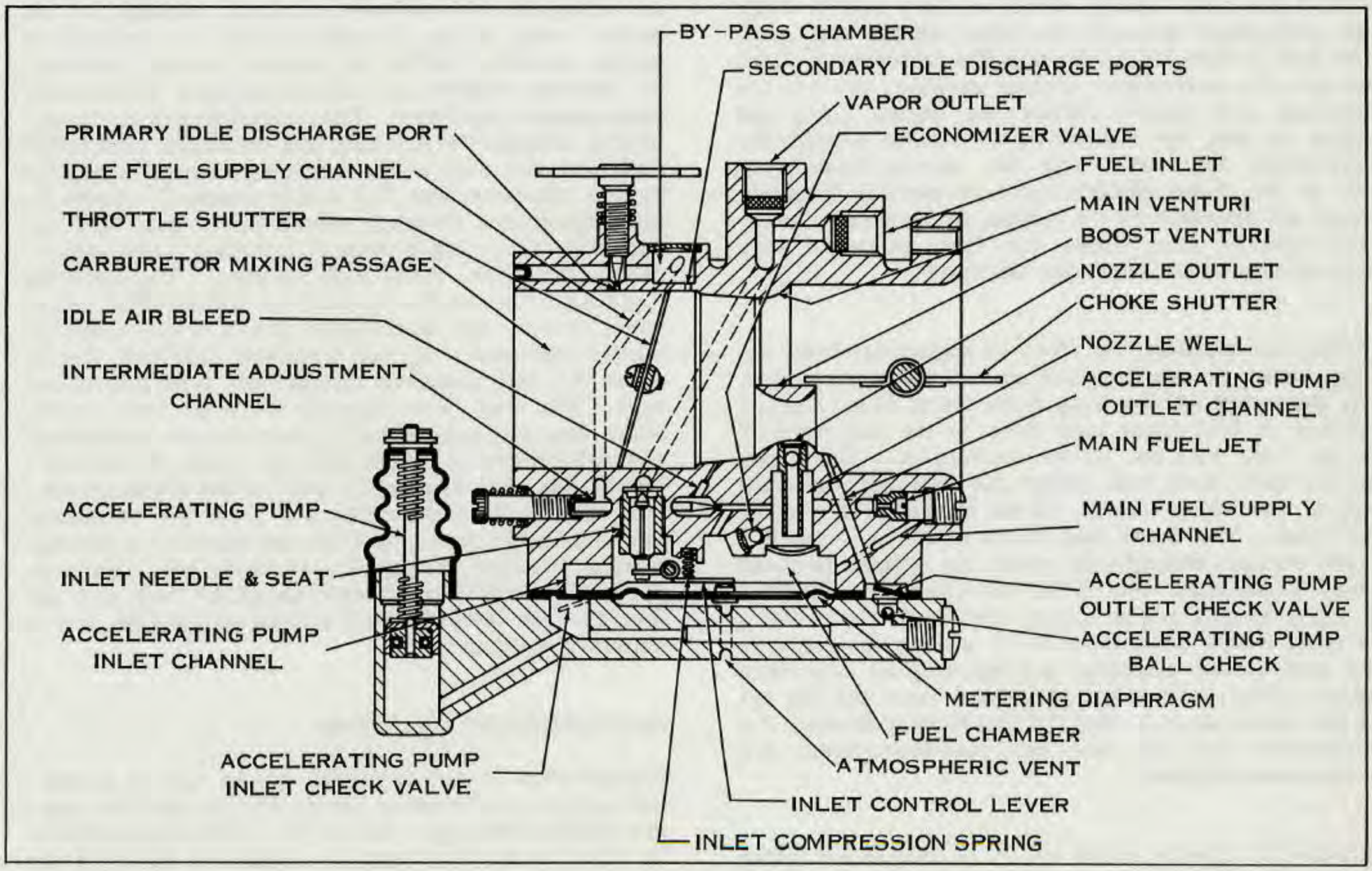


Figure 3F-1. Carburetor Cross Section - Model HD

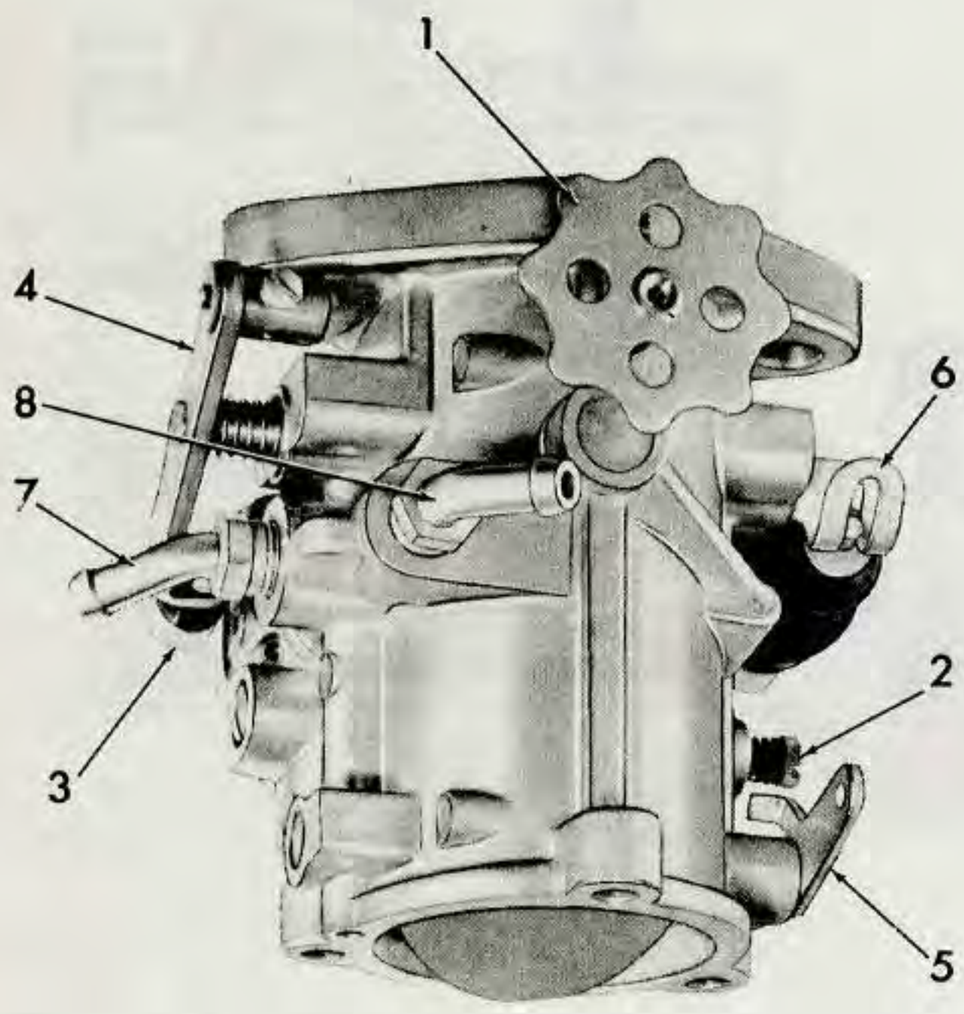
ADJUSTING CARBURETOR (See Fig. 3F-7)

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 plugged. 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.

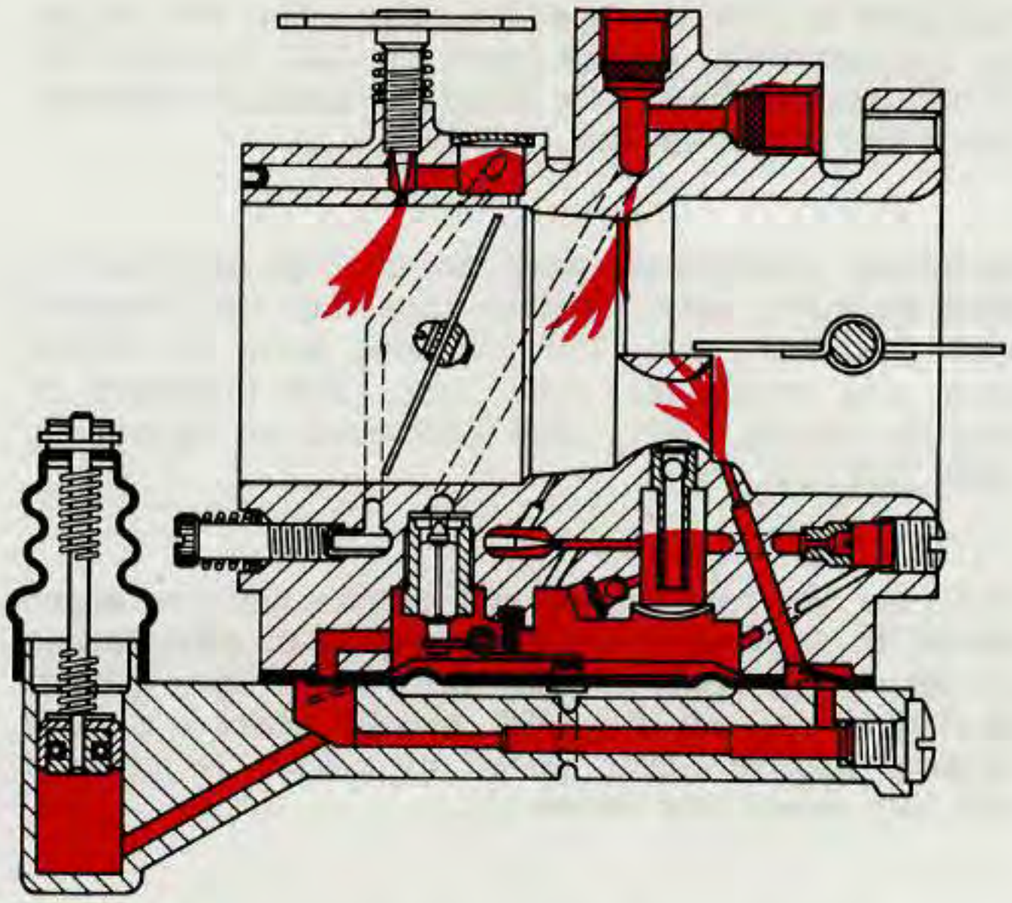


Figure 3F-4. Accelerating

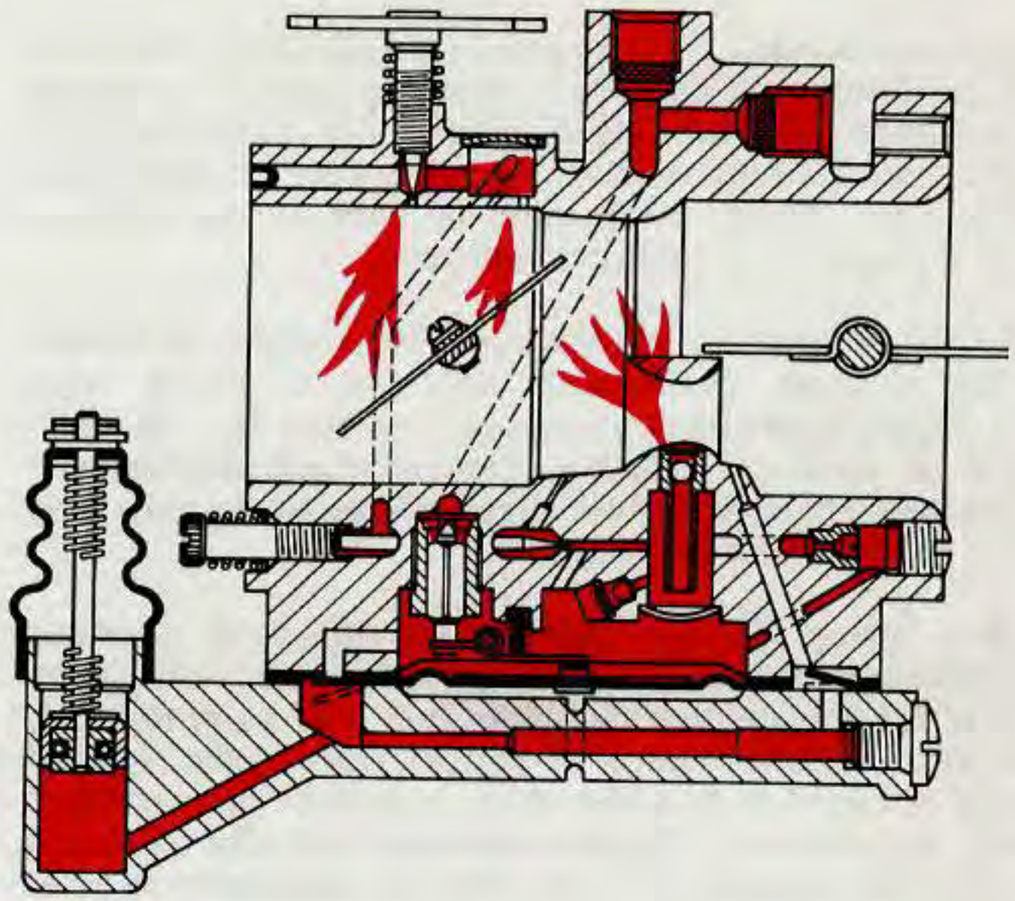


Figure 3F-5. Intermediate Speed

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

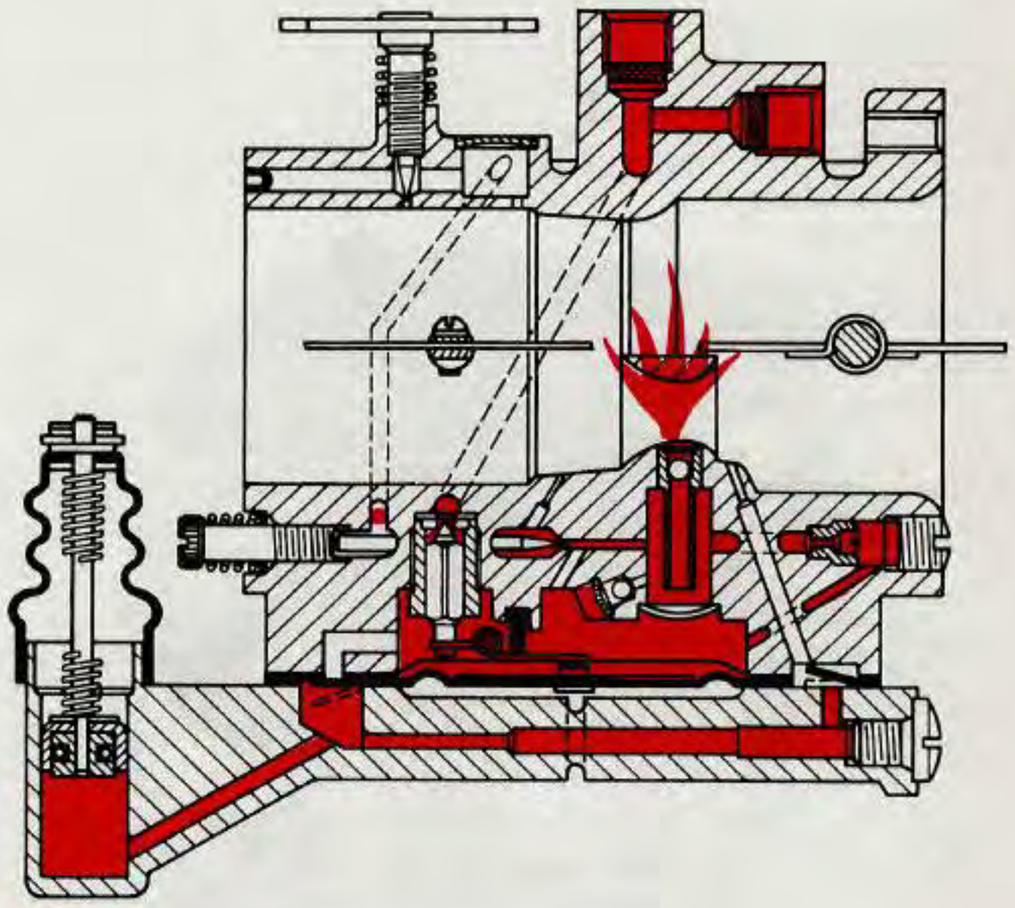


Figure 3F-6. High Speed

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.

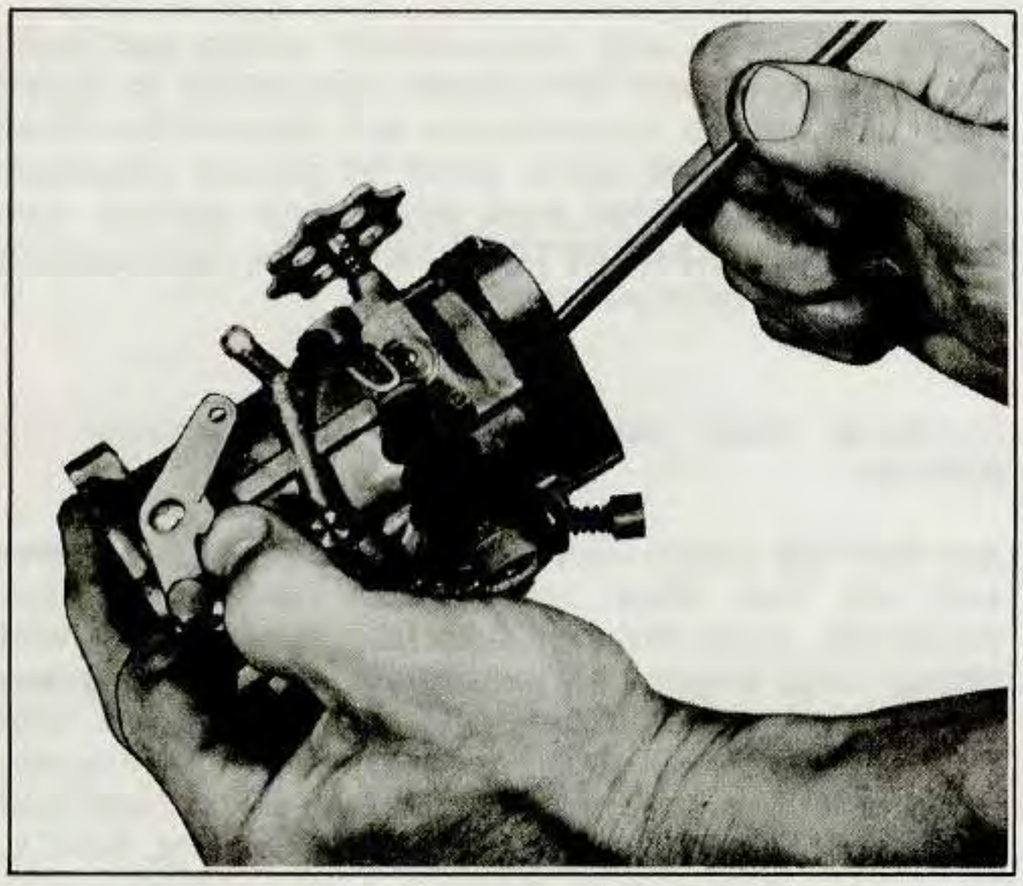


Figure 3F-7B. Checking Main Nozzle Ball Check Valve for Leakage

Vacuum should release ball, and pressure should seat ball in nozzle assembly.

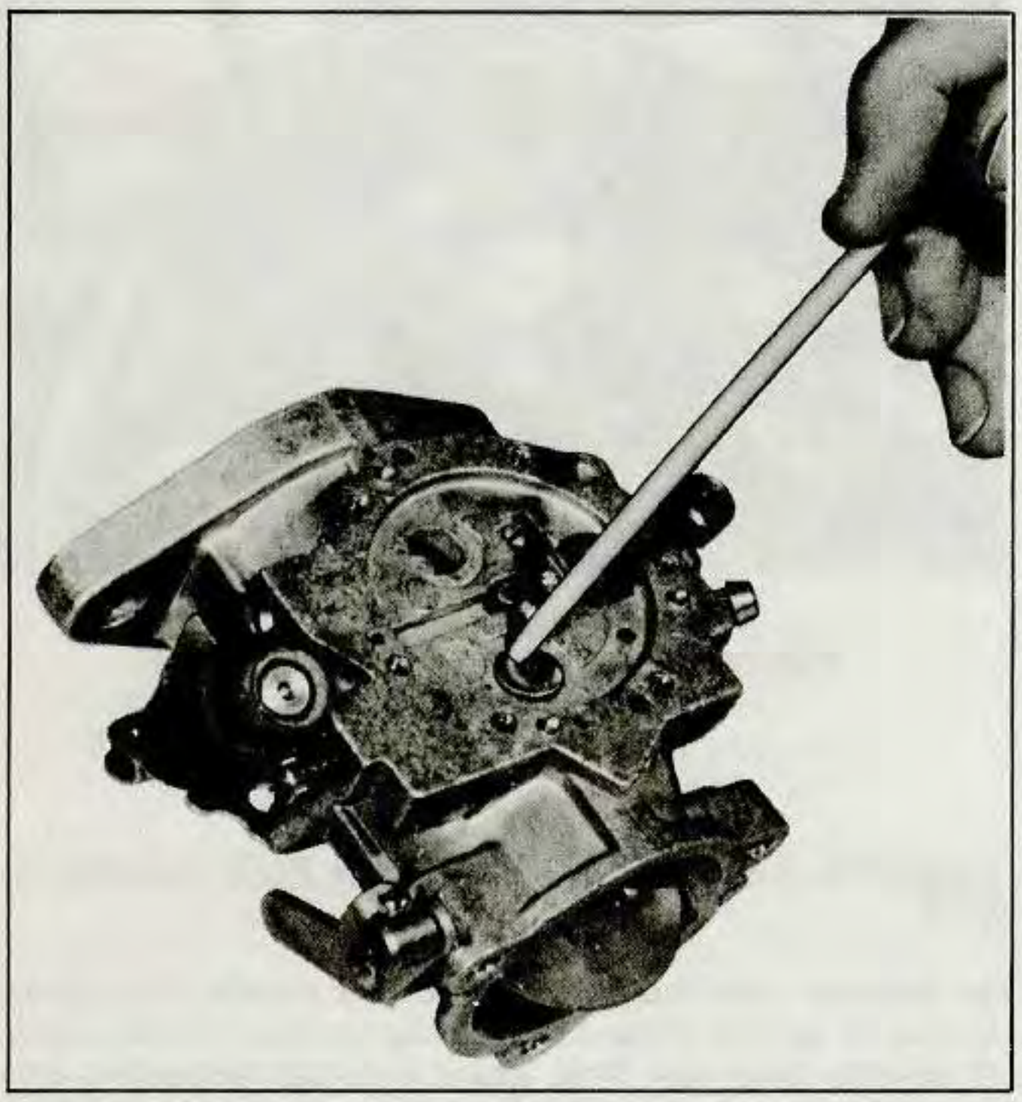


Figure 3F-7C. Removing Main Nozzle Welch Plug

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

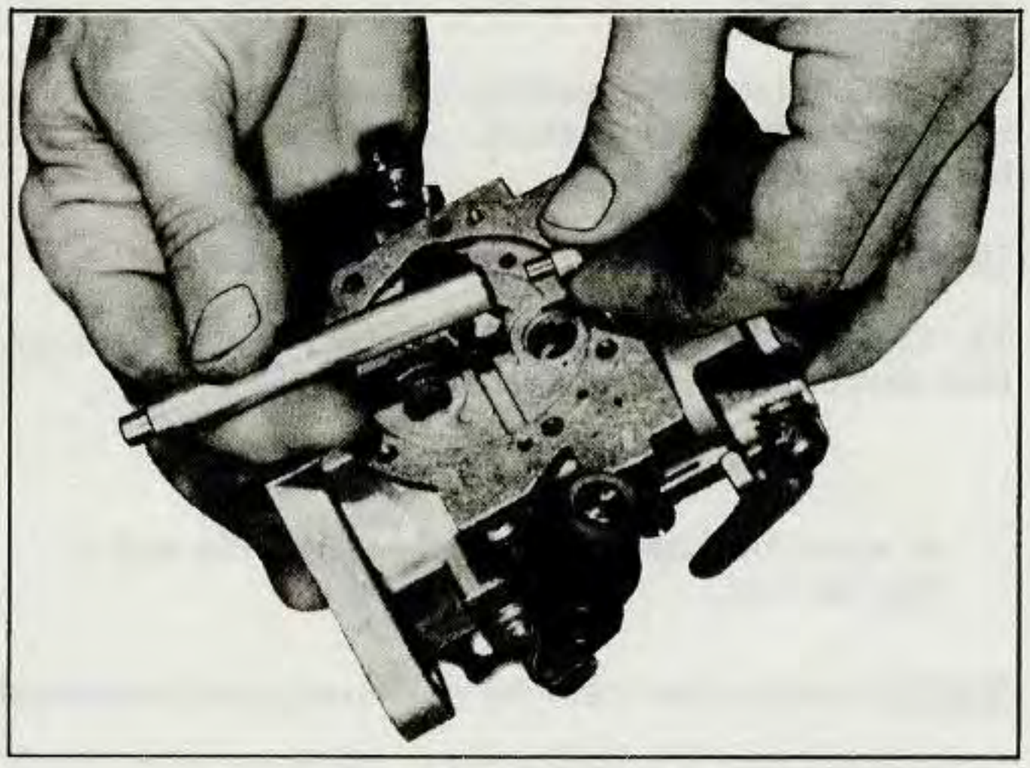


Figure 3F-7E. Installing Main Nozzle

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

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.

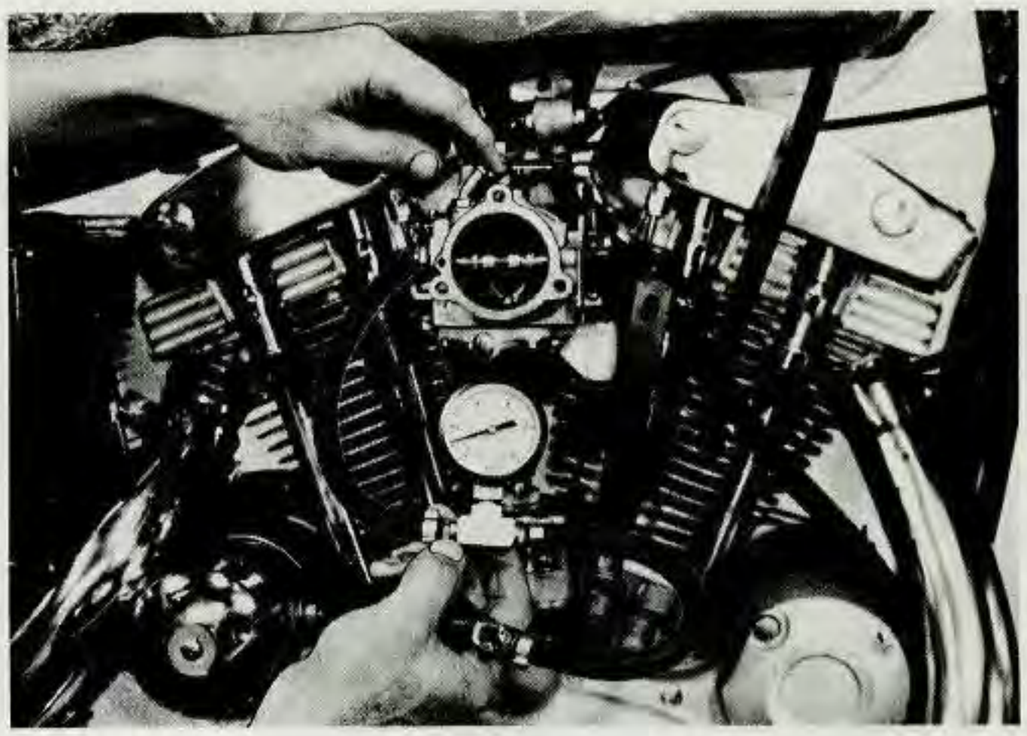


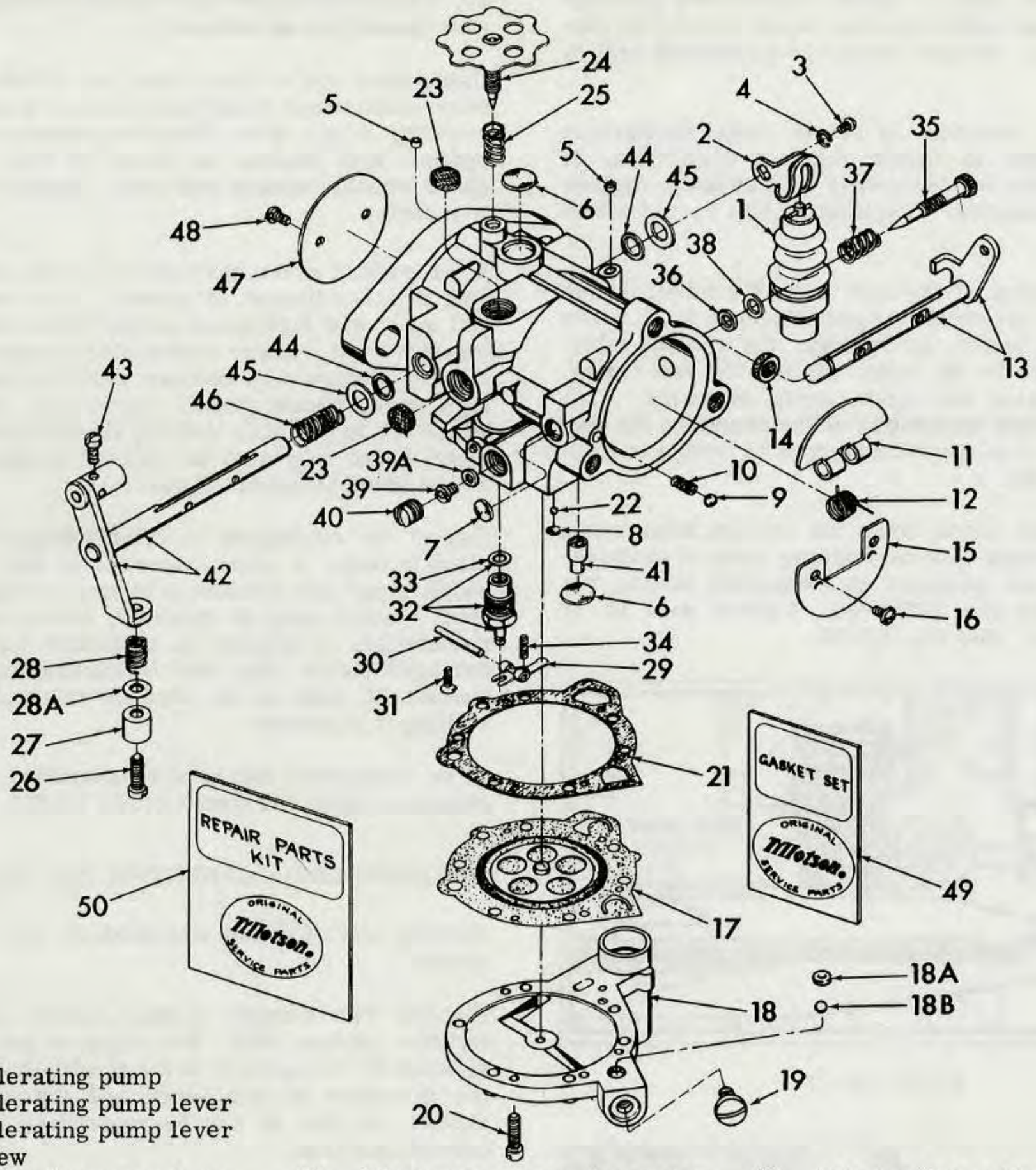
Figure 3F-7A. Checking Inlet Needle and Seat for Leakage

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.



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

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.

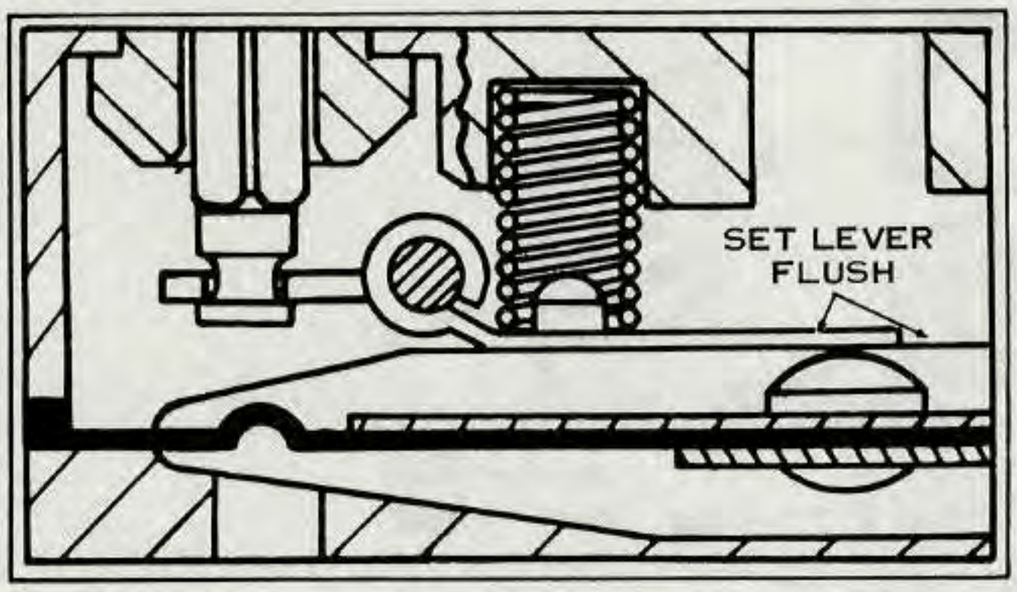


Figure 3F-7F

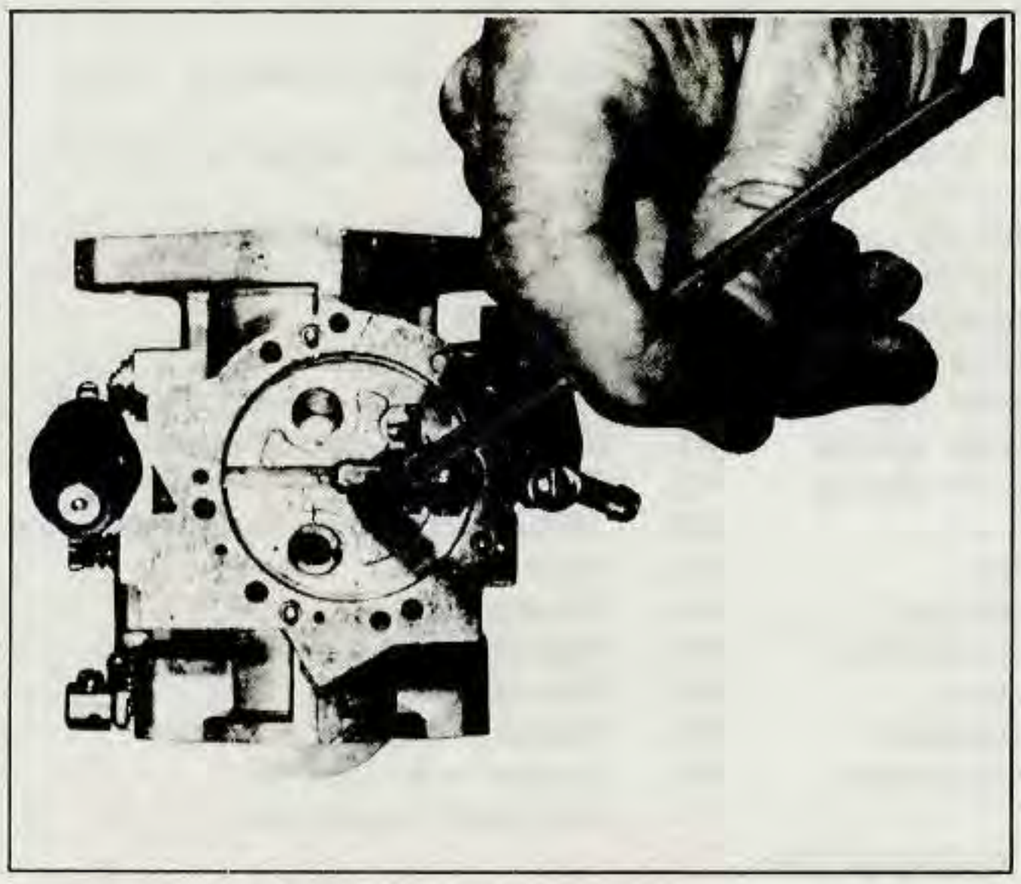


Figure 3F-7G. Checking Economizer Ball Check Valve for Leakage

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).

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 adjustment (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.)

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.

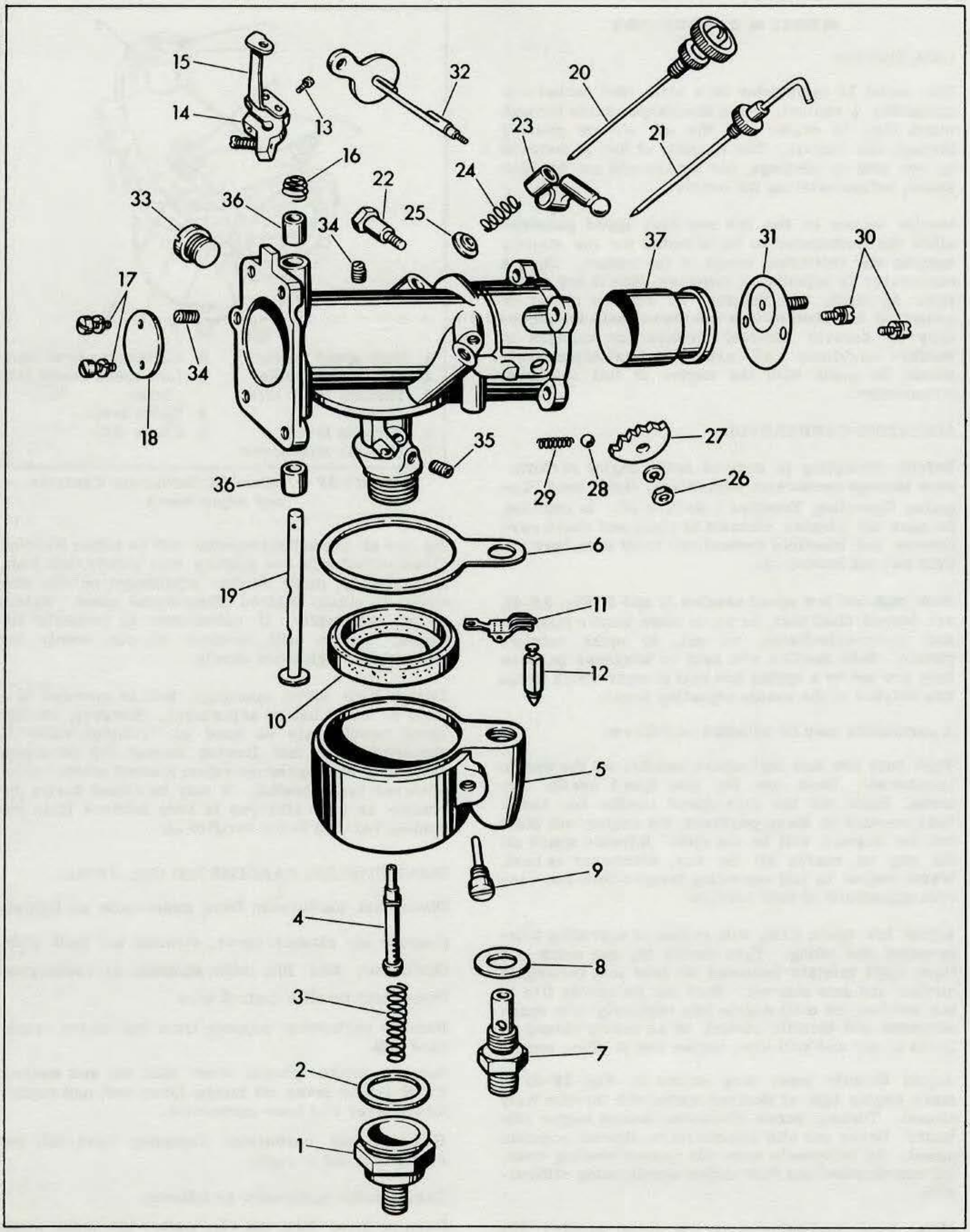


Figure 3F-9A. Model M Carburetor - Exploded View

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.

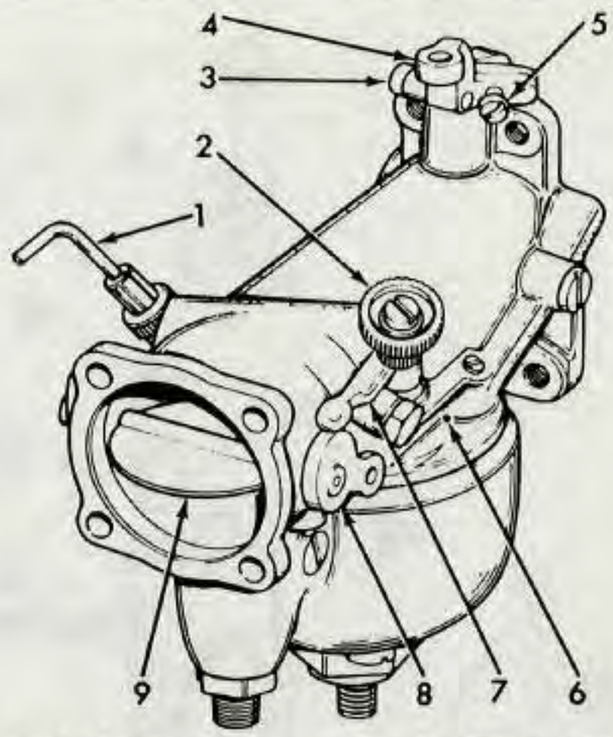
A carburetor may be adjusted as follows:

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.



1. High speed needle
2. Low speed needle
3. Throttle lever lock screw
4. Throttle lever
5. Throttle stop screw
6. Carburetor bowl vent
7. Low speed needle lift lever
8. Choke lever
9. Choke disc

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).

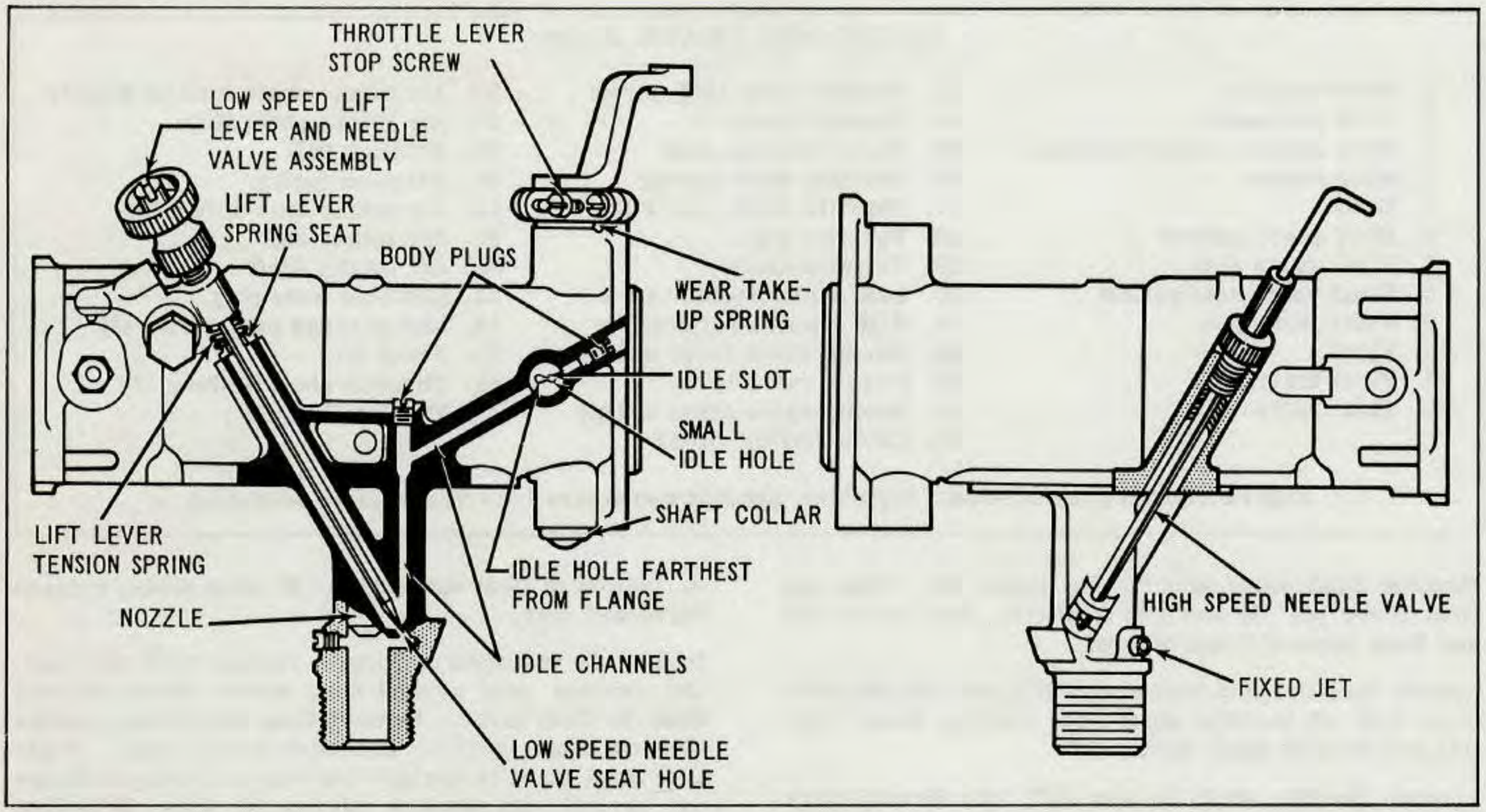


Figure 3F-9B. Model M Carburetor Passages and Needle Seats

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."

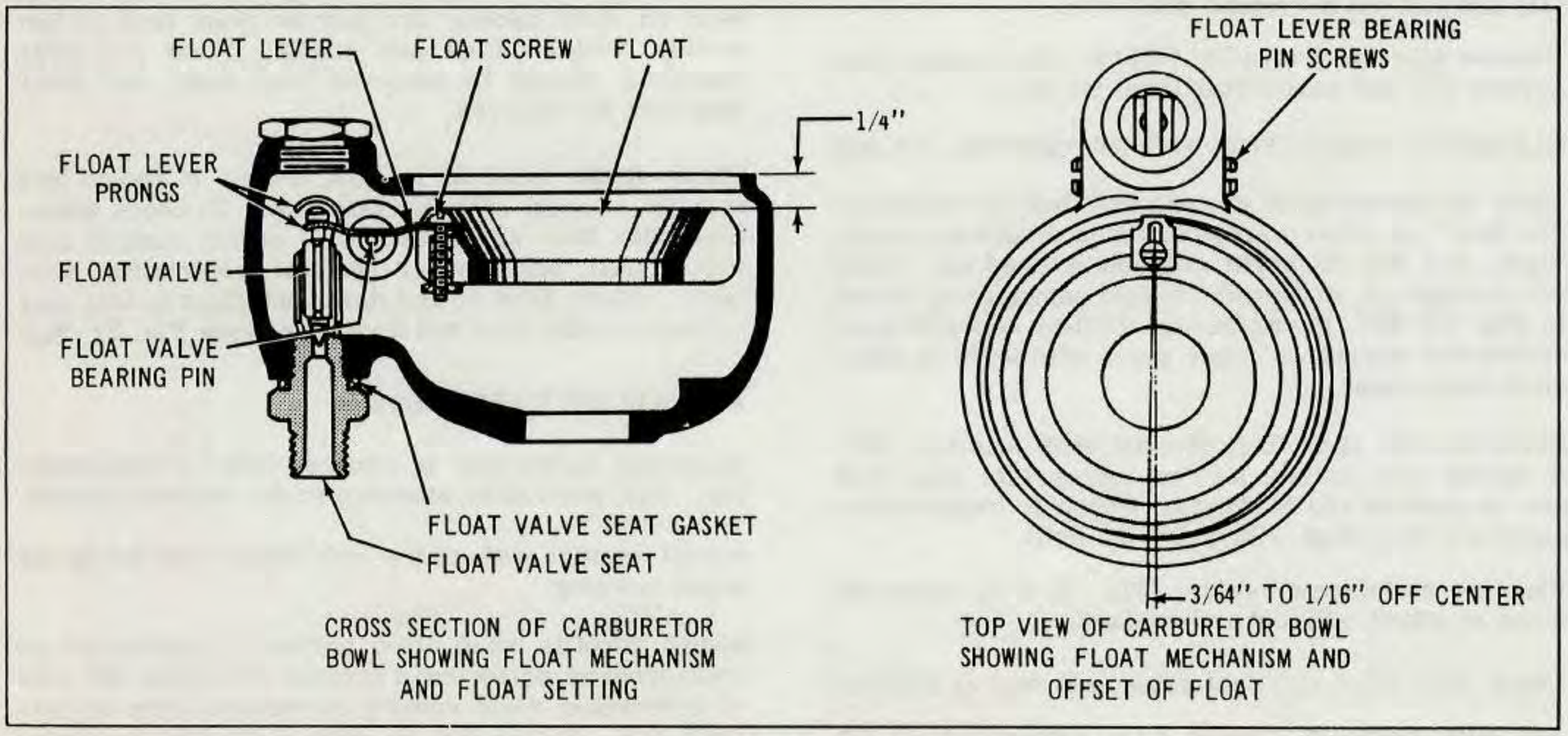


Figure 3F-9C. Adjusting Model M Bowl Float and Needle

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.

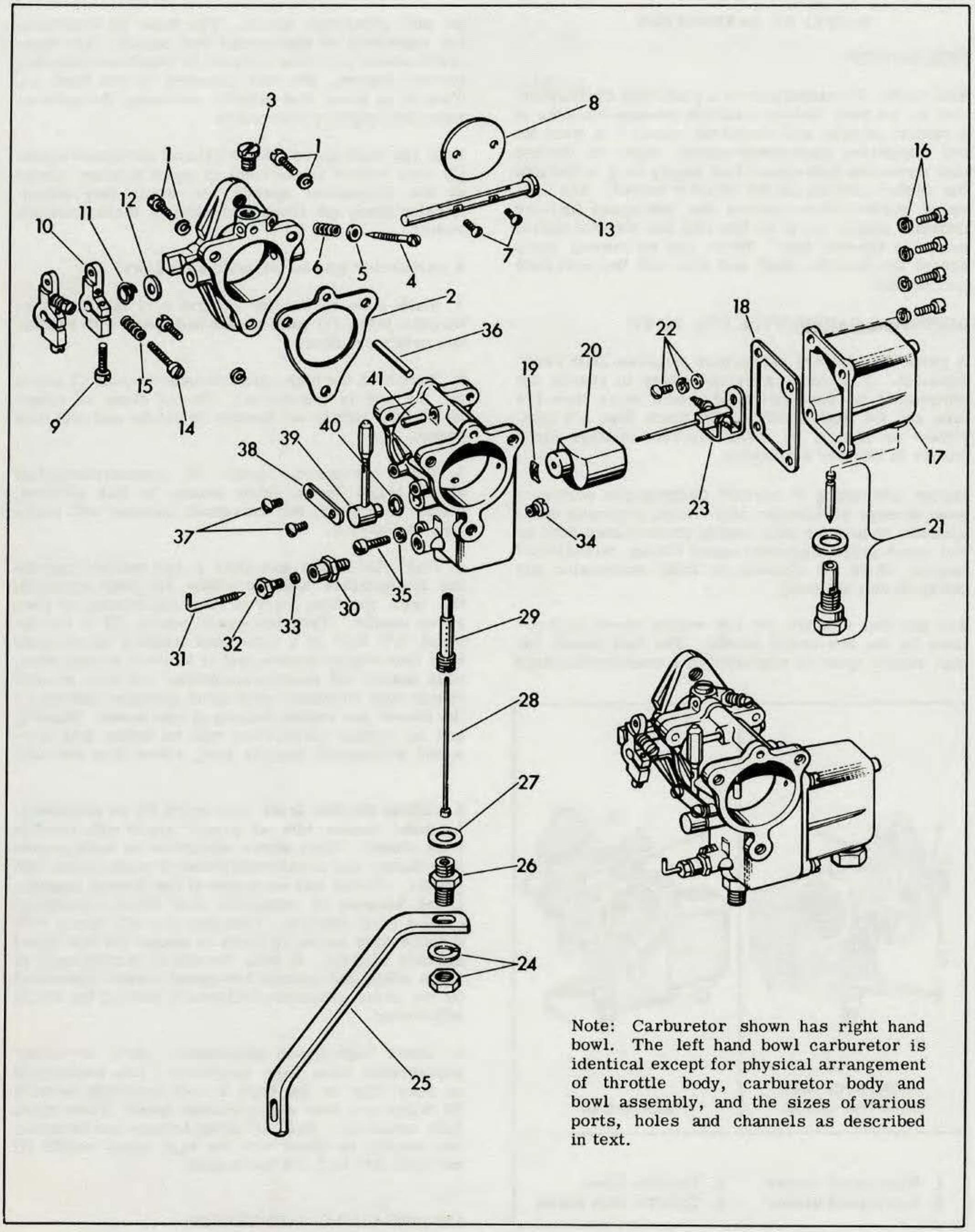
Check needle head fit in float lever. It should be a free fit to about .003 in. clearance. To check clearance with float assembled, hold needle against seat with small screwdriver without restricting float lever. Move float up and down and observe free play between needle head and float lever (see Fig. 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



Note: Carburetor shown has right hand bowl. The left hand bowl carburetor is identical except for physical arrangement of throttle body, carburetor body and bowl assembly, and the sizes of various ports, holes and channels as described in text.

Figure 3F-9E. Model DC Carburetor - Exploded View

MODEL DC CARBURETOR

DESCRIPTION

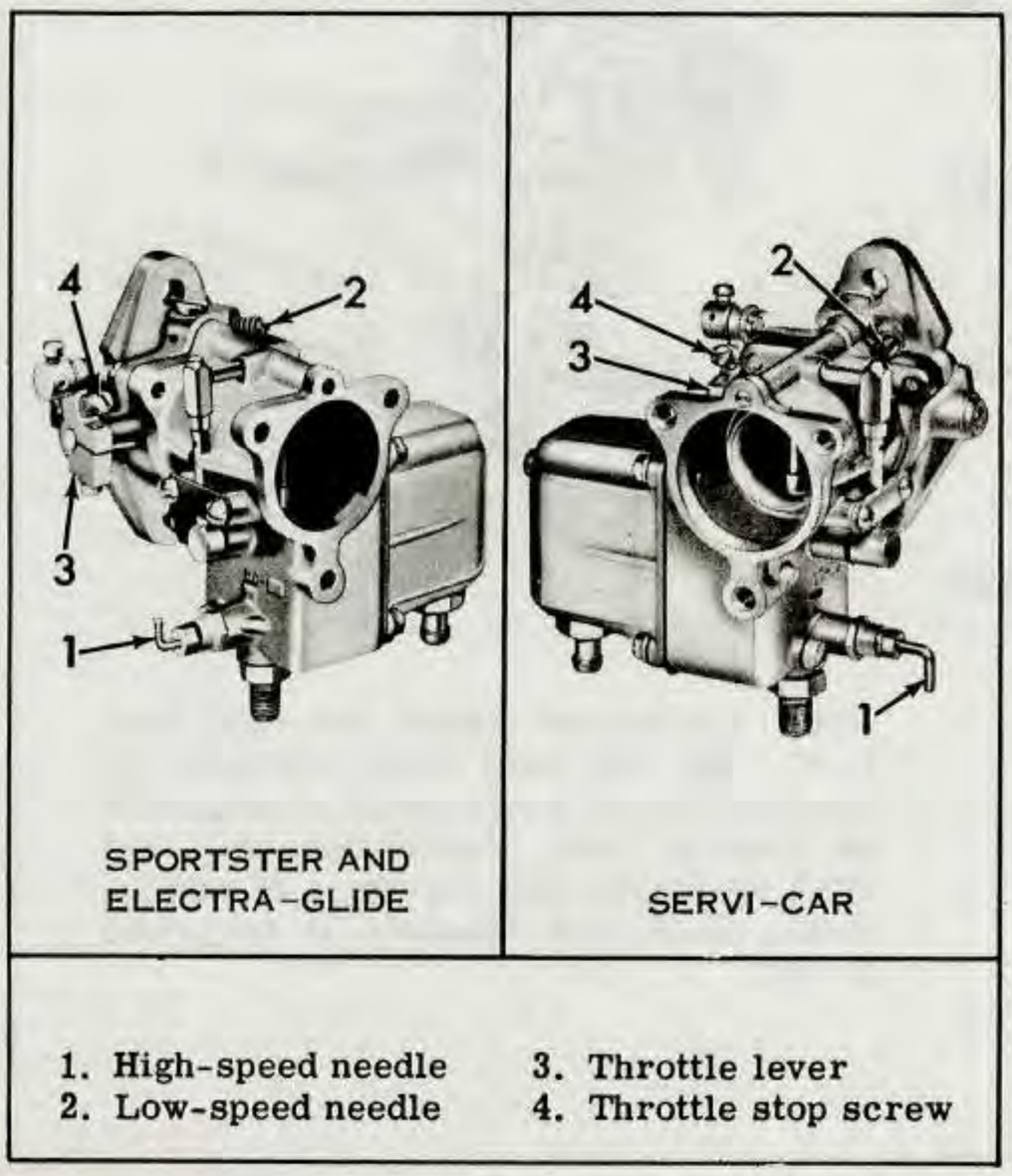
The model DC carburetor is a plain tube carburetor; that is, its main fuel-air mixture passage consists of a venturi section and discharge nozzle. A fixed jet and adjustable high-speed needle valve of limited size meter the high-speed fuel supply as it is fed into the venturi section of the throttle 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.



1. High-speed needle
2. Low-speed needle
3. Throttle lever
4. Throttle stop screw

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:

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.

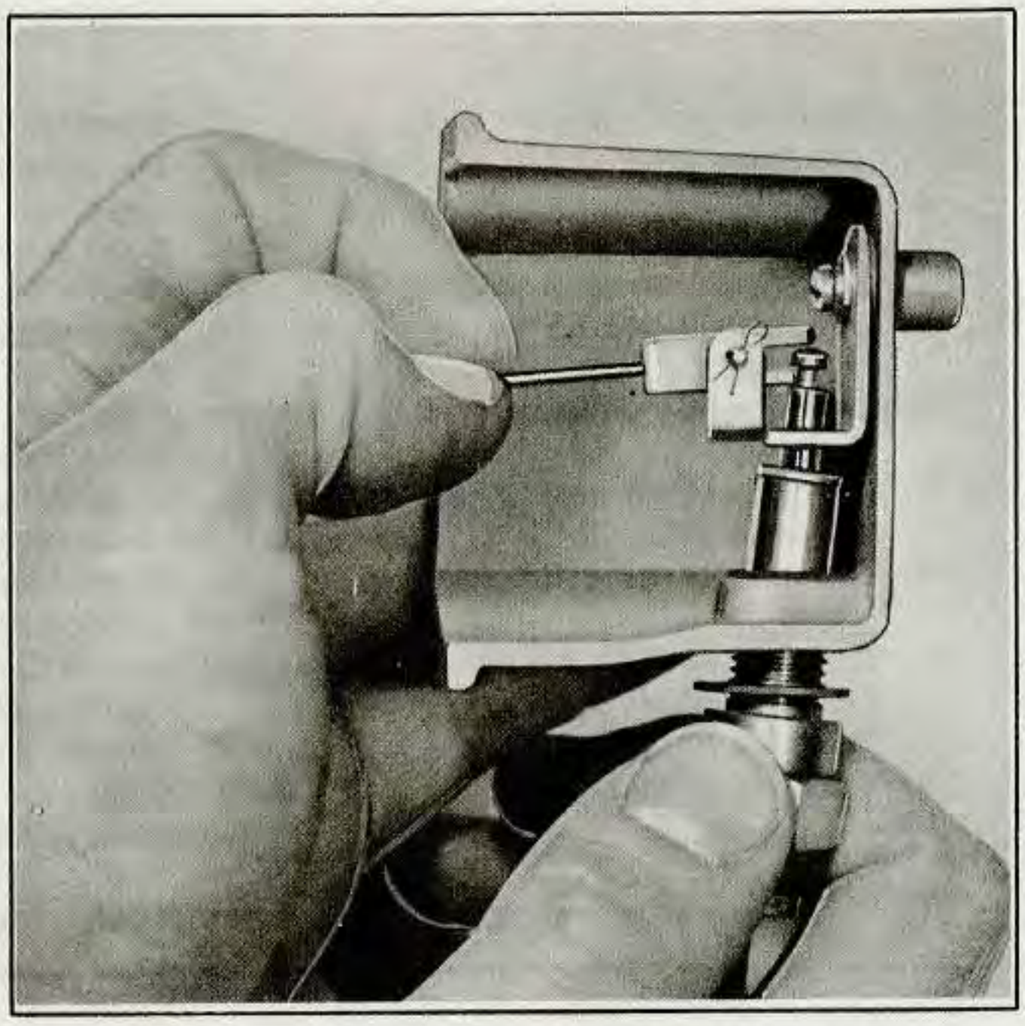


Figure 3F-9F. Engaging Model DC Float Lever in Valve Stem Groove

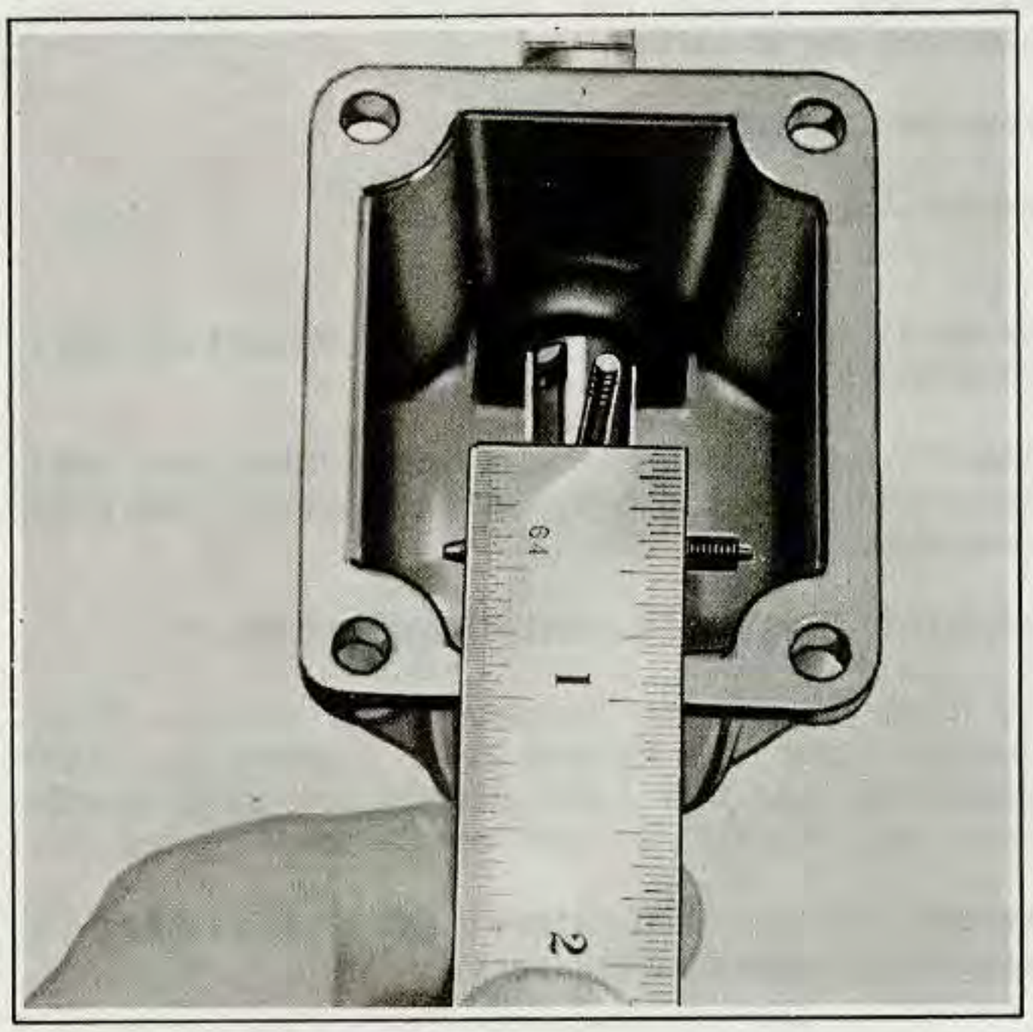


Figure 3F-9G. Checking Model DC Float Setting

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.

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).

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

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."

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.

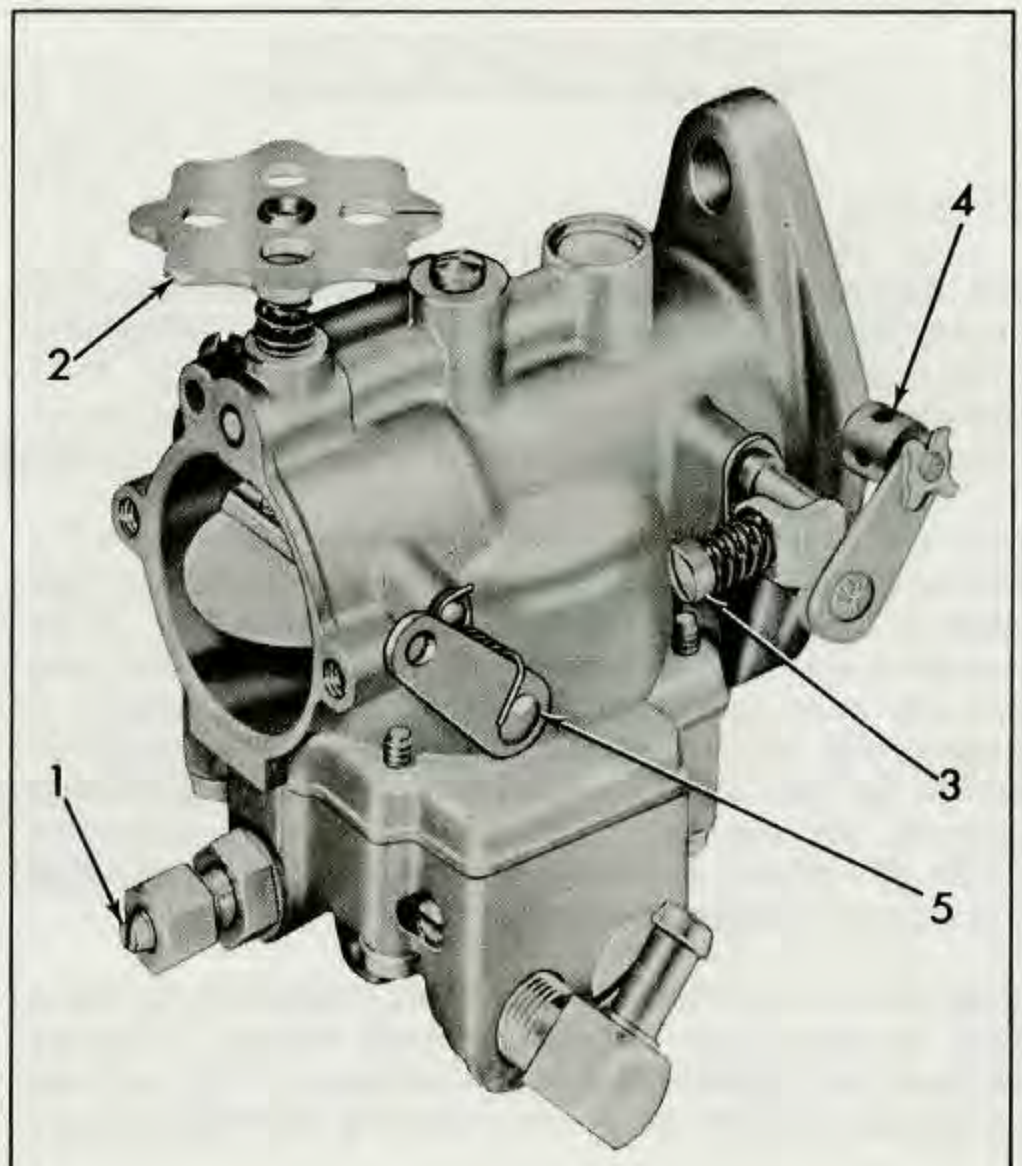
Remove carburetor to manifold mounting gasket (1), gasoline line elbow (1A) and inlet screen (1B). Remove main mixture screw (2), packing nut (3), packing (4), gland (5), and main packing screw gland gasket (6). Remove 4 bowl screws and lockwashers (7). Remove bowl (8), and gasket (9) from carburetor 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.

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)

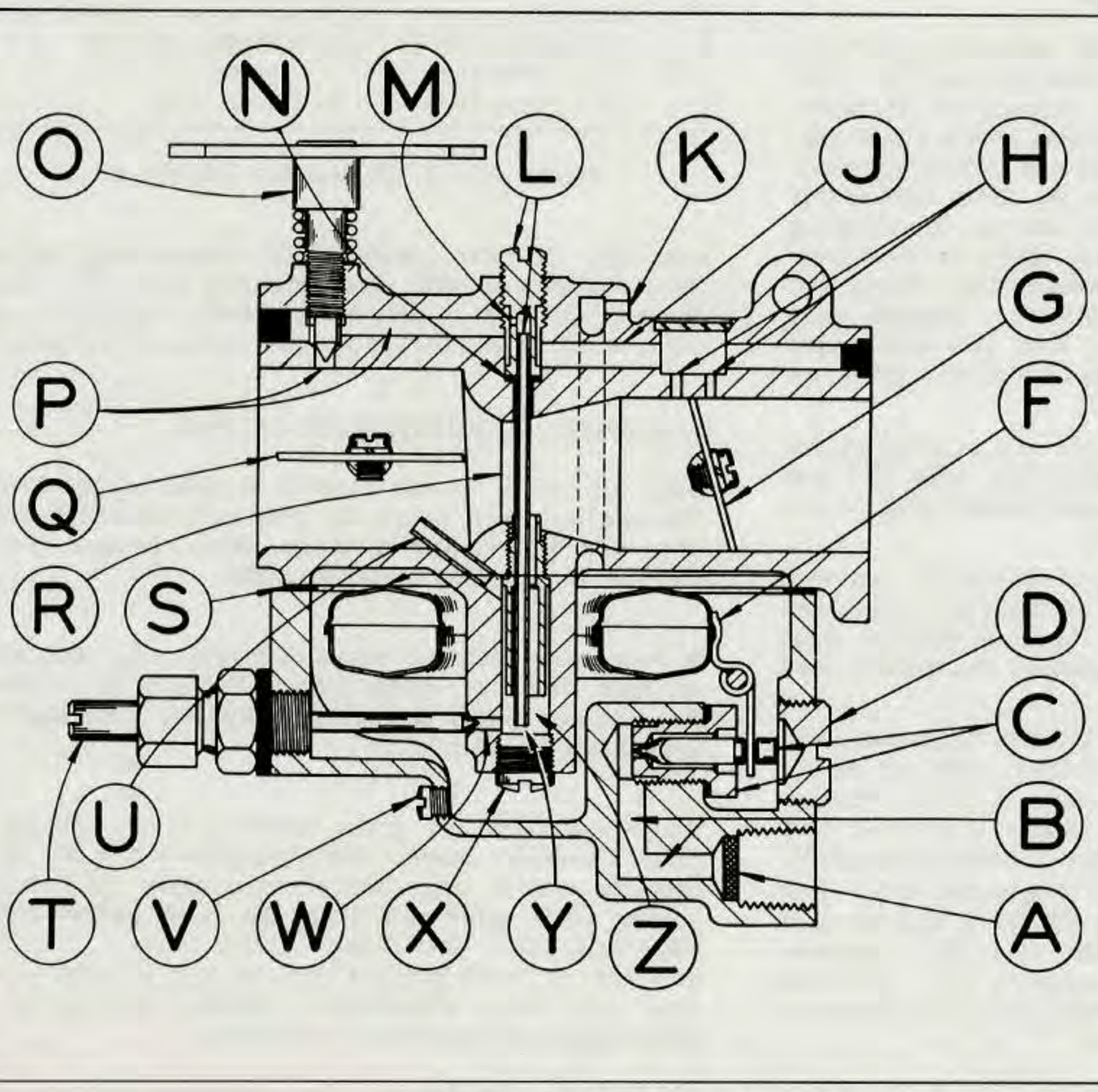
A carburetor once properly adjusted requires little if any readjustment. Before attempting to correct faulty engine performance through carburetor adjustment, eliminate all other possible causes for engine trouble. Such as bad spark plugs, incorrect spark timing, misadjusted tappets, dirty air cleaner, 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



A Fuel inlet screen
B Main fuel supply channel
C Inlet needle and seat
D Float valve plug screw
F Float
G Throttle disc
H Idle mixture discharge ports
J Idle mixture channel
K Bowl air vent
L Idle tube and plug
M Idle tube fuel orifice
N Idle tube gasket
O Idle adjustment screw
P Idle air bleed channels
Q Choke disc
R Venturi
S Bowl gasket
T Main nozzle adjusting screw
U Main nozzle air bleed tube
V Fuel bowl drain screw
W Main nozzle orifice
X Main nozzle channel plug
Y Main nozzle
Z Main nozzle sump

Figure 3F-12. MD Carburetor Cross Section

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.

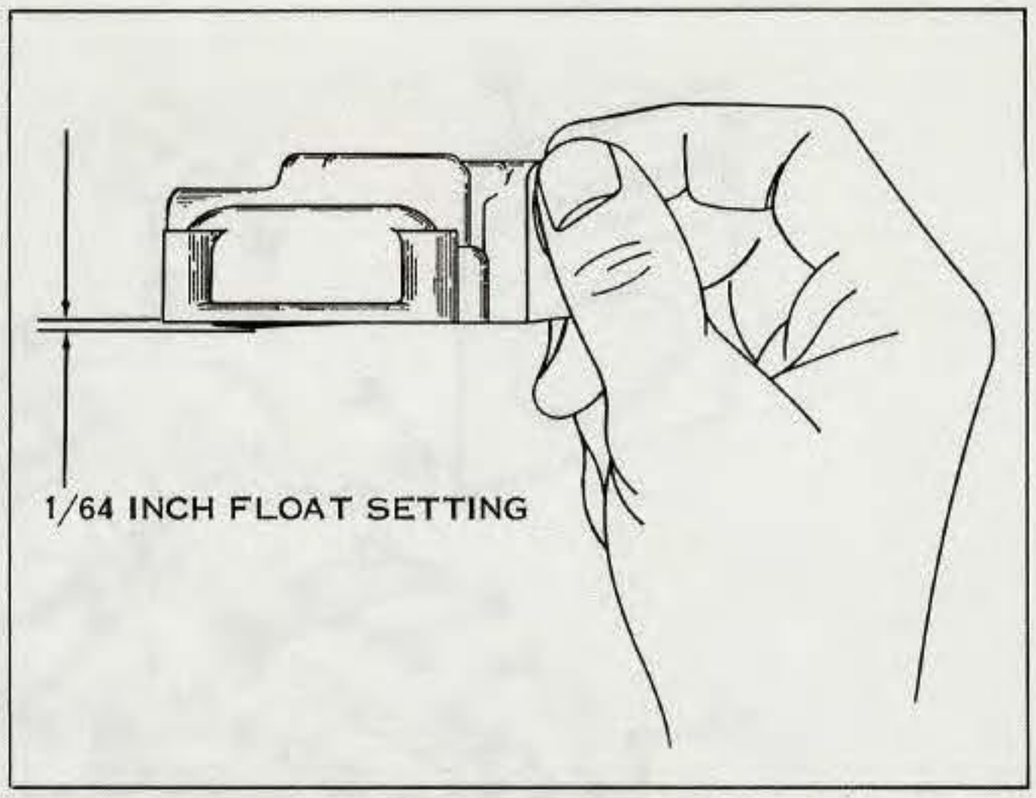


Figure 3F-15. Float Setting

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)

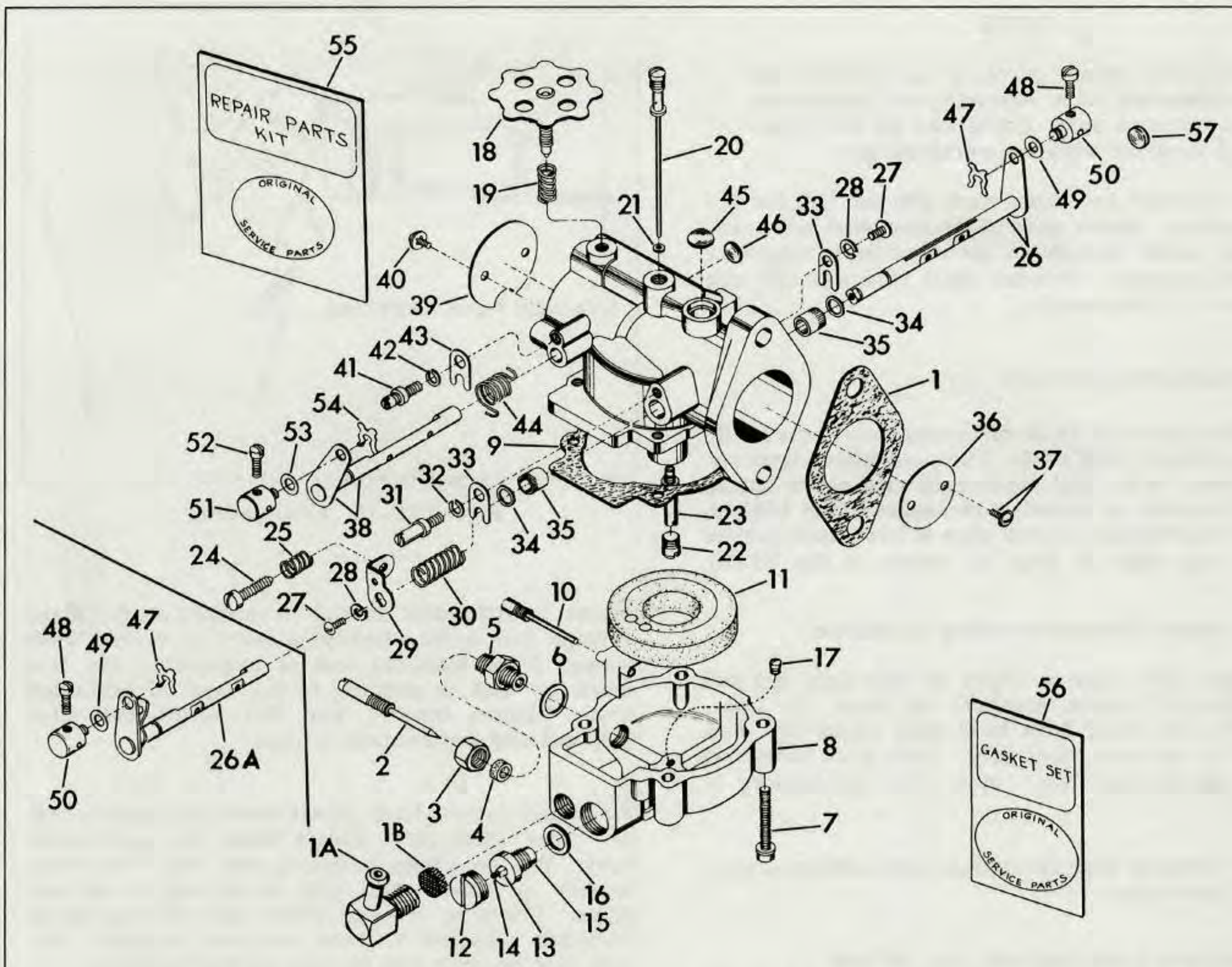
To reassemble carburetor reverse the disassembly procedure. Be sure to tighten idle tube (20). Check the float to make sure it moves freely and is set at specified level.

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."



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

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.

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.

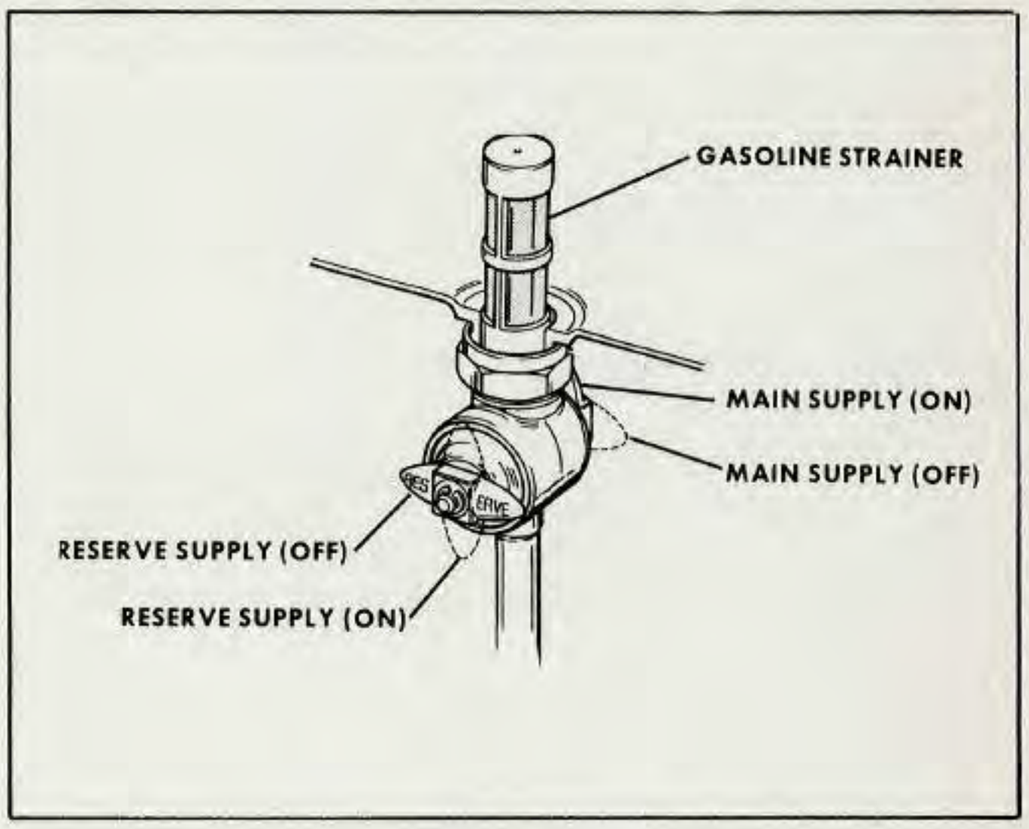


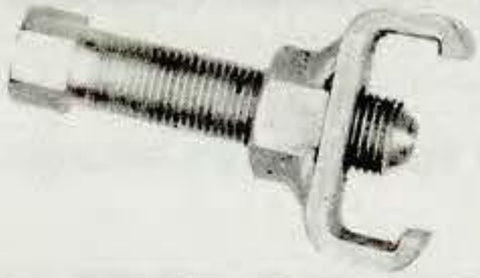
Figure 3F-16. Diaphragm Type Fuel Supply Valve and Strainer

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.

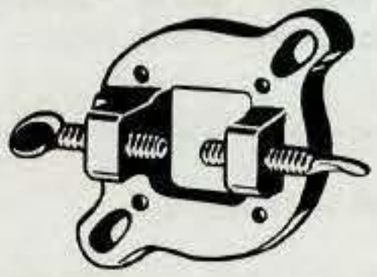
Before installing supply valve, coat threads with a fuel sealer.

95724-57 TAPPET GUIDE PULLER



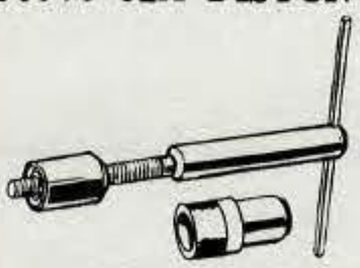
Used to pull tappet guide from crankcase after tappet body adjusting screw is removed.

95952-33 CONNECTING ROD CLAMPING TOOL



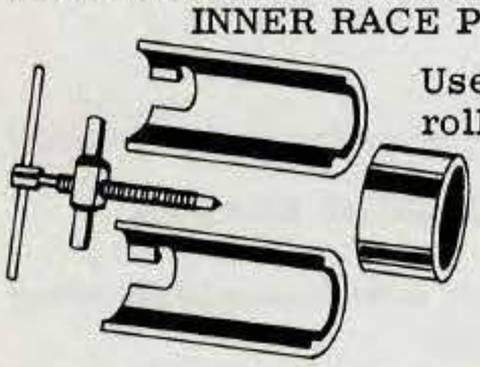
Used to hold connecting rod firmly so accurate work can be done when fitting piston pin bushing without disassembling crankcase.

95970-32A PISTON PIN BUSHING TOOL



Used to remove and replace piston pin bushings without removing connecting rod from crankcase.

96015-52 SPROCKET SHAFT TIMKEN BEARING INNER RACE PULLER



Used to pull bearing inner roller race.

96015-56 SPROCKET SHAFT EXTENSION AND BEARING PULLER

Used to remove sprocket shaft extension.



96137-52A FLYWHEEL SUPPORT PLATE

Used with arbor press for separating flywheels. Also to press Timken bearing onto sprocket shaft.

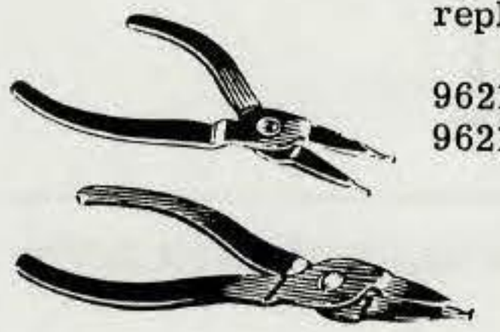


96181-26 PISTON SQUARING PLATE



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.

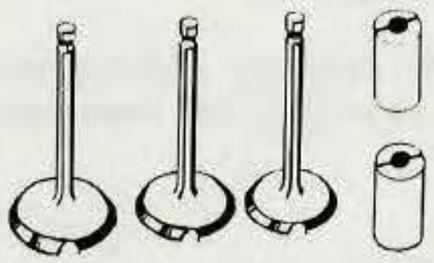
96331-57 PISTON INSERTER RING TOOLS



Used to insert pistons with rings into cylinders. Tool compresses rings to bore size.

96489-63 VALVE SEATING GAGE SET - SPORTSTER

For checking valve seat location. Tool consists of 2 intake valves and one exhaust valve, and intake and exhaust gages having a step to show limits to which valve seat should be ground.



94545-26 CRANKPIN NUT AND SPROCKET NUT WRENCH



Fits 1" Hex

94546-41 FLYWHEEL SHAFT NUT WRENCH

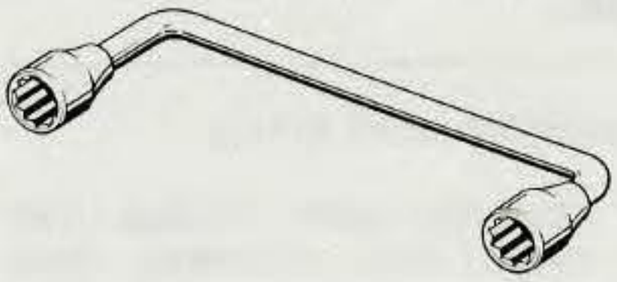


Fits 1-5/16" and 1-3/16" Nuts.

94589-29A HEAD BOLT WRENCH (9/16")

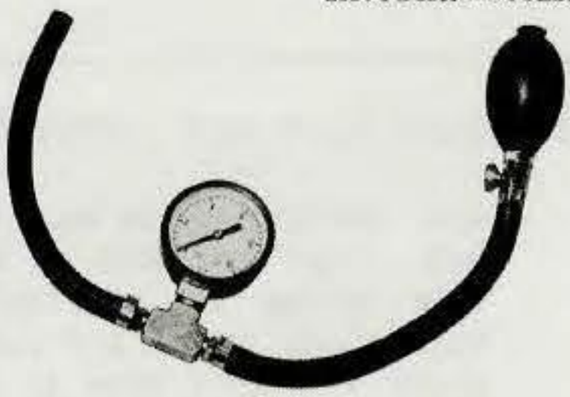


94590-30 CYLINDER HEAD BOLT WRENCH (9/16")



94750-68 CARBURETOR LEAKAGE TESTER

Used to check inlet valve and internal leakage.

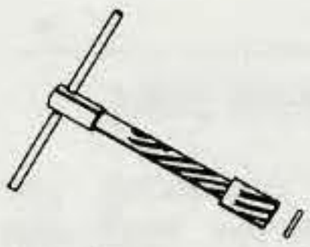


94800-26 SPIRAL EXPANSION REAMER



Used for reaming pistons and upper connecting rod bushings.

94803-37 CAM SHAFT AND TIMER SHAFT BUSHING REAMER



The lower end (removable and held in place by pin) is for reaming timer drive shaft bushings in gear case cover.

94804-57 ROCKER ARM BUSHING REAMER



Used to line ream replacement rocker arm bushings to correct size.

94806-57 IDLER GEAR BUSHING REAMER



9/16 in. REAMER

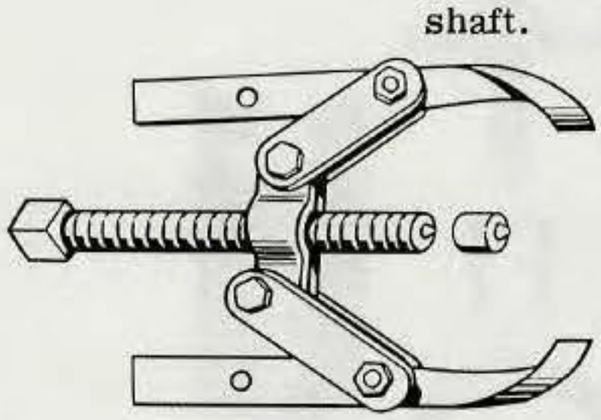
94812-37A PINION SHAFT BUSHING REAMER



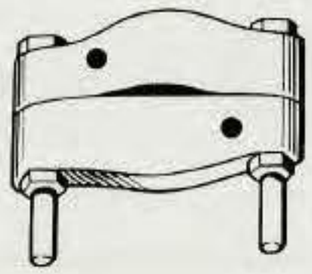
Used to size pinion shaft cover bushings.

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.

96796-47 VALVE SPRING TESTER

Special fixture with adjustable platform used with Torque Wrench Part No. 96795-47.

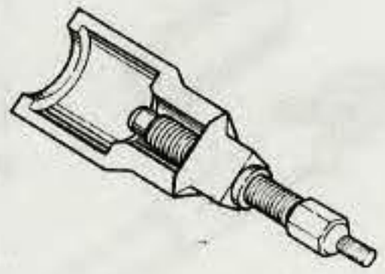


96830-51 PINION GEAR PULLER AND COLLARS



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 adaptor to attach hose fitting to 1958 and later 1/8 NPT thread oil pump outlet.

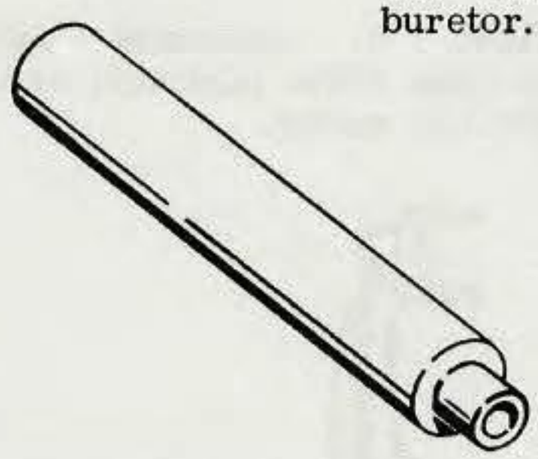
96960-68 CARBURETOR CHECK VALVE TEST TOOL

For Tillotsen diaphragm carburetor.

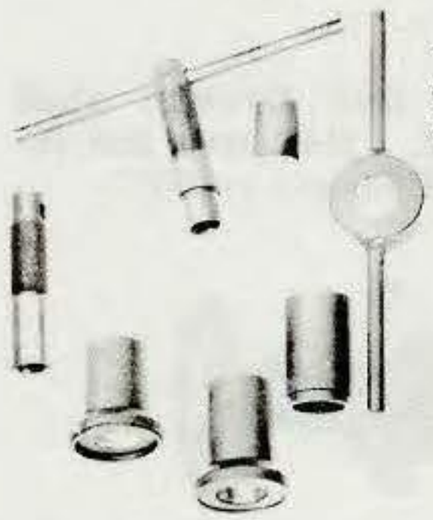


96962-68 CARBURETOR MAIN NOZZLE PUNCH

For Tillotsen diaphragm carburetor.

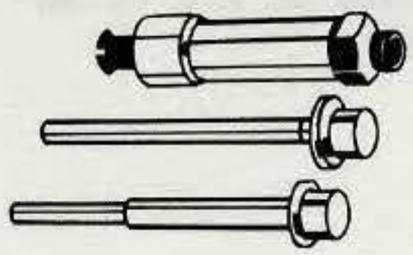


97081-54 SPROCKET SHAFT BEARING INSTALLING TOOL



A tool for installing flywheel assembly into crankcase Timken bearing.

97270-60 NEEDLE BEARING PULLER



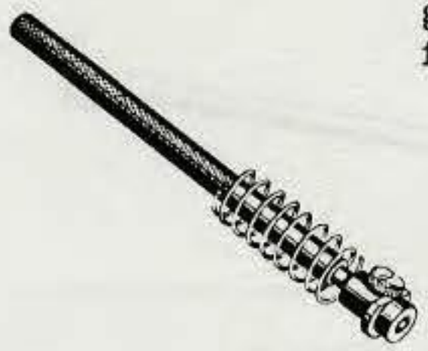
Used to remove and assemble camshaft needle bearings without disassembling crankcases.

97087-65 HOSE CLAMP PLIERS



Used for tightening band type metal clamps on oil lines.

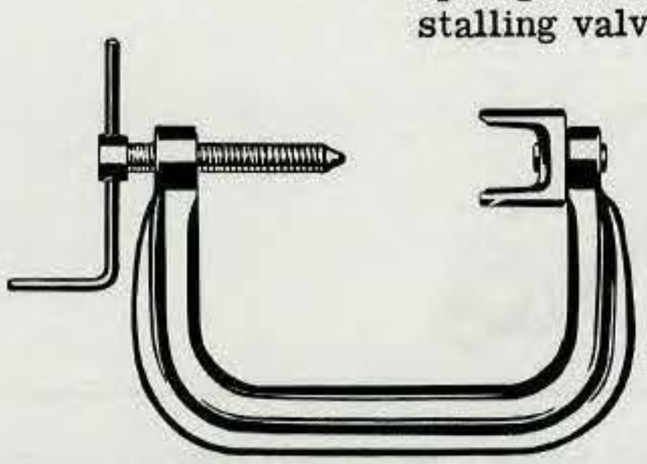
96550-36 VALVE GRINDING TOOL



Used to rotate valve when grinding or lapping seat surfaces.

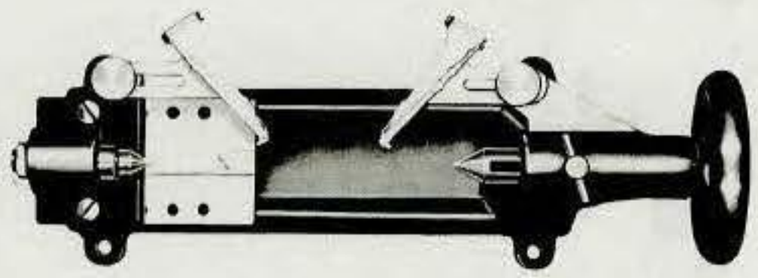
96600-36 VALVE SPRING COMPRESSOR

Used to compress valve springs while removing or installing valves.



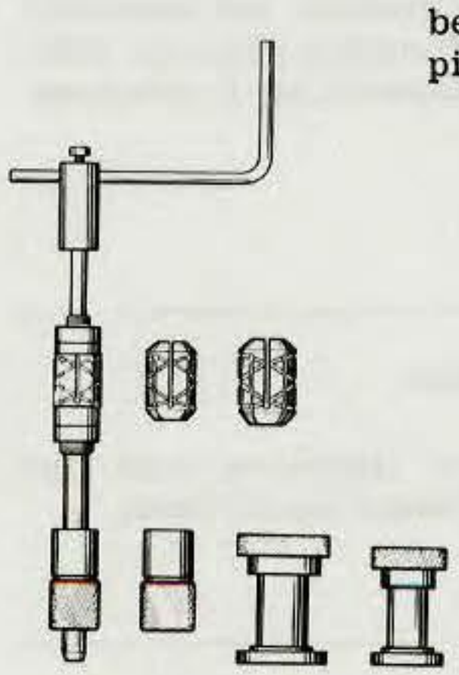
96650-30 TRUING STAND

Used to true flywheel shaft alignment. Measures and indicates alignment to .001".



96710-40 CRANKCASE MAIN BEARING LAP

Aligns right and left main bearing races as well as lapping to size.



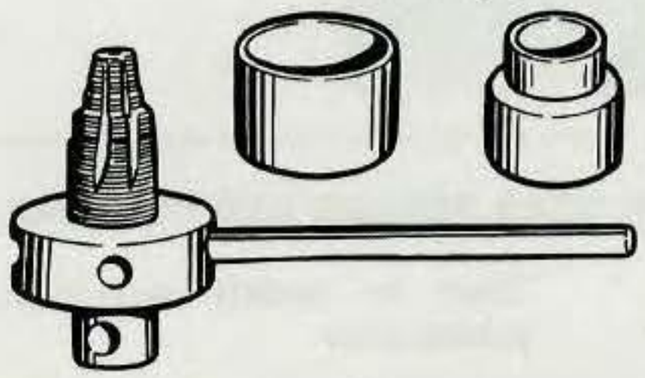
96740-36 CONNECTING ROD LAPPING ARBOR



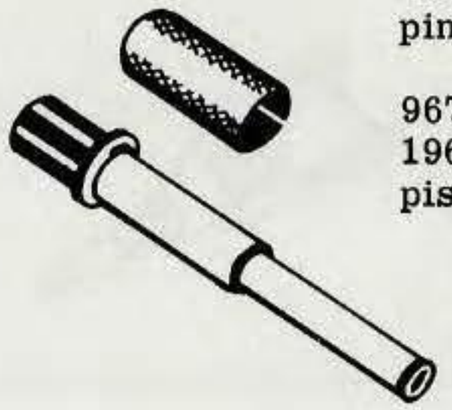
Used to lap connecting rod bearing races when fitting new rollers.

96760-36 CRANKCASE CAM GEAR SHAFT BUSHING REMOVER

Used to remove crankcase and gear case cover gear shaft bushings.



96780-58A PISTON PIN LOCK RING TOOL



Used to install spiral piston pin lock rings.

96781-66 extra plug for late 1966 model 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.

TRANSMISSION 4

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Kick Starter	4C-3
Electric Starter	4C-6
Gear Box	4D-13
Tools	4T-1

GENERAL

SPECIFICATIONS

GENERAL

CLUTCH (4B)

Type	Dry - Multiple disc
Capacity	1900 in.-lbs.
Set up Spring Pressure	150 lbs.
Spring adjustment	3/16 in. from inner surface of spring tension adjusting plate to outer surface of spring cup flange
Clutch bearing	.0005 in. - .002 in. loose
Clutch cover	Must be leak proof. Do not coat gasket with sealer
Clutch release rod movement	.095 in. - .115 in.

CHAIN

Type primary)	3/8 in. pitch triple chain
Looseness	5/8 to 7/8 in. slack (cold engine) 3/8 to 5/8 in. slack (hot engine)

STARTER (4C)

Minimum clearance between clutch teeth on starter clutch gear and clutch --- .040 in. with starter crank in up position.

Crankshaft endplay	.001 in. - .007 in.

GEAR BOX (4D)

SHIFTER MECHANISM	Must operate freely in all positions.

MAINSHAFT GROUP

Clutch gear ball bearing in case	.0001 in. - .0012 in. loose
Ball bearing on clutch gear	.0001 in. loose - .0009 in. tight
Clutch gear on mainshaft	.001 in. - .002 in. loose
Mainshaft right side roller bearing	.0006 in. - .0014 in. loose
Mainshaft end play	.004 in. - .009 in.
Third gear	
On shaft	.002 in. - .003 in. loose
End play	.015 in. - .025 in.

COUNTERSHAFT GROUP

Countershaft end bearings	Retained needle roller bearing
Bearing fit on shaft ends	.0005 in. - .002 in. loose
Bearing fit in case	press
End play	.004 in. - .009 in.
Second gear	
On shaft	.001 in. - .0025 in. loose
Low gear	
On shaft	.0005 in. - .0016 in. loose
End play	.004 in. - .009 in.
Drive gear	
On shaft	.001 in. - .0025 in. loose
End play	.004 in. - .009 in.
Clearance between clutch faces	
Countershaft low and third gear	.038 in. - .058 in.
Countershaft second and third gear	.038 in. - .058 in.

DESCRIPTION

GENERAL

The Sportster Model transmission consists of three major assemblies including the clutch, starter and gear box.

CLUTCH

The purpose of the clutch is to disengage and engage the engine from the rear wheel for starting, stopping and shifting gears.

The Sportster clutch is a multiple disc dry clutch with steel plates and fiber (friction) plates set alternately in the clutch shell and sprocket housing. The friction plates are keyed to the housing and the other set to the clutch hub and through it, to the transmission and rear wheel. The plates driven by the engine are called driving plates, those connected to the clutch hub, the driven plates.

When the clutch is fully engaged, strong springs force the plates together and cause them to turn as a unit, with the result that the power transmitted through the engine sprocket, primary drive chain and clutch is transferred to the rear wheel through the transmission.

STARTER

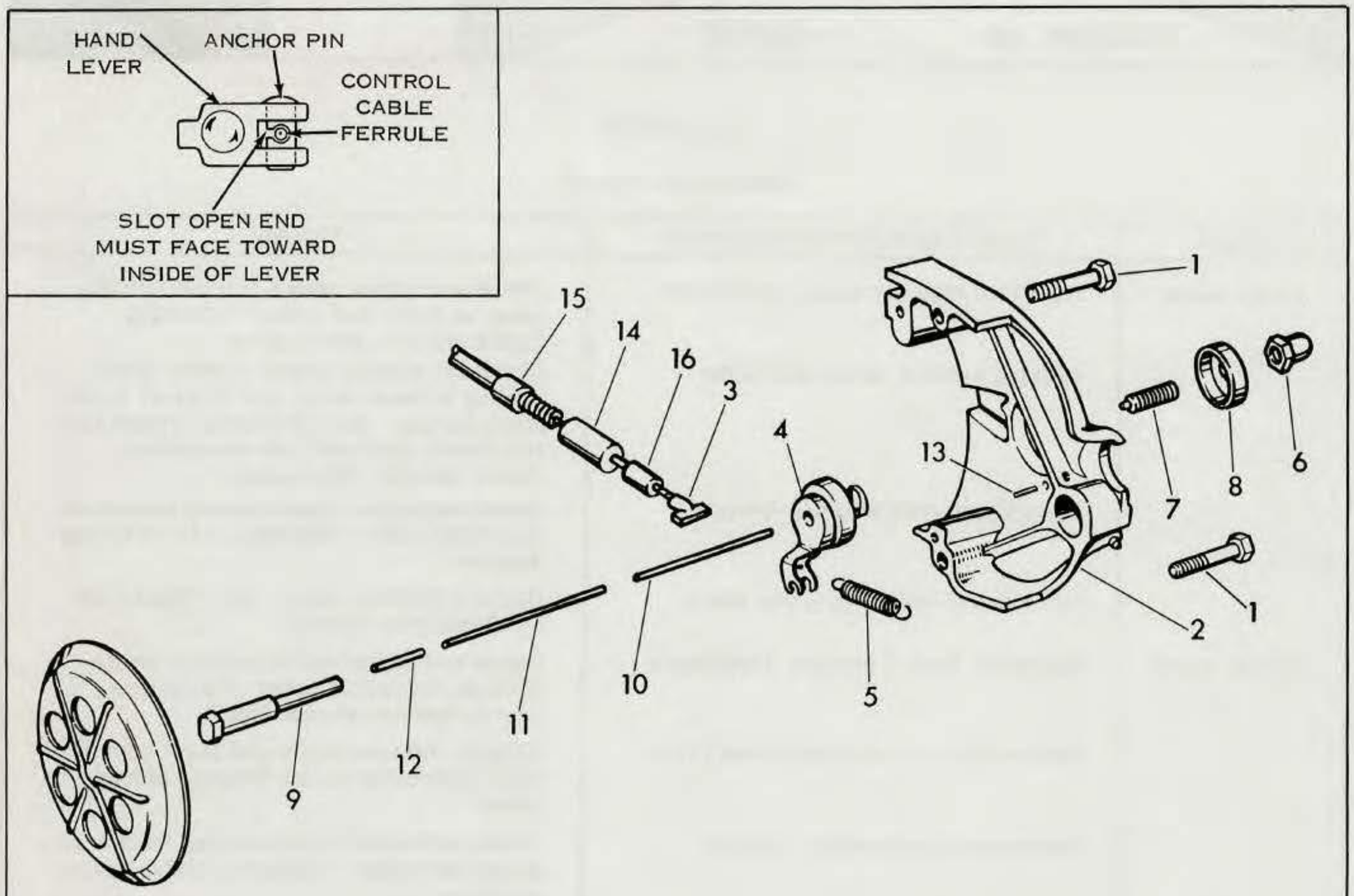
The kick starter provides a means of starting an engine by manual power. When the pedal is moved in downward stroke, ratchet teeth of starter clutch gear and starter clutch are engaged, transmitting the force to clutch sprocket, primary drive chain and to engine sprocket.

On 1967 and later models an electric starter motor and Bendix type drive unit engages a ring gear on the clutch to crank the engine.

GEAR BOX

The Sportster gear box is a 4-speed constant mesh type, (contained in an extension of the crankcase), that permits the rider to vary the ratio of engine speed to the rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is foot operated by the gear shifter lever on the right side of the engine which transmits the force through a gear shifter shaft, actuating a pawl carrier, pawls and gear shifter cam. The shifter cam moves shifter forks which slide a series of gear clutches on the mainshaft and countershaft into mesh with the various gears to obtain the desired gear ratios.



1. Sprocket cover bolt (2)
2. Sprocket cover
3. Control cable end
4. Clutch release worm and lever
5. Clutch release worm and lever spring
6. Clutch adjusting screw lock nut
7. Clutch adjusting screw
8. Clutch release worm cover
9. Clutch release rod - left
10. Clutch release rod - right
11. Clutch release rod - right center
12. Clutch release rod - left center
13. Sprocket cover roll pin
14. Clutch cable felt seal retainer
15. Clutch cable ferrule (2)
16. Clutch cable felt seal

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

Figure 4B-6. Clutch Release Mechanism - Exploded View

See Fig. 4B-8. Remove twelve clutch cover screws (1), six retainers (2), clutch cover (3) and gasket (4).

Loosen cover evenly in several places. Do not pry cover loose at one point as cover may be sprung out of shape and will not be oil-tight when reassembled.

With clutch cover (3) removed, the clutch releasing disc (10), clutch springs (8), spring-tension adjusting plate (7) and six spring adjusting nuts are in view. Three of the spring-tension adjusting nuts (5) have 7/16 in. hex-heads and three nuts (6) have 1/2 in. hex-heads. All spring-tension adjusting nuts are recessed to conform to raised portion of spring-tension adjusting plate which provides a lock for the nuts. Tighten each of the six nuts one-half turn at a time. The nuts must always remain in their locked positions after adjustment is made.

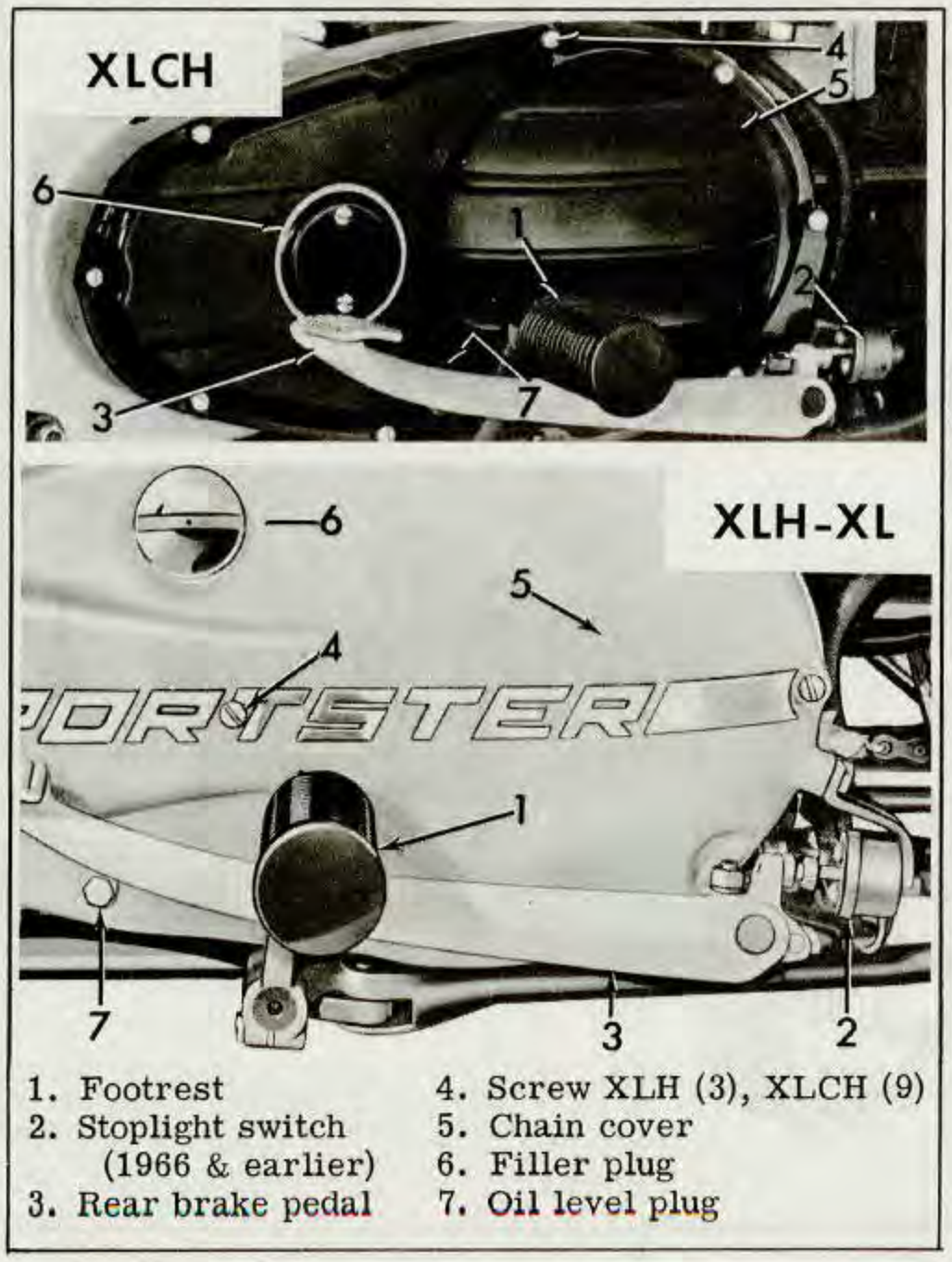
Tightening the spring-tension adjusting nuts moves the spring-tension adjusting plate (7) closer to the outside surface of the clutch releasing plate (10). The inner surface of the spring-tension adjusting plate should measure 3/16 in. from the outer surface of the flange on the clutch spring cups (9) for normal clutch spring-tension adjustment. When increasing spring tension, do not diminish above distance to less than 7/64 in. or clutch will not release.

REPLACING CLUTCH CONTROL CABLE AND COIL (Fig. 4B-6)

Remove starter crank, exhaust pipe and muffler. Remove right front footrest and two transmission sprocket cover bolts (1). With a mallet, lightly tap cover (2), at the same time working cover off starter shaft. Loosen adjusting screw lock nut (6) and adjusting screw (7). Disengage clutch cable end (3) from clutch release worm and lever (4) by moving lever forward, (as positioned on motorcycle) until approximately 1 in. of cable remains in gearcase cover. At the same time, press coil in (towards oil pump) and down to free from cover. Loosen clip securing coil to left front frame member and disengage cable from hand lever. Control cable and coil assembly can now be removed from motorcycle.

To remove cable only, first remove sprocket cover from motorcycle and cut off cable end (3). Disengage cable from hand lever and pull out from upper end of coil.

A new control cable coil should be approximately 47-3/4 in. long for speedster bars and 51-1/16 in. long for buckhorn bars. Strip approximately 5/8 in. insulated covering from upper coil end, and approximately 1-1/4 in. from lower end before installing upper and lower ferrules (15). To attach rubber control housing oiler, simply strip off approximately 1/4 in. insulated covering, 7 in. from hand lever, and slip oiler in place.



1. Footrest
2. Stoplight switch (1966 & earlier)
3. Rear brake pedal
4. Screw XLH (3), XLCH (9)
5. Chain cover
6. Filler plug
7. Oil level plug

Figure 4B-7. Removing Front Chain Cover

NOTE

Clutch hand lever, control coil and cable are available from the factory completely assembled for speedster and buckhorn handlebars.

When installing new cable, lubricate cable with grease as it is being inserted in coil (hand lever end). Correctly position upper cable end in hand lever anchor pin. 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. Insert felt seal retainer (14) and felt seal (16) on lower cable end. Insert cable end (3) on cable, 7-11/16 in. from lower ferrule as shown in Fig. 4B-6. Cut cable off at end (3). Spread cable strands in cable end countersunk hole and flow a hard solder in hole to securely join together. Engage cable end with fingers of lever. Install sprocket cover (2) with bolts (1). Install footrest, exhaust pipe and muffler and starter crank. Adjust clutch release mechanism as described under "Adjusting Clutch Release Mechanism."

DISASSEMBLING CLUTCH RELEASE MECHANISM (Fig. 4B-6)

Remove sprocket cover and disengage clutch cable end from clutch release worm and lever (4) as described under "Replacing Clutch Control Cable and Coil."

To free clutch release worm and lever (4) from sprocket cover, disengage spring (5), remove adjusting screw lock nut (6), adjusting screw (7) and clutch release worm cover (8).

If it is necessary to remove clutch release rods, first disassemble clutch parts (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10, Fig. 4B-8) as described in "Disassembling Clutch." Remove clutch release rod - left (9, Fig. 4B-6). Drift release rods 10, 11 and 12, from clutch side to sprocket side. Roll pin (13) is a press fit in sprocket cover.

INSPECTING CLUTCH RELEASE MECHANISM (Fig. 4B-6)

Thoroughly wash clutch release parts in cleaning solvent and blow dry with compressed air.

Examine clutch release worm and lever (4) for wear in sprocket cover. Too much play at this point will reduce clutch release considerably, causing clutch to drag. Replace parts if badly worn.

Inspect the fingers of lever (4), for engagement with clutch control cable end (3). If worn excessively, replace parts.

Replace spring (5) if worn or damaged. New spring length is approximately 1-25/32 in.

Inspect the tips of clutch release rods (9, 10, 11 and 12) for scoring or excessive wear. Damage to release rods is usually caused by excessive clutch spring tension.

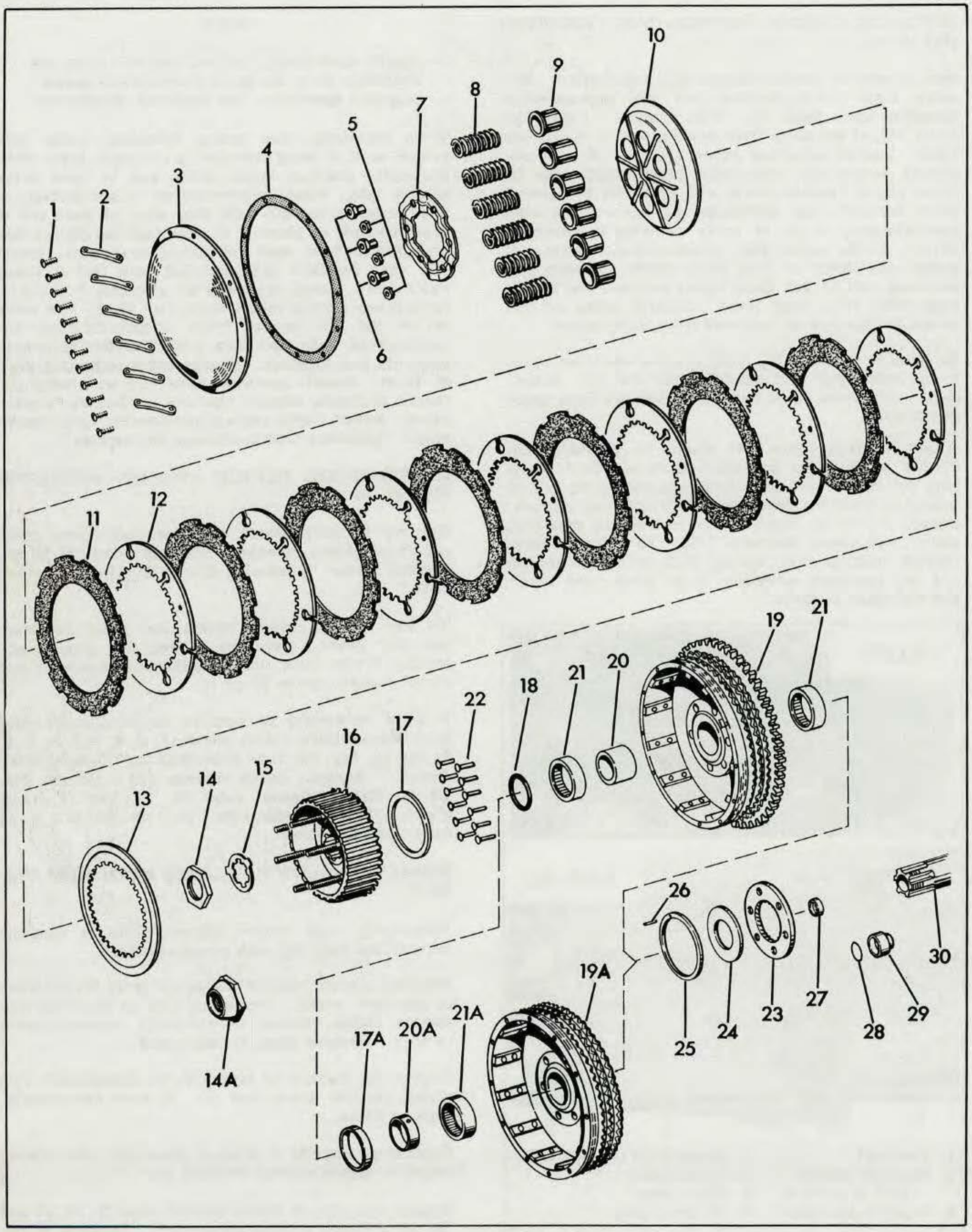


Figure 4B-8. Clutch - Exploded View

LEGEND FOR FIGURE 4B-8

1. Clutch cover screw (12)	14. Hub nut (1967 XLH)	22. Sprocket rivet (12)
2. Clutch cover screw retainer (6)	14A. Hub nut (1966 & earlier)	23. Starter clutch
3. Clutch cover	15. Hub nut lock washer	24. Sprocket bearing washer (variable-size)
4. Clutch cover gasket	16. Clutch hub assembly	
5. Hub stud nut (3)	17. Clutch hub oil seal (1967 XLH)	25. Sprocket hub washer
6. Hub stud nut - long (3)	17A. Clutch hub oil seal (1966 & earlier)	26. Sprocket hub washer pin
7. Pressure plate	18. Clutch hub O-ring (1967 XLH)	27. Clutch gear (push rod) oil seal
8. Clutch spring (6)	19. Clutch shell (1967 XLH)	
9. Backing plate cup (6)	19A. Clutch shell (1966 & earlier)	28. Clutch gear extension O-ring (1966 & earlier)
10. Releasing disc	20. Clutch hub spacer (1967 XLH)	
11. Friction drive plate (7)	20A. Clutch hub spacer (1966 & earlier)	29. Clutch gear extension (1966 & earlier)
12. Driven plate (7)	21 Needle bearing (2 - 1967 XLH)	
13. Backing plate	21A. Needle bearing (1 - 1966 & earlier)	30. Clutch gear

Figure following name of part indicates quantity necessary for one complete assembly.
Note: 1966 and earlier parts also used for 1967 XLCH.

ASSEMBLING CLUTCH RELEASE MECHANISM (Fig. 4B-6)

Assembly is essentially the reverse order of disassembly. Dip ends of release rods in oil. Insert clutch release rod - left (9) in clutch gear end. Slip release rods (12, 11 and 10) in place from sprocket side in order shown (see Fig. 4B-6). Install clutch parts (10-1, Fig. 4B-8) as described under, "Assembling Clutch."

Assemble clutch release lever and worm (4), spring (5), cover (8), adjusting screw (7) and lock nut (6). Check lever and worm action by moving lever back and forth. Engage cable (3) end with fingers of lever and install sprocket cover (2) with bolts (1). Inject "Grease-All" grease through fitting to lubricate worm.

Check the operation of the release lever to be sure lever returns to stop pin, when clutch hand lever is released. A sticking worm or clutch control cable causes lever to stop short of pin, thus reducing effective clutch release rod travel, causing clutch to slip.

Install footrest, exhaust pipe, muffler and starter crank. Adjust clutch release mechanism as described under "Adjusting Clutch Release Mechanism."

DISASSEMBLING CLUTCH

Remove front chain cover and clutch cover as described under "Adjusting Clutch Spring Tension."

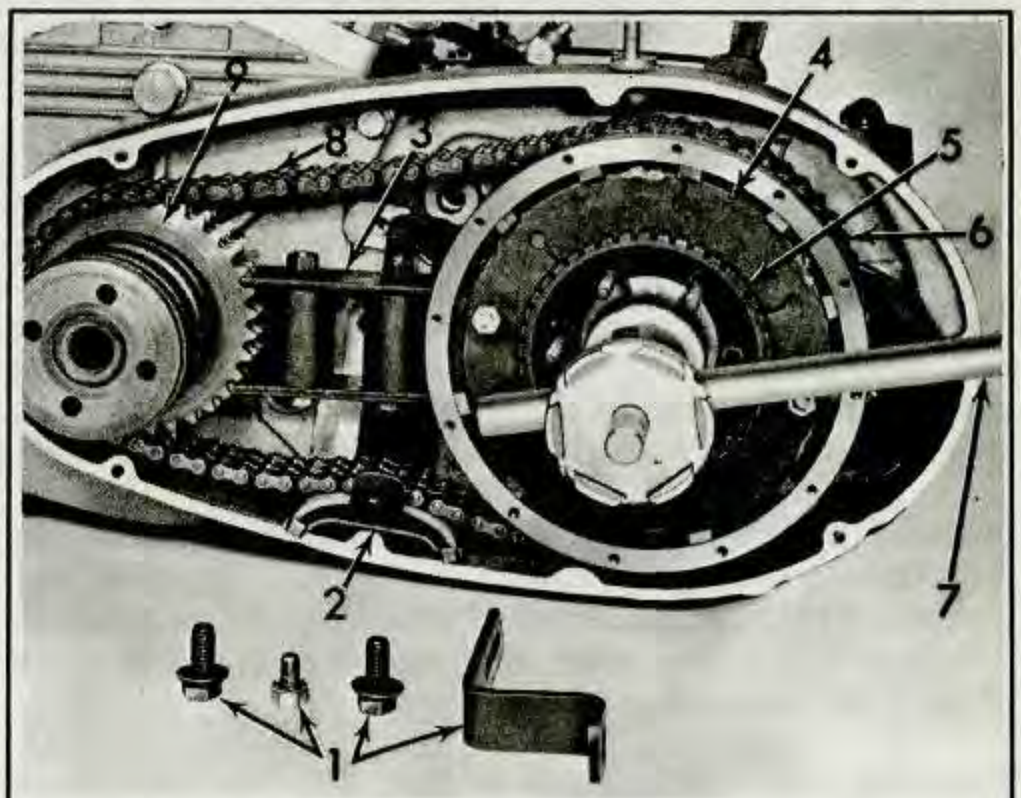
See Fig. 4B-8 and proceed as follows. Remove the three 7/16 in. hex-head nuts (5), and three 1/2 in. hex-head nuts (6). Remove spring-tension adjusting plate (7), springs (8), spring cups (9), releasing disc (10), seven clutch friction-drive plates (11), seven clutch steel-driven plates (12) and backing plate (13). All plates may be easily removed by tipping engine, or removed individually; using a piece of wire with a hook formed on one end.

See Fig. 4B-9. Remove front chain adjuster brace and three front chain adjuster cap screws (1). This will leave the chain adjuster (2) loose behind the front chain. Install Sprocket Locking Link Tool (3), Part No. 97200-55, between engine sprocket teeth and clutch sprocket teeth to prevent clutch and compensating sprocket from turning.

Insert Clutch Lock Plate (4), Part No. 97175-55, between clutch hub (5) and sprocket (6) as shown in Fig. 4B-9. Bend ears of lock washer (15, Fig. 4B-8) away from hub nut and remove release rod - left (9, Fig. 4B-6). Remove clutch hub nut (14 or 14A, Fig. 4B-8) using Wrench, Part No. 94647-52, (7, Fig. 4B-9).

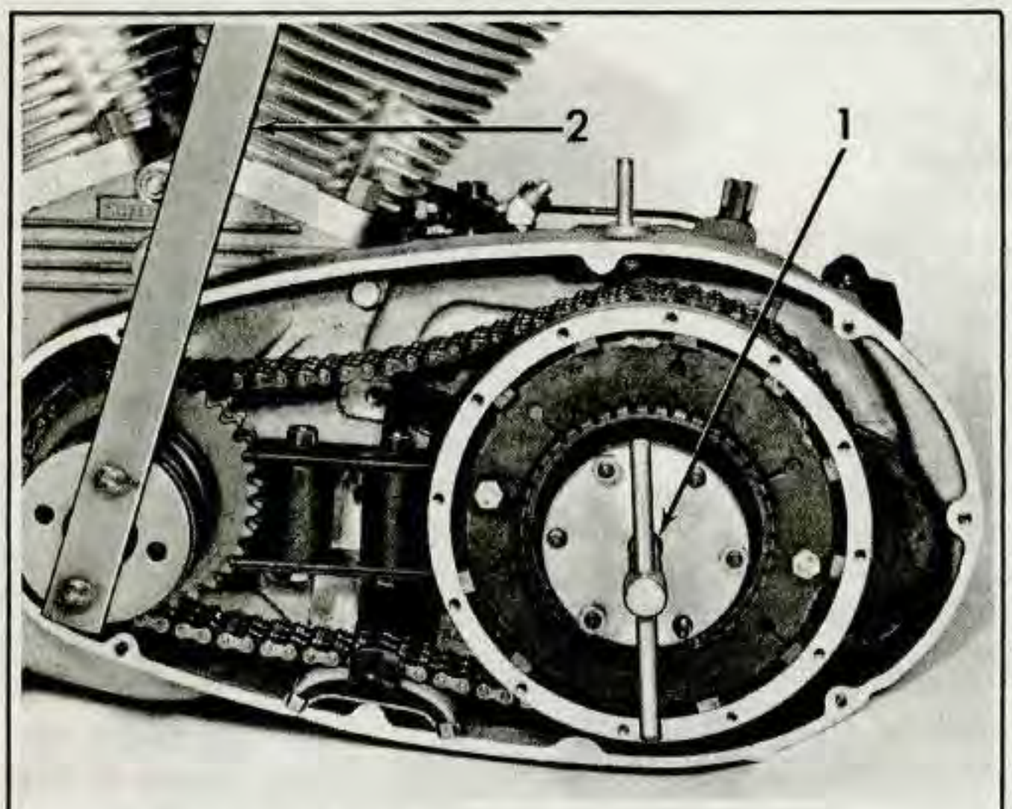
Pry hub nut lock washer from hub and discard. Pry oil seal (27, Fig. 4B-8) from clutch gear end with screw driver or release rod end that has been wiped dry. Install clutch Hub Puller (1), Part No. 95960-52, and remove clutch hub (16) from splines of clutch gear as shown in Fig. 4B-10. Remove O-ring (18) from groove in clutch gear (30) (1967 XLH only).

Using Compensating Sprocket Shaft Wrench (2), Part No. 94557-55, remove shaft nut as shown in Fig. 4B-10,



1. Front chain adjuster brace and cap screws
2. Front chain adjuster
3. Sprocket locking link tool
4. Clutch lock plate
5. Clutch hub
6. Clutch shell
7. Clutch hub nut wrench
8. Front chain
9. Compensating sprocket

Figure 4B-9. Removing and Installing Clutch Hub Nut



1. Clutch hub puller
2. Compensating sprocket shaft wrench

Figure 4B-10. Removing Clutch Hub.
Removing and Installing Compensating Sprocket

and in one move, free clutch shell (6), front chain (8) and engine sprocket (9) as shown in Fig. 4B-9. Remove clutch hub spacer (20 or 20A).

Earlier clutch gears have a rubber O" ring (28) and extension (29). Remove extension from clutch gear end by applying pressure against shoulder of extension inside gear shaft, or by tapping with a rawhide mallet. To remove rubber "O" ring, simply pry ring from groove of gear extension.

INSPECTING AND REPAIRING CLUTCH (Fig. 4B-8)

Carefully examine clutch cover (3) sealing surface for scratches, distortion or any damage that might result in oil leakage to clutch. Discard gasket (4) and replace with a new one when reassembling clutch.

Inspect clutch springs (8) for damage or collapsed condition. Spring damage usually results from excessive heat. Free length of a new spring is approximately 1-5/8 in. Any that check below this limit should be replaced.

Examine the clutch release disc (10), for excessive wear, grooving or scoring on running surface. Replace if necessary.

Pay particular attention to the seven clutch-friction drive plates (11). Plates that are badly worn, grooved, scored or oil-soaked, should be replaced. Plates in relatively good condition, can be cleaned and sanded down with a medium-grade sandpaper and re-used. Do not re-use plates that have been saturated with oil.

Examine the seven clutch driven plates (12) for excessive wear and damage. Plates that are badly worn, grooved, warped, burned or scored should be replaced. Plates that have turned blue from heat only, and are smooth and generally in good condition, can be used again after being thoroughly cleaned.

When reassembling, always replace lock washer (15) to insure an oil-tight seal between clutch hub and end of clutch gear.

Inspect clutch hub spacer (20 or 20A) for appreciable shake or play in needle bearings (21 or 21A). Check for wear in bearing path of inner race and examine needle roller bearings. If bearings are worn, scored or damaged, replacement of part is necessary. Spacer is a slip-fit in clutch shell. To replace bearings, see "Replacing Clutch Shell Needle Bearing and Starter Clutch."

Oil seal (17 or 17A) is a press fit and can be pryed from clutch sprocket. Be very careful not to damage seal during removal operation. Expand rubber exterior of seal and carefully check for hair-line cracks in seal surface. If any wear or damage is evident, replace seal to insure an oil-tight closure between clutch sprocket and clutch hub.

Inspect clutch shell (19 or 19A) for badly worn or loose keys, loose rivets, worn sprocket teeth, damaged ring gear teeth marred or damaged cover sealing surface. If noticeably damaged, replacement clutch shell is recommended. However, if a rivet is loose with no other apparent damage, a new rivet can be installed. On starter clutch side, set rivets until flush to .010 in. (maximum) above face of starter clutch. Rivets securing keys, must be headed with a .080 in. minimum clearance from rivet head to bottom of sprocket tooth. Seal new rivets on both sides using a solvent-proof sealer.

Check starter clutch (23) teeth. If badly worn or damaged replace part as described in "Replacing Clutch Sprocket Needle Bearing and Starter Clutch."

Examine clutch gear oil seal (27) for wear or damage by expanding seal surface and carefully checking for hair-line cracks. If any wear or damage is evident, replace seal to insure oil-tight closure between end of clutch gear and release rod - left.

Replace clutch hub rubber "O" ring (18) if worn or damaged.

REPLACING CLUTCH SPROCKET NEEDLE BEARING AND STARTER CLUTCH (Fig. 4B-8)

To remove clutch sprocket needle bearings (21 or 21A), washers (24 and 25) and starter clutch (23), remove oil seal (17) and rivets (22) from sprocket. Needle roller bearings (21 or 21A) and roll pin (26) are press fit.

To reassemble clutch sprocket, press needle roller bearings in place pressing on "printed side of bearings only." Press single bearing (21A) in from inside of sprocket shell to a depth of .025 to .029 in. measuring from clutch shell inner face to edge of bearing.

Roll pin (28) correctly positioned, should extend .08 in. from sprocket face to top of pin.

On 1967 XLH model having 2 bearings (21), press first bearing in to a depth of .010 to .015 in. measuring from clutch shell to inner face of bearing. Then press other bearing flush against first bearing from starter clutch side.

Position washer (25) on roll pin. Temporarily select and insert variable-sized washer (24) in clutch sprocket. Washers are available in several sizes of .002 in. thickness difference. Lay starter clutch (24) on back plate. With plate held down under pressure, insert feeler gauge and measure clearance between variable-size washer and starter clutch. Select and try different variable size washers until .001 to .004 in. clearance is obtained.

NOTE

Allow approximately .001 in. for pull of rivets.

When correct clearance between washer and starter clutch is obtained, feed rivets into countersunk holes from inside of sprocket shell. Head rivets until flush to .010 in. maximum above face of starter clutch. Seal rivets on both sides using a solvent-proof sealer.

With lip facing in, press oil seal (17) into clutch shell.

ASSEMBLING CLUTCH (Fig. 4B-8)

Assembly is essentially the reverse order of disassembly. Be certain that all parts are clean, free of oil and dry before reassembling.

Press 1966 and earlier extension (29) in clutch gear using aluminum paint as a sealer and install hub nut "O" ring (28). Install oil seal (27). Do not forget to insert clutch release rod - left (9, Fig. 4B-6). Apply a light coat of grease to needle roller bearings, and compensating sprocket shaft extension and install spacer (20 or 20A) and "O" ring (18) on clutch gear. Assemble clutch sprocket, front chain and compensating sprocket in one move. Be sure chain adjuster is positioned loose behind chain. Reassemble compensating sprocket as described under "Assembling Compensating Sprocket."

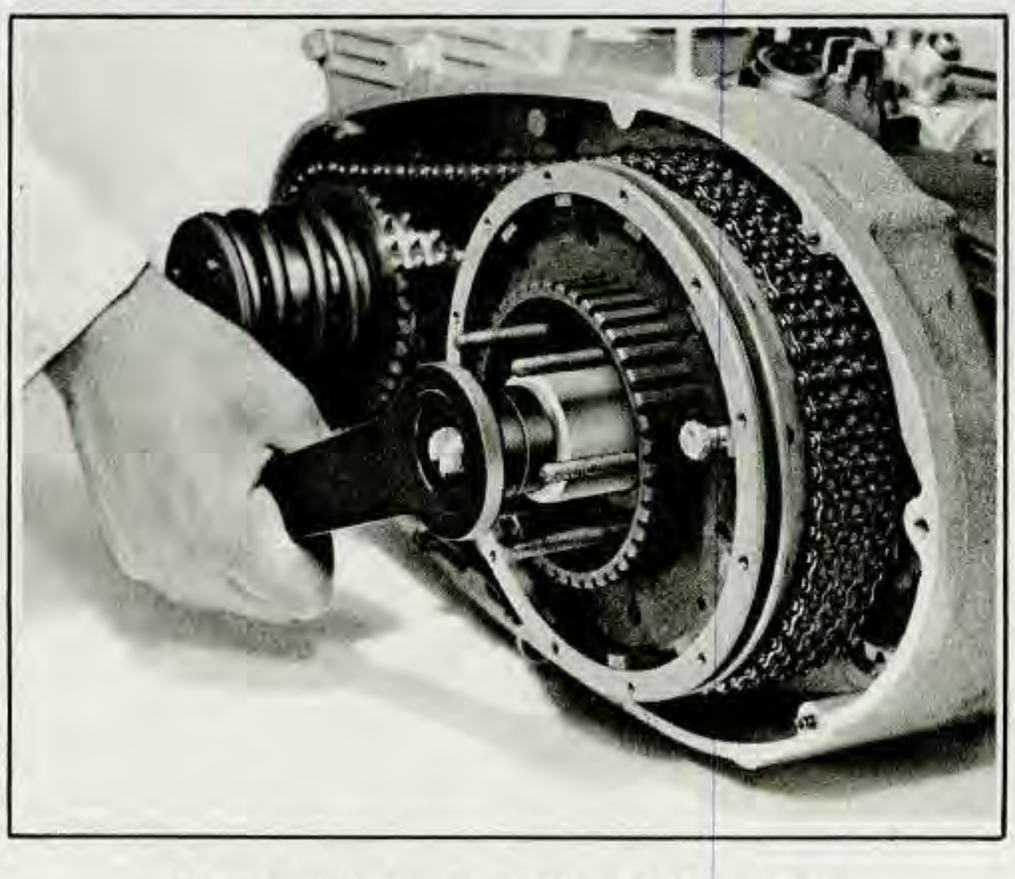


Figure 4B-11. Installing Clutch Hub

Install clutch hub on clutch gear splines using Clutch Hub Installing Tool, Part No. 97170-55A, as shown in Fig. 4B-11. Install Lock Plate, Part No. 97175-55, and Sprocket Locking Link Tool, Part No. 97200-55, as shown in Fig. 4B-9.

Install a new lock washer (15) over clutch gear splines and install hub nut (14 or 14A, Fig. 4B-8) using Wrench, Part No. 94647-52, as shown in Fig. 4B-9. Follow up hand tightening by striking wrench handle with a soft mallet to securely seat nut to at least 150 ft-lbs torque. Bend ear of washer (15) against hex-head of hub nut. Clutch hub must run free on shaft after tightening.

IMPORTANT

If starter clutch, clutch shell or clutch gear have been replaced, it is absolutely necessary to check the clearance between teeth on starter clutch gear and starter clutch as described in "Starter," Section 4C.

Tighten and adjust front chain tensioner as described under "Front Chain Adjustment," Section 2B.

See Fig. 4B-8. Remove locking tools and install backing plate (13) over clutch hub splines, against back side of hub, recessed side facing out.

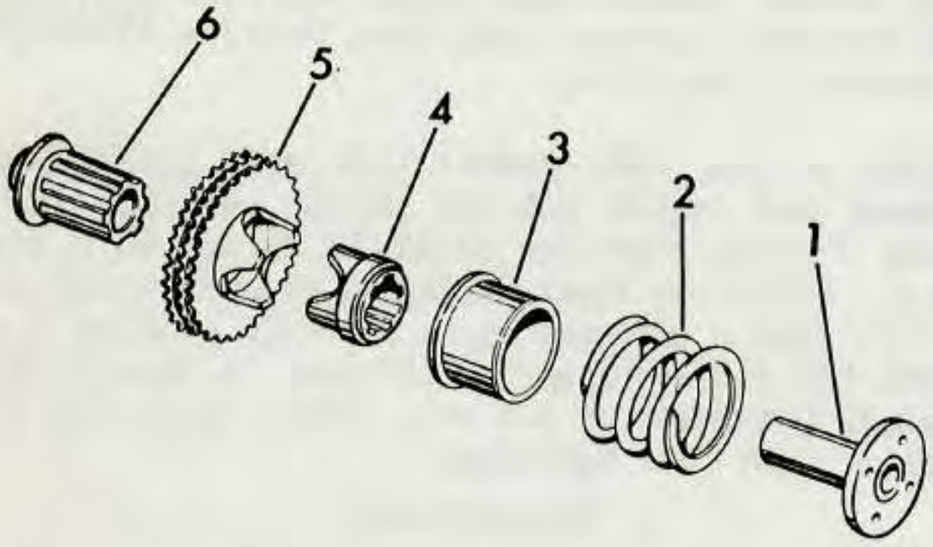
Place a steel plate (12) next to the recessed plate (13). Place a friction plate (11) into clutch shell and sprocket assembly and push inward against the second metal plate. Alternate with steel plates and friction plates until seven friction plates are in position. This will leave a friction plate on the outside. Make sure all plates have free movement.

Install releasing plate (10) on clutch hub (16) so the clutch hub studs are exactly centered in the clutch spring cup holes. Do this by aligning the larger of the two depressions on the rim of the clutch releasing plate with the notched tooth of the clutch hub.

Install clutch spring cups (9), springs (8) and spring-tension adjusting plate (7) into position with the raised surface facing outward. Start three 1/2 in. hex-head (long) nuts (6) on their respective studs. Pull these nuts down evenly until the spring-tension adjusting plate is pulled over the remaining three studs a sufficient distance to allow starting the 7/16 in. hex-head nuts (5). Draw the six spring-tension adjusting nuts down evenly until the inside of the spring-tension adjusting plate (7) measures 3/16 in. out from the outside surface of flange of the clutch spring cups (9) at the 6 stud locations. This is proper clutch spring-tension adjustment when new clutch plates are used. Install clutch shell and sprocket cover (3), screws (1) and retainers (2), with new gasket (4). Install gasket without sealer, graphite-side facing cover. Very lightly stake retainer (2) to lock screw (1).

CAUTION

A heavy blow is very likely to distort cover, disjoining the seal.



1. Sprocket shaft nut
2. Sprocket spring
3. Sprocket sliding cam sleeve
4. Sprocket sliding cam
5. Engine sprocket
6. Sprocket shaft extension

Figure 4B-12. Compensating Sprocket - Exploded View

See Fig. 4B-7. Install chain cover (5) and screws (4) with new gasket. If necessary, use gasket seal on both sides of gasket. Assemble rear brake pedal (3), stoplight switch (2) and footrest (1).

With motorcycle standing straight up, remove oil filler plug (6) and oil level plug (7). Add oil through filler plug, (same grade of oil used in engine), until it begins to overflow through oil level hole. Allow excess oil to flow from hole (7) until it ceases to run. This is correct oil level. Reassemble oil level and and filler plugs.

REMOVING COMPENSATING SPROCKET (Fig. 4B-12)

Loosen clutch sprocket and front chain as described in "Disassembling Clutch." Then remove compensating sprocket shaft nut (1), using Shaft Nut Wrench, Part No. 94557-55, as shown in Fig. 4B-10. Remove spring (2), sliding cam sleeve (3), sliding cam (4), sprocket (5), front chain and clutch shell together. Use Sprocket Shaft Extension Puller, Part No. 96015-56, to remove extension (6) from sprocket shaft if necessary (see Fig. 4B-13).

INSPECTING COMPENSATING SPROCKET (Fig. 4B-12)

Wash all parts in cleaning solvent and blow dry with compressed air. Carefully examine sprocket teeth, shaft splines and sliding cam surfaces for wear or scoring. Replace any parts that show excessive wear or damage.

NOTE

Extension (6) and cam (4) are matched at the factory according to spline engagement, therefore, they must be used as a set only.

A collapsed or damaged spring (2), will be evident by very turbulent cam action. If this condition exists, install a new spring.

INSTALLING COMPENSATING SPROCKET (Fig. 4B-12)

Install sprocket shaft extension (6) on end of sprocket shaft, using Tool Set, Part No. 97081-54, as described in "Assembling Crankcase," Section 3E.

Apply a light coat of grease to shaft extension splines and assemble sprocket (5) front chain and clutch shell together. See "Assembling Clutch."

Install sliding cam (4) on extension (6), being very careful to correctly match like splines to ensure free movement of cam on extension. Assemble parts (3, 2 and 1). Tighten sprocket shaft nut (1) securely, using Compensating Sprocket Shaft Wrench, Part No. 94557-55.

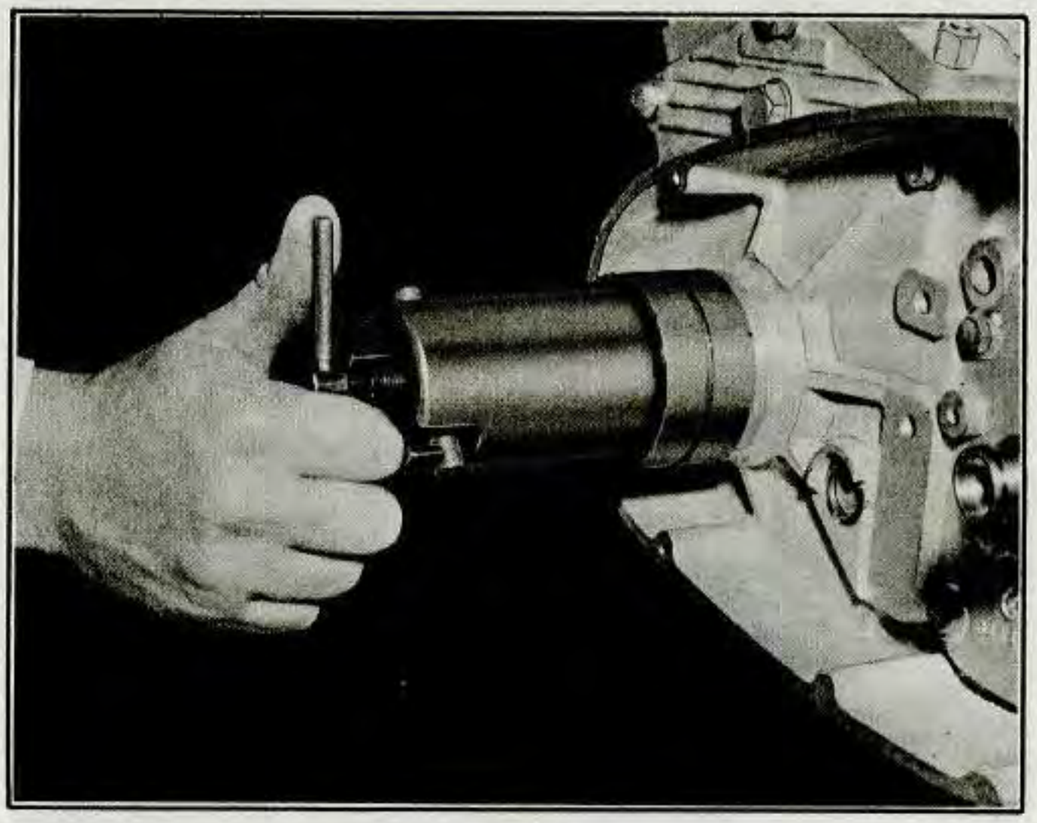


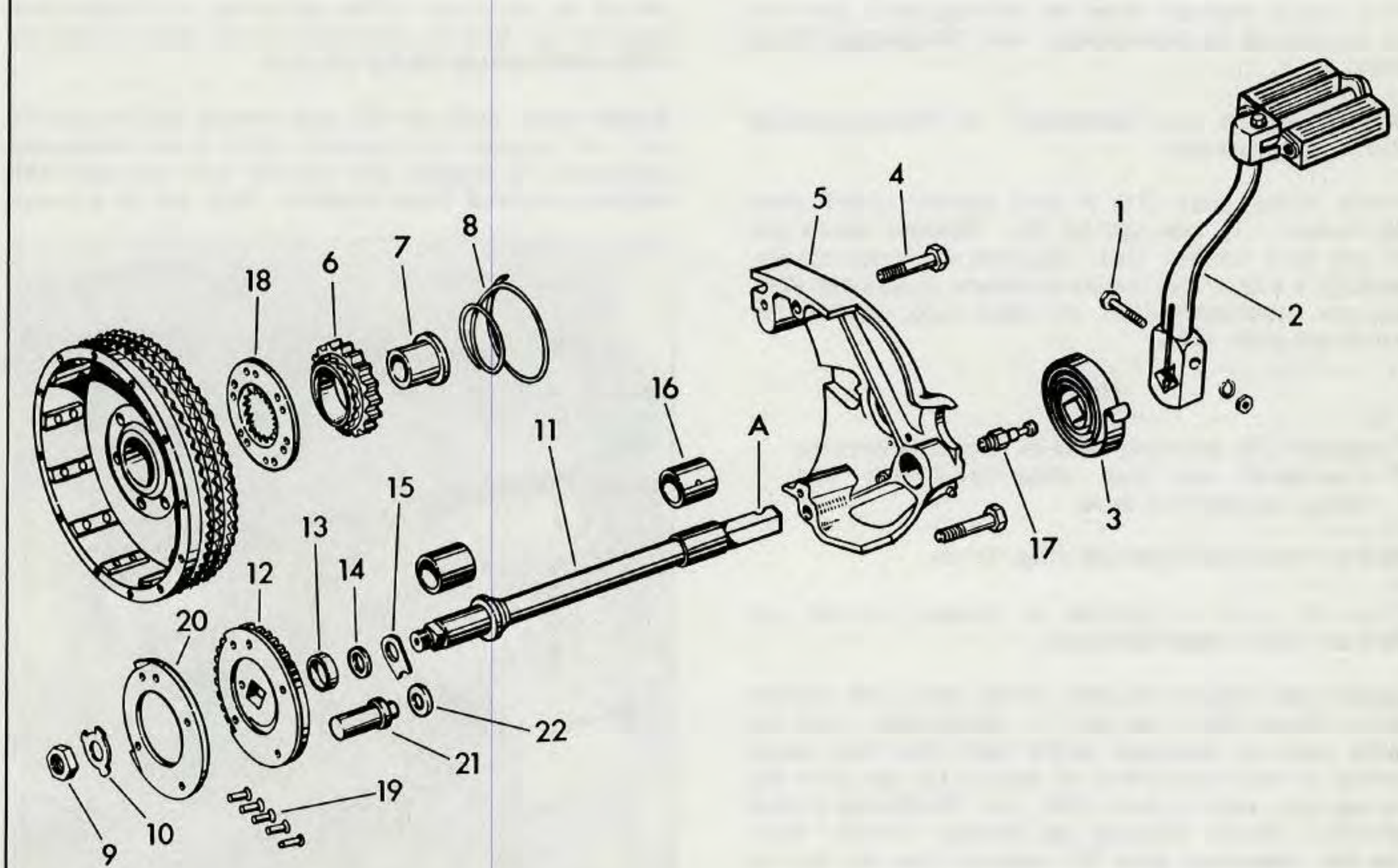
Figure 4B-13. Removing Sprocket Shaft Extension

KICK STARTER

GENERAL

The kick starter is designed for rugged service and will seldom require attention. However, if any irregularity should develop it is of utmost importance the engine be turned off and starter mechanism serviced immediately.

See Fig. 4C-2. A service problem will be indicated by starter gears ratcheting (clicking) with engine running, and starter crank upright as positioned on motorcycle. Ratcheting is caused by the starter clutch gear (6) teeth making partial contact with starter clutch (18) teeth, as the result of either a loose starter shaft nut (9), excessive crankshaft (11) end play or a loose starter crank gear cam plate (20).



1. Crank clamp bolt, lock washer and nut
2. Crank and pedal assembly
3. Crank spring
4. Sprocket cover bolt (2)
5. Sprocket cover
6. Starter clutch gear
7. Clutch sprocket spacer available (long or short)
8. Clutch spring
9. Shaft nut
10. Crank gear lock washer
11. Crankshaft
12. Crank gear
13. Crank oil seal
14. Crankshaft shim - .007"
15. Shaft thrust plate
16. Shaft bushing (2)
17. Spring stud
18. Starter clutch
19. Crank gear cam plate rivet (5)
20. Crank gear cam plate
21. Crank gear stop pin
22. Crank gear stop pin washer

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

Figure 4C-2. Kick Starter - Exploded View

If the kick starter crank (2) slips or partially engages when crank is rotated through its cycle, check for badly worn starter clutch teeth (18 and 6), damaged spring (8) or clutch gear (6) binding on spacer (7).

DISASSEMBLY (Fig. 4C-2)

Remove starter crank clamp bolt (1) and with a screw driver pry crank (2) from shaft. Press down on end of starter spring (3) and at the same time pry spring off shaft (11). Loosen exhaust pipe and muffler.

Remove transmission sprocket cover bolts (4). With a mallet lightly tap cover (5), at the same time pulling cover from shaft. Disengage clutch cable end from clutch release lever by moving lever forward (as positioned on motorcycle) and disengaging from lever.

Remove clutch as described in "Disassembling Clutch," Section 4B.

Rotate crank gear (12) to free starter clutch gear (6), spacer (7) and spring (8). Remove crank nut (9) and lock washer (10). Tap end of starter crankshaft (11) with a soft mallet to loosen from gear (12). Remove crankshaft (11), oil seal (13), shims (14) and thrust plate (15).

NOTE

Shims (14) are only used to establish correct crankshaft end play when crankshaft and thrust washer are worn.

INSPECTION AND REPAIR (Fig. 4C-2)

Clean all parts in gasoline or cleaning solvent and blow dry with compressed air.

Inspect and replace starter clutch gear and starter clutch (6 and 18), if necessary. Especially check for badly worn or damaged clutch teeth that may cause partial or no engagement of clutch (18) and gear (6). To replace starter clutch (18), see "Replacing Clutch Sprocket Needle Bearing and Starter Clutch," Section 4B. Examine gear (6) bushing face for burred or damaged condition affecting free movement of gear on spacer (7). Recheck for binding by assembling gear on spacer and note action of two parts.

Examine starter clutch spring (8) for collapsed condition or breakage, and compare with new spring, if possible. New spring free length is approximately 1 in.

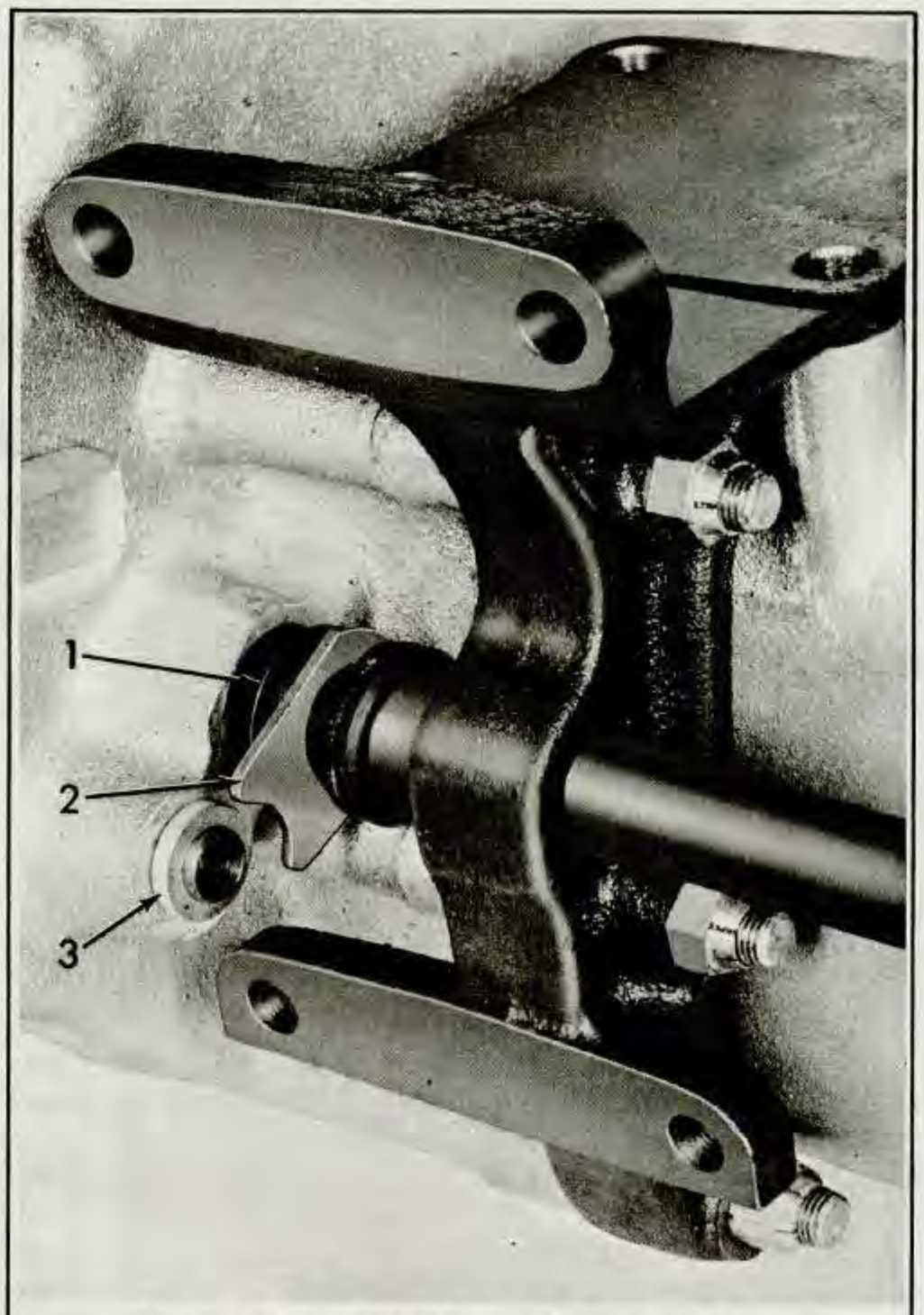
Inspect starter crankshaft (11) for bent condition or badly worn bearing surfaces and particularly for wear on thrust washer (15) and shaft collar faces. Temporarily position shaft (11), seal (13) and washer (15), gear (12), washer (10) and nut (9) in left case and check crankshaft end play with dial indicator. If end play is not within specified limits of .001 to .007 in. it is absolutely necessary to shim crankshaft. Use .007 in. thickness shim, Part No. 6802, between crankcase and thrust washer to obtain correct fit.

Examine starter crank gear assembly (12) for wear and damage. Pay particular attention to cam plate (20) ears for wear or bent condition. Check for loose cam plate rivets (19) that may result in cam plate separating from crank gear. Cam plate may be replaced providing gear (12) is in good condition. When riveting new cam plate to crank gear, insert rivets from gear side.

Check lock washer (10) and oil seal (13), if worn or damaged, replace parts.

Bronze bushings (16) are a press fit in transmission sprocket cover (5) and left crankcase. Bushings are long life parts and will seldom require replacement, however, if shaft (11) is not badly worn and excessive starter crankshaft radial play is noted, bushings should be replaced. When installing sprocket cover bushing be sure to correctly align hole in bushing with cover grease fitting channel.

Starter gear stop pin (21) and washer (22) ordinarily will not require replacement, and it is recommended procedure to inspect and replace stop pin only with engine removed from chassis. Stop pin is a press



1. Starter crankshaft shim - .007"
2. Starter shaft thrust plate
3. Starter crank gear stop pin washer

Figure 4C-3. Installing Starter Crankshaft

fit in crankcase. Washer is locked in place by peening stop pin end.

ASSEMBLY (Fig. 4C-2)

Install oil seal (13) in left crankcase. Slip thrust washer (15) on starter crankshaft (11), flat side of washer up as positioned on motorcycle. Insert steel shims (14) on crankshaft if needed, as described under "Inspection and Repair," and install crankshaft in left case engaging notched thrust plate (15) with stop pin washer (22) using grease to hold in place (see Fig. 4C-3).

Turn starter crankshaft until notch (A, Fig. 4C-2) is upright as positioned on motorcycle. Place starter crank gear on squared end of shaft, recessed portion of cam plate facing down, end of slot against stop pin as shown in Fig. 4C-4. When positioning crank gear (12) on shaft (11) be extremely careful that thrust washer does not become dislocated from stop pin washer (see Fig. 4C-3).

Slip lock washer (10) over crankshaft end (11) engaging prong of washer with hole in crank gear face. Install and securely tighten crank nut (9), with flat side of nut against washer.

Slip starter clutch gear (6) over spacer (7), grooved side of gear bushing against lip of spacer collar. Position small end of spring (8) in clutch gear bushing groove.

Press starter clutch gear assembly over clutch gear, compressing spring (8) and at the same time turning starter crank gear to permit meshing of gear teeth.

Return starter crank gear to original position as shown in Fig. 4C-4, with clutch gear held against cam plate by spring tension.

CAUTION

If clutch sprocket spacer only (7), is replaced, the new spacer must be exactly the same length as the old spacer. Spacers are available in two lengths, 1.025 and 1.047 in. If starter clutch gear (6), starter clutch (18), clutch sprocket hub or clutch gear are replaced it is absolutely necessary to check the clearance between teeth on starter clutch gear (6) and starter clutch (18) as follows:

1. Measure distance from end of clutch sprocket spacer to top of starter clutch gear teeth.

2. On clutch sprocket assembly, measure distance from top of starter teeth to clutch sprocket thrust washer.

3. Subtract the sprocket reading (2) from the clutch gear reading (1) to obtain clearance.

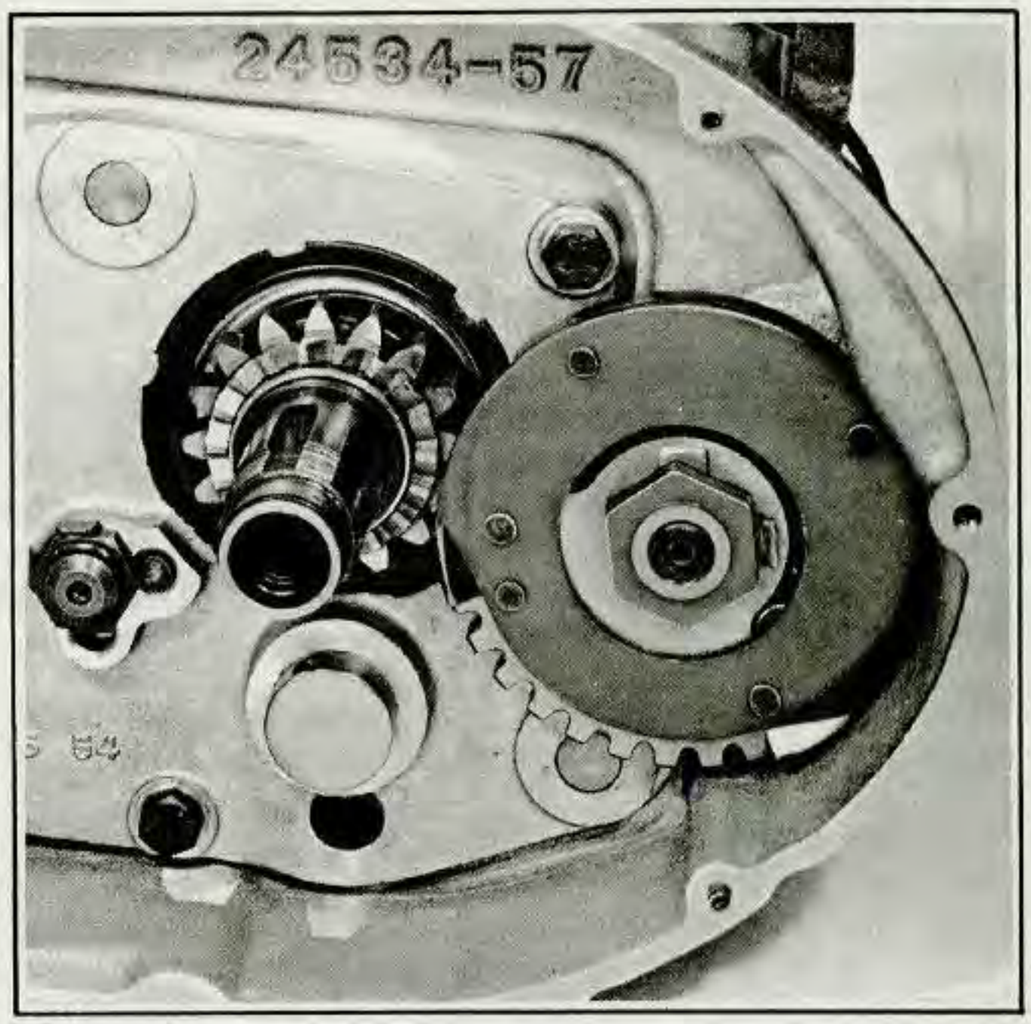


Figure 4C-4. Positioning Starter Crank Gear on Starter Shaft

4. If resulting clearance is less than .040 in. using short spacer (7), length 1.025 in., install long spacer, length 1.047 in., to obtain .040 in. minimum clearance.

The following alternate method may also be used:

Using a discarded Clutch Sprocket Assembly, Part No. 37701-57, improvise a gauge to measure clearance between clutch teeth on starter gear (6) and clutch (18). Cut a "pie-shaped" section from the clutch shell to permit measurement between teeth with feeler gauge. Temporarily slip improvised clutch shell gauge over clutch gear and hold firmly against spacer (7). With a feeler gauge measure clearance between clutch teeth. If measured clearance is less than .040 in. using short spacer (7), length 1.025 in., install long spacer, length 1.047 in., to obtain .040 in. minimum clearance. See "Transmission Specifications," Section 4A.

Reassemble clutch as described in "Assembling Clutch," Section 4B.

Engage clutch cable end with clutch release lever and install transmission sprocket cover (5) and bolts (4). Install exhaust pipe and muffler.

Slip spring (3) over squared end of shaft (11), end of spring and notch (A, Fig. 4C-2) up as positioned on motorcycle. Using a screwdriver rotate spring clockwise and engage with stud (17). Install bolt, lock washer and nut (1).

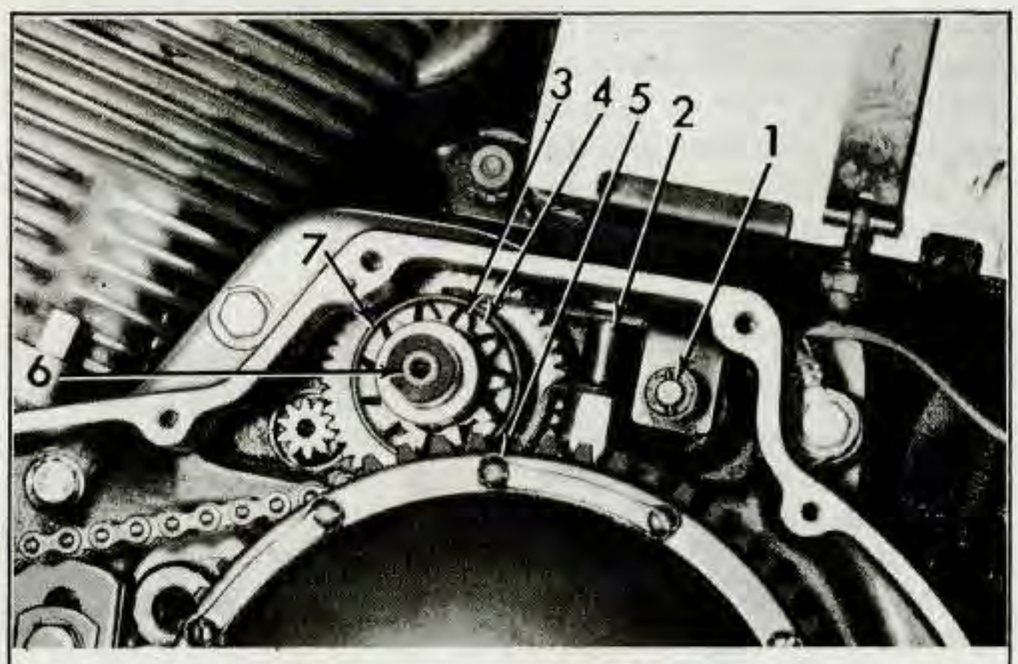
ELECTRIC STARTER

STARTER DRIVE (Fig. 4C-4A)

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.



1. Armature shaft
2. Shifter lever
3. Shifting collar
4. Pinion gear
5. Clutch ring gear
6. Starter shaft
7. Overrunning clutch

Figure 4C-4A. Starter Drive

DISASSEMBLING STARTER AND SOLENOID (Fig. 4C-4B)

DISASSEMBLING SOLENOID:

Remove solenoid as follows:

Remove battery cover and 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 (21). Pull pinion gear and shaft assembly (14) from housing (26). Then remove gear (23) from drive shaft.

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 (22) which has a left hand thread. Remove bearing race (17). Remove pinion and shifter collar assembly (18). Remove lock ring (19) to separate gear (20) and shifter collar (21).

To remove starter shifter lever (25), it is necessary to either remove starter drive housing (26) or remove battery and carrier to gain access to screw (24).

Remove screw (24) and lever (25) from housing (26).

Remove starter motor (30) and housing (26) as an assembly by removing two bolts and lockwashers (not shown) from chain housing on left side of crankcase. (See Starter Motor, Section 5L-5.)

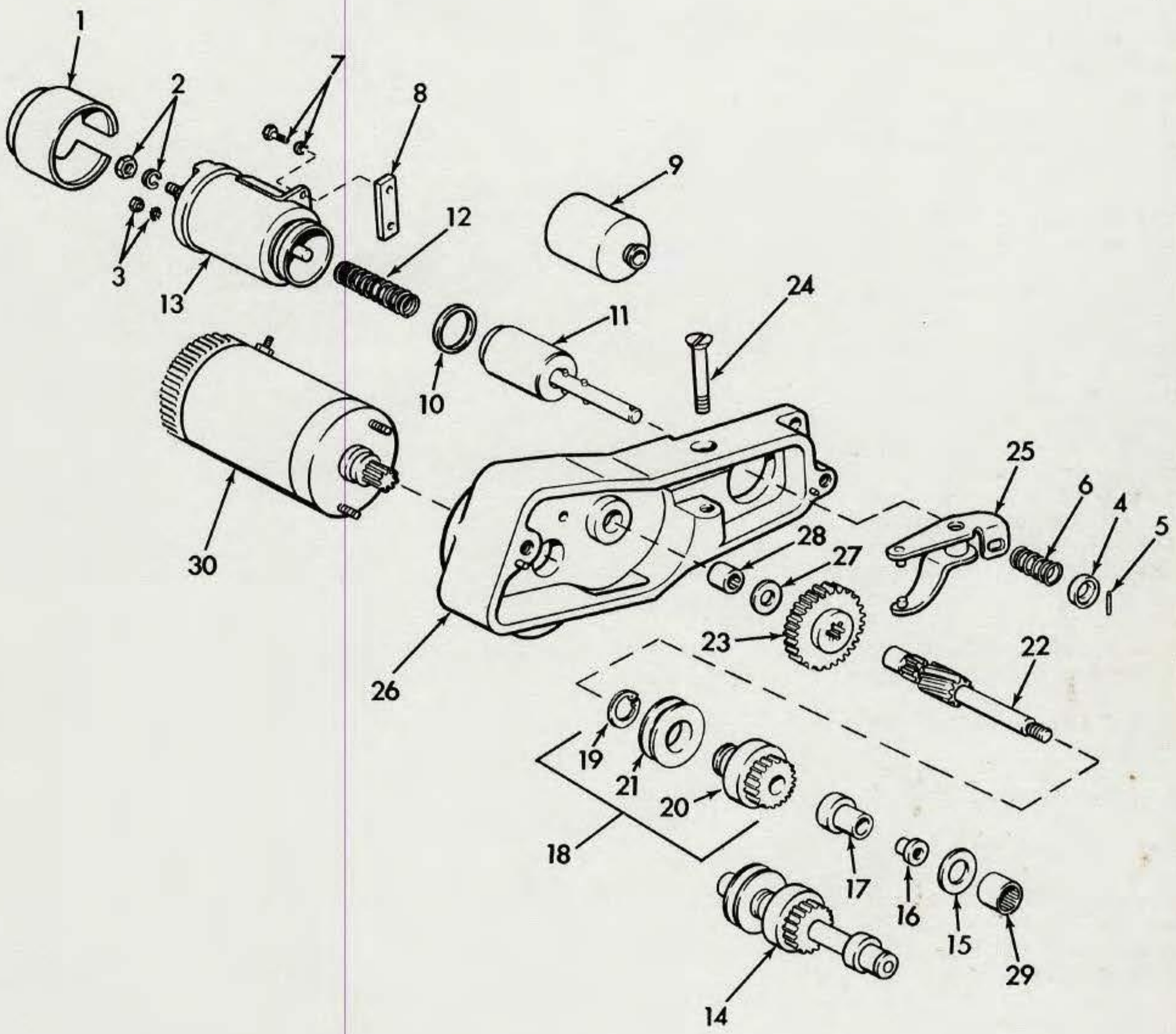
Needle bearings (28) and (29) are pressed into housings at shaft ends. Washer (27) presses out with needle bearing (28).

To service starter motor see Section 5L.

ASSEMBLING STARTER AND SOLENOID (Fig. 4C-4B)

Assembly is essentially the reverse of disassembly except as follows:

Clean needle bearings (28 and 29) and repack with grease. If replaced, needle bearing (28) should be pressed in flush with outside of housing. Stake



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. Bearing race
18. Pinion and shifter collar assembly
19. Lock ring
20. Pinion gear
21. Shifter collar
22. Shaft
23. Drive gear
24. Shifter lever screw
25. Shifter lever
26. Starter shaft housing
27. Washer
28. Needle bearing
29. Needle bearing
30. Starter motor

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

Figure 4C-4B. Starter Shaft, Housing and Solenoid - Exploded View

washer (27). Pinion (20) 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.

GEAR BOX

GENERAL

The transmission shifter mechanism, mainshaft and countershaft groups are an integral part of the engine crankcase assembly. These groups may be serviced directly by removing the access cover from the crankcase as described in "Removing Transmission Access Cover," thereby exposing all transmission parts for repair.

When transmission repair is needed in conjunction with crankcase, flywheel or general overhaul the usual procedure is to not disturb the access cover, but to disassemble the transmission after the crankcases have been separated. This procedure is described below. Skip following paragraph if transmission is to be serviced through access cover.

CRANKCASE AND TRANSMISSION DISASSEMBLY

Disassemble crankcase as described in "Disassembling Crankcase," Section 3E. Position left crankcase side on workbench, transmission compartment facing up.

See Figs. 4D-19 and 4D-20, and proceed to disassemble transmission. Remove countershaft low gear washer (19) and low gear (18). Free mainshaft assembly (2, 3, 5, 8, 7, and 6, Fig. 4D-20). Slip mainshaft second gear (1) from shifter fork (10, Fig. 4D-19). Free shifter mechanism from access cover by removing gear shifter cam cap screw (1) and retainer ring (2, Fig. 4D-19). Remove countershaft low gear washer (11), third gear (12, Fig. 4D-20) and shifter fork (10, Fig. 4D-19). Remove countershaft assembly, (17, 16, 15, 14 and 13, Fig. 4D-20).

If further disassembly is necessary, proceed as follows:

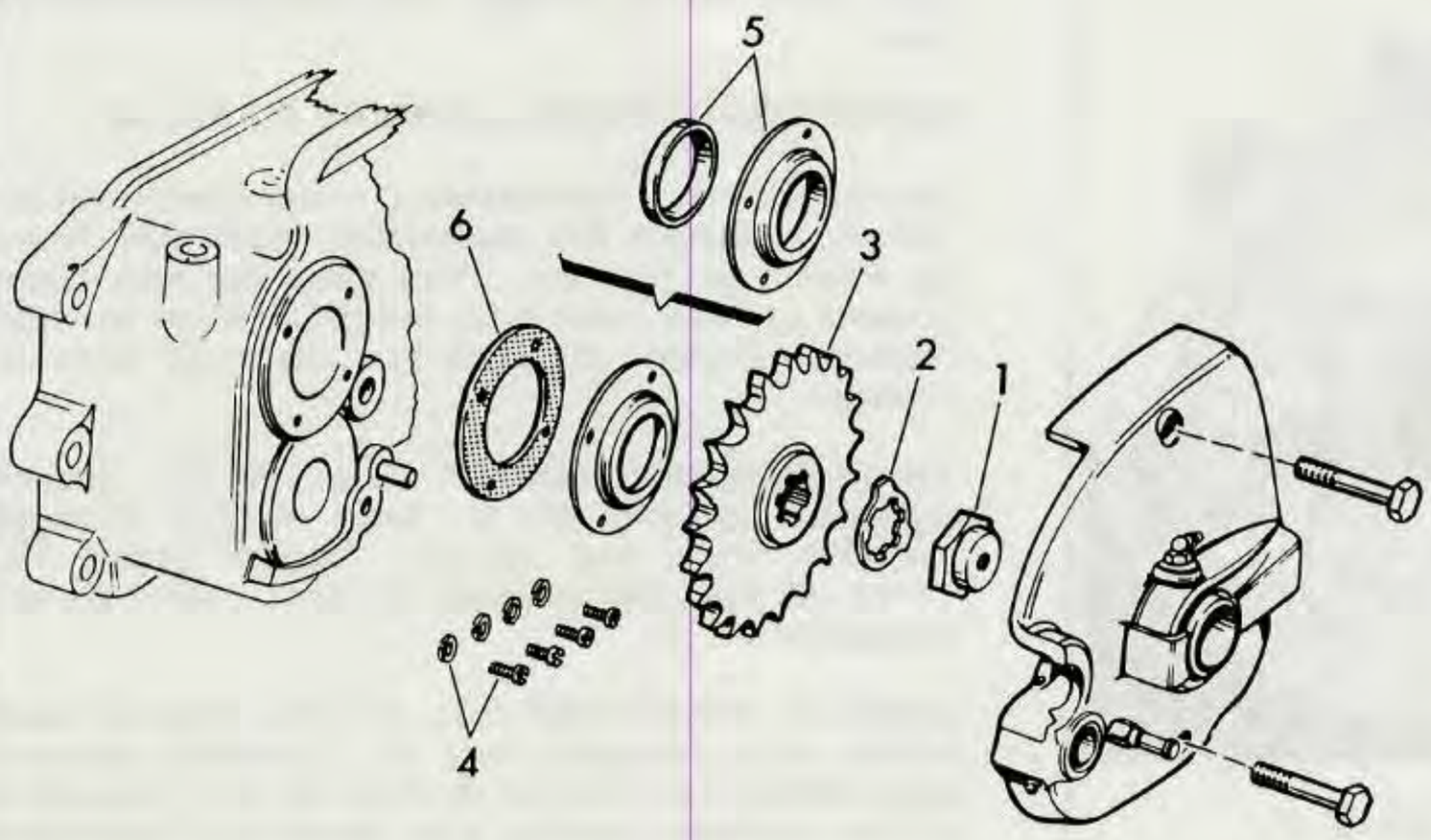
Disassemble shifter mechanism as described in "Disassembling Shifter Mechanism." Disassemble mainshaft and countershaft groups as described in "Disassembling Mainshaft and Countershaft Group."

REMOVING TRANSMISSION ACCESS COVER

Unless transmission is damaged inside so that it cannot be shifted from one position to another, shift into high gear. Place an oil drain pan under clutch and remove footrest, stoplight switch, rear brake foot pedal, chain case cover, clutch, front chain and compensating sprocket as described in "Clutch," Section 4B.

Remove starter crank assembly, right footrest and foot shift lever. Loosen exhaust pipe, remove transmission sprocket cover, starter crank gear, starter clutch gear and starter crankshaft as described in "Starter," Section 4C.

Loosen mainshaft nut (1) and disconnect rear chain by removing chain connecting link. See Fig. 4D-15



1. Mainshaft nut
2. Mainshaft lock washer
3. Mainshaft sprocket
4. Oil seal retainer screw and lock washer (4)
5. Oil seal and retainer
6. Oil seal gasket

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

Figure 4D-15. Transmission Mainshaft Sprocket

and proceed as follows. Remove transmission mainshaft nut (1) and lock washer (2). If mainshaft sprocket (3) is tight on shaft use All Purpose Claw Puller to remove sprocket. To avoid tooth breakage grasp two teeth with each end of puller. Remove retainer screws (4), oil seal and retainer (5) and gasket (6).

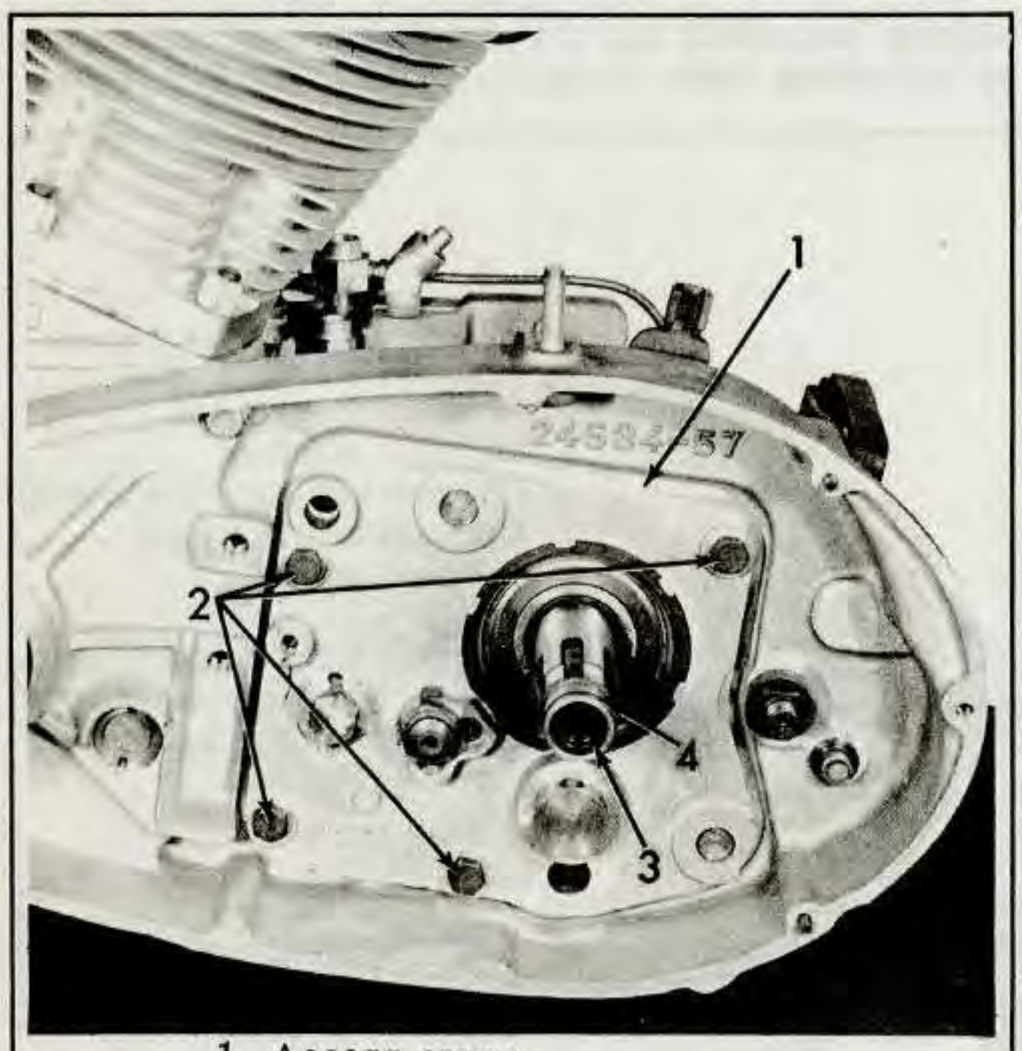
See Fig. 4D-16. Remove four access cover cap screws (2). Pry clutch gear oil seal (3), from clutch gear with screwdriver or release rod end that has been wiped dry. Remove hub nut rubber "O" ring (4), (if used) from clutch gear extension groove. Using Transmission Access Cover Puller, Part No. 95560-57, loosen access cover from left crankcase side as shown in Fig. 4D-17. Remove access cover from crankcase with transmission parts that remain attached to the cover (see Fig. 4D-18).

DISASSEMBLING SHIFTER MECHANISM (Fig. 4D-19)

To free shifter mechanism from access cover, remove mainshaft second gear (1, Fig. 4D-20), cap screw (1, Fig. 4D-19) and retainer ring (2). With a "Tru-Arc" Pliers remove retaining ring (3) and washer (4). Free cam (5), pawl carrier (6), pawl carrier support (7) and pawl carrier support shims (7A) (if used). Remove pawl carrier springs (8) and shifter pawls and springs (9). To free shifter forks (10) and finger rollers (11), remove countershaft assembly (17, 16, 15, 14 and 13, Fig. 4D-20).

DISASSEMBLING MAINSHAFT AND COUNTERSHAFT GROUP (Fig. 4D-20)

Remove mainshaft (2), thrust washer (3) and 23 rollers (4) from right crankcase. Remove low gear (5) from mainshaft splines. Pry retainer ring (6) from groove in mainshaft and discard ring. Slip washer (7) and third gear (8) from mainshaft.



1. Access cover
2. Access cover cap screws (4)
3. Clutch gear oil seal
4. Hub nut rubber "O" ring (XLCH, 1966 & earlier XLH)

Figure 4D-16. Transmission Access Cover

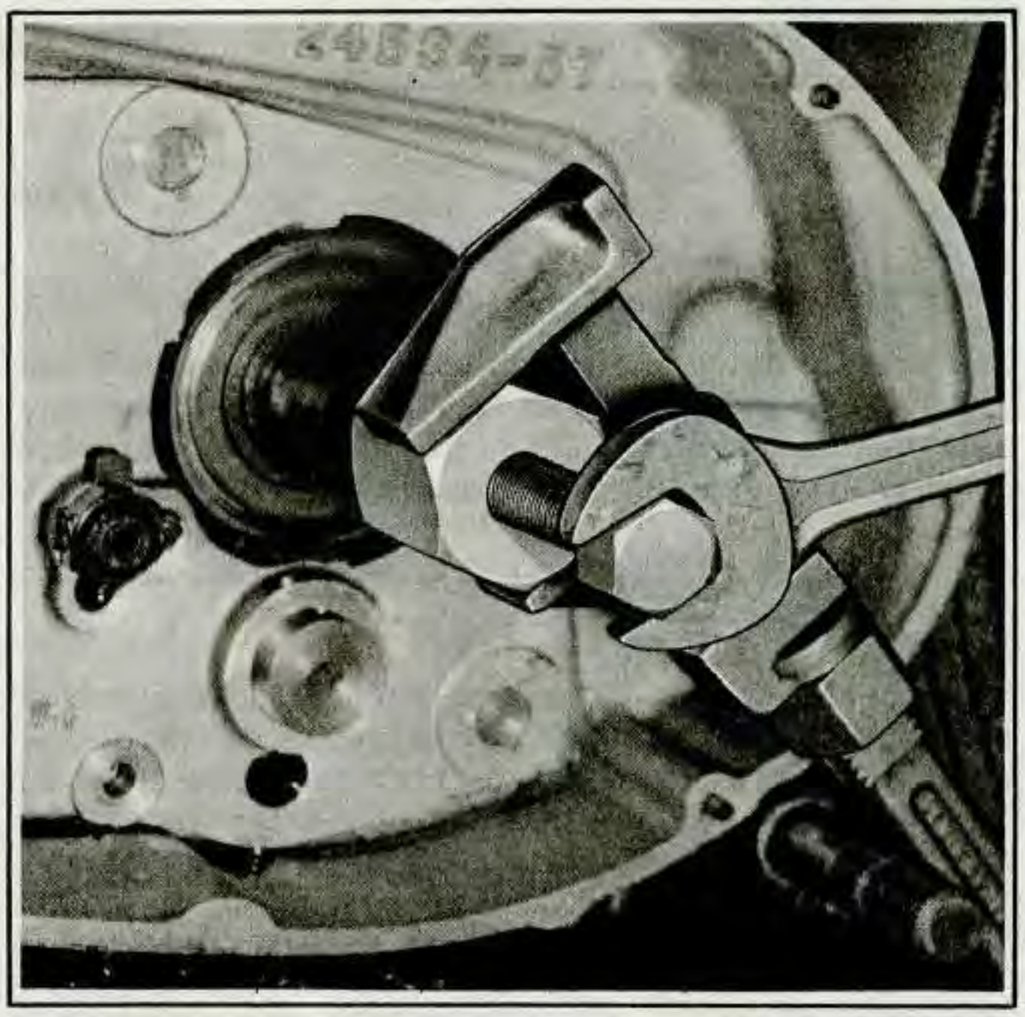


Figure 4D-17. Removing Transmission Access Cover

Support access cover (9) on arbor press, clutch gear threaded end up. Carefully press clutch gear (10) from ball bearing (20). Remove low gear washer (11) and third gear (12) from countershaft. Press drive gear (13) from countershaft splines and remove gear spacer (14), second gear (15) and thrust washer (16). Free countershaft low gear (18) and low gear washer (19). Drift out oiler plug (22) from inside of access cover.

INSPECTION AND REPLACEMENT OF PARTS

Thoroughly clean transmission compartment and all shifter, mainshaft and countershaft parts with cleaning solvent or gasoline. Blow parts dry with compressed air and inspect to determine if any must be replaced. Replace all parts that are badly worn or damaged.

TRANSMISSION SPROCKET (Fig. 4D-15). Inspect mainshaft sprocket (3) for badly worn or damaged sprocket teeth and splines. Discard gasket (6). Check oil seal and retainer (5), lock washer (2) and mainshaft nut (1).

SHIFTER MECHANISM (Fig. 4D-19). Discard gear shifter cam retaining ring (3). Carefully examine gear shifter cam (5) for grooved or worn cam slots at the various running gear positions. Excessive wear at thrust points will make the transmission difficult to shift through gear range.

Inspect gear shifter pawl carrier (6) for depressions or grooves worn in fingers that engage shifter

lever arm shaft (17). A badly worn yoke is caused by rubbing action of lever arm shaft ball, and will result in transmission jumping out of gear. Examine pawl carrier support for breakage or minute surface cracks, Loosely assemble shifter cam (5), pawl carrier (6), support (7), shims (7A) (if used), and check bearing action for appreciable play. Parts that show extremely worn or pitted surfaces should be replaced.

Examine pawl carrier springs (8) for breakage or damage caused by acids in oil. If possible, compare old springs with new springs. New spring free length is approximately 2-25/32 in.

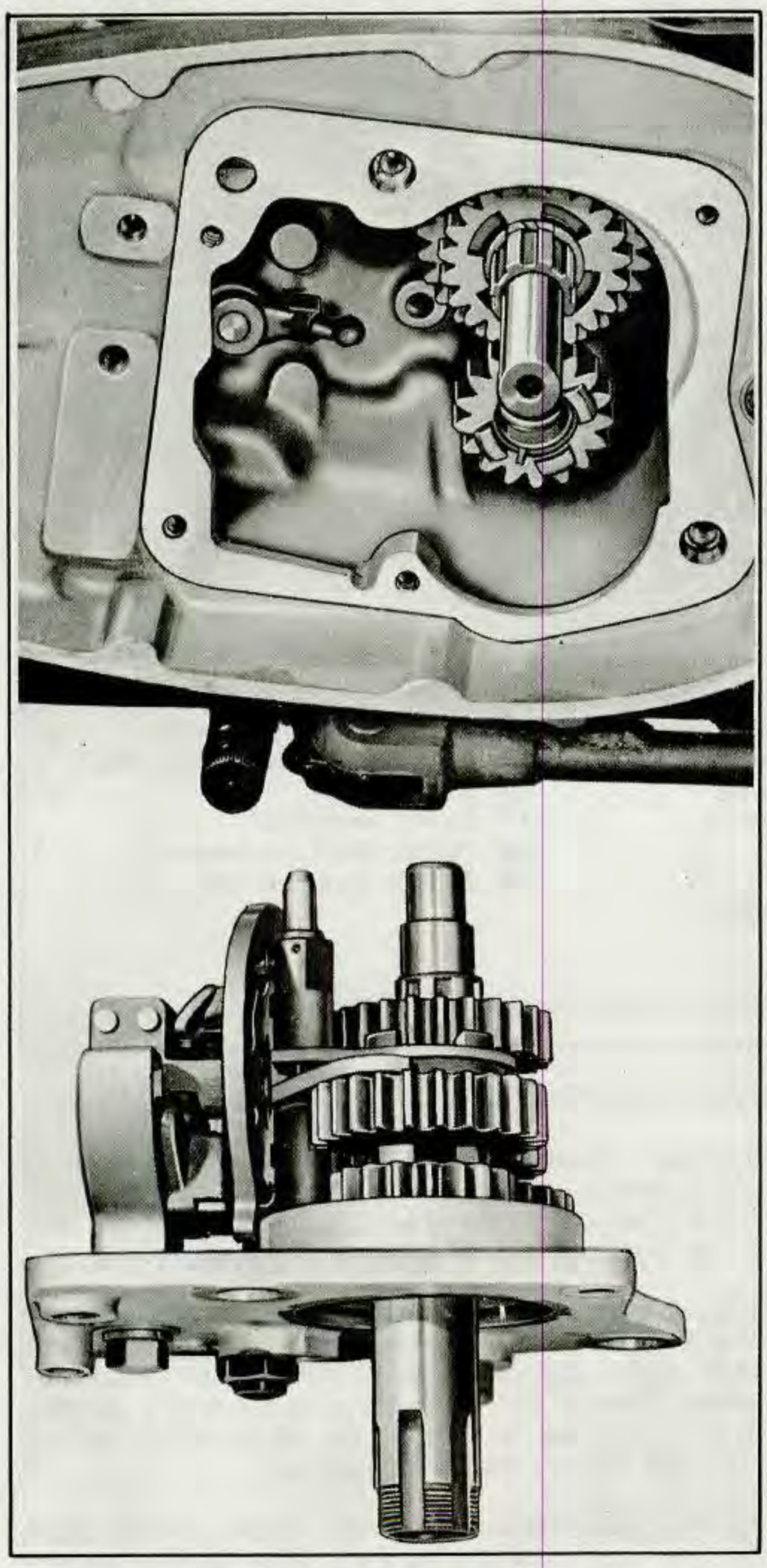


Figure 4D-18. Transmission Access Cover Removed

NOTE

Do not use cadmium plated, 14-coil pawl carrier springs. Use only cadmium plated, 16-coil springs or black phosphatized springs, 14 or 16-coil, when reassembling pawl carrier support.

Examine shifter pawls and springs (9) for wear, grooves, cracks or breakage. Insert right and left pawl springs in their respective carrier (6) holes and check operation. Pawl must be free in carrier. Free length of new springs is approximately 1-7/32 in.

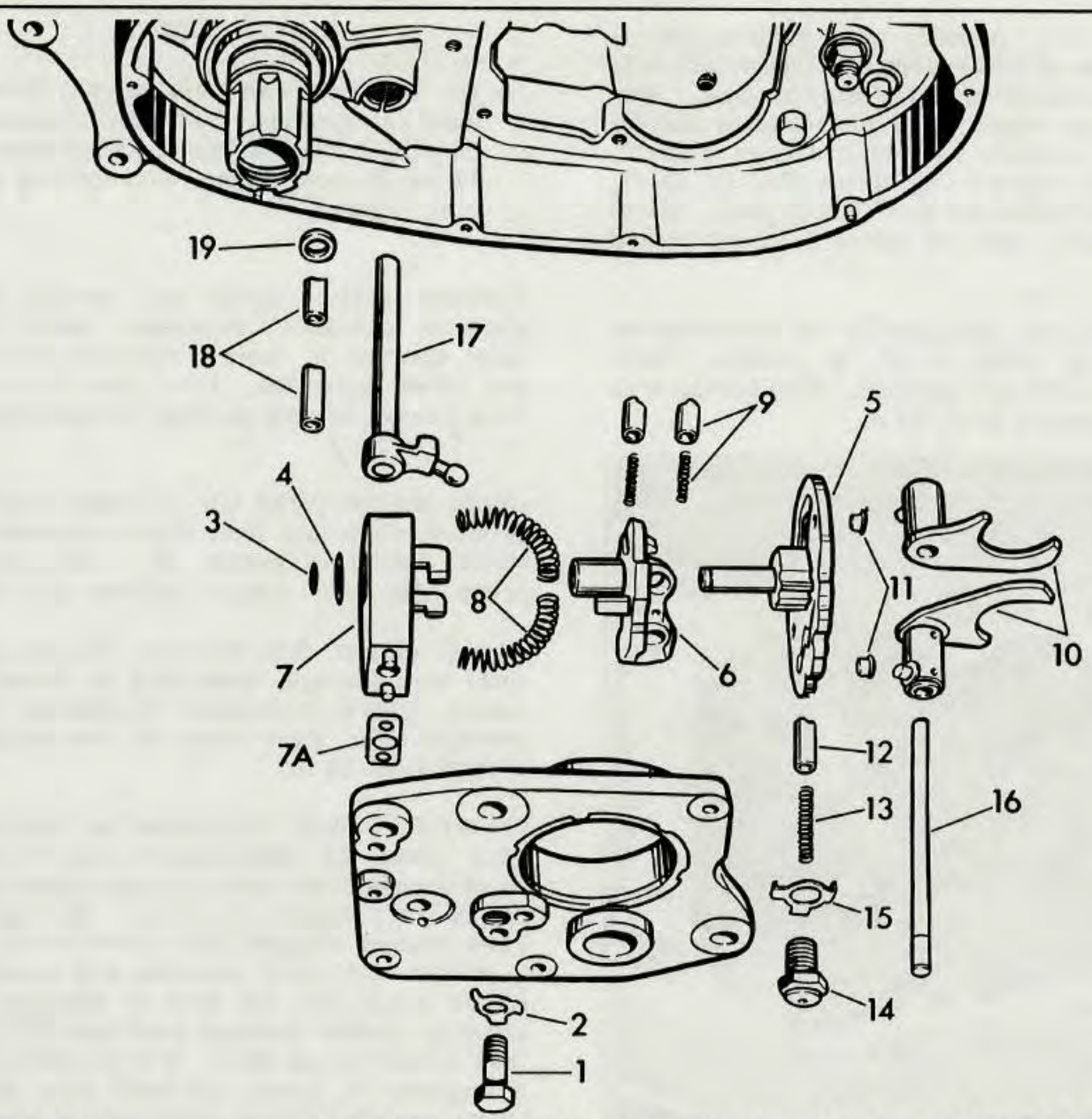
Check shifter forks (10) for bent condition or deep grooves worn into fork fingers caused by excessive thrust action of gears. Also examine both shifter forks (10) and finger rollers (11) for breakage.

Inspect shifter cam follower (12) and spring (13) for wear and damage, especially on thrust face of follower. Check movement of follower and spring in retainer (14). Free length of new spring is approximately 1-19/32 in.

Shifter fork shaft (16) should be removed from access cover for replacement only. Shaft is a press fit in access cover and is gauge-aligned at the factory for correct position in cover. New parts order access covers shipped from factory will also include a shifter fork shaft installed and correctly aligned. Check shaft (16) for bent or damaged condition by slipping shifter forks on shaft and noting if they have free movement on shaft. If it is absolutely necessary to replace 16, press old shaft from cover and align cover on arbor press, inner side of cover up. Press new shaft into cover being extremely careful to keep shaft perpendicular to cover face.

Inspect gear shifter lever arm shaft (17) for wear or bent condition. Temporarily install shaft in crankcase and check for appreciable play in bushings (18). If inspection indicates replacement of bronze bushings (18), it is first necessary to remove gearcase cover as described in "Gearcase," Section 3D. Pry oil seal (19), from recess in shaft hole with screwdriver and drift bushings from right case and gearcase cover. After pressing in new bushings, install lever arm shaft (17). Shaft must work freely in bushings. Remove any high spots from bushings with a half-inch reamer. To ensure against oil leakage, replace oil seal (19) when reassembling.

MAINSHAFT AND COUNTERSHAFT GROUP (Fig. 4D-20). Inspect gears for badly battered, chipped or rounded dogs and slots at all thrust points. This condition will be evidenced by transmission jumping out of gear. Examine gear teeth for pitting, scoring, cracked, chipped condition or case hardening worn through. Inspect mainshaft, countershaft and all gears for pitting, grooving and excessive wear on bearing surfaces. Slip gears on shafts and check for wear and appreciable play. If not within specification limits as given in "Transmission Specifications," Section 4A, replace worn parts.



1. Cam cap screw
2. Cap screw retainer ring
3. Cam retaining ring
4. Cam shaft thrust washer
5. Gear shifter cam
6. Pawl carrier
7. Pawl carrier support
7A. Shim (.010 thick) as required
8. Pawl carrier springs (2)
9. Pawl and springs (2)
10. Gear shifter forks (2)
11. Finger rollers (2)
12. Cam follower
13. Cam follower spring
14. Cam follower retainer
15. Cam follower retainer ring
16. Fork shaft
17. Lever arm shaft
18. Shifter shaft bushings (2)
19. Shifter shaft oil seal

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

Figure 4D-19. Shifting Mechanism - Exploded View

To replace low gear bushing (23), simply press old bushing out and new bushing in. To replace clutch gear bushing (27) and needle roller bearing (28), first remove extension (26) with vise grip pliers. Drift bushing (27) from gear. Drift needle roller bearing (28) and washer (29) from opposite end of gear. Press new bushing into clutch gear shaft. Insert mainshaft in clutch gear and check to be sure shaft is .001 to .002 in. loose in gear. New bushing may close up and require reaming to size. Use Reamer, Part No. 94829-42, for this operation. Install needle roller bearing and spacer, pressing on printed side of bearing only. Assemble extension to end of clutch gear using aluminum paint as a sealer. Install new oil seal and hub nut "O" ring.

Position mainshaft and then countershaft in flywheel truing device. Rotate shafts and with a dial indicator check shafts for bent condition. Shafts that are .003 in. or more out of true must be replaced.

Inspect mainshaft ball bearing (20). Tolerances of clutch gear in ball bearing and ball bearing in access cover are given in "Transmission Specifications," Section 4A. If bearing is not within specification limits or is worn to the extent that it has appreciable play or shake, replace it.

To free ball bearing (20) from access cover, first remove and discard snap ring (21). Support access cover on arbor press and press ball bearing from

cover. Apply pressure to outer bearing race during pressing operation. Do not drive bearing from cover using a hammer and drift, as damage to bearing is likely to result.

To reassemble ball bearing, reverse order of disassembly. Install new snap ring (21).

Examine all thrust washers and replace any that are badly worn or damaged.

Inspect rollers (4) and roller bearing race (30) and replace if badly pitted, scored or worn beyond fitting specifications.

To remove a badly worn bearing race, remove retainer ring (31) and roller bearing washer (32). Discard ring (31). Heat case surrounding bearing and drift race inward from outside of case. Press new race in until shoulder is against case inner surface. See "Transmission Specifications," Section 4A for correct fit of mainshaft right side roller bearing.

Replace needle roller bearings (33 and 34) if worn and not within tolerances outlined in "Transmission Specifications," Section 4A. Bearings are a press fit and should be removed for replacement of parts only. Apply pressure to printed side of bearing when pressing into position. Press needle roller bearing (34) into access cover 5/64 in. from inner side. (Oiler plug (22) is installed with oil hole up, as positioned on access cover, after countershaft end play has been established.)

INTERCHANGEABLE ACCESS COVERS

Beginning with the 1957 Sportster, the crankcase and access cover were re-designed incorporating straight dowels, making the access cover interchangeable from one left crankcase to another.

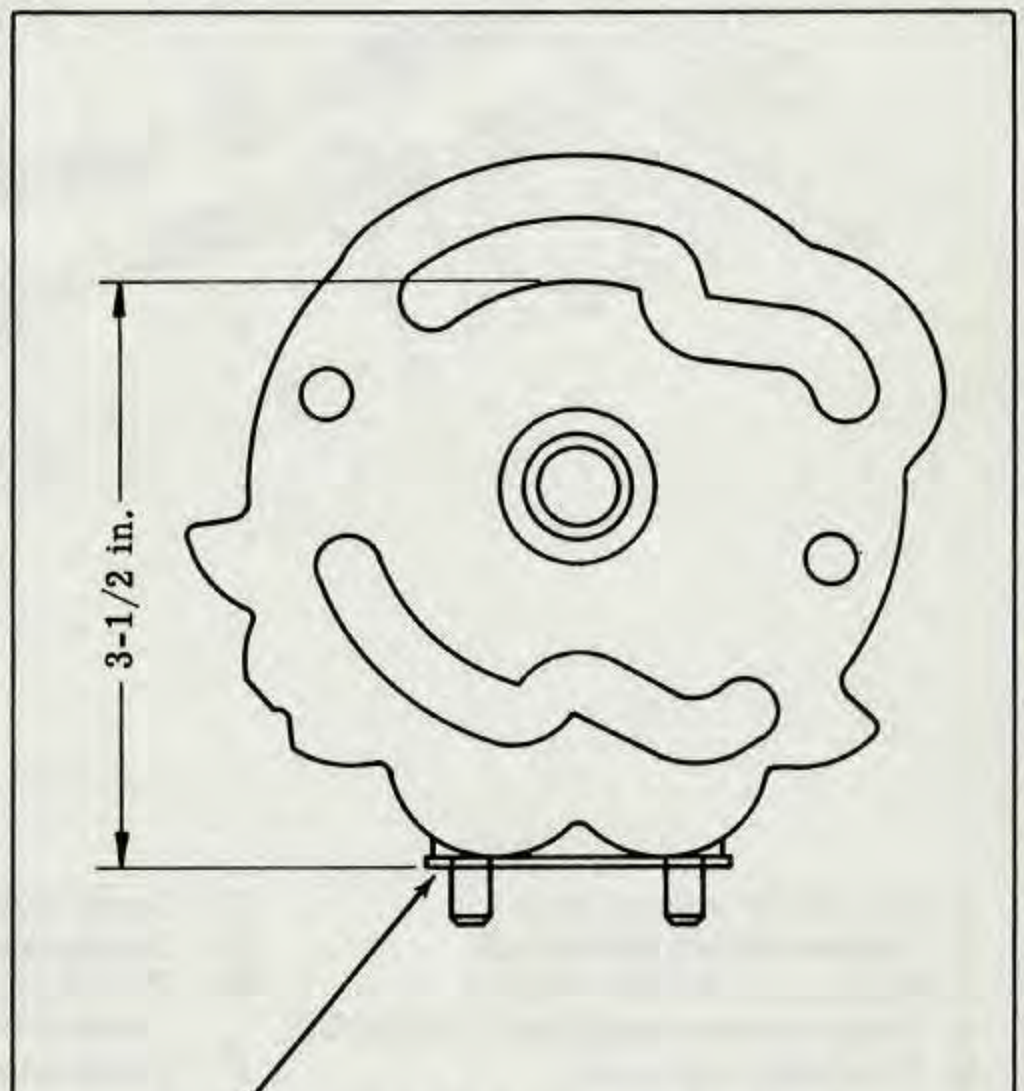
This new design was also incorporated on all K and KH model crankcases available through parts order. This replacement crankcase is identified by the letter "D" stamped near the engine number pad on the left case.

It is very important to note, that the re-designed access cover with <u>straight dowels IS NOT</u> interchangeable with the earlier access covers using <u>dowel cones.</u>

Therefore, the late style Transmission Access Cover, Part No. 34844-57, can be used only as a replacement on 1957 and later Sportsters and all later style parts order crankcases identified by the letter "D."

ASSEMBLING TRANSMISSION

See Fig. 4D-19. Install retainer ring (15) and retainer (14) in access cover. Insert springs (8) into slots of support (7). Position carrier (6) in support (7). Insert right and left shifter pawls and springs (9) into their respective sockets, top ratchet engaging grooves facing each other. Hold spring loaded pawls in place with a thin spoke or knife blade and assemble cam (5), carrier (6) and support (7) with shims (7A) (if used). With "TruArc" pliers install washer (4) and new retaining ring (3). Hold down one pawl at a time with knife blade and operate cam (5) to make sure pawls are free and correctly engaging with ratchet of cam (5). Shims (7A) are used to adjust height of shifter assembly to dimension shown in Fig. 4D-19A to assure the operation of shifter forks.



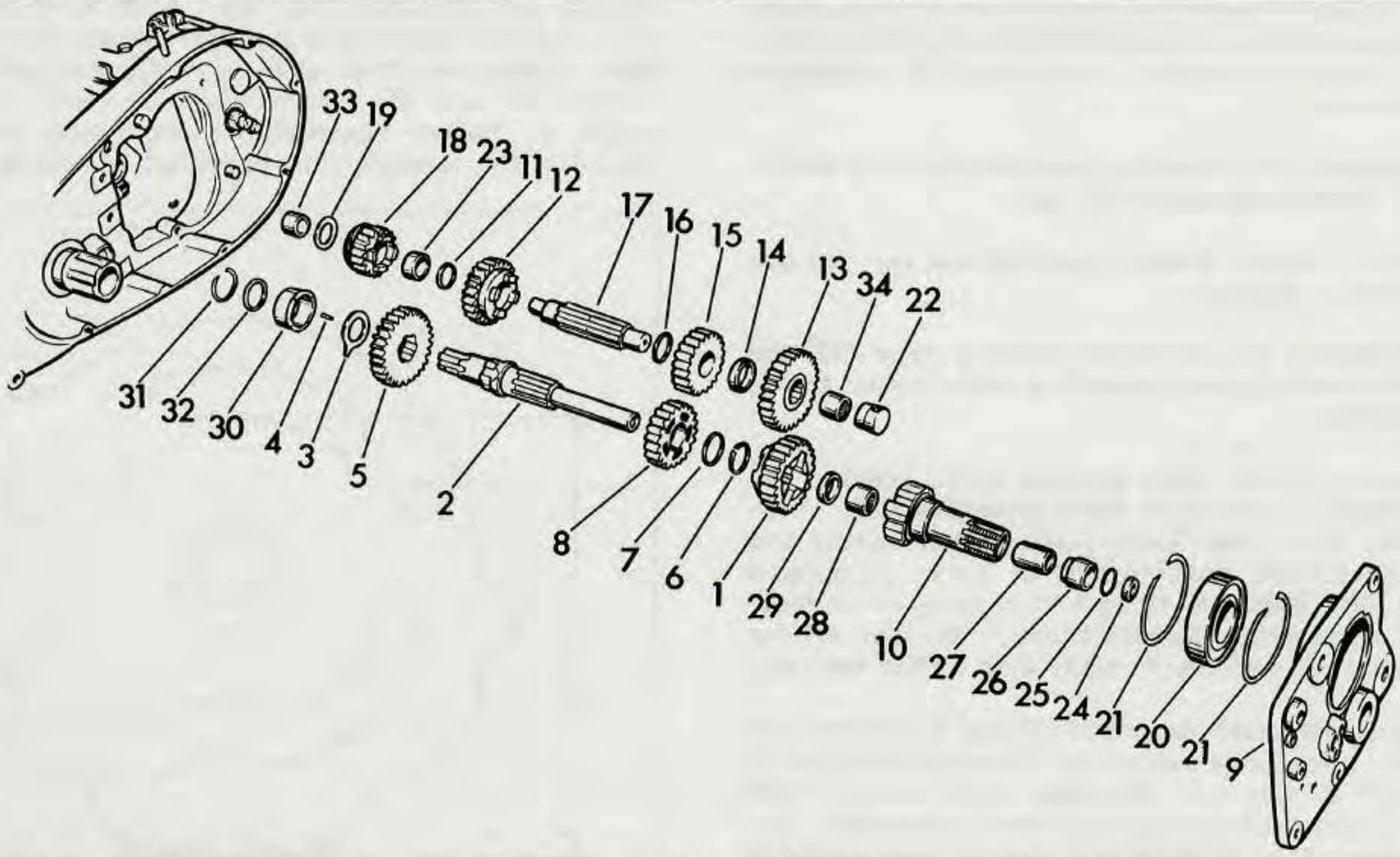
Rotate cam to 3rd gear position and shim as required using quantity of .010 thick shims (7A, fig. 4D-19) necessary to obtain 3-1/2 in. dimension measured to cam surface as shown.

Figure 4D-19A. Pawl Carrier Support Shimming Dimension

See Fig. 4D-20. Supporting access cover on arbo. press table, install clutch gear (10) into ball bearing. Assemble thrust washer (16), second gear (15) and gear spacer (14) on countershaft (17). Assemble drive gear (13) on shaft. Make sure gear (15) turns free. Install countershaft group in access cover.

In one move, install mainshaft second gear (1) and shifter fork (10, Fig. 4D-19). Slip fork on shaft (16, Fig. 4D-19) finger roller stud positioned towards access cover and fork finger engaged in running slot of gear. Repeat operation with second fork and countershaft third gear (12), finger roller stud positioned away from access cover.

Install finger rollers (11) on shifter forks and insert cam followers (12) and spring (13) in follower (14, Fig. 4D-19). Be sure cam follower (12) is free in cam follower retainer (14).



1. Mainshaft second gear
2. Transmission mainshaft
3. Mainshaft thrust washer
4. Transmission mainshaft roller (23)
5. Mainshaft low gear
6. Mainshaft third gear retainer ring
7. Mainshaft third gear washer
8. Mainshaft third gear
9. Access cover
10. Clutch gear
11. Countershaft low gear washer
12. Countershaft third gear
13. Countershaft drive gear
14. Countershaft gear spacer
15. Countershaft second gear
16. Countershaft second gear thrust washer
17. Transmission countershaft
18. Countershaft low gear
19. Countershaft low gear washer
20. Mainshaft ball bearing
21. Mainshaft ball bearing snap ring (2)
22. Countershaft oiler plug
23. Countershaft low gear bushing
24. Clutch gear oil seal
25. Clutch hub nut "O" ring
26. Clutch gear oil seal extension
27. Clutch gear bushing
28. Clutch gear needle roller bearing
29. Mainshaft thrust washer
30. Mainshaft roller bearing race
31. Mainshaft roller bearing retainer ring
32. Mainshaft roller bearing washer
33. Countershaft bearing - closed end
34. Countershaft bearing - open end

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

Figure 4D-20. Countershaft and Mainshaft Group - Exploded View

Assemble shifting mechanism to access cover with cap screw (1) and retainer ring (2, Fig. 4D-19). In the same operation, engage shifter fork finger rollers in slots of shifter cam (5).

Install the following parts on mainshaft (2, Fig. 4D-20): Low gear (5), third gear (8), third gear washer (7) and retainer ring (6). Always replace ring (6). Use Sleeve, Part No. 96396-52, to install (6) in groove of mainshaft. This tool prevents the retainer ring from spreading out of shape during the assembly operation.

Insert assembled mainshaft group in second gear (1) and clutch gear (10). Select the thinnest low gear variable washer (11) available and position against shoulder on countershaft. Position low gear (18) on shaft and with a feeler gauge check clearance between clutch faces of gears (18 and 12). Use variable-size washers to attain .038 to .058 in. clearance. Washers are available in .065, .075, .085, .100 in. thickness.

See Fig. 4D-18. With all parts assembled to access cover, except variable-size washers (3 and 19), rollers (4), washer (32) and retainer ring (31), check operation of transmission by shifting through range of gears several times. Then shift into neutral position (between first and second gear positions), and with a feeler gauge check clearance between clutch faces of gears (15 and 12). If correct clearance of .038 to .058 in. is not obtained, it is possible that shifter forks (10) are bent and should be replaced.

ESTABLISHING MAINSHAFT AND COUNTERSHAFT END PLAY

Temporarily select the thinnest variable low gear washer (Fig. 4D-20) and mainshaft third gear washer (3) and install in their respective positions. Install washer (3), ear of washer down as positioned in transmission compartment, using grease to hold in place.

Temporarily install access cover to crankcase with all transmission parts. Carefully align cover on dowel pins and with a rawhide mallet, gently tap cover into position. Secure access cover with four cap screws (2, Fig. 4D-15).

Using a dial indicator, check end play of mainshaft (2), gauging from sprocket side of shaft. Move shaft back and forth and measure end play. With access cover still in place, measure end play of countershaft from access cover side using a dial indicator. Bend a discarded spoke and wedge in countershaft (17) end hole. Pull and push countershaft and at the same time, measure amount of end play. If end play of either transmission mainshaft (2) or countershaft (17) is not within .004 to .009 in. limits, it is necessary to remove access cover and install correct size variable thickness washers (3 and 19) to obtain correct fit. Variable size washers are available in .050, .055, .060, .065, .070 and .075 in. thickness.

With mainshaft and countershaft end play established, center the gear shifter lever arm shaft (17, Fig. 4D-19), so that it will engage with gear shifter pawl yoke when access cover is in place. Make sure lever arm is correctly engaged with shifter pawl yoke by lightly rotating countershaft (17) and testing for engagement.

With transmission and access cover assembled, install 23 mainshaft rollers (4, Fig. 4D-20) in bearing race using grease to hold in position. Install roller bearing washer and roller bearing retainer ring (32 and 31).

INSTALLING MAINSHAFT SPROCKET, STARTER AND CLUTCH ASSEMBLIES

Install foot shift lever and shift transmission into fourth gear. See Fig. 4D-15. Install gasket (6), oil seal and retainer (5) and screws (4). Do not tighten screws (4). Temporarily position sprocket (3) on mainshaft to correctly locate retainer (5). Remove sprocket (3) and securely tighten screws (4). Reassemble sprocket, lock washer (2) and mainshaft nut (1). Bend ears of lock washer (2) against head of nut (1). Install release rod end, and chain. Tighten nut (1).

Install starter as described in "Starter," Section 4C.

Install clutch as described in "Clutch," Section 4B.

Fill transmission compartment with engine oil as described in "Lubrication," paragraph following.

CRANKCASE AND TRANSMISSION ASSEMBLY PROCEDURE

The following assembly procedure should be followed only if the crankcases have been separated, an operation normally performed in conjunction with a complete engine overhaul.

Position left crankcase ride on workbench with transmission compartment facing up. Proceed to assemble transmission shifter mechanism, mainshaft and countershaft groups as described in "Assembling Transmission."

To establish correct transmission mainshaft and countershaft end play, temporarily assemble right and left crankcase sides together, less flywheel assembly with two upper and two lower case bolts. Then, follow the procedure for establishing correct end play as described in "Establishing Mainshaft and Countershaft End Play." Disregard instructions pertaining to removing and installing access cover.

When transmission is completely reassembled and correct tolerances established, continue to reassemble crankcase as described in "Assembling Crankcase," Section 3E. Fill transmission compartment with engine oil as described below.

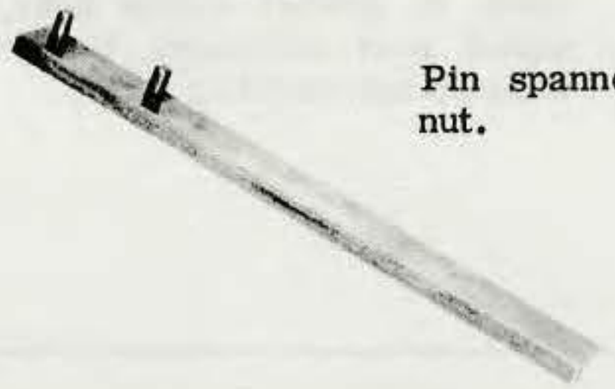
LUBRICATION

With motorcycle standing straight up, remove oil filler plug and oil level plug. The oil filler plug is located near the top of the chain case cover and the oil level plug is located near the bottom of the chain case cover.

Refill transmission with same grade of oil used in engine. Add oil until it begins to overflow through oil level hole. Permit excess oil to flow from oil level hole until it ceases to run. This is correct oil level. Re-insert and tighten oil level and oil filler plug.

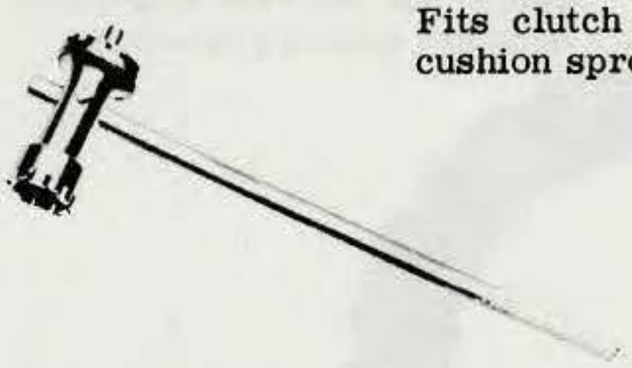
Drain transmission and refill to correct level with fresh, clean oil once each year or every 5000 miles, whichever comes first. If transmission should become submerged in water, drain immediately and refill with clean oil to the correct level.

94557-55 COMPENSATING SPROCKET SHAFT NUT WRENCH



Pin spanner wrench for shaft nut.

94647-52 CLUTCH HUB NUT AND ENGINE SPROCKET LOCK NUT WRENCH

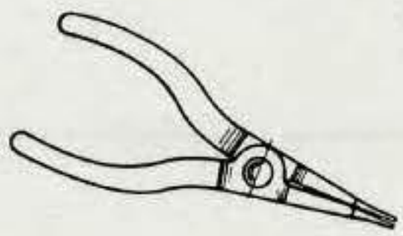


Fits clutch hub nut and engine cushion sprocket lock nut.

94829-42 CLUTCH GEAR BUSHING REAMER



95017-61 EXTERNAL LOCK RING PLIERS



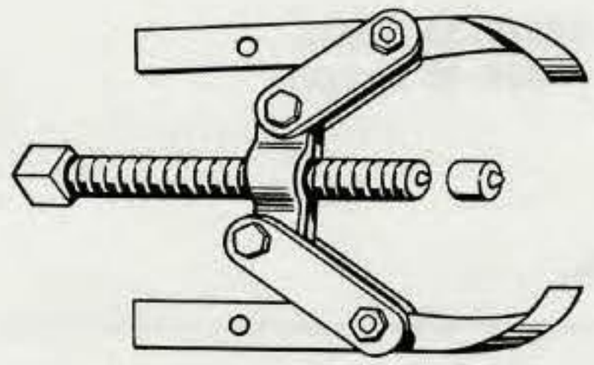
Special pliers for removing and replacing lock rings.

95560-57 TRANSMISSION ACCESS COVER PULLER

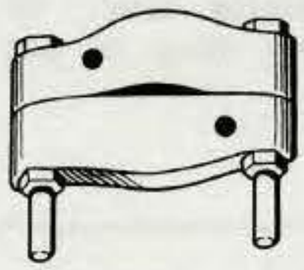


Screws onto clutch gear end and pulls transmission access cover which is a press fit on two dowels.

95635-46 ALL PURPOSE CLAW PULLER

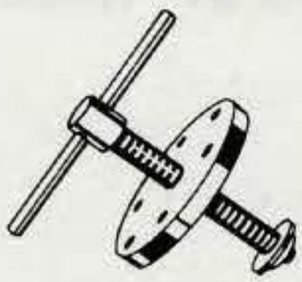


95637-46 WEDGE ATTACHMENT FOR CLAW PULLER



Used in combination with claw puller for pulling close fitting gears or bearings.

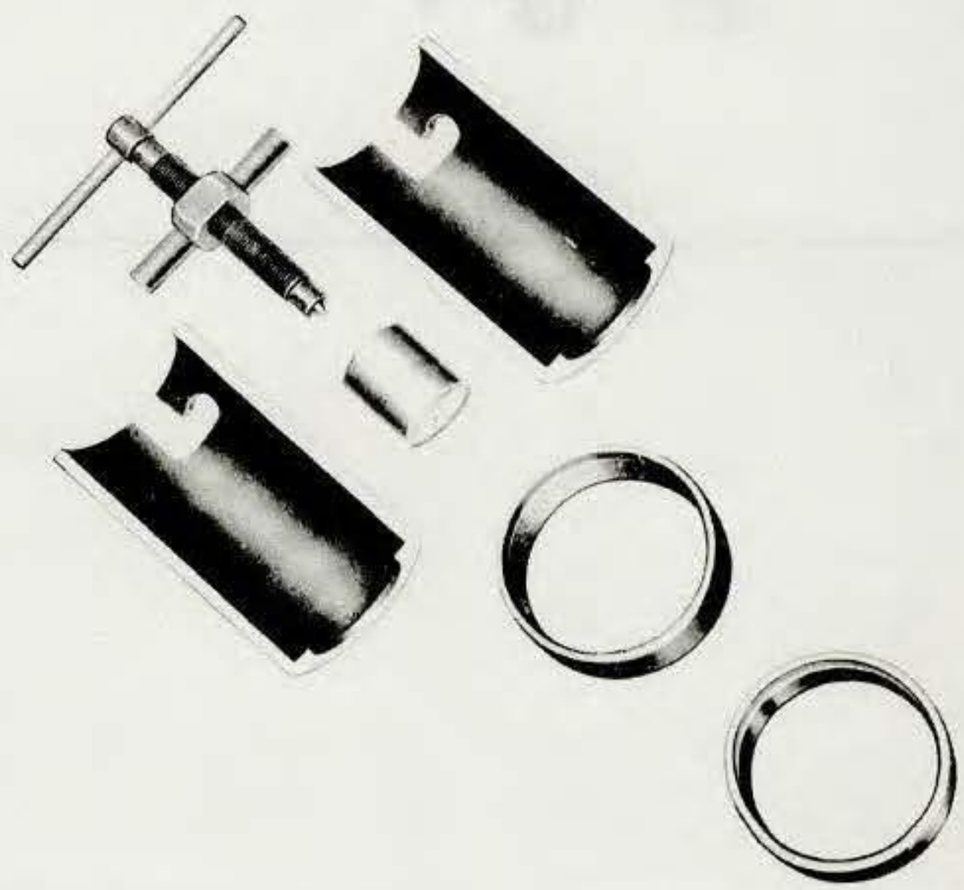
95960-52 CLUTCH HUB PULLER



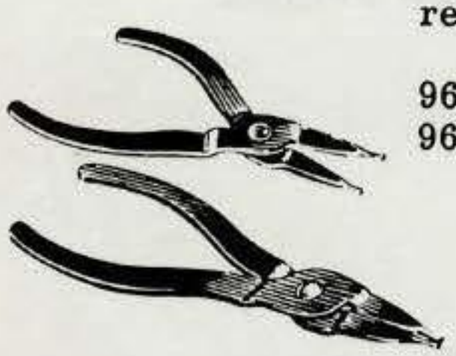
Used to pull clutch hub from clutch gear spline.

96015-56 SPROCKET SHAFT EXTENSION PULLER

Used to remove sprocket shaft extension.



INTERNAL LOCK RING PLIERS



Special pliers for removing and replacing lock rings.

96215-49 Small.
96216-49 Large.

96396-52 MAINSHAFT 3RD GEAR RETAINING RING SLEEVE



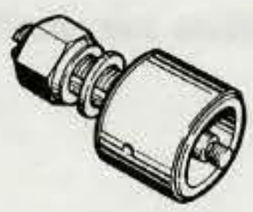
For installation of mainshaft 3rd gear retaining ring - to insure retaining ring is not spread too much.

97081-54 SPROCKET SHAFT BEARING TOOL

For installing flywheel assembly into crankcase Timken bearing.



97170-55A HUB INSTALLING TOOL



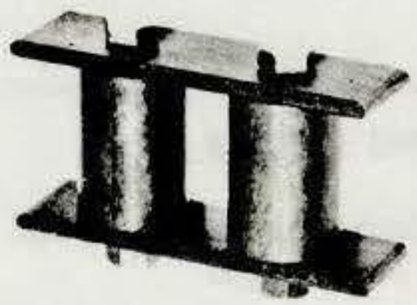
Used to install clutch hubs, clutch gear extension, transmission mainshaft sprocket.

97175-55 CLUTCH LOCK PLATE

Used to hold clutch shell from turning when engine sprocket, clutch hub and rear chain front sprocket nuts are removed.



97200-55 SPROCKET LOCKING LINK



Locks the engine sprocket teeth and the clutch sprocket teeth to prevent rotation when nuts are removed or installed.

ELECTRICAL 5

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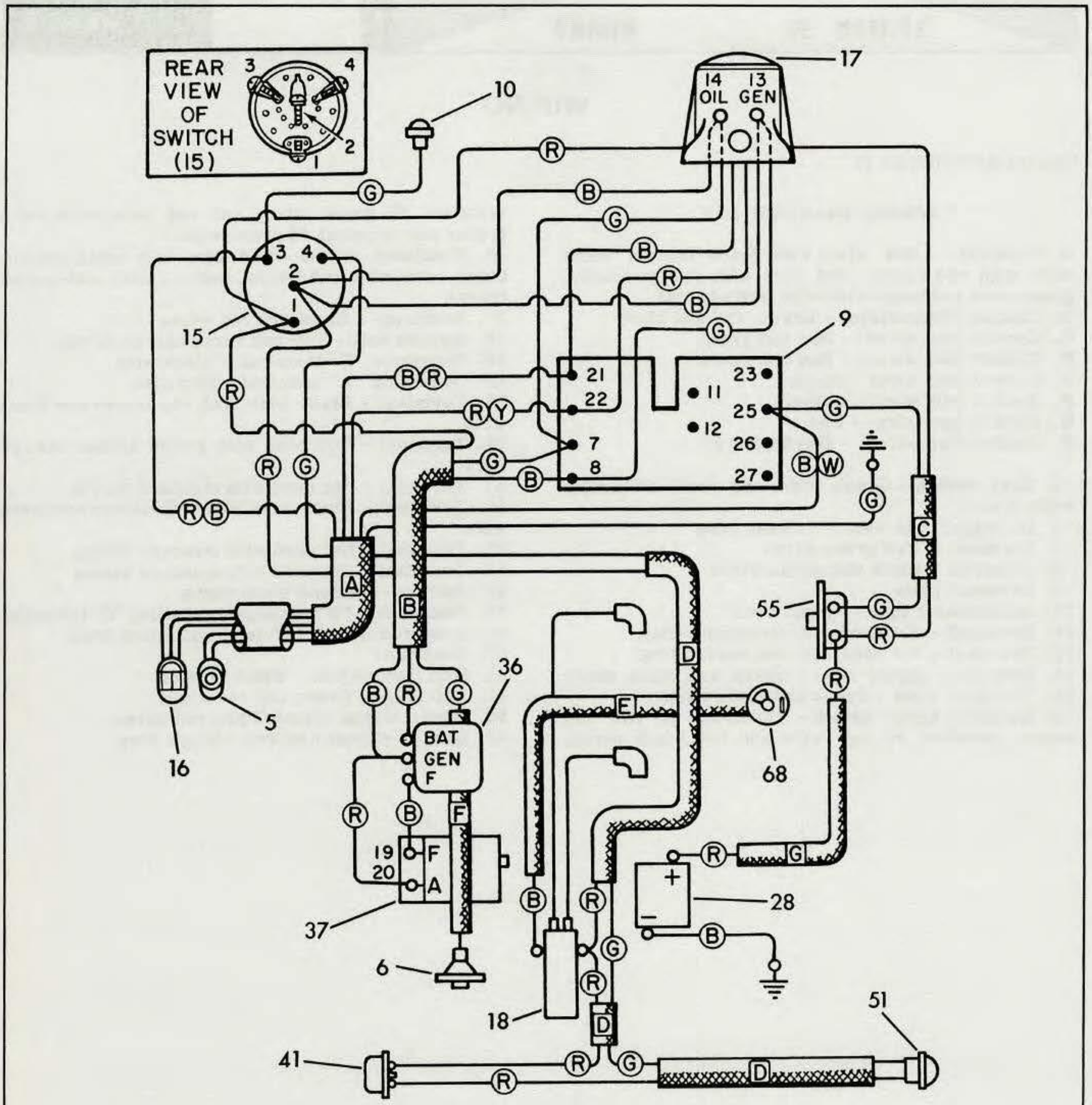
WIRING

1959-64 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar - Red wire with black tracer, black wire with red tracer, red wire with yellow tracer, green wire and black wire with white tracer
B. Conduit (three wires) - Green, red and black
C. Conduit (two wires) - Red and green
D. Conduit (two wires) - Red and green
E. Conduit (one wire) - Black
F. Conduit (one wire) - Green
G. Conduit (one wire) - Red
H. Conduit (two wires) - Black and red

5. Horn switch - Green wire and black wire with white tracer
6. Oil signal light switch - Green wire
7. Terminal - Two green wires
8. Terminal - Black and green wires
9. Terminal plate
10. Speedometer light - Green wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Generator signal light - Green and black wires
14. Oil signal light - Green and black wires
15. Ignition - Light switch - Terminal #1 two red wires, terminal #2 red wire and two black wires, terminal #3 green wire, and red wire with black tracer and terminal #4 green wire
16. Headlamp switch - Red wire with black tracer, black wire with red tracer, and red wire with yellow tracer
17. Headlamp - Black and red wires
18. Ignition coil - Two red wires and black wire
19. Generator "F" terminal - Black wire
20. Generator "A" terminal - Red wire
21. Terminal - Black wire with red tracer and black wire
22. Terminal - Red wire with yellow tracer and red wire
23. Terminal - Not used with standard wiring
25. Terminal - Black wire with white tracer and green wire
26. Terminal - Not used with standard wiring
27. Terminal - Not used with standard wiring
28. Battery - Red and black wires
36. Regulator - "B" terminal, red wire; "G" terminal, black and red wires; "F" terminal, black wire
37. Generator
41. Stop light switch - Two red wires
51. Tail lamp - Green and red wires
55. Horn - Green wire and two red wires
68. Ignition circuit breaker - Black wire



KEY TO COLOR CODE	
(B) BLACK	(B)(R) BLACK WITH RED TRACER
(G) GREEN	(B)(W) BLACK WITH WHITE TRACER
(R) RED	(R)(B) RED WITH BLACK TRACER
	(R)(Y) RED WITH YELLOW TRACER
Letters in [ ] identify cables and conduit housed wires	

Figure 5B-2. 1959-64 Sportster H - Wiring Diagram

WIRING

1959-62 SPORTSTER CH

WIRING DIAGRAM KEY

A. Conduit (One wire) - Black

B. Conduit (One wire) - Black

C. Conduit (Two wires) - Red and green wires

D. Conduit (One wire) - Red

E. Conduit (Two wires) - Red and green wires

F. Conduit (Two wires) - Red and green wires

1. Horn Switch - Black wire
2. Headlamp - Black and red wires
3. Ignition Cutout Switch - Black wire
4. Generator -
   "F" Terminal - Green wire
   "A" Terminal - Red wire
5. Headlamp Switch -
   Terminal "B" - Red wire
   Terminal 1 - Green wire
   Terminal 2 - Red wire
   Terminal 3 - Black wire
6. Fuse - Two green wires
7. Voltage Regulator -
   "F" Terminal - Green wire
   "GEN" Terminal - Red wire
   "BAT" Terminal - Red wire
8. Magneto - Black wire
9. Stoplight Switch - Two red wires
10. Tail and Stop Lamp - Red and green wires
11. Horn -
    Upper Terminal - Black wire
    Lower Terminal - Three red wires

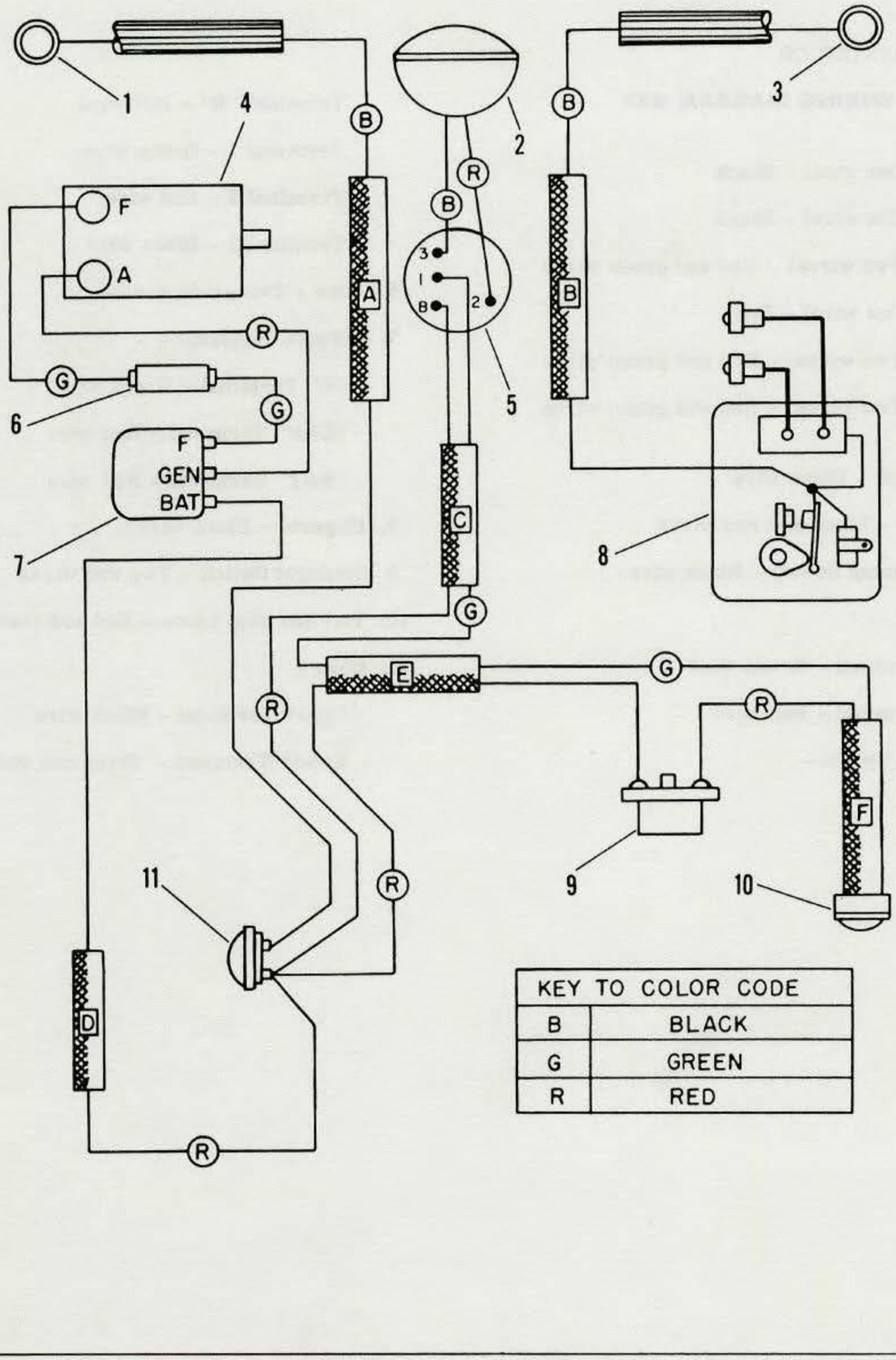


Figure 5B-7. 1959-62 Sportster CH - Wiring Diagram

WIRING

1963-64 SPORTSTER CH

WIRING DIAGRAM KEY

A. Conduit (One wire) - Black

B. Conduit (One wire) - Black

C. Conduit (Two wires) - Red and green wires

D. Conduit (One wire) - Red

E. Conduit (Two wires) - Red and green wires

F. Conduit (Two wires) - Red and green wires

G. Conduit (Three wires) - 2 Red and 1 Black wire

1. Horn Switch - Black wire
2. Headlamp - Black and red wires
3. Dimmer Switch - 2 Red and 1 Black wire
4. Ignition Cut-out Switch - Black wire
5. Generator

   "F" Terminal - Black wire

   "A" Terminal - Red wire
6. Light Switch - 2 Red and 1 Green wire
7. Ignition ground switch lock
8. Voltage Regulator -

   "F" Terminal - Black wire

   "GEN" Terminal - Red wire

   "BAT" Terminal - Red wire
9. Magneto - Black wire
10. Stop Light Switch - Two red wires
11. Tail and Stop Lamp - Red and green wires
12. Horn -

    Upper Terminal - Black wire

    Lower Terminal - Three red wires and capacitor wire
13. Capacitor

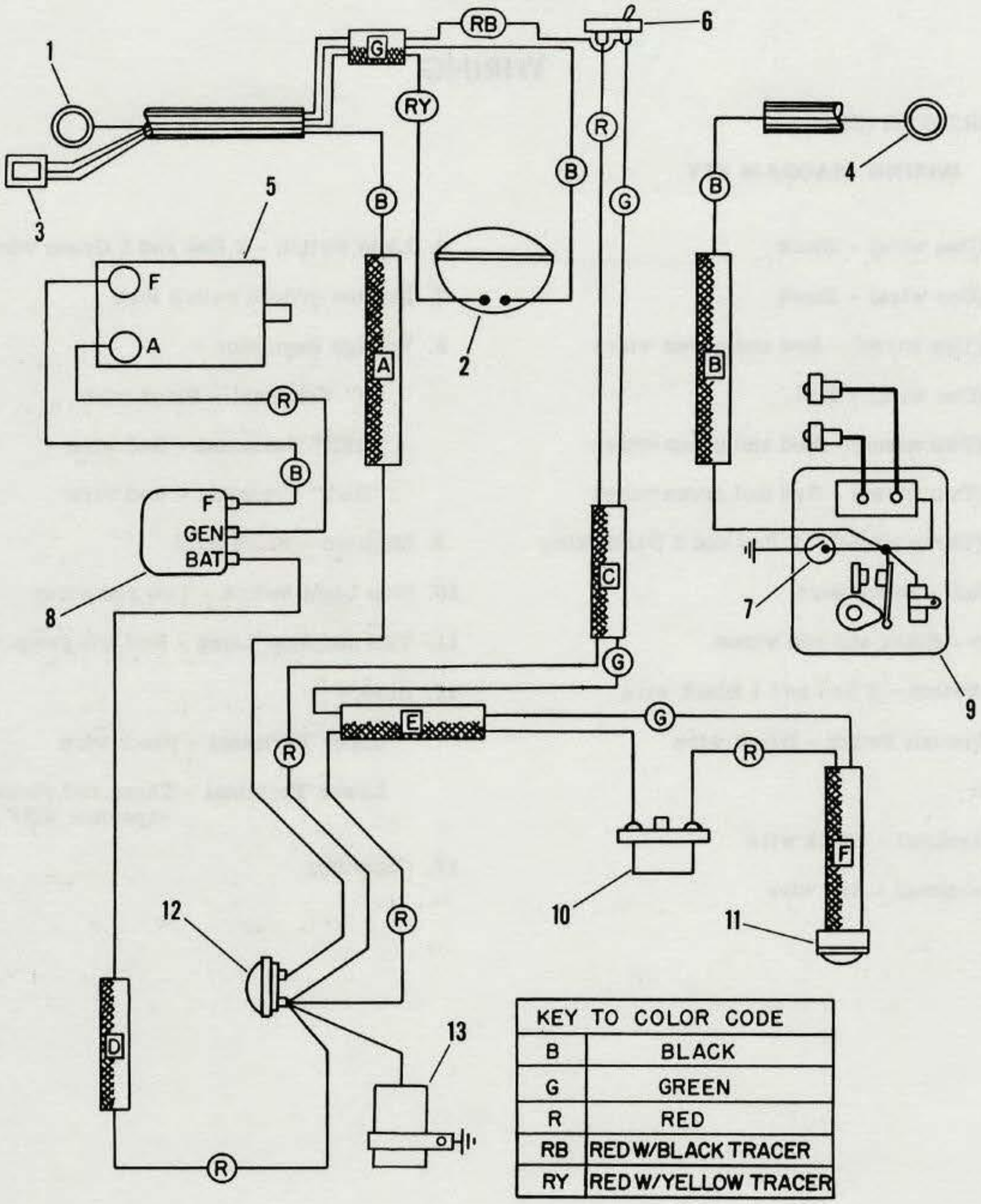


Figure 5B-12. 1963-64 Sportster CH - Wiring Diagram

WIRING

1965-66 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar - Red wire with black tracer, black wire with red tracer, red wire with yellow tracer, 2 black wires.
B. Conduit (three wires) - Green, red and black
C. Conduit - green wire
D. Conduit (two wires) - Red and green
E. Conduit (one wire) - Black
F. Conduit (one wire) - Green
G. Conduit (3 wires) - Red and 2 green
H. Conduit (two wires) - Black and red

5. Horn switch - 2 black wires
6. Oil signal light switch - Green wire
7. Terminal - Two green wires
8. Terminal - Black, red, and rectifier positive terminal.
9. Terminal plate
10. Speedometer light - Green wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Generator signal light - Green and black wires
14. Oil signal light - Green and black wires
15. Ignition - Light switch - Terminal #1 red wire, terminal #2 red wire and three black wires, terminal #3 green wire, and red wire with black tracer and terminal #4 green wire
16. Headlamp switch - Red wire with black tracer, black wire with red tracer, and red wire with yellow tracer
17. Headlamp - Black and red wires
18. Ignition coil - Three red wires and black wire
19. Generator "F" terminal - Green wire
20. Generator "A" terminal - Red wire
21. Terminal - Black wire with red tracer and black wire
22. Terminal - Red wire with yellow tracer and red wire
23. Terminal - Not used with standard wiring
25. Terminal - Black wire and green wire
26. Terminal - Not used with standard wiring
27. Terminal - Not used with standard wiring
28. Terminal - Green wire and rectifier negative terminal.
29. Front battery -
    Negative Terminal - black wire
    Positive Terminal - white wire
30. Rear Battery -
    Positive Terminal - red wire
    Negative Terminal - white wire
31. Generator - See Terminals 19 and 20
32. Regulator -
    B+ Terminal - 2 Red wires
    DF Terminal - Green wire
    D+ Terminal - Black wire
    Gnd Terminal - Black wire
    G1 Terminal - Not used with standard wiring
33. Terminal, Frame Screw - 2 black wires
34. Stoplight Switch - 2 red wires
35. Tail Lamp - Red and green wires
36. Horn - Green wire
37. Circuit Breaker - 2 Black wires
38. Rectifier -
    Positive Terminal (painted red) to terminal No. 8.
    Negative Terminal to terminal No. 28.

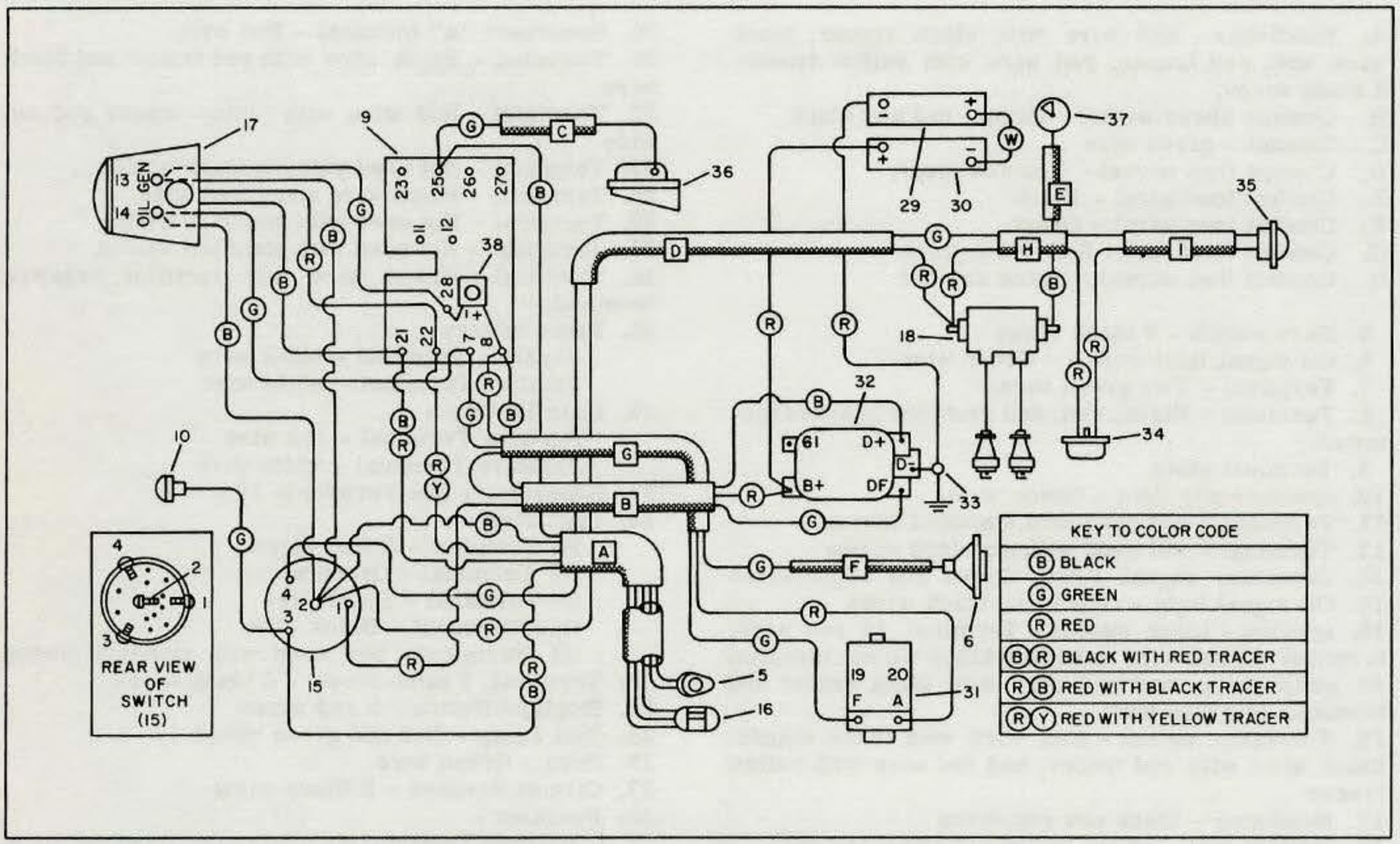


Figure 5B-17. 1965-66 Sportster H - Wiring Diagram

WIRING

1965-66 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar - Red wire with black tracer, black wire with red tracer, red wire with yellow tracer, 2 black wires.
B. Conduit (three wires) - Green, red and black
C. Conduit - green wire
D. Conduit (two wires) - Red and green
E. Conduit (one wire) - Black
F. Conduit (one wire) - Green
G. Conduit (3 wires) - Red and 2 green
H. Conduit (two wires) - Black and red

5. Horn switch - 2 black wires
6. Oil signal light switch - Green wire
7. Terminal - Two green wires
8. Terminal - Black, red, and rectifier positive terminal.
9. Terminal plate
10. Speedometer light - Green wire
11. Terminal - Not used with standard wiring
12. Terminal - Not used with standard wiring
13. Generator signal light - Green and black wires
14. Oil signal light - Green and black wires
15. Ignition - Light switch - Terminal #1 red wire, terminal #2 red wire and three black wires, terminal #3 green wire, and red wire with black tracer and terminal #4 green wire
16. Headlamp switch - Red wire with black tracer, black wire with red tracer, and red wire with yellow tracer
17. Headlamp - Black and red wires
18. Ignition coil - Three red wires and black wire
19. Generator "F" terminal - Green wire
20. Generator "A" terminal - Red wire
21. Terminal - Black wire with red tracer and black wire
22. Terminal - Red wire with yellow tracer and red wire
23. Terminal - Not used with standard wiring
25. Terminal - Black wire and green wire
26. Terminal - Not used with standard wiring
27. Terminal - Not used with standard wiring
28. Terminal - Green wire and rectifier negative terminal.
29. Front battery -
    Negative Terminal - black wire
    Positive Terminal - white wire
30. Rear Battery -
    Positive Terminal - red wire
    Negative Terminal - white wire
31. Generator - See Terminals 19 and 20
32. Regulator -
    B+ Terminal - 2 Red wires
    DF Terminal - Green wire
    D+ Terminal - Black wire
    Gnd Terminal - Black wire
    G1 Terminal - Not used with standard wiring
33. Terminal, Frame Screw - 2 black wires
34. Stoplight Switch - 2 red wires
35. Tail Lamp - Red and green wires
36. Horn - Green wire
37. Circuit Breaker - 2 Black wires
38. Rectifier -
    Positive Terminal (painted red) to terminal No. 8.
    Negative Terminal to terminal No. 28.

1966 SPORTSTER CH

WIRING DIAGRAM KEY

A. Conduit (one wire) - Black
B. Conduit (one wire) - Black
C. Conduit (two wires) - Red and green
D. Conduit (one wire) - Black
E. Conduit (two wires) - Red and green
F. Conduit (two wires) - Red and green
G. Conduit (three wires) - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
H. Conduit (two wires) - Green and red

1. Horn switch - Two black wires
2. Headlamp - Black wire with red tracer and red wire with yellow tracer
3. Headlamp dimmer switch - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
4. Ignition cut-out switch - Black wire
5. Generator
   "F" terminal - Green wire
   "A" terminal - Black wire
6. Light switch - Red, green and red with black tracer wires
7. Ignition ground switch lock
8. Voltage regulator -
   "DF" terminal - Green wire
   "D+" terminal - Red wire and condenser wire
   "B+" terminal - Two red wires
   "61" terminal - Black wire
9. Magneto - Black wire
10. Stop light switch - Two red wires
11. Tail and stop lamp - Red and green wires
12. Horn - Black wire
13. Capacitor - Center black wire connected to regulator "61" terminal
14. Grounding screw - Black wire
15. Speedometer lamp

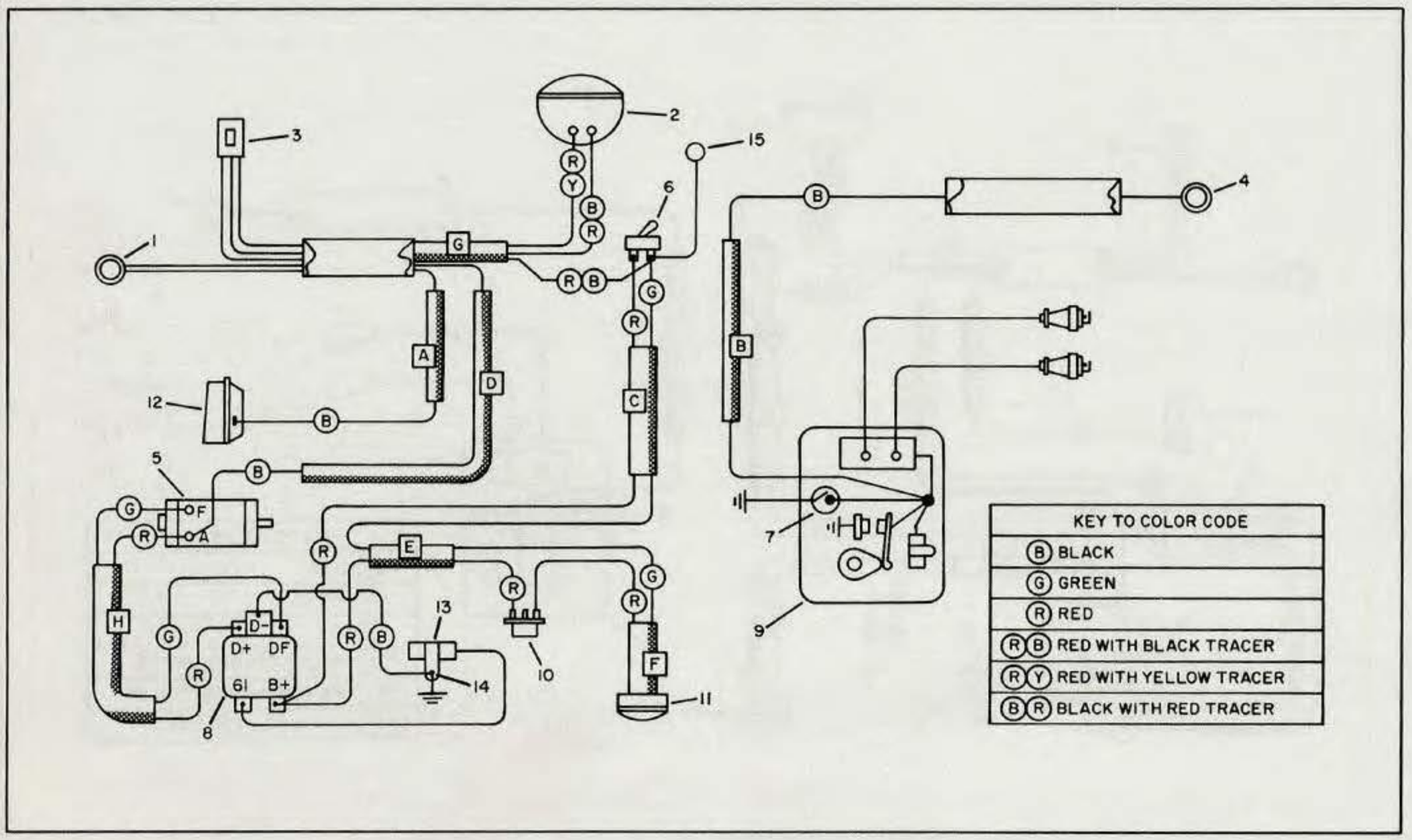


Figure 5B-19. 1966 Sportster CH Wiring Diagram

WIRING

1965 SPORTSTER CH

WIRING DIAGRAM KEY

A. Conduit (One wire) - Black
B. Conduit (One wire) - Black
C. Conduit (Two wires) - Red and green
D. Conduit (One wire) - Black
E. Conduit (Two wires) - Red and green
F. Conduit (Two wires) - Red and green
G. Conduit (Three wires) - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
H. Conduit (Two wires - Green and red

1. Horn Switch - Two black wires
2. Headlamp - Black wire with red tracer and red wire with yellow tracer
3. Dimmer Switch - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
4. Ignition Cut-out Switch - Black wire
5. Generator
"F" Terminal - Green wire
"A" Terminal - Red and black wires
6. Light Switch - (3 wires) - Red, green and red with black tracer
7. Ignition ground switch lock
8. Voltage Regulator -
"61" Terminal - Condenser black wire
DF Terminal - Green wire
D+ Terminal - Red wire and condenser wire
B+ Terminal - Two red wires
Gnd Terminal - Black wire
9. Magneto - Black wire
10. Stop Light Switch - Two red wires
11. Tail and Stop Lamp - Red and green wires
12. Horn - Black wire
13. Capacitor - Lead connected to Regulator 61 terminal
14. Grounding Screw - Black wire and condenser ground starp.

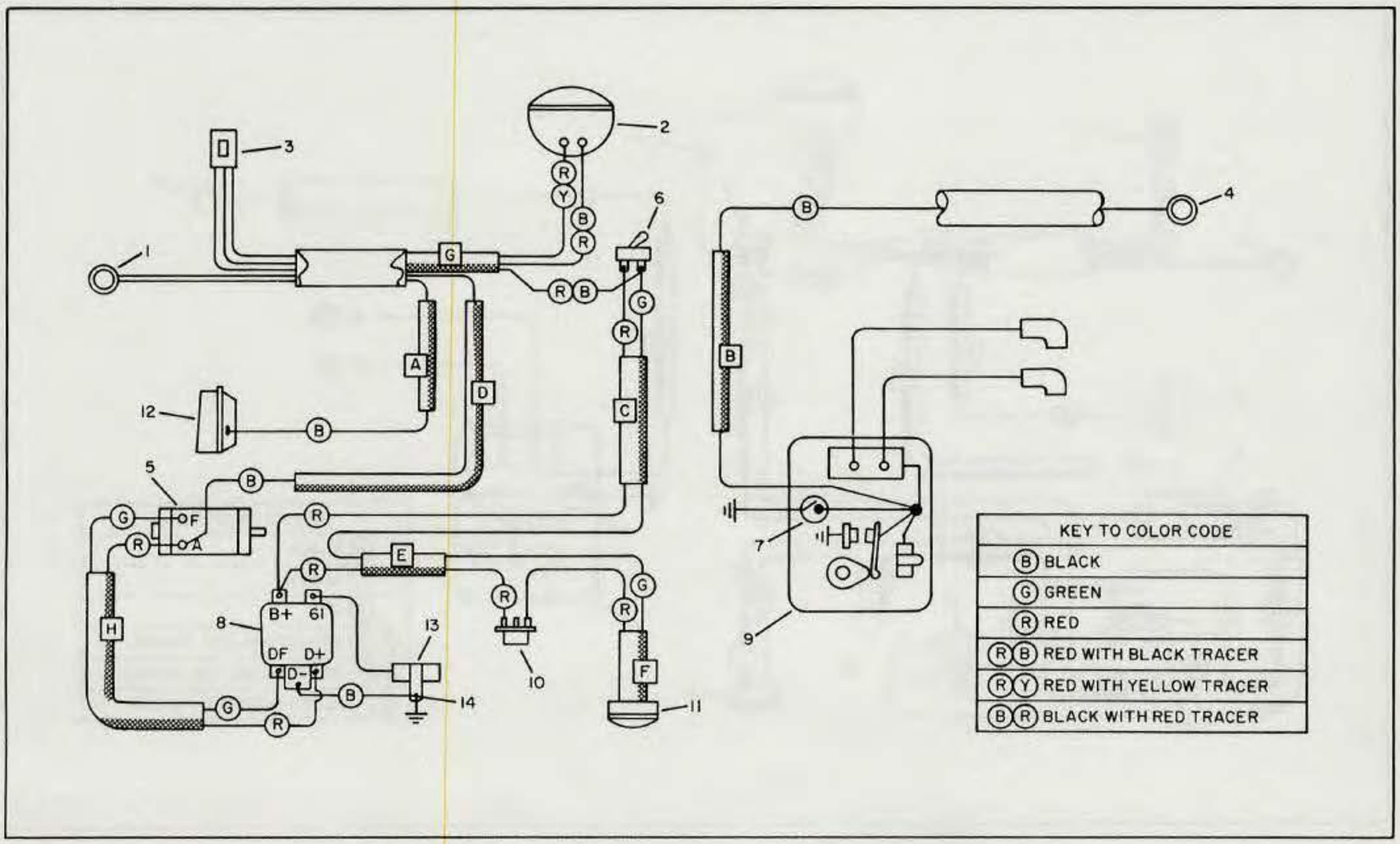


Figure 5B-18. 1965 Sportster CH Wiring Diagram

1967-69 SPORTSTER CH

WIRING DIAGRAM KEY

A. Conduit (one wire) - Black
B. Conduit (one wire) - Black
C. Conduit (two wires) - Red and green
D. Conduit (one wire) - Black
E. Conduit (two wires) - Red
F. Conduit (two wires) - Red and green
G. Conduit (three wires) - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
H. Conduit (two wires) - Green and red

1. Horn switch - Two black wires
2. Headlamp - Black wire with red tracer and red wire with yellow tracer
3. Headlamp dimmer switch - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
4. Ignition cut-out switch - Black wire
5. Generator
   "F" terminal - Green wire
   "A" terminal - Black wire
6. Light switch - Red, green and red with black tracer wires
7. Ignition ground switch lock
8. Voltage regulator -
   "DF" terminal - Green wire
   "D+" terminal - Red wire and condenser wire
   "B+" terminal - Two red wires
   "D-" terminal - Black wire
9. Magneto - Black wire
10. Stop light switch - Two red wires
11. Tail and stop lamp - Red and green wires
12. Horn - Black wire
13. Capacitor - Black wire connected to regulator "D-" terminal
14. Grounding screw - Black wire
15. Speedometer lamp
16. High beam indicator lamp
17. Terminal strip

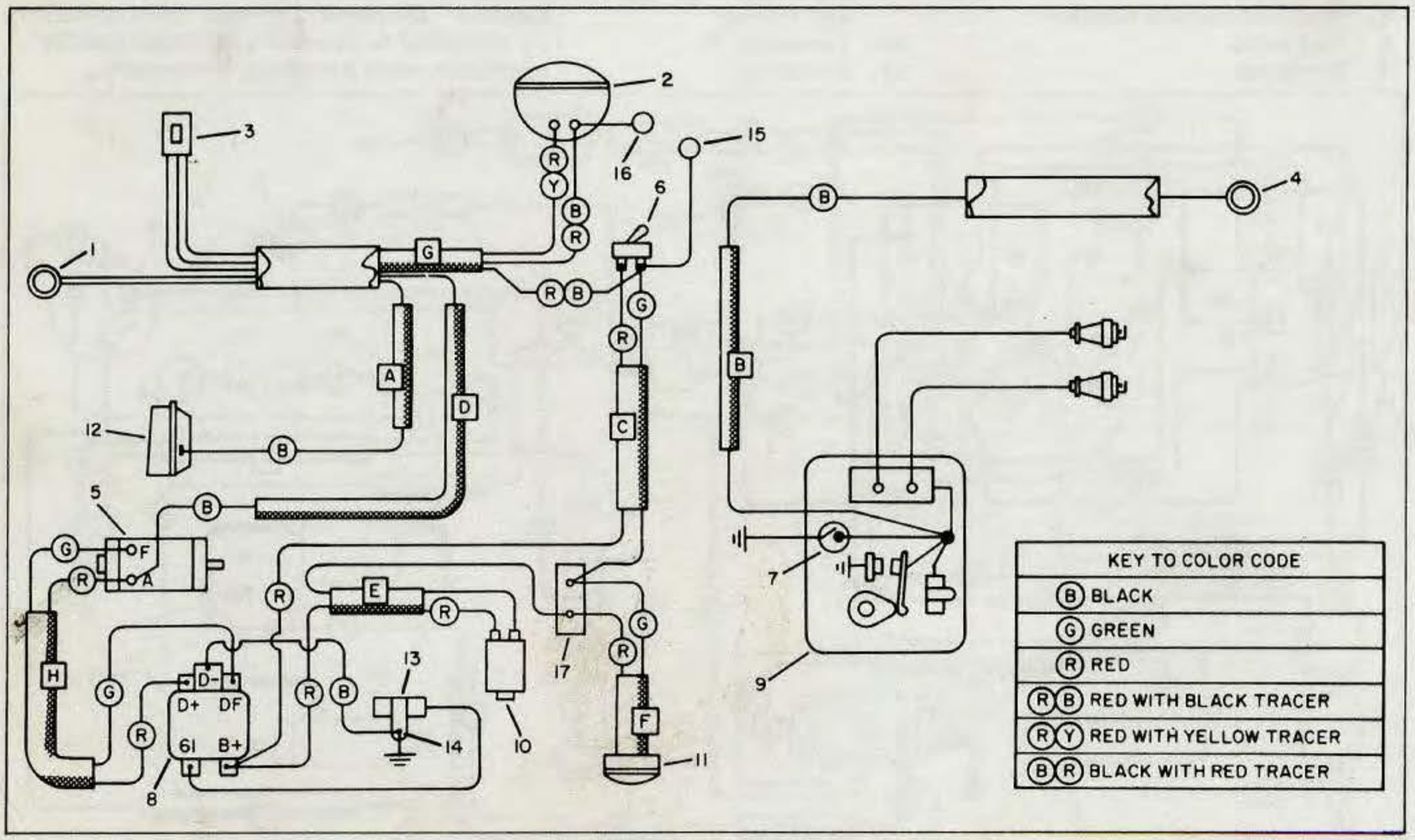


Figure 5B-24. 1967-69 Sportster CH Wiring Diagram

1967 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar (five wires) - red wire with black tracer, black wire with red tracer, red wire with yellow tracer, and 2 black wires
B. Conduit (two wires) - green and red
C. Conduit (one wire) - red
D. Conduit (two wires) - red and green
E. Conduit (one wire) - red
F. Conduit (one wire) - red
G. Conduit (one wire) - black
H. Conduit (two wires) - red
I. Conduit (one wire) - black
J. Conduit (one wire) - green
K. Conduit (two wires) - black
L. Conduit (five wires) - brown, yellow, black, red and green

1. Headlamp dimmer switch
2. Horn switch
3. Generator "F" and "A" terminals
4. Regulator
   "BAT" terminal
   "GEN" terminal
   "F" terminal
5. Overload circuit breaker
6. Tail lamp
7. Terminal
8. Terminal
9. Junction terminal board
10. Starter motor
11. Terminal - not used with standard wiring
12. Terminal
13. Starter solenoid
14. Battery
15. Stoplight switch
16. Ignition coil
17. Circuit breaker
18. Ignition - light switch
19. Oil signal light switch
20. Starter button
21. Horn
22. Terminal plate
23. Terminal
24. Speedometer light
25. Terminal
26. Terminal - not used with standard wiring
27. Terminal - not used with standard wiring
28. Terminal
29. Terminal - not used with standard wiring
30. Terminal
31. Terminal
32. Oil signal light
33. High beam indicator light
34. Generator indicator light
35. Headlamp
36. Left direction signal pilot lamp
37. Right direction signal pilot lamp
38. Tachometer light

KEY TO COLOR CODE	
B	Black
Y	Yellow
BN	Brown
G	Green
R	Red
B R	Black with Red tracer
R B	Red with Black tracer
R Y	Red with Yellow tracer

Caution: Disconnect ground cable at battery (-) terminal to prevent accidental starter operation when servicing motorcycle.

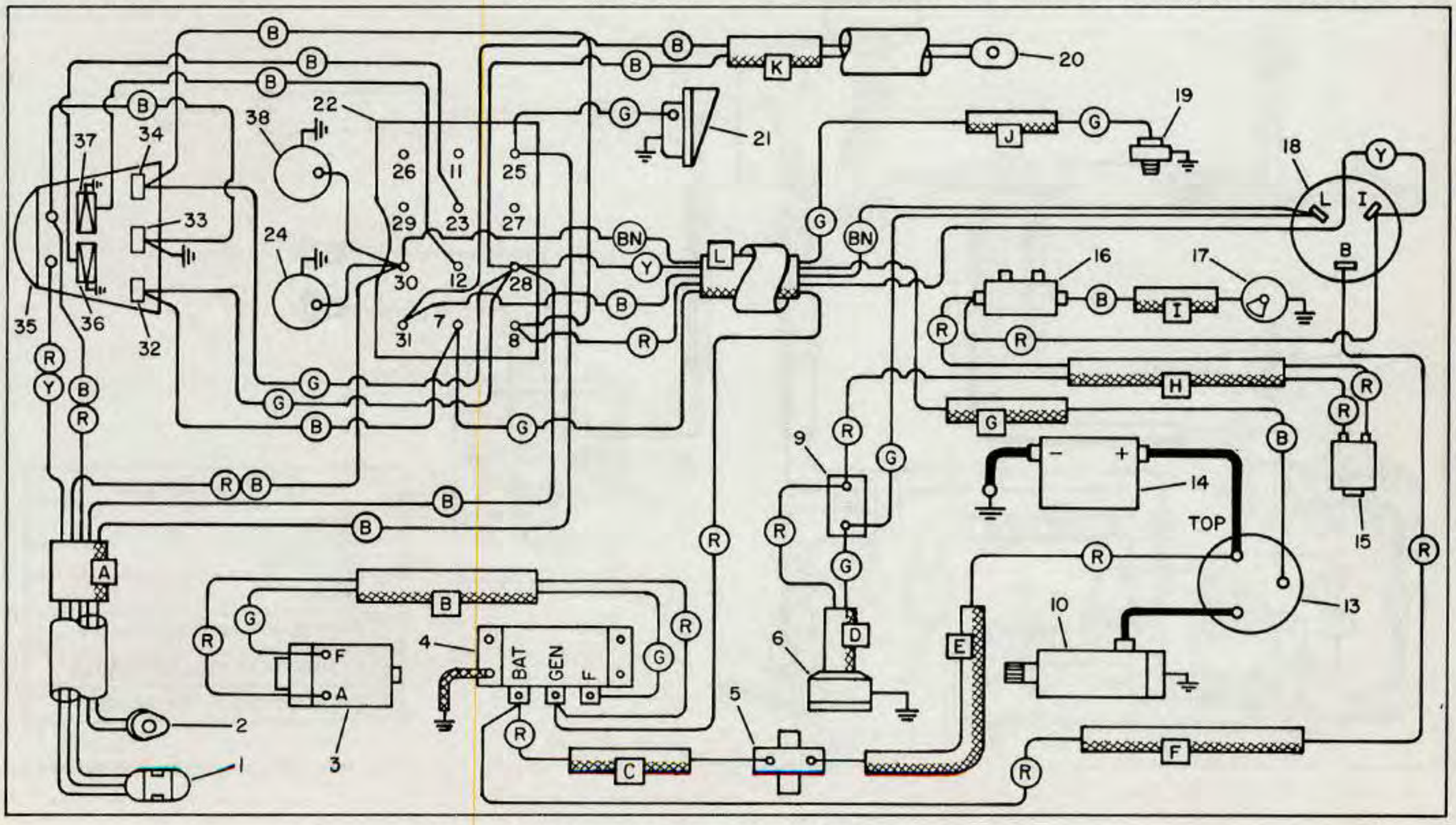


Figure 5B-23. 1967 Sportster H Wiring Diagram

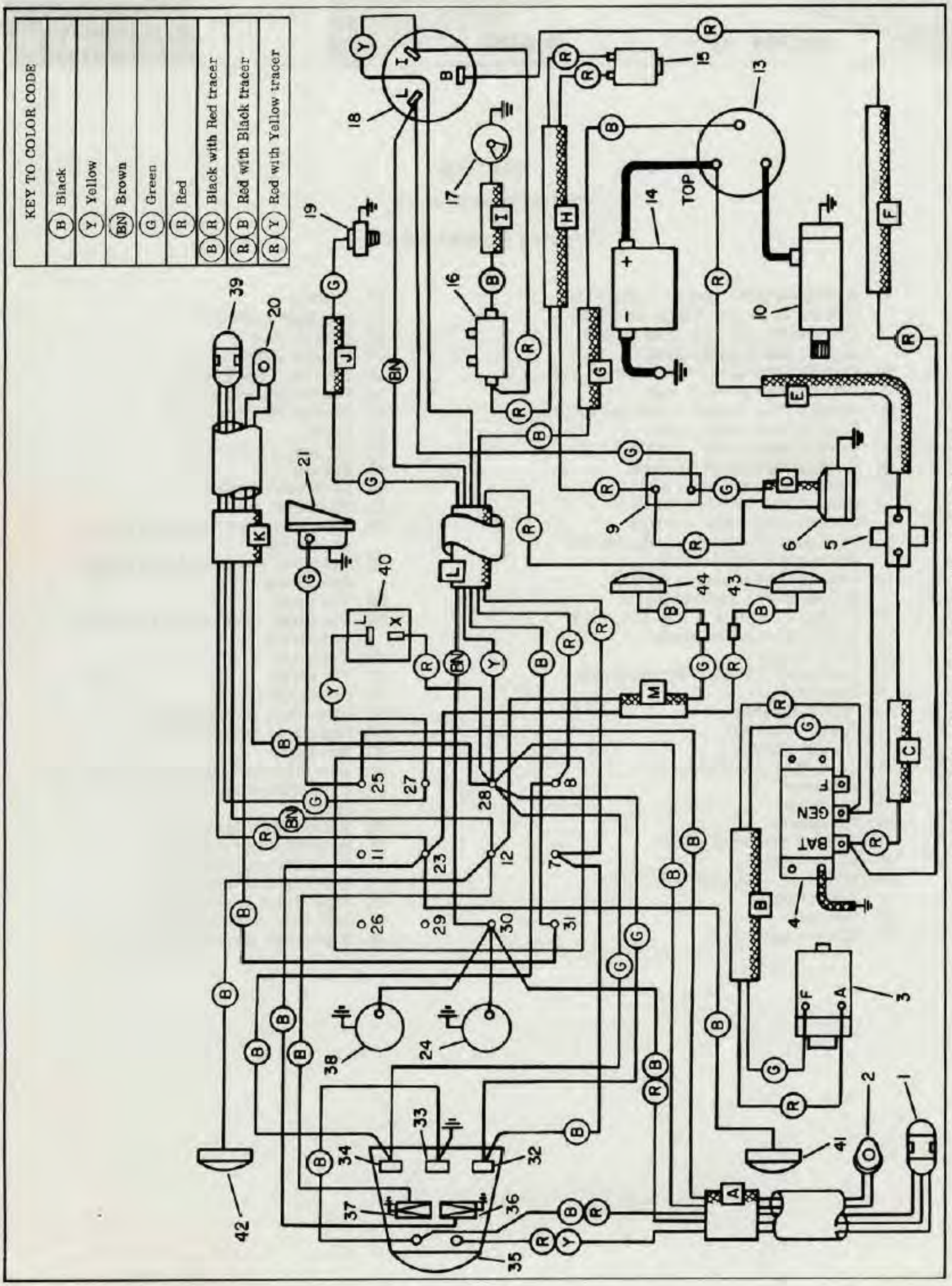


Figure 5B-23A. 1968-69 Sportster H - Wiring Diagram

WIRING

1968-69 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar (five wires) - red wire with black tracer, black wire with red tracer, red wire with yellow tracer, and 2 black wires
B. Conduit (two wires) - green and red
C. Conduit (one wire) - red
D. Conduit (two wires) - red and green
E. Conduit (one wire) - red
F. Conduit (one wire) - red
G. Conduit (one wire) - black
H. Conduit (two wires) - red
I. Conduit (one wire) - black
J. Conduit (one wire) - green
K. Handlebar (5 wires) - red, brown, green and 2 black wires
L. Conduit (five wires) - brown, yellow, black, red and green
M. Conduit (2 wires) - red and green
1. Headlamp dimmer switch
2. Horn switch
3. Generator "F" and "A" terminals
4. Regulator
"BAT" terminal
"GEN" terminal
"F" terminal
5. Overload circuit breaker
6. Tail lamp
7. Terminal
8. Terminal
9. Junction terminal board
10. Starter motor
11. Terminal - not used with standard wiring
12. Terminal
13. Starter solenoid
14. Battery
15. Stoplight switch
16. Ignition coil
17. Circuit breaker
18. Ignition - light switch
19. Oil signal light switch
20. Starter button
21. Horn
22. Terminal plate
23. Terminal
24. Speedometer light
25. Terminal
26. Terminal - not used with standard wiring
27. Terminal - not used with standard wiring
28. Terminal
29. Terminal - not used with standard wiring
30. Terminal
31. Terminal
32. Oil signal light
33. High beam indicator light
34. Generator indicator light
35. Headlamp
36. Left direction signal pilot lamp
37. Right direction signal pilot lamp
38. Tachometer light
39. Direction signal switch
40. Direction signal flasher
41. Left front direction lamp
42. Right front direction lamp
43. Left rear direction lamp
44. Right rear direction lamp

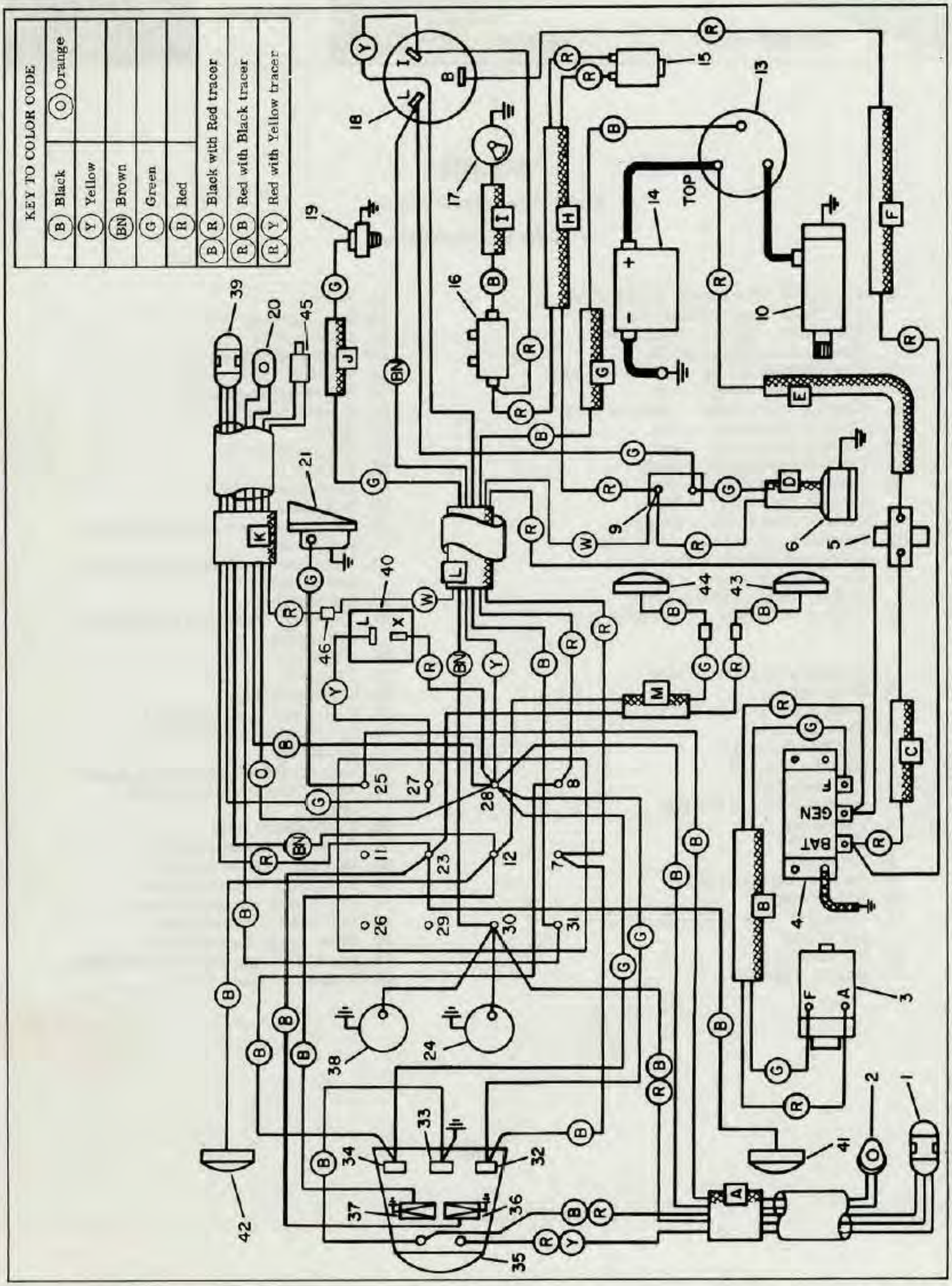


Figure 5B-23B. Late 1969 Sportster H - Wiring Diagram

WIRING

LATE 1969 SPORTSTER H

WIRING DIAGRAM KEY

A. Handlebar (five wires) - red wire with black tracer, black wire with red tracer, red wire with yellow tracer, and 2 black wires
B. Conduit (two wires) - green and red
C. Conduit (one wire) - red
D. Conduit (two wires) - red and green
E. Conduit (one wire) - red
F. Conduit (one wire) - red
G. Conduit (one wire) - black
H. Conduit (two wires) - red
I. Conduit (one wire) - black
J. Conduit (one wire) - green
K. Handlebar (5 wires) - red, brown, green and 2 black wires
L. Conduit (five wires) - brown, yellow, black, red and green
M. Conduit (2 wires) - red and green

1. Headlamp dimmer switch
2. Horn switch
3. Generator "F" and "A" terminals
4. Regulator
   "BAT" terminal
   "GEN" terminal
   "F" terminal
5. Overload circuit breaker
6. Tail lamp
7. Terminal
8. Terminal
9. Junction terminal board
10. Starter motor
11. Terminal - not used with standard wiring
12. Terminal
13. Starter solenoid
14. Battery
15. Stoplight rear switch
16. Ignition coil
17. Circuit breaker
18. Ignition - light switch
19. Oil signal light switch
20. Starter button
21. Horn
22. Terminal plate
23. Terminal
24. Speedometer light
25. Terminal
26. Terminal - not used with standard wiring
27. Terminal - not used with standard wiring
28. Terminal
29. Terminal - not used with standard wiring
30. Terminal
31. Terminal
32. Oil signal light
33. High beam indicator light
34. Generator indicator light
35. Headlamp
36. Left direction signal pilot lamp
37. Right direction signal pilot lamp
38. Tachometer light
39. Direction signal switch
40. Direction signal flasher
41. Left front direction lamp
42. Right front direction lamp
43. Left rear direction lamp
44. Right rear direction lamp
45. Stoplamp front switch (Late 1969)
46. Connector (Late 1969)

LATE 1969 SPORTSTER CH

A. Conduit (one wire) - Black
B. Conduit (one wire) - Black
C. Conduit (two wires) - Red and green
D. Conduit (one wire) - Black
E. Conduit (two wires) - Red
F. Conduit (two wires) - Red and green
G. Conduit (three wires) - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
H. Conduit (two wires) - Green and red

WIRING DIAGRAM KEY

1. Horn switch - Two black wires
2. Headlamp - Black wire with red tracer and red wire with yellow tracer
3. Headlamp dimmer switch - Red wire with black tracer, red wire with yellow tracer, black wire with red tracer
4. Ignition cut-out switch - Black wire
5. Generator
   "F" terminal - Green wire
   "A" terminal - Black wire
6. Light switch - Red, green and red with black tracer wires
7. Ignition ground switch lock
8. Voltage regulator -
   "DF" terminal - Green wire
   "D+" terminal - Red wire and condenser wire
   "B+" terminal - Two red wires
   "D-" terminal - Black wire
9. Magneto - Black wire
10. Stoplight rear switch - Two red wires
11. Tail and stop lamp - Red and green wires
12. Horn - Black wire
13. Capacitor - Black wire connected to regulator "D-" terminal
14. Grounding screw - Black wire
15. Speedometer lamp
16. High beam indicator lamp
17. Terminal strip
18. Stoplamp front switch (Late 1969)
19. Connector (Late 1969)

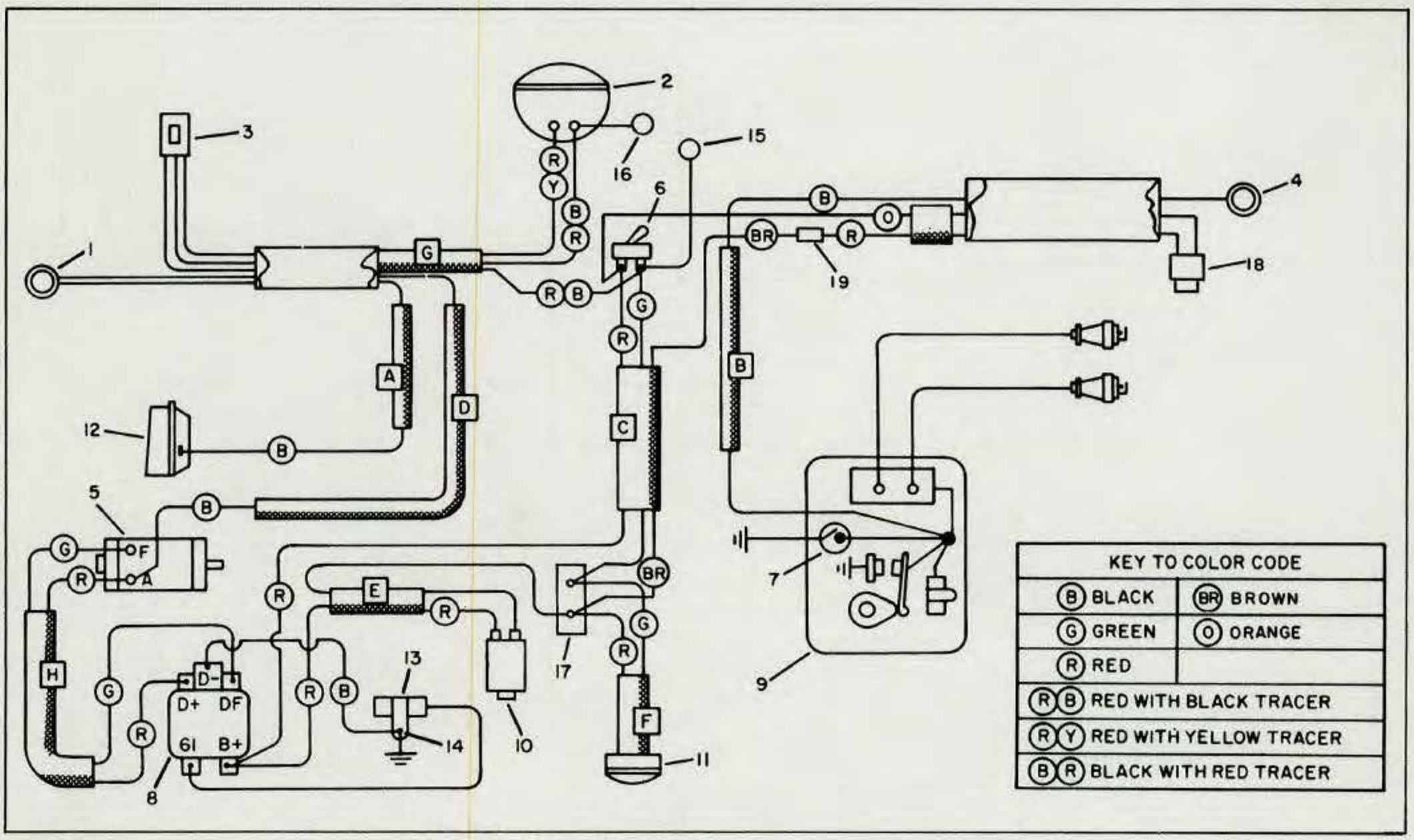


Figure 5B-23C. Late 1969 Sportster CH Wiring Diagram

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.

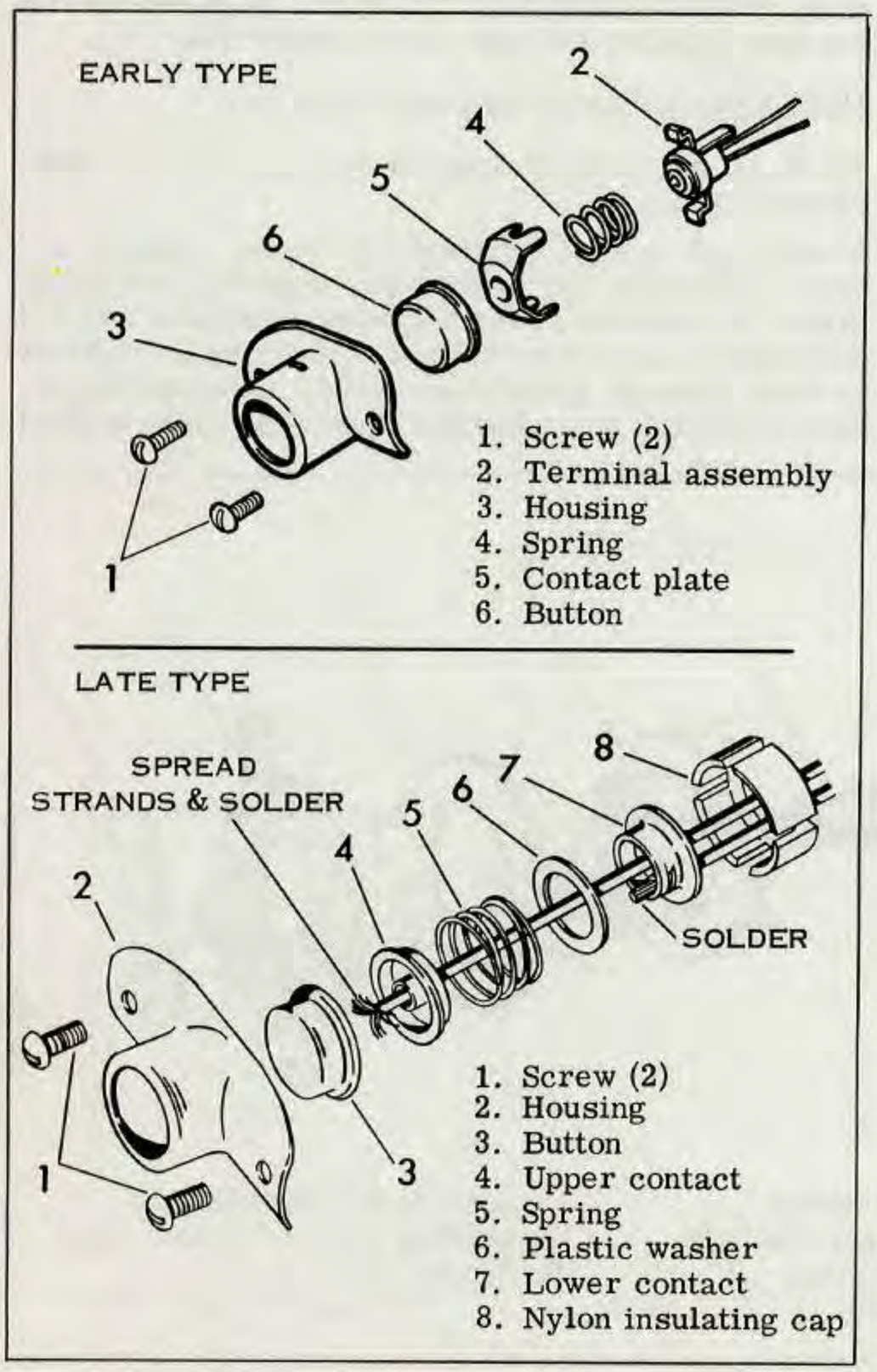


Figure 5C-1A. Button Switches - Exploded View

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).

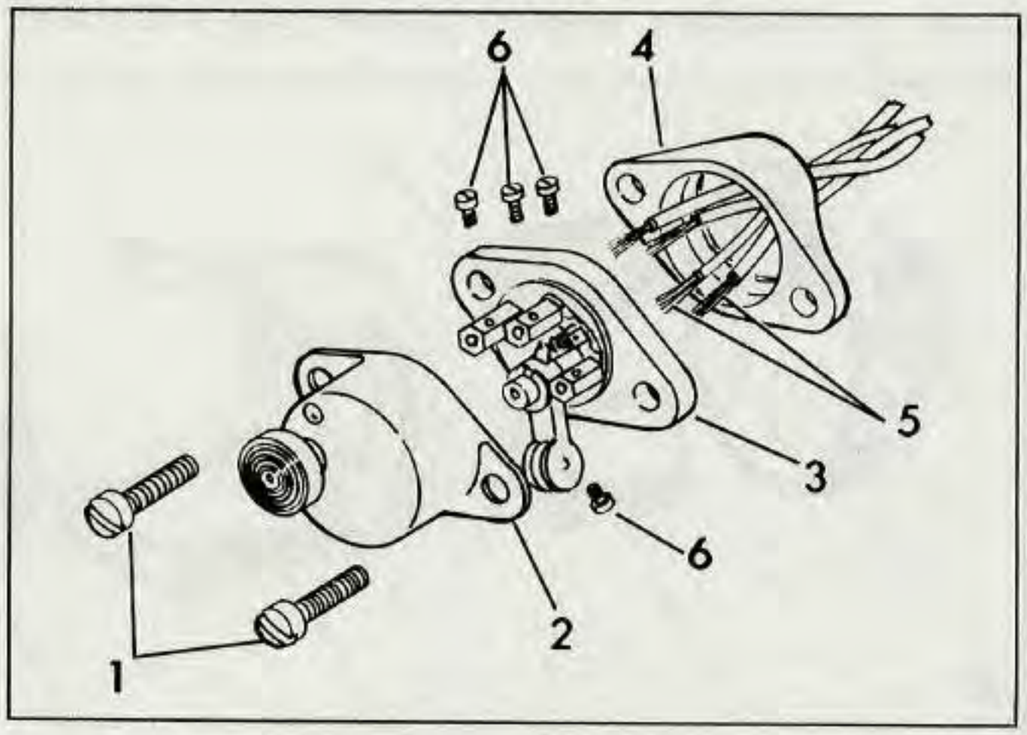


Figure 5C-1B. Dimmer and Horn Switch Exploded View

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.

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.

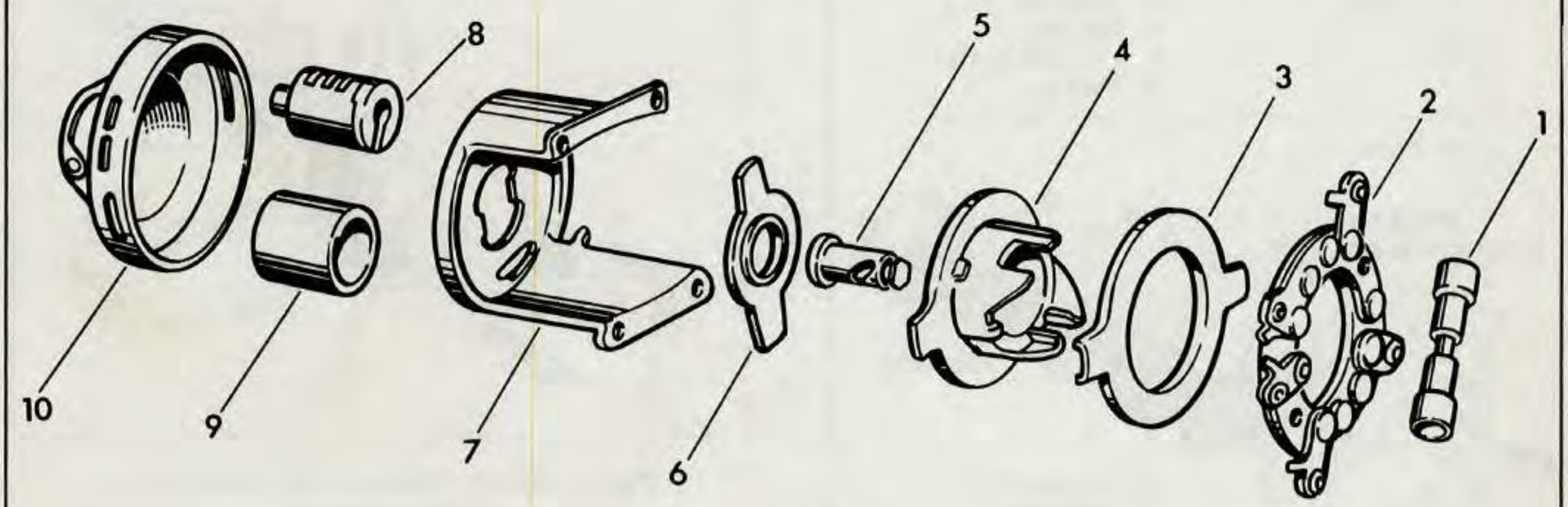
Switch base (7) and lock plate (6) can be removed from switch cover. Note that narrow end of elongated hole in lock, and lug on switch lock (8) which fits into hole in lock plate, are toward lock cover hinge.

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

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.

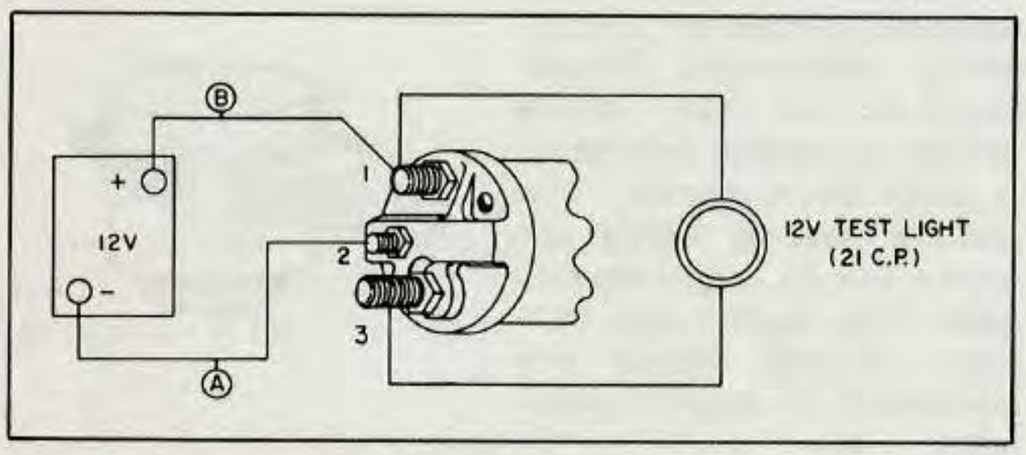


Figure 5C-1F. Test Circuit for Electra-Glide, 1967 Sportster and 1966 Servi-car Solenoid

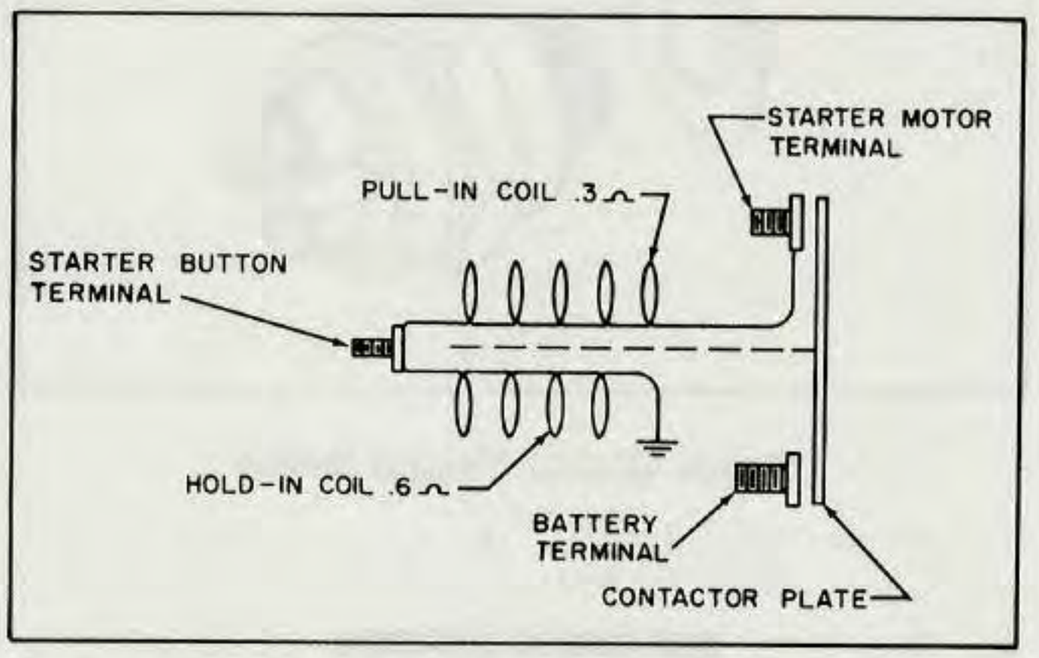


Figure 5C-1G. Solenoid Internal Wiring Diagram - Electra-Glide, 1967 Sportster and 1966 Servi-car

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.

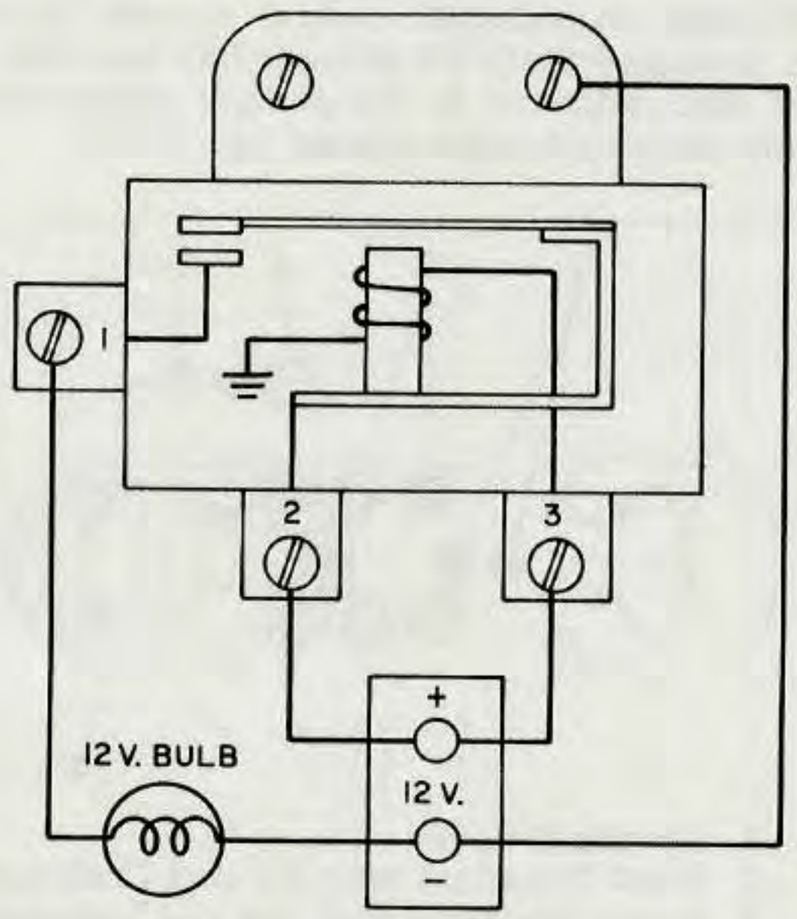


Figure 5C-1E. Starter Relay Internal Wiring Diagram and Test Circuit

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.

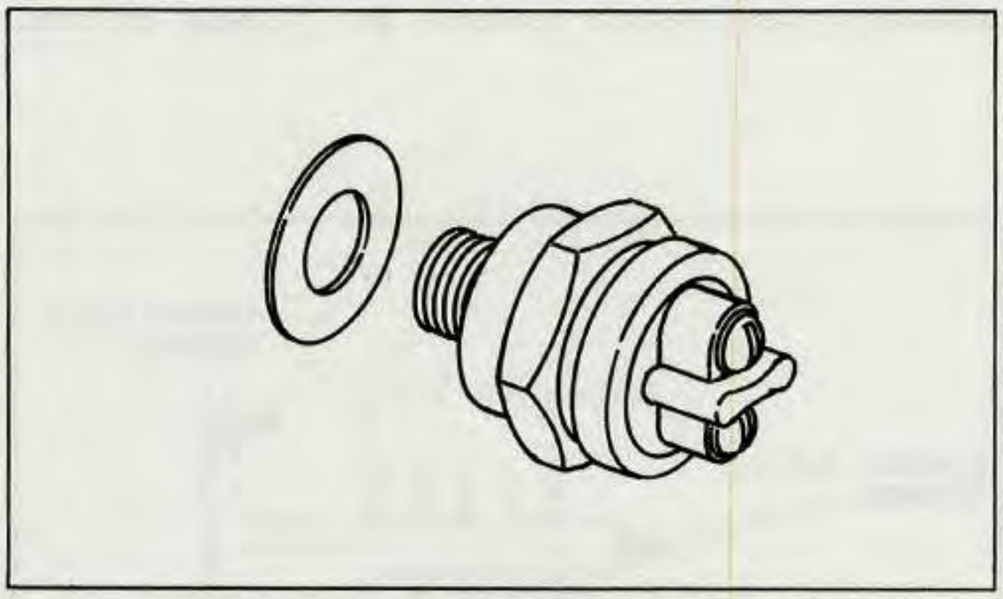


Figure 5C-1C. Neutral Switch

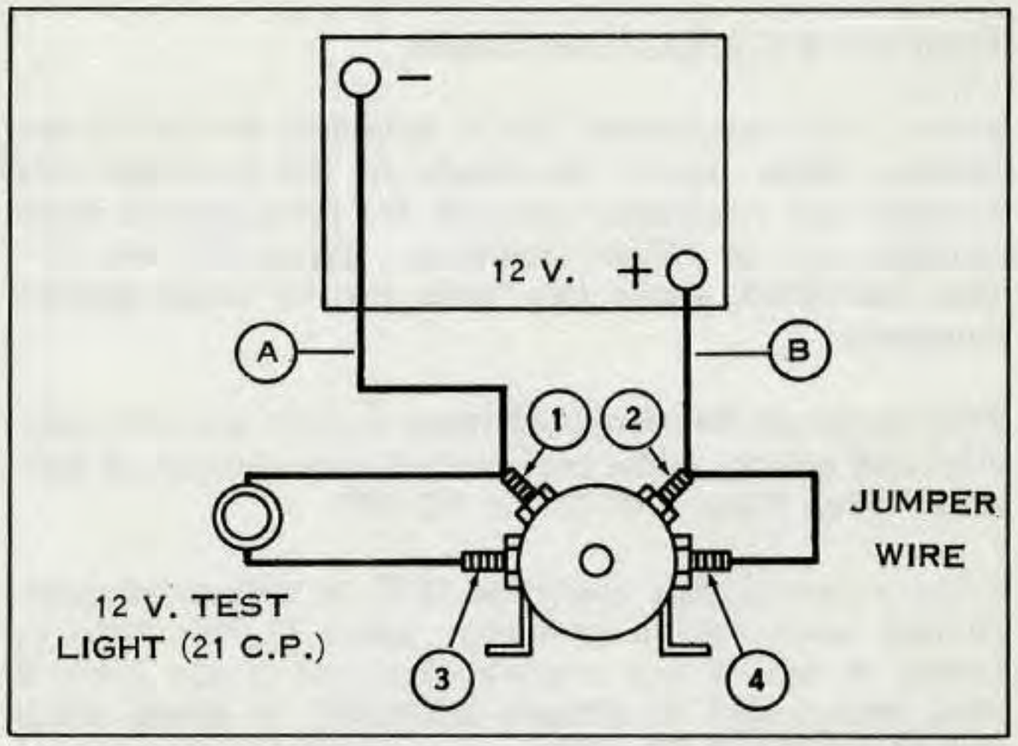
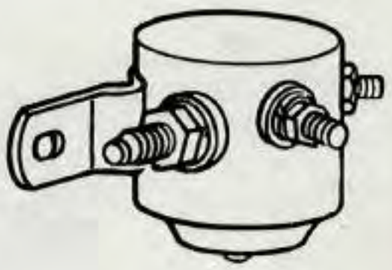


Figure 5C-1D. Test Circuit for 1964-65 Servi-car Solenoid

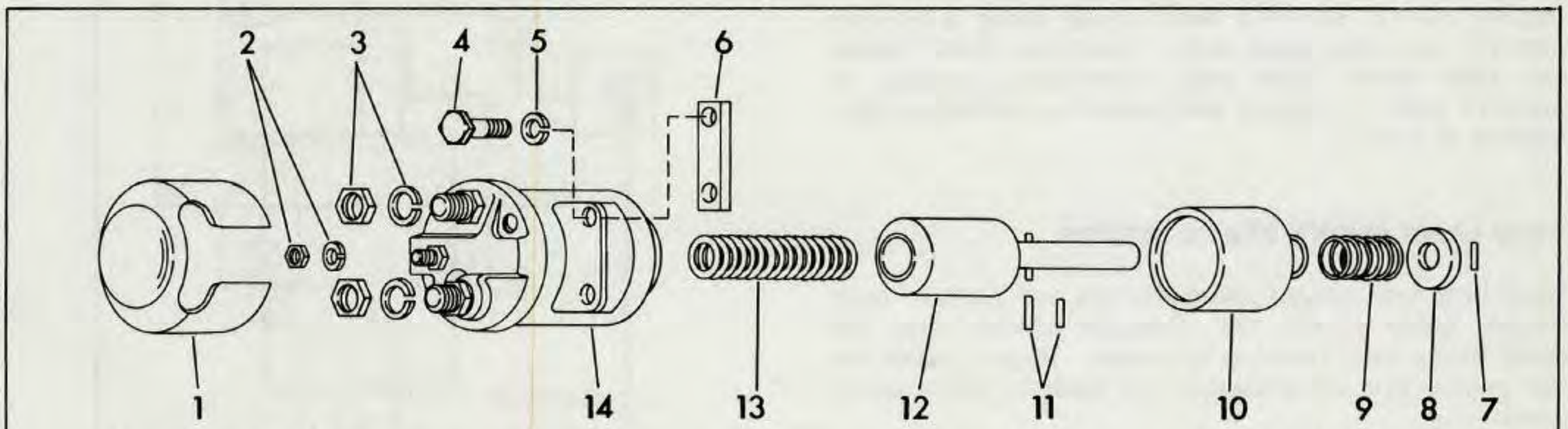
SOLENOID SWITCH

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.

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.



1 Terminal Cover
2 Small Terminal Stud Nut and Lockwasher
3 Large Terminal Stud Nut and Lockwasher (2)
4 Bolt
5 Lockwasher
6 Spacer Plate
7 Pin
8 Cap Washer
9 Spring
10 Rubber Boot
11 Roll Pins (2)
12 Armature Shaft
13 Return Spring
14 Housing

Figure 5C-1E. Electra-Glide 1967 Sportster and 1966 Servi-car Solenoid - Exploded View

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	1	50 Watts	45 Watts	67717-64	67717-59
	Headlamp Lo Beam		45 Watts	35 Watts		
	Tail Lamp Tail Lamp	1	4 C.P.	3 C.P.	68165-64	68165-47
	Tail Lamp Stop Light		32 C.P.	21 C.P.		
	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	1	50 Watts	45 Watts	67717-64	67717-48B
	Headlamp Lo Beam		45 Watts	35 Watts		
	Tail Lamp Tail Lamp	1	4 C.P.	3 C.P.	68165-64	68165-47
	Tail Lamp Stop Light		32 C.P.	21 C.P.		
	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

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.

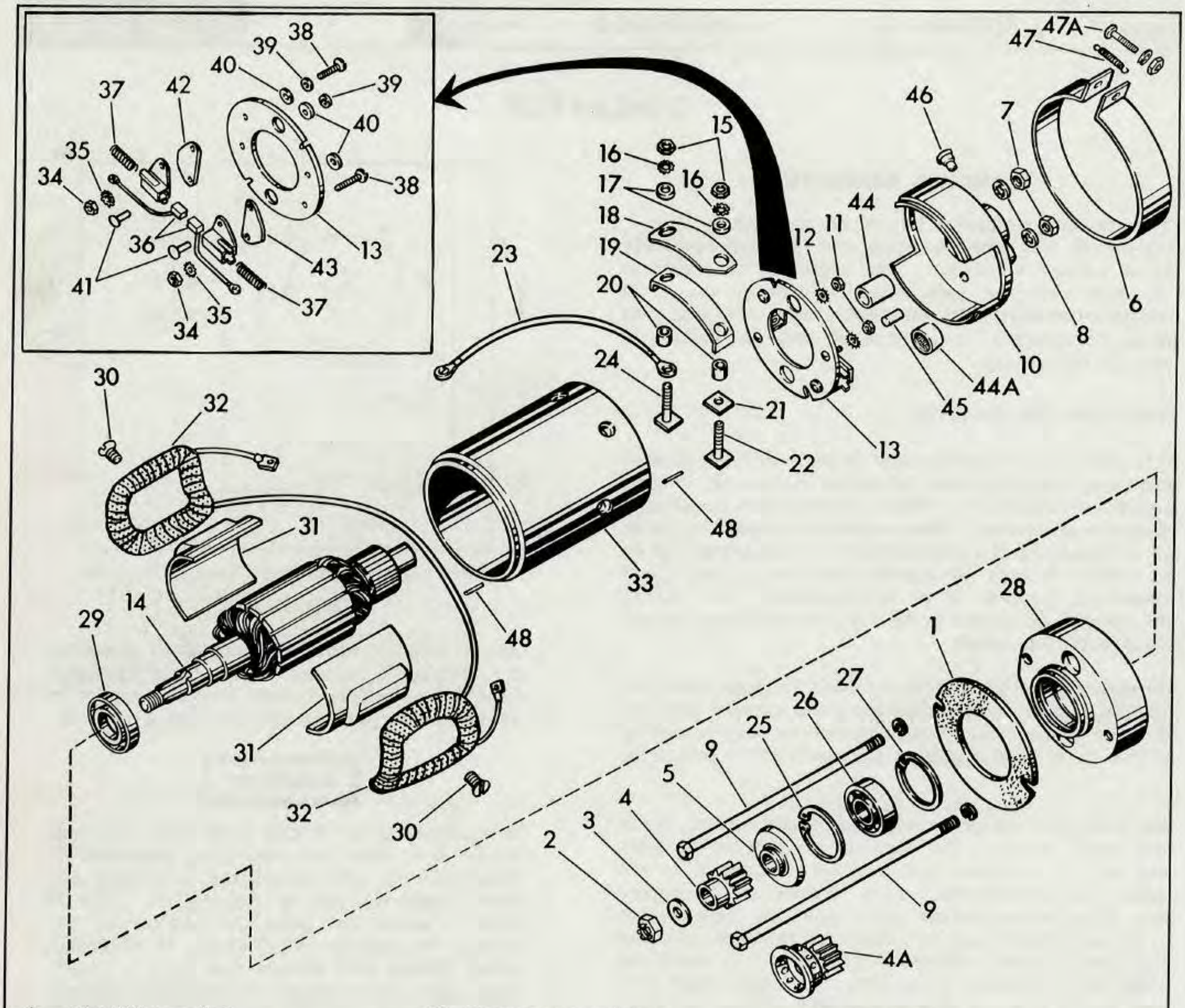
Draw a horizontal line on a wall or screen exactly the same height as the center of the headlamp to be checked and adjusted. Then, position the motorcycle on a level surface with headlamp approximately 25 feet away from the test pattern. Have a rider sit on the motorcycle to simulate actual running conditions. 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.



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

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

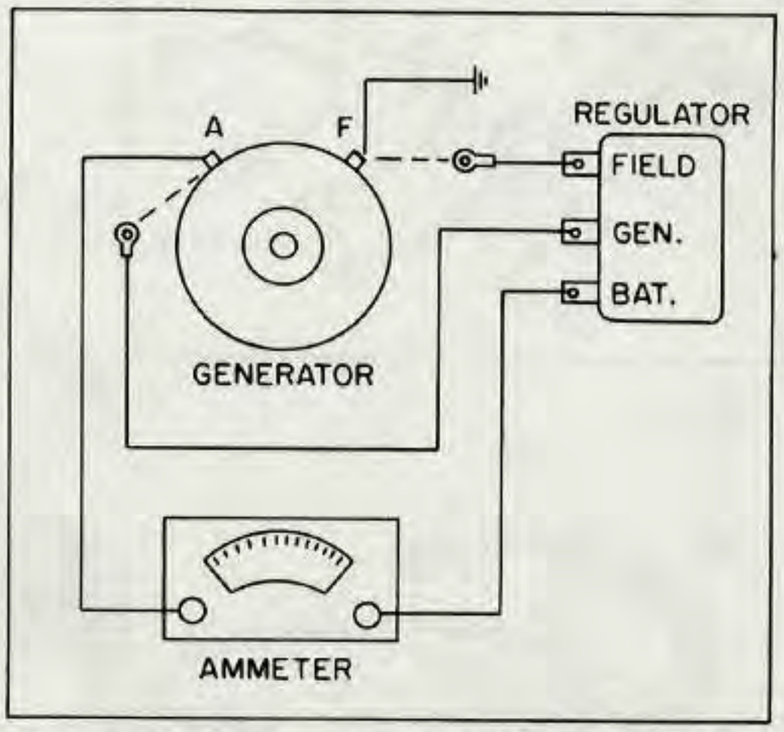
It is possible to trouble shoot faulty generator without removing the generator from the engine or, if necessary to remove it, without completely disassembling the generator. When a generator stops charging or not charging at a satisfactory rate as evidenced by a "dead" battery or signal light on switch 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 5I). 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.



Figure 5E-4. Testing Armature for Short



Figure 5E-5. Testing Armature for Open Circuit

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."

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.

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.

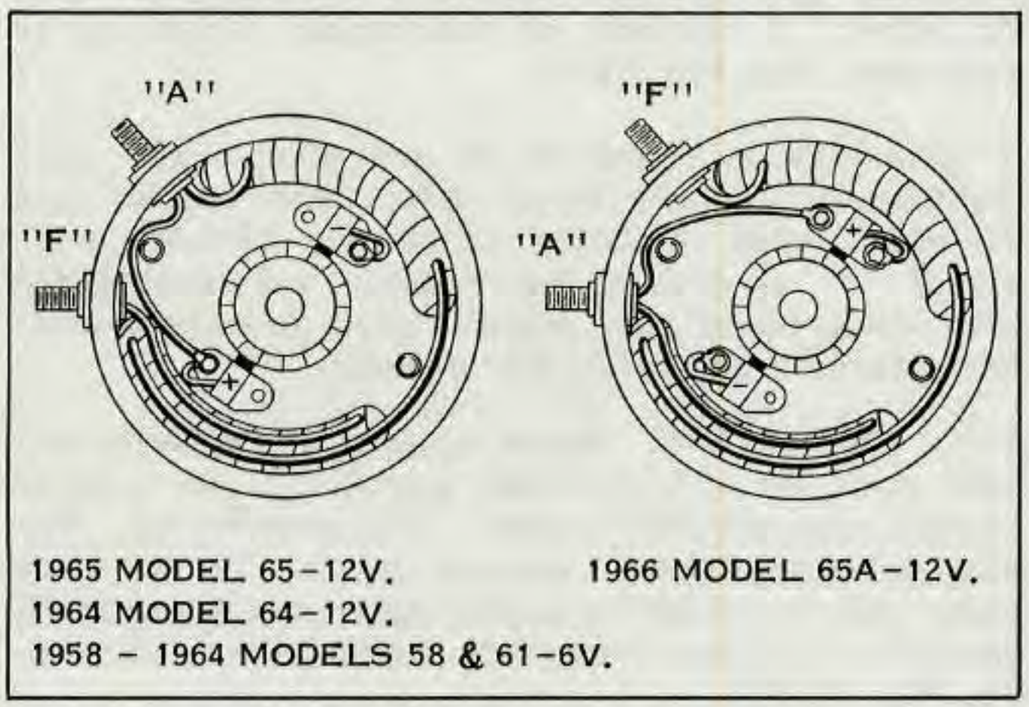


Figure 5E-2. Generator Wiring Diagrams

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.

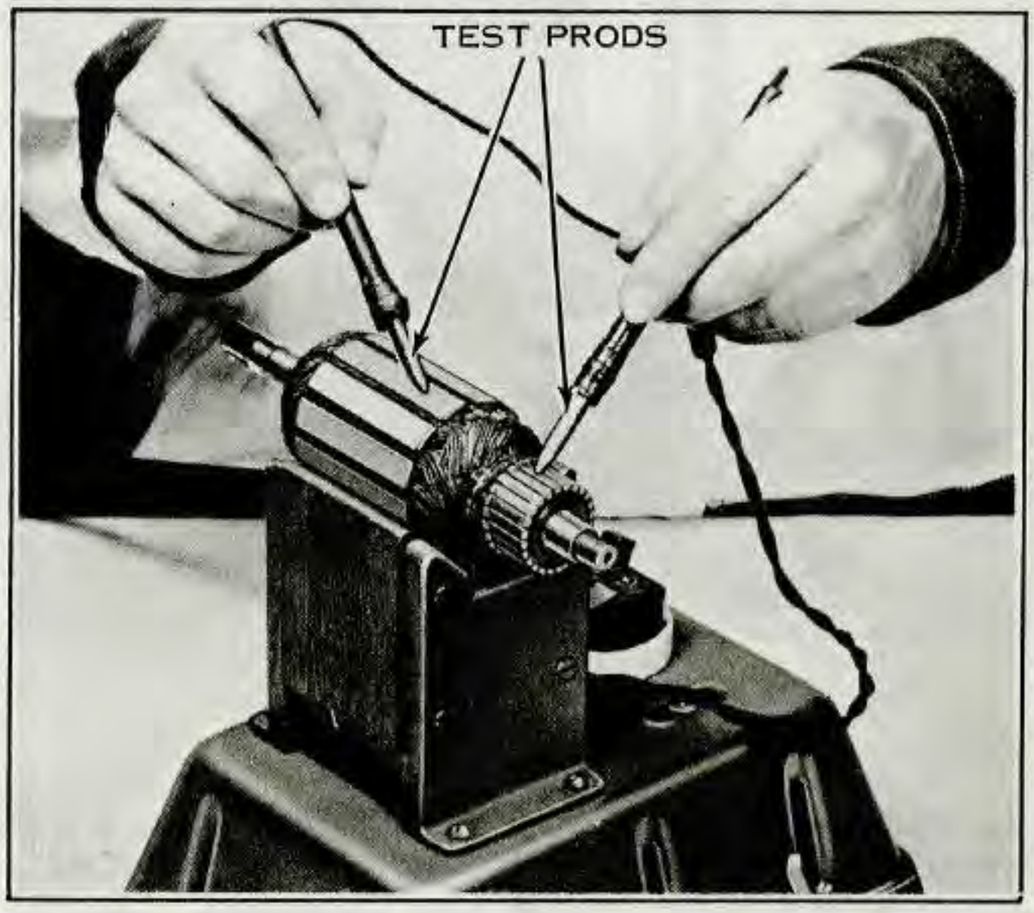


Figure 5E-3. Checking Armature for Grounded Winding

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.

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

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.

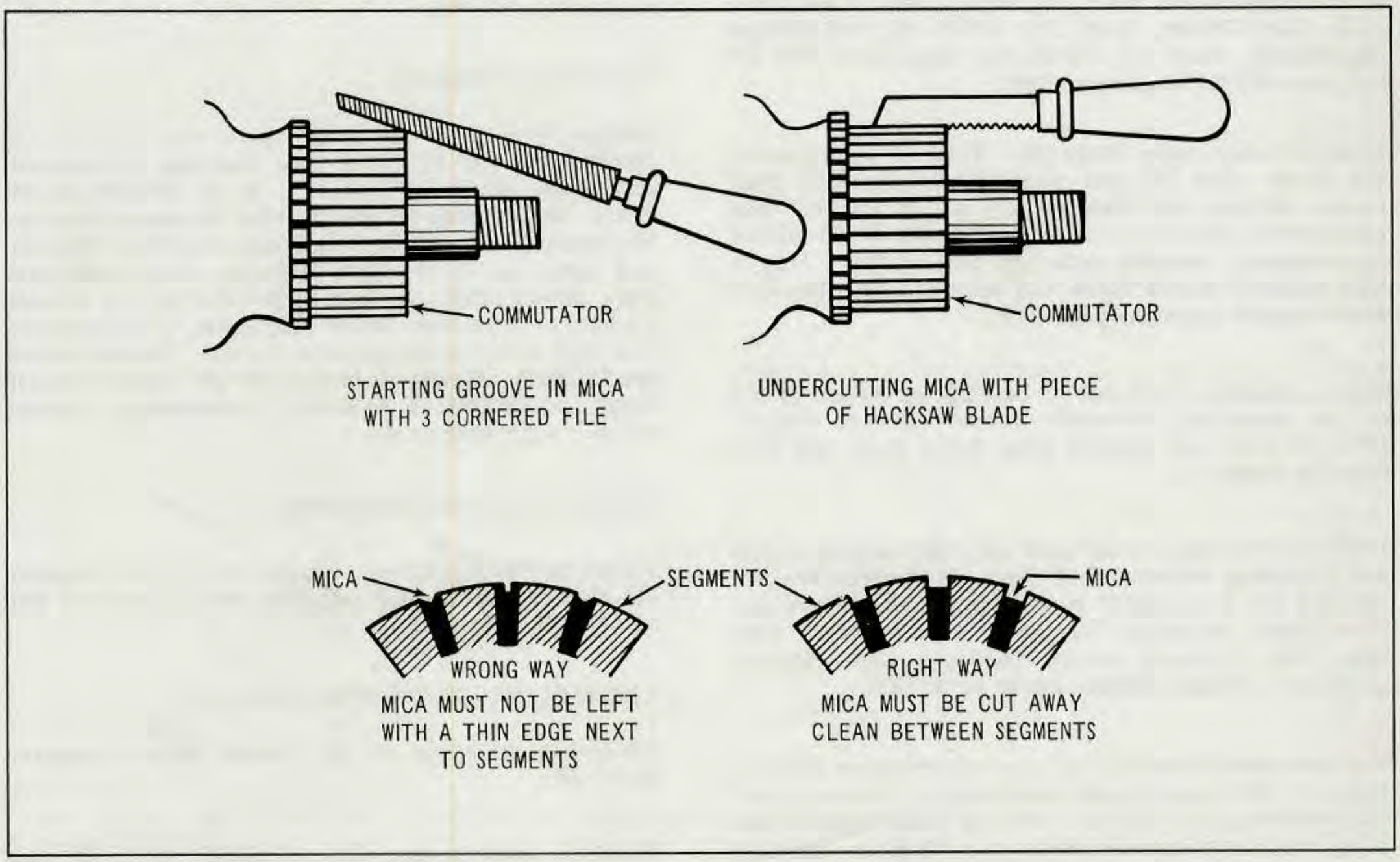


Figure 5E-6. Recessing Mica Separators

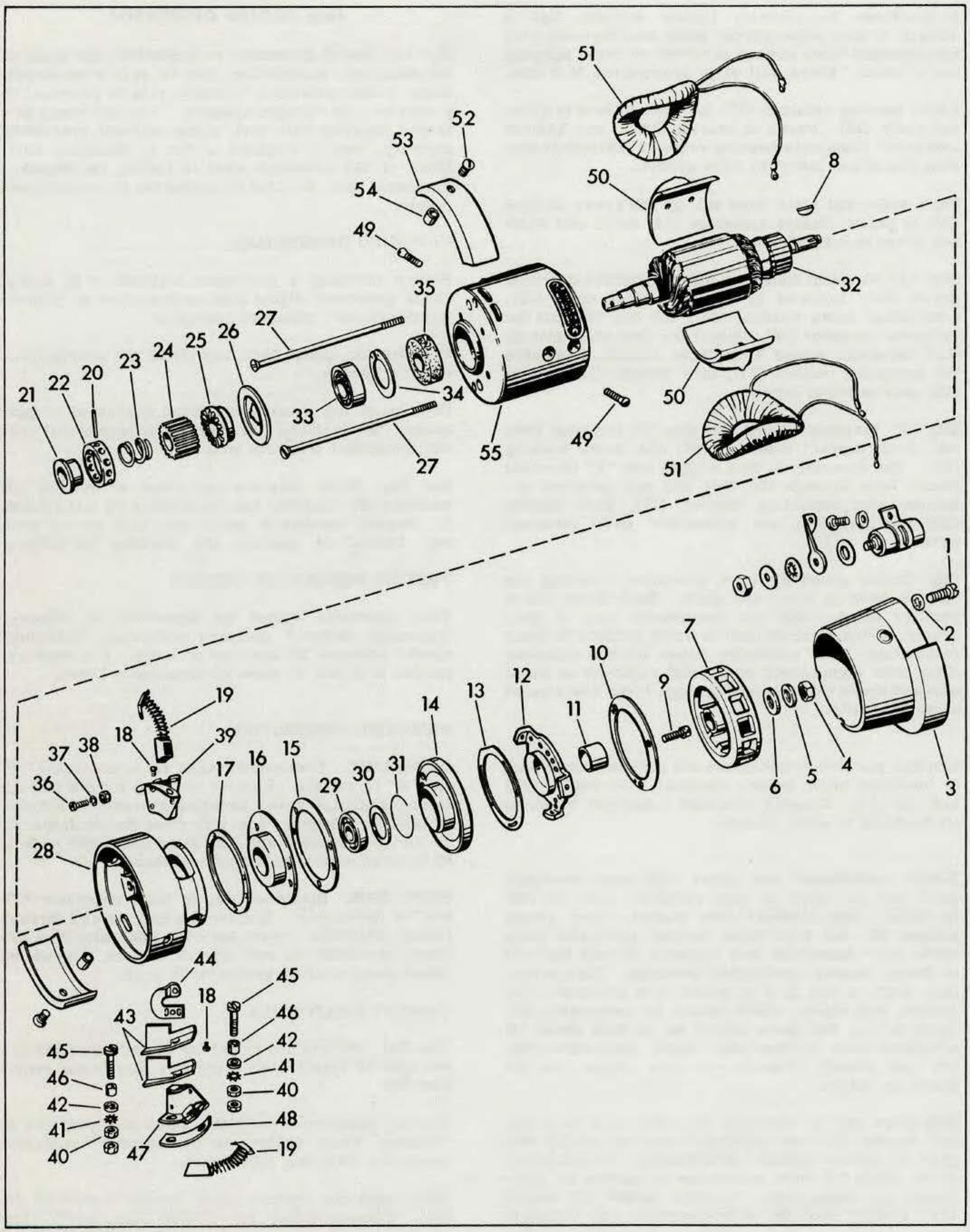


Figure 5E-7. Fan Cooled Generator

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 (28). 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.

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.

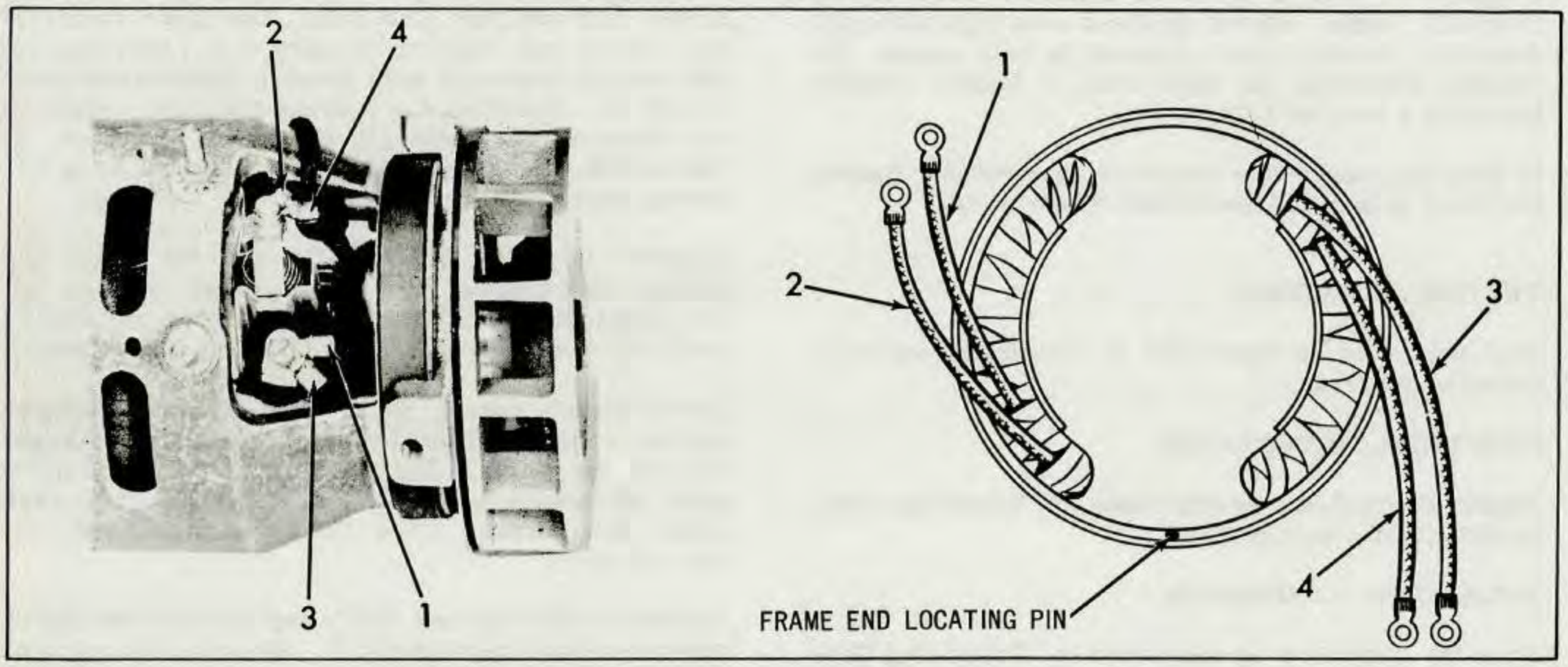


Figure 5E-7A. Fan Cooled Generator Wiring

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.

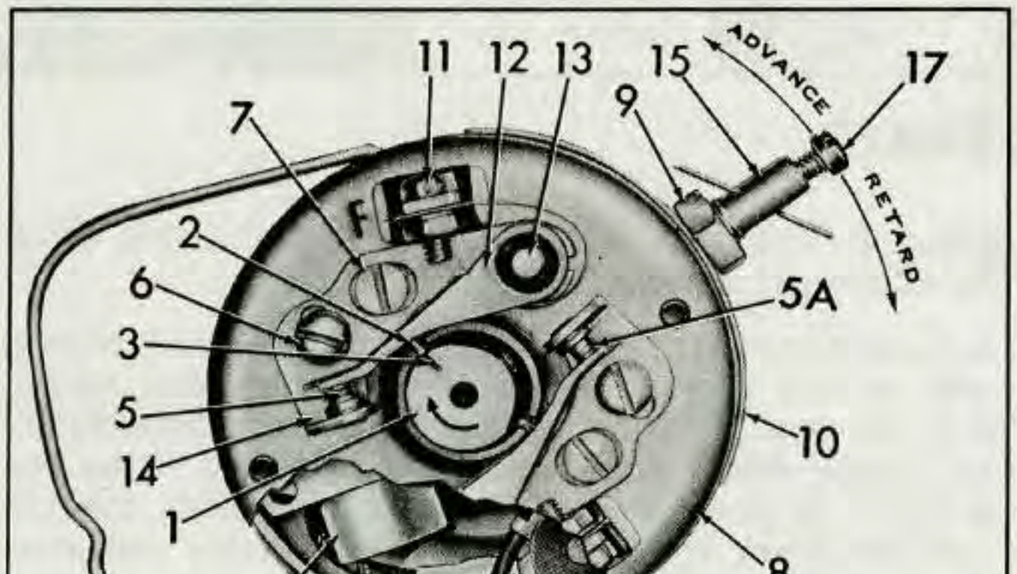
Remove three fan baffle plate screws (9) and lift off baffle plate (10), fan spacer (11), fan housing spider (12) and end plate (13). Use Claw Puller to pull brush end bearing housing (14). Ball bearing (29) should come off with bearing housing and parts 30 and 31. However, the bearing sometimes stays 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.



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-

CIRCUIT BREAKER

DESCRIPTION

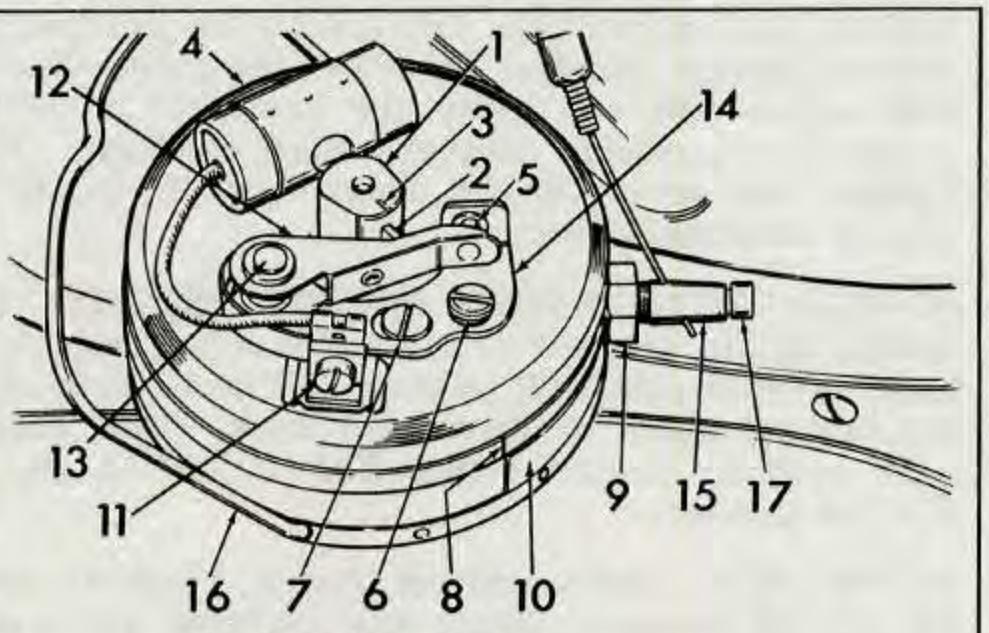
The ignition system has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, switch, primary coil, breaker points, condenser and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

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

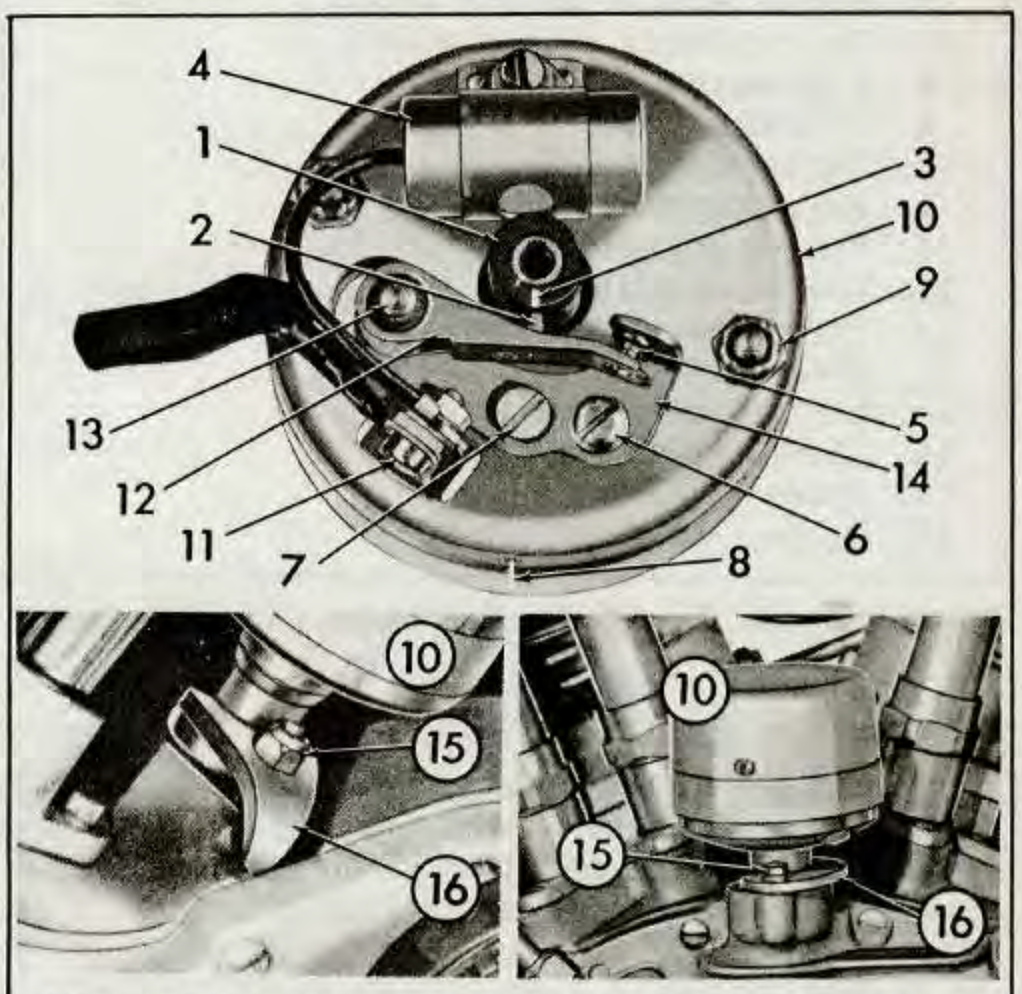
Figure 5F-1. Single Contact Point Circuit Breaker - Manual Advance

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).

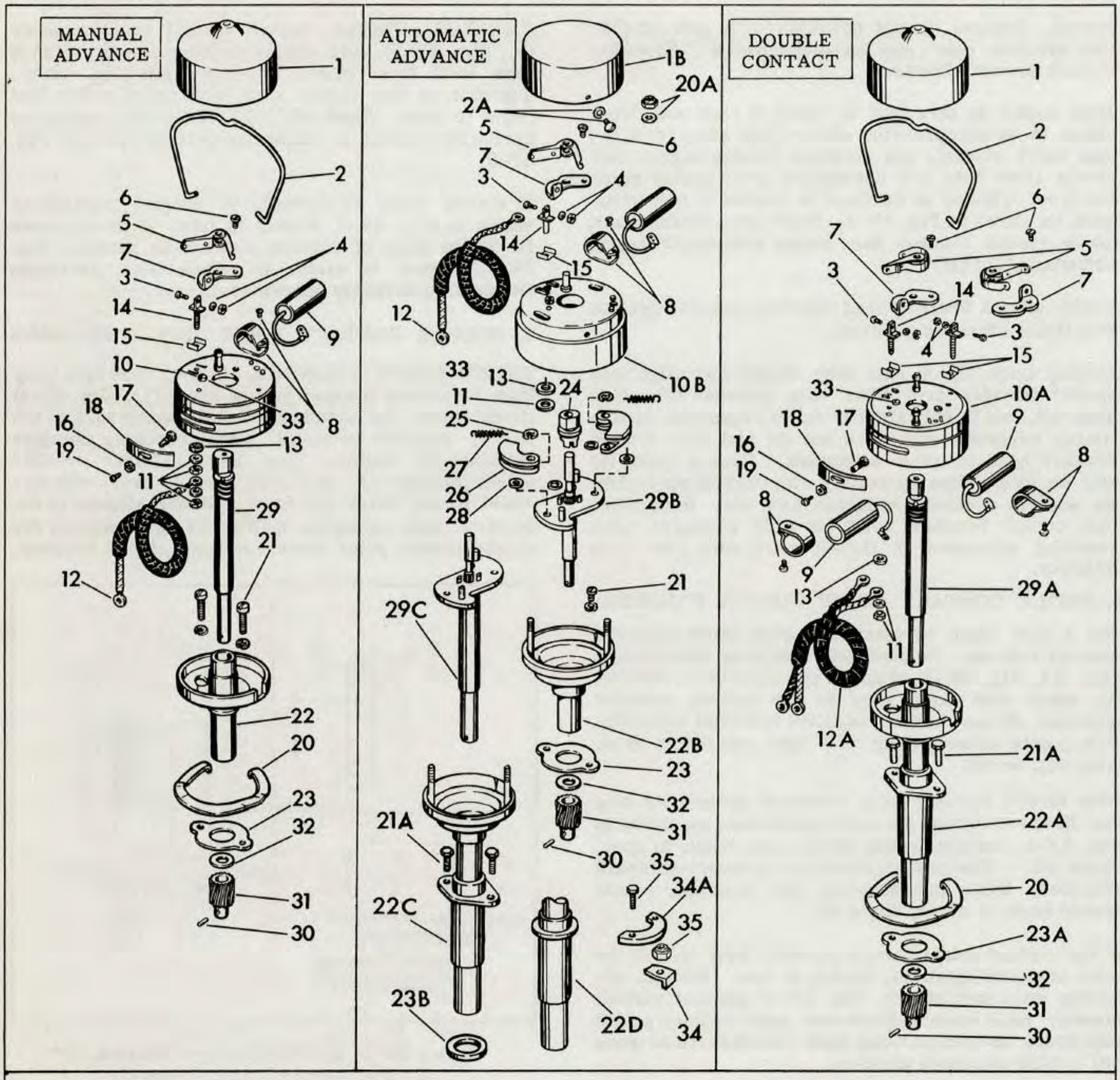
Ignition spark is produced by operation of separate circuit breaker contact points and ignition coils for each spark plug. The breaking of each set of breaker points by a single-lobe cam on the timer shaft determines the spark timing. The single-lobe cam opens the breaker points, individually firing 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



	10, 10A, 10B. Base	22, 22A, 22B, 22C. Stem
	11. Stud nuts and washers	23, 23A, 23B. Gasket or O-ring
1. Cover	12, 12A. Cable	24. Cam
1B. Cover	13. Wire stud fiber washer	25. Clip (2)
2. Cover retainer	14. Wire stud	26. Flyweight (2)
2A. Cover screw and lock washer	15. Wire stud insulator	27. Flyweight spring (2)
3. Wire stud screw	16. Adjusting stud lock nut	28. Washer (4)
4. Wire stud nut and lock washer	17. Adjusting stud	29, 29A, 29B, 29C. Camshaft
5. Lever, contact point	18. Adjusting stud plate	30. Gear pin
6. Adjustable point locking screw	19. Control wire lock screw	31. Gear
7. Contact point and support	20. Base retainer	32. Shaft washer
8. Condenser bracket and screw	20A. Base nut and washer (2)	33. Eccentric screw
9. Condenser	21, 21A. Crankcase screw (2)	34, 34A. Stem clamp
		35. Clamp nut or bolts

Figure 5F-2. Circuit Breakers - Exploded View

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.

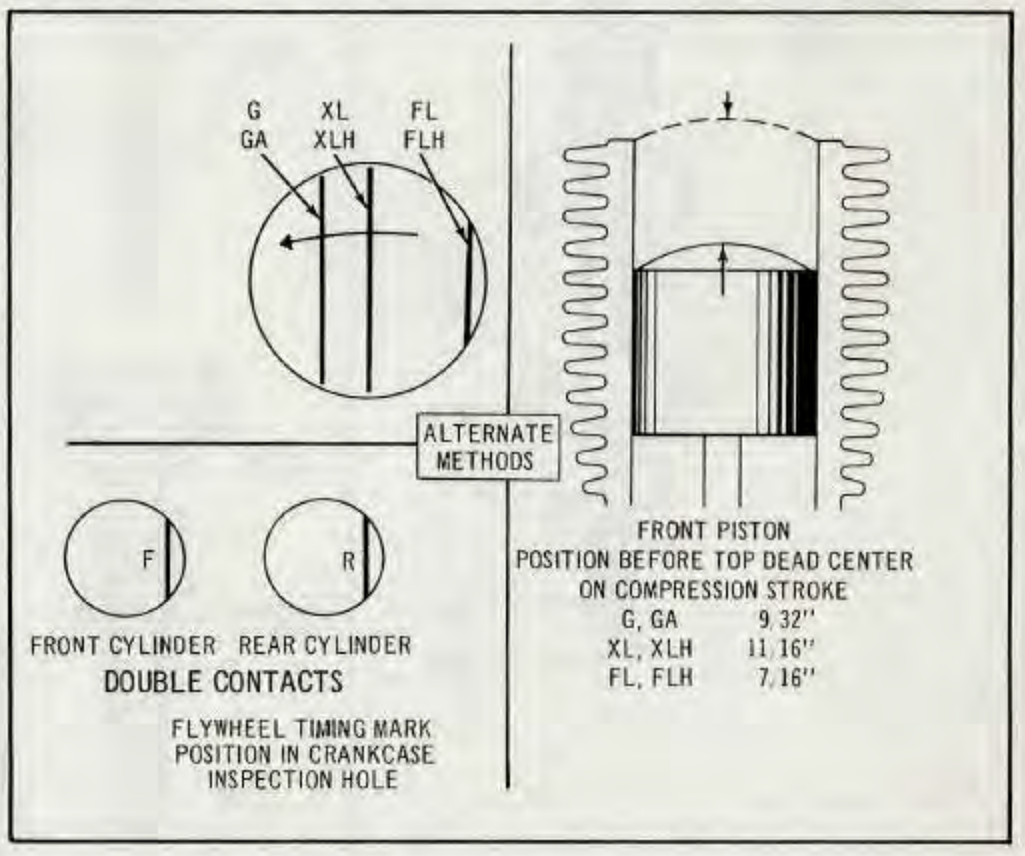


Figure 5F-3. Ignition Timing - Schematic - Manual Advance Circuit Breaker

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.

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.

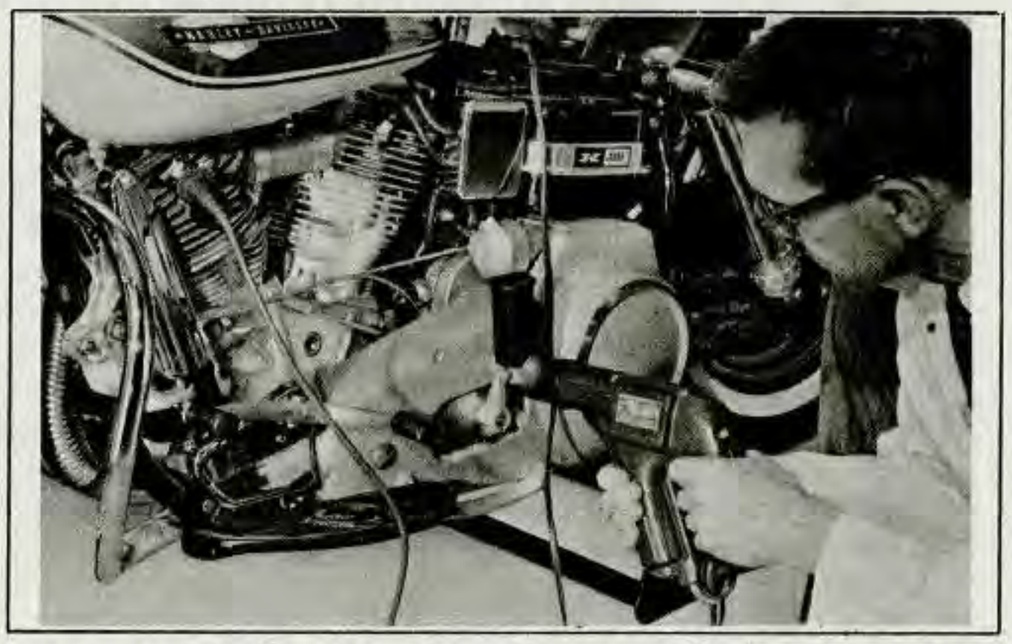


Figure 5F-3B. Checking Timing with Strobe-Lite

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

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).

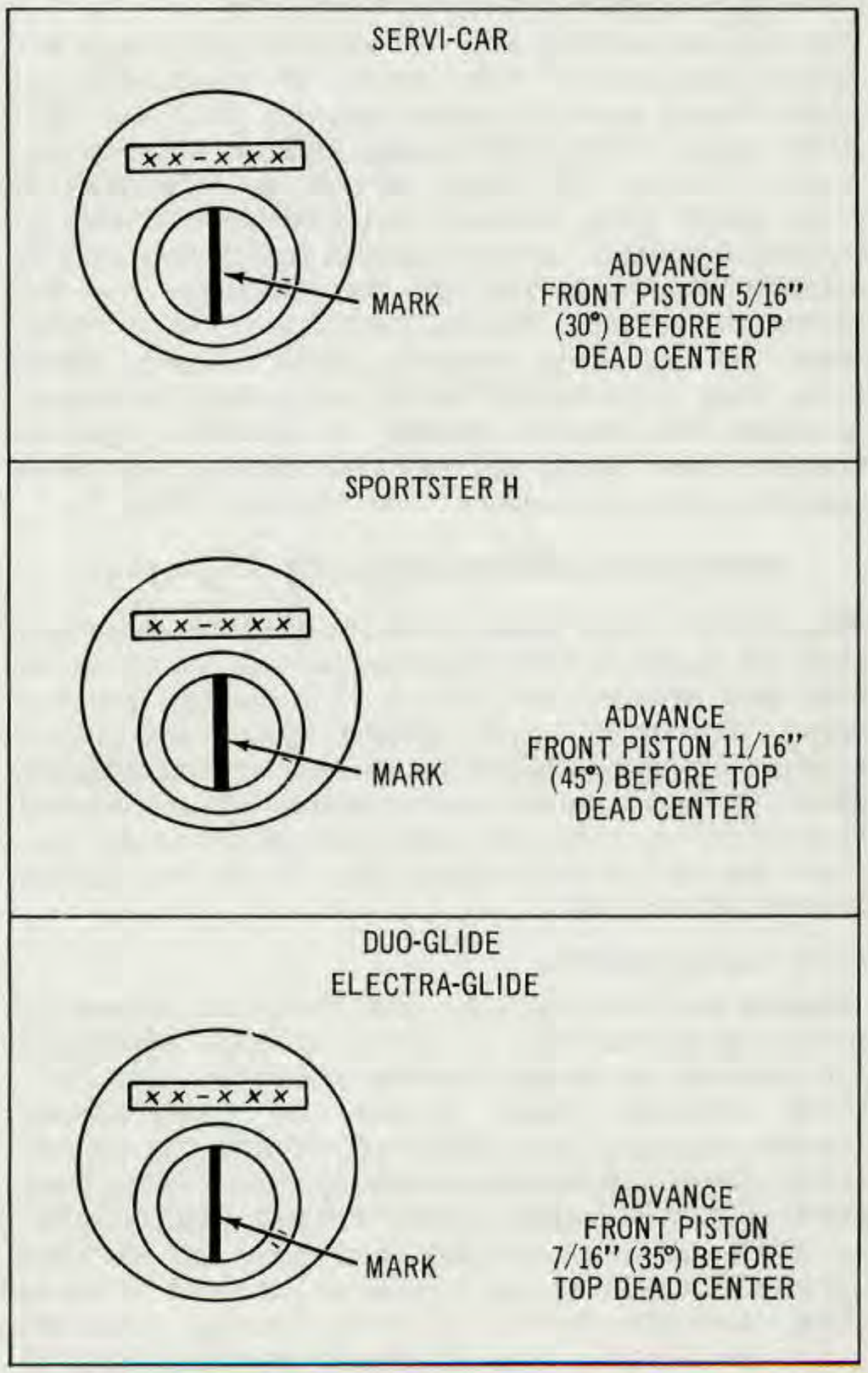


Figure 5F-3A. Ignition Timing Schematic, Automatic Advance Circuit Breaker

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

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

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

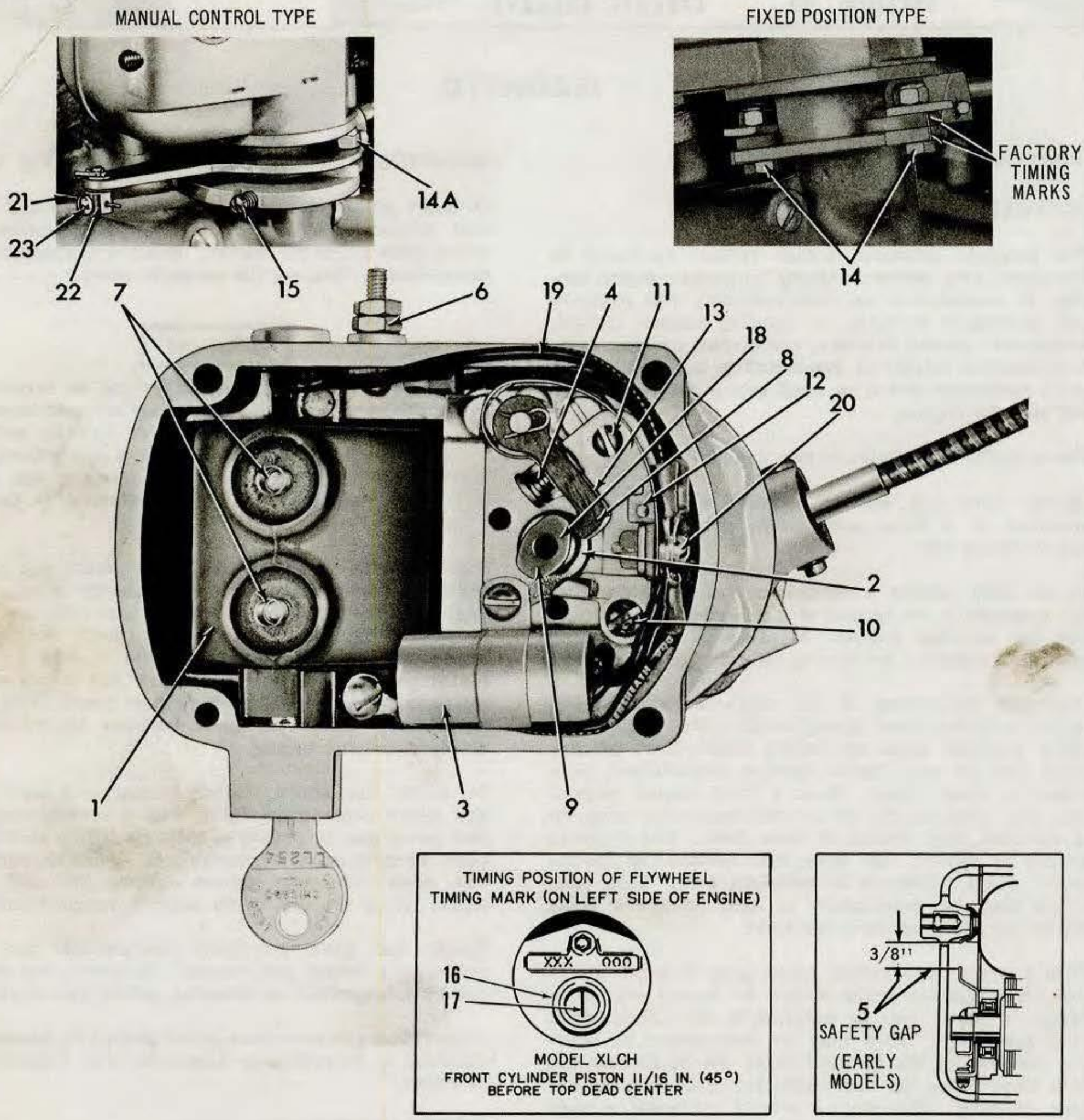
Remove spark plugs to permit engine to turn easily; remove screw plug from timing inspection hole in left side of crankcase. Telescope front push rod cover so that opening and closing of valve can be observed. Turn engine in direction in which it runs until front piston is on compression stroke (just 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.



1	Induction Coil	13	Cam Oiler Felt
2	Rotor	14	Magneto Mounting Bolts & Nuts (1964 & earlier)
3	Condenser	14A	Magneto Mounting Bolts (1965)
4	Circuit Breaker Points	15	Magneto Advance Stop Screw (1965 to early 1967)
5	Safety Gap Points (1964 & earlier)	16	Timing Inspection Hole
6	Ignition Cut-out Terminal Post	17	Timing Mark
7	Coil Secondary Terminal Spring	18	Narrow Cam Lobe
8	Cam Follower	19	Coil Lead Wire
9	Cam	20	Breaker Point Terminal Post
10	Pivot Screw	21	Control Wire (1965)
11	Adjustment Screw	22	Swivel Block (1965)
12	Adjustment Pry Location	23	Control Wire Set Screw (1965)

Figure 5F-6. Magneto

When advancing spark, hold pressure on magneto housing so it follows movement of adjusting screw. However, do not change adjustment of screw more than one turn away from established factor setting since this will affect retarded timing. Correct amount of timing retard for starting engine will be provided by setting stop screw (15) so that distance between screw head and its seat on plate is approximately 3/16 inch.

The late 1967 XLCH model does not have an advance stop adjustment screw. A slot and pin in the base plates control the degree of retard to a fixed amount.

To check the ignition timing proceed as follows:

1. Remove spark plugs to permit engine to turn easily; remove plug from timing inspection hole (16) in left side of crankcase. Then remove front intake push rod cover so that opening and closing of valve can be observed. Remove magneto cover by removing four screws and set circuit breaker point gap at exactly .015 in. See "Adjusting Circuit Breaker Points."

2. Turn engine in direction in which it runs until just after front intake valve closes and piston is coming up on compression stroke. Continue turning engine very slowly (less than one-half revolution) until timing mark (170 on flywheel is aligned exactly in center of inspection hole (16).

3. On 1964 and earlier models see that timing marks on magneto base and magneto mounting plate are in alignment.

4. Narrow cam lobe (18) should now be located counterclockwise from cam follower (8), and breaker points should be just opening. If points have opened early or have not yet opened, the magneto must be shifted on base to get correct timing. On 1965 to early 1967 model, minor adjustment can be made by adjusting screw (15). (Be sure magneto is in fully advanced position.)

A timing light can be used to accurately determine when points open as follows: Disconnect coil lead wire (19) from breaker point terminal post (20) to open coil connection. (Other wires should remain attached to terminal post). Connect other terminal of battery to the magneto metal housing. When the points are closed, the lamp will be on and when the points open the lamp will go out.

5. If points cannot be opened by shifting magneto housing within limits of slots in magneto mounting base, or if point opening occurs after magneto housing has turned to a position where it will interfere with the carburetor air cleaner, it is probable that timing according to original factory marks has been lost. This would occur if magneto were loosened and lifted far enough so its drive gears become unmeshed, or if the case were opened and gears removed and installed, or if magneto circuit breaker parts were removed and replaced for any reason. In this case unbolt magneto from case and lift far enough to bring its driving gears out of mesh. Turn circuit breaker cam approximately as much as cam appeared to be out of required position, and push assembly back down into gearcase, re-engaging its drive gears. If circuit breaker still cannot be shifted far enough to obtain point opening, repeat operation of lifting magneto and changing engagement of driving gears until proper point timing is obtained.

After correct timing is obtained, secure magneto base mounting bolts and recheck ignition timing as follows: Turn engine in direction in which it runs until just after front intake valve closes and piston is coming up on compression stroke. Continue turning engine very slowly until timing light goes out, then see if flywheel timing mark (17) is in center of hole. If timing mark is not in center of hole loosen mounting bolts or turn adjusting screw to shift magneto as required. When rechecking always turn engine in the direction it runs. When correct timing is obtained, retighten the magneto base mounting bolts, reconnect coil lead wire to point terminal post and reinstall magneto cover.

CHECKING TIMING WITH STROBE-LIGHT

Where a strobe-light timing light is available, adjusting and checking ignition timing is done with engine running at a fast idle speed, viewing flywheel timing mark in crankcase timing hole. This method is recommended since it is made under actual running conditions.

REMOVING MAGNETO (Fig. 5F-6)

Remove carburetor from the motorcycle to provide sufficient clearance for removal of magneto assembly. See Sportster Fuel System, Section 3F.

Disconnect spark plug cables at magneto. Disconnect ground switch terminal wire at magneto terminal (6). Remove tachometer drive assembly if used. Loosen control wire set screw. Remove the two mounting nuts and bolts (14 or 14A). Lift shaft and housing assembly from gearcase.

INSTALLING MAGNETO (Fig. 5F-8)

If magneto adapter plate (47 or 47A) has been removed make sure oil seal ring (49) and gasket (48) (if used) are in place before mounting adapter plate on gear case with screws (46). Install inside magneto mounting bolt (44), in place and assembly screws (46). On magnetos having manual retard, adapter plates (47A) and 47B) must be installed together.

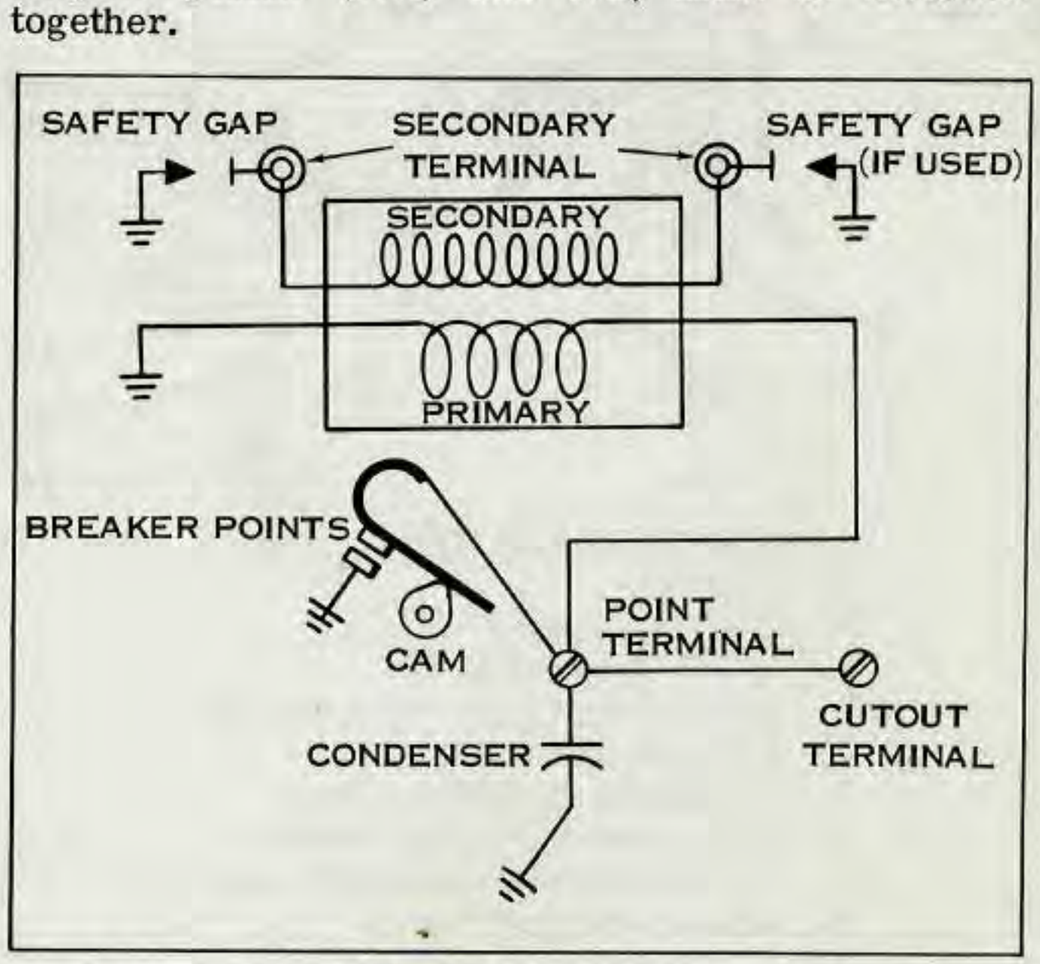
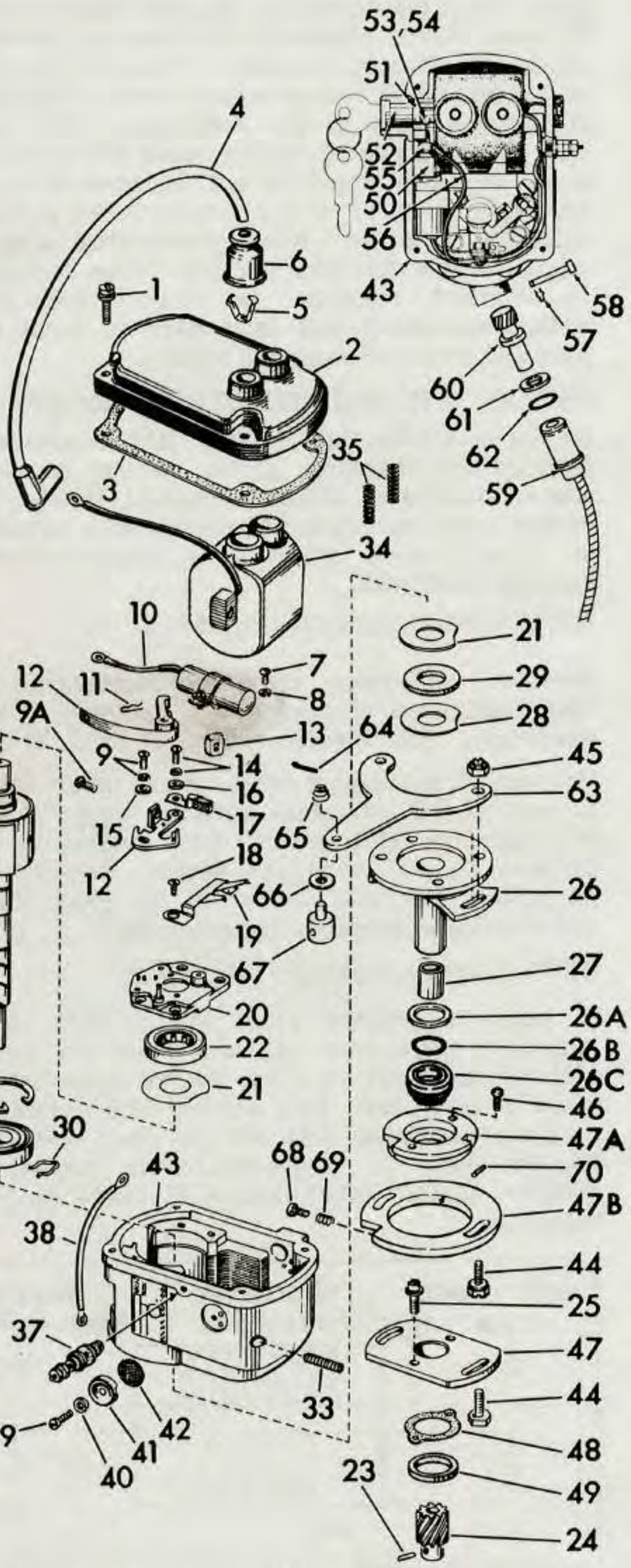


Figure 5F-7. Internal Connections of Magneto



1 End Cap Screw (4)
2 End Cap
3 End Cap Gasket
4 Spark Plug Cable (2)
5 Spark Plug Cable Terminal (2)
6 Cable Protector (2)
7 Condenser Mounting Screw
8 Condenser Mounting Washer
9 Breaker Arm Terminal Screw
9A Contact Support Screw
10 Condenser and Bracket
11 Fulcrum Pin Snap Ring
12 Set of Points
13 Breaker Arm Wick
14 Contact Support Screw and Washer
15 Contact Support Screw Washer
16 Contact Support Screw Washer
17 Cam Wick and Holder
18 Bearing Support Screw (4)
19 Safety Gap (To late 1964)
20 Bearing Support
21 Rotor Drive (1) Grease Retainer Washer (1)
22 Rotor Cam End Bearing
23 Rotor Drive Gear Pin
24 Rotor Drive Gear
25 Drive Housing Screw (4)
26 Drive Housing
26A O-Ring Washer (Late 1965 to early 1968)
26B O-Ring (Late 1965 to early 1968)
26C Seal (Late 1968)
27 Drive Housing Bushing
28 Rotor Drive End Seal Outer Washer
29 Rotor Drive End Seal
30 Rotor Drive End Shaft Snap Ring
31 Rotor Drive End Bearing Snap Ring
32 Rotor Drive End Bearing
33 Coil Bridge Set Screw (2)
34 Coil
35 Coil Lead Spring (2)
36 Rotor
37 Primary Ground Switch Terminal
38 Ground Switch Terminal Wire
39 Vent Cover Screw (2)
40 Vent Cover Washer (2)
41 Vent Cover (2)
42 Vent Screen (2)
43 Housing
44 Adapter to Magneto Bolt (2)
45 Adapter to Magneto Bolt Nut (2)
46 Adapter Screw (2)
47 Adapter (1964 & earlier)
47A Inner Adapter Plate (1965)
47B Outer Adapter Plate (1965)
48 Adapter to Crankcase Gasket (Early 1965)
49 Magneto to Crankcase Oil Seal Ring
50 Ground Switch Lock Insulating Block
51 Retainer Clip
52 Switch Lock Body
53 Spring
54 Ball
55 Insulating Block Terminal Screw
56 Ground Switch Lock Wire
57 Tachometer Drive Retaining Pin Clip
58 Tachometer Drive Retaining Pin
59 Tachometer Drive Cable
60 Tachometer Drive Gear
61 Tachometer Drive Gear Thrust Washer
62 Tachometer Drive Cable O-Ring
63 Control Arm (1965)
64 Cotter Pin (1965)
65 Spring (1965)
66 Washer (1965)
67 Swivel Block (1965)
68 Set Screw (1965 to early 1967)
69 Set Screw Spring (1965 to early 1967)
70 Roll Pin (Late 1967)

Figure 5F-8. Magneto

Insert rotor shaft into gearcase. Install magneto on adapter plate and attach with bolts (44) and nuts (45). On magnetos having manual retard, install magneto control arm (63) before replacing mounting bolt nuts.

Adjust ignition timing. See "Timing Ignition."

On manual retard magneto install control wire (21) through swivel blocks (22) when handlebar grip control and magneto are in fully advanced position. Turn handlebar grip control to full retard then to advance position and check to see that magneto has returned to fully advanced position against screw stop. Readjust control wire in swivel block if necessary.

INSPECTION AND REPLACEMENT OF PARTS (Fig. 5F-6)

Inspect circuit breaker points (4). Normally, point contact surfaces should appear clean, dull gray, and slightly rough. If contact points are dirty, they may be cleaned with a strip of hard surface paper saturated with clean white gasoline. If points are pitted, burned or worn badly, they should be replaced.

Point faces must seat squarely against each other. If bent, square up by bending contact plate.

To replace a set of circuit breaker points remove screw (20). Remove fulcrum pin snap ring and lift circuit breaker lever from pivot stud. Remove screws (10 and 11), cam wick holder and circuit breaker stationary contact.

Install new points in reverse order of disassembly. 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. 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. The cam oiler felt (13), if dry or hard, should be replaced by a new factory-impregnated wick.

The condenser (3) 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.

If the coil (1) is suspected of being defective replace with a proven new coil and note whether engine performance has improved.

DISASSEMBLING MAGNETO (Fig. 5F-8)

Remove four end cap screws (1), end cap (2) and end cap gasket (3). Pull the two spark plug cables (4) from the end cap (2). The spark plug cable terminal (5) may be removed by sliding the cable protector (6) up the spark plug cable (4) and prying it loose with a screwdriver.

Remove condenser mounting screw (7), condenser mounting washer (8) and breaker arm terminal screw (9A). Remove condenser and bracket (10).

Pry the fulcrum pin snap ring (11) loose from the fulcrum pin and slip off the breaker arm half of the set of points (12). Remove the breaker arm wick (13) from the breaker arm.

Remove contact support screws (14 and 9), contact support locking screw washer (16 and 15), cam wick and holder (17) and stationary half of set of points (12).

Remove the four bearing support screws (18), safety gap (19) (if used) and bearing support (20). Pry rotor drive and grease retainer washer (21) from bearing support (20) and remove rotor cam end bearing (22). File one end of the rotor drive gear pin (23) and punch it out with a punch. Pull rotor drive gear (24) from shaft. Remove the four drive housing screws (25) and slip the drive housing (26) off the shaft. Remove O-ring retainer washer (26A) and O-ring (26B). If necessary remove the drive housing bushing (27) from the inside of the drive housing (26).

Remove rotor drive end seal outer washer (28), rotor drive end seal (29) and rotor drive and grease retainer washer (21). Force rotor drive end shaft snap ring (30) from rotor shaft.

Remove rotor (36) from housing (43).

Remove rotor drive end bearing snap ring (31) and rotor drive end bearing (32).

Remove the two coil bridge set screws (33) and coil (34). Remove the two coil lead springs (35) from coil (34).

Remove primary ground switch terminal (37) and ground switch terminal wire (38).

Remove the two vent cover screws (39), vent cover washers (40), vent covers (41) and vent screen (42).

ASSEMBLING MAGNETO (Fig. 5F-8)

Assemble magneto in reverse order of disassembly.

Do not tap or hammer rotor into housing. Such jarring could destroy the magnetism thus reducing the current generating capabilities of the magneto.

Install magneto and reconnect wires.

GROUND SWITCH LOCK (Fig. 5F-8)

To remove ground switch lock proceed as follows: remove end cap (2). Between the ground switch lock insulating block (50) and the magneto housing (43) there is a retainer clip (51) on the lock body (52). Using a piece of metal or knife, depress retainer

clip and at the same time, using key in switch as a lever, pull key out to exert pressure and also turn slightly at same time to pull switch lock out of magneto housing. Be careful not to lose ground lock spring (53) and ground lock ball (54) which are found in ground switch insulating block screw (55) hole.

To reassemble switch lock, insert ground switch lock into magneto housing making sure that retainer clip is on top of inside switch housing. Take knife and depress body retainer clip (51) and push ground lock switch into magneto housing so retainer clip engages housing. Loosen condenser screw (7) to facilitate removal of ground switch insulating block screw. Remove ground switch insulating block screw (55) and ground switch wire (56). Insert ground lock ball and then ground lock spring. Replace ground switch insulating block wire and screw, and tighten condenser screw.

TACHOMETER (Special Equipment)

Grease tachometer drive gears at base of magneto, with All-Purpose grease every 2000 miles. Remove clip (57) from retaining pin (58) to pull out drive gear and cable (59). Fill housing hole with grease. Also remove drive gear (60) with thrust washer (61) from cable (59) and fill casing hole with grease.

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

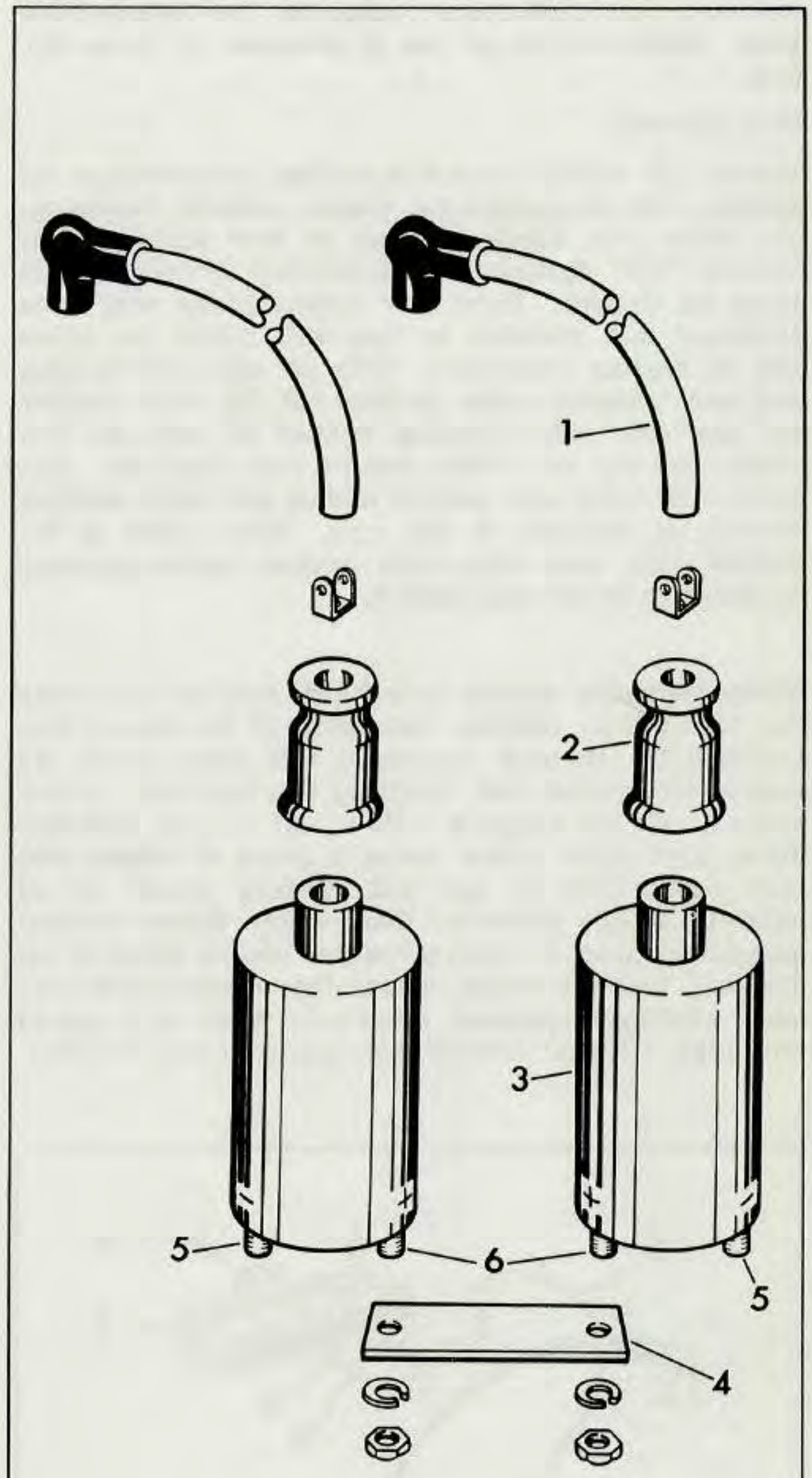
NOTE

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

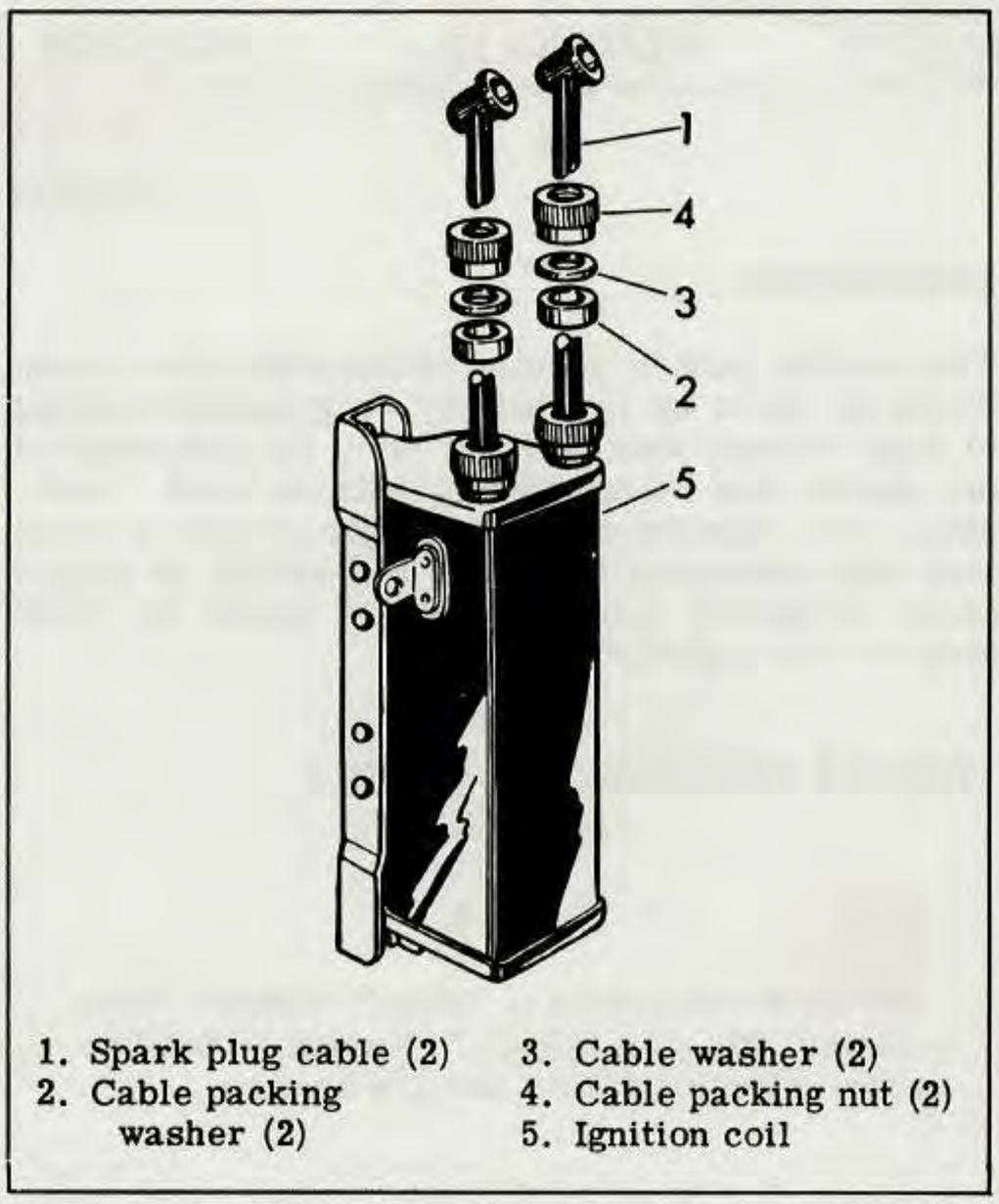
(Fig. 5G-2 and 5G-2B)

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)

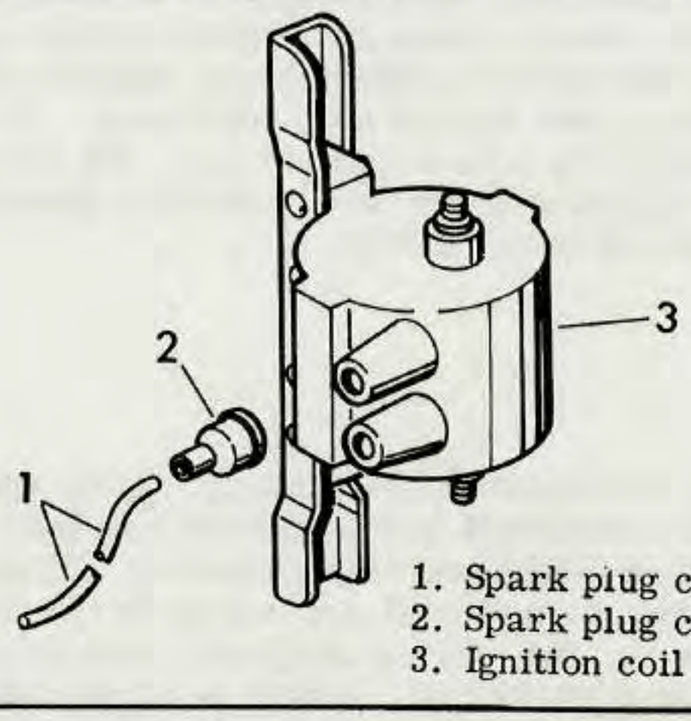
Warm coil slightly to soften sealing compound so old cables may be pulled out easily, without breakage. To warm coil allow current to flow through it by turning "ON" ignition switch (circuit breaker points must be closed). Have new cables ready with ends trimmed and rounded so they will follow the holes 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)
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

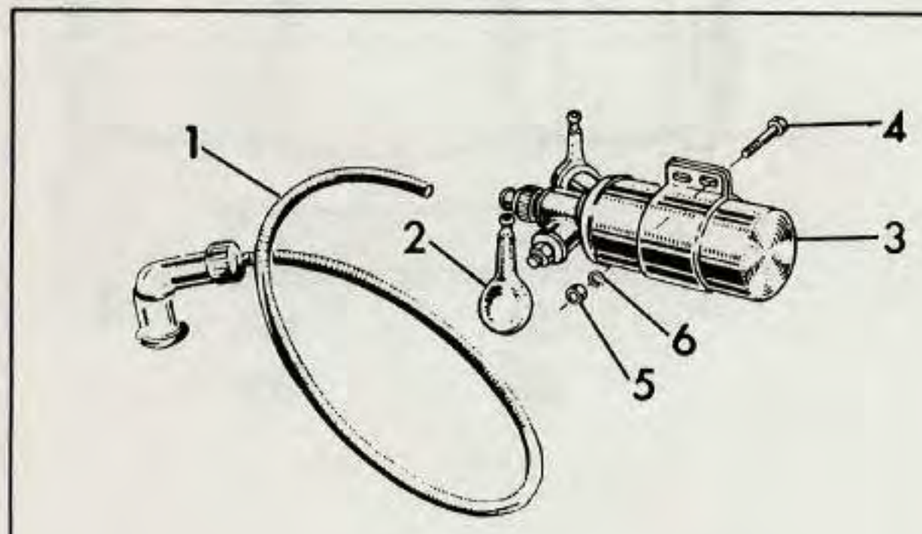


1. Spark plug cable
2. Spark plug cable boot
3. Ignition coil

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.



1. Spark plug cable
2. Terminal cover (2)
3. Spark coil
4. Mounting screw
5. Nut
6. Washer

Figure 5G-2C. Ignition Coil - Sprint

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.

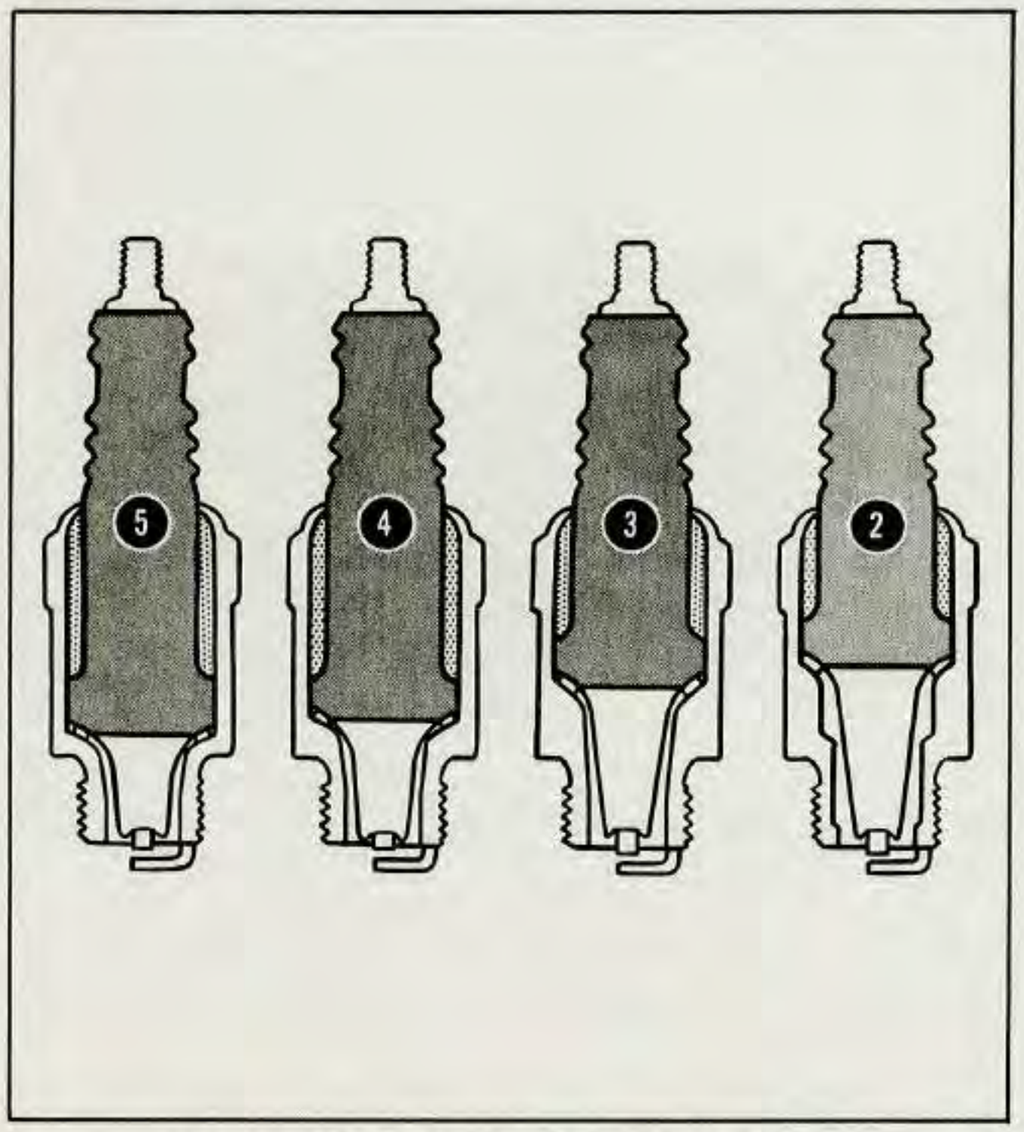


Figure 5H-1. Spark Plug Heat Range

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-

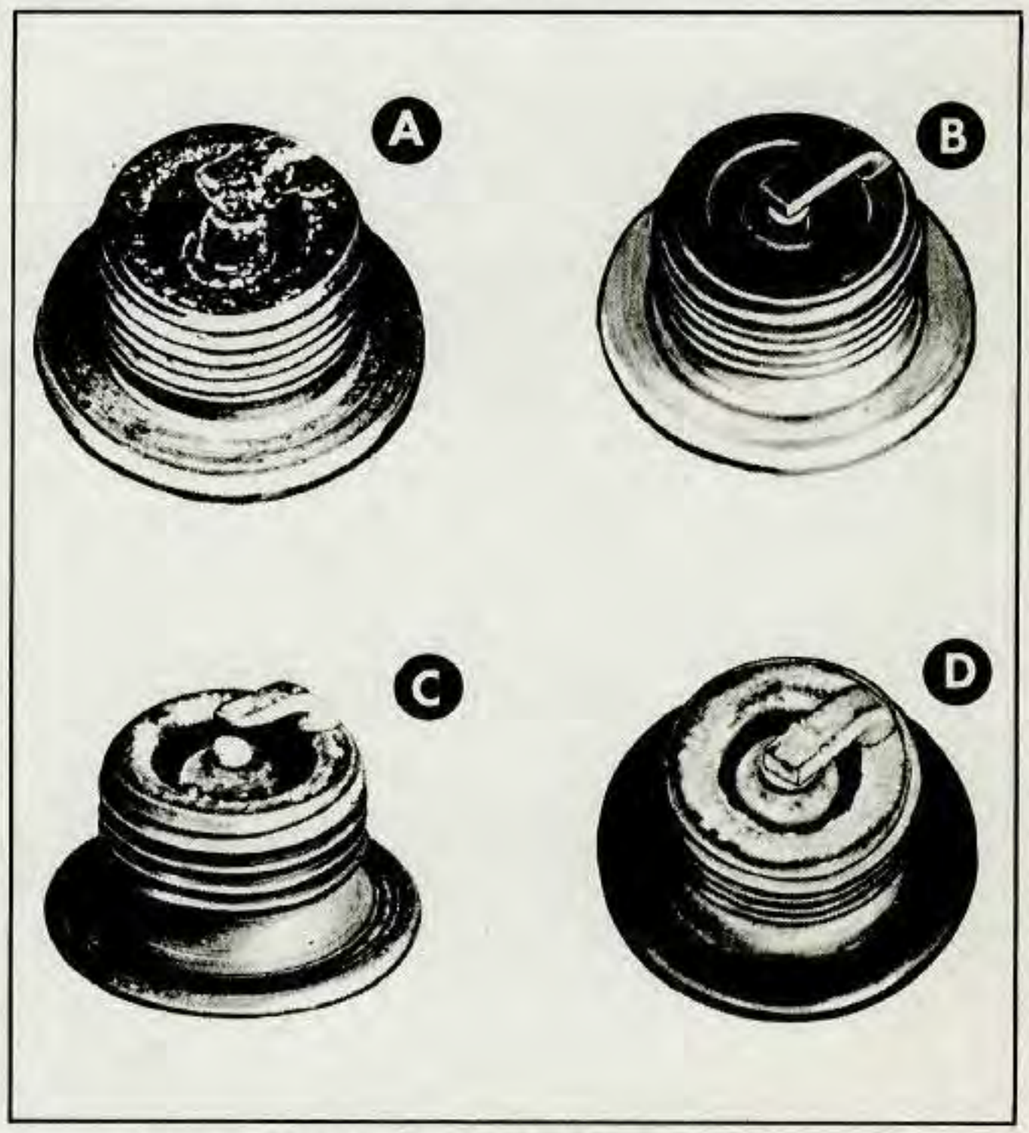


Figure 5H-2. Type of Plug Base Deposits

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.

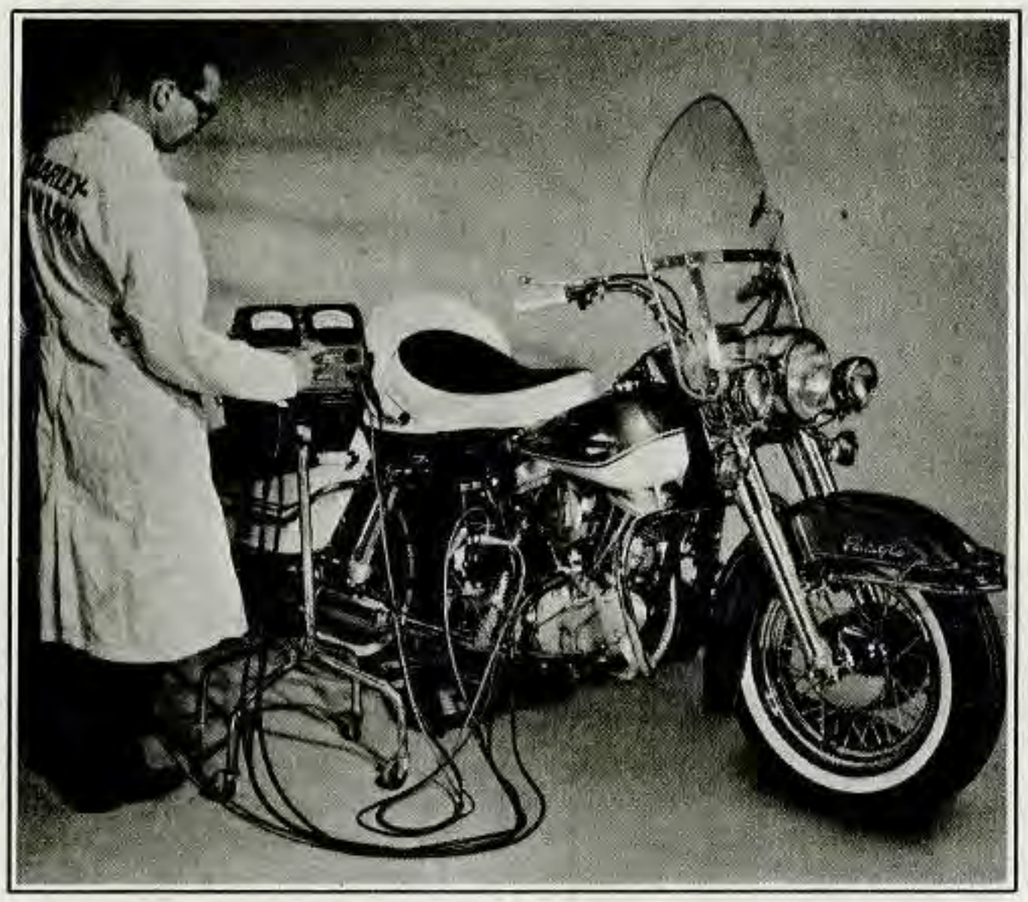
INSTALLING SPARK PLUGS

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 1118 707B 1118 707C 1118 707D	1R 116 1R 118 1R 118 1R 118A	3 Unit Current & Voltage	20 (17.5 - 20.5)	6.6 (5.9 - 6.7)	7.5 (7.2 - 7.5)	Model 51, 2-brush fan-cooled generator.	
74511-58	1119 187C 1119 187D	1R 118 1R 118A	3 Unit Current & Voltage	15 (13.5 - 16.5)	6.6 (5.9 - 6.7)	7.4 (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 Model 58 and 61 Generator	
74510-47A	118 995	1R 116	2 Unit Voltage		6.4 (5.9 - 6.7)	7.2 (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 (5.0 - 6.0)	6.7 (6.5 - 6.8)	Model 58 and 61 Generators	
74510-64	1119 614	1R 119A	3 Unit Current & Voltage	10 (9.0 - 11.0)	12.4 (11.8 - 13.0)	14.3* (13.9 - 14.5)*	Model 64 and later 12V. generator. (*Upper contact operation. Operation on lower contacts must be .1 to .3 volt lower.)	
74510-65	1100 687	1R 262	2 Unit Voltage		12.5 (11.5 - 13.5)	14.4* (13.5 - 14.9)*	Delcotron Alternator	
ALL 6-VOLT REGULATORS	CURRENT REGULATOR AIR GAP .075 IN. VOLTAGE REGULATOR AIR GAP .075 IN.				CUTOUT RELAY POINT OPENING .020 IN. CUTOUT RELAY AIR GAP .020 IN.			
ALL 12-VOLT REGULATORS	CURRENT REGULATOR AIR GAP .075 IN. VOLTAGE REGULATOR AIR GAP VARIES WITH SETTING.				CUTOUT RELAY AIR GAP AND POINT OPENING .020 IN. 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

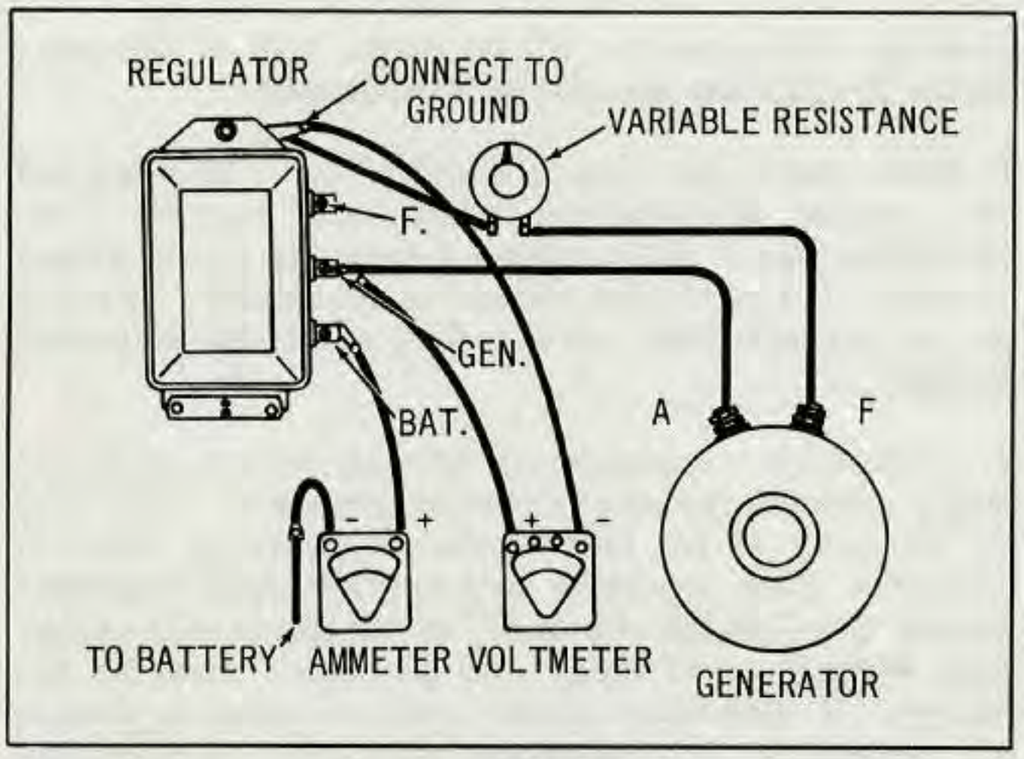


Figure 5I-2.

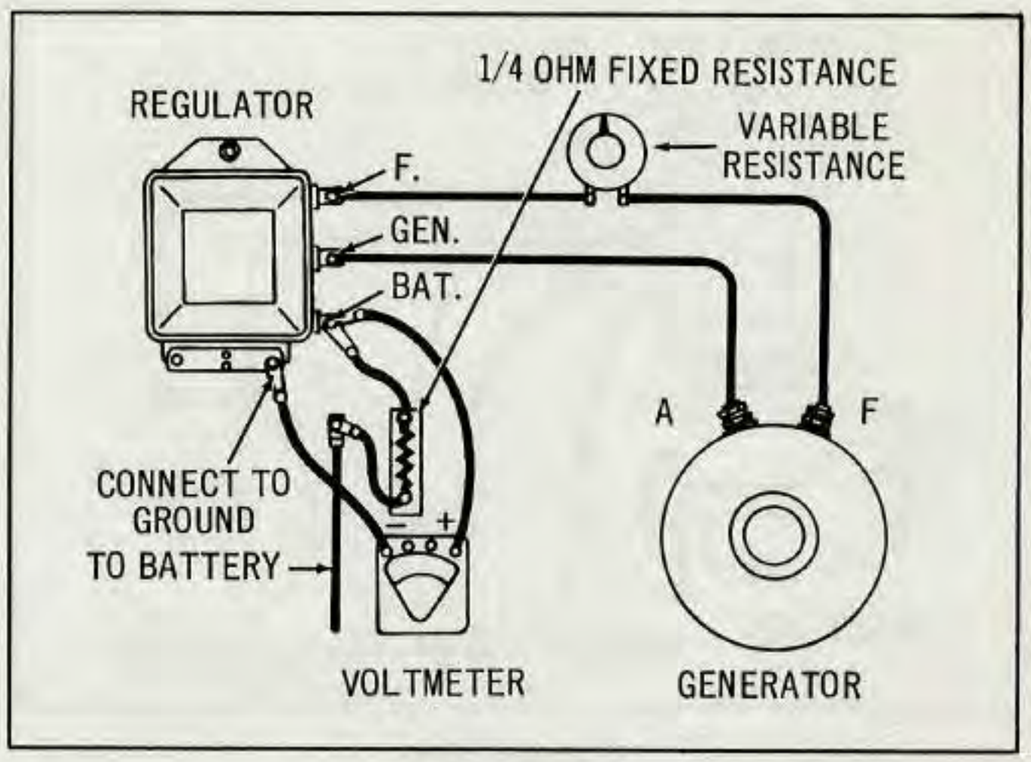


Figure 5I-3.

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.

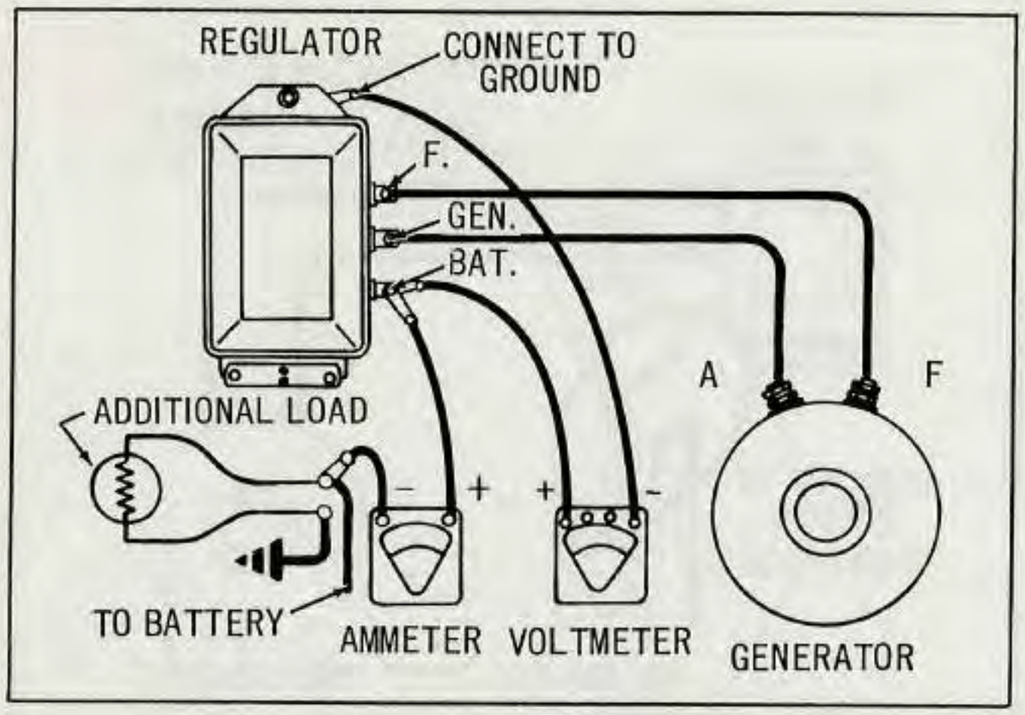


Figure 5I-4.

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.

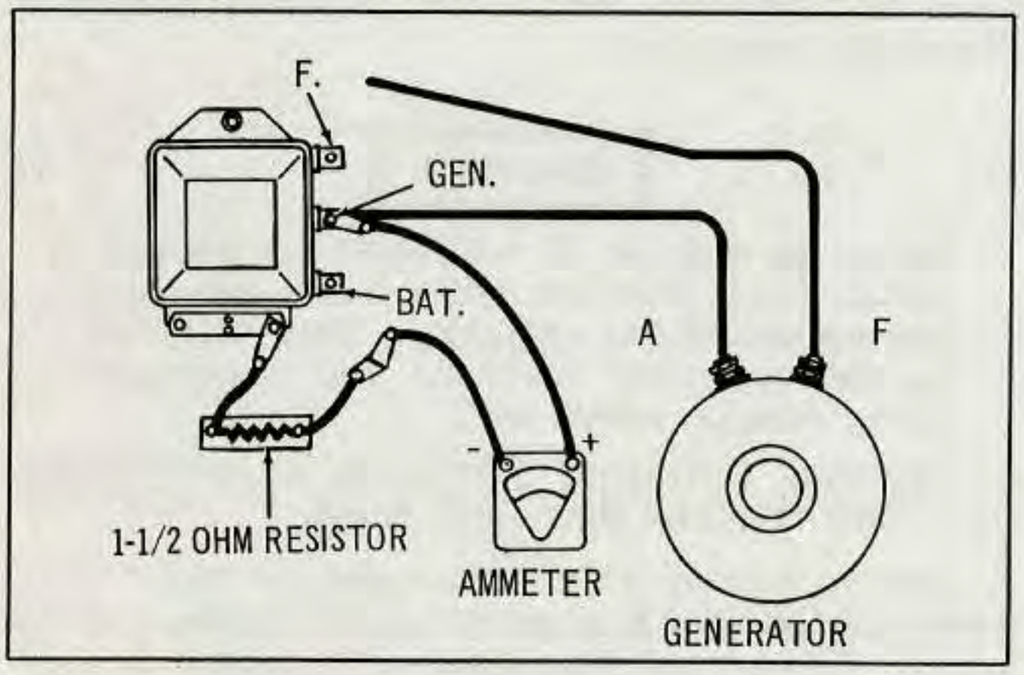


Figure 5I-5.

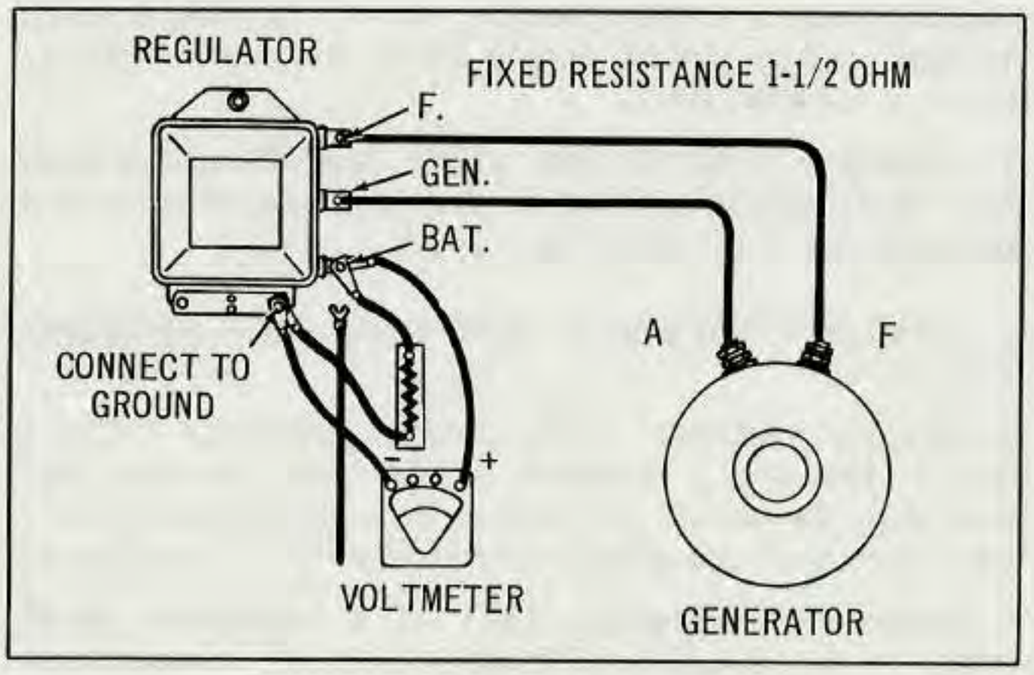


Figure 5I-6.

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

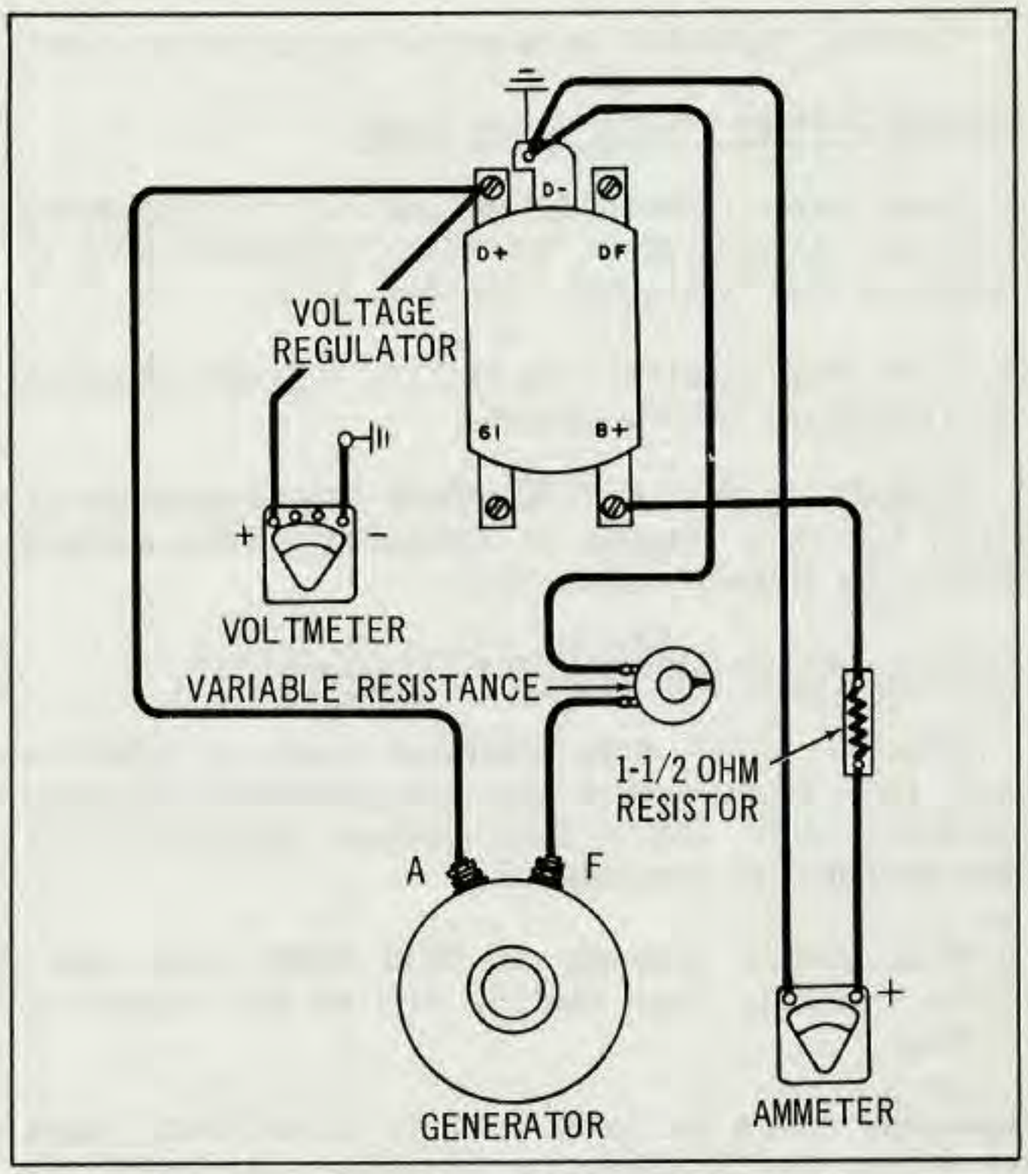


Figure 5I-7.

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 Sporster 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.

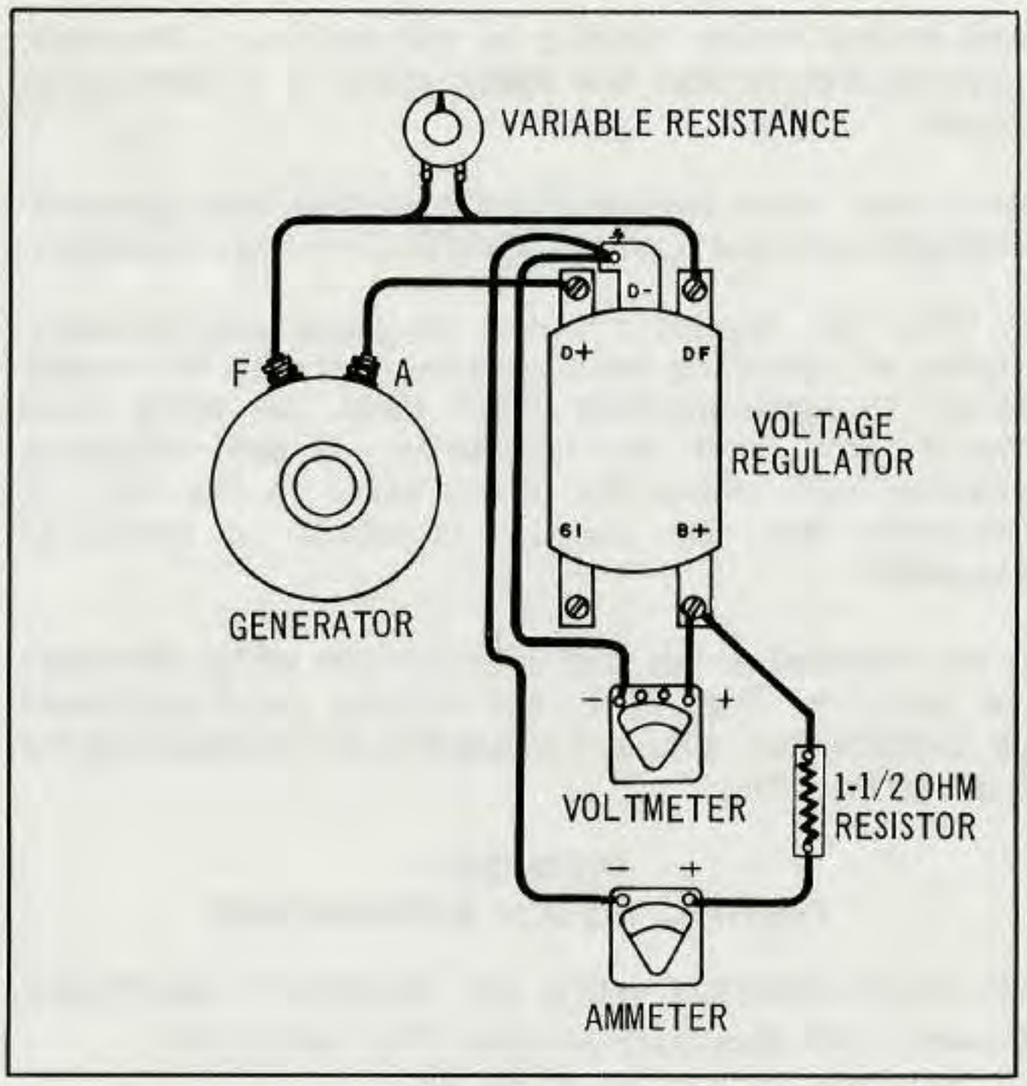


Figure 5I-8.

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.

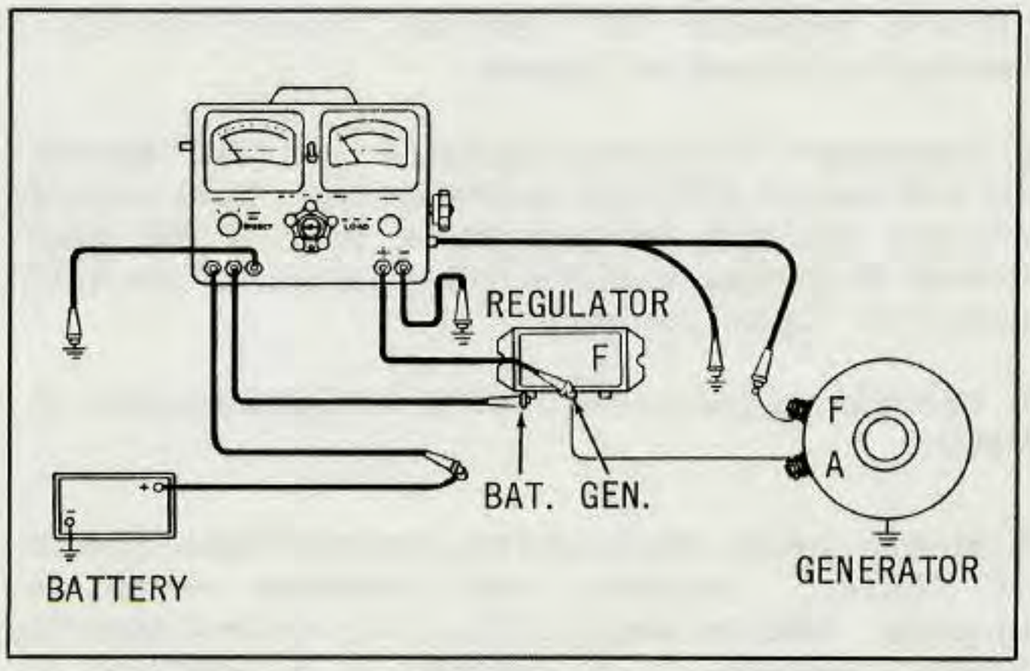


Figure 5I-9.

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.

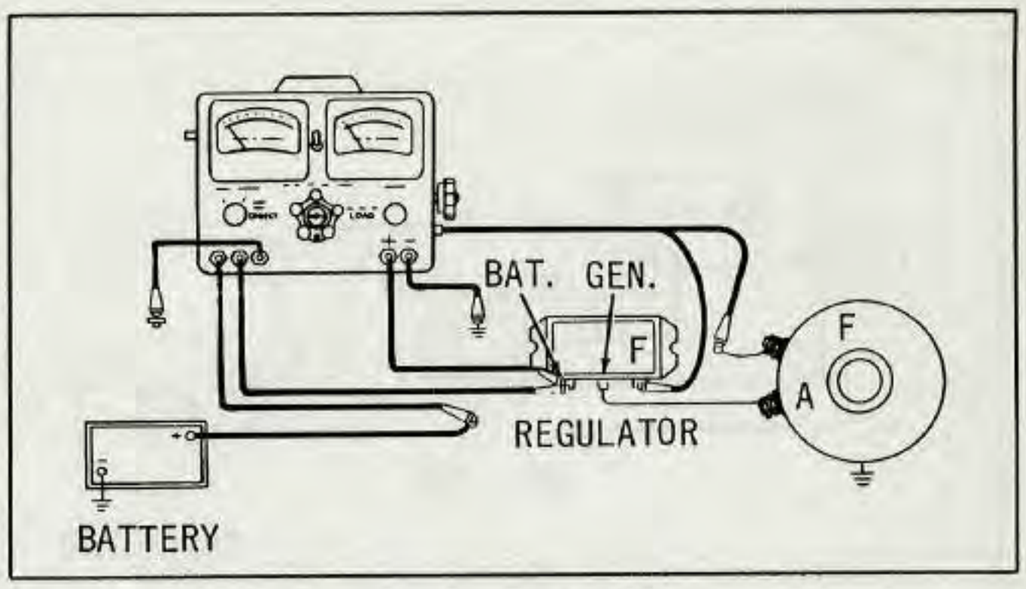


Figure 5I-10.

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.

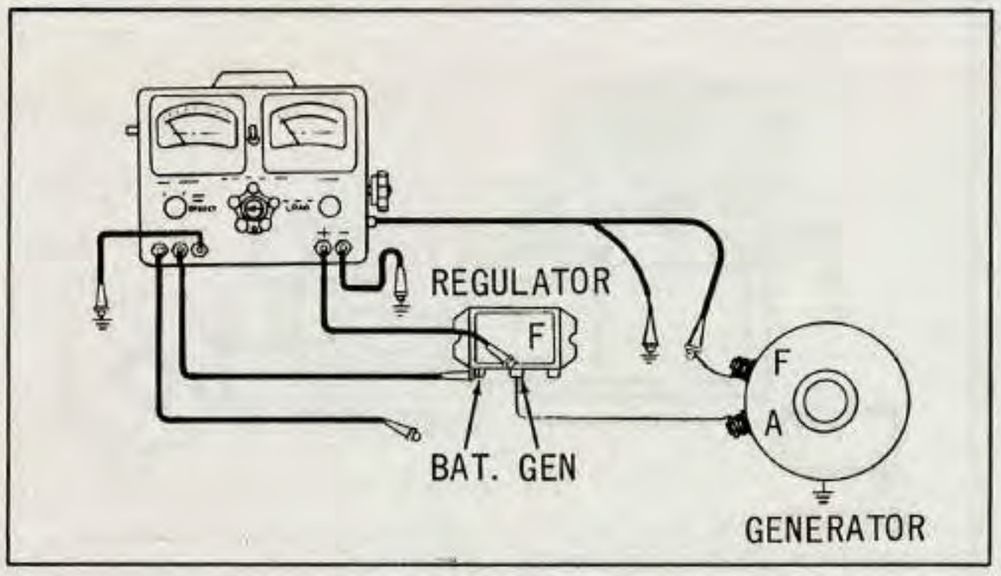


Figure 5I-11.

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.

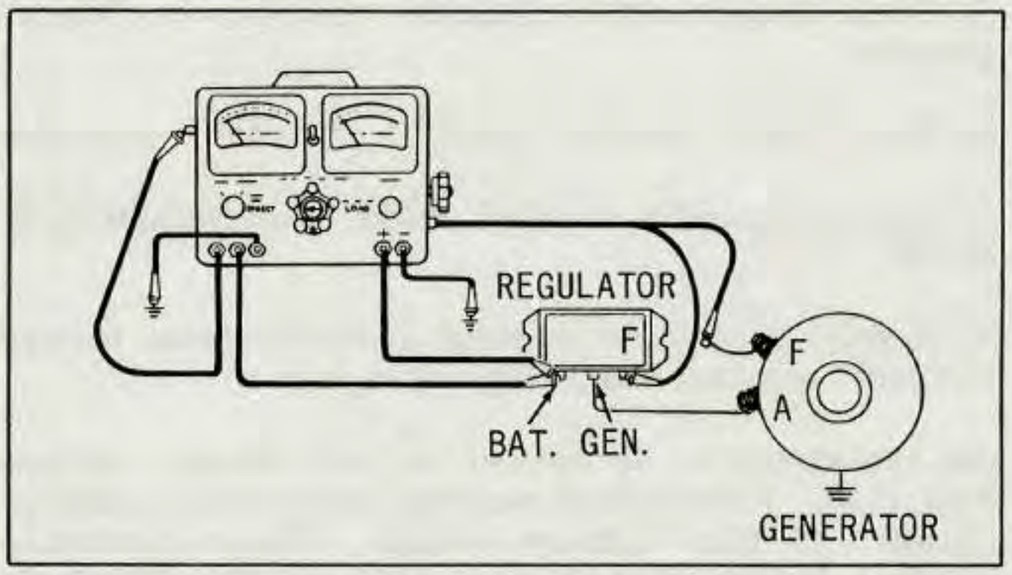


Figure 5I-12.

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 1965 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 connnect 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.

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.

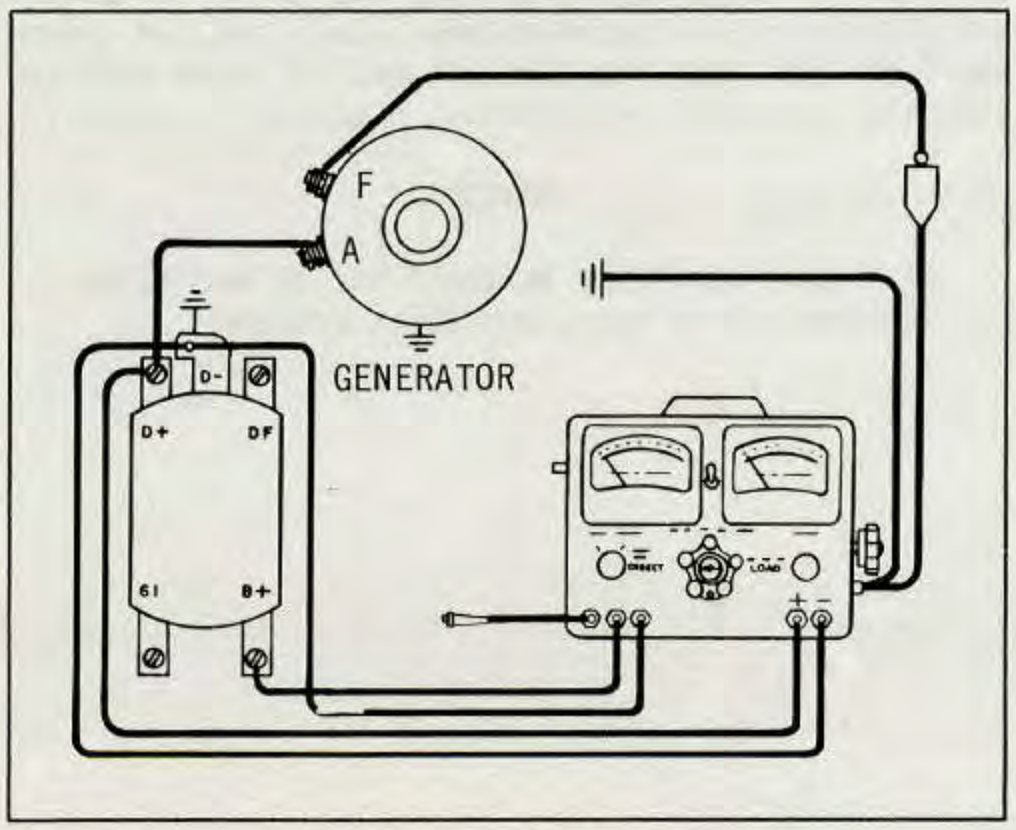


Figure 5I-13.

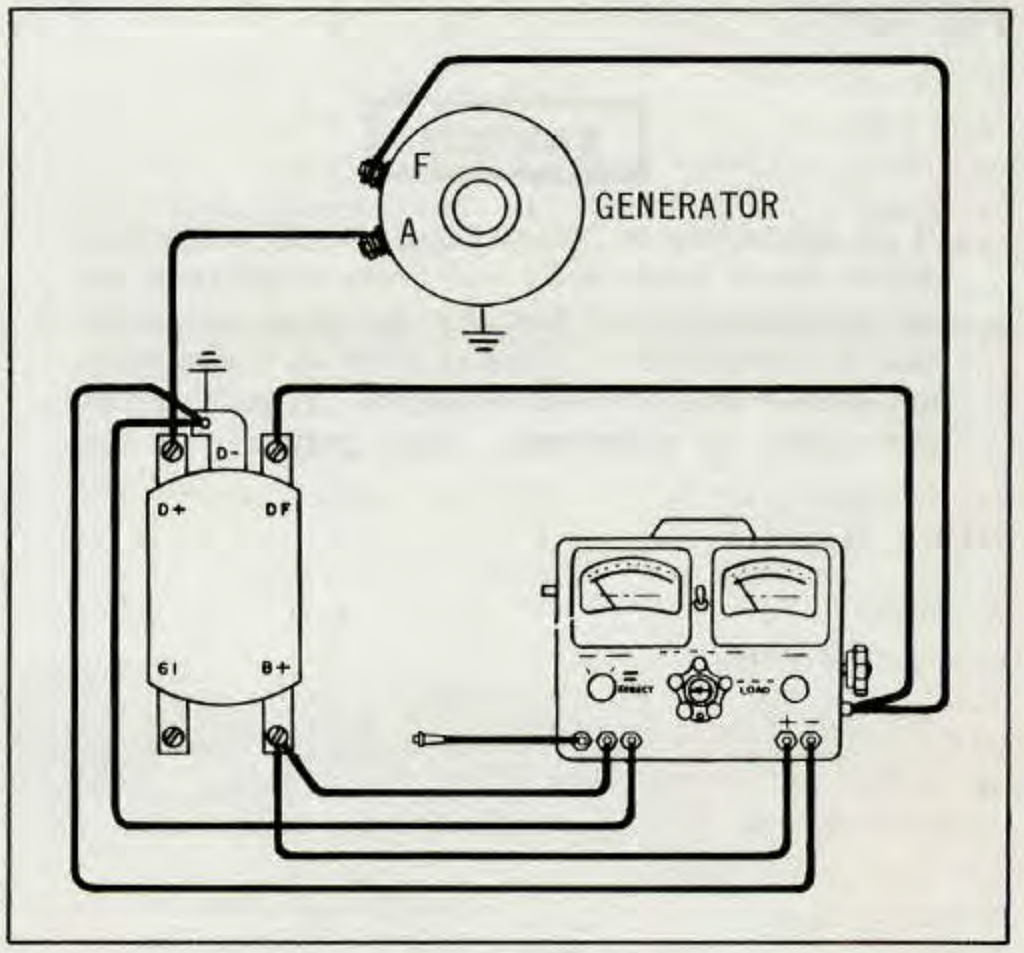


Figure 5I-14.

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

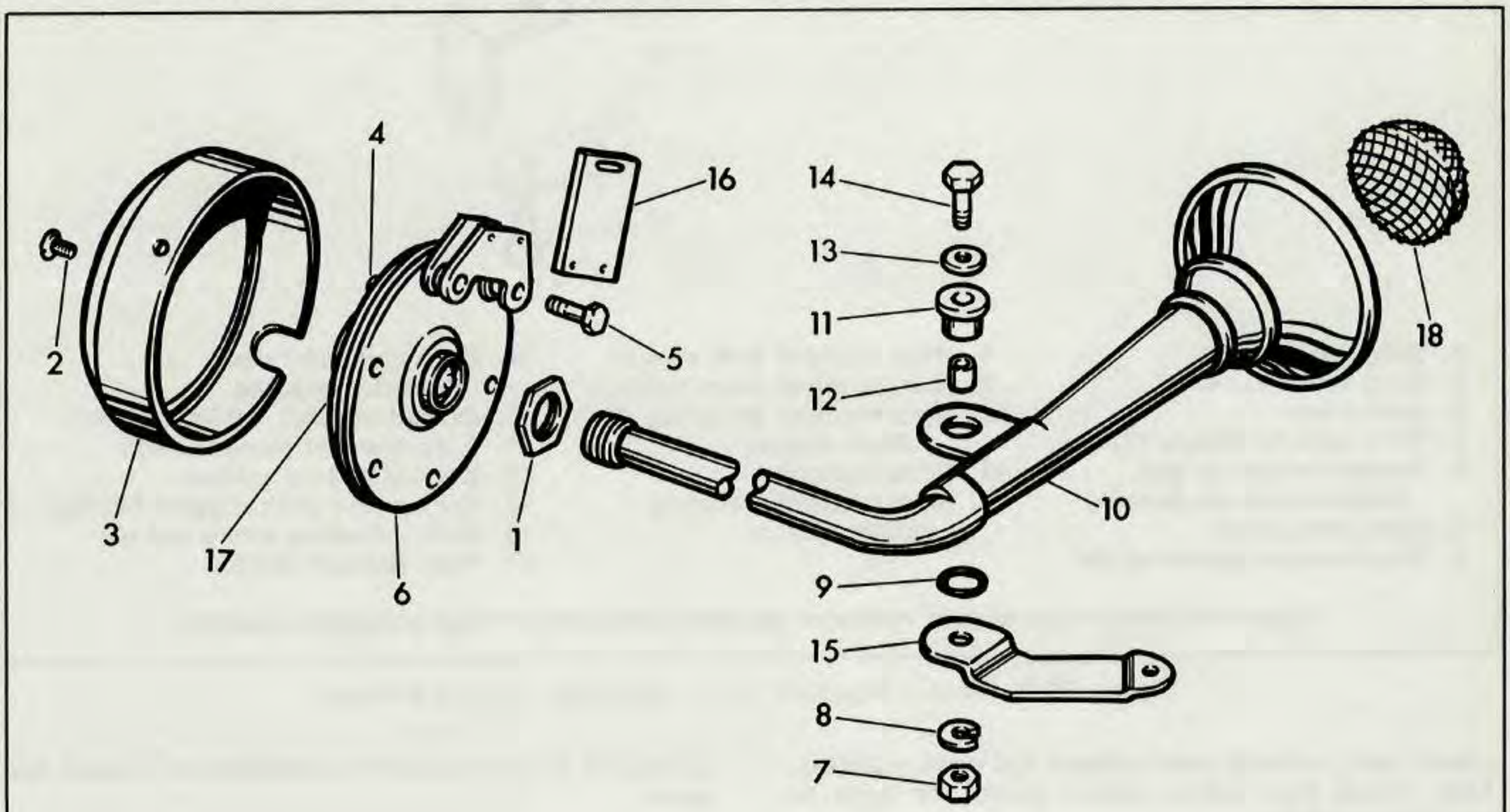
TRUMPET HORN - 1964 AND EARLIER DUO-GLIDE AND SPORTSTER

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.

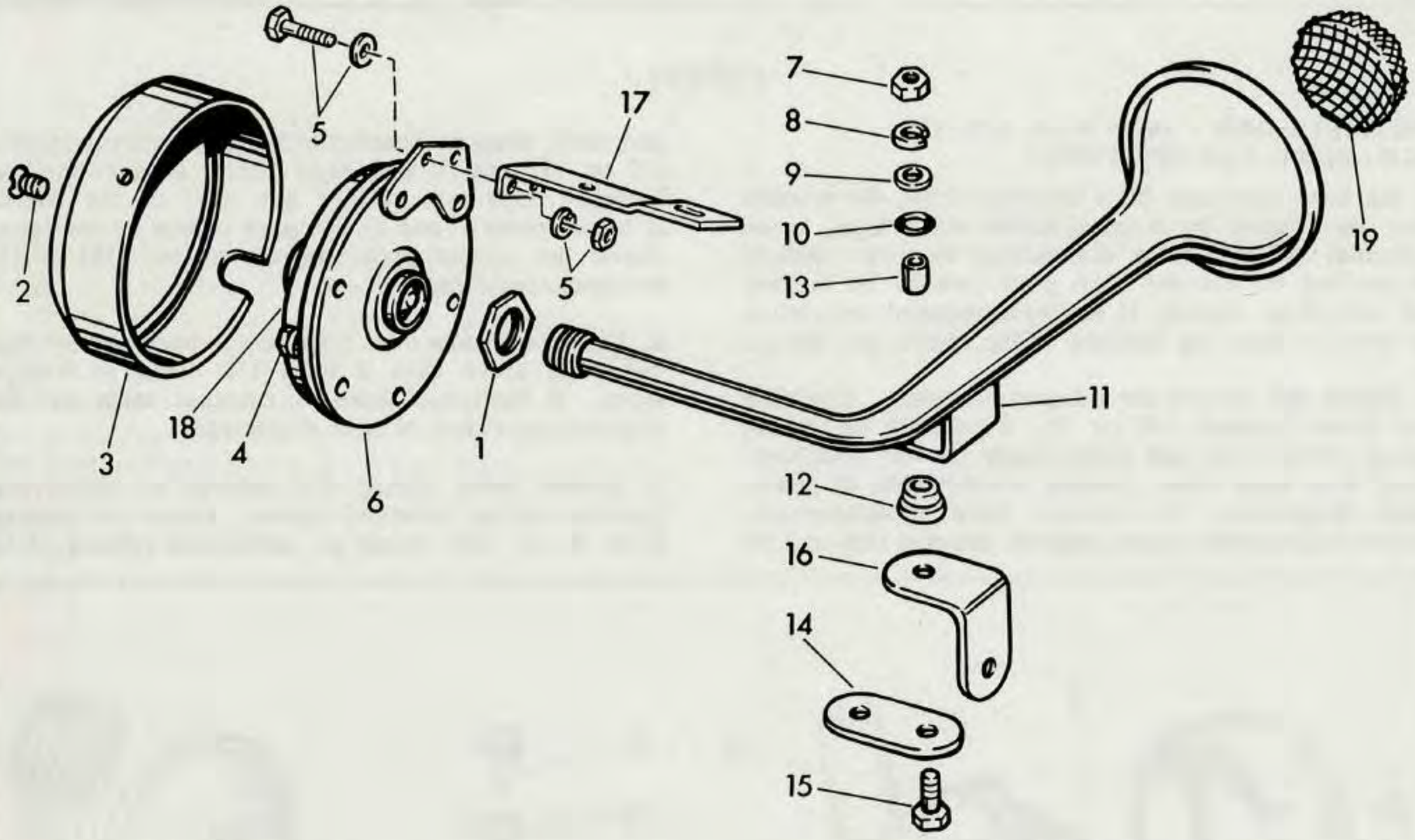
3. Inspect horn wiring for damage or loose connections at the terminal points. Loose or damaged horn wires will result in inadequate voltage at the



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)

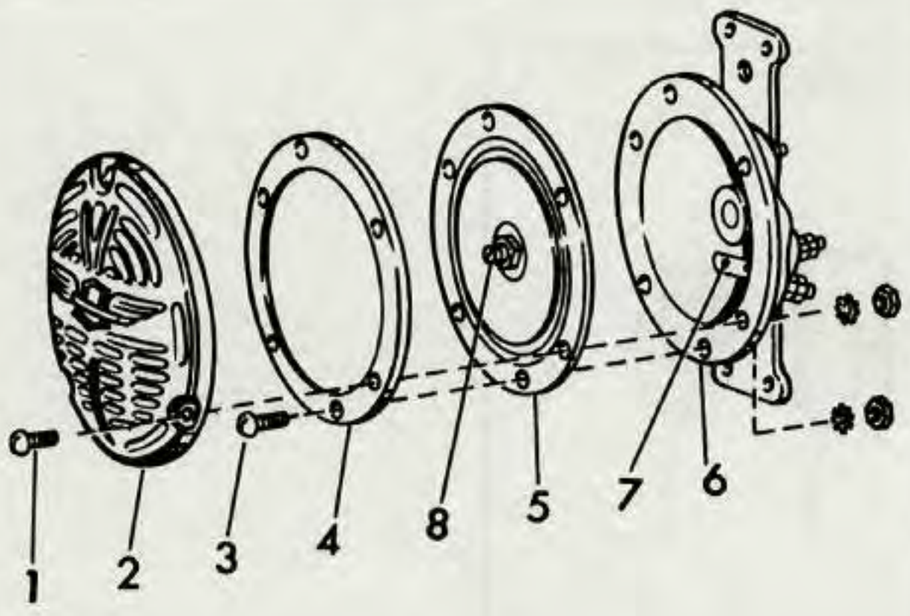
To disassemble the horn, simply follow the order of disassembly as illustrated. When installing the horn power pack to the trumpet, tighten the power pack 2 - 2-1/2 turns on the trumpet stem before tightening nut (1). Be careful to correctly position all parts as shown to insure correct alignment of 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.

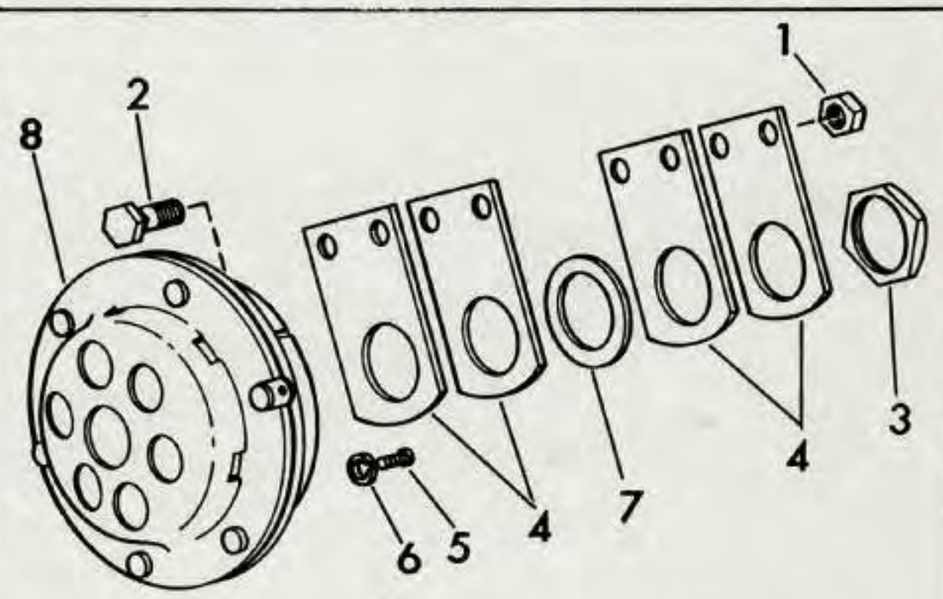
Air gap adjusting screw (8) should be left as originally set by the manufacturer. However, in the event horn does not appear to operate correctly after all other possible disorders have been eliminated (includes cleaning of contact points), the air gap adjusting screw can be turned to correct tone and 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.

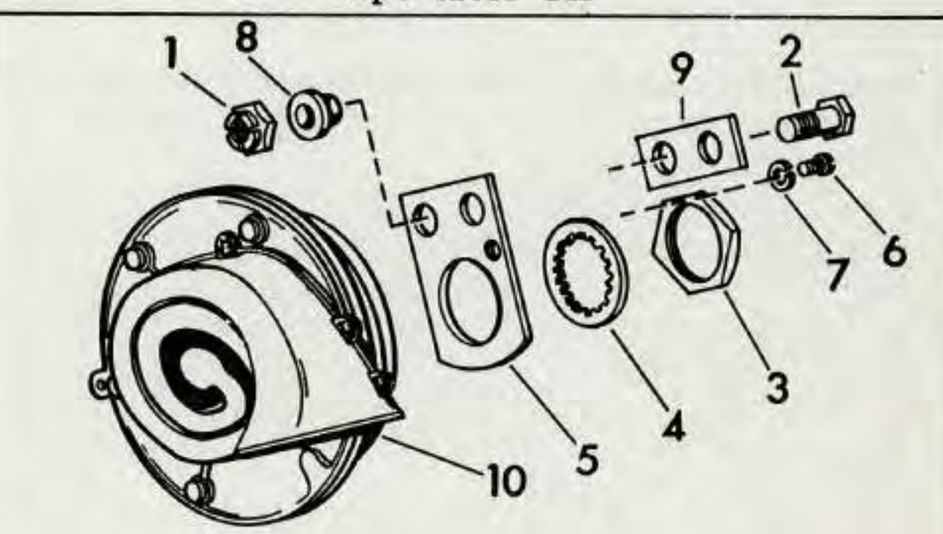
1962 AND LATER SERVI-CAR, SPORTSTER CH 1965 AND LATER DUO-GLIDE/ELECTRA-GLIDE

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.



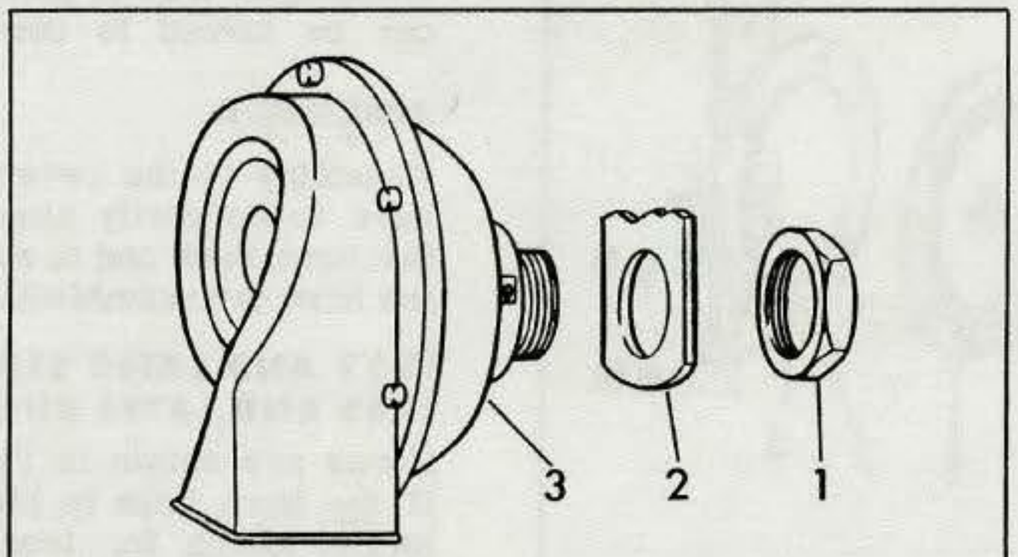
1. Nut (2)
2. Bolt (2)
3. Core nut
4. Bracket lamination (4)
5. Adjusting screw
6. Lock washer
7. Washer
8. Horn

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 nub 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.

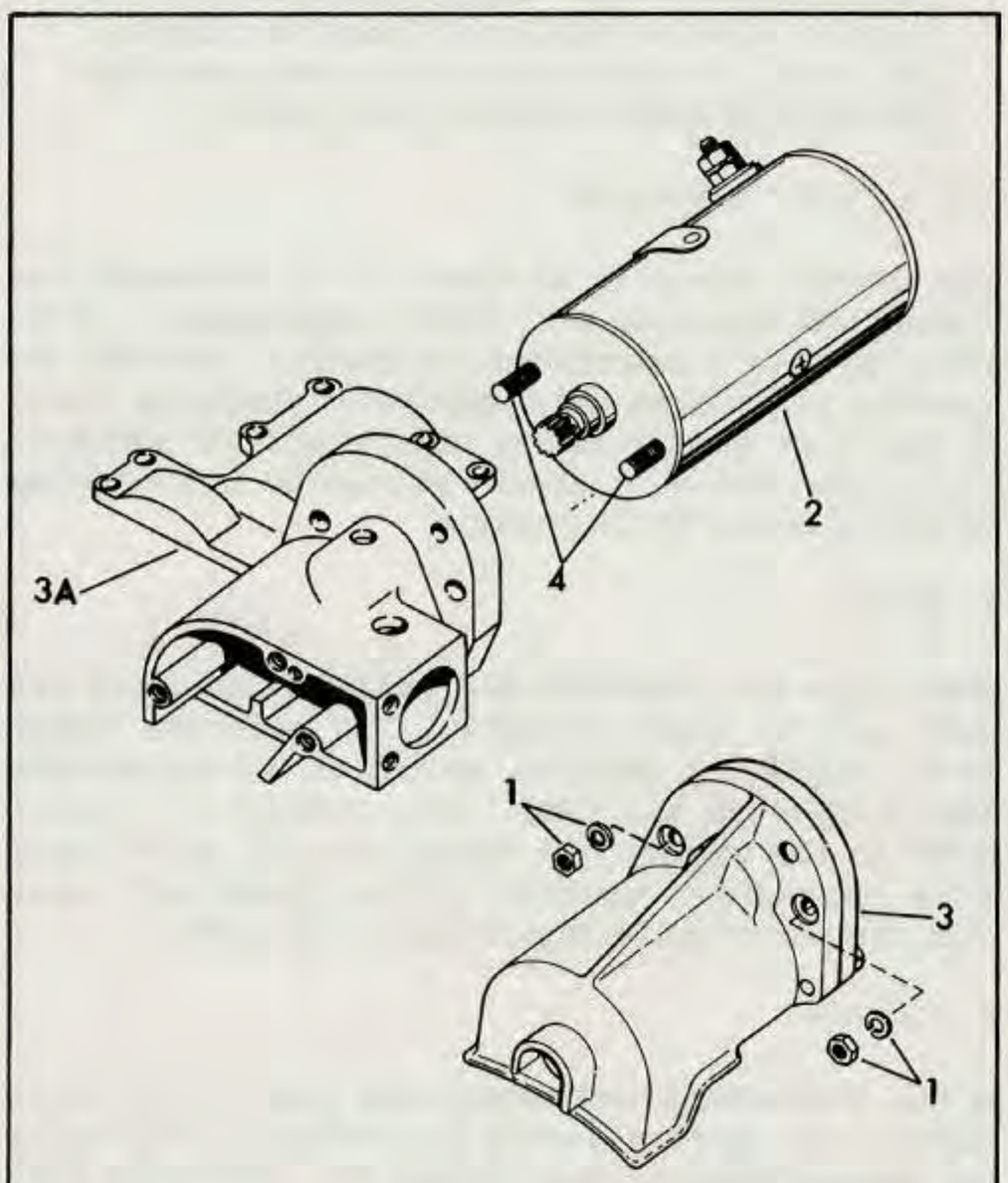
REPAIRING ARMATURE

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.

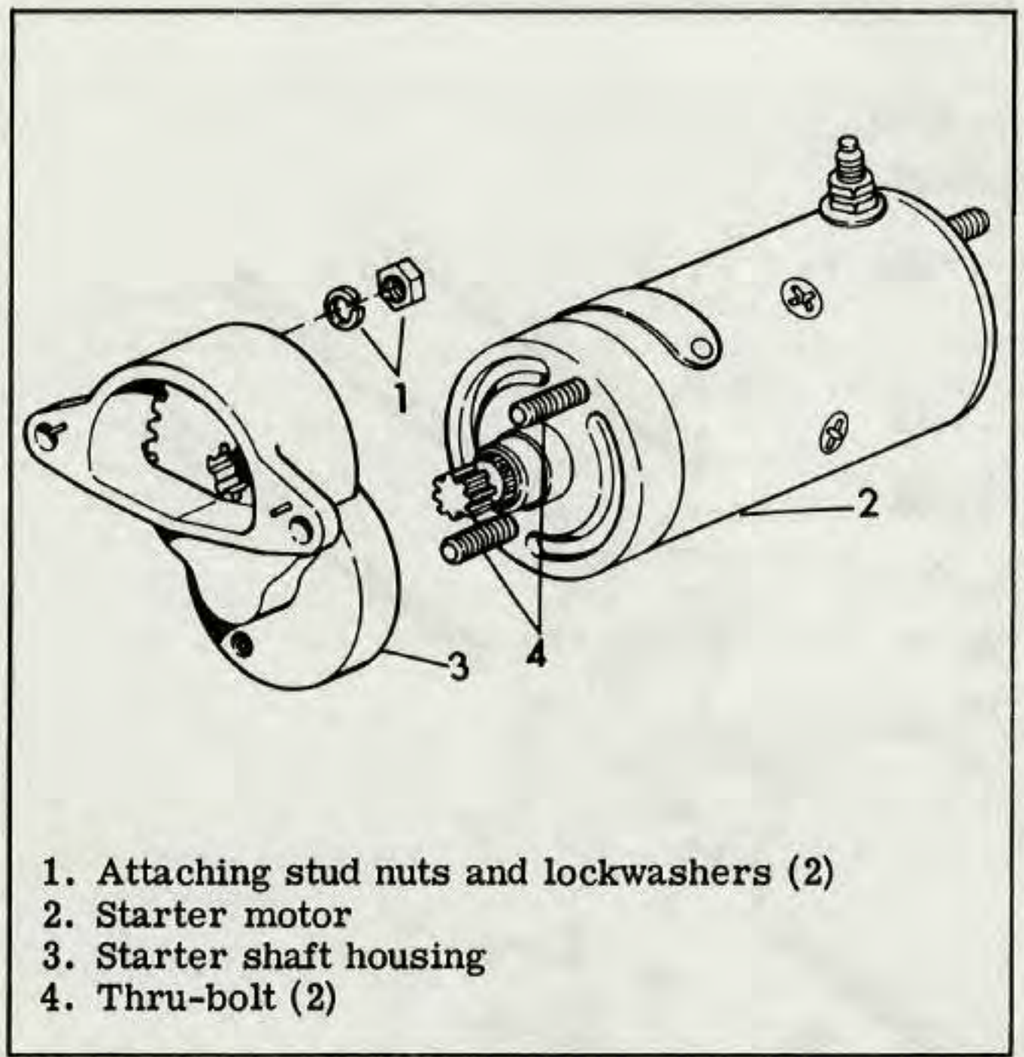
Inspect bushings (Item 21, Fig. 5L-8 and 5L-9) in drive end and commutator end frames, and commutator end thrust washer (22). Replace any excessively worn parts. Inspect bearing (23) in 4-pole type and replace if worn to excessive looseness.

For additional service and testing procedures, see Delco-Remy service bulletin No. 1M-152.



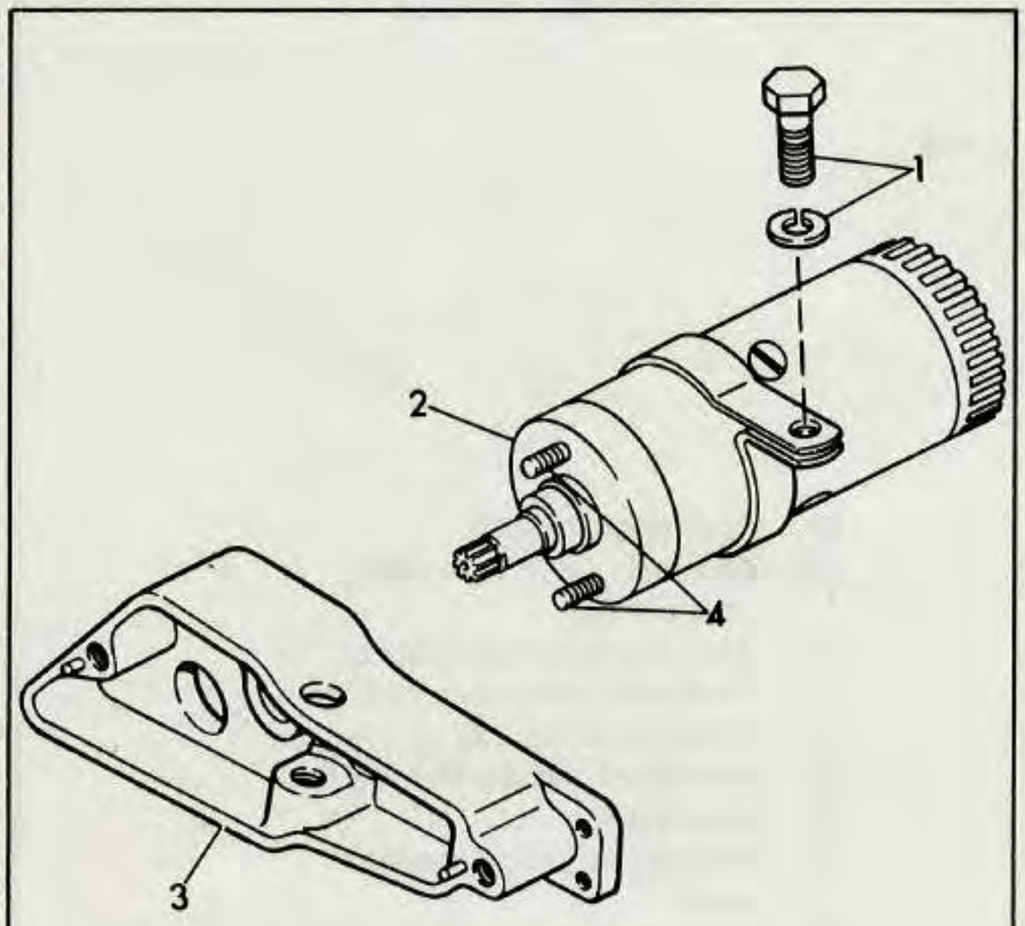
1. Thru-bolt nuts and lockwashers (1964-65) (2)
2. Starter motor
3. Transmission cover (1964-65 Servi-car)
3A. Transmission cover (1966 Servi-car)
4. Thru-bolt (2)

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.

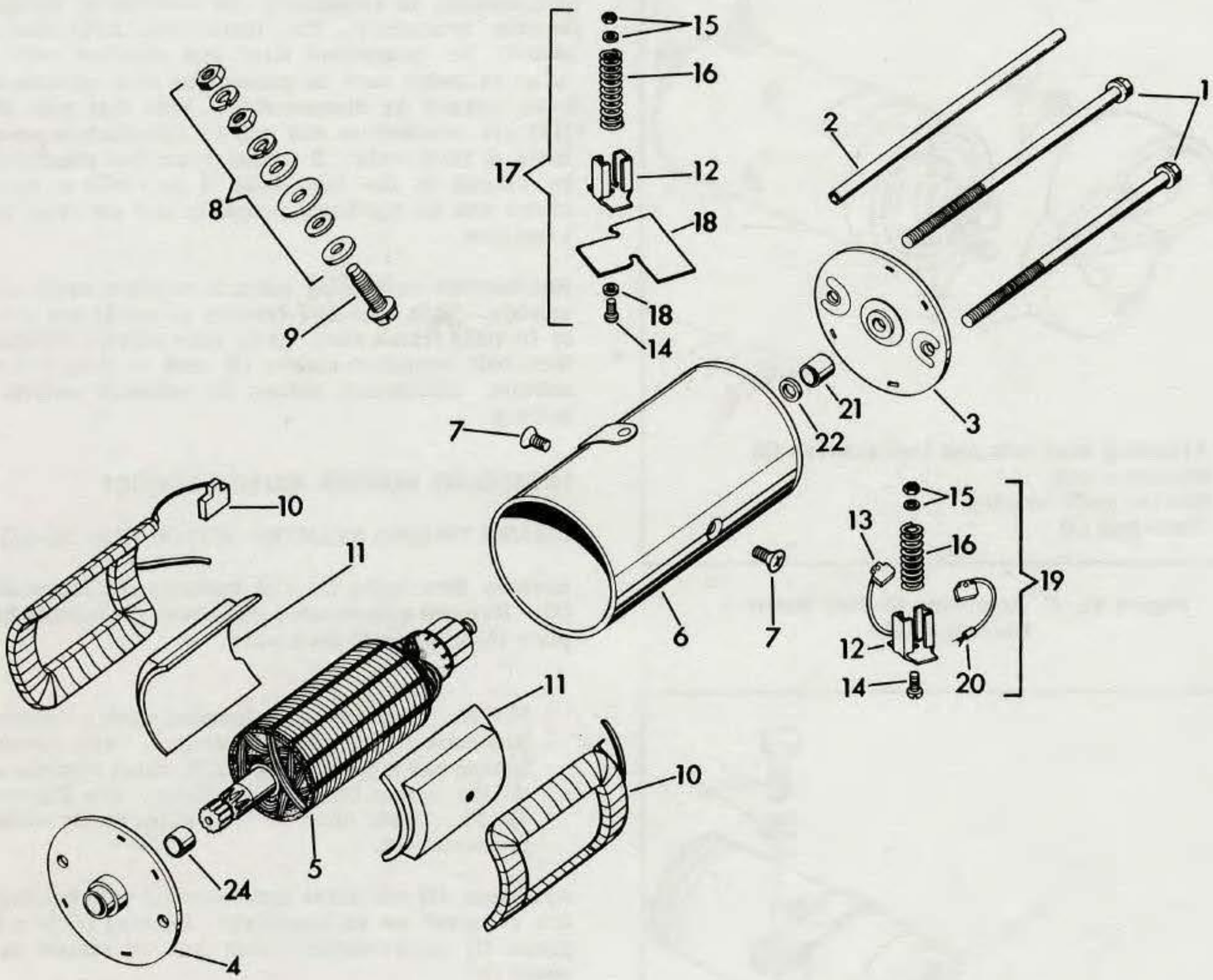
NOTE: End cover is marked with a double line next to the motor terminal. Also brush holder has a positioning notch which registers on the motor terminal insulator. See Figure 5L-12. Parts must be located correctly when reassembled.

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.

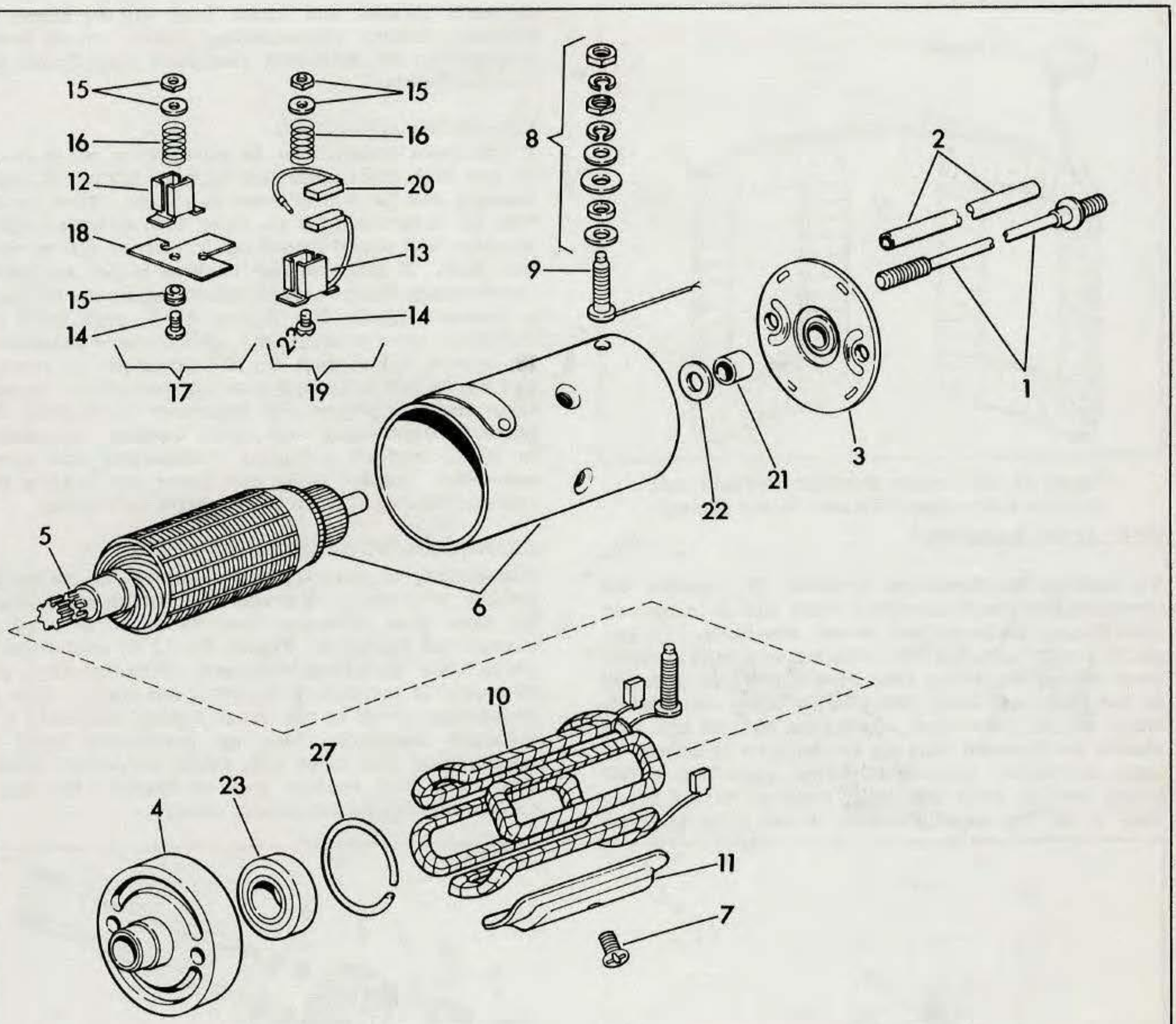
CHECKING FRAME AND FIELD ASSEMBLY

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

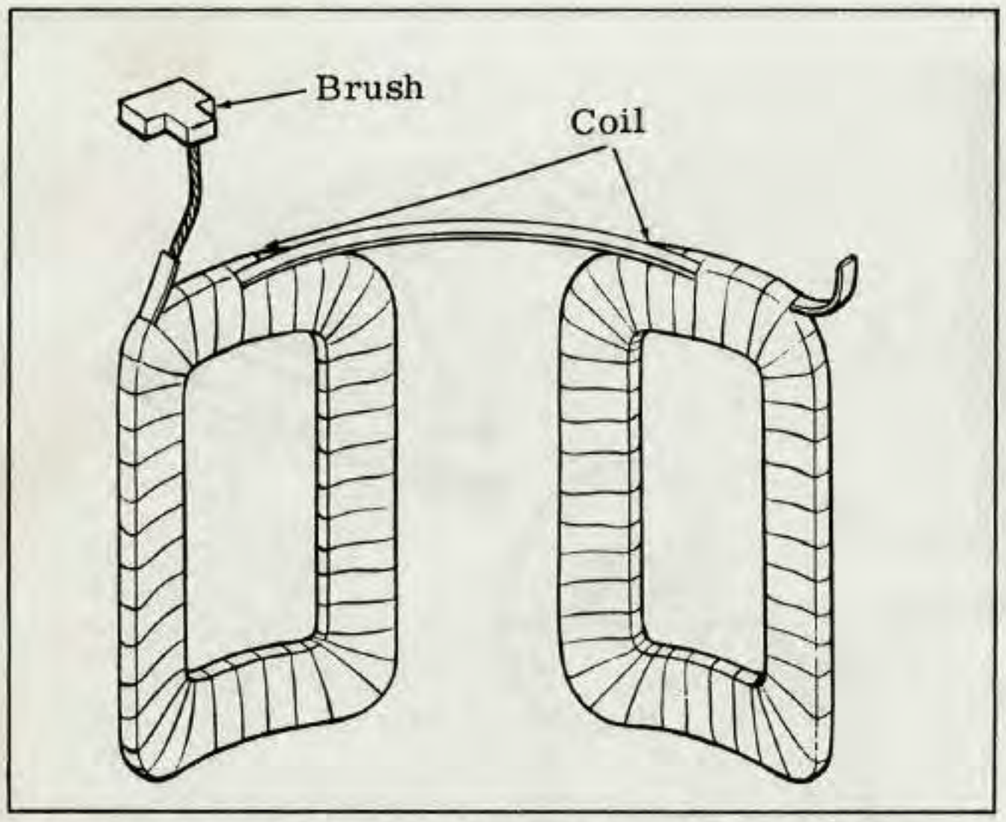


Figure 5L-10. Brush Position on Field Coil
(2-Pole Delco-Remy Starter Motor Shown)

REPLACING BRUSHES

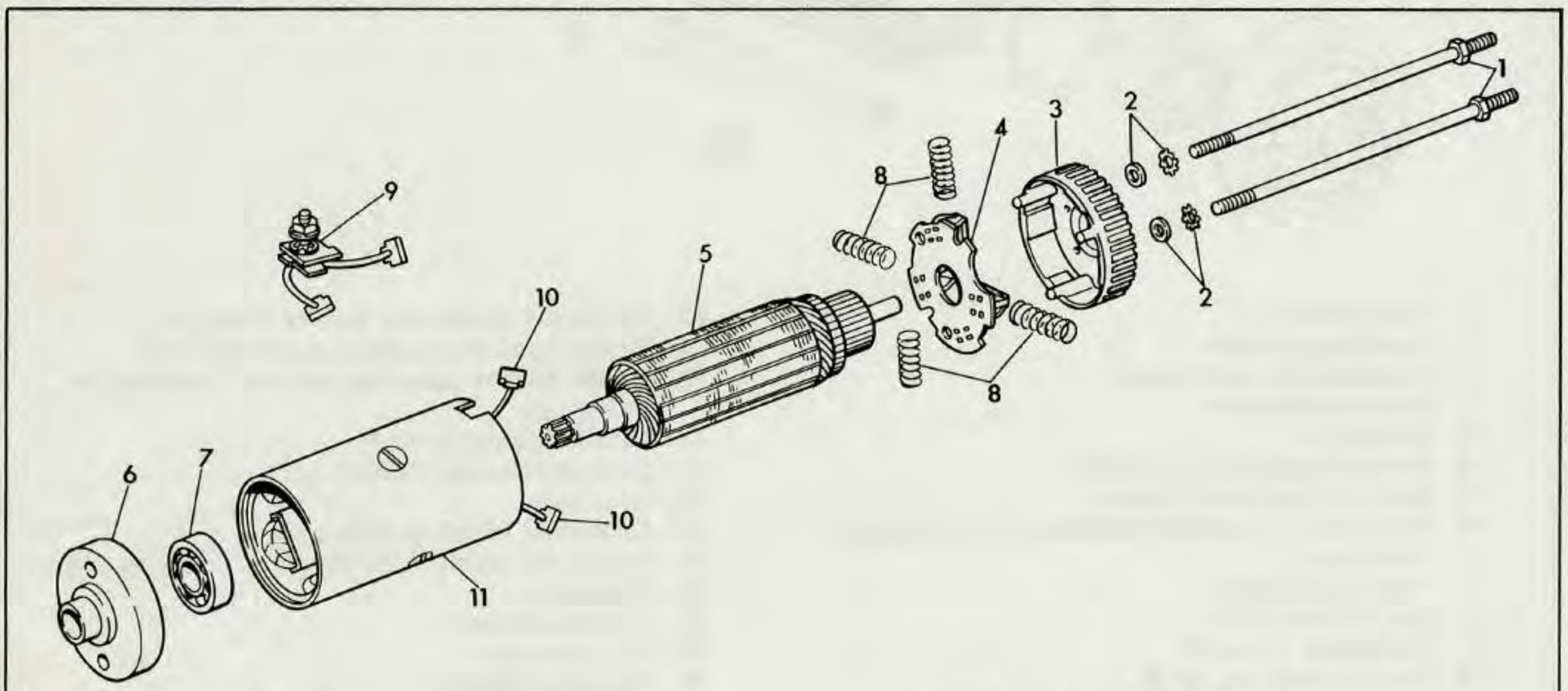
To replace the insulated brushes (9), remove the terminal and brush assembly from slot in frame and install new terminal and brush assembly. To replace ground brushes (10) attached to the field coils, first cut off old brush lead wire where it is attached to the field coil lead. Thoroughly clean coil 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

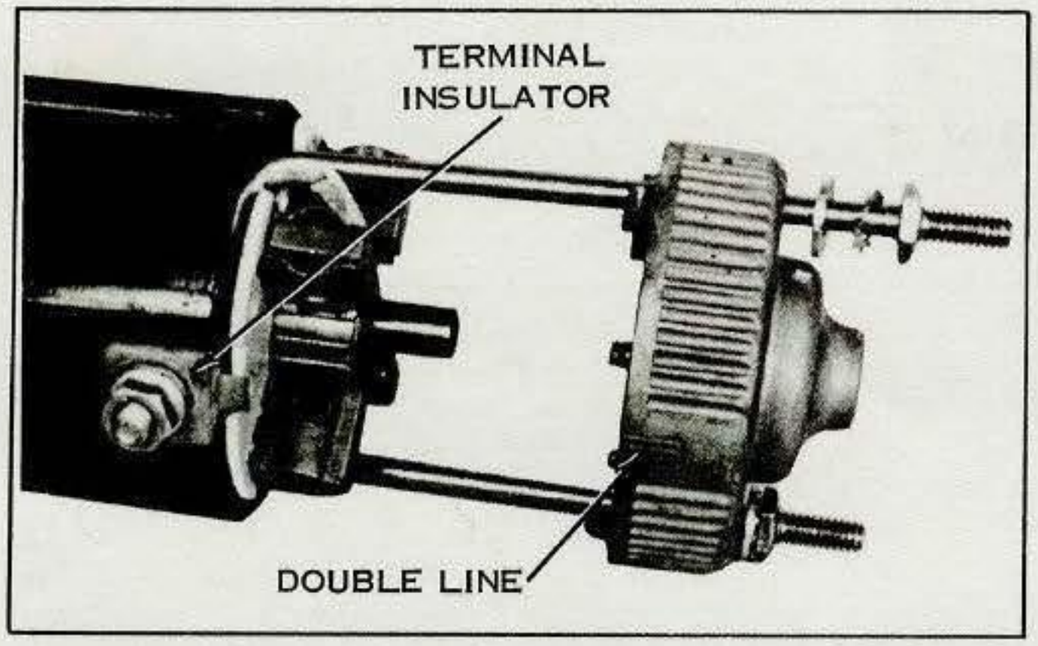


Figure 5L-12. Positioning Prestolite Starter Motor Cover

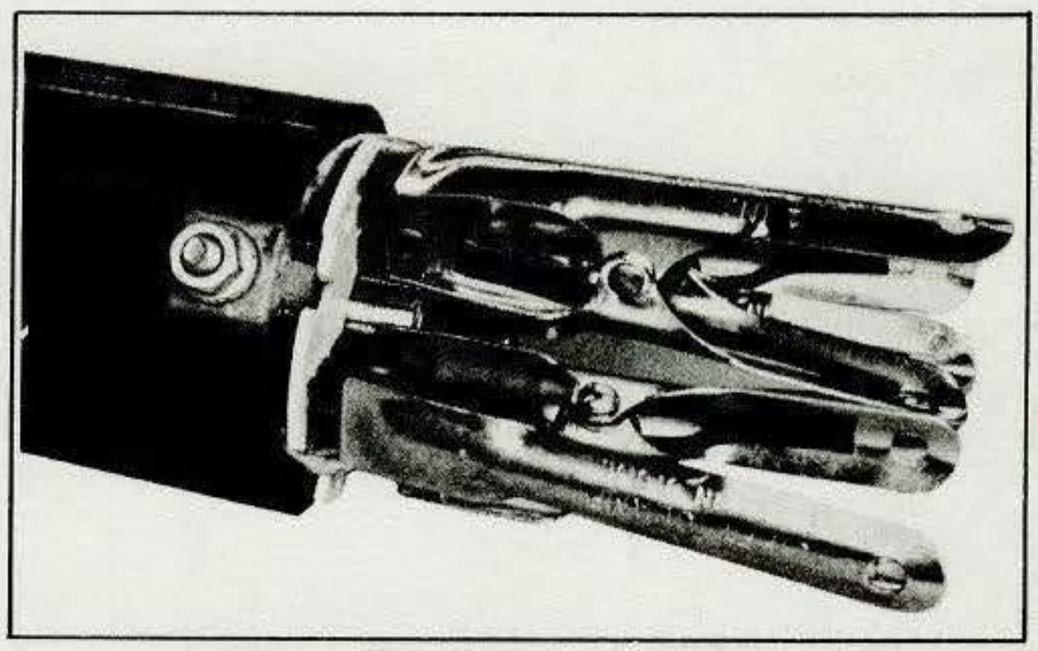


Figure 5L-13. Using Clamps to Hold Brushes in Place

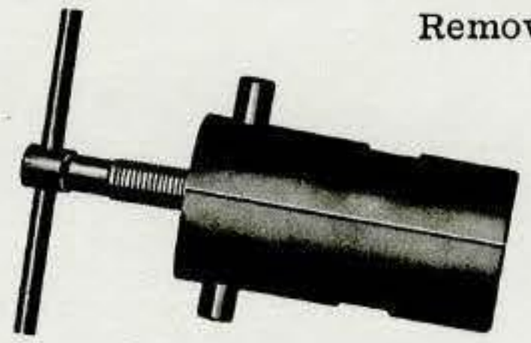
SUN POWER TIMING LIGHT MODEL PTL-45



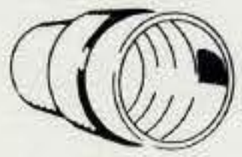
Order from Sun Electric Corp., Chicago, Ill.

95715-19A GEAR PULLER

Removes generator drive gear.



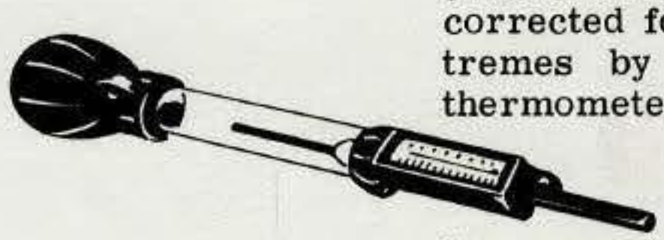
96295-65 TIMING MARK VIEW PLUG



Clear plastic plug threads into crankcase timing hole for accurate ignition timing with strobe light timing.

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

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Instruments	6D-1

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.

Harley-Davidson

Milwaukee, Wisconsin 53201

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