CHAPTER ONE

GENERAL INFORMATION

This handbook covers all service operations for late-model Norton twins—from changing a spark plug to overhauling an engine. The information applies specifically to the following models:

750 Commando — Standard
750 Commando — Combat
850 Commando Mark II and Mark IIA
850 Commando Mark III
(Electric Start)

In addition, the majority of the engine and transmission service procedures, as well as those for the front and rear suspension units and drum types brakes, are applicable to the earlier 750 G15 CS and the 750 Atlas. To further aid servicing of these early models, an engine exploded view is included in addition to electrical system schematics.

A WORD OF CAUTION

The large-displacement Norton twin is a high-performance motorcycle designed for high-speed touring and open-class production racing. As such, it represents a total design approach; engine performance, chassis geometry, and component selection are all carefully integrated to provide not only high performance but safe performance as well. Alterations to or substitution of suspension and brake components in an attempt to improve a late model or update an early one are not recommended. Changes in wheelbase, trail, caster, center of gravity, etc., resulting from uninformed chassis modification can render the motorcycle unsafe.

PARTS ORDERING

To prevent inadvertent installation of an incorrect part, always state your motorcycle's serial number when ordering replacement components. In this way your dealer can determine the correct part. Your motorcycle will be safer and more enjoyable as a result.

SERVICE HINTS

Most of the service procedures described can be performed by anyone reasonably handy with tools. However, carefully consider your own capabilities before attempting any operation which involves major disassembly of the engine or transmission.

Some operations, for example, require the use of a press. It would be wiser to have them performed by a shop equipped for such work, rather than to try the job yourself with makeshift equipment. Other procedures require precision measurements. Unless you have the skills and

equipment to make them, it would be better to have a motorcycle shop do the work.

Repairs are faster and easier if the motorcycle is clean before you begin work. There are special cleaners for washing the engine and related parts. Just brush or spray on the solution, let it stand, then rinse it away with a garden hose. Clean all oily or greasy parts with cleaning solvent as you remove them. *Never use gasoline as a cleaning agent.* It presents an extreme fire hazard. Always work in a well-ventilated area when using cleaning solvent. Keep a fire extinguisher, rated for gasoline fires, handy just in case of emergency.

Special tools are required for some service procedures. Some of these may be purchased through Norton dealers. If you are on good terms with the dealer's service department, you may be able to borrow his.

Much of the labor charge for repairs made by dealers is for removal and disassembly of other parts to reach the defective one. It is frequently possible to do all this yourself, then take the affected subassembly to the dealer for repair.

Once you decide to tackle a job yourself, read the entire section in this handbook pertaining to it. Study the illustrations and the text until you have a thorough idea of what's involved. If special tools are required, make arrangements to get them before you begin work. It's frustrating to get part way into a job and then discover that you are unable to complete it.

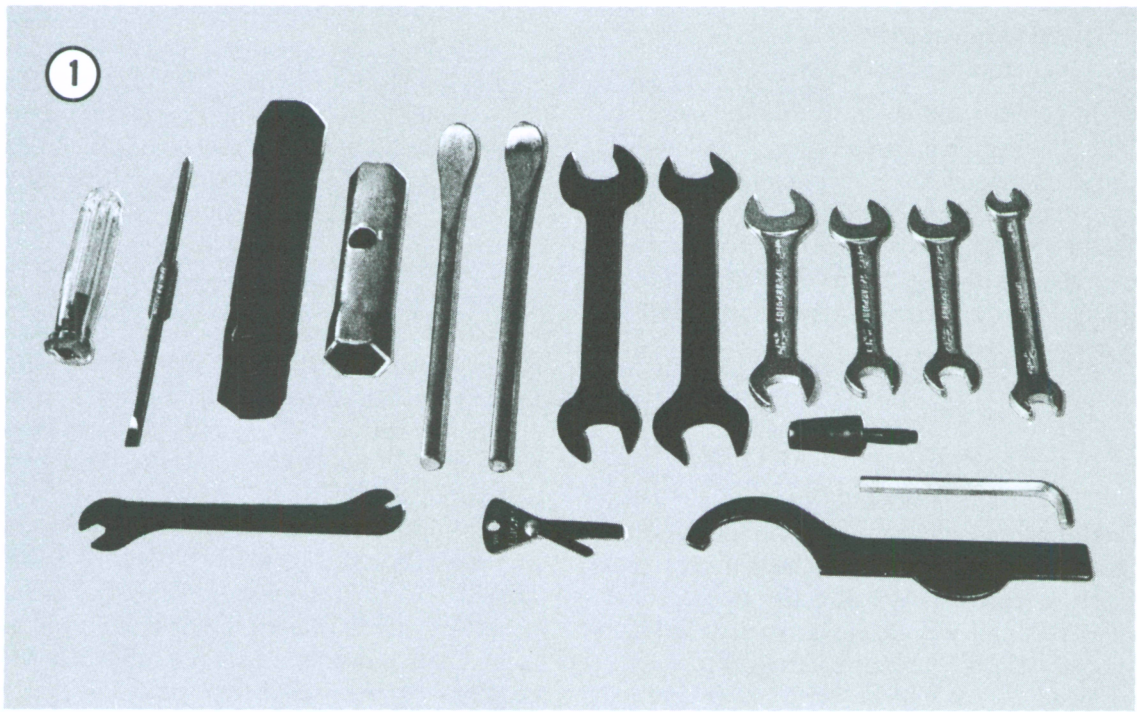
TOOLS

To properly service your motorcycle, you will need an assortment of ordinary hand tools. As a minimum, these include:

1. Combination wrenches
2. Socket wrenches
3. Plastic mallet
4. Small hammer
5. Snap ring pliers
6. Phillips screwdrivers
7. Slot screwdrivers
8. Impact driver
9. Pliers
10. Feeler gauges
11. Spark plug gauge
12. Spark plug wrench
13. Dial indicator
14. Drift

An original equipment tool kit, like the one shown in **Figure 1**, is available through most Norton dealers and is suitable for most minor servicing.

Electrical system servicing requires a voltmeter, ohmmeter or other device for determining continuity, and a hydrometer for the battery.



There are only 3 essential special tools required for working on the Norton — clutch spring compressor, Figure 69, Chapter Four; engine sprocket puller, Figure 73, Chapter Four; and a C wrench for removing and tightening the exhaust headpipe nuts.

EXPENDABLE SUPPLIES

Certain expendable supplies are required. These include grease, oil, gasket cement, liquid fastener-locking compound, rags, and cleaning solvent. These items are available at most motorcycle shops and auto supply stores. Distilled water for batteries is available at supermarkets.

SAFETY FIRST

A professional mechanic can work for years and never sustain a serious injury. If you observe a few rules of common sense and safety, you can enjoy many hours safely servicing your own machine. You can also hurt yourself or damage your motorcycle if you ignore these rules.

1. Never use gasoline as a cleaning solvent.
2. Never smoke or use a torch around flammable liquids, such as cleaning solvent.
3. Never smoke or use a torch in areas where batteries are being charged. Highly explosive hydrogen gas is formed during the charging process. And never arc the terminals of a battery to see if it has a charge; the sparks can ignite the explosive hydrogen as easily as would an open flame.
4. If welding or brazing is required on the motorcycle, remove the fuel tank and set it a safe distance away—at least 50 feet.
5. Always use the correct size wrench for turning nuts and bolts, and when a nut is tight, think for a moment what would happen to your hand if the wrench were to slip.
6. Keep your work area clean and uncluttered.
7. Wear safety goggles in all operations involving drilling, grinding, the use of a chisel, or an air hose.
8. Don't use worn tools.
9. Keep a fire extinguisher handy. Be sure it is rated for gasoline and electrical fires.

CHAPTER TWO

PERIODIC MAINTENANCE AND LUBRICATION

Regular maintenance is the best guarantee of a trouble-free, long-lasting motorcycle. An afternoon spent now, cleaning and adjusting, can prevent costly mechanical problems in the future and unexpected breakdowns on the road.

The procedures presented in this chapter can be easily carried out by anyone with average mechanical skills. The operations are presented step-by-step and if they are followed, it is difficult to go wrong.

SERVICE INTERVALS

The services and intervals shown in **Table 1** are recommended by the factory. Strict adherence to these recommendations will go a long way in ensuring long service life from your Norton.

For convenience in maintaining your motorcycle, most of the services shown in the table are described in this chapter. However, some procedures which require more than minor disassembly or adjustment are covered elsewhere in this book as indicated.

TIRE PRESSURE

Tire pressures should be checked and adjusted to accommodate rider and luggage weight. A simple, accurate gauge can be purchased for a few dollars and should be carried in the motorcycle tool kit. The appropriate tire pressures are shown in **Table 2.**

BATTERY ELECTROLYTE LEVEL

The battery is the heart of the electrical system. It should be checked and serviced as indicated. The majority of electrical system troubles can be attributed to neglect of this vital component.

The electrolyte level may be checked with the battery installed. However, it's necessary to remove the left cover plate (**Figure 1**). The electrolyte level should be maintained between the 2 marks embossed on the battery case (**Figure 2**). If the electrolyte level is low, it's a good idea to remove the battery from the motorcycle so that it can be thoroughly serviced and checked.

1. On 750 and 850 Mark II models, slide the metal loops off the hold-down bar and remove the bar (**Figure 3**). On 850 Mark III models, disconnect the battery strap buckle from the hook on the battery carrier (**Figure 4**).
2. Disconnect the electrical leads from the battery terminals—first the positive (ground) and then the negative (**Figure 5**).
3. Disconnect the vent pipe and lift the battery out of the holder.

Table 1 SERVICE INTERVALS

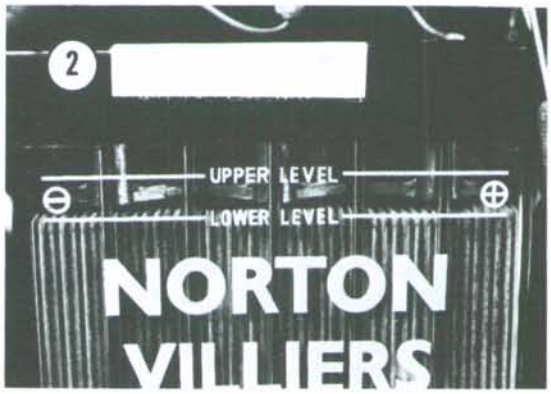
Weekly	Check tire pressure
Every 2 weeks	Check battery electrolyte level
Every 250 miles	Check engine oil tank level
Every 1,000 miles	Check primary chaincase oil level Adjust rear chain Lubricate all control cables with oil Adjust both brakes (optional disc brake is non-adjustable) Check disc brake fluid level Examine disc brake pads for wear
Every 2,500-3,000* miles	Check timing and adjust contact breaker points Clean spark plugs and set gaps Change primary chaincase oil Check clutch adjustment Check primary chain adjustment Change engine oil Lubricate and adjust rear chain Check gearbox oil level Check front and rear rubber engine mountings for side-play Change oil in forks Grease rear brake pedal pivot Check isolastic mountings for free-play
Every 5,000-6,000* miles	Change gearbox oil Replace oil filter element Clean contact breaker points Lubricate contact breaker cam felt and auto advance unit Grease brake expander pivots (one stroke of grease gun) Check and adjust valve rocker clearances Check and adjust camshaft chain Fit new air filter element Check and oil swinging arm bushings
Every 10,000-12,000* miles	Repack wheel bearings (including the rear wheel sprocket bearing) with grease Dismantle and clean both carburetors and check for wear

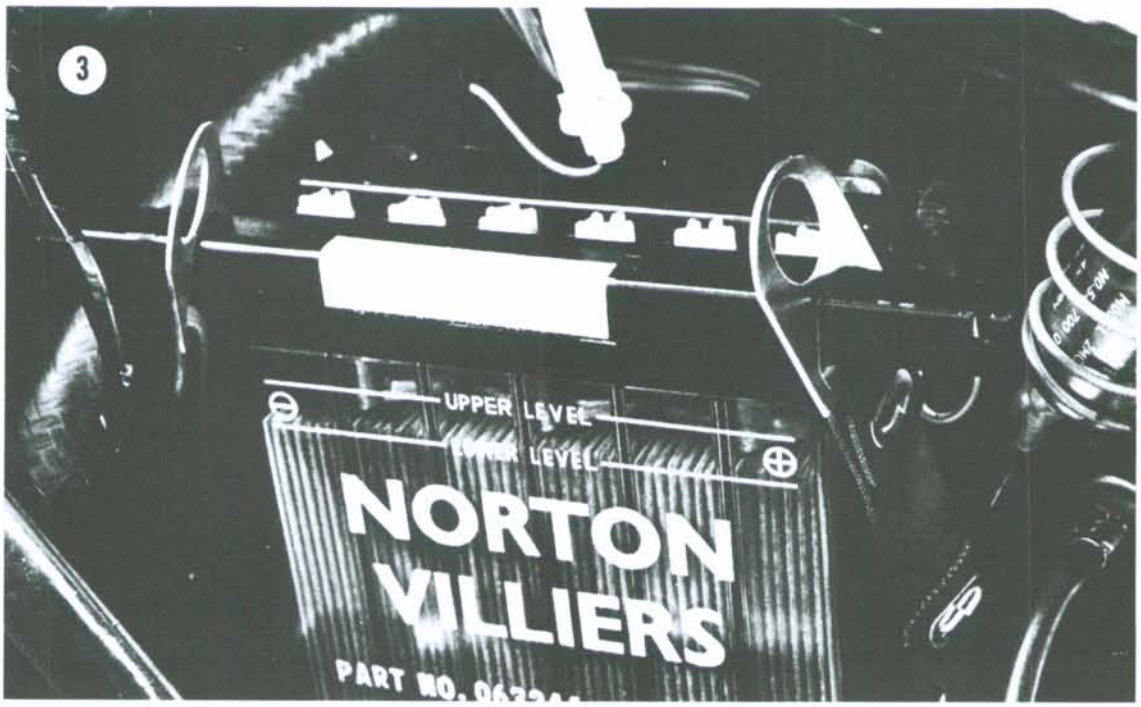
*Longer intervals correspond to factory-recommended intervals for 850 Mark II and Mark III models.

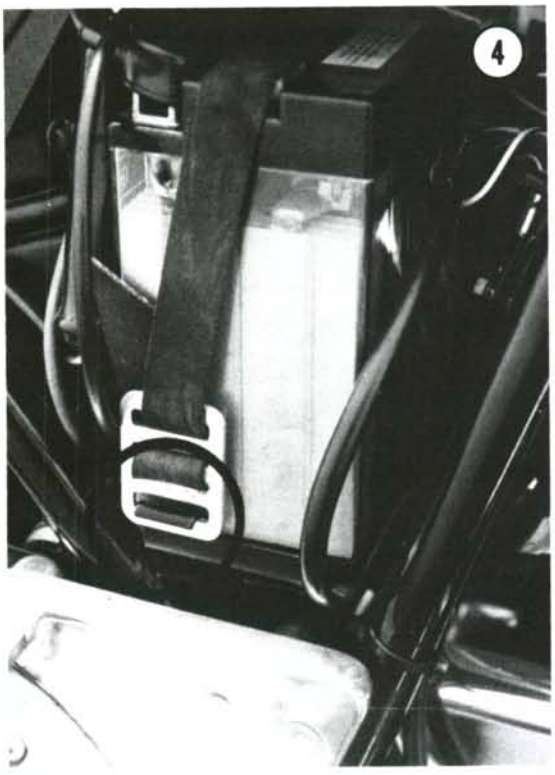
Table 2 TIRE PRESSURES

Load		Pressure*
Rider only (approx. 170 lb.)	Front	24 psi (1.7 Kg/sq. cm)
	Rear	26 psi (1.8 Kg/sq. cm)
Rider and passenger (approx. 340 lb.)	Front	26 psi (1.8 Kg/sq. cm)
	Rear	28 psi (1.969 Kg/sq. cm)
Rider and passenger plus 100 lb. luggage (approx. 440 lb.)	Front	28 psi (1.969 Kg/sq. cm)
	Rear	32 psi (2.250 Kg/sq. cm)

*Dunlop only—Avon min. 26 psi front and rear.







CAUTION

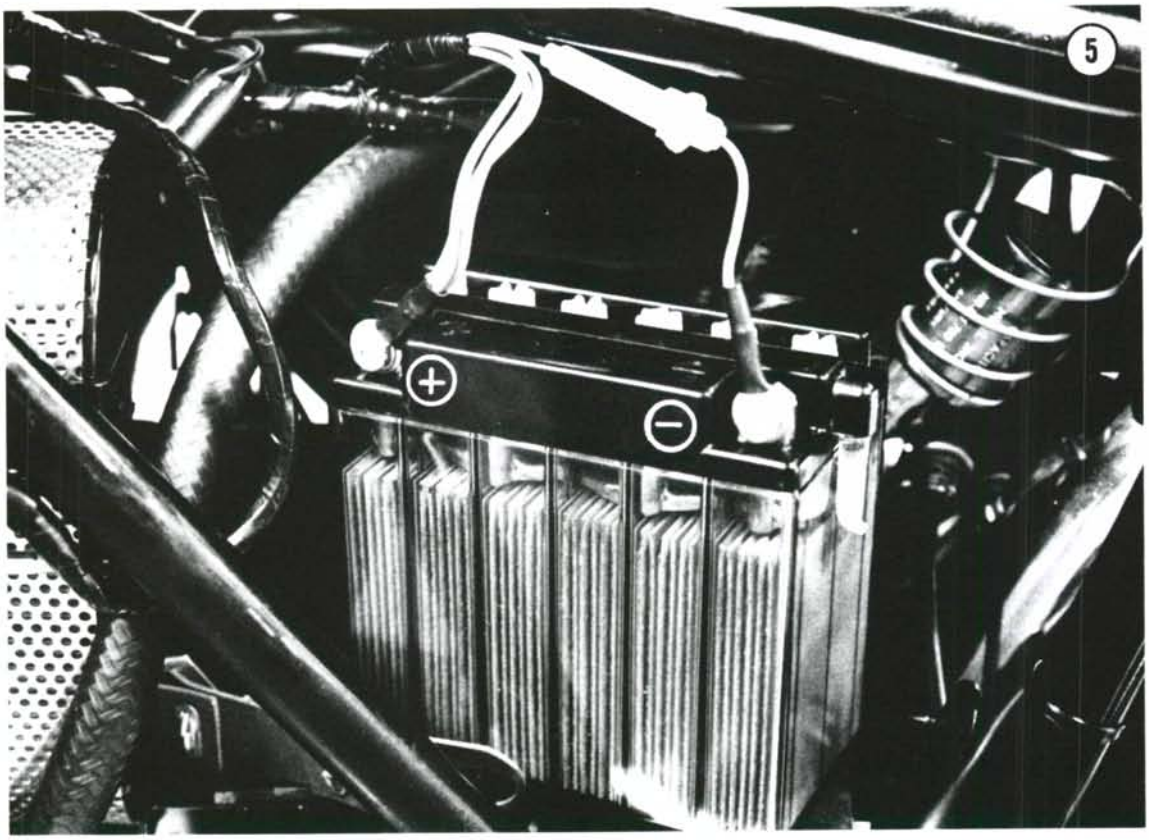
Be careful not to spill battery electrolyte on painted or polished surfaces. The liquid is highly corrosive and will damage the finish.

4. Remove the caps from the battery cells and add distilled water to correct the level. *Never* add electrolyte (acid) to correct the level.

5. After the level has been corrected and the battery allowed to stand for a few minutes, check the specific gravity of the electrolyte in each cell with a hydrometer. Follow the hydrometer manufacturer's instructions for reading the instrument. The specific gravity should be 1.270-1.290 at a temperature of 60°F. If it is substantially less, charge the battery at a rate of one ampere for at least 4 hours or until the specific gravity is at an acceptable level.

WARNING

During charging, highly explosive hydrogen gas is released from the battery. The battery should be charged only in a well-ventilated area, and open flames and lighted cigarettes should be kept



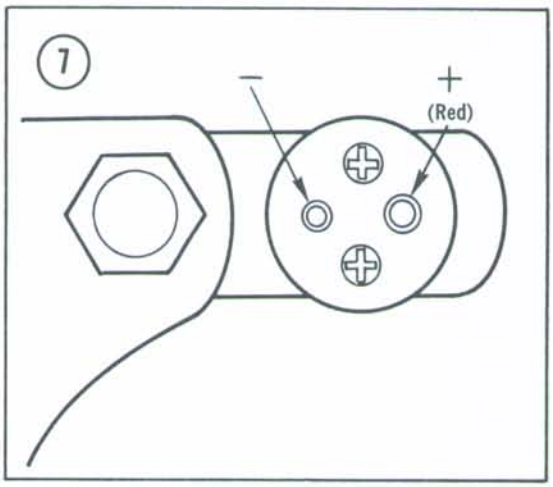
away. Never check the charge of the battery by arcing across the terminals; the resulting spark can ignite the hydrogen gas.

6. Connect the positive charger lead to the positive battery terminal and the negative charger lead to the negative battery terminal.

NOTE: *The battery may be connected to a charger using the electrical outlet on the right side of the motorcycle (***Figure 6***). The plug should be wired as shown in* **Figure 7**. *The battery leads on the motorcycle must be connected.*

7. Remove the vent caps from the battery, set the charger at 12 volts, and switch it on. If the output of the charger is variable, it's best to select a low setting—1½ to 2 amps.

8. After the battery has been charged for about 8 hours, turn off the charger, disconnect the leads, and check the specific gravity. It should be within the limits specified above. If it is, and if it remains stable after one hour, the battery is charged.

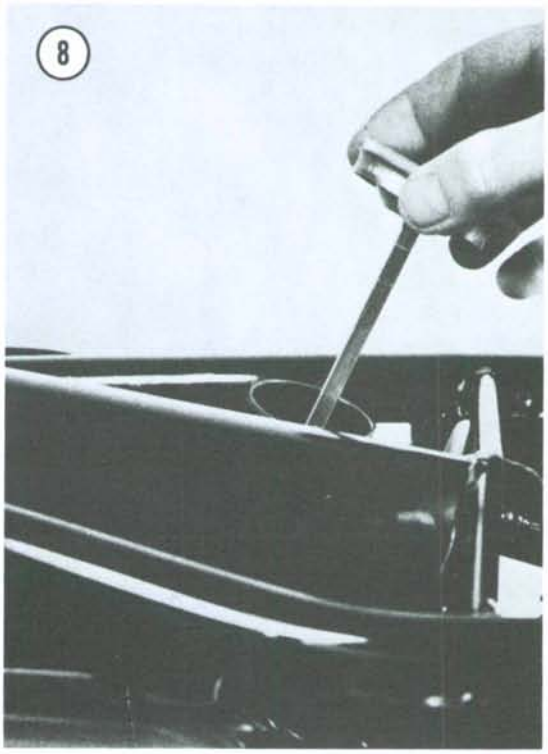


9. Clean the battery terminals and case, and reinstall it in the motorcycle, reversing the removal steps. Coat the terminals with Vaseline or silicone spray to retard decomposition of the terminal material.

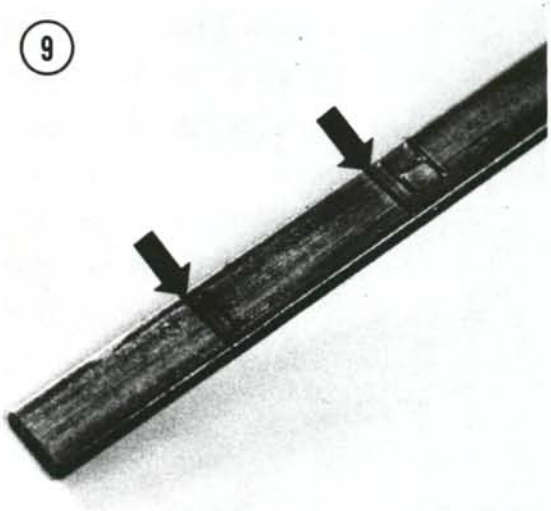
ENGINE OIL

Checking Level

Engine oil level is checked with the dipstick mounted in the tank filler cap (**Figure 8**).



1. Start the engine and allow it to run for a couple of minutes so that the excess oil will be returned from the crankcase to the oil tank.
2. Remove the seat and unscrew the filler cap from the oil tank. Visually check to see that the oil is circulating in the tank. Replace the filler cap to prevent oil from being splashed out.
3. Shut off the engine and allow the oil to settle in the tank. Then, check the level with the dipstick. The oil level should be above the "L" mark but not above the "H" mark (**Figure 9**); if the level is above the "H" mark, oil will overflow into the air filter. If necessary, add the recommended grade of oil to correct the level. Install the filler cap and tighten it securely.



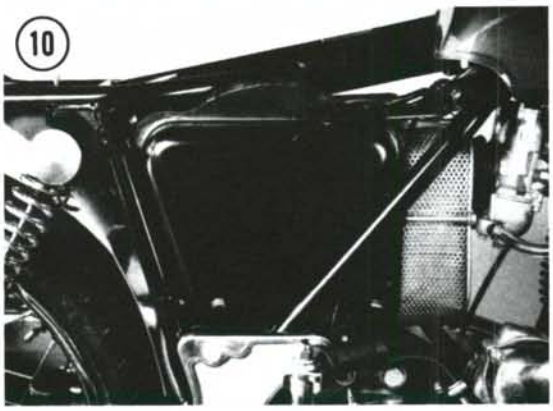
Changing

The factory recommended oil change interval is 2,500-3,000 miles. This assumes that the motorcycle is operated in moderate climates. In extremely cold climates, oil should be changed every 30 days. The time interval is more important than the use interval because acids formed by gasoline and water vapor from condensation will contaminate the oil even if the motorcycle is not run for several months. Also, if the motorcycle is operated under dusty conditions the oil will get dirty more quickly and should be changed more frequently than recommended.

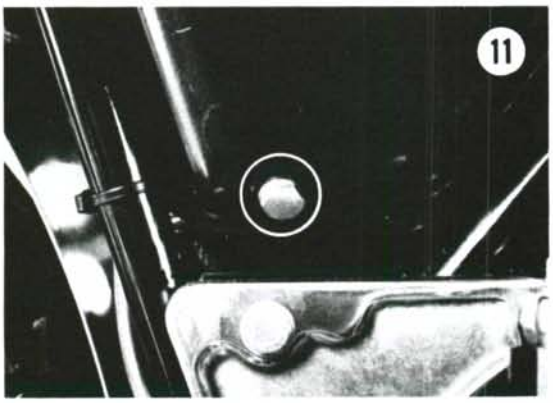
Use only a detergent oil with an API rating of SE or better. The quality rating is stamped on the top of the can. Try always to use the same brand of oil. Oil additives are not recommended.

A 50W oil is recommended for use at ambient temperatures above 0°F (—18°C).

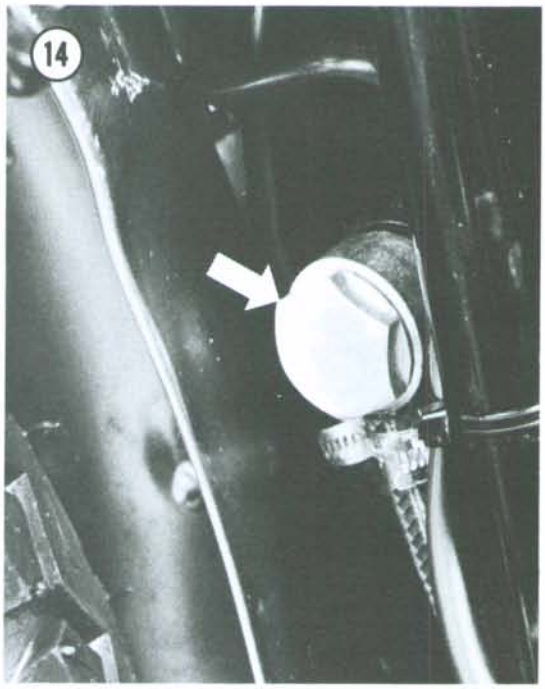
1. Start the engine and run it until it is warm. Then shut it off.
2. Remove the seat and the right side cover (**Figure 10**).

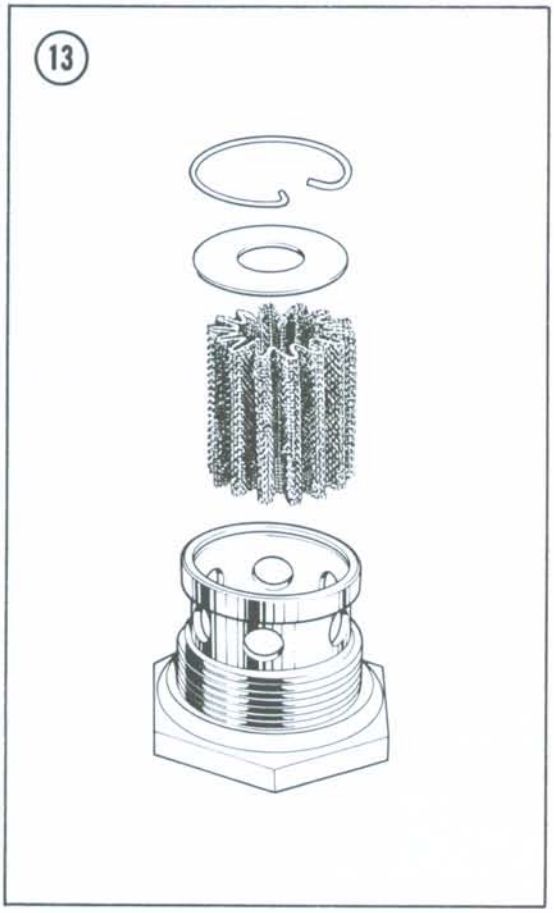


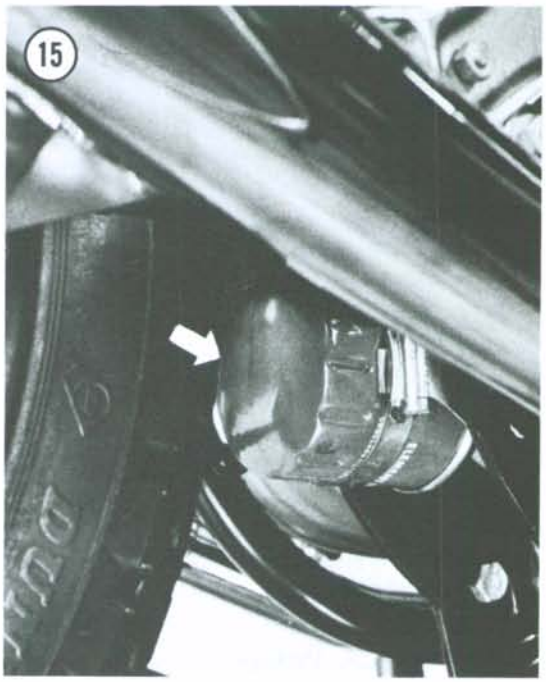
3. Remove the drain plug from the oil tank (**Figure 11**). On early models, remove the bolt which attaches the oil filter union to the tank.



4. Remove crankcase drain plug (with 1½ in. socket) and sump filter if fitted (**Figure 12**). Dismantle the sump filter (**Figure 13**) and clean it thoroughly in solvent. Clean the magnetic drain plug. Remove the filter from the oil tank (**Figure 14**) and thoroughly clean it with solvent.
5. Remove and discard the oil filter element (5,000-6,000-mile interval). See **Figure 15**.
6. When the oil has drained, install a new filter element and a new clamp and reinstall the drain







plugs and tank and sump filters. Fill the oil tank with fresh oil to the level described earlier (3 qts.—U.S.; 5 pts. Imp.—U.K.; 2.8 liters). Start the engine and run it at a moderate, steady speed. Visually check the oil circulation in the tank. Because the sump was drained earlier, the

scavenge side of the oil pump will not immediately begin to pump oil back to the tank. Shut the engine off and allow the oil to settle for a couple of minutes. Recheck the level and correct it if necessary.

7. Reinstall the side cover and the seat.

PRIMARY CHAINCASE

The oil level in the primary chaincase should be checked every 1,000 miles and changed every 2,500 miles.

Checking Level

1. With the motorcycle sitting level, remove the level plug from the chaincase (**Figure 16**). If the oil level is correct, a small amount of oil should run out of the hole.

2. On 750 and 850 Mark II models, if oil does not run out, drain and refill the primary case as described below; it is important that the case contain exactly 7 ounces (200cc) of oil. On 850 Mark III models, if oil does not run out, remove the filler cap and slowly add oil (SAE 20W-50) until it begins to run out of the level hole.

3. Reinstall the level plug and the filler cap. See Figure 16.

Changing

1. Remove the left footrest. Place a drip pan beneath the chaincase and remove the center bolt. Tap along the edges of the chaincase with a soft mallet to break the seal and allow the oil to drain.

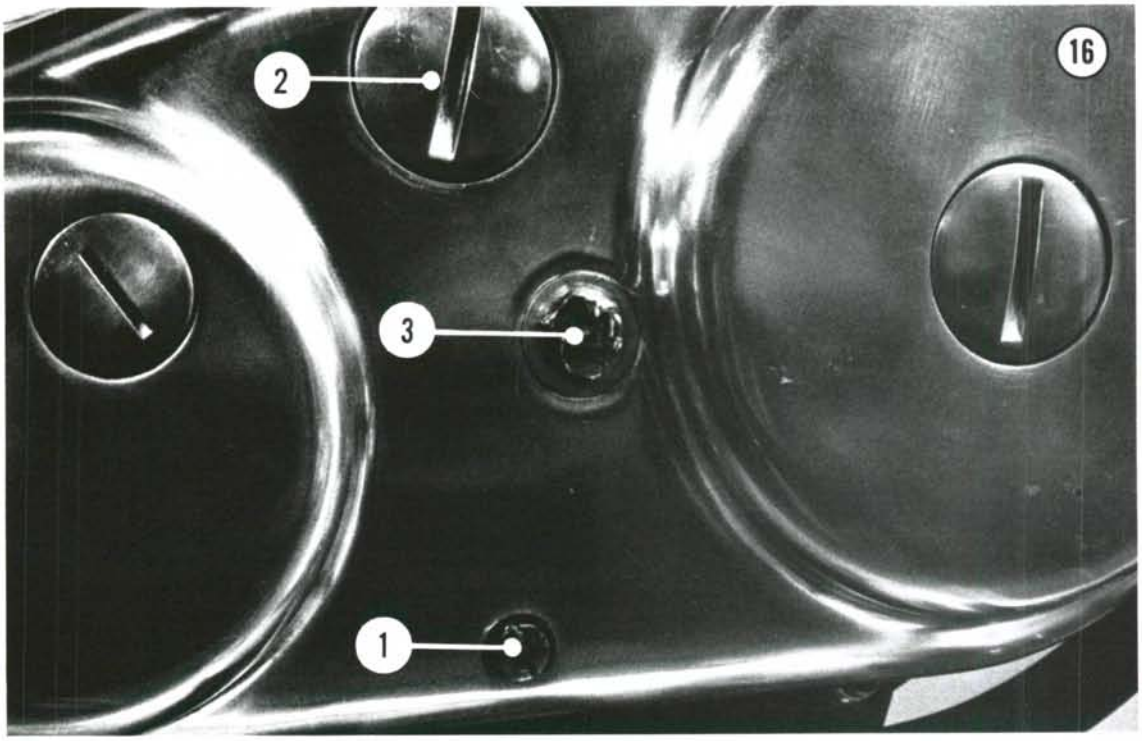
2. Remove the chaincase cover and clean it and the inner case with solvent.

3. Reinstall the chaincase cover and remove the filler cap and level plug.

4. Pour 7 ounces of clean SAE 20W-50 oil into the chaincase through the filler opening. Wait a moment until the oil ceases to run out of the level hole and then install the plug and cap. Reinstall the footrest.

TRANSMISSION

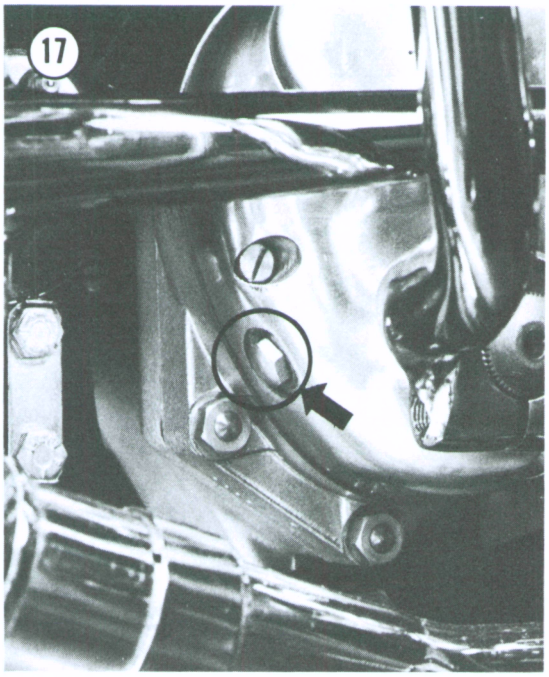
The transmission oil should be checked every 2,500 miles and should be changed every 5,000 miles.



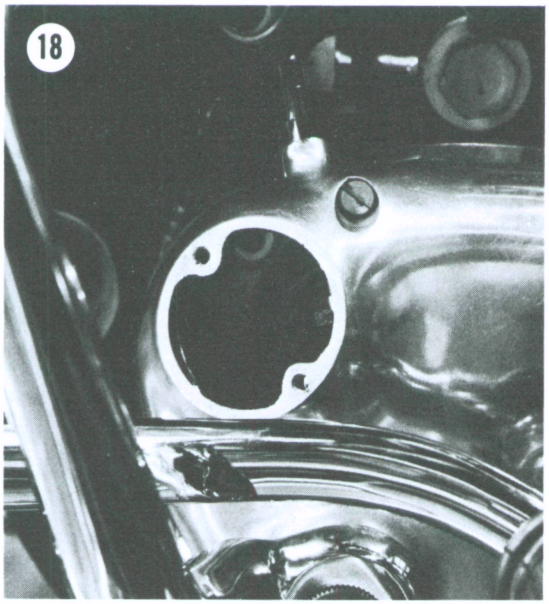
1. Level plug 2. Fill plug 3. Center bolt (except Mk III)

Checking Level

1. Remove the level plug from the transmission (**Figure 17**). If the oil level is correct, a small amount of oil should run out of the hole.

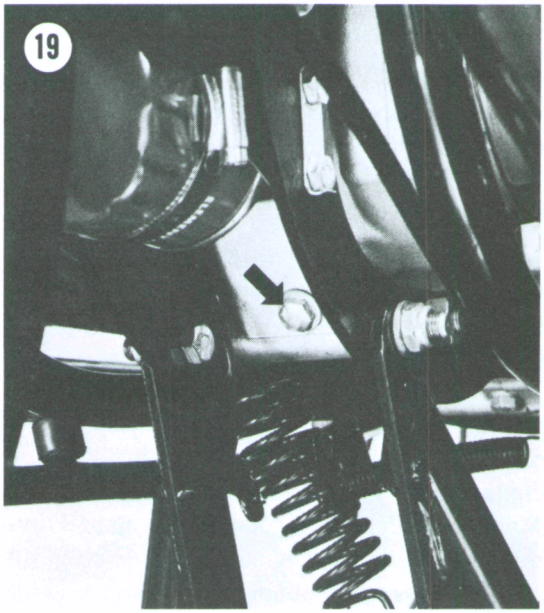


2. If oil does not run out, remove the filler cap (**Figure 18**) and slowly add oil (SAE 90 EP) until it just begins to run out of the level hole.
3. Reinstall the level plug and the filler cap.



Changing

1. Ride the motorcycle for several miles to warm up the oil in the transmission.
2. Place a drip pan beneath the transmission and remove the filler cap and drain plug (**Figure 19**).

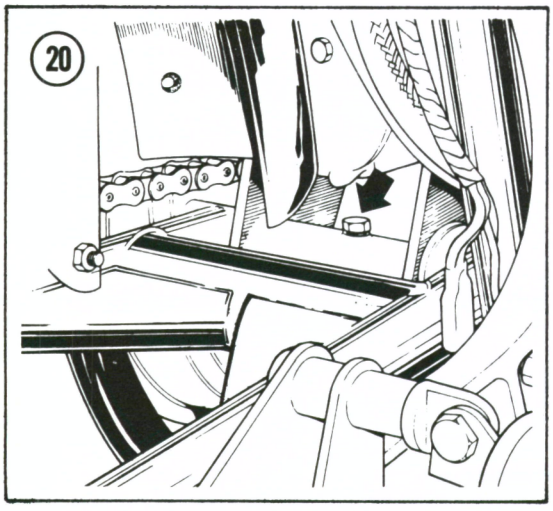


3. After the oil is drained, reinstall the drain plug and fill the transmission with 14.5 ounces of oil (U.S.); 0.75 pts. Imp. (U.K.); 420cc. Wait a few minutes until the oil has drained down into the transmission. Then remove the level plug and permit the excess oil to drain out.
4. Reinstall the level plug and the filler cap.

SWINGING ARM

Oil in the swinging arm pivot of 750 and 850 Mark II models should be checked every 5,000 miles and added to if necessary. The oiled wicks used in 850 Mark III models are good for the life of the swinging arm pivot bushings and need be replaced only when the bushings are replaced.

1. Remove the spindle locating bolt from the top of the swinging arm pivot (**Figure 20**).
2. Use a grease gun filled with SAE 140 oil. Inject oil into the pivot tube through the lube fitting (**Figure 21**) until it begins to run out of the spindle locating bolt hole. If a grease gun is not available, the lube fitting can be removed and oil added with a pumper-type oil can.



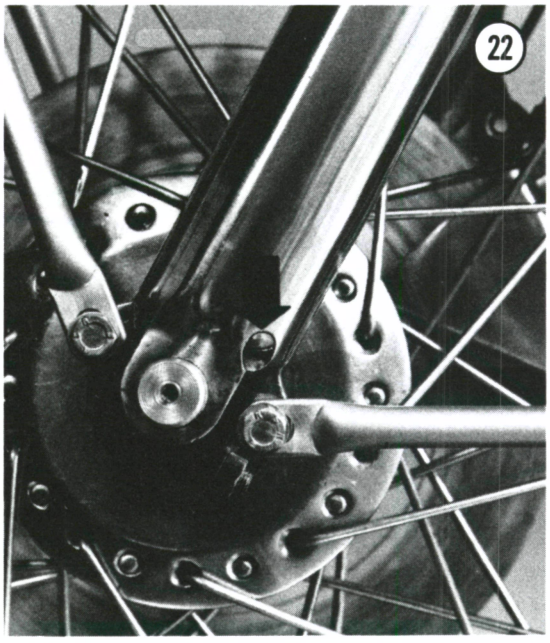
3. Reinstall the spindle locating bolt and the lube fitting (if removed).

FRONT FORK

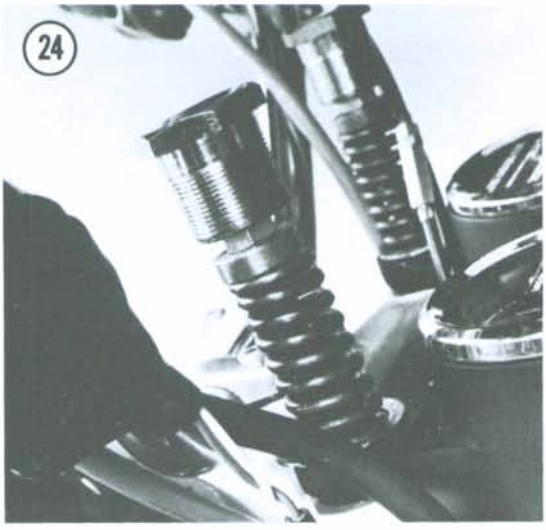
The damping oil in the front fork should be changed every 2,500 miles or at any time excessive bouncing of the front end indicates a low oil level. There is no practical way of checking and correcting the level; each fork leg must contain exactly 150cc (5 ounces) of damping oil if the front supension is to operate correctly.

If after the oil has been changed the front suspension continues to bounce or "hobby-horse," a major service may be required. In such case, refer to Chapter Ten.

1. Turn the front end to left lock, place a drip pan beneath the left fork leg, and remove the drain screw (**Figure 22**).



2. When the oil has ceased to drain, lock the front brake and depress the front end several times to expel residual oil. Reinstall drain plug.
3. Turn the front end to right lock and drain the right leg in the same manner as for the left.
4. Place a clean shop towel over the gas tank to protect it.
5. Unscrew the fill plugs (1-5/16 in. socket) from the tops of the fork legs (**Figure 23**). Wrap a shop rag around each of the instruments and tape them in place to prevent damage to them and the gas tank.
6. Lift the front wheel to expose the springs and support it with a block of wood (**Figure 24**).
7. Unscrew the filler plugs from the tops of the damper rods (**Figure 25**).
8. Remove the block from beneath the wheel and fully extend the forks.
9. Fill each fork leg with 150cc (5 ounces) of any of the oils shown in **Table 3**. See **Figure 26**.



NOTE: *Each leg will probably not accept all of the oil at first. Cover the top of the fork tube with your hand and pump the slider slowly up and down to distribute the oil and then add more oil until the entire 150cc has been poured in.*

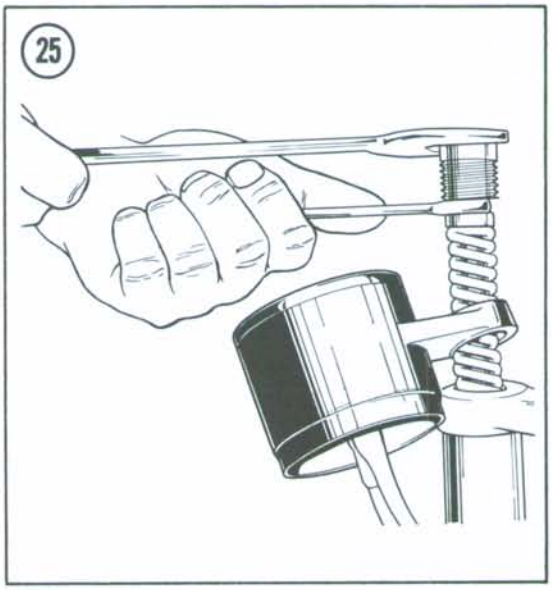
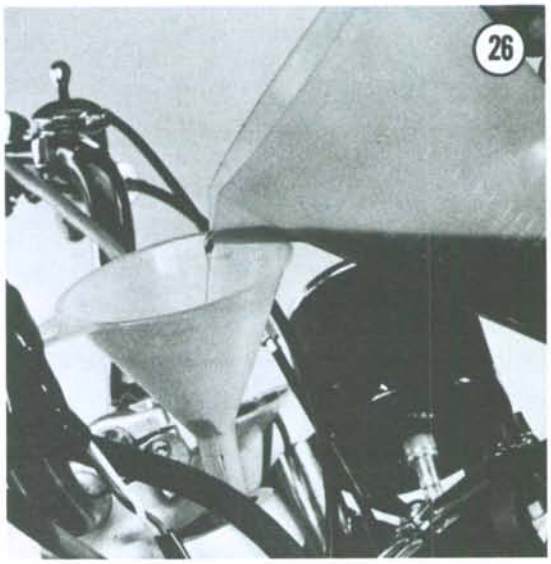
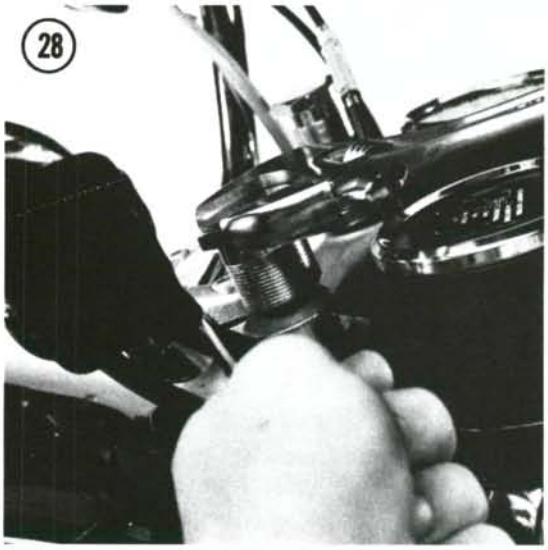


Table 3 FORK OIL

Brand	Type
Castrol	Castrolite 10W 30
BP	BP Super Visco-Static 10W 40
Shell	Shell Super Motor Oil
Mobil	Mobiloil Super
ESSO	Uniflo
Texaco	Havoline Motor Oil 10W 30
Duckham's	Duckham's Q5500
Sun Oil	Sunoco Special Motor Oil 20W 50



10. Raise and block the wheel once again. Screw the locknuts all the way on to the bottom thread (**Figure 27**). Slide the instrument mounts over the springs and screw on the filler caps and lock them with the nuts (**Figure 28**).



11. Remove the block and lower the front wheel. Screw in the top caps and tighten them securely. Reinstall the handlebars.

HYDRAULIC DISC BRAKE

The hydraulic fluid level in the disc brake master cylinder should be checked every 1,000 miles and the brake pads should be checked for wear. Bleeding the hydraulic system, servicing the master cylinder, caliper, and disc, and replacing brake pads are covered in Chapter Eight.

Fluid Level

1. Clean the reservoir cap thoroughly with a dry rag and unscrew it. Remove the flexible bellows and set it in the upturned cap to prevent it from getting dirty (**Figure 29**).

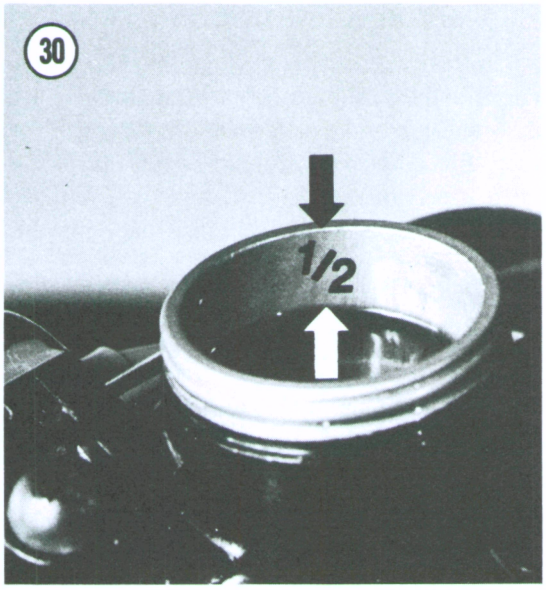
2. The fluid level in both brake reservoirs should be ½ in. (13mm) from the top edge (**Figures 30 and 31**). If necessary, correct the level by adding any DOT 3 approved hydraulic brake fluid.
3. Reinstall the bellows with the closed end down. Do not pour hydraulic fluid into the bellows. Check the vent hole in the top of the cap to make sure it is open and screw the cap on tightly.

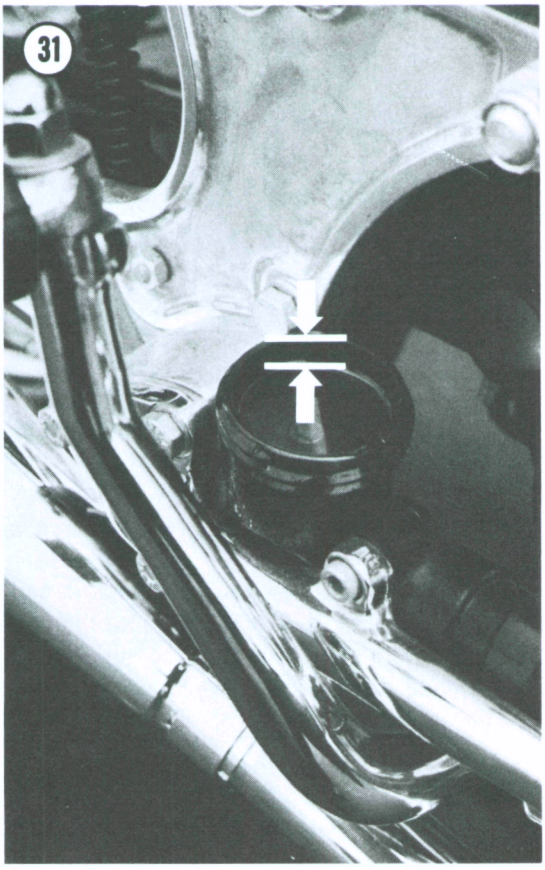
CAUTION

Be careful not to spill the brake fluid on painted surfaces or bring it in contact with plastic or rubber components.

Brake Pad Wear

Inspect the brake pads for excessive or uneven wear, scoring, and oil or grease imbedded in





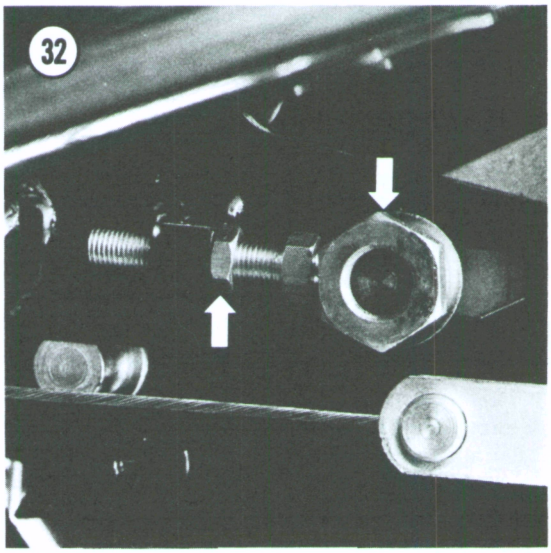
the friction material. If any of these conditions exist, replace the pads, as a set, as described in Chapter Eight.

REAR CHAIN

The rear drive chain should be checked and adjusted every 1,000 miles and removed, cleaned, and lubricated every 2,500 miles.

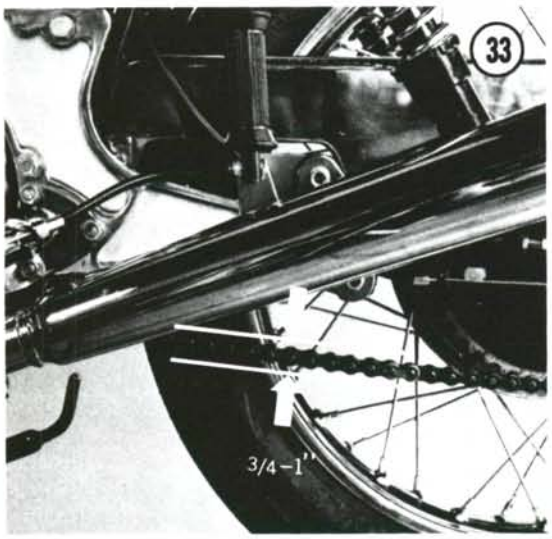
Adjustment

1. Loosen the axle nuts (**Figure 32**) and the chain adjuster locknuts.



2. Screw the adjusters either in or out as required, in equal amounts. The free movement of the chain, midway between the sprockets, should be ¾-1 in. (19-25mm) with a rider seated on the motorcycle (**Figure 33**). Rotate the rear wheel to move the chain to another position and recheck the adjustment; chains rarely wear or stretch evenly and as a result the free-play will not remain constant over the entire chain. At its tightest point it should have no less than ¾ in. free-play and at its loosest the free-play should not be greater than one inch. If the chain cannot be adjusted within these limits it is excessively worn and stretched and should be replaced.

3. When the adjustment is correct, sight along the chain from the rear sprocket to see that it is correctly aligned. It should leave the top of the rear sprocket in a straight line. If it is cocked to one side or the other, the rear wheel is incorrectly aligned and must be corrected by turning the adjusters counter to one another until the chain and sprocket are correctly aligned. When



the alignment is correct, readjust the free-play as described above and tighten the adjuster locknuts and axle nuts securely.

Cleaning and Lubrication

The rear chain is lubricated by a restricter type oiler connected to the engine oil tank. Every 2,500 miles, remove, thoroughly clean, and lubricate the chain.

1. Disconnect the master link and remove the chain from the motorcycle. If a piece of old chain is available, connect it to the motorcycle's chain before it is removed and leave the old chain around the gearbox sprocket to make chain replacement easier.

2. Inspect the chain for excessive wear and stretch. Scribe 2 marks 12½ in. (317mm) apart on a flat surface. With the chain compressed to its minimum free length, the marks should line up with pivot pins exactly 20 links apart (**Figure 34**). When the chain is extended, the 20 links should not exceed 12¾ in. (324mm).

3. Immerse the chain in a pan of cleaning solvent and allow it to soak for about a half hour.

4. Scrub the rollers and side plates with a stiff brush and rinse the chain in clean solvent to carry away loosened grit. Hang up the chain and allow it to dry thoroughly.

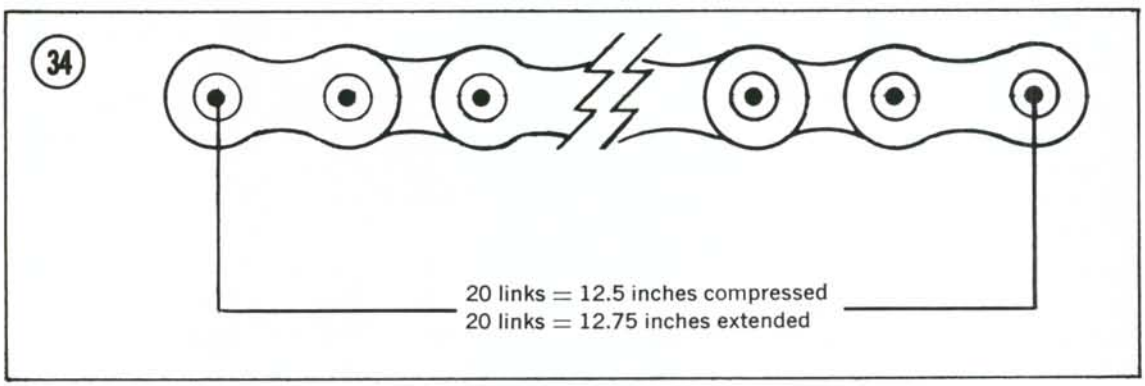
5. Lubricate the chain with a good grade of chain lubricant carefully following the manufacturer's instructions. As an alternative, lubricate by soaking in a pan of heated all-purpose grease such as Castrol Graphited Grease, Shell Retinex A or DC, Mobilgrease MP, or Marfax All-Purpose Grease. Heating permits the grease to penetrate the rollers and pins, but extreme care must be taken.

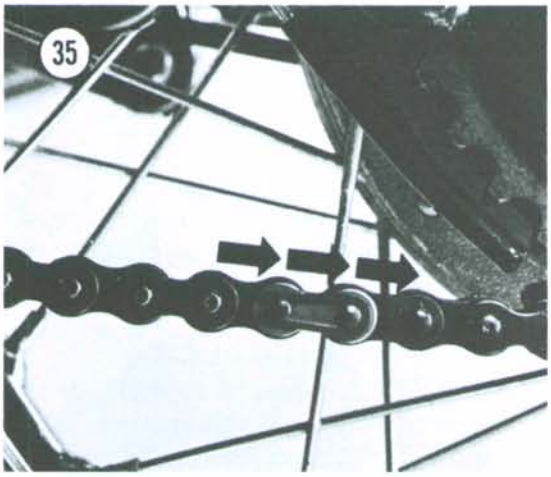
WARNING

If the grease is heated excessively it may reach its flash point, resulting in a dangerous and difficult to extinguish fire. NEVER heat the grease with an open flame or on a hot plate. Heat it only by placing the grease pan in a larger pan containing about an inch of boiling water, and only after the water has been removed from the heat source.

After the chain has soaked in the grease for about a half hour, remove it from the pan and wipe off all the excess grease with a clean rag.

6. Reinstall the chain on the motorcycle. Use a new clip on the master link and install it so that the closed end of the clip faces the direction of chain travel (**Figure 35**).





7. Adjust the free-play of the chain as described earlier in this section.

CONTROL CABLES

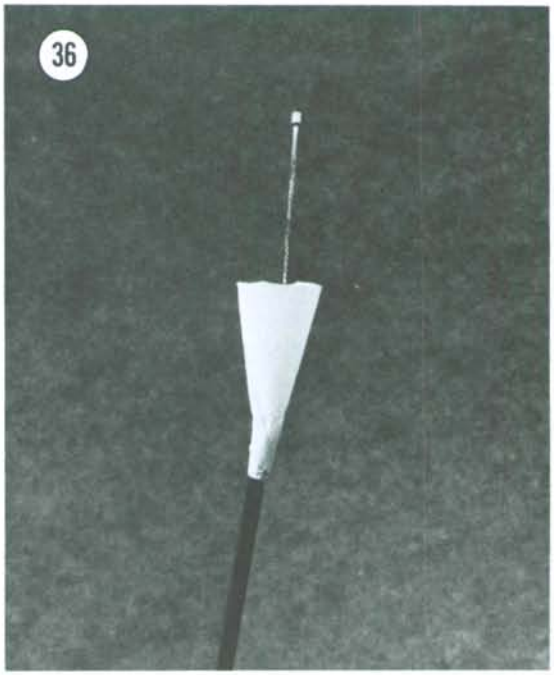
The control cables, with the exception of the Teflon lined throttle cable on 850 Mark III models, should be lubricated every 1,000 miles. In addition, all cables should be adjusted at this interval. The cables should be inspected periodically for fraying and the cable sheaths should be checked for chafing. The cables are expendable items and should be replaced when found to be faulty.

Lubrication

The control cables can be lubricated either with oil or with any one of the popular commercial cable lubricants and a cable lubricator. The first method requires more time and the complete lubrication of the entire cable is less certain.

Oil Method

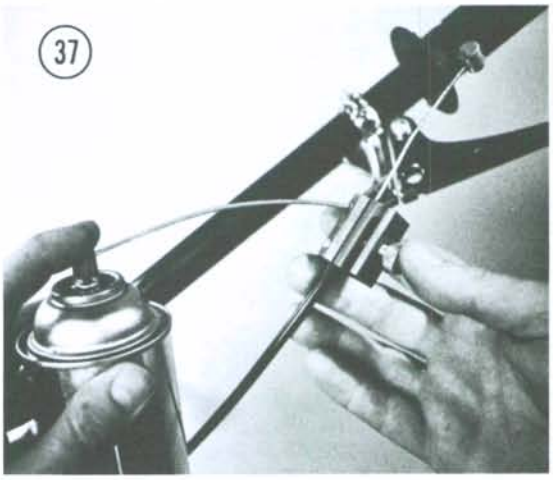
1. Disconnect the cable from the control (throttle grip, clutch lever, etc.).
2. Make a cone from a stiff piece of paper and tape it to the end of the cable sheath (**Figure 36**).
3. Hold the cable upright and pour a small quantity of light oil into the cone. Work the cable in and out of the sheath for several minutes to help the oil migrate down between the cable and sheath.



4. Remove the cone, reconnect the cable, and adjust it as described below.

Lubricator Method

1. Disconnect the cable from the control.
2. Attach the lubricator in accordance with the manufacturer's instructions (**Figure 37**).



3. Insert the lubricant can nozzle in the lubricator, press the button on the can, and hold it down until the lubricant begins to flow out of the other end of the cable.

NOTE: *On throttle and choke cables, remove the carburetor cap so the lubricant will not run into the carburetor.*

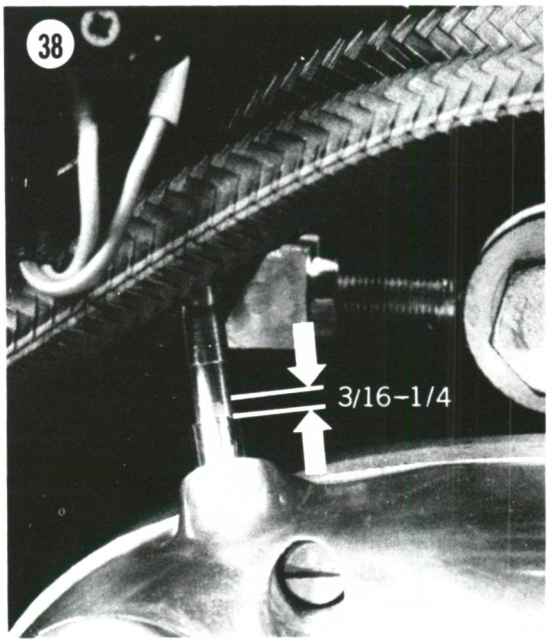
4. Remove the lubricator, reconnect the cable to the control, and adjust it as described below.

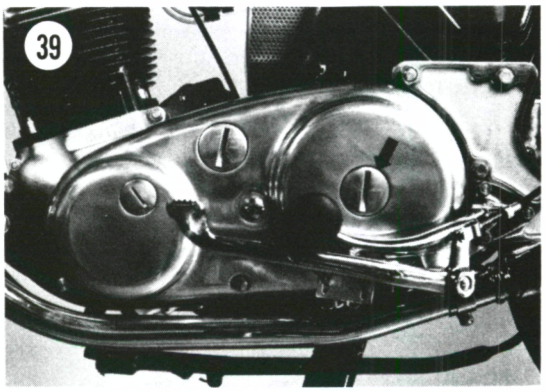
Throttle Cable Adjustment

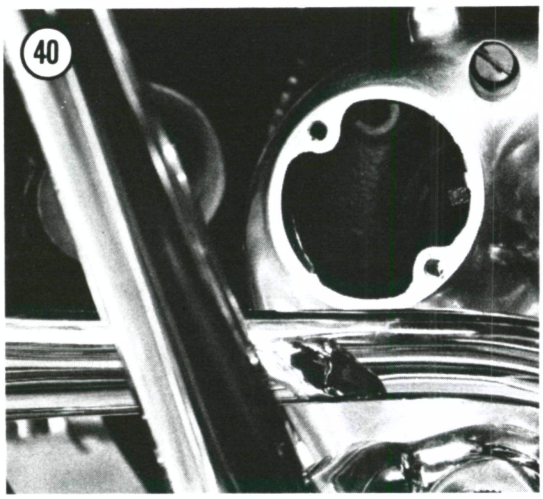
Throttle cable adjustment is described under *Tune-up* at the end of this chapter.

Clutch Cable Adjustment

There should be 3/16-1/4 in. (4.6-6.3mm) free play in the clutch cable sheath (**Figure 38**). If this free play cannot be obtained with the adjuster on the clutch control lever, screw the adjuster all the way in and remove the clutch adjuster cover from the primary chaincase (**Figure 39**) and the inspection cover from the transmission (**Figure 40**). Check to see if there is any movement in the clutch operating lever (**Figure 41**). If there is, the basic adjustment is all right and it should be possible to adjust the free play at the hand control. If there isn't any movement, loosen the locknut (**Figure 42**) and slowly turn the adjuster screw counterclockwise until there is movement in the operating lever. Turn the adjuster screw clockwise until you feel it touch the clutch operating rod, then back it out *one full turn*. Hold the screw to prevent it from turning further and tighten the locknut. Turn the cable adjuster at the hand control out until the free play is correct, as shown above.



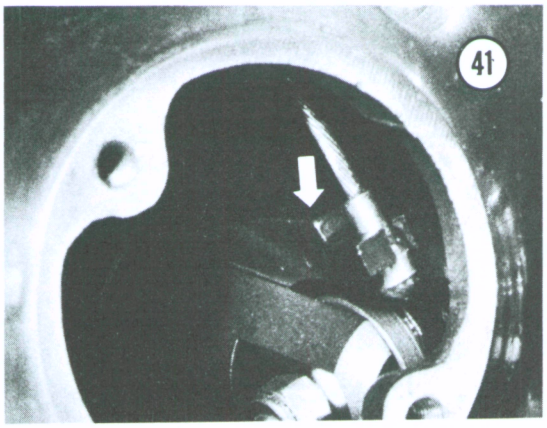


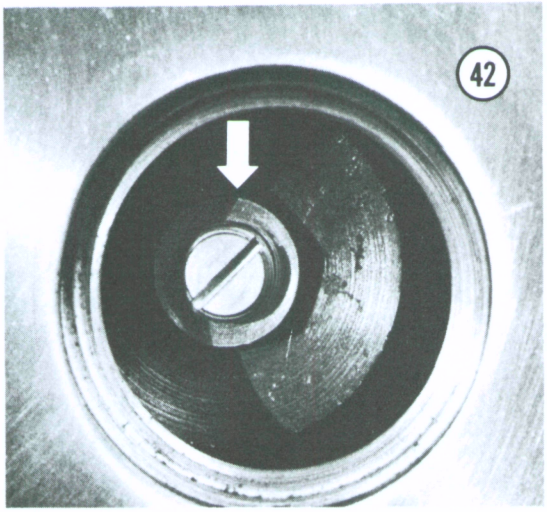


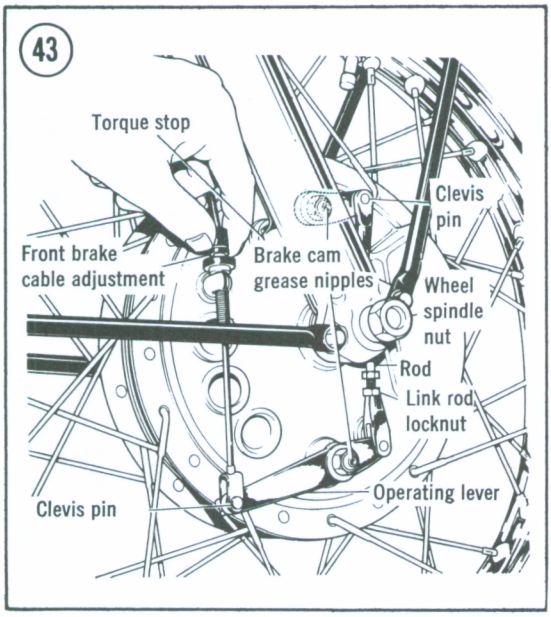
BRAKE ADJUSTMENT

Front Brake (Drum Type)

The front brake cable should be adjusted so that there is a minimum of brake lever movement required to actuate the brake, but it must not be so closely adjusted that the brake shoes contact the drum with the lever relaxed. The primary adjustment should be made with the control lever adjuster. Because of normal brake wear, this adjustment will eventually be "used up." It is then necessary to loosen the control lever adjuster and screw out the adjuster on the brake backing plate (**Figure 43**) until the control





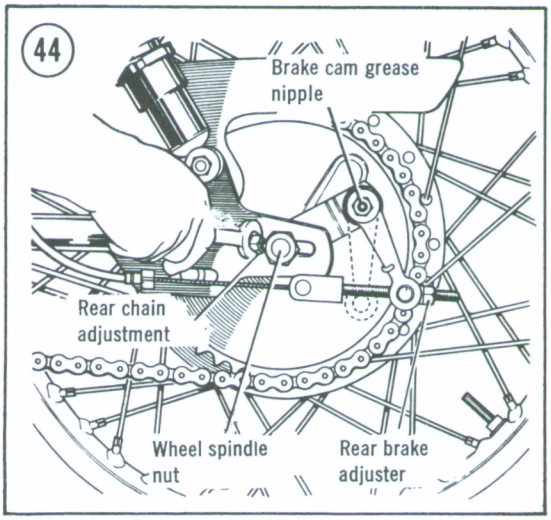


lever adjuster can be used once again for fine adjustment. After the backing plate adjuster has been extended, be sure to tighten the locknut.

Adjustment of the connecting link between the brake cams is described in Chapter Eight.

Rear Brake (Drum Type)

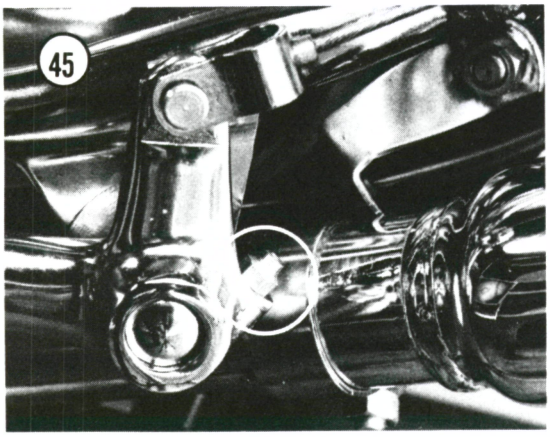
When the brake is fully applied the brake arm should be near perpendicular to the cable (**Figure 44**). Adjust the rear brake cable if necessary. After adjustment, release the brake pedal and spin the rear wheel to make sure the shoes do not contact the drum when the pedal is relaxed.

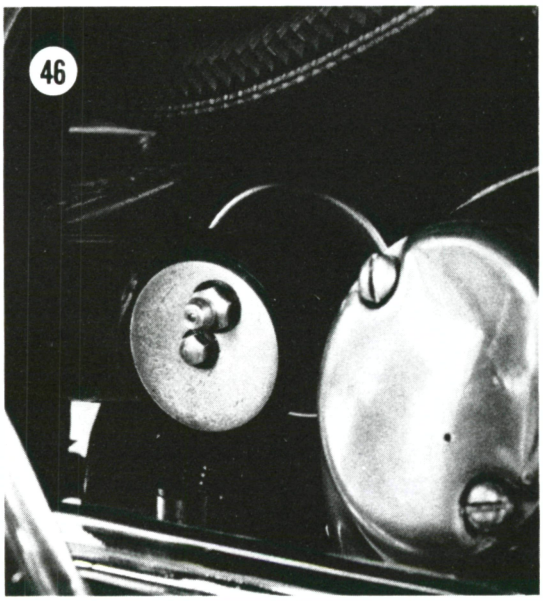


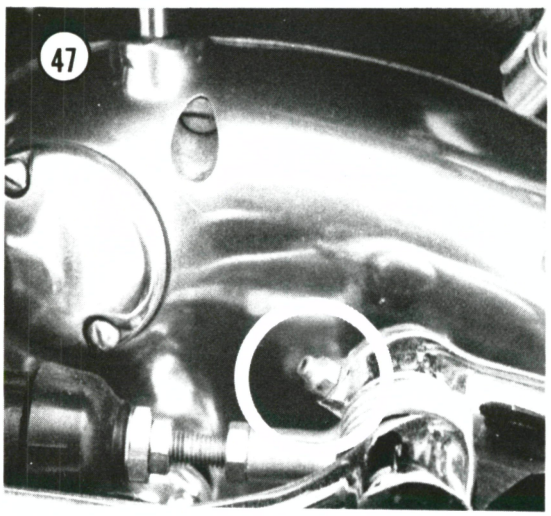
If the brake lever moves past vertical when the brake is applied, it is likely that the brake lining is worn and should be replaced. Refer to Chapter Nine.

GREASE FITTINGS

Grease fittings on 750 and 850 Mark II models are located on the brake cam pivots (2 cams on the drum type front brake, Figure 43), rear brake pedal pivot (**Figure 45**), and swinging arm pivot (**Figure 46**). On 850 Mark III models there is a single grease fitting on the rear brake pedal pivot (**Figure 47**). These points should be lubricated at the intervals shown in Table 1. For fittings on brake components, one stroke of a hand-type grease gun is sufficient. Lubrication of the swinging arm pivot was described earlier.

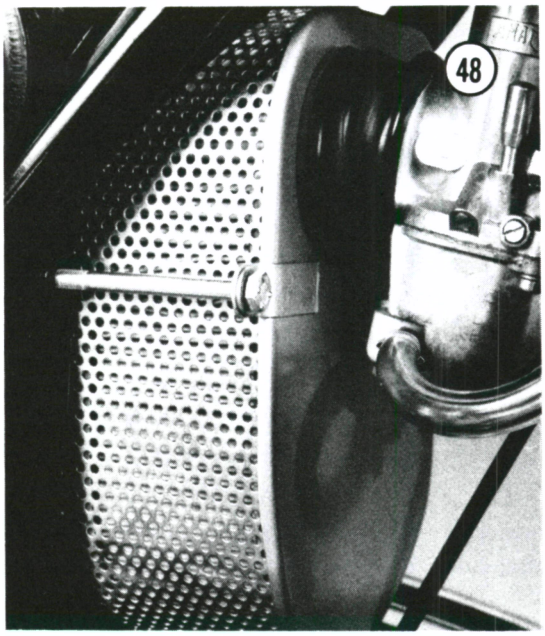






AIR FILTER

The carburetor air filter element on 750 and 850 Mark II models (**Figure 48**) should be replaced every 5,000 miles or sooner if it appears to be excessively clogged. The service life of the filter can be extended by cleaning the element. Large particles can be dislodged by tapping the filter on a work bench or other flat surface, and fine particles can be removed by blowing them out with low-pressure air applied to the inside of the element.



The carburetor air filter element on 850 Mark III models is an oil-wetted type that can be used almost indefinitely, provided it is cleaned and oiled periodically and the foam is not torn or deteriorated. The element should be serviced every 3,000 miles, or more frequently if the motorcycle is operated in extremely dusty conditions. Unscrew the 3 bolts which hold the filter cover in place (**Figure 49**) and slide the element out of the air box, taking care not to snag the foam on the carburetor drain plugs. Wash the filter thoroughly in clean gasoline, wring it out, and allow it to dry.

WARNING

Be extremely careful; clean the element out of doors and keep the gasoline away from all flame and potential

sources of sparks. Pour the dirty gasoline into a sealable container (not glass) and discard it in the trash.

After the cleaned element has dried, saturate it with clean engine oil, wring out the excess, and install the element in the air box.

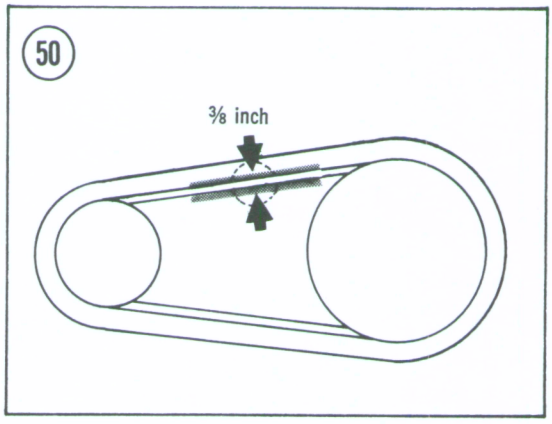
WHEEL BEARINGS

The wheel bearings should be cleaned and repacked with grease every 10,000 miles or after submergence or prolonged running in deep water. The correct service procedures are presented in Chapters Eight and Nine.

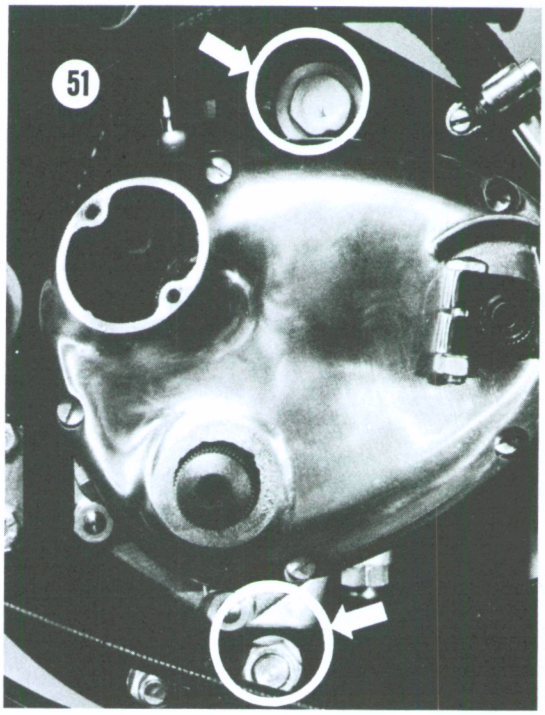
PRIMARY CHAIN ADJUSTMENT

The primary chain on all models except the 850 Mark III which is fitted with a hydraulic tensioner, must be adjusted each time the primary drive assembly is disturbed, and checked every 25,000 miles and adjusted if necessary. Total up-and-down movement of the chain should be ⅜ in. (9.5mm). See **Figure 50**.

1. Remove the oil fill/inspection cap from the top center of the primary chaincase and check the movement of the chain with your finger. Rotate the crankshaft and chain with the kickstarter and check the movement in several locations. At the tightest position, the movement should be ⅜ in. If it is greater or less than this, proceed with the next steps.



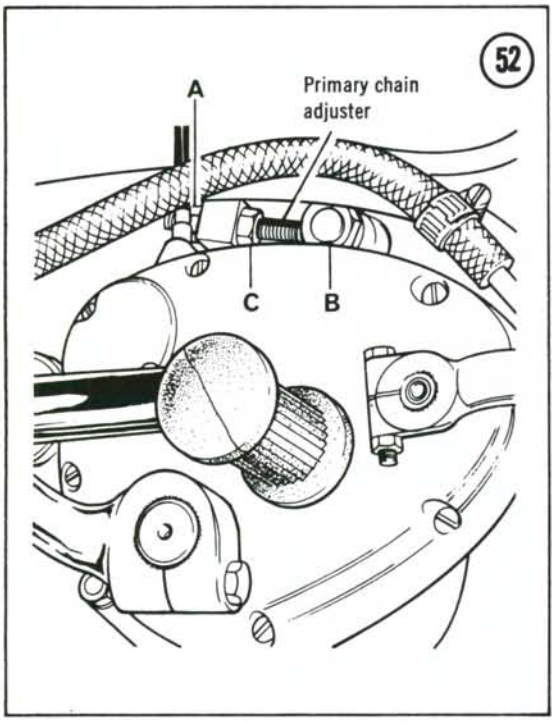
2. Loosen the top gearbox bolt (do not turn the captive nut on the left side) and the bottom nut (**Figure 51**).



3. Loosen the front adjuster nut several turns (**Figure 52**). Tighten the rear adjuster nut until the chain is tight, then back it off until the movement of the chain is correct, while at the same time tightening the front adjuster nut.

TUNE-UP

A complete tune-up should be performed every 2,500 miles (650cc and 750cc models)



or 3,000 miles (850cc Mark II and Mark III models) of normal riding. More frequent tune-ups may be required if the motorcycle is ridden primarily in stop-and-go traffic.

The expendable ignition parts (spark plugs, points, and condenser) should be routinely replaced at every other tune-up or when the point contacts or spark plug electrodes show signs of erosion. In addition, this is a good time to replace the air filter element. Have the new parts on hand before you begin.

Because different systems in an engine interact, the procedures should be done in the following order:

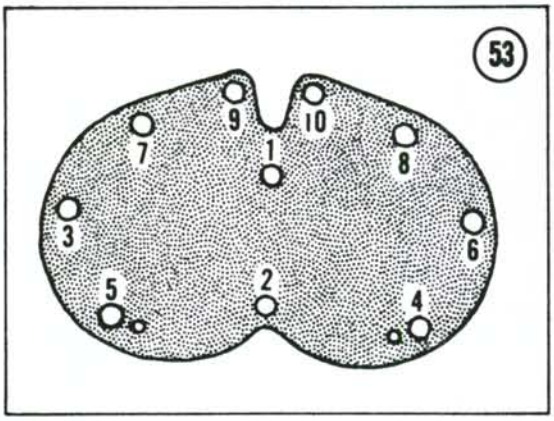
a. Tighten cylinder head bolts
b. Adjust valve clearances
c. Work on ignition system
d. Adjust carburetors

Cylinder Head Bolts

1. Raise or remove the seat.

2. Shut off the fuel taps, disconnect the lines, and remove the fuel tank. On all original equipment Commando tanks, the front is mounted on 2 studs beneath the tank and held with self-locking nuts. The rear mount on some models uses a rubber loop which passes beneath the top frame tube, while others are held in place with a metal cross bar.

3. Tighten the nuts and bolts in the sequence shown in **Figure 53** to 20 ft.-lb. (2.75 mkg) for the smaller (5/16 in.) bolts and 30 ft.-lb. (3.68 mkg) for the larger (⅜ in.) nuts and bolts. The fuel tank can be left off at this time.



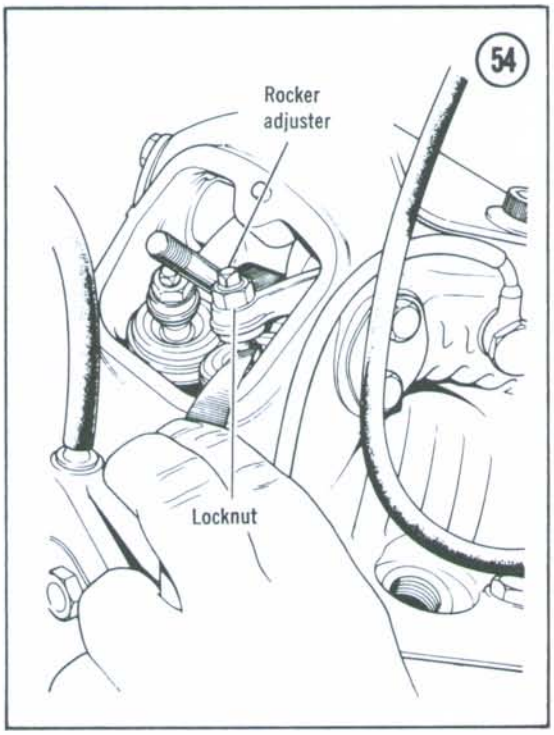
Valve Clearance Adjustment

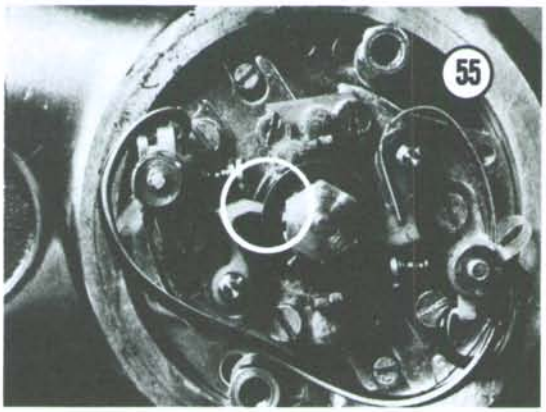
Valve clearance adjustment must be made with the engine cold. For standard 750cc engines and all 850cc engines, the inlet clearance is 0.006 in. (0.15mm) and the exhaust clearance is 0.008 in. (0.2mm); for the 750cc Combat engine, the inlet clearance is 0.008 in. (0.2mm) and the exhaust clearance is 0.010 in. (0.25mm).

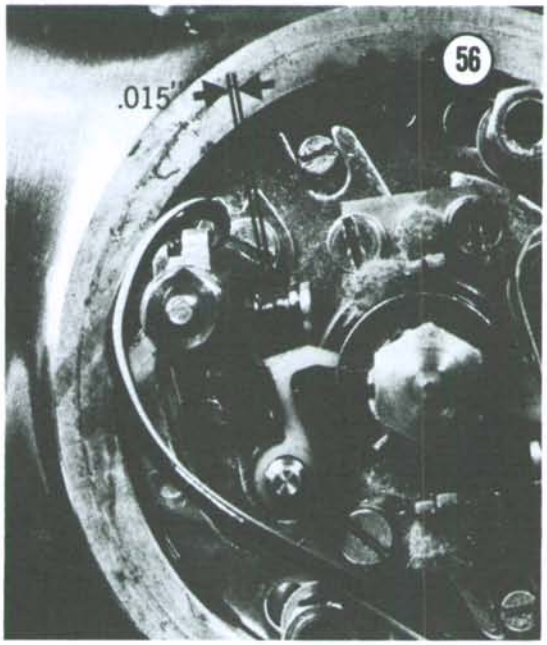
1. Remove the rocker covers and unscrew the spark plugs from the cylinder head.

2. Rotate the crankshaft with the kickstarter until the left inlet valve is completely open (**Figure 54**). Check the clearance of the right inlet valve and rocker. When the clearance is correct, there will be a slight resistance on the feeler gauge when it is inserted and withdrawn.

3. To correct the clearance, back off the locknut and screw the adjuster out far enough to insert the feeler gauge with no resistance. Screw in the adjuster until a slight resistance can be felt on the gauge. Hold the adjuster to prevent it from turning further and tighten the locknut. Then, recheck the clearance to make sure the adjuster did not turn after the correct clearance was achieved.







4. Rotate the crankshaft to open the right intake valve completely and check and adjust the clearance of the left inlet valve and rocker. Then, check and adjust the exhaust valves and rockers in the same manner.

5. When all the clearances have been checked and adjusted, install the rocker covers, making sure the gaskets are aligned and in good condition. Reinstall the fuel tank.

Ignition System

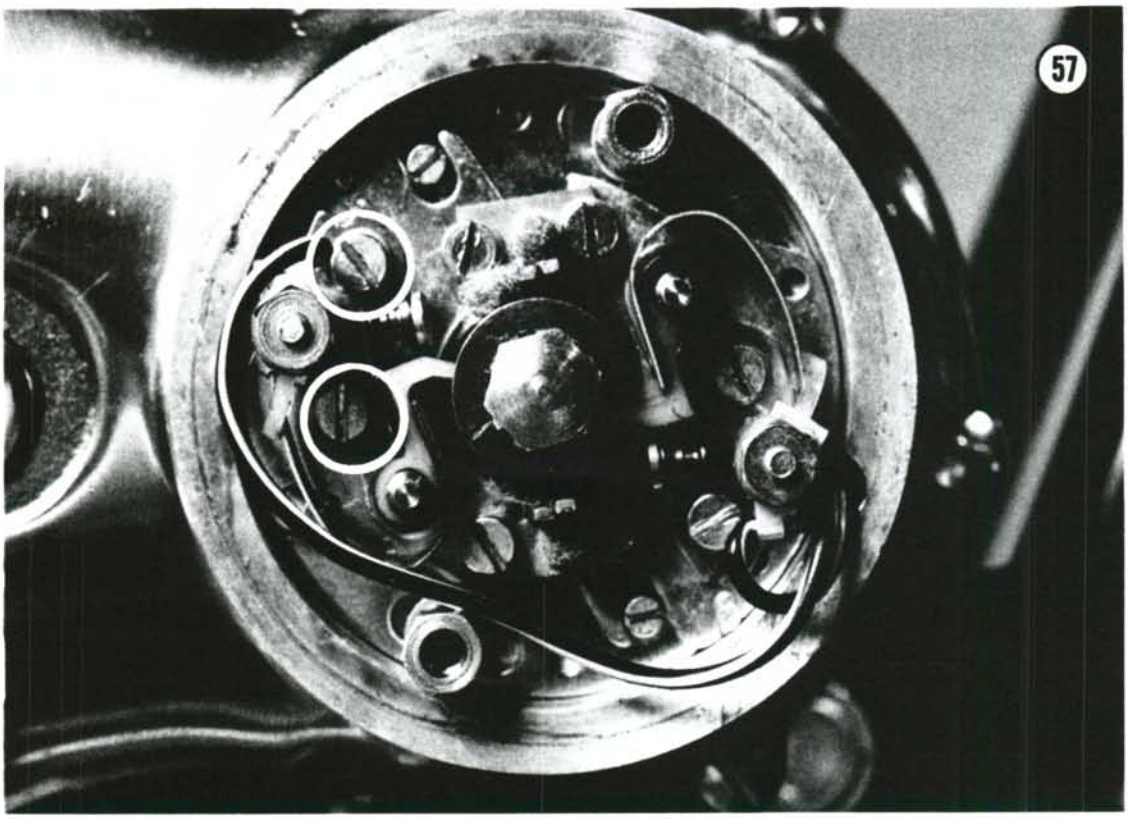
Two similar contact breaker assemblies are used on Norton Commandos. They are described in Chapter Seven along with instructions for removal, inspection, and installation. When the breaker assembly has been replaced, or determined to be serviceable, adjust as described below.

1. Remove the spark plugs from the cylinder head and rotate the crankshaft with the kickstarter to line up the mark on the point cam with the lifter heel on one of the contacts (**Figure 55**). This is the maximum contact opening.

2. Measure the contact gap with a flat feeler gauge (**Figure 56**). It should be 0.015 in. (0.38mm). If it is not, loosen the breaker lockscrews (**Figure 57**) and move the plate in or out until the gap is correct. Tighten the lockscrews and recheck the gap to make sure the plate did not move when the screws were retightened.

3. Rotate the crankshaft to line up the cam mark with the other lifter heel and adjust this contact set in the same manner as above.

4. Examine the spark plugs and compare their condition to **Figure 58**. Their condition is an indication of engine condition and can warn of developing trouble. If the plugs are in good condition and can be reused, clean them with a wire brush and blow out scale and deposits with compressed air.



WARNING

Hold the electrode end of the plug away from you when blowing the scale out with air.

5. Set the spark plug electrode gap at 0.028 in. (0.71mm) by bending the side electrode. For normal use, and for all models except the 750 Combat, Champion N7Y spark plugs are recommended; however, equivalent plugs of different manufacture can be used if their heat range corresponds to that of the N7Y. Plugs that are too cold can cause hard starting. If they are too hot, they can cause preignition which may result in engine damage.

Champion N6Y spark plugs are recommended for use in 750 Combat engines and for sustained high-speed operation in other engines.

6. Screw the plugs into the cylinder head using new gaskets to ensure a good seal. Tighten them firmly but not so tight that there is risk of damaging the threads in the head. Reconnect the high-tension leads.

NOTE: *If the static timing procedure referenced below is used, do not install the spark plugs; it will be easier to rotate the crankshaft if there is no compression in the cylinders.*

7. Refer to *Ignition Timing*, Chapter Seven, and accurately time the ignition. Two methods can be used—static timing and dynamic timing (with the use of a strobe). The static method is accurate enough for most situations, but strobe timing is essential for complete timing accuracy required for maximum performance. If static timing is used, install the spark plugs and connect the high-tension leads as described above after the timing has been set.

Carburetion

For stock engines, standard factory jetting is good for most situations. Engine modifications that affect flow or cylinder volume, as well as prolonged operation at extremes of altitude or humidity, require changes in jetting and needle

58

SPARK PLUG CONDITION

NORMAL

- Identified by light tan or gray deposits on the firing tip.
- Can be cleaned.

GAP BRIDGED

- Identified by deposit buildup closing gap between electrodes.
- Caused by oil or carbon fouling. If deposits are not excessive, the plug can be cleaned.

OIL FOULED

- Identified by wet black deposits on the insulator shell bore electrodes.
- Caused by excessive oil entering combustion chamber through worn rings and pistons, excessive clearance between valve guides and stems, or worn or loose bearings. Can be cleaned. If engine is not repaired, use a hotter plug.

CARBON FOULED

- Identified by black, dry fluffy carbon deposits on insulator tips, exposed shell surfaces and electrodes.
- Caused by too cold a plug, weak ignition, dirty air cleaner, too rich a fuel mixture, or excessive idling. Can be cleaned.

LEAD FOULED

- Identified by dark gray, black, yellow, or tan deposits or a fused glazed coating on the insulator tip.
- Caused by highly leaded gasoline. Can be cleaned.

WORN

- Identified by severely eroded or worn electrodes.
- Caused by normal wear. Should be replaced.

FUSED SPOT DEPOSIT

- Identified by melted or spotty deposits resembling bubbles or blisters.
- Caused by sudden acceleration. Can be cleaned.

OVERHEATING

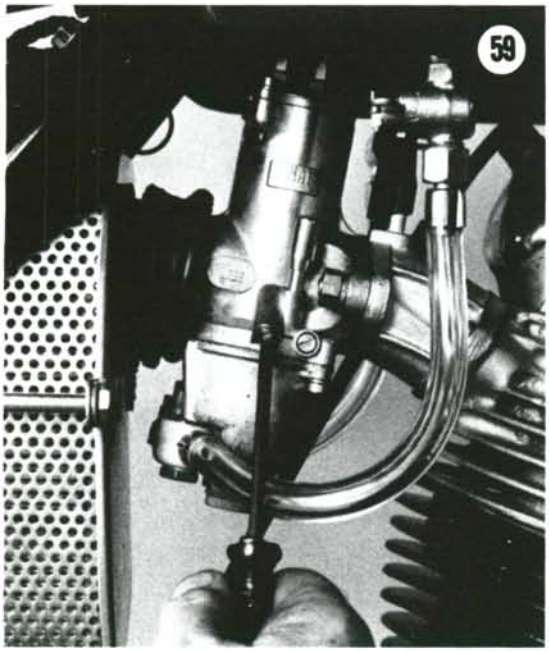
- Identified by a white or light gray insulator with small black or gray brown spots and with bluish-burnt appearance of electrodes.
- Caused by engine overheating, wrong type of fuel, loose spark plugs, too hot a plug, or incorrect ignition timing. Replace the plug.

PREIGNITION

- Identified by melted electrodes and possibly blistered insulator. Metallic deposits on insulator indicate engine damage.
- Caused by wrong type of fuel, incorrect ignition timing or advance, too hot a plug, burned valves, or engine overheating. Replace the plug.

position. These are described in detail in Chapter Eleven, *Performance Improvement*. The checks and adjustments that follow assume that jetting and needle position are correct.

1. Loosen the throttle stop screws in both carburetors until the throttle slides are completely closed (**Figure 59**).



2. Loosen the locknuts on the cable adjusters (**Figure 60**) and turn the adjusters either in or out until there is no perceptible end play in the cable sheaths when the slides are closed. Also, when the throttle grip is turned, the throttle slides must begin to lift together. When the throttle slides are synchronized, hold the adjusters to prevent them from turning and tighten the locknuts.

3. Start the engine, allow it to warm up for about a minute, and turn the throttle so that it idles slightly faster than normal. Turn each of the throttle stop screws in slowly until they hold the slides in this position with the throttle released.

4. With insulated pliers or screwdriver, pull the spark plug lead off one of the spark plugs. Screw in the pilot air screw (**Figure 61**) on the carburetor on the opposite cylinder until the engine begins to falter (too lean). Then screw

it out—the engine will begin to run smoothly again—until the engine falters once again (too rich). Slowly screw it in until the engine begins to run smoothly. Usually, the best position for the screw is midway between the too-lean and the too-rich idling positions (about 1 to 1½ turns out).

5. Reconnect the spark plug lead on the opposite cylinder, disconnect the lead on the cylinder just adjusted, and adjust the other cylinder in the same manner.

6. With both pilot air screws adjusted and both spark plug leads connected, the idle speed will probably be too fast. In such case, carefully unscrew each of the throttle stop screws equally until the idle is acceptable. Recheck the end play in the throttle cable sheaths. It should be ⅛ in. (3mm) for each cable (**Figure 62**).

CHAPTER THREE

TROUBLESHOOTING

Diagnosing motorcycle ills is relatively simple if you use orderly procedures and keep a few basic principles in mind.

Never assume anything. Don't overlook the obvious. If you are riding along and the bike suddenly quits, check the easiest, most accessible problem spots first. Is there gasoline in the tank? Is the gas petcock in the ON or RESERVE position? Has a spark plug wire fallen off? Check the ignition switch. Sometimes the weight of keys on a key ring may turn the ignition off suddenly.

If nothing obvious turns up in a cursory check, look a little further. Learning to recognize and describe symptoms will make repairs easier for you or a mechanic at the shop. Describe problems accurately and fully. Saying that "it won't run" isn't the same as saying "it quit on the highway at high speed and wouldn't start," or that "it sat in my garage for three months and then wouldn't start."

Gather as many symptoms together as possible to aid in diagnosis. Note whether the engine lost power gradually or all at once, what color smoke (if any) came from the exhausts, and so on. Remember that the more complicated a machine is, the easier it is to troubleshoot because symptoms point to specific problems.

You don't need fancy equipment or complicated test gear to determine whether repairs can be attempted at home. A few simple checks could save a large repair bill and time lost while the bike sits in a dealer's service department. On the other hand, be realistic and don't attempt repairs beyond your abilities. Service departments tend to charge heavily for putting together a disassembled engine that may have been abused. Some won't even take on such a job—so use common sense; don't get in over your head.

OPERATING REQUIREMENTS

An engine needs three basics to run properly: correct gas/air mixture, compression, and a spark at the right time. If one or more are missing, the engine won't run. The electrical system is the weakest link of the three. More problems result from electrical breakdowns than from any other source. Keep that in mind before you begin tampering with carburetor adjustments and the like.

If a bike has been sitting for any length of time and refuses to start, check the battery for a charged condition first, and then look to the gasoline delivery system. This includes the tank, fuel petcocks, lines, and the carburetors. Rust may have formed in the tank, obstructing fuel flow. Gasoline deposits may have gummed up carburetor jets and air passages. Gasoline tends

to lose its potency after standing for long periods. Condensation may contaminate it with water. Drain old gas and try starting with a fresh tankful.

Compression, or the lack of it, usually enters the picture only in the case of older machines. Worn or broken pistons, rings, and cylinder bores could prevent starting. Generally, a gradual power loss and harder and harder starting will be readily apparent in this case.

STARTING DIFFICULTIES

Check gas flow first. Remove the gas cap and look into the tank. If gas is present, pull off a fuel line at the carburetor and see if gas flows freely. If none comes out, the fuel tap may be shut off, blocked by rust or foreign matter, or the fuel line may be stopped up or kinked. If the carburetor is getting usable fuel, turn to the electrical system next.

Check that the battery is charged by turning on the lights or by beeping the horn. Refer to your owner's manual for starting procedures with a dead battery. Have the battery recharged if necessary.

Pull off a spark plug cap, remove the spark plug, and reconnect the cap. Lay the plug against the cylinder head so its base makes a good connection, and turn the engine over with the kickstarter. A fat, blue spark should jump across the electrodes. If there is no spark, or only a weak one, there is electrical system trouble. Check for a defective plug by replacing it with a known good one. Don't assume a plug is good just because it's new.

Once the plug has been cleared of guilt, but there's still no spark, start backtracking through the system. If the contact at the end of the spark plug wire can be exposed, it can be held about ⅛ inch from the head while the engine is turned over to check for a spark. Remember to hold the wire only by its insulation to avoid a nasty shock. If the plug wires are dirty, greasy, or wet, wrap a rag around them so you don't get shocked. If you do feel a shock or see sparks along the wire, clean or replace the wire and/or its connections.

If there's no spark at the plug wire, look for loose connections at the coil and battery. If all seems in order there, check next for oil or dirty contact points. Clean points with electrical contact cleaner, or a strip of paper. On battery ignition models, with the ignition switch turned on, open and close the points manually with a screwdriver.

No spark at the points with this test indicates a failure in the ignition system. Refer to Chapter Seven (*Ignition and Electrical Systems*) for checkout procedures for the entire system and individual components. Refer to the same chapter for checking and setting ignition timing.

Note that spark plugs of the incorrect heat range (too cold) may cause hard starting. Set gaps to specifications. If you have just ridden through a puddle or washed the bike and it won't start, dry off plugs and plug wires. Water may have entered the carburetor and fouled the fuel under these conditions, but wet plugs and wires are the more likely problem.

If a healthy spark occurs at the right time, and there is adequate gas flow to the carburetor, check the carburetor itself at this time. Make sure all jets and air passages are clean, check float level, and adjust if necessary. Shake the float to check for gasoline inside it, and replace or repair as indicated. Check that the carburetors are mounted snugly, and no air is leaking past the manifold. Check for a clogged air filter.

Compression may be checked in the field by turning the kickstarter by hand and noting that an adequate resistance is felt, or by removing a spark plug and placing a finger over the plug hole and feeling for pressure.

An accurate compression check gives a good idea of the condition of the basic working parts of the engine. To perform this test, you need a compression gauge. The motor should be warm.

1. Remove the plug on the cylinder to be tested and clean out any dirt or grease.
2. Insert the tip of the gauge into the hole, making sure it is seated correctly.
3. Open the throttle all the way and make sure the chokes on the carburetors are open.
4. Crank the engine several times and record the highest pressure reading on the gauge. Run the test on each of the cylinders. Refer to Chapter Four (*Engine, Primary Drive, and Clutch*) to interpret results.

POOR IDLING

Poor idling may be caused by incorrect carburetor adjustment, incorrect timing, or ignition system defects. Check the gas cap vent for an obstruction.

MISFIRING

Misfiring can be caused by a weak spark or dirty plugs. Check for fuel contamination. Run the machine at night or in a darkened garage to check for spark leaks along the plug wires and under the spark plug cap. If misfiring occurs only at certain throttle settings, refer to the carburetor chapter for the specific carburetor circuits involved. Misfiring under heavy load, as when climbing hills or accelerating, is usually caused by bad spark plugs.

FLAT SPOTS

If the engine seems to die momentarily when the throttle is opened and then recovers, check for a dirty main jet in the carburetor, water in the fuel, or an excessively lean mixture.

POWER LOSS

Poor condition of rings, pistons, or cylinders will cause a lack of power and speed. Ignition timing should be checked.

OVERHEATING

If the engine seems to run too hot all the time, be sure you are not idling it for long periods. Air-cooled engines are not designed to operate at a standstill for any length of time. Heavy stop and go traffic is hard on a motorcycle engine. Spark plugs of the wrong heat range can burn pistons. An excessively lean gas mixture may cause overheating. Check ignition timing. Don't ride in too high a gear. Broken or worn rings may permit compression gases to leak past them, heating heads and cylinders excessively. Check oil level and use the proper grade lubricants.

BACKFIRING

Check that the timing is not advanced too far. Check fuel for contamination.

ENGINE NOISES

Experience is needed to diagnose accurately in this area. Noises are hard to differentiate and harder yet to describe. Deep knocking noises usually mean main bearing failure. A slapping noise generally comes from loose pistons. A light knocking noise during acceleration may be a bad connecting rod bearing. Pinging, which sounds like marbles being shaken in a tin can, is caused by ignition advanced too far or gasoline with too low an octane rating. Pinging should be corrected immediately or damage to pistons will result. Compression leaks at the head-cylinder joint will sound like a rapid on-and-off squeal.

PISTON SEIZURE

Piston seizure is caused by incorrect piston clearances when fitted, fitting rings with improper end gap, too thin an oil being used, incorrect spark plug heat range, or incorrect ignition timing. Overheating from any cause may result in seizure.

EXCESSIVE VIBRATION

Excessive vibration may be caused by loose motor mounts, worn engine or transmission bearings, loose wheels, worn swinging arm bushings, a generally poor running engine, broken or cracked frame, or one that has been damaged in a collision. See also *Poor Handling*.

CLUTCH SLIP OR DRAG

Clutch slip may be due to worn or glazed plates, incorrect adjustment, or too much oil in the primary chaincase. A dragging clutch could result from damaged or bent plates, incorrect adjustment, uneven clutch spring pressure, or a tight primary chain.

POOR HANDLING

Poor handling may be caused by improper tire pressures, a damaged frame or swinging arm, worn shocks or front forks, weak fork springs, a bent or broken steering stem, misaligned wheels, loose or missing spokes, worn tires, bent handlebars, worn wheel bearing, or dragging brakes.

If shimmy, or "head shaking" occurs during deceleration, the alignment of the front tire on the rim should be checked. Misalignment, particularly for tires with a center groove, can cause the front wheel to "hunt" in a rapid oscillating motion when the weight is transferred forward during deceleration. To check for alignment, support the motorcycle so the front tire is clear of the ground. Place a short strip of masking tape on the front fender, lined up with the center groove in the tire. Now, spin the front wheel and sight along the tread, from the front of the motorcycle and visually line up the tire groove with the tape on the fender. If the alignment is correct, the groove will not waver; however, if the tire is misaligned, the groove will waver back and forth.

This condition can often be corrected by deflating the tire, soaping the seating bead, and rotating the tire 90 degrees. After the tire has been reinflated, recheck the alignment as before. Also, if the tire is rotated on the rim, the balance of the wheel should be checked and corrected if necessary.

BRAKE PROBLEMS

Sticking brakes may be caused by broken or weak return springs, improper cable or rod adjustment, or dry pivot and cam bushings. Grabbing brakes may be caused by greasy linings which must be replaced. Brake grab may also be due to out-of-round drums or linings which have broken loose from the brake shoes. Glazed linings or glazed brake pads will cause loss of stopping power.

LIGHTING PROBLEMS

Bulbs which continuously burn out may be caused by excessive vibration, loose connections that permit sudden current surges, poor battery connections, or installation of the wrong type bulb.

A dead battery or one which discharges quickly may be caused by a faulty generator or rectifier. Check for loose or corroded terminals. Shorted battery cells or broken terminals will keep a battery from charging. Low water level will decrease a battery's capacity. A battery left uncharged after installation will sulphate, rendering it useless.

A majority of light and horn or other electrical accessory problems are caused by loose or corroded ground connections. Check those first, and then substitute known good units for easier troubleshooting.

TROUBLESHOOTING GUIDE

The following "quick reference" guide summarizes the troubleshooting process. Use it to outline possible problem areas, then refer to the specific chapter or section involved.

LOSS OF POWER

Cause	Things to check
Poor Compression	Piston rings and cylinders Head gaskets Crankcase leaks
Overheated engine	Lubricating oil supply Clogged cooling fins Ignition timing Slipping clutch Carbon in combustion chamber
Improper mixture	Dirty air cleaner Restricted fuel flow Gas cap vent holes
Miscellaneous	Dragging brakes Tight wheel bearings Defective chain Clogged exhaust system

STEERING PROBLEMS

Problem	Things to check
Hard steering	Tire pressure Steering stem head Steering head bearings
Pulls to one side	Unbalanced shock absorbers Drive chain adjustment Front/rear wheel alignment Unbalanced tires

Cause	Things to check
Pulls to one side (contd.)	Defective swinging arm Defective steering head
Shimmy	Drive chain adjustment Loose or missing spokes Deformed rims Worn wheel bearings Wheel balance

BRAKE TROUBLES

Problem	Things to check
Poor brakes	Worn linings Brake adjustment Oil or water on brake linings Loose linkage or cables Low fluid level

Cause	Things to check
Noisy brakes	Worn or scratched lining Scratched brake drums Dirt in brake housing
Unadjustable brakes	Worn linings Worn drums Worn brake cams

GEARSHIFTING DIFFICULTIES

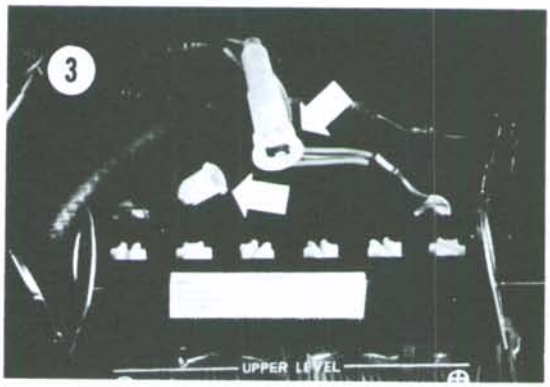
Cause	Things to check
Clutch	Adjustment Friction plates Steel plates—distorted Oil quantity

Cause	Things to check
Transmission	Oil quantity Oil grade Shift adjustment Shift quadrant Shift forks

CHAPTER FOUR

ENGINE, PRIMARY DRIVE, AND CLUTCH

The Norton twin (**Figure 1**—Commando, and **Figure 2**—Atlas and G15) is a non-unit engine; that is, the engine and transmission do not share a common case. As a result, major engine service, including a complete rebuild, can be carried out without disturbing the transmission. Upper end service (cylinder head, cylinders, pistons) can be accomplished without removing the engine from the frame. Lower end service requires that the engine be removed from the frame which in turn requires that the primary drive and clutch be removed.



CYLINDER HEAD

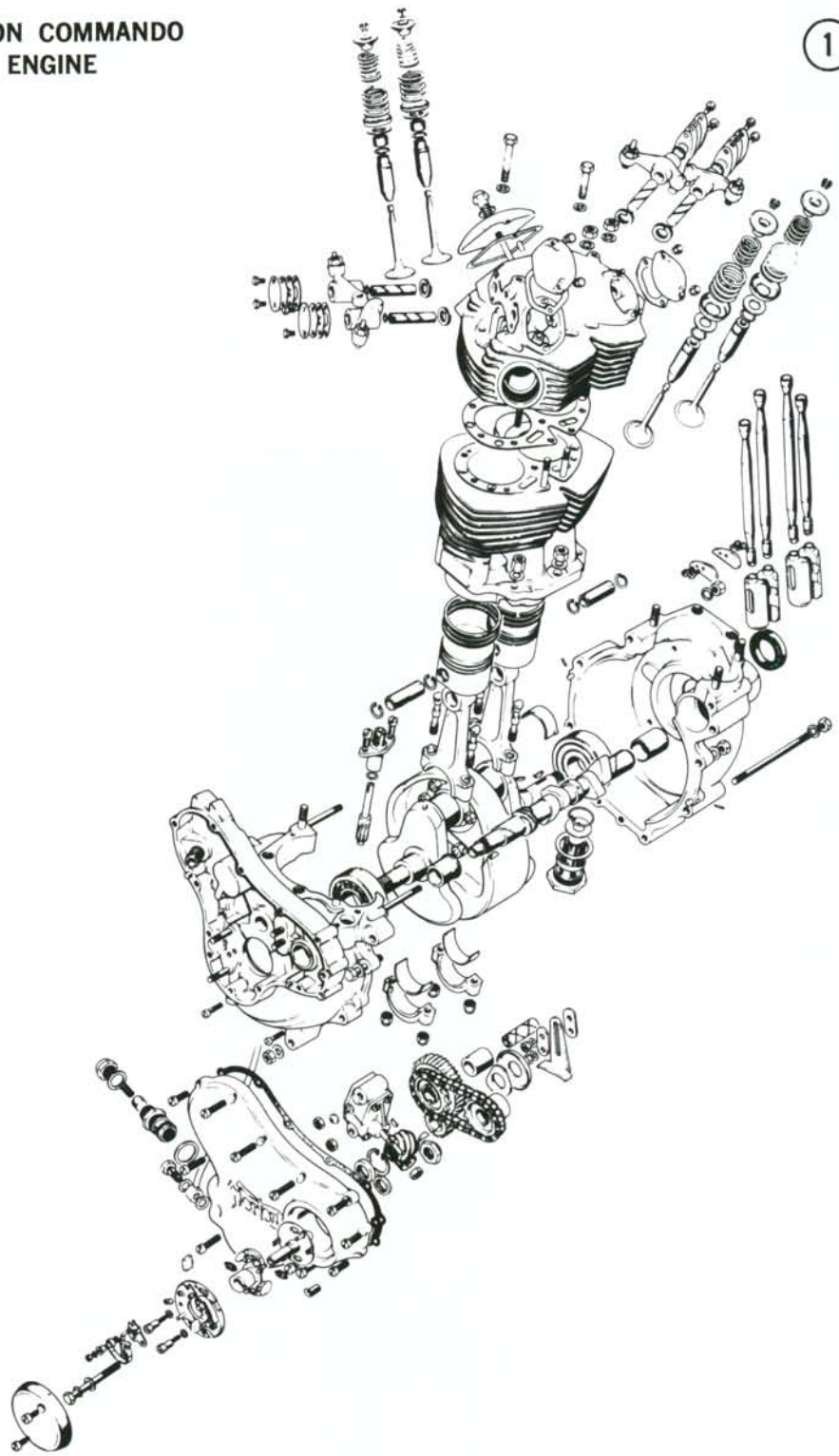
Cylinder head service is presented as a complete rebuild procedure so that the relationship of the components can be better understood. Naturally, not all situations require that all parts be replaced. However, every check, inspection, and measurement called for in this section should be made each time the head is removed to ensure that all parts are within specifications. If a wear component, such as a valve guide, is satisfactory, its service procedure need not be carried out.

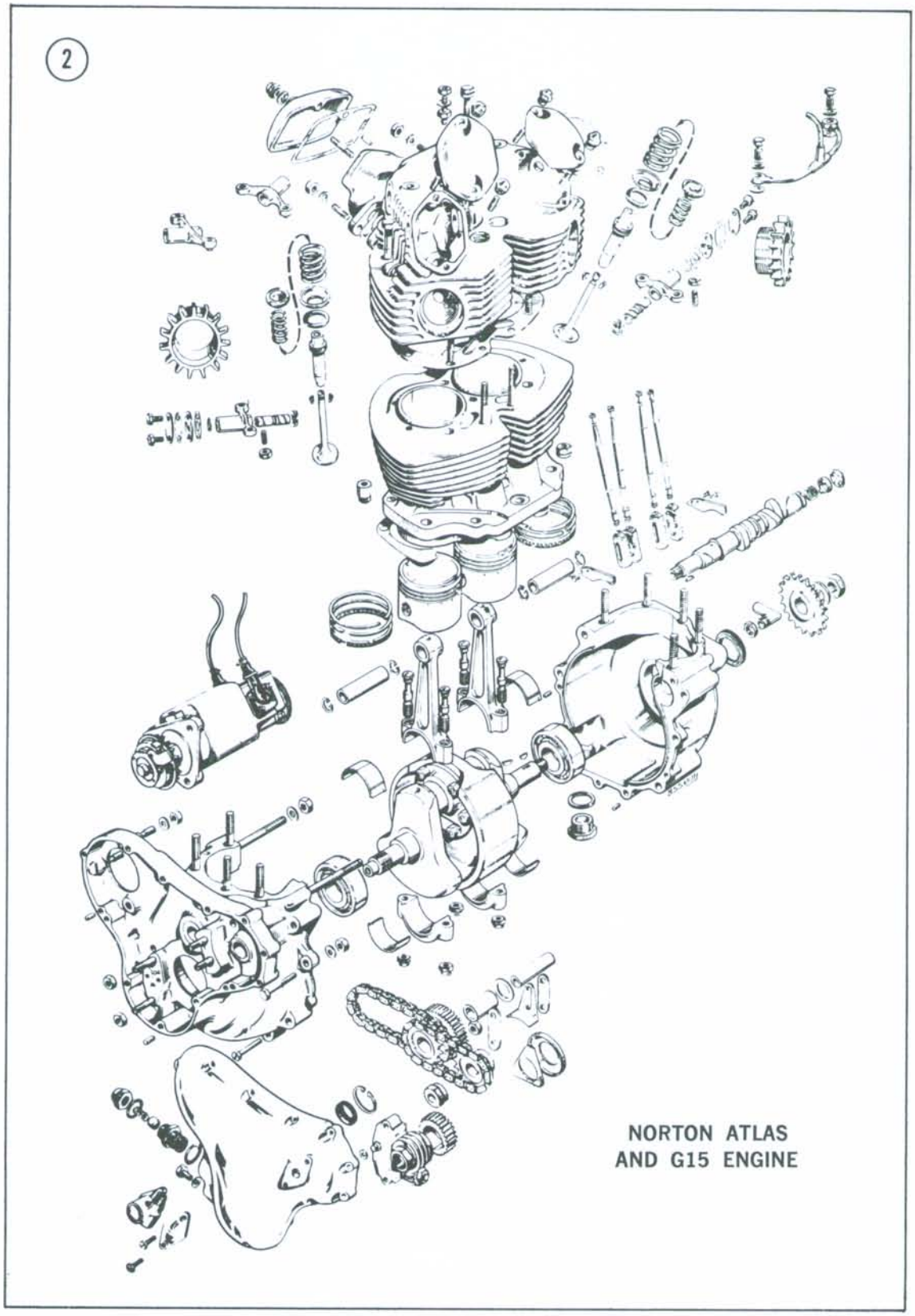
Removal

1. Raise or remove the seat. Disconnect the negative battery lead at the fuse holder and remove the fuse (**Figure 3**).
2. Shut off the fuel taps, disconnect the lines, and remove the fuel tank. On all original equipment Commando tanks (**Figure 4**), the front is mounted on 2 studs beneath the tank and held with self-locking nuts. The rear mount on some models uses a rubber loop which passes beneath the top frame tube, while others are held in place with a metal cross bar.
3. Straighten the lock tabs on the finned head-pipe clamps (**Figure 5**) and unscrew the clamps. Unscrew the muffler mounting nuts and the balance pipe clamp nuts (**Figures 6A and 6B**) and remove each exhaust system as a unit.
4. Refer to Chapter Six and remove carburetors.
5. Carefully pull the caps off the spark plugs and unscrew them. Remove the entire coil assembly

NORTON COMMANDO
ENGINE

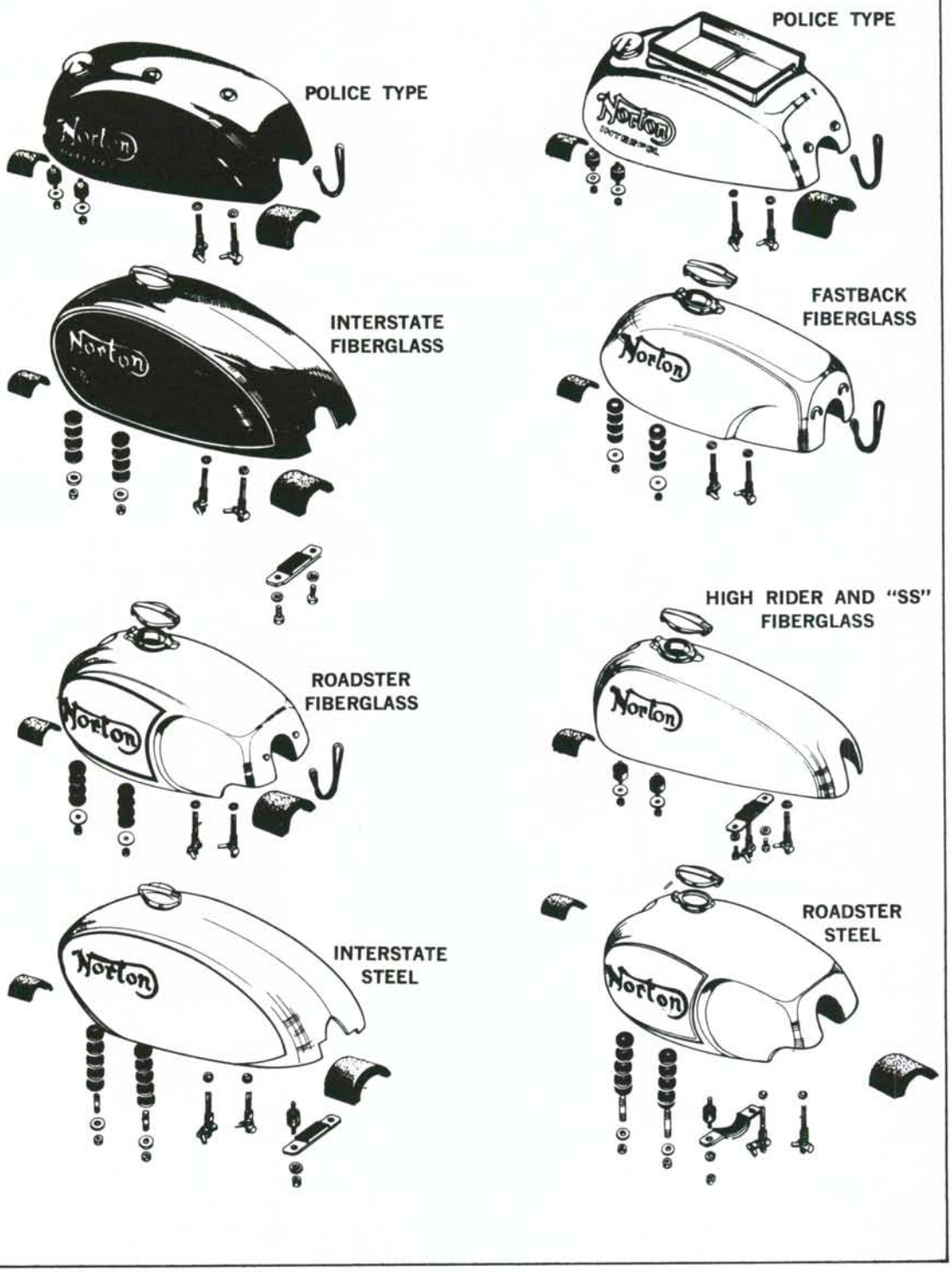
1

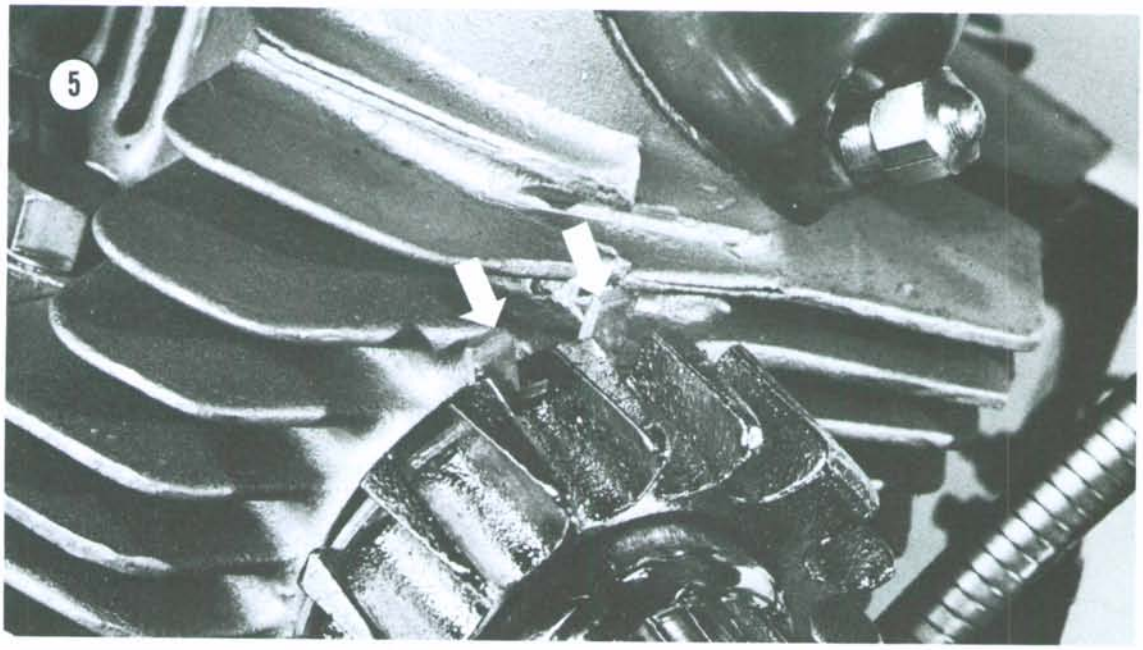


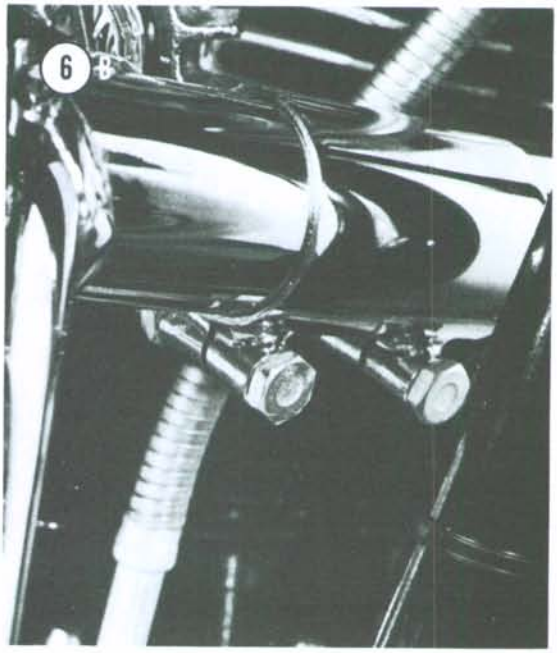


NORTON ATLAS
AND G15 ENGINE

COMMANDO FUEL TANKS





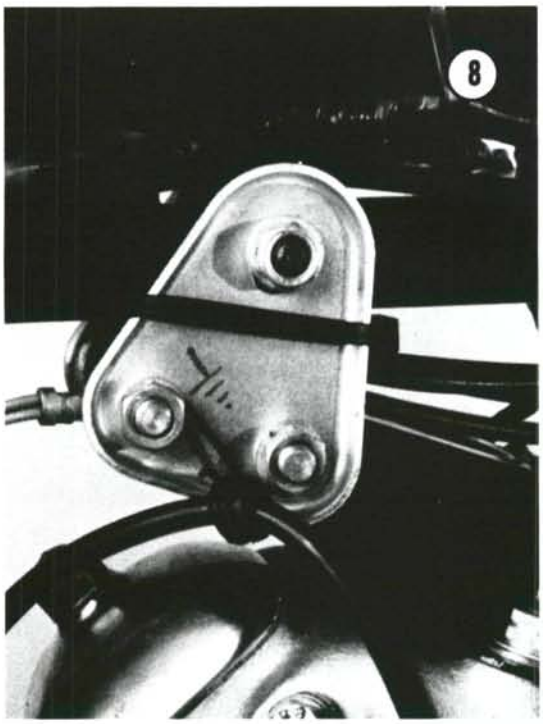


from the frame as a unit (**Figure 7**). Instead of unplugging the leads and risking incorrect installation later on, tie the assembly to the handlebar with a piece of cord.

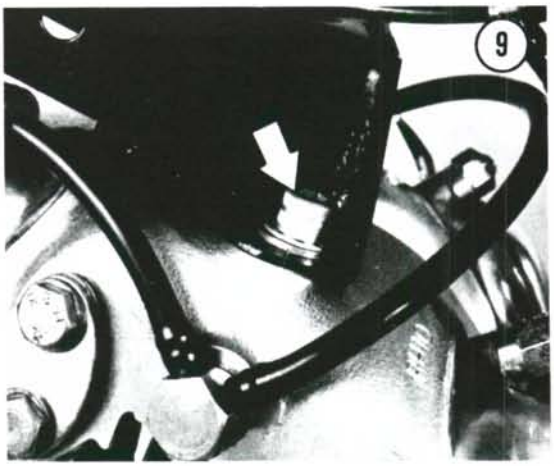
6. Unscrew the nuts which mount the headsteady to the frame (**Figure 8**). Unscrew the 3 Allen screws (**Figure 9**) and remove the headsteady from the head.

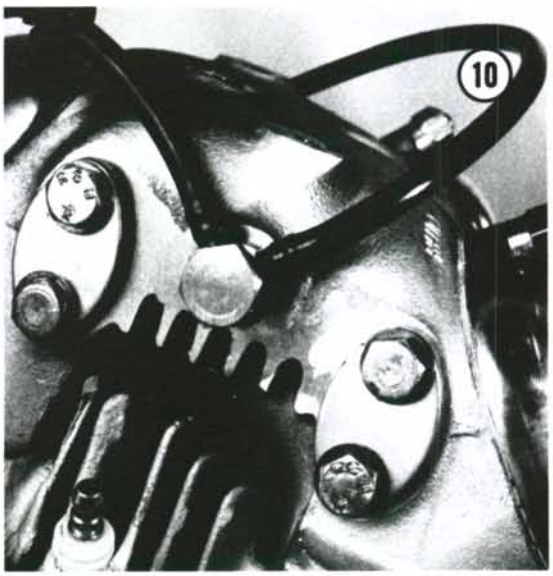
On 850 Mark III models, loosen the nut which holds the spring trunion to the head and disconnect the ends of the spring from the trunion. Remove the spring from the frame bracket.

7. Unscrew the bolts from the rocker feed pipe (**Figure 10**) and lift the pipe from the head. There's no need to disconnect the pipe from the engine lower end; however, it should be tied or taped out of the way.



8. With the transmission in gear, rotate the rear wheel to bring the pistons to TDC. Unscrew the cylinder nuts and bolts in the pattern shown in **Figure 11**, beginning with No. 2. Remove the front center bolt last. Lift the head, move the pushrods as far into the head as possible (**Figure 12**), and remove it from the engine.

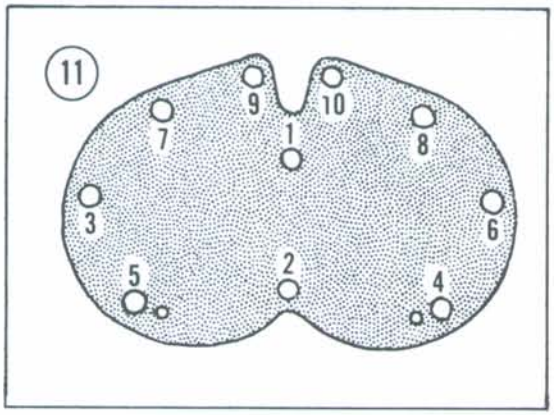


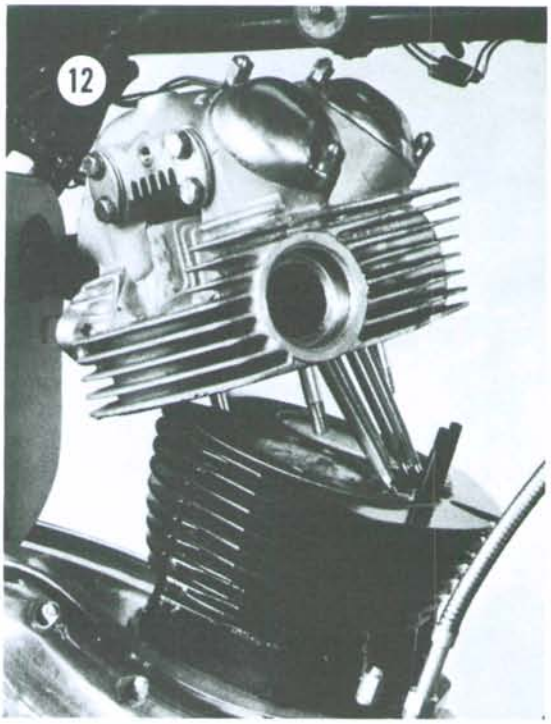


Disassembly

1. Remove the rocker covers and gaskets (**Figure 13**) and the spindle cover plates and gaskets (**Figure 14**).

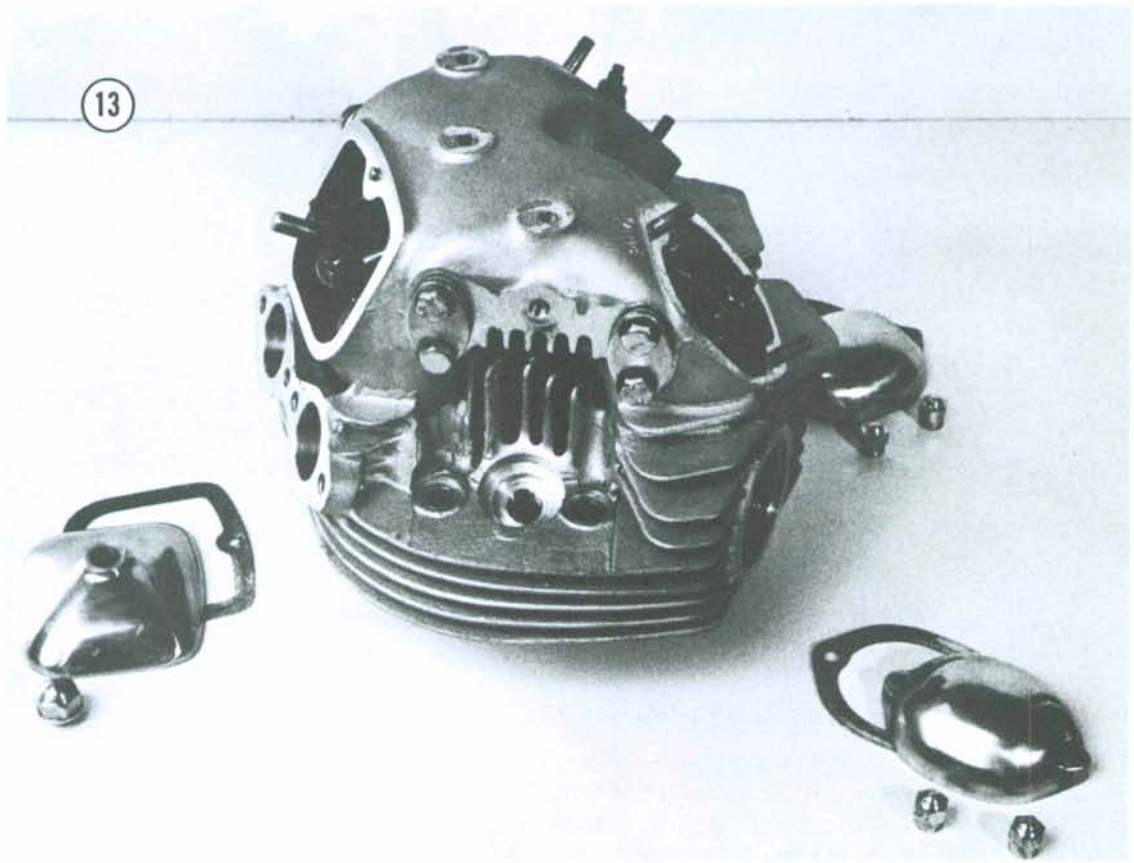
2. Heat the cylinder head in an oven, at 300°F, for 30 minutes. Screw a slide hammer shaft (Norton tool No. 064298) into the end of the rocker spindle and withdraw the rocker spindle. If a slide hammer is not available, an inexpensive substitute extractor tool like that shown in **Figure 15** can be fabricated.

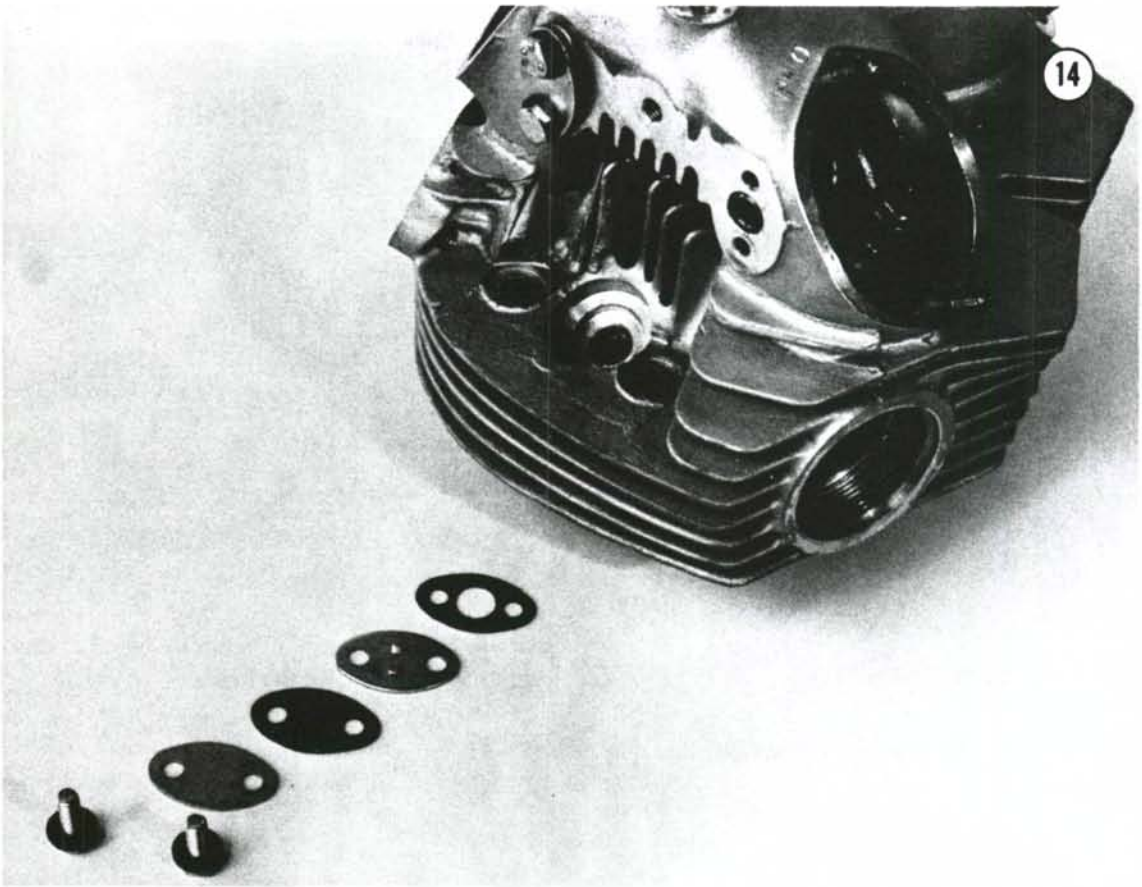




Repeat the procedure for the remaining 3 shafts. Remove the rockers and the thrust washers.

3. Double nut the inlet rocker cover stud, Tighten the nuts securely against one another, and unscrew the stud with a wrench on the bottom nut (**Figure 16**). Compress each of the valve springs in turn (**Figure 17**) and remove the keepers from the valve stem (**Figure 18**) with a

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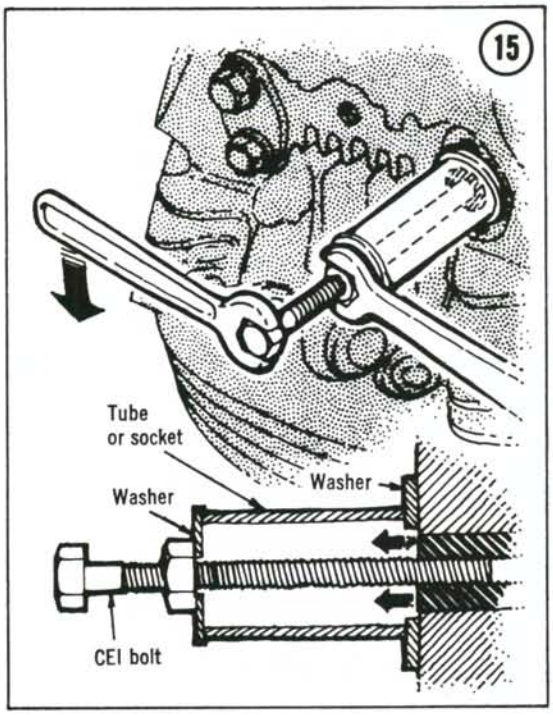
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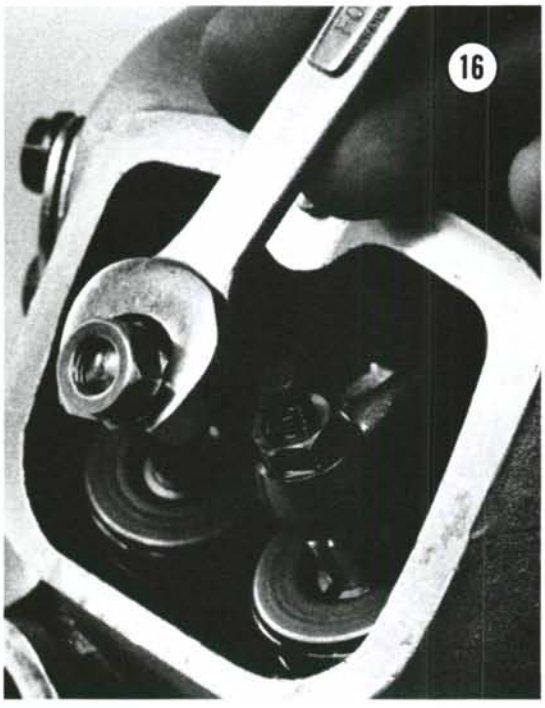
Tube
or socket
Washer
Washer
CEI bolt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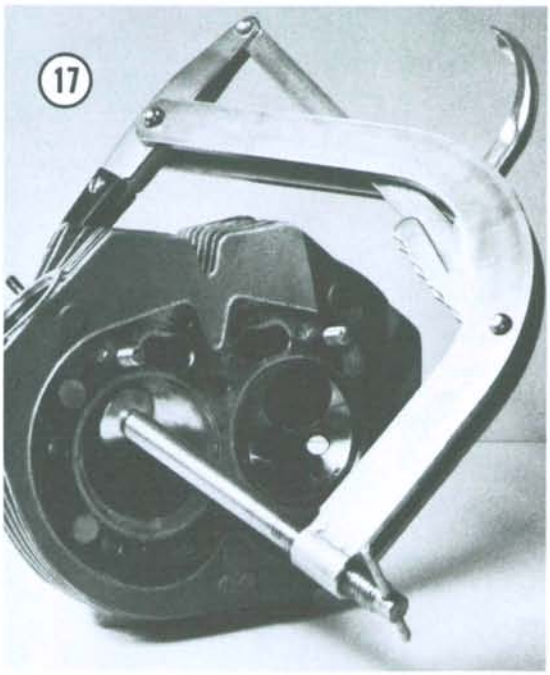
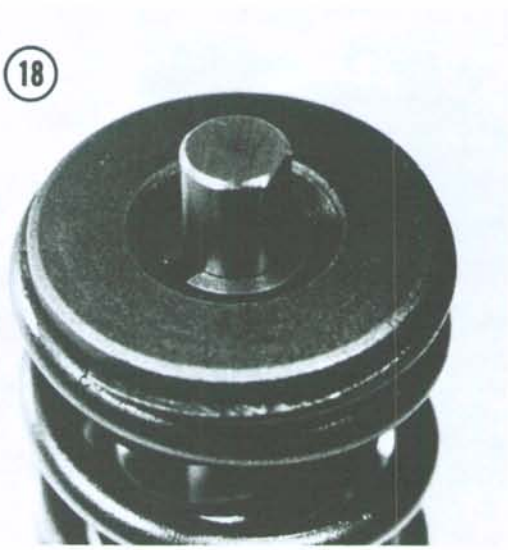
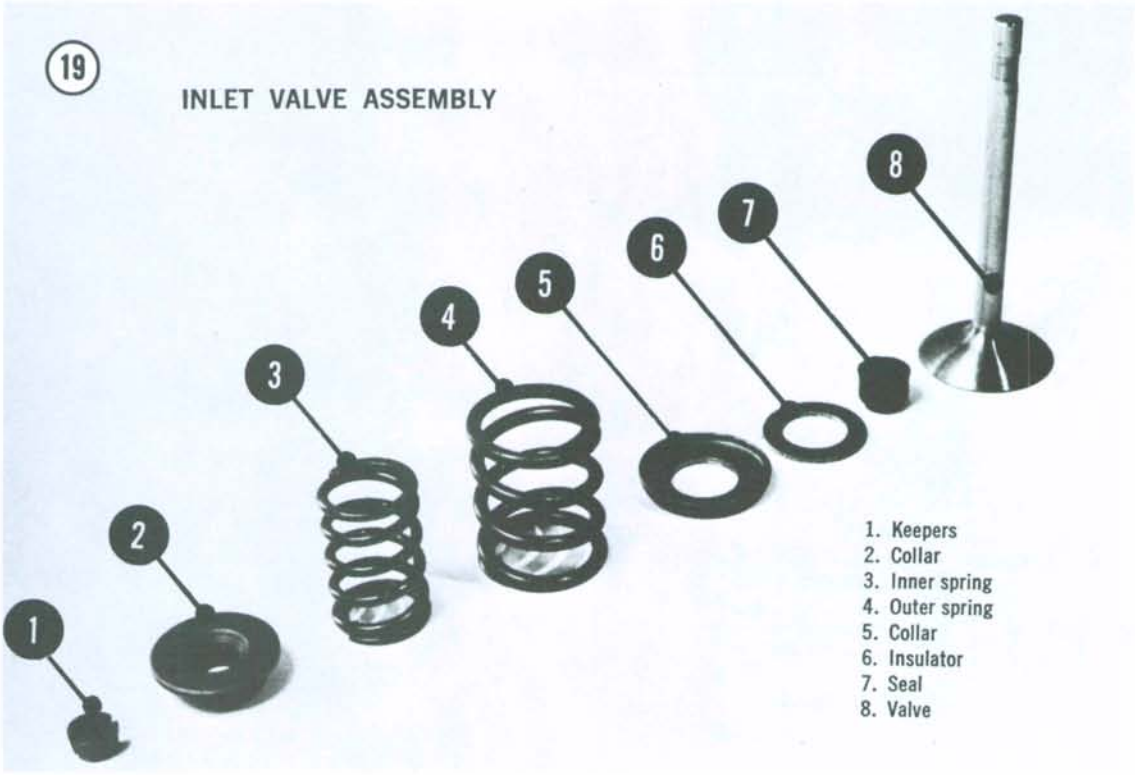


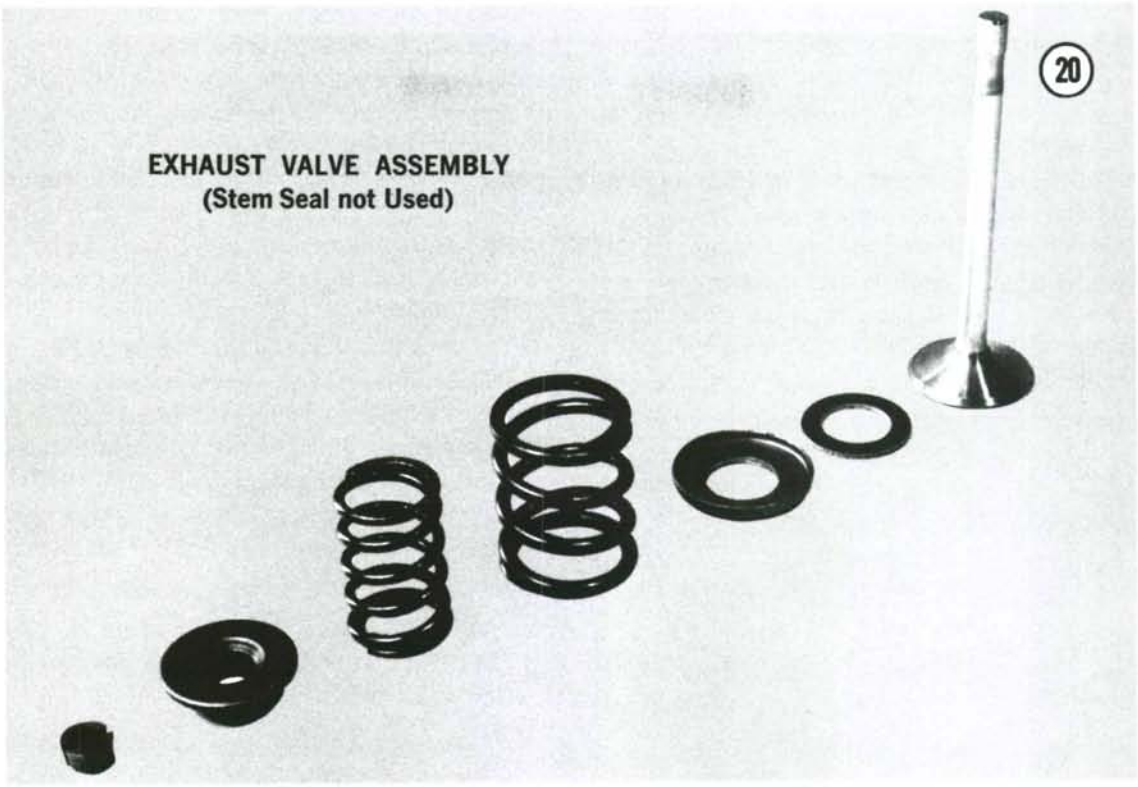


small magnet or screwdriver. Release the compresser and remove the valve, springs, collars, and the stem seals (inlet only). See **Figures 19 and 20**. Keep each valve assembly together and mark it for location in the head.

Inspection

1. Clean the carbon from the combustion chambers, exhaust ports, valves, and piston crowns



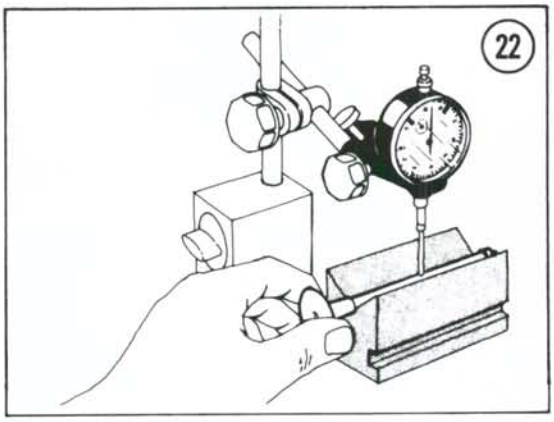


using either a special chemical carbon remover or a scraper made of *soft* metal, such as aluminum. Then clean all of the parts in solvent and dry them.

> NOTE: *Don't remove the carbon ridges around the tops of the cylinders or from the piston above the top compression ring.*

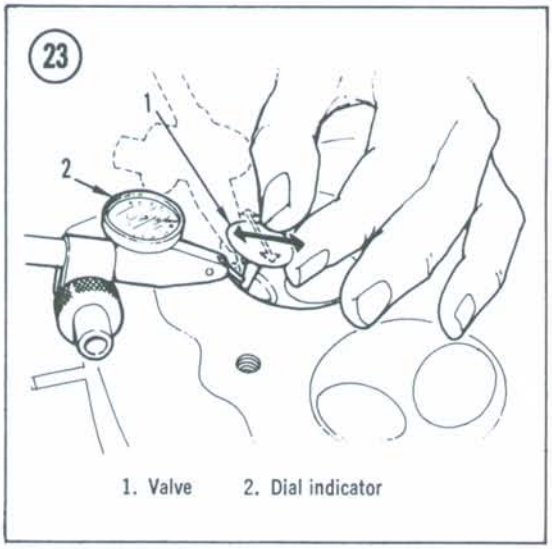
2. Inspect the contact surface of each valve for burning (**Figure 21**). Minor roughness and pitting can be removed by reseating the valve, but excessive unevenness to the contact surface is an indication the valve is not serviceable. The contact surface of the valve may be ground on a valve grinding machine, but it's best to replace a burned or damaged valve with a new one.

Inspect the valve stems for wear and roughness and measure the vertical runout of the valve face as shown in **Figure 22**. The runout should not exceed 0.001 in. (0.025mm).



3. Measure the free length of the valve springs. The inner springs should be 1.482 in. (37.642mm) and the outer springs should be 1.618 in. (41.097mm). Replace any springs that are short.

4. Install each of the valves in its guide, in turn, and measure the clearance of the stem and the guide (**Figure 23**) in 2 axes to determine if the guide has worn oval. If the measurements are different for the 2 axes, or if the clearance is greater than 0.006 in. (0.152mm), the guide should be replaced.



5. Check the valve seats for excessive wear or pitting that can't be removed by lapping the valve. In such cases, the seat must be recut. Also, the seat will have to be recut if the valve guide is replaced.

> NOTE: *Both the replacement of a valve guide and recutting a valve seat require special tools and skills. This work should be entrusted to a Norton service shop or to a cylinder head rebuilding service.*

6. Measure the bores of the rockers and the rocker shafts. The difference (clearance) should be no greater than 0.0020 in. (0.051mm).

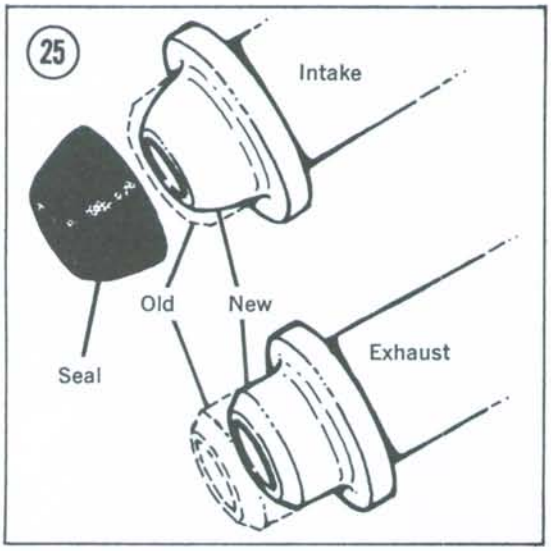
Assembly

1. Lap each valve in its seat using a fine grade of grinding compound and a hand lapping stick. Apply compound to the contact surface of the valve and set the valve into the head. Wet the suction cup on the end of the lapping stick and stick it to the head of the valve. Lap the valve to the seat by rotating the lapping stick in both directions (**Figure 24**). Every 5 to 10 seconds, rotate the valve head 180° in the seat, continue lapping until the contact surfaces of the valve and the seat are a uniform grey. Wash the head thoroughly with solvent, making sure no compound remains in the ports or the valve guides.

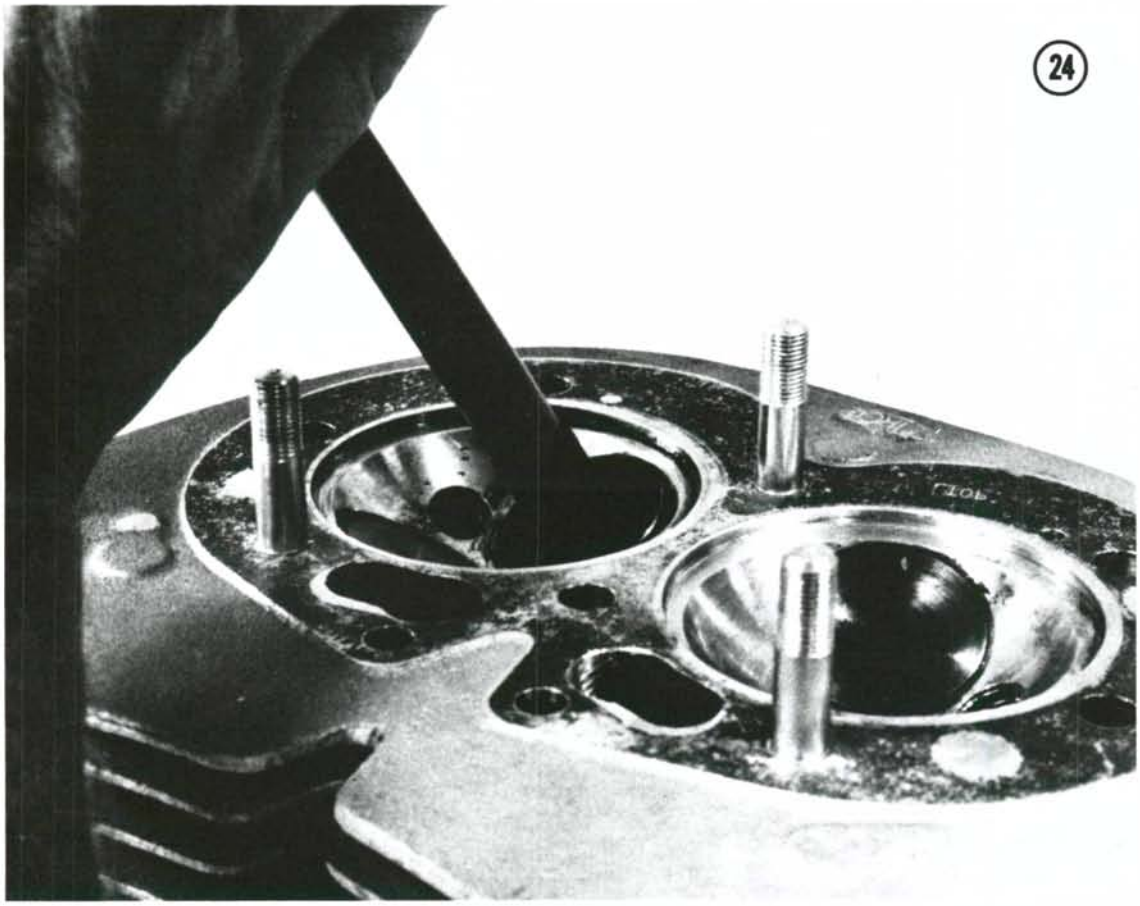
2. Oil the valve stems and install the valves in the head and reassemble the collars and springs in the order shown in Figures 19 and 20. All 1971 and earlier engines must have heat insulators installed between the bottom spring collar and the head on the inlet valves, and all models must have the insulators installed on the exhaust valves.

> NOTE: *When guide replacement is required on early engines, late model guides* (**Figure 25**) *should be installed to reduce oil consumption. Also, stem-to-guide seals must be installed on the inlet valve guides.*

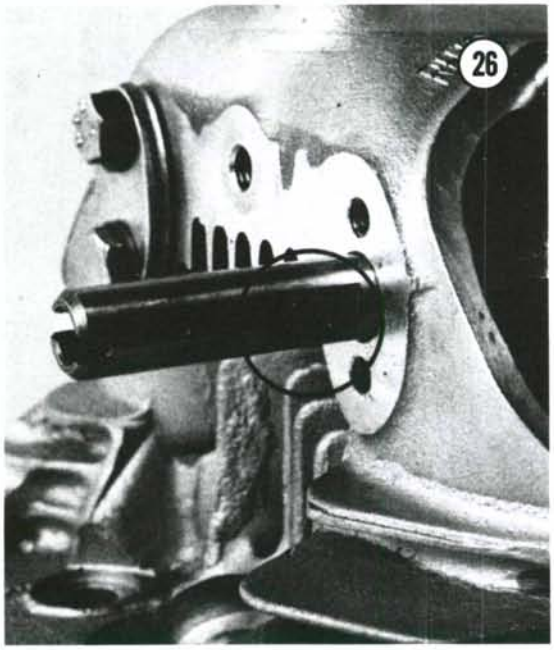
Also, on heads equipped with the type of guide shown in **Figure 25**, the stem and guide seals must be installed on the inlet valves (Figure 19).

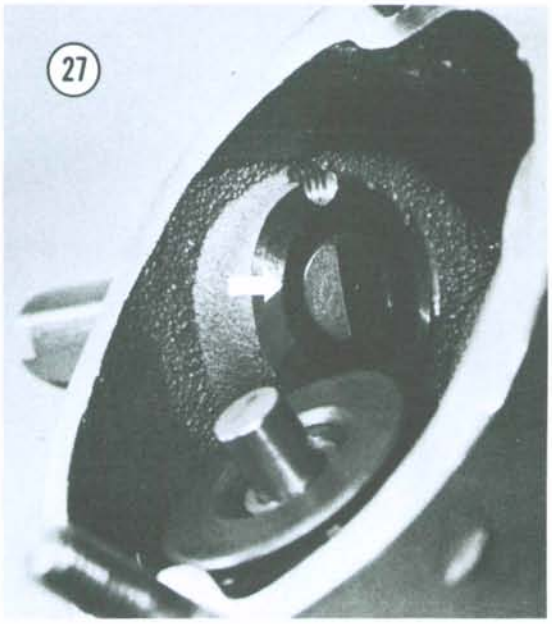


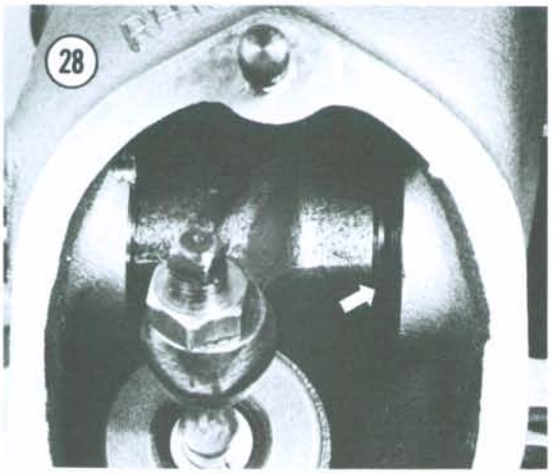
Compress each valve assembly and install the split keepers in the top collars. Make sure the keepers are firmly seated in the collar and the valve stem groove.

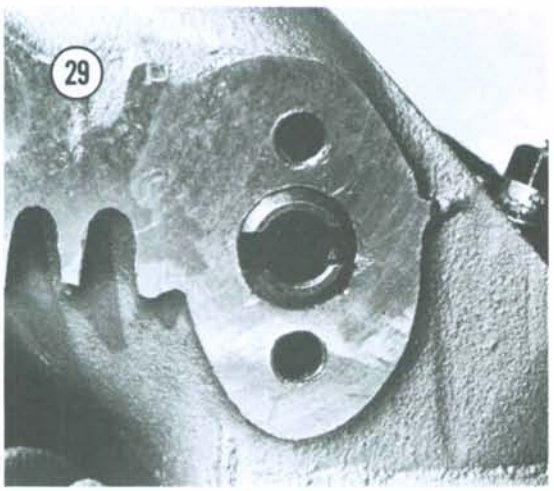


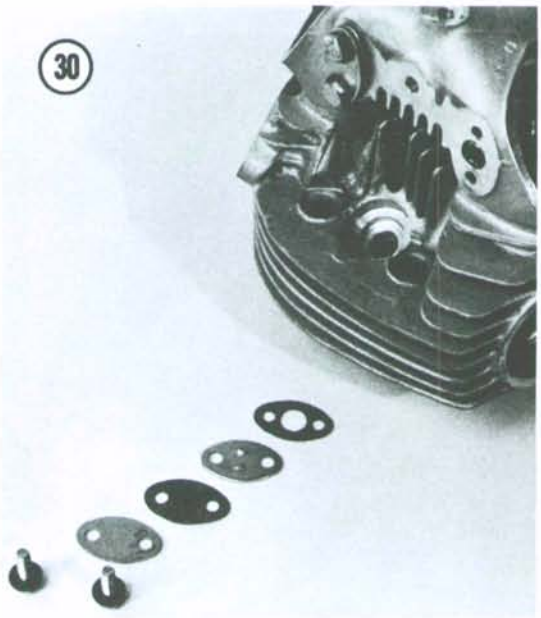
3. Heat the cylinder head and start one of the rocker shafts into its bore. On the exhaust rockers, the flat on the shaft (**Figure 26**) should face forward, and on the inlet rockers the flat should face to the rear. Carefully tap the shaft in until it protrudes about 1/16 in. (1.6mm) into the case (**Figure 27**). Install a plain washer on the end of the shaft and set the rocker in place. Tap the shaft in part way so that it engages the rocker and fits the spring washer between the end of the rocker and the inside wall (**Figure 28**). Tap the shaft in until it passes through the spring washer and into the opposite boss in the head. If necessary, rotate the spindle using the slit in the outer end and line up the spindle as shown (**Figure 29**). Finally, tap the spindle the rest of the way in until the spindle is flush with or slightly beneath the machined surface. Install the gaskets and plates in the order shown (**Figure 30**). Repeat the procedure for each of the other rockers.











Installation

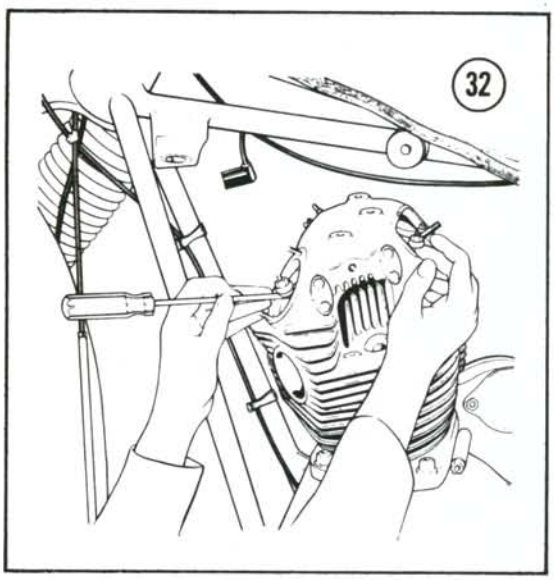
1. Make certain the mating surfaces of the head and cylinders are clean and set the head gasket on top of the cylinders. If the position of the pistons has been disturbed, bring them to TDC by rotating the rear wheel with the transmission in gear. This is necessary to provide sufficient room for setting the head in place.

> NOTE: *It is recommended that the latest head gasket with a "Flame Ring" be installed when the head is removed for service. The new gasket is an improvement over the copper and composition fiber/metal types. Before installing the gasket, clean the cylinder and head mating surfaces with a non-petroleum base solvent such as lacquer thinner and install the gasket without gasket cement. Part numbers for the "Flame Ring" gasket are: 750 — No. 063844; 850 — No. 065051.*

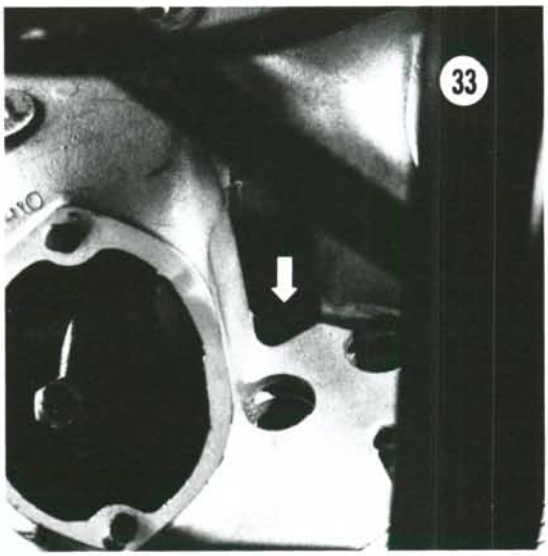
2. Set the long intake pushrods—cups first—in the inside bores and the shorter exhaust pushrods in the outside bores (**Figure 31**). Push the rods into the head as far as they will go. Hold the head in one hand and hold the pushrods in place with the other. Position the head over the cylinders and let the pushrods down into their bores.

They will locate automatically on the cam followers.

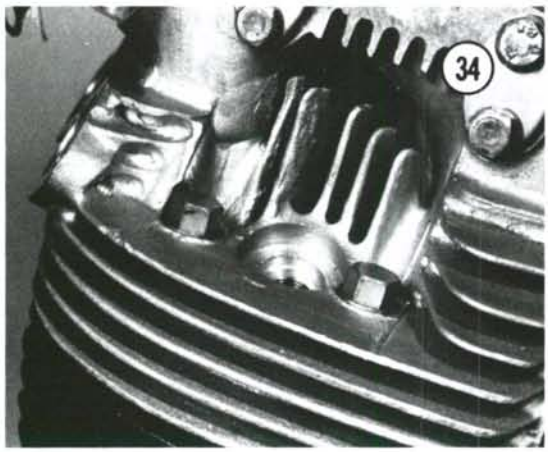
3. Before the head can be set in place on the cylinder, the pushrods must be lined up with the rockers. Begin with the long rods and carefully guide them into contact with the rockers, using a small screwdriver or probe (**Figure 32**). Then do the same with the shorter pushrods.



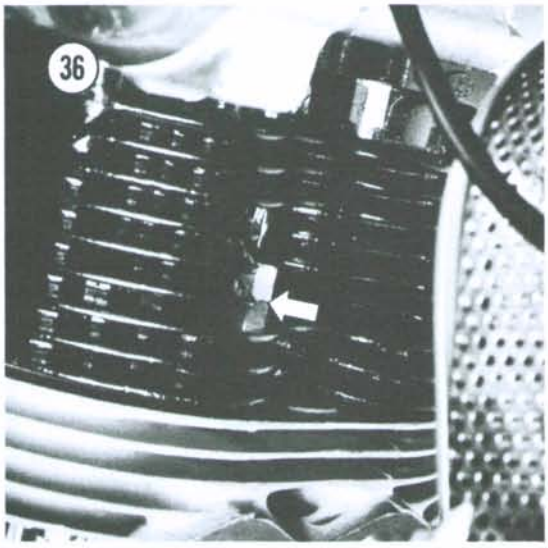
4. Screw in the short bolt located at the center of the front of the head (**Figure 33**). Make sure all the pushrod cups are engaged with the rockers and tighten this bolt to pull the head down onto the cylinders against the valve spring pressure.



5. Install the bolts and washers on each side of the spark plug holes (**Figure 34**). Screw the long nuts onto the studs beneath the exhaust ports (**Figure 35**) and conventional nuts onto the studs beneath the intake ports (**Figure 36**). None of these require washers. Next, screw the 2 nuts with washers onto the front studs (**Figure 37**). Tighten the nuts and bolts in the sequence shown in Figure 11 to 20 ft.-lb. (2.75 mkg) for the smaller (5/16 in.) bolts and 30 ft.-lb. (3.68 mkg) for the larger (⅜ in.) nuts and bolts.



6. Adjust the valve clearances as described below and reassemble the remaining components in reverse order of their removal. The spark plugs should be installed as soon as the valve

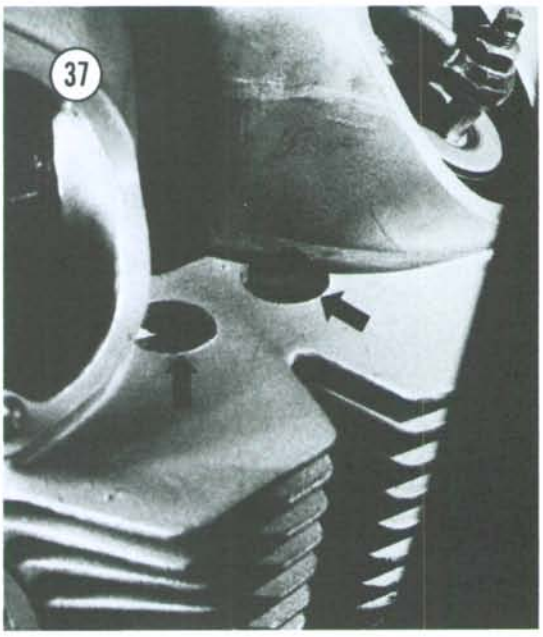


clearances have been set to prevent nuts or washers from falling into the cylinders.

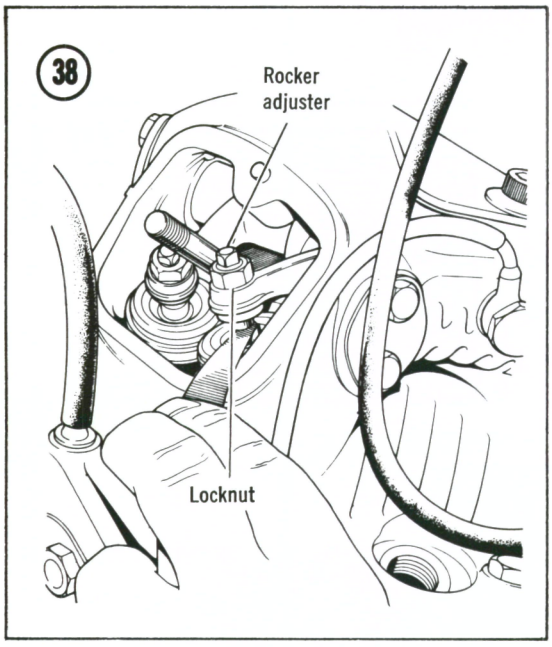
Make sure the tubing to the rocker feed pipe is not crimped or in contact with the head or headsteady. Check the wiring to the coil cluster to make sure like colors are connected to like colors. Finally, don't forget to reinstall the fuse in the holder on the battery negative lead.

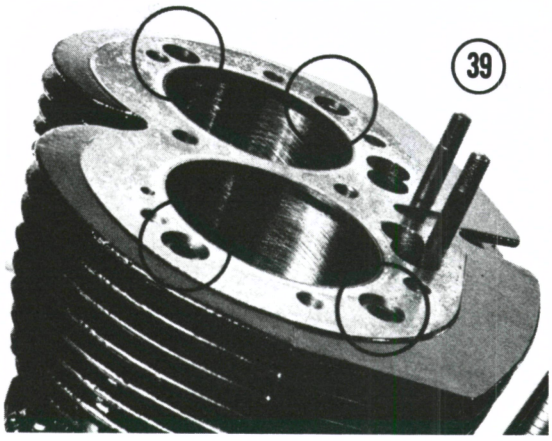
VALVE ADJUSTMENT

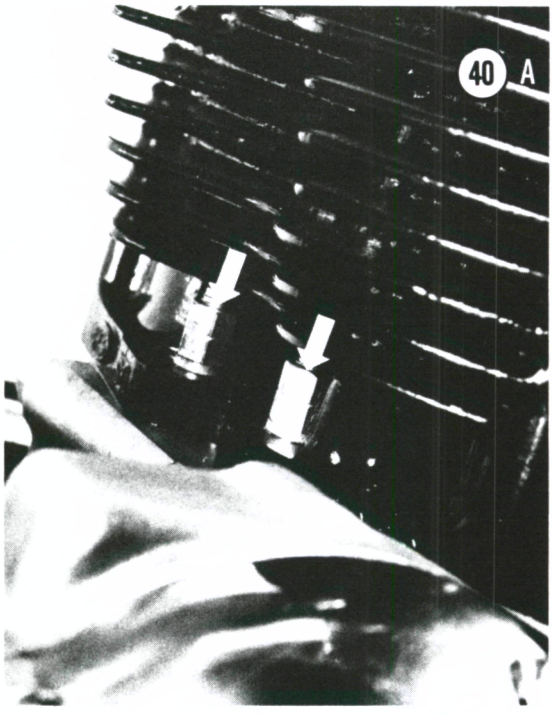
Clearance of rockers should be adjusted at 2,500-3,000-mile intervals and each time cylinder head or any part of valve train is removed and installed. The clearances should be checked and set with the engine cold. For the standard 750 and 850 engines, the inlet clearance is 0.006 in. (0.15mm) and the exhaust clearance is 0.008 in. (0.2mm); for the 750 Combat engine, the inlet clearance is 0.008 in. (0.2mm) and the exhaust clearance is 0.010 in. (0.25mm).



1. Remove the rocker covers and unscrew the spark plugs from the head.
2. Rotate the crankshaft using the kickstarter until the left inlet valve is completely open (**Figure 38**). Check the clearance of the right inlet valve and rocker. When the clearance is correct, there will be a slight resistance on the feeler gauge when it is inserted and withdrawn.
3. To correct the clearance, back off the locknut and screw the adjuster out far enough to insert the gauge with no resistance. Screw the adjuster in until a slight resistance can be felt in the gauge. Hold the adjuster to prevent it from turning further and tighten the locknut. Recheck the clearance to make sure the adjuster didn't turn after the correct clearance was achieved.
4. Rotate the crankshaft to open the right intake valve completely and check and adjust the clearance of the left valve and rocker. Then, check and adjust the exhaust valves and rockers in the same manner.







CYLINDERS AND PISTONS

Cylinder wear should be checked each time the head is removed or if such symptoms as excessive oil consumption, performance degradation, or piston slap indicate the possibility of the cylinders being worn beyond service limits.

Removal

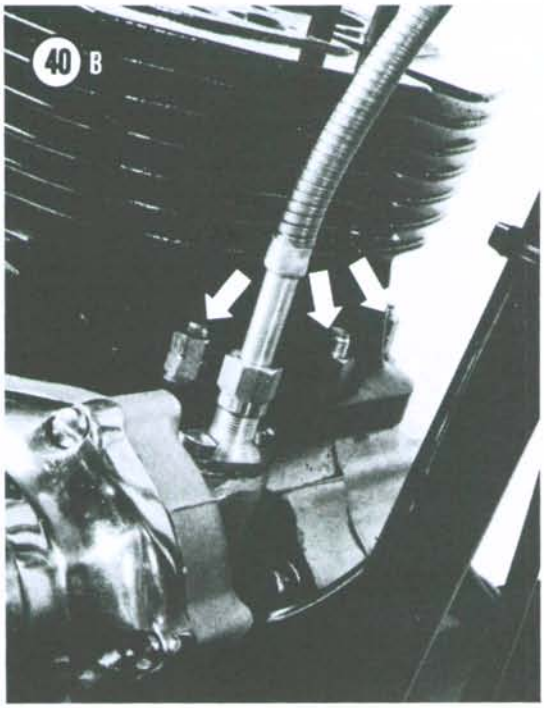
1. Remove cylinder head as described earlier.

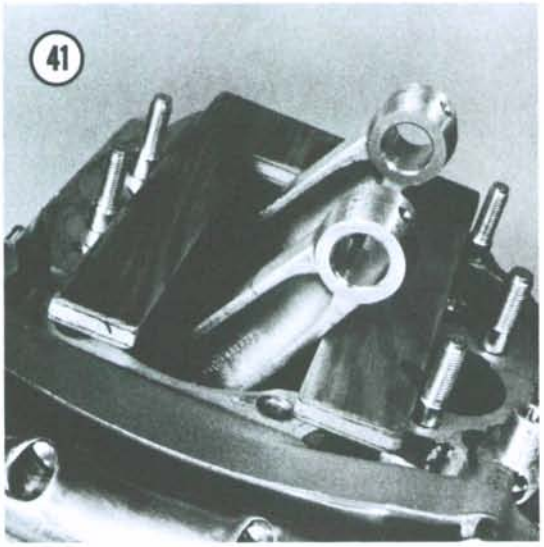
NOTE: *On 750 engines, it is not necessary to remove the head from the cylinder; they can be removed together as an assembly after the spark plugs have been removed, the crankshaft is rotated to bring the pistons to* BDC, *and the cylinder base nuts are unscrewed.*

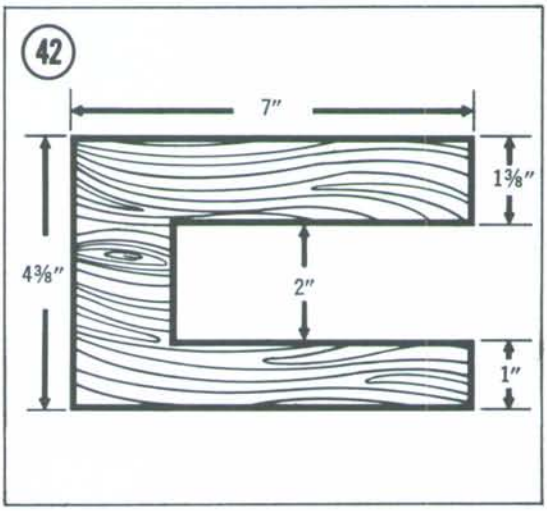
2. On 850 engines, unscrew the 4 thru-bolts (**Figure 39**) and 5 nuts (**Figures 40A and 40B**). On 750 engines, unscrew 9 nuts around the base of the cylinders. The nuts must be unscrewed progressively; it's essential to lift the cylinder assembly so that the nuts will not jam against the fin above them. Remove all washers (there are none on the front center stud) before lifting the cylinder assembly off the pistons. Prevent the rods from falling forward or backward against the crankcase as the cylinder is lifted free.

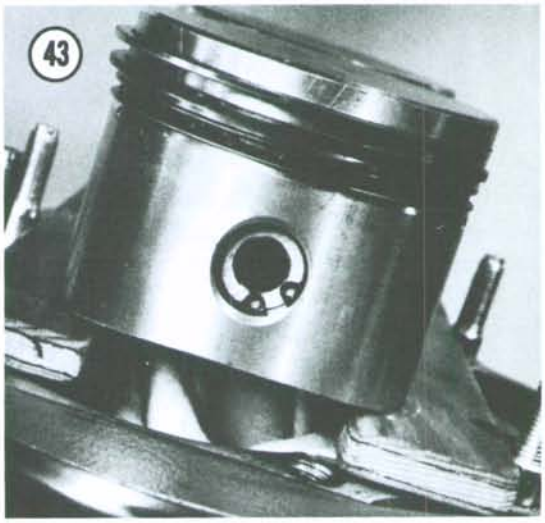
3. Stuff a clean shop rag into the top of the crankcase to prevent small parts and dirt from falling into the crankcase. A wooden block made from soft wood (like the one shown in **Figures 41 and 42**) will protect the connecting rods, crankcase opening, and piston skirts.

NOTE: *On 850 engines, mark the pistons, "right" and "left" and "front" so that they may be installed in the locations and direction from which they were removed.*









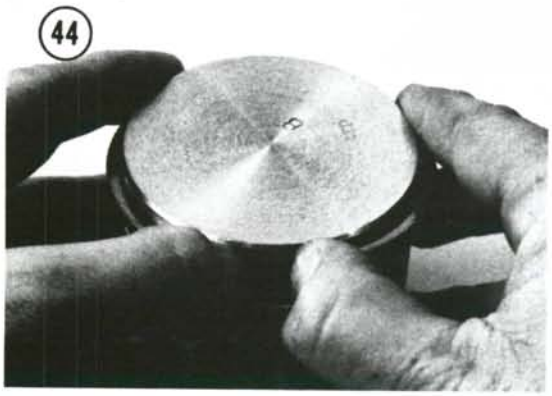
4. Remove the circlips from the wrist pin bores in the pistons (**Figure 43**) and press the pins out with a drift or a small socket on an extension. The piston must be held securely so that none of the force that is required to push out the pin is applied to the connecting rod. It's advisable to have someone help you hold the piston. Under no circumstances should you hammer on the drift; if the pin can't be moved, warm the piston for several minutes by wrapping a rag, heated in hot water, around it.

Inspection

1. Remove the rings from the pistons by spreading the ring ends with your thumbs and lifting the rings up evenly (**Figure 44**). Carefully clean the carbon from the piston crown with a chemical remover or with a soft scraper. Try not to remove or damage the carbon ridge around the circumference of the piston above the top ring. If the pistons, rings, and cylinders are found to be dimensionally correct and can be reused, removal of the carbon ring from the tops of pistons or the carbon ridges from the tops of cylinders will promote excessive oil consumption.

CAUTION

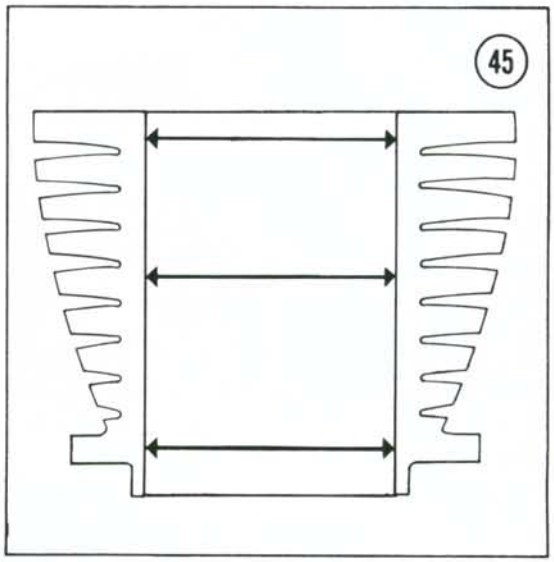
The rail portions of the oil scraper can be very sharp. Be careful when handling them to avoid cut fingers.



Clean the ring grooves in the pistons using either a groove scraper or a piece of old ring. Then clean the piston in solvent and dry it thoroughly.

2. Measure the cylinder bores at the points shown in **Figure 45** in 2 axes—in line with the wrist pins and at 90° to the pins. If taper or out-of-round are greater than 0.005 in. (0.127mm), the cylinders must be bored to the next oversize and new pistons installed. Bore sizes are shown in **Table 1**.

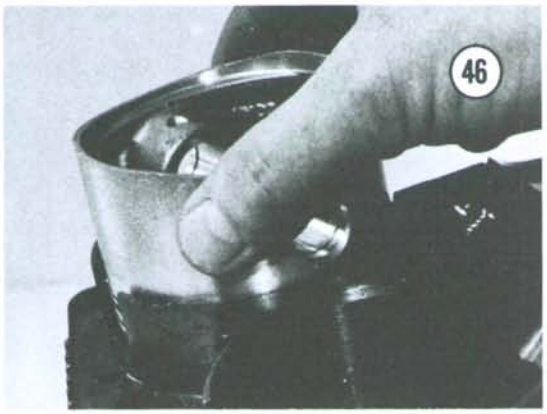
NOTE: *The new pistons should be obtained before the cylinders are bored so that pistons can be measured; slight manufacturing tolerances must be taken into account to determine the actual bore size and the working clearance. Piston-to-cylinder clearance should be 0.0035-0.0040 inch (0.089-0.10mm).*



If a cylinder gauge or inside micrometer is not available, cylinder wear can be checked by placing a compression ring in the cylinder at the locations shown in Figure 45 and measuring the ring gap with a flat feeler gauge. The ring must be positioned squarely into the cylinder. This can be accomplished by pushing it into place with the head of a piston (**Figure 46**). This method is not as accurate as the first and if any doubt exists about the serviceability of a cylinder, the unit should be checked by a dealer.

Table 1 BORE SIZES

Engine	Piston	Bore Size
750cc	Standard:	2.875 in. (73.025mm)
	+ 0.010 in. oversize	2.885 in. (73.279mm)
	+ 0.020 in. oversize	2.895 in. (73.477mm)
	+ 0.030 in. oversize	2.905 in. (73.787mm)
	+ 0.040 in. oversize	2.915 in. (74.041mm)
850cc	Standard:	3.032 in. (77.013mm)
	+ 0.010 in. oversize	3.042 in. (77.267mm)
	+ 0.020 in. oversize	3.052 in. (77.521mm)
	+0.040 in. oversize	3.072 in. (77.970mm)
	+0.060 in. oversize	3.092 in. (78.477mm)



Installation

1. Make certain the threads of the crankcase studs are clean and apply a light coat of grease to them. Carefully coat the cylinder mounting flange with Loctite "Plastic Gasket" or gasket cement.

NOTE: *Omit the base gasket (early models) to reduce oil seepage at the cylinder flange. Normal flexing of the crankcase causes the gasket to extrude after several thousand miles, promoting bothersome seepage.*

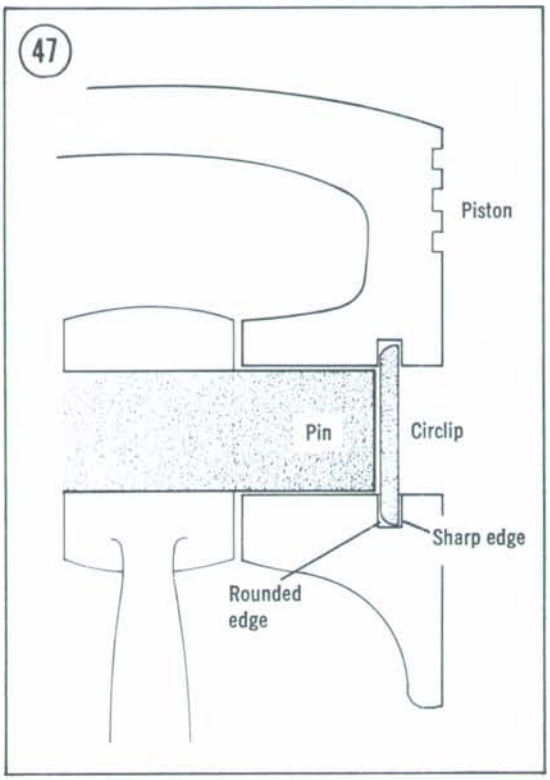
2. Install one circlip in each piston. Make sure the clip is installed with the sharp edge facing out (**Figure 47**) so the clip will lock in the groove. Heat the pistons in hot water.

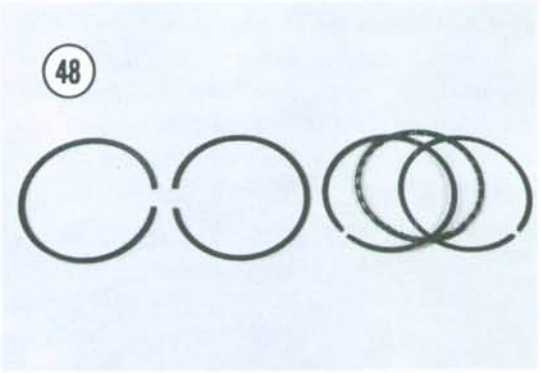
3. Lightly oil the wrist pin bores in the connecting rods and pistons, set the pistons in place on the rods, and push the pins in, taking care to support the pistons so there is no side loading on the rods. Then fit the remaining circlips, again making sure the sharp edge of each clip faces outward.

CAUTION

The piston stamped RH *must be installed on the right connecting rod and the one stamped* LH *must be installed on the left. Also, the* EX *stamp on each piston must face forward, toward the exhaust ports.*

4. Rotate the crankshaft to bring the pistons into contact with the wooden block and install the rings—first the oil scraper, then the second and top compression rings (**Figure 48**). Rotate

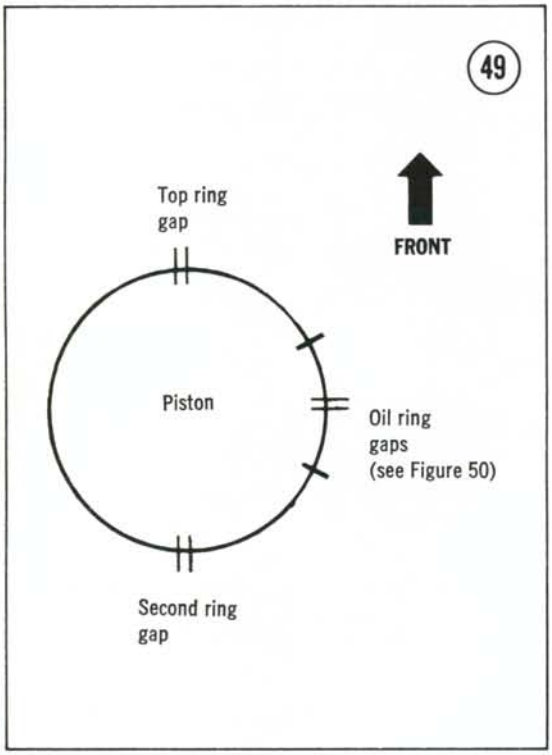




the rings in the grooves to position the end gaps as shown in **Figure 49**. When aligning the scraper ring, make sure the gaps in the rail and the expander are staggered and that the ends of the expander do not overlap (**Figure 50**).

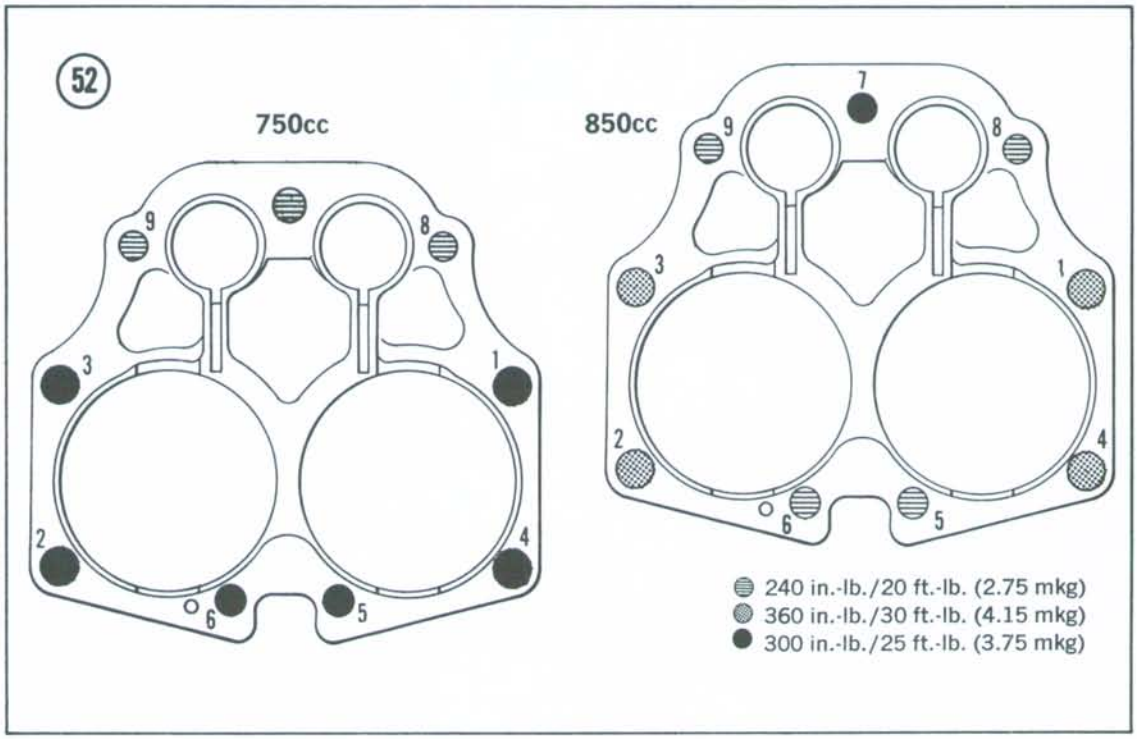
5. Lightly oil the pistons and install the ring compressors (**Figure 51**). The compressors should be snug enough to compress the rings but not so tight that they won't slip easily down and off the rings when the cylinders are installed.

6. Set the cylinder block in place on top of the pistons and push it quickly and evenly down over



the pistons and rings. Remove the ring compressors and the wooden block and lower the cylinder block part way down over the studs so the washers and nuts can be installed.

7. Tighten the nuts in the sequence and to the torque values indicated in **Figure 52**.
8. Install the cylinder head as described earlier.



BREAK-IN

Following cylinder servicing (boring, honing, new rings, etc.) and major lower end work, the engine should be broken in just as though it were new. The performance and service life of the engine depend greatly on a careful and sensible break-in.

For the first 500 miles no more than one-third throttle should be used and speed should be varied as much as possible within the one-third throttle limit. Prolonged, steady running at one speed, no matter how modeate, is to be avoided, as is hard acceleration.

Following the 500-mile service (below) increasingly more throttle can be used but full throttle should not be used until the motorcycle has covered at least 1,000 miles and then it should be limited to short bursts until 1,500 miles have been logged.

The mono-grade oils recommended for break-in and normal use (**Table 2**) provide a superior bedding pattern for rings and cylinders than do multi-grade oils. As a result, piston ring and cylinder bore life are greatly increased. However, the factory has found that complete bedding does not occur until about 1,200 miles and during this period oil consumption will be higher than normal. It is therefore important to frequently check and correct the oil level. At no time, during break-in or later, should the oil level be allowed to drop below the "L" mark on the dipstick; if the oil level is low, the oil will become overheated resulting in insufficient lubrication and increased wear.

Table 2 RECOMMENDED MONO-GRADE BREAK-IN OILS

Castrol GP or HD 40
Kendall Racing 40
Shell—Aero Shell No. 80, 40W
Torco Racing 40
Valvoline Racing 40

500-Mile Service

It is essential that the oil and filter be changed and the sump filter cleaned after the first 500 miles. In addition, it is a good idea to change the oil and filter and clean the sump filter at the completion of break-in (about 1,500 miles) to ensure that all of the particles produced during

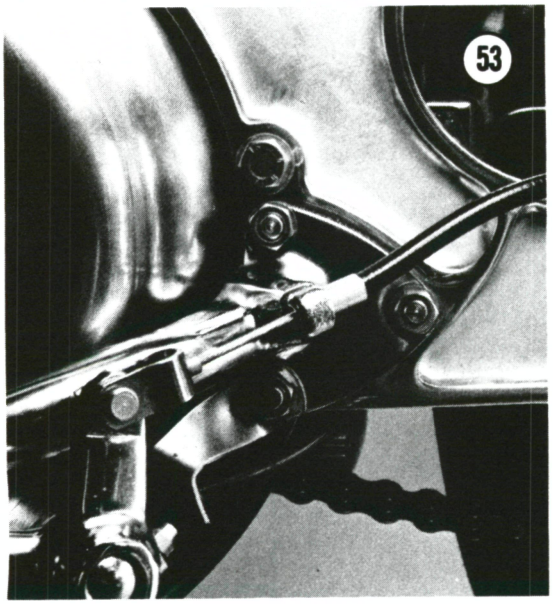
break-in are removed from the lubrication system. The small added expense may be considered a smart investment that will pay off in increased engine life.

PRIMARY DRIVE AND CLUTCH

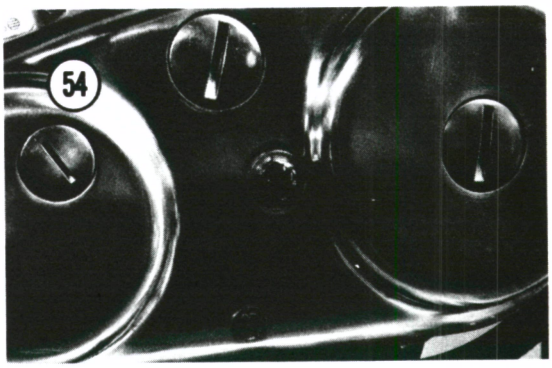
The entire primary drive assembly must be removed from the motorcycle before the crankcase can be removed.

Disassembly

1. On 750 and 850 Mark II models, remove the nuts and washers which hold the left footrest and rear brake pedal assembly in place (**Figure 53**). Pull the unit off the studs and allow it to hang on the brake cable. On Mark III models it is not necessary to remove the gear selector pedal; simply remove the left footrest.

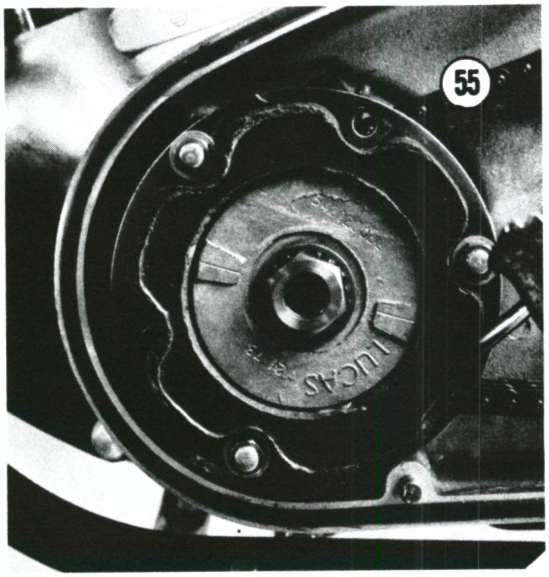


2. Place a drip pan beneath the primary chaincase. The pan should be as long as the chaincase to prevent oil from being spilled when the cover is removed. On 750 and 850 Mark II models, unscrew the nut in the center of the cover (**Figure 54**). On 850 Mark III models, unscrew the 11 screws located around the outer edge of the case. Pull the cover off the alignment dowels and away from the chaincase. Remove any oil that remains in the bottom of the chaincase.



NOTE: *If the entire primary drive assembly is to be removed, proceed in sequence with the next step and remove the alternator rotor and stator. However, if only the clutch is being serviced, there's no need to disturb the alternator. Skip Steps 3 through 7.*

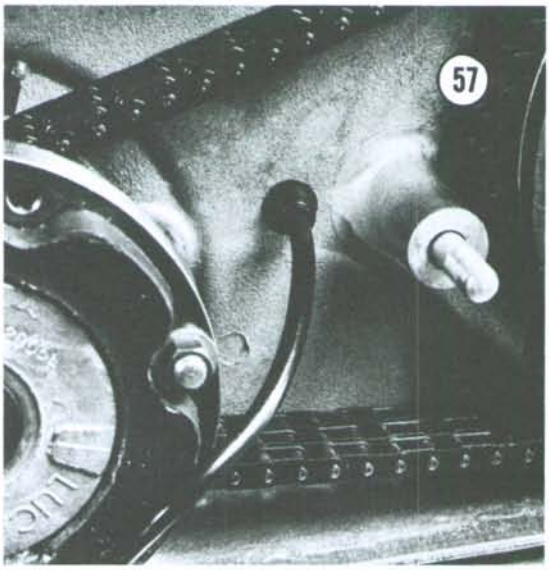
3. On 750 and 850 Mark II models, reinstall the footrest/brake pedal assembly and screw the nuts on finger-tight. On all models, depress the brake pedal to lock the rear wheel and prevent the clutch from turning, unscrew the rotor nut (**Figure 55**), and remove the large washer.



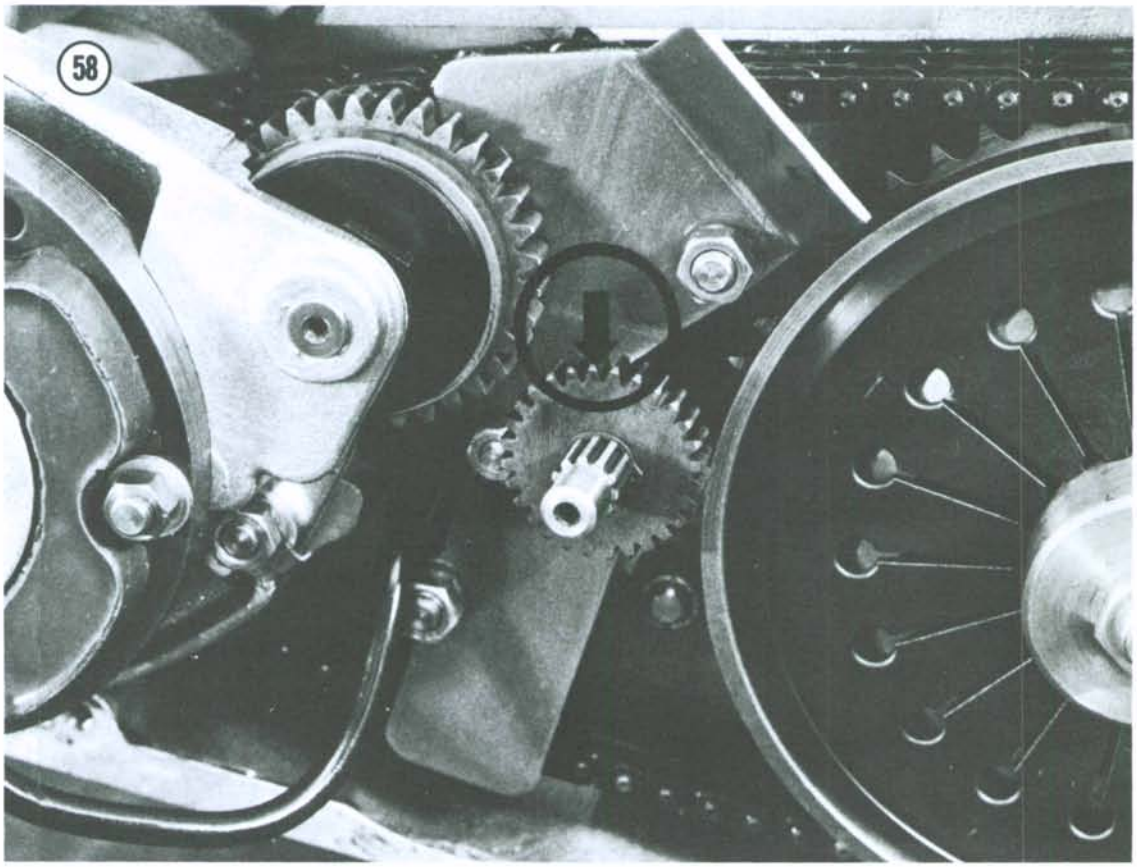
4. Unplug the stator leads (**Figure 56**) and carefully pull the leads and the rubber grommet out of the primary chaincase (**Figure 57**). On 850 Mark III models, remove the shifter cross shaft (**Figure 58**) by pulling it straight out to the left.

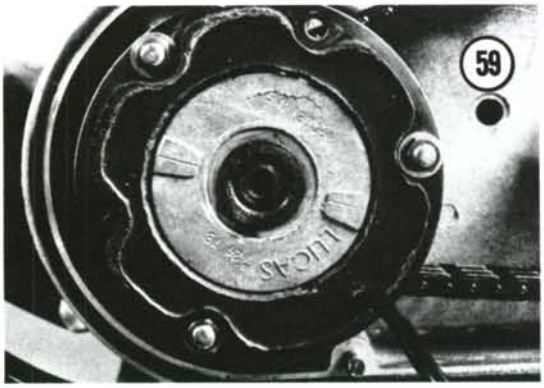
NOTE: *For most operations the stator lead need not be removed from the case. Make sure, however, that the stator is not allowed to hang from the electrical lead.*

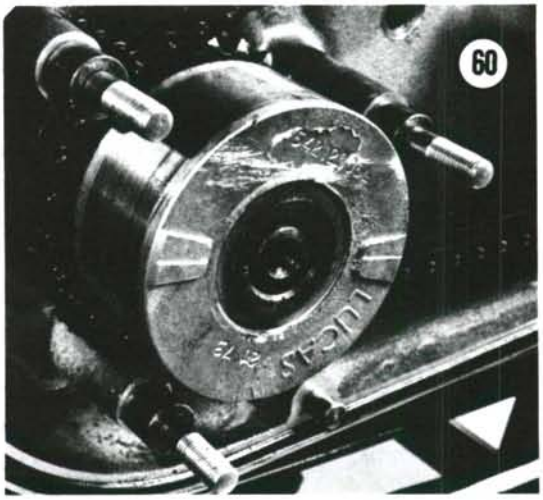
5. Unscrew the stator mounting nuts, remove the washers, and pull the stator off the studs (**Figure 59**). On 750 and 850 Mark II models, remove the spacers from the studs (**Figure 60**).

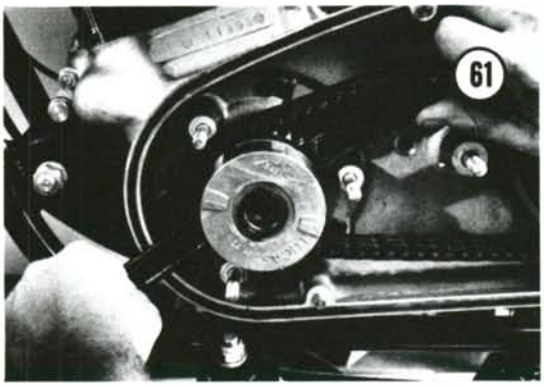


6. Pull the rotor off the crankshaft. If necessary, the rotor may be broken loose from the shaft by applying pressure with 2 tire irons (**Figure 61**). Remove the key, spacer, and shims from the

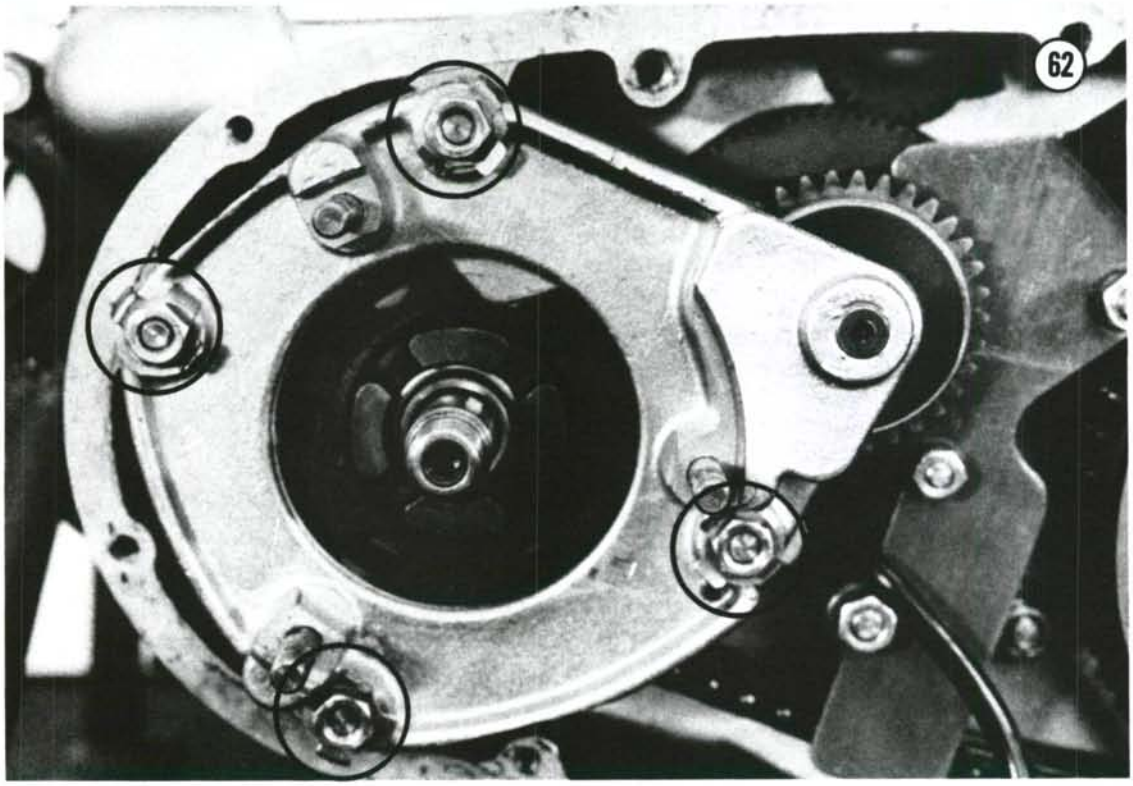


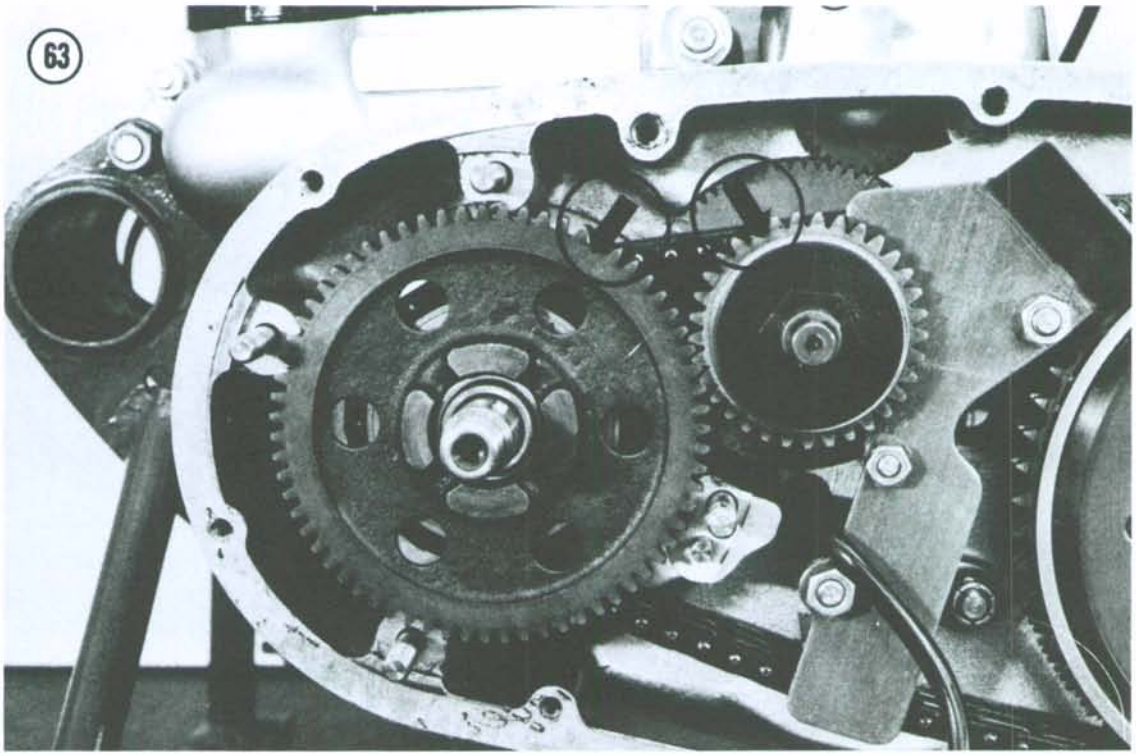






shaft. Set the rotor into the stator, wrap the assembly in clean newspaper and set it aside. On 850 Mark III models, straighten the lock tabs on the nuts which attach the inner frame, unscrew the nuts, and pull the frame off the studs (**Figure 62**). Remove the inner washer, bushing, starter gear, and starter intermediate drive assembly (**Figure 63**). Remove the sprag

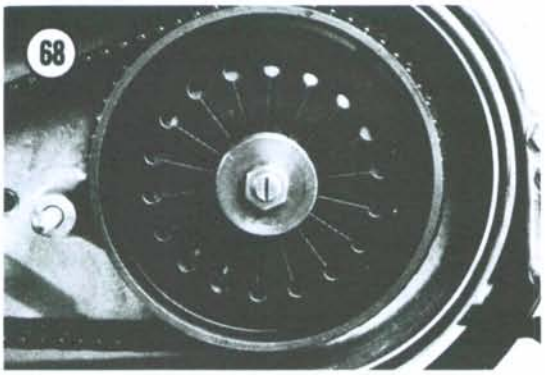


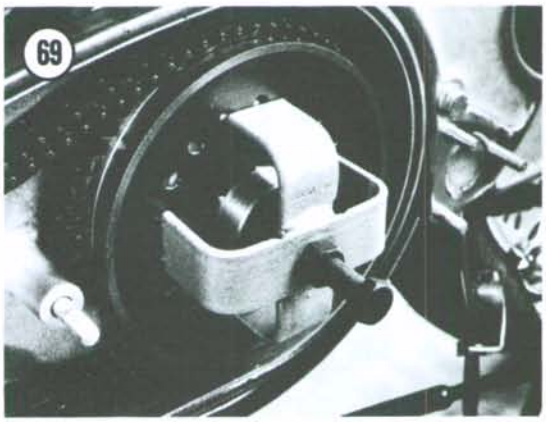


clutch and bushing (**Figure 64**) and inner race (**Figure 65**) from the crankshaft. Unscrew the nuts from the tensioner cover plate (**Figure 66**) and remove it. Note the location of the smaller nut. Hold the top and bottom tensioner pads in place to prevent them from jumping out of the tensioner body and pull the tensioner off the studs (**Figure 67**).

7. Unscrew the clutch adjuster locknut and the adjuster screw from the center of the diaphragm (**Figure 68**).

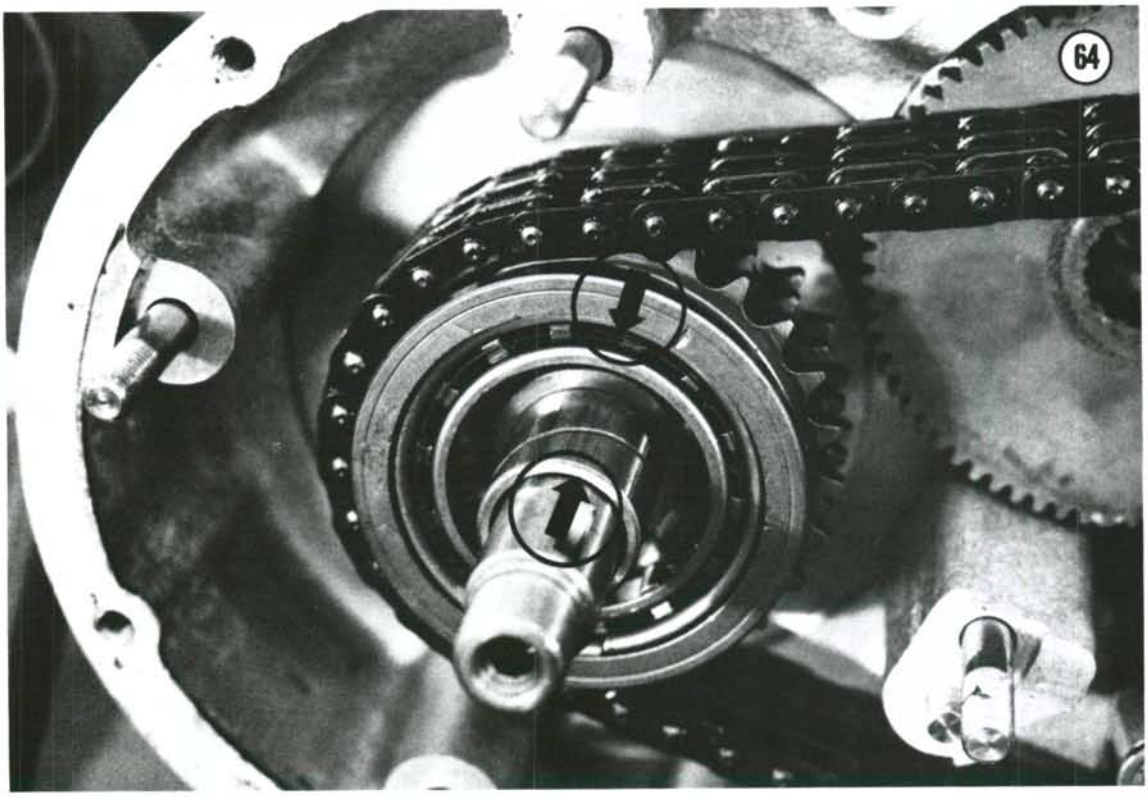
8. Install the diaphragm compressor (Norton tool No. 060999) on the diaphragm (**Figure 69**).





The tool bolt must be threaded into the diaphragm at least 6 full turns. Hold the compressor arms to prevent them from turning and turn the compressor nut clockwise until the spring rotates freely in the clutch housing.

9. Use the tip of a small screwdriver to lift the end of the diaphragm retaining clip out of its groove (**Figure 70**) and peel it out of the groove all around the circumference. Remove the tool and the diaphragm together. If the diaphragm is in good condition and is to be reused, it's not necessary to remove the tool. If the tool must be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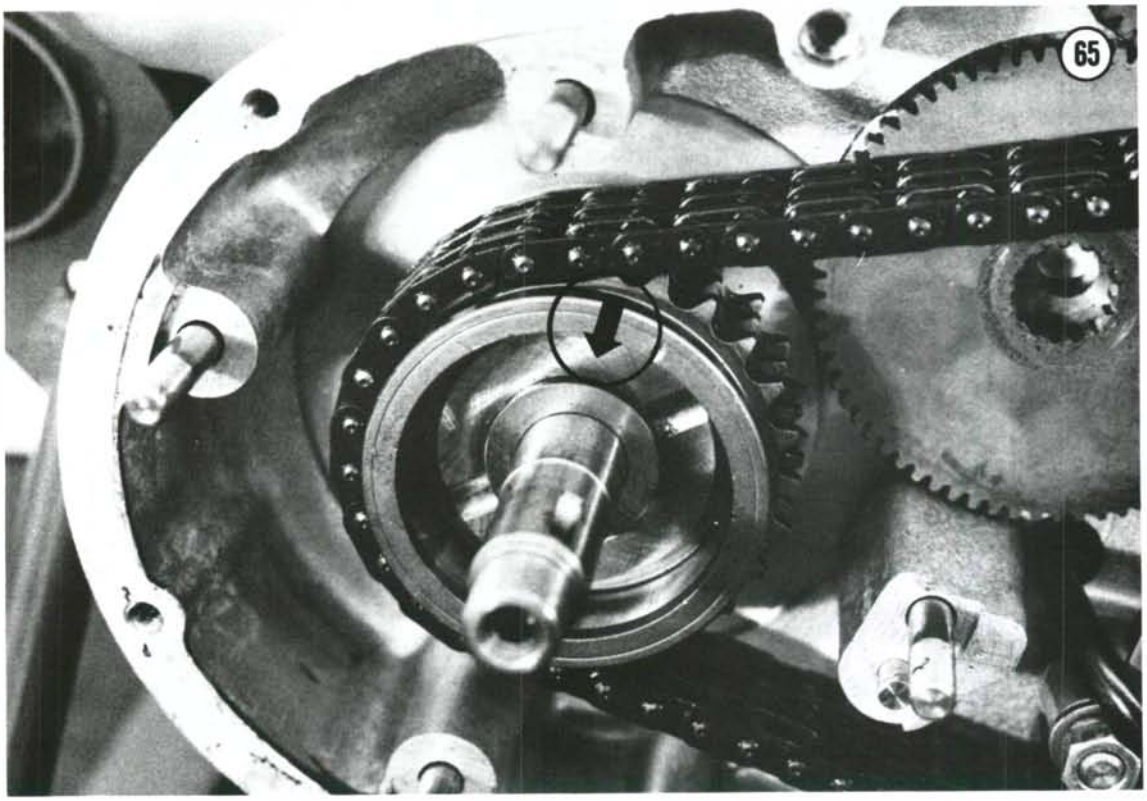
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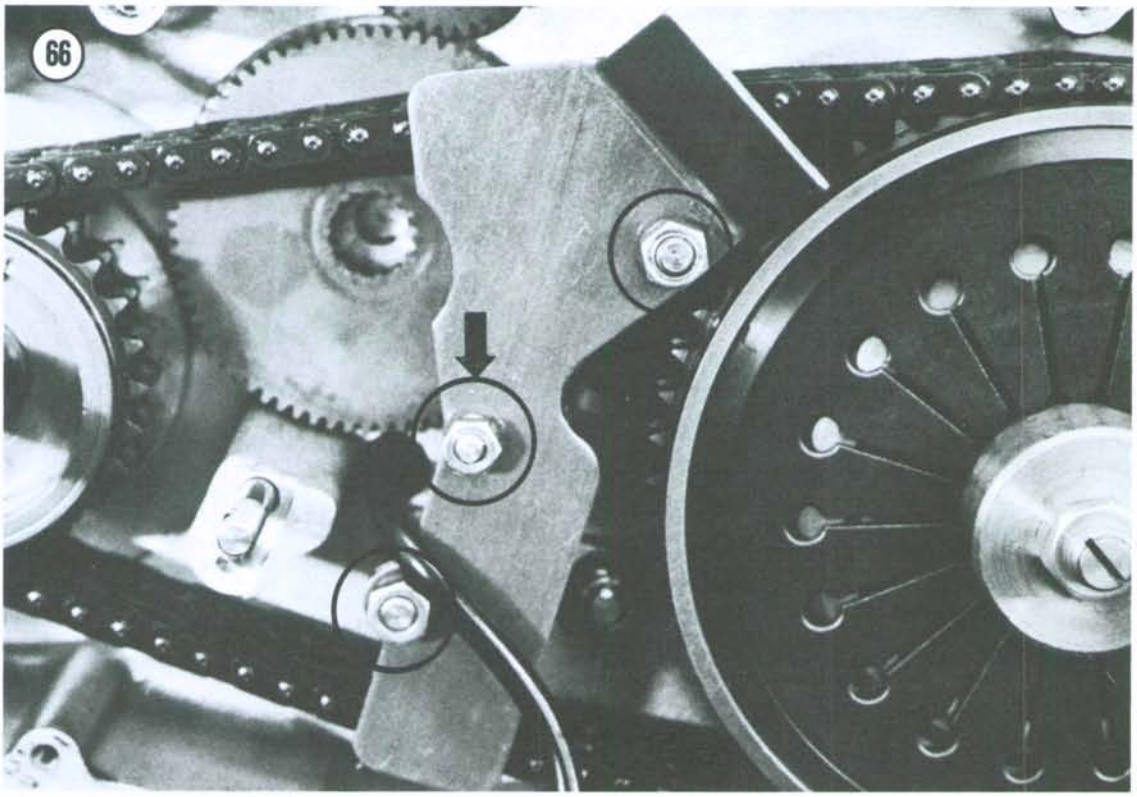
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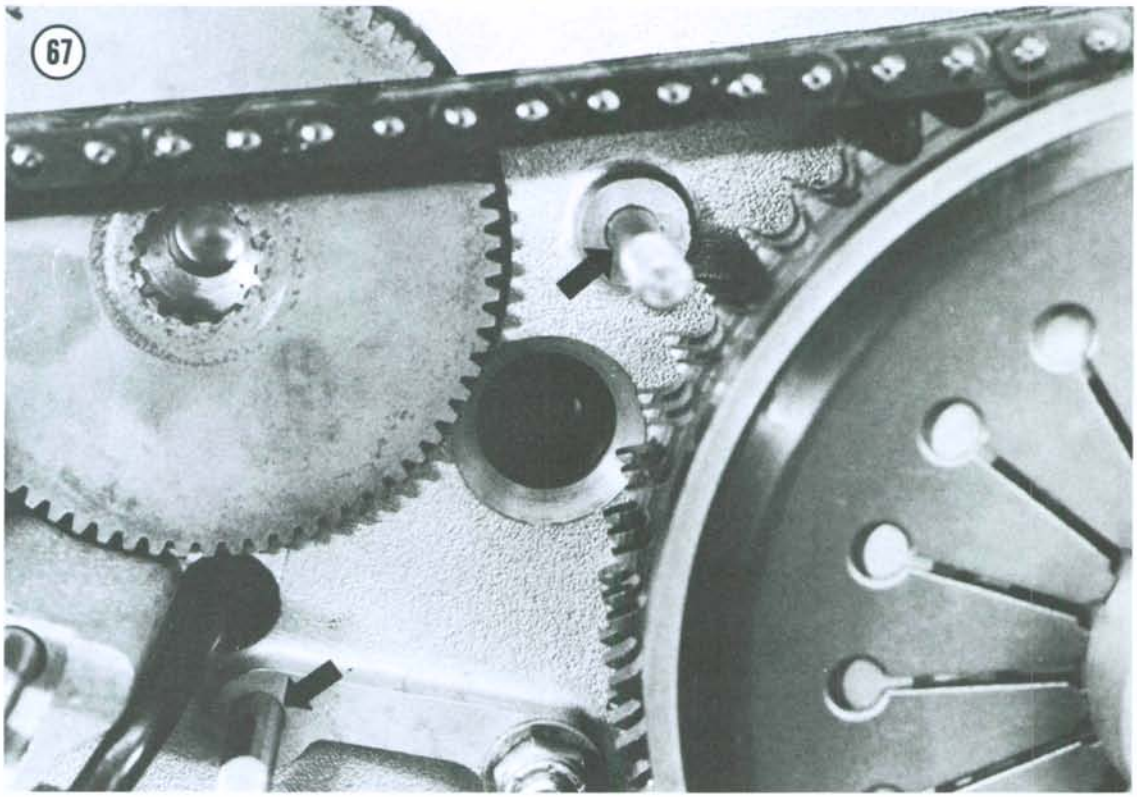
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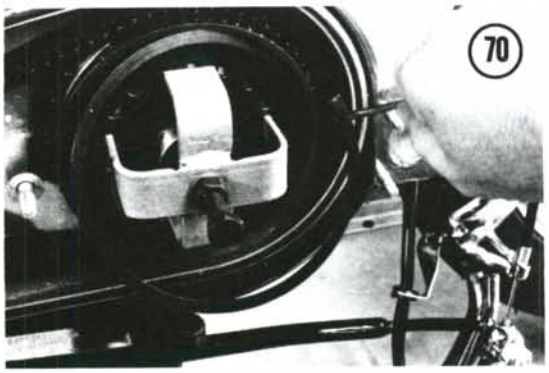


removed, however, hold the bolt with one wrench and turn the compressor nut counterclockwise until the diaphragm is completely relaxed before unscrewing the bolt.

CAUTION

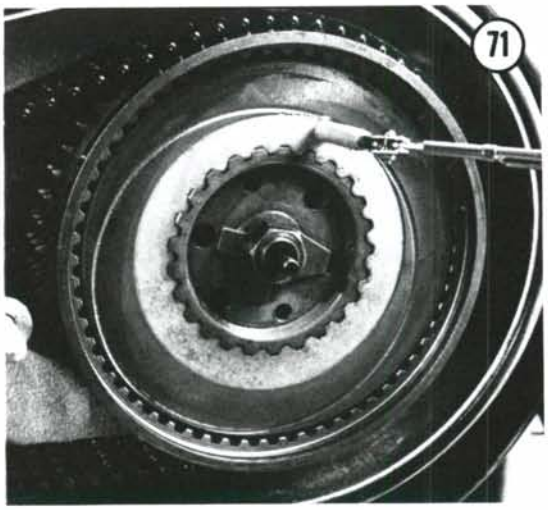
Any attempt to remove the diaphragm circlip without use of the compressor tool would be extremely hazardous and at the very least could cause severe damage to the clip and the clutch body. Installation of the diaphragm and clip without the use of the compressor is virtually impossible. If the tool cannot be purchased or borrowed, the job should be entrusted to a Norton service shop.

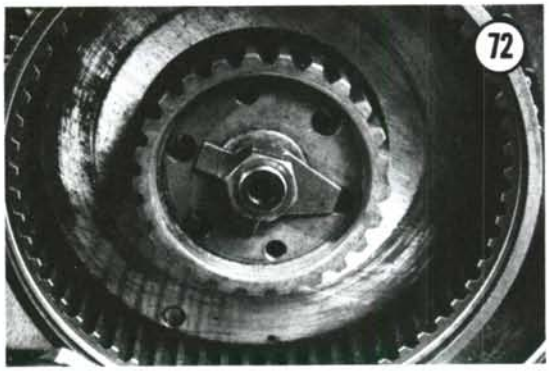
10. If only the clutch is being serviced, remove the plates one at a time using a small magnet to draw them out of the body and off the hub (**Figure 71**). Then refer to the inspection and assembly sections which follow. If the entire primary drive is to be removed, however, leave the plates installed and proceed with the steps which follow.

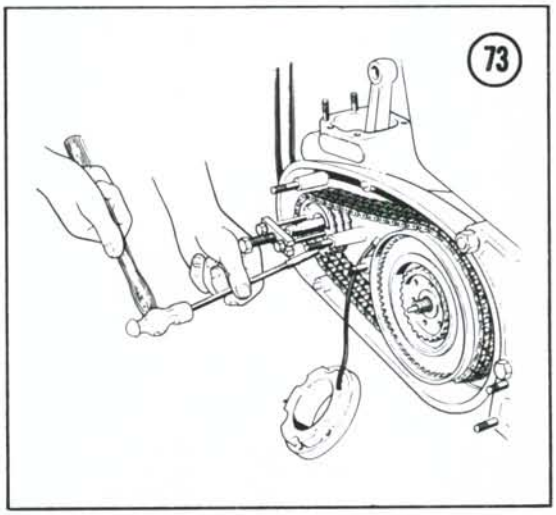
11. On 750 and 850 Mark II models, with the footrest/brake pedal assembly installed as described above, depress the brake pedal (all models) to lock the rear wheel and prevent the clutch hub from turning. Straighten the lockwasher tabs and unscrew and remove the nut, washer, and tabwasher (**Figure 72**).

12. Install the sprocket puller (Norton tool No. 064297) on the engine sprocket (**Figure 73**). Screw the puller bolts in at least 8-10 turns and then turn in the center bolt tightly against the end of the crankshaft. Rap the sprocket sharply with a steel drift and hammer to jar the sprocket loose from the taper on the crankshaft. Remove the puller from the sprocket.

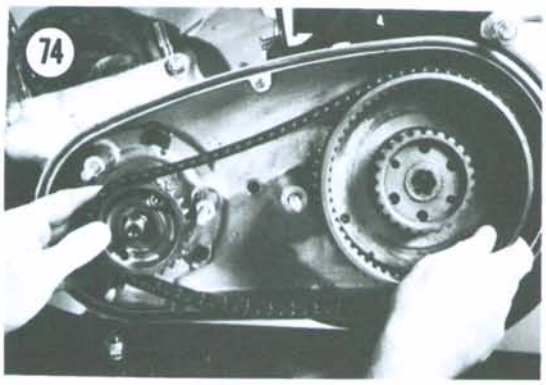
13. On 750 and 850 Mark II models, once again remove the footrest/brake pedal assembly and



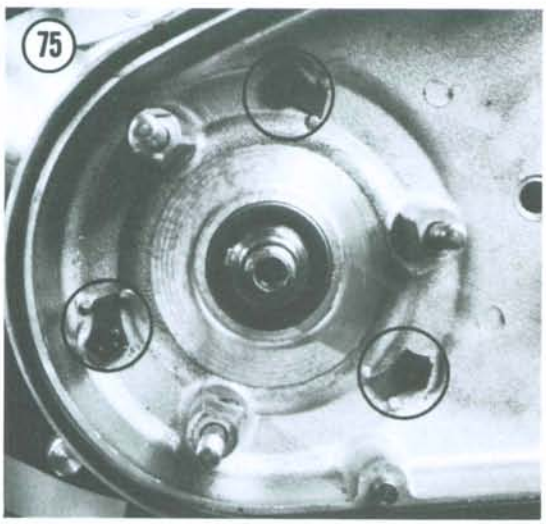


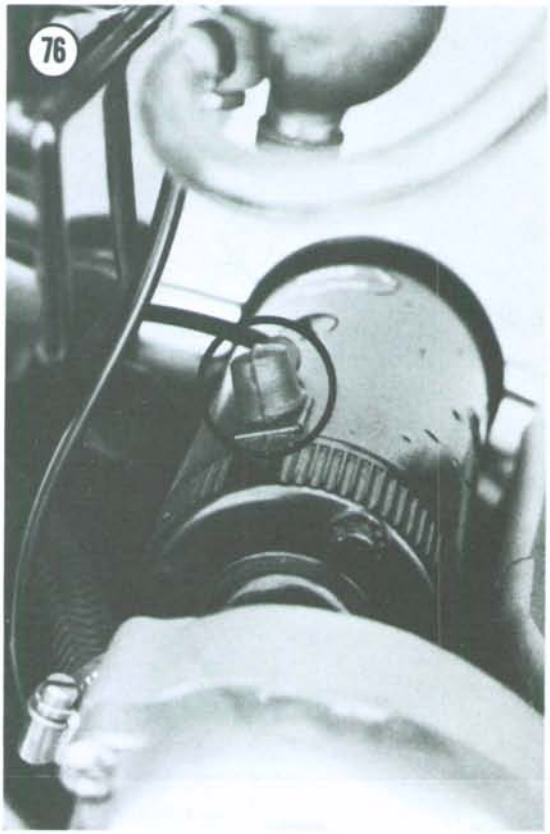


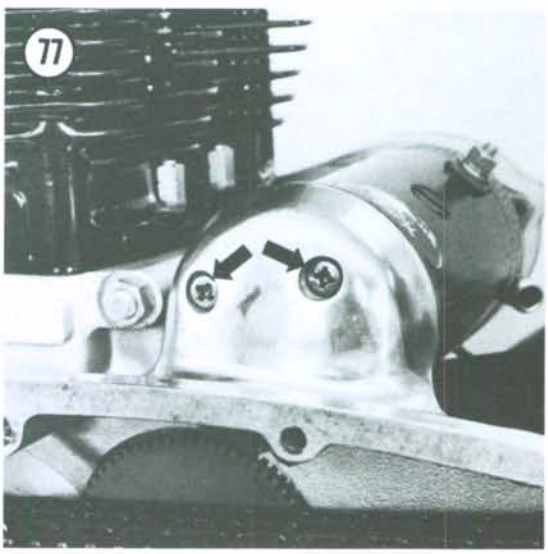
pull off the engine sprocket, chain, and clutch together (**Figure 74**). Note the location and arrangement of the spacer and shims on the main transmission shaft and remove them and set them out of the way. These pieces locate the clutch sprocket in alignment with the engine sprocket and should not be substituted or eliminated during assembly.



14. On 750 and 850 Mark II models, straighten the tab washers on the chaincase mounting bolts (**Figure 75**), unscrew them, and pull the chaincase away from the engine and transmission. Screw the bottom 2 bolts back into the crankcase to prevent oil from dripping out. On 850 Mark III models, disconnect the electrical lead to the starter (**Figure 76**), unscrew the starter mounting screws (**Figure 77**), and pull the starter out of the primary case. Unscrew the nut from the center of the inside case half and pull the case off the long crankcase studs.



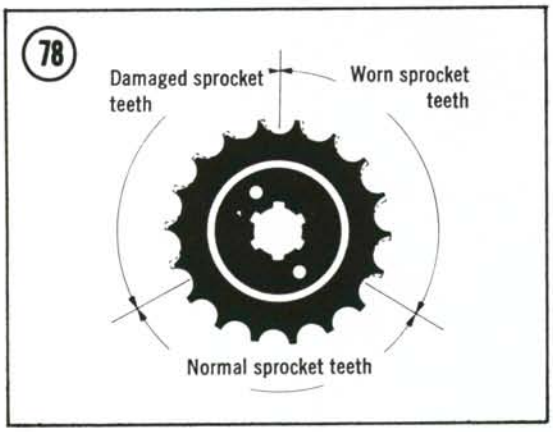


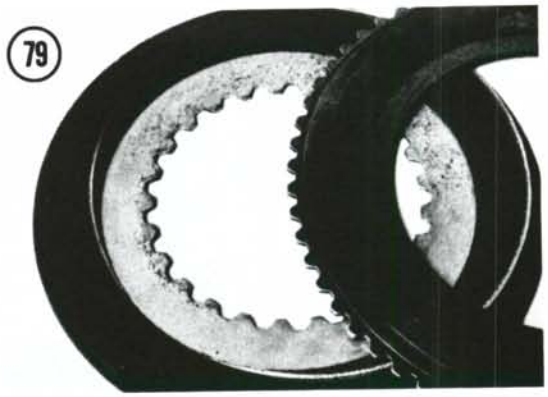


Inspection

1. Inspect the O-rings, rubber cover seal, and alternator cable grommet for wear or deterioration and replace any of these pieces that are defective.

2. Inspect the rollers of the primary chain and the sprocket teeth for wear and damage. Normally, these components will last for many thousands of miles; however, incorrect chain tension or extremely dirty oil can cause undercutting of the sprocket teeth (**Figure 78**) and accelerated wear on the chain rollers.





of the sprockets should be checked and corrected if necessary by adding or removing shims from the transmission main shaft, behind the clutch wheel. The outer row of teeth on each sprocket must be the same distance from the mating edge of the primary chaincase (**Figure 80**).

3. After thoroughly washing and drying the clutch plates, inspect the splines for wear (**Figure 79**) and check the contact surfaces of all the plates for signs of burning, galling, and deep grooving. All questionable plates should be replaced.

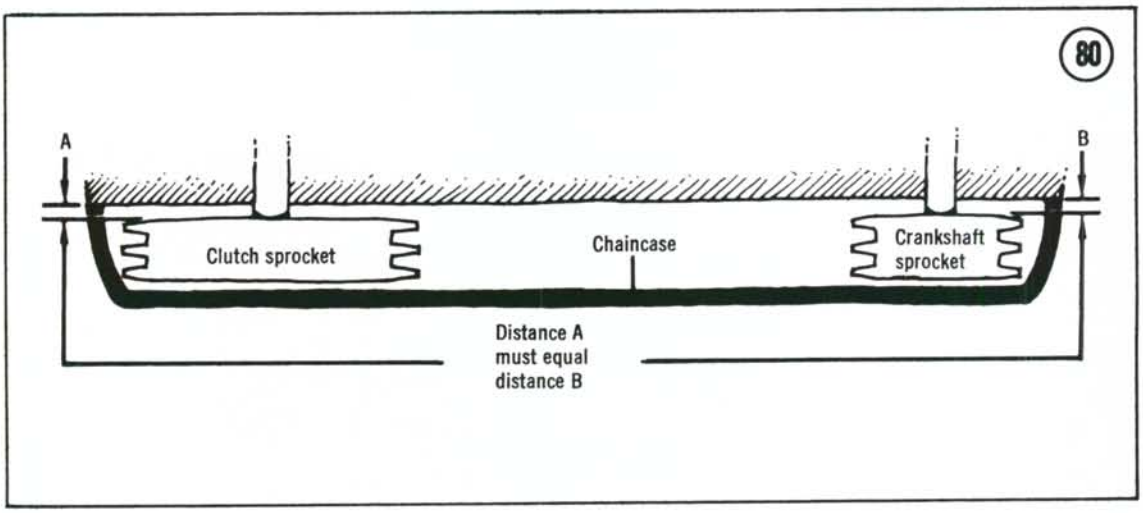
4. Check the splines on the clutch hub and in the drum for signs of wear and damage and replace as necessary.

NOTE: *If one or both of the primary sprockets are replaced, the alignment*

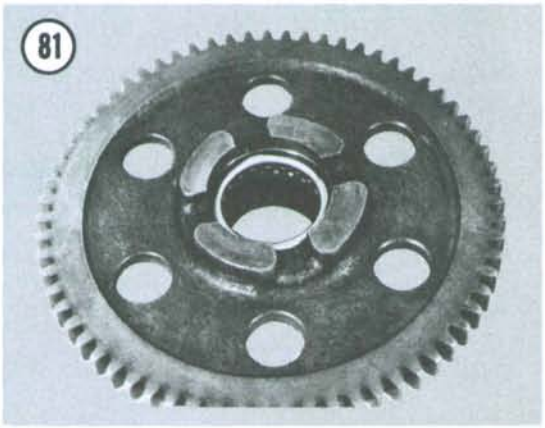
5. Inspect the chaincase and outer cover for cracks and fractures and for damage to the sealing surfaces. Repairs to either of these castings should be attempted only by a specialist experienced in the repair of non-ferrous precision castings.

The following inspection points apply only to the 850 Mark III:

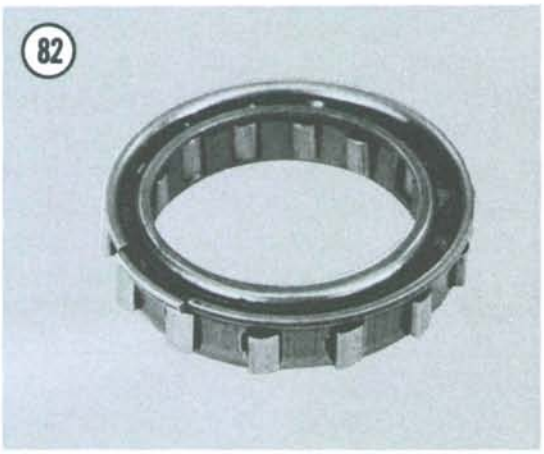
6. Inspect the teeth of the starter gears for chipping and excessive wear. Minor burnishing of contact areas is acceptable but deep scarring or



chipped teeth are reason for replacement. Inspect the rollers and cage in the crankshaft starter gear for wear and damage and replace the bearing assembly if necessary (**Figure 81**).

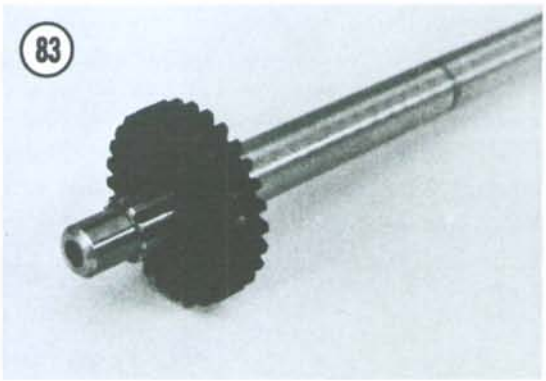


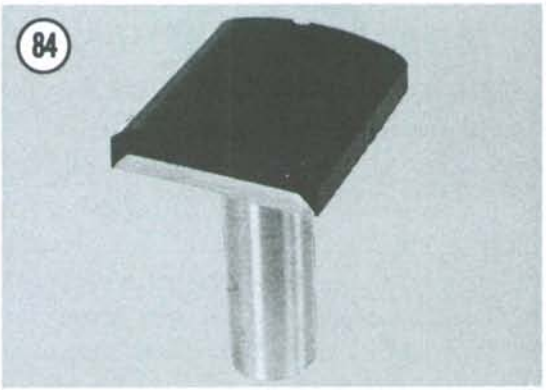
7. Check the sprag clutch (**Figure 82**) for wear and damage. Counter-rotate the inner and outer cages. The rollers should extend and retract with no effort or binding.



8. Inspect the gear selector cross-over assembly for damaged teeth and splines (**Figure 83**). If the gear teeth are damaged, resulting in shifting difficulties, the gearset can be rotated 180° to eliminate the damaged teeth from the mesh.

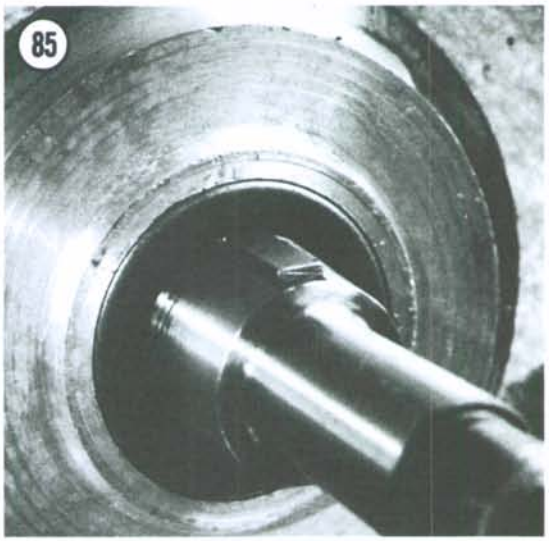
9. Check the rubber contact shoes of the chain tensioner (**Figure 84**) for deeply worn grooves. These pieces will wear normally and they should be replaced before the primary chain wears through the rubber and comes in contact with the metal.



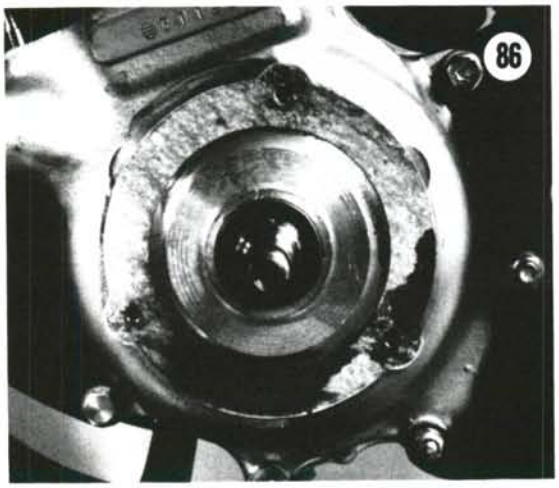


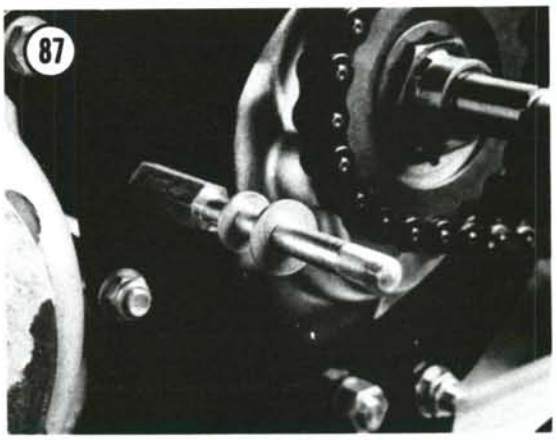
Assembly

1. Install the engine sprocket key in its recess in the crankshaft (**Figure 85**). Make sure it seats completely and that there is no roughness along the flat which would prevent it from entering the keyway in the sprocket.



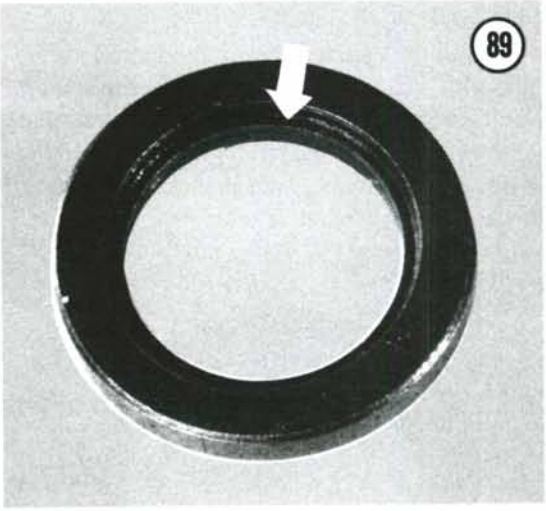
2. Lightly coat both sides of the crankcase/chaincase gasket with Loctite "Plastic Gasket" or gasket cement and set it in place on the crankcase (**Figure 86**). Place the flat washer and shim (if one was removed) on the end of the chaincase center stud (**Figure 87**).

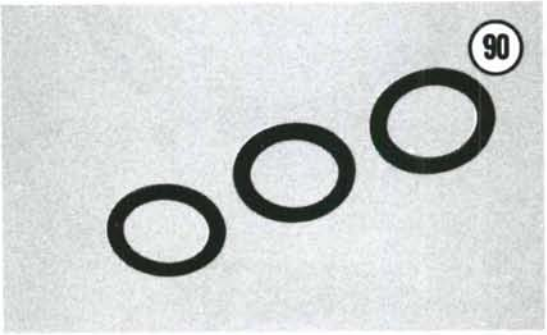


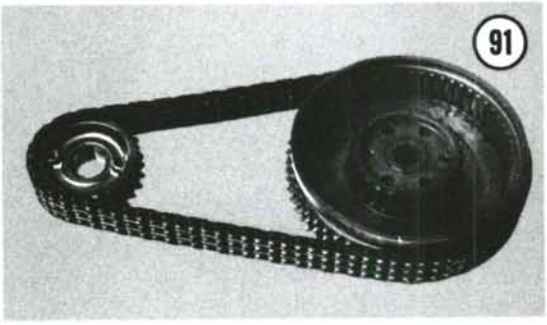


3. Set the chaincase in position, making sure the seal in the case does not snag on the transmission main shaft (**Figure 88**). On 750 and 850 Mark II models, install the 3 bolts with tab washers which hold the chaincase to the crankcase, tighten them securely, and bend the tabs over to lock them in place. On 850 Mark III models, screw in and tighten the chaincase center nut.

4. Install the clutch spacer (recess toward the transmission—**Figure 89**) on the main shaft, followed by the shim or shims (**Figure 90**). Assemble the sprocket and the chain (**Figure 91**). Set



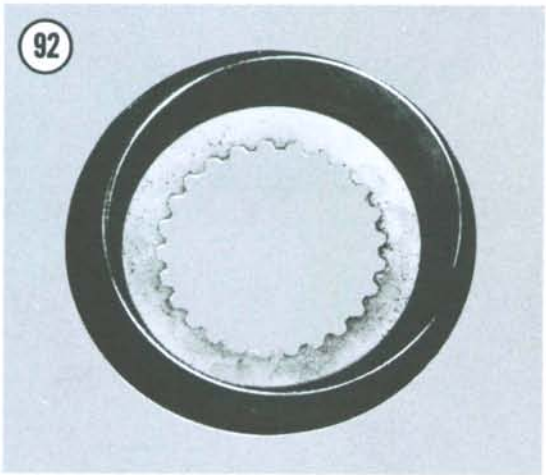


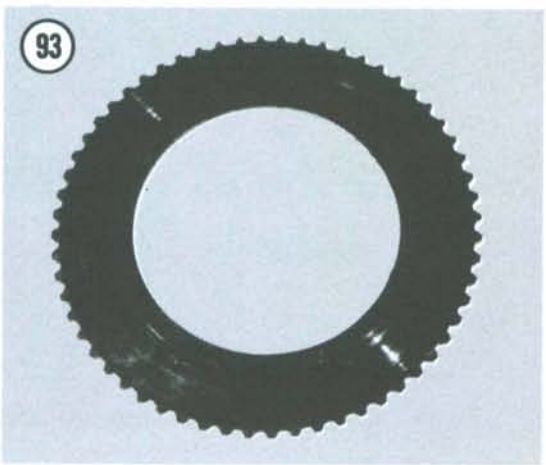


them in position on their shaft and rotate them to line up the keyway in the crankshaft sprocket with the key in the shaft and push the sprockets and chain all the way on together.

5. Line up the splines in the clutch center hub with the splines on the transmission main shaft and push it on. Install the washer and nut. If the washer is a tab type, engage 2 of the tabs with the holes in the hub. Install the footrest/brake lever assembly as before, depress the brake pedal, and tighten the center nut to 70 ft.-lb. (9.68 mkg). Bend the tab washer over to engage 2 flats on the nut.

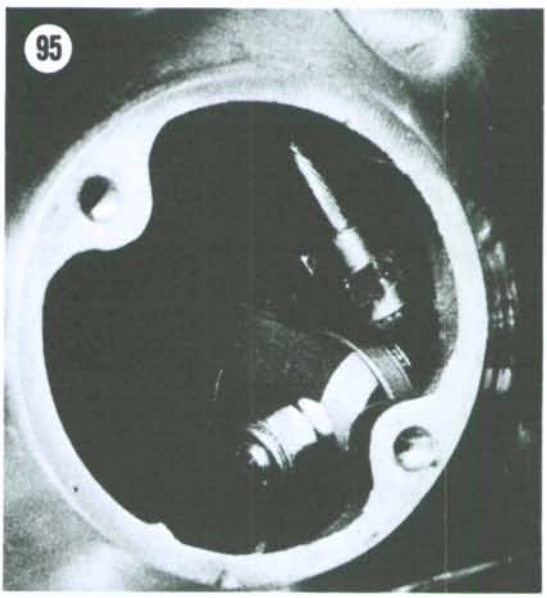
6. Install the clutch plates in the carrier, beginning with a friction plate (splines on inner diameter — **Figure 92**), followed by a steel plate (splines on outer diameter—**Figure 93**), alternating plates until all 9 are in place. Then install the iron pressure plate (**Figure 94**).



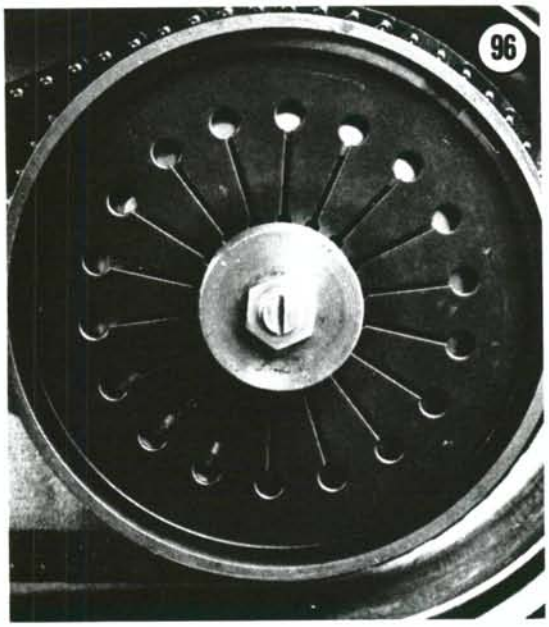


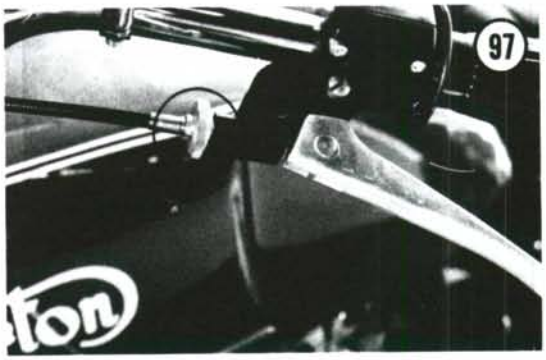
7. Reinstall the assembled compressor tool and diaphragm as before, making sure the compressor nut is backed off to permit the plate to relax until the center bolt has been threaded into the diaphragm at least 6 full turns. Then turn the compressor nut clockwise until the diaphragm is flat and set the diaphragm into the clutch as far as it will go. Start one end of the diaphragm clip into the groove in the clutch body and press it into place until it is fully seated all the way around the clutch. Turn the compressor nut counterclockwise until the diaphragm is relaxed and unscrew the tool's center bolt.

8. Remove the inspection cover from the right side of the transmission and check to see that the clutch operating lever is correctly positioned (**Figure 95**). If it is not, pull it up into place so the recess in the lever engages the roller.

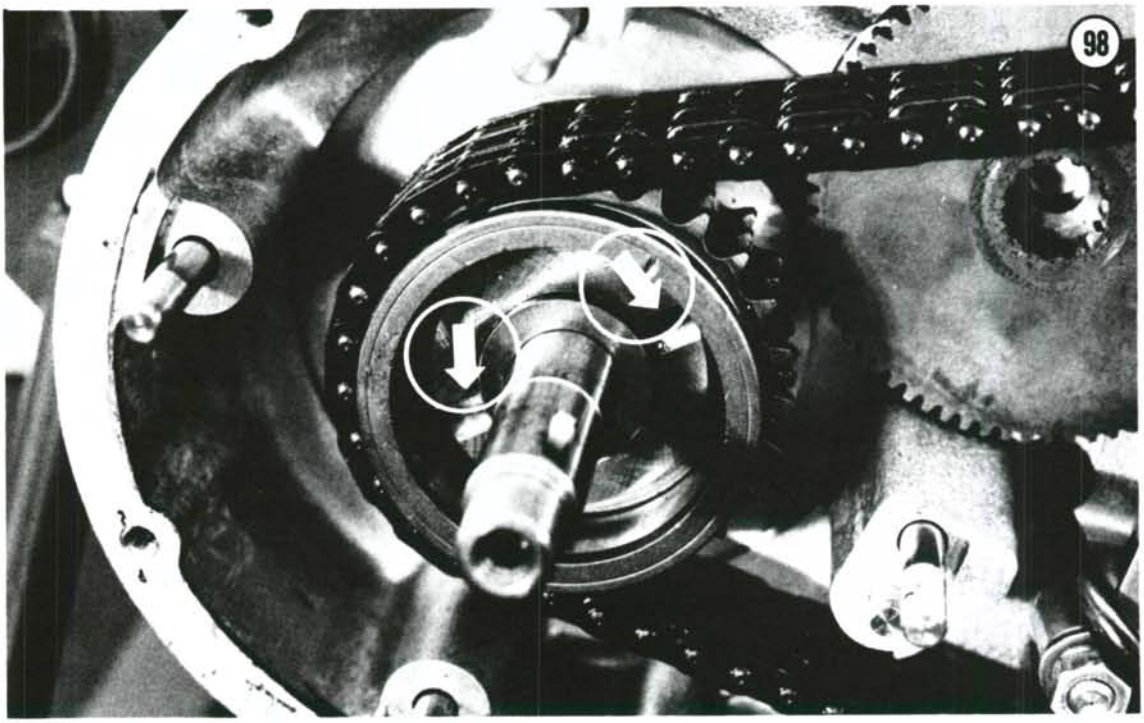


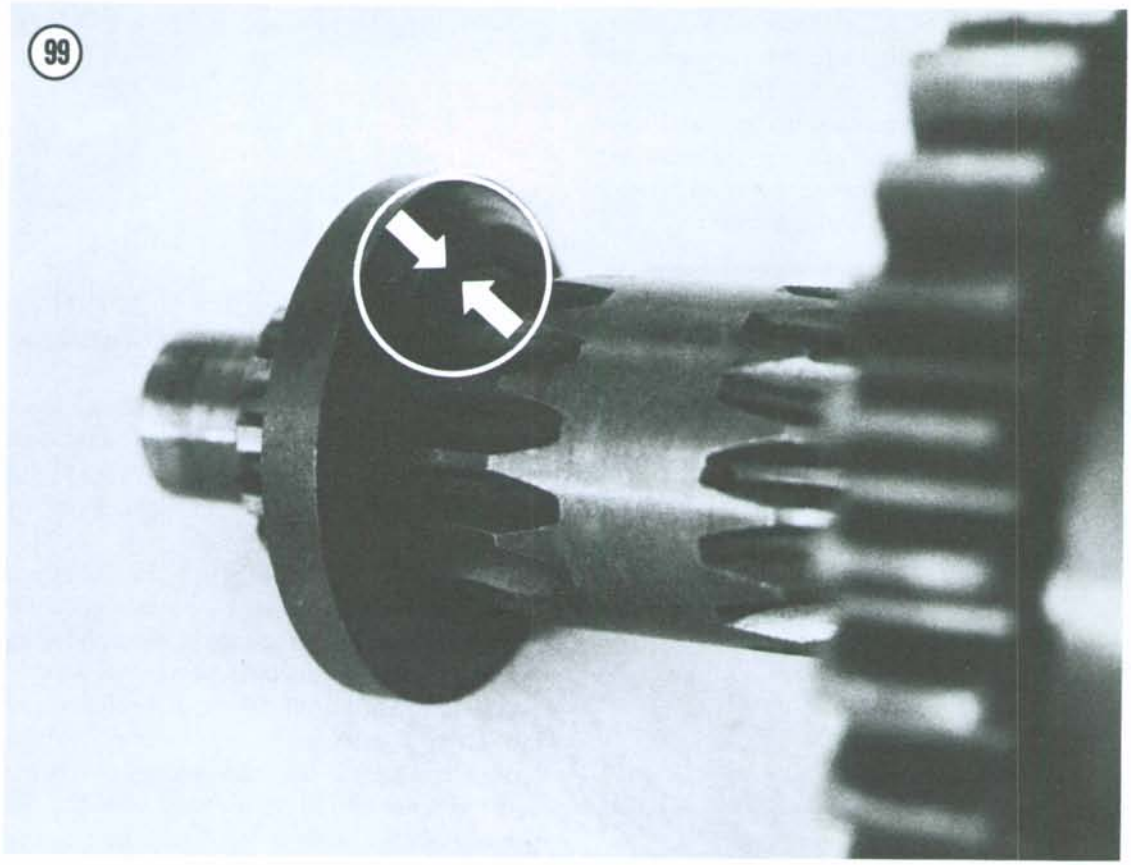
9. Install the clutch adjuster screw and locknut (**Figure 96**). Turn the hand control cable adjuster all the way in (**Figure 97**) and turn the adjuster screw in until the diaphragm just begins to lift or move outward. Then turn the screw out one full turn, hold it to prevent it from turning further, and tighten the locknut securely.





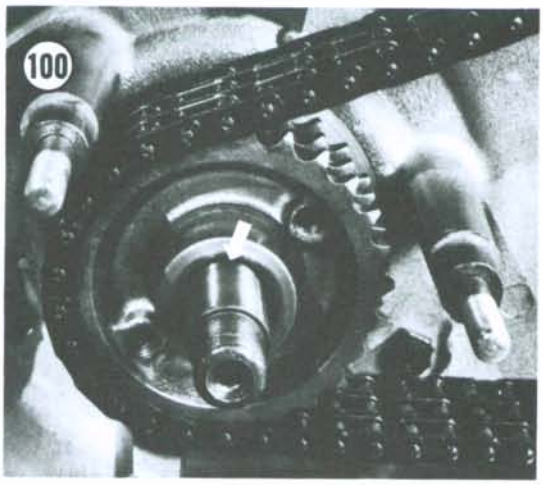
10. On 850 Mark III models, install the inner race for the sprag clutch in the crankshaft sprocket with the notched side of the race facing out (**Figure 98**). Set the sprag clutch in the sprocket with the flanged side facing *in*. Tilt the clutch outward from the top and introduce the bottom edge first. Install the bushing, starter gear (with the castellated side of the hub facing out), and the washer. Refer to the disassembly instructions and install the chain tensioner and the starter intermediate drive assembly. Make certain the recess in the thrust washer covers the circlip (**Figure 99**). Move the large idler gear up into engagement with the small idler gear before attempting to fit the intermediate drive assembly.



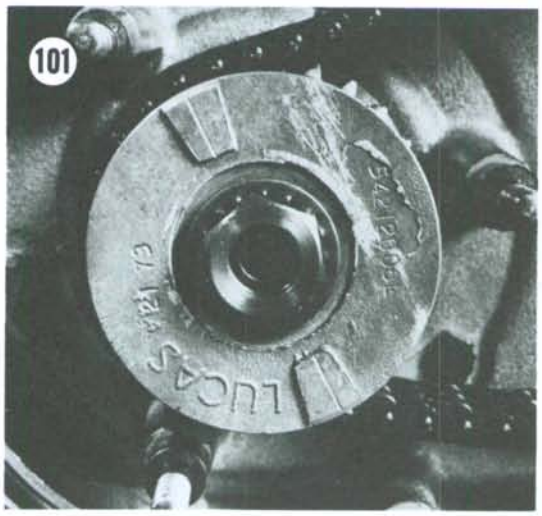


Install the inner frame on the studs, screw on and tighten the nuts, and bend the tab washers over against one flat on each nut.

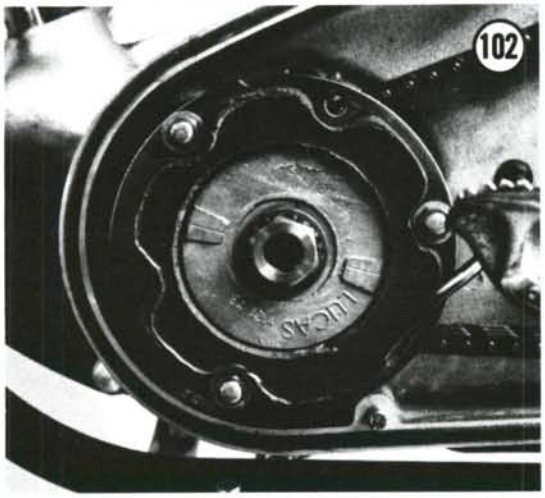
11. On 750 and 850 Mark II models, install the shims and spacer (recess outward) on the crankshaft (**Figure 100**) and set the rotor key in its recess.



12. Inspect the rotor for any particles it may have attracted and clean it if necessary. Install it on the shaft, lined up with the key and with the timing marks facing out (**Figure 101**). Install the washer and nut, apply the rear brake, and tighten the nut to 70-80 ft.-lb. (9.68-11.06 mkg).

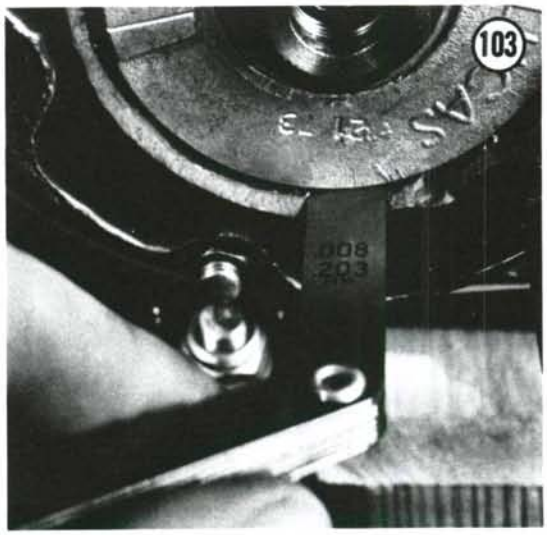


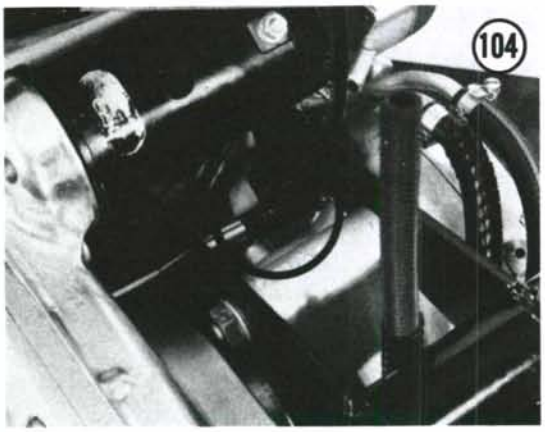
13. Thread the stator leads through the chaincase and press the grommet into the hole, making sure it is fully seated. Set the stator spacers on their studs and install the stator with the lead on the outside positioned at about 5 o'clock (**Figure 102**). Install the washers and nuts and tighten them to 15 ft.-lb. (2.07 mkg). On 750 and 850 Mark II models, check the air gap between the rotor and stator with a flat feeler gauge (**Figure 103**). Ideally, it should be even all the way around but not less than 0.008-0.010 in. (0.203-0.254mm) at any one point. If the gap is less than this, it may be possible to realign the stator by loosening the nuts, pushing the stator in the direction of the smallest gap, and retightening the nuts to the torque specified. If this does not work, one or more of the studs is probably bent. It may then be possible to correct the gap by very carefully realigning the studs. Should this fail, the studs should be replaced with new ones that are known to be straight. When the air gap is correct, reconnect the stator leads.



On 850 Mark III models, set the stator in place and push it on evenly so the stator body fits inside the machined stud bosses. Install the washers and nuts and tighten them progressively in a criss-cross pattern to draw the stator on evenly all the way around. The air gap on Mark III models is self-adjusting.

Install the gear selector cross-over shaft making sure its splines correctly engage the splines in the connector sleeve (**Figure 104**). Install the

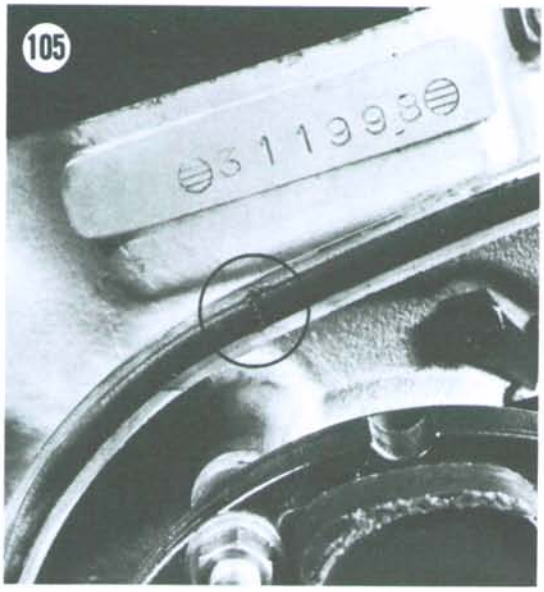




starter with the electrical post facing up and screw in and tighten the mounting screws. Reconnect the electrical lead.

14. On 750 and 850 Mark II models, install the rubber sealing ring in the groove in the inner chaincase with the joint seal at the top (**Figure 105**). Set the outer cover in place, carefully aligning it with the dowels. Push the cover on evenly and install the mounting bolt and washer. Install the level plug, timing inspection plug, and clutch adjuster plug, with O-rings.

On 850 Mark III models, lightly coat both surfaces of the gasket with gasket cement and set the gasket in place over the hollow alignment dowels, Hold the cover up to the primary case and position the gear selector pedal in its operating position and push the cover on, moving the pedal slightly if necessary so that its gear can engage the gear on the cross-over shaft. Screw in



and tighten the case screws in a criss-cross pattern. Note the location of the long screw which passes through the case and screws into the starter motor (**Figure 106**).

15. For Mark II models, refer to Chapter Two, *Primary Chain Adjustment*, and adjust the primary chain so that there is total up-and-down movement of the chain of ⅜ in. (9.5mm) at the tightest point.

16. Pour 7 ounces (200cc) of an oil recommended in Chapter Two into the chaincase and install the fill plug with its O-ring.

17. Install the footrest/brake pedal assembly.

ENGINE LOWER END

Service to the engine lower end requires that the crankcase assembly be removed from the motorcycle. The complete primary drive assembly must first be removed and it's advisable that the head, cylinders, and pistons be removed also; they'll have to come off anyway and the task of removing them with the engine installed in the frame is considerably easier. In addition, the decrease in engine weight at the point at which the crankcase is lifted from the frame will be greatly appreciated.

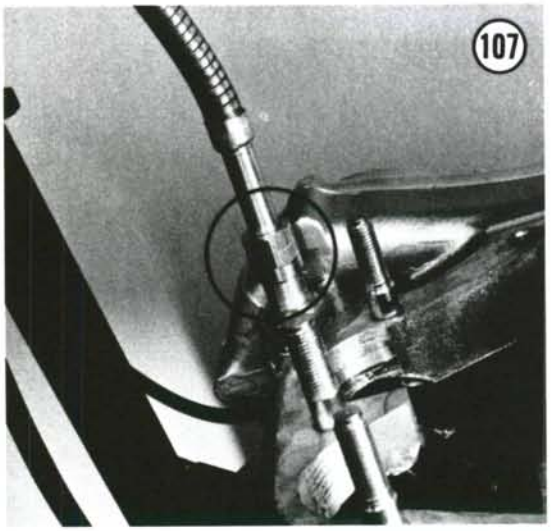
Because of differences in work habits and availability or absence of certain tools such as a suitable large bench vise, or an elevated workstand, no hard-and-fast rule is set down here for the point at which the crankcase assembly should be removed from the motorcycle. It may be removed at Step 8 as described, or you may elect to wait until Step 13 has been completed.

The lower end service procedure is presented as a complete rebuild. To service and repair major components related to the lower end but not requiring its removal and disassembly, disassemble the engine up to the point at which the affected part can be reached and then reassemble from that point on beginning with the appropriate step in the *Assembly* section; just be sure that a subsequent component has not been affected by the failure or deterioration of a component located earlier in the disassembly procedure.

Removal and Disassembly

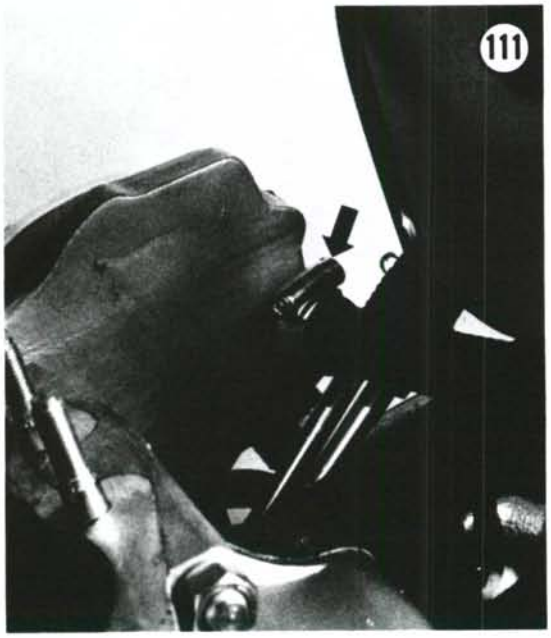
1. Refer to earlier sections in this chapter and remove the seat, fuel tank, coil assembly, exhaust system, cylinder head, cylinders, pistons, and primary drive assembly.

2. Unscrew the tachometer cable collar (**Figure 107**) and pull the cable out of the crankcase. On 750 and 850 Mark II models, unscrew the gear indicator bolt (**Figure 108**) and remove the indicator. Loosen the bolt in the gear selector pedal (**Figure 109**) and pull the pedal off the shaft. On all models, unscrew the rocker feed pipe bolt (**Figure 110**) and remove the washers from each side of the union.



3. Place a drip pan beneath the engine. On 850 models, loosen the clamp on the crankcase breather hose (**Figure 111**) and pull the hose off the nipple and direct it so that residual oil will drain into the pan. On 750 models, remove the 2 bolts which hold the breather to the crankcase, pull the breather away and remove the gasket (**Figure 112**). Unscrew the bolt from the oil pipe junction (**Figure 113**) and remove it and the gasket.

4. Loosen the crankcase filter located beneath the engine (**Figure 114**) on 850 models, and



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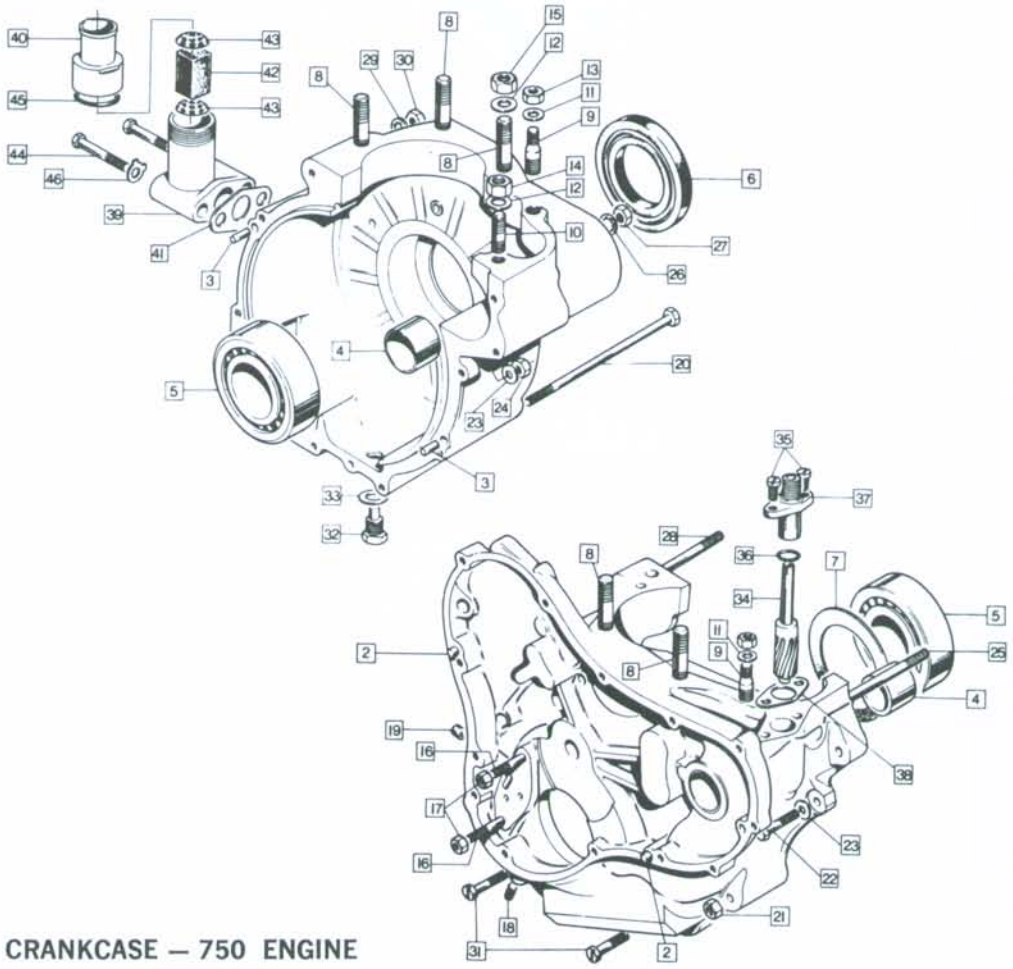
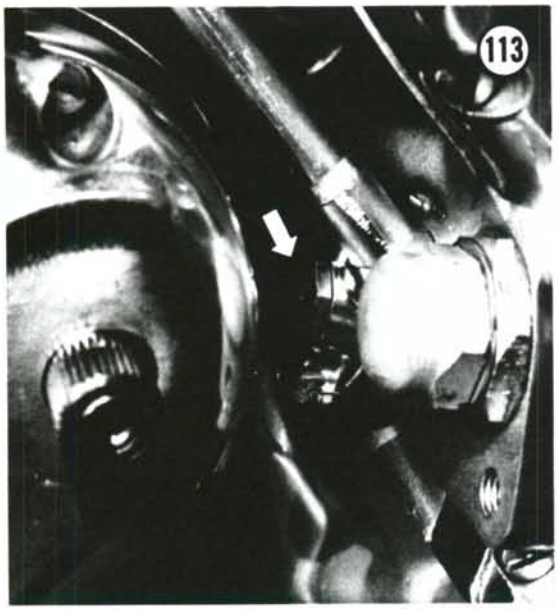
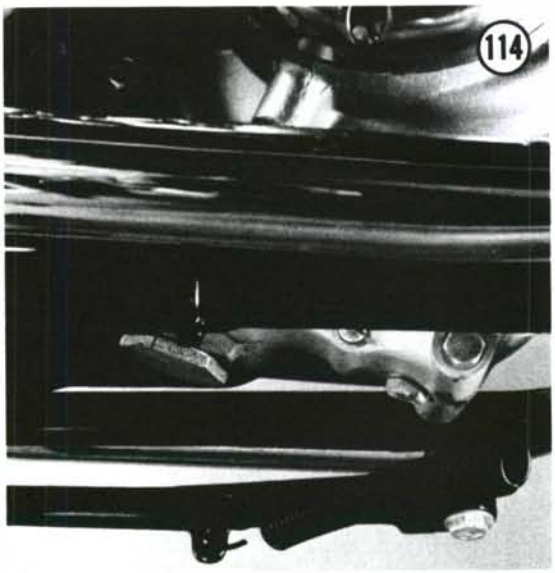
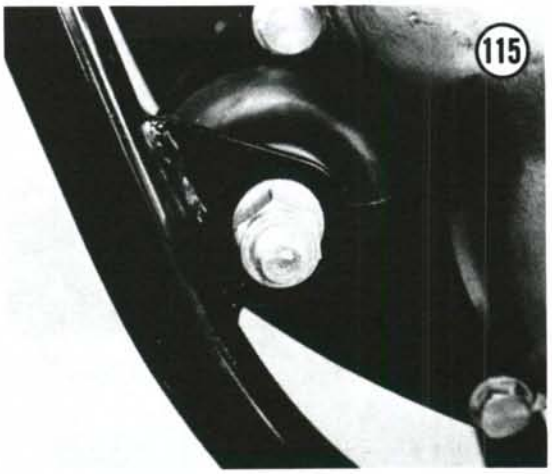


CRANKCASE — 750 ENGINE

1. Crankcase
2. Crankcase dowel
3. Crankcase dowel
4. Camshaft bushing
5. Main bearing
6. Main bearing oil seal
7. Main bearing shim
8. Cylinder stud, front
9. Cylinder stud stepped
10. Cylinder stud, front
11. Cylinder stud washer
12. Cylinder stud washer
13. Cylinder stud nut
14. Cylinder stud nut
15. Cylinder stud nut
16. Oil pump stud
17. Oil pump stud nut
18. Grub screw-oil stop
19. Junction block dowel
20. Crankcase bolt, long
21. Crankcase bolt nut
22. Crankcase bolt, short
23. Crankcase bolt washer
24. Crankcase bolt nut
25. Crankcase stud stop, front
26. Crankcase stud washer
27. Crankcase stud nut
28. Crankcase stud stop, rear
29. Crankcase stud washer
30. Crankcase stud nut
31. Crankcase screw, T.S. to D.S. at sump
32. Magnetic sump plug
33. Sump plug washer
34. Gear tachometer
35. Screw
36. O-ring
37. Housing
38. Tachometer housing gasket
39. Breather tube
40. Sump filter body
41. Filter washer
42. Filter gauze
43. Strainer
44. Bolt
45. Filter body washer
46. Tab washer

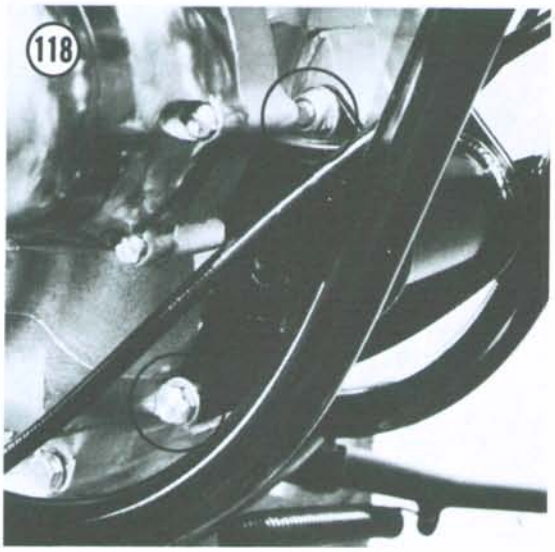


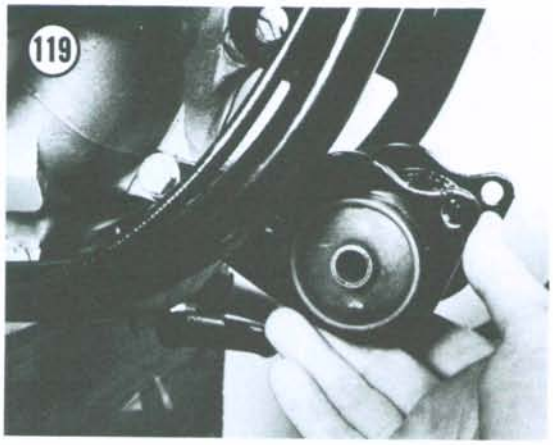


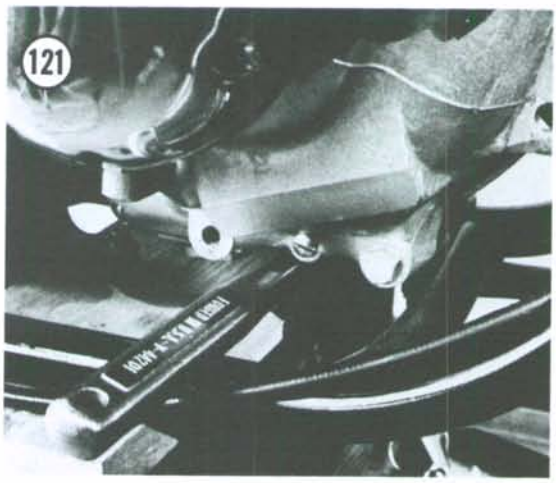


unscrew the drain plug on all models and allow the crankcase to drain.

5. Unscrew the left nut from the front mount (**Figure 115**), line up one of the flats on the right end bolt head so it will clear the timing case (**Figure 116**), and tap it about halfway out. Peel back the left cover (**Figure 117**) and remove the spacer, end cap, and shims. Unscrew the nuts from the engine mounting bolts (**Figure 118**) and remove the bolts. Remove the complete front mount (**Figure 119**).





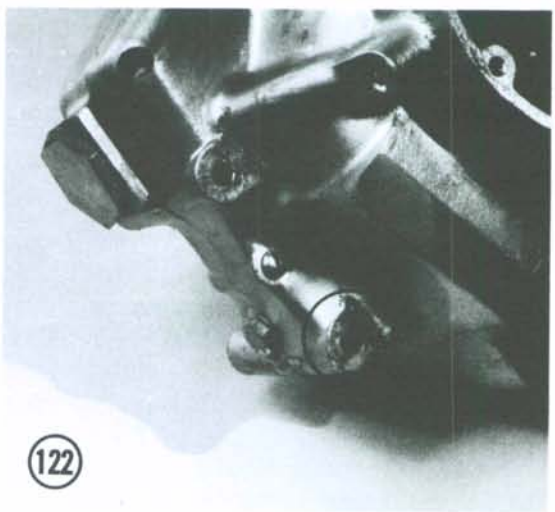


6. Remove the bottom- and center-rear engine bolts (**Figure 120**). When removing the bottom bolt it will be necessary to lift up on the crankcase so the bolt will clear the frame.

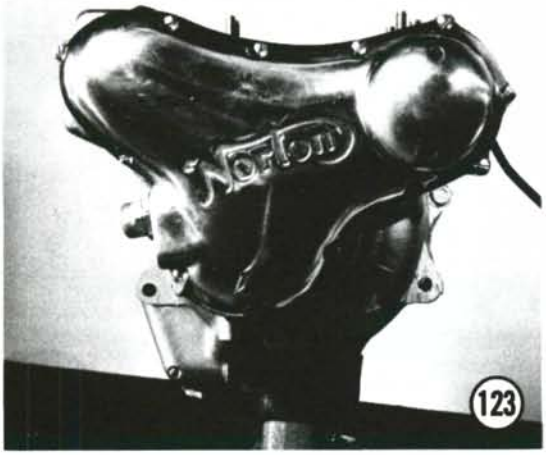
7. On models equipped with a sump filter, lift the front of the engine and place a long drift or socket extension beneath it so that it is supported on the frame rails (**Figure 121**). Remove the filter and allow the remaining oil to drain.

8. Unscrew the nut from the top rear engine bolt (Figure 120), lift up on the engine, and pull the bolt out. Lift the crankcase assembly out of the frame, taking care not to damage it on the mounts.

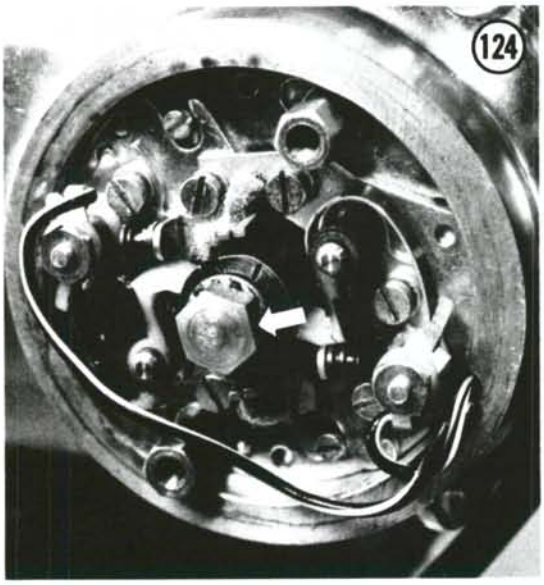
9. Remove the bottom front crankcase bolt (**Figure 122**). Mount the crankcase assembly in a bench vise fitted with protective jaw covers.

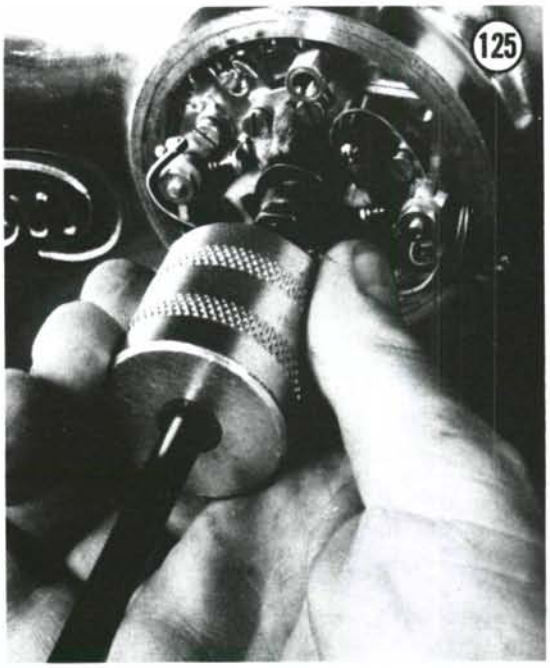


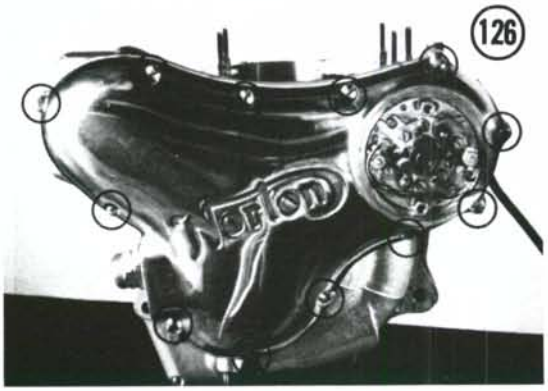
The timing side of the crankcase should face you and the vise should be tight enough to hold the crankcase firmly (**Figure 123**).



10. Remove the contact breaker cover, unscrew the breaker cam bolt and remove it along with the 2 washers (**Figure 124**). Screw the end of the slide hammer (Norton tool No. 064298) into the end of the cam at least 6 full turns, pull the slide sharply to free the cam from the taper on the shaft (**Figure 125**), and remove it. Unscrew the 12 screws from the timing cover (**Figure 126**). Carefully tap the cover loose with a soft mallet and remove it from the crankcase. Feed the electrical leads through the hole in the case, one at a time.

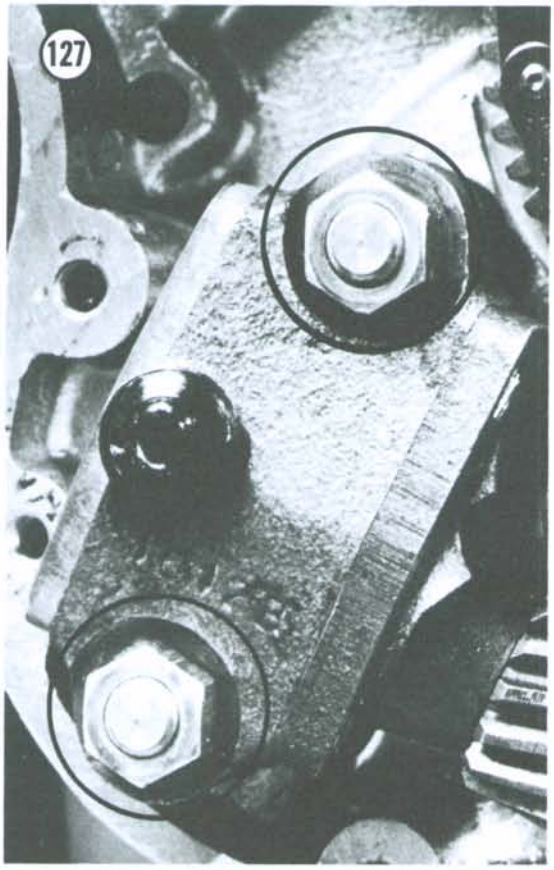


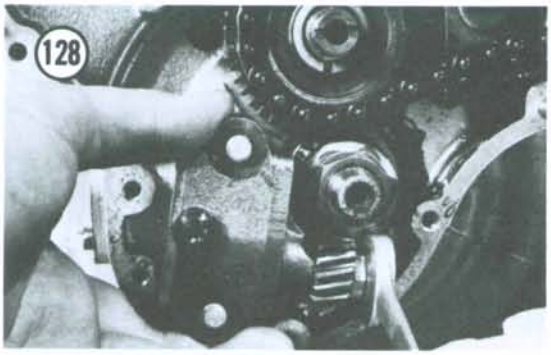


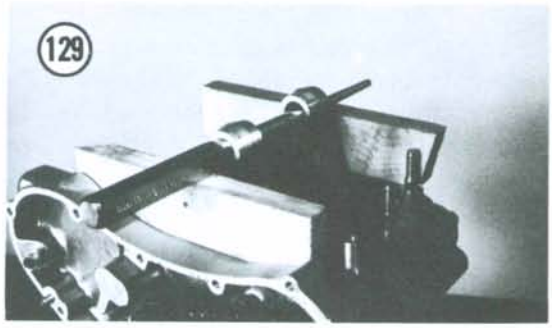


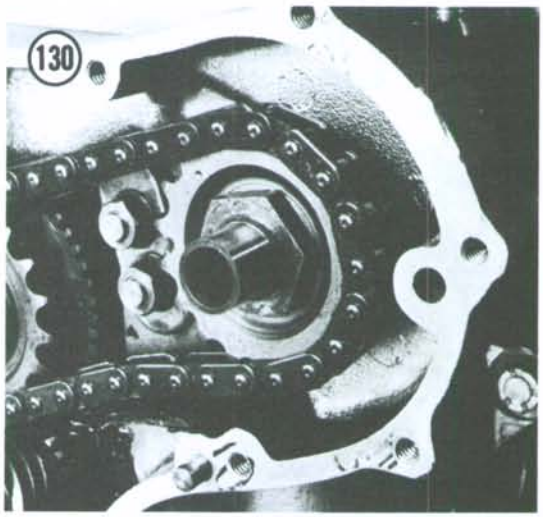
11. Unscrew the oil pump nuts (**Figure 127**) and rotate the pump drive gear bolt (**Figure 128**) clockwise with a wrench to draw the pump away from the case. Place 2 blocks of wood over the top opening in the crankcase, pass a drift through the wrist pin holes in the connecting rods, and turn the oil pump worm nut clockwise to bring the drift in contact with the blocks (**Figure 129**). Unscrew the worm nut (left-hand thread) using even pressure on the wrench. Remove the worm gear from the shaft.

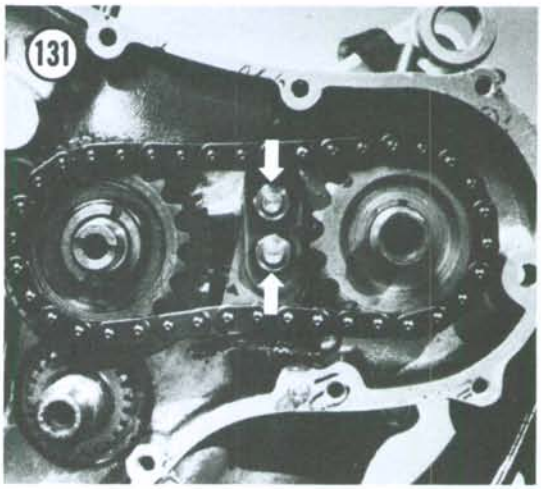
12. Unscrew the camshaft nut (**Figure 130**), again using even pressure on the wrench. Loosen the nuts on the timing chain tensioner (**Figure 131**) and remove the sprockets, idle gear,







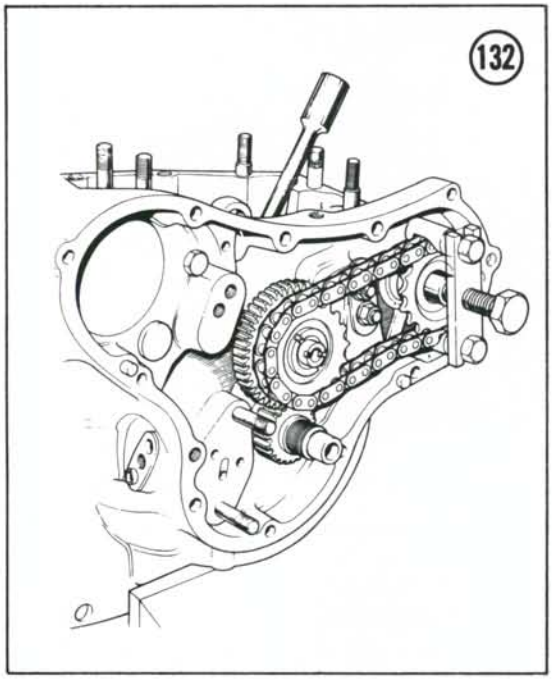


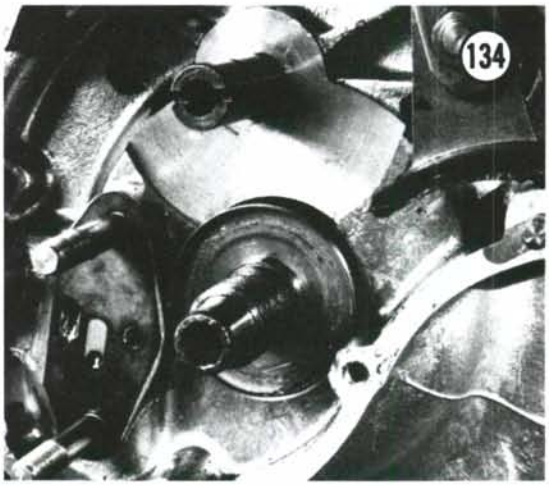


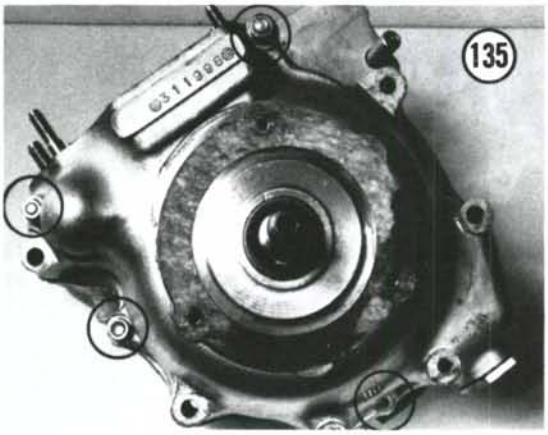
and chain together with the aid of a puller (**Figure 132**).

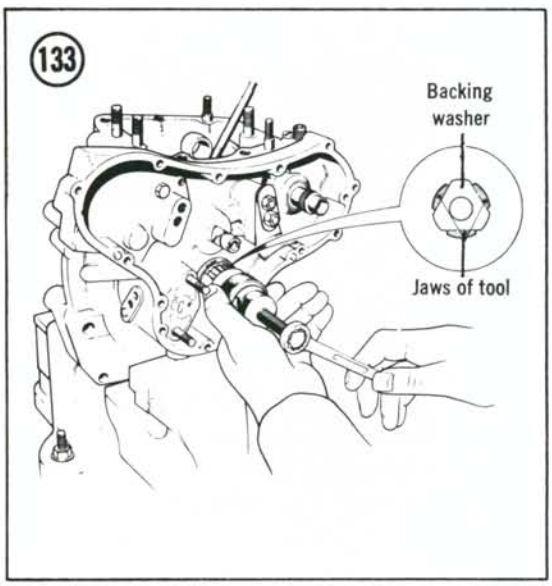
13. Install the extractor (Norton tool No. ET.2003) on the crankshaft pinion gear with the tool jaws lined up with the flats on the washer (**Figure 133**). Hold the tool to prevent it from rotating and turn the puller bolt clockwise to remove the pinion. Remove the key from the shaft and the washer. With a small magnet, remove the lipped seal disc (**Figure 134**). It's not necessary to remove the chain tensioner unless the contact shoe is deeply worn and must be replaced.

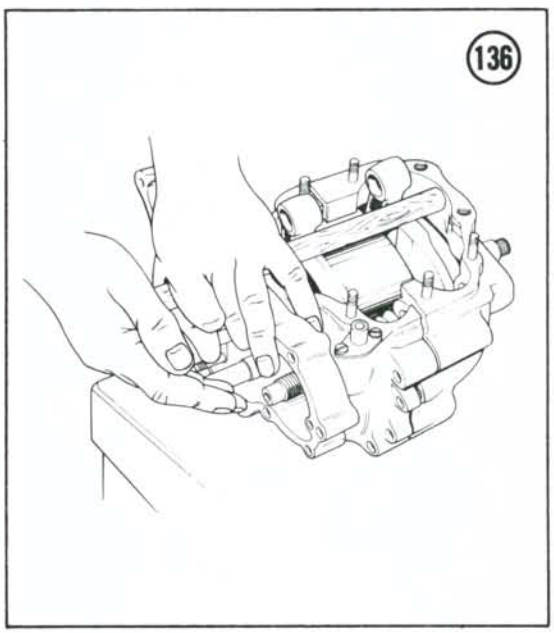
In such case, the tensioner should be replaced with the latest type which has a rubber facing on the slipper surface, resulting in quieter operation and reduced wear of the chain sideplates.





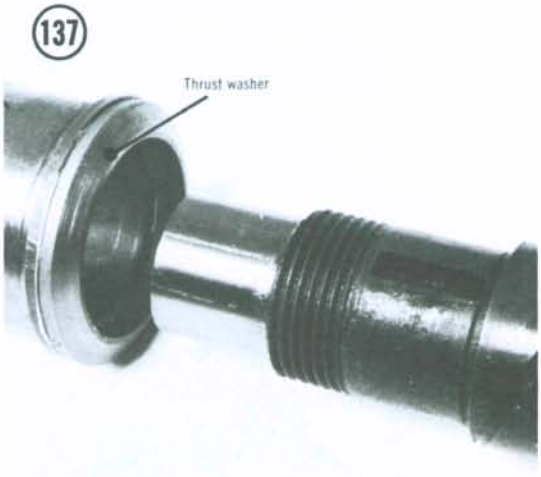






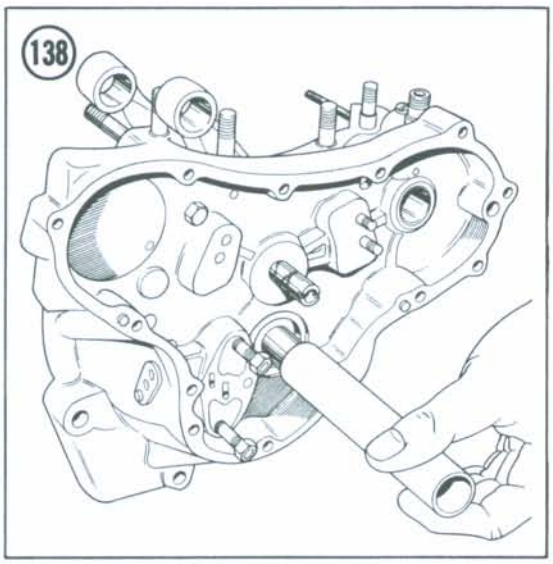
14. Remove the crankcase from the vise. Unscrew the nuts, bolts, and screws which hold the crankcase halves together (**Figure 135**). Separate the cases with a soft wood dowel applied against the cylinder recess in the timing side (**Figure 136**). Remove the engine breather disc and spring (750 engines prior to No. 200000) from the drive-side cam bushing as the cases are separated.

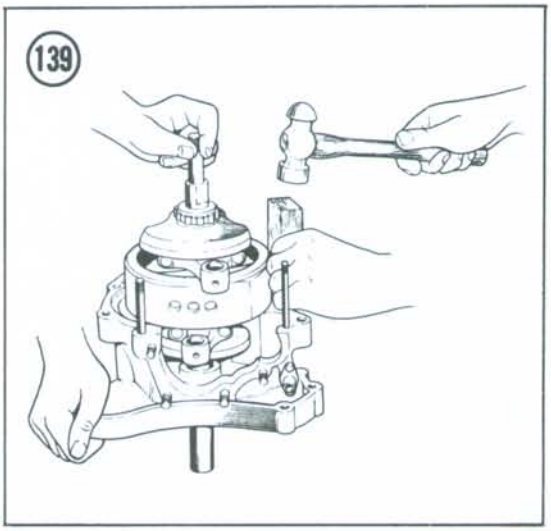
15. Remove the camshaft and thrust washer from the timing case (**Figure 137**). On engines from No. 200000 to 300000, remove the flat thrust washer.



16. Fit a suitably-sized length of tubing over the end of the crankshaft (**Figure 138**). With assistance, stand the tube on end on a work bench and tap along the mating surface of the crankcase with a block of wood and a hammer to drive the case off the bearing (**Figure 139**).

NOTE: *This is not necessary on engines with a roller bearing on the timing side of the crankshaft (after Number 200000).*





If necessary, the crankcase may be heated with a propane torch in the area of the bearing.

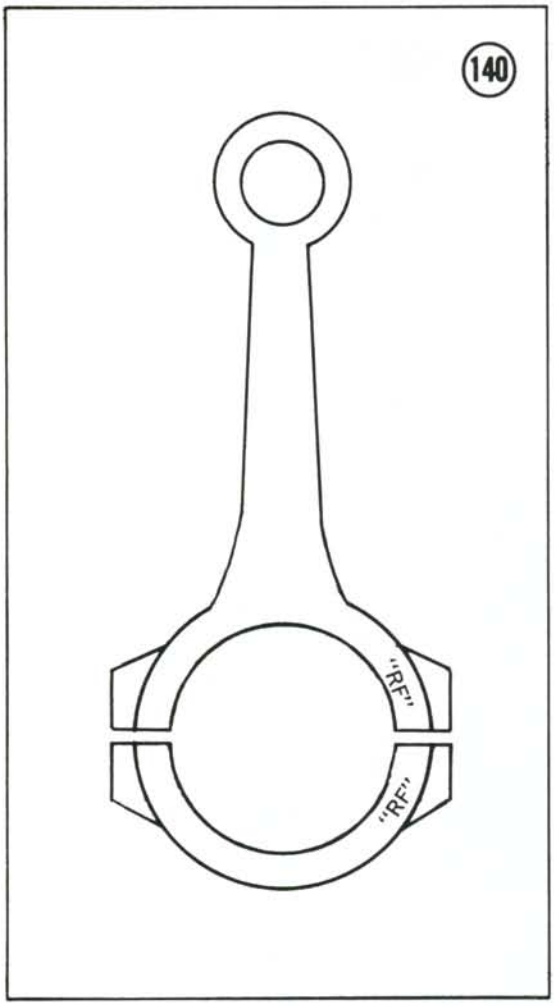
17. Unscrew the nuts from one of the connecting rods and remove the rod and end cap from the crank. Mark both the cap and rod for position (right or left) and direction (front). See **Figure 140**. Then remove the other rod assembly and mark it appropriately. Under no circumstances should the rods and caps be interchanged, switched from one side to the other, or reversed (along a vertical axis) when they are reinstalled.

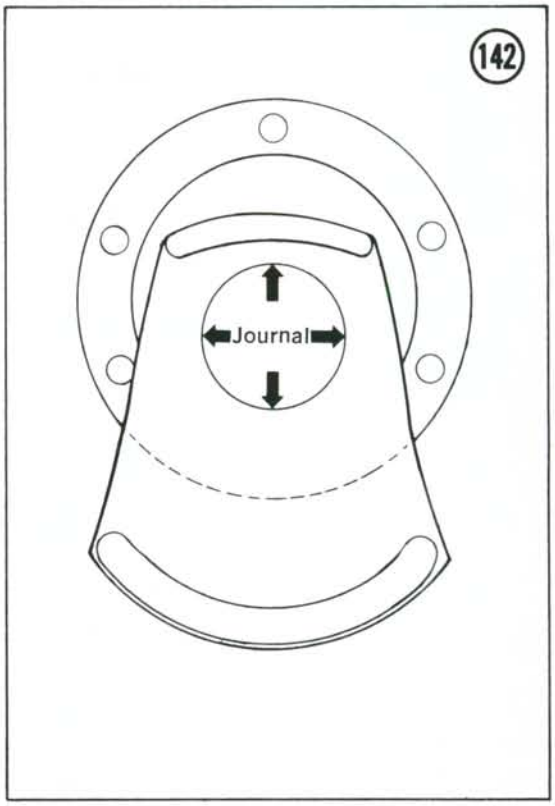
18. Scribe a "T" on the timing side of the flywheel so that it may be installed in the same position from which it was removed. Unscrew the nuts from the timing side (**Figure 141**) and break the crank halves loose from the flywheel with a soft mallet or a hammer and soft drift. The crank should be parted over a drip pan to catch the oil remaining in the assembly.

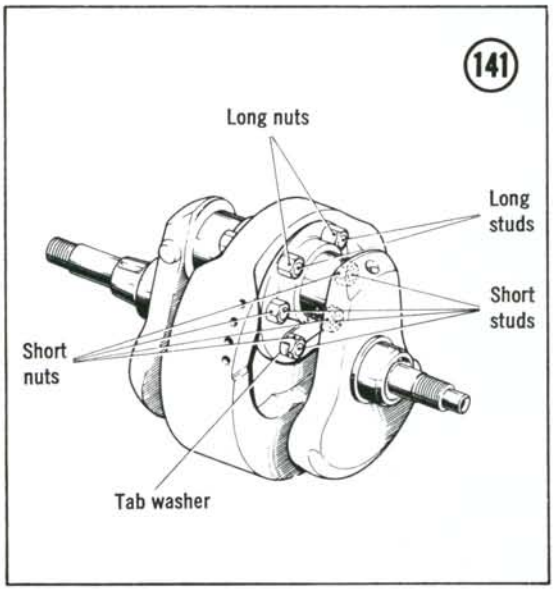
Inspection

1. Thoroughly clean all the parts in solvent and dry them. Pay particular attention to the crank assembly which will likely have an accumulation of sludge in the crank halves and the flywheel. Blow out the oilways in the crank with air pressure. Do the same with oil feed and filter lines.

2. Inspect the crank journals for scoring and galling. Minor roughness may be removed with fine emery cloth. Measure the journals on the horizontal and vertical axes (**Figure 142**) to







check for out-of-roundness. If the difference between the 2 axes on either journal is greater than 0.0015 in. (0.038mm), the journals must be ground to the next undersize with a 0.090 in. (2.28mm) face radius (**Figure 143** and **Table 3**) and new bearings installed.

New bearings are available in finished sizes of —0.010, —0.020, —0.030, and —0.040 to correspond to the specified regrind dimensions.

3. If the connecting rod journals do not have to be reground, inspect the connecting rod bearings for scoring and galling. Minor roughness may be removed with fine emery cloth but no attempt should be made to salvage a bearing that is deeply scored or galled. If crank journal wear is very slight, consideration may be given to replacing the bearings with a new set of the same size. However, if any doubt exists, it's preferable to have the journals reground to the next undersize and appropriate bearings installed.

4. Rotate the main bearings by hand, either in the cases or on the crankshaft, and check for roughness and radial play. The bearings should

(143)

CRANK JOURNAL MEASUREMENTS

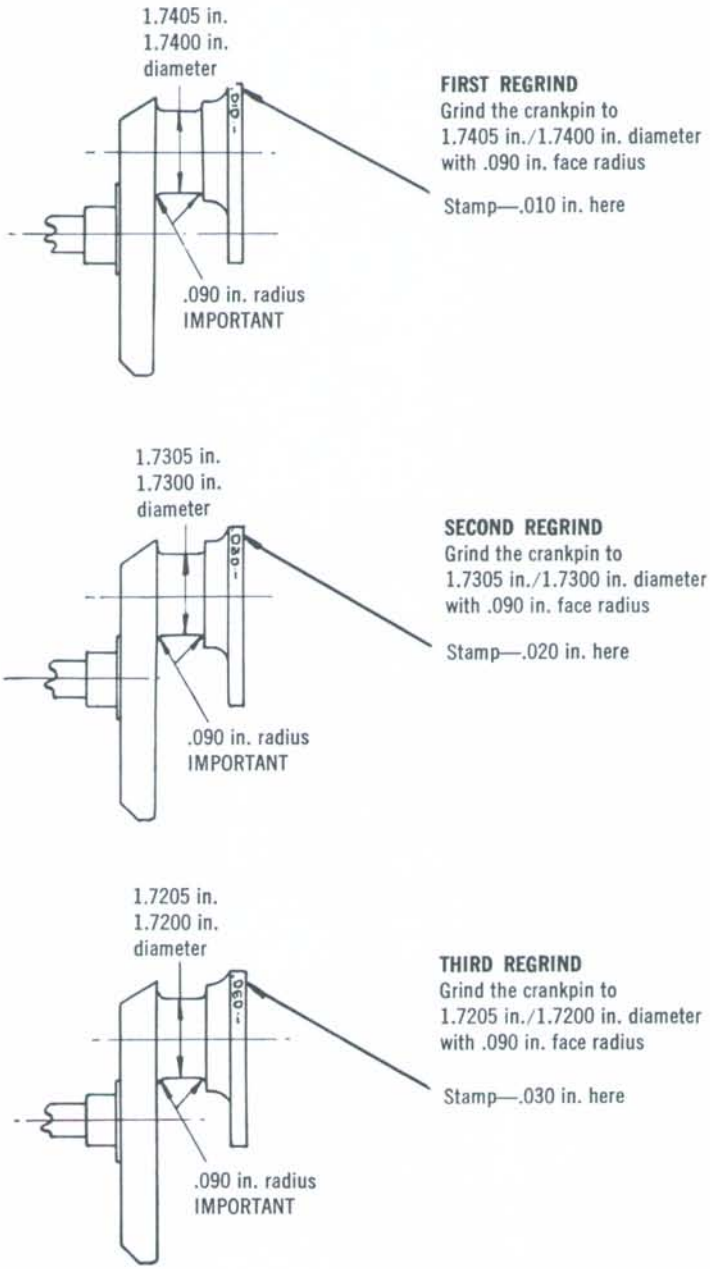


Table 3 JOURNAL REGRIND SIZES

Regrind	Dimension (Crankpin dia.)	Size Stamp
First	1.7405-1.7400 in. (44.175-44.162mm)	.010
Second	1.7305-1.7300 in. (43.921-43.908mm)	.020
Third	1.7205-1.7200 in. (43.667-43.654mm)	.030

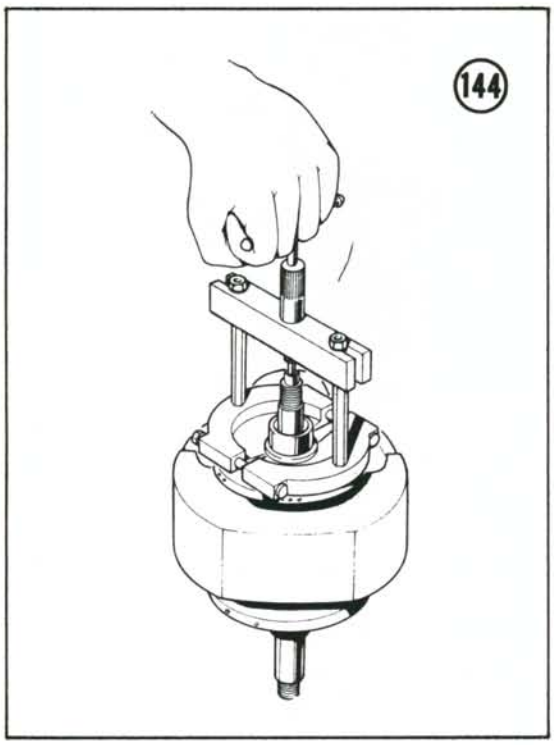
turn smoothly and exhibit no appreciable play. If a bearing is to be replaced, it's first necessary to heat the case in the area of the bearing and then dislodge the bearing either with a soft drift applied to the bearing inner race (timing side ball-type bearings) or by rapping the case sharply on a piece of soft wood.

The cast must also be heated when a bearing is being installed, and the bearing should fit completely into the bore with no effort.

CAUTION

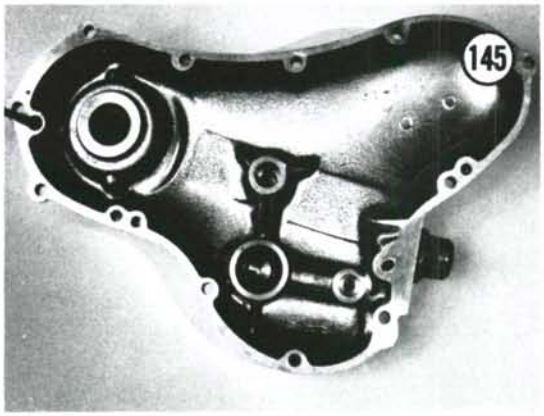
When heating the case during removal or installation of a bearing, do not bring the flame in contact with any part of the bearing; even a brief exposure to the flame can destroy the case hardening on the bearing.

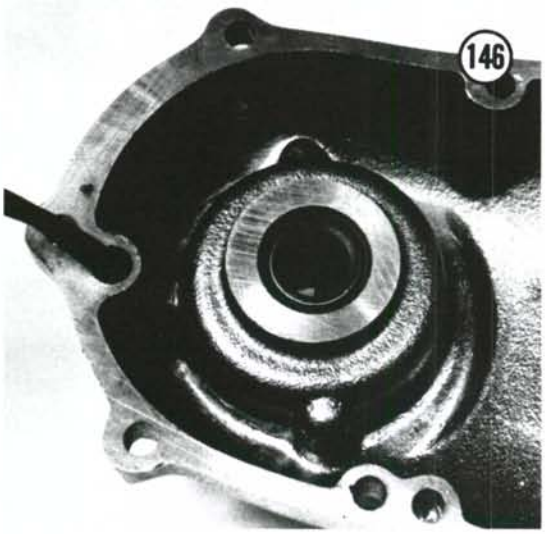
On engines equipped with roller main bearings, inner races should be removed from crankshaft with a puller (Norton tool No. 063970). See **Figure 144**.



5. Check the cam bushings, journals, and lobes for wear and damage. Minor roughness on the lobes may be removed with fine emery cloth.

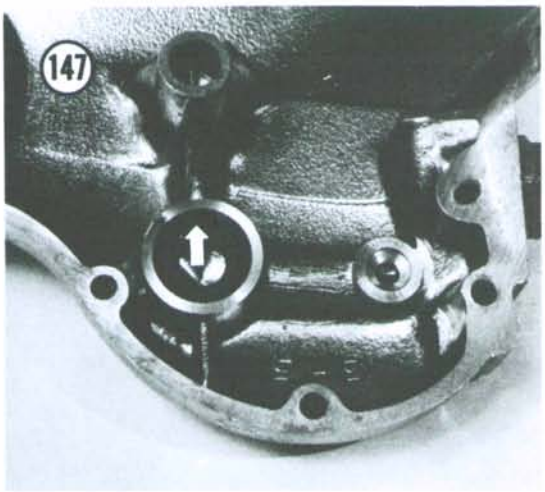
6. Inspect the seals in the timing cover for damage or deterioration (**Figure 145**). Oil in the contact breaker cavity is a good indication that the contact breaker seal is failing and should be replaced. The seal can be removed by prying it out with a screwdriver; be careful not to damage the case. Press a new seal evenly into the seal bore with the open side facing out (**Figure 146**), using Norton tool No. 064292.

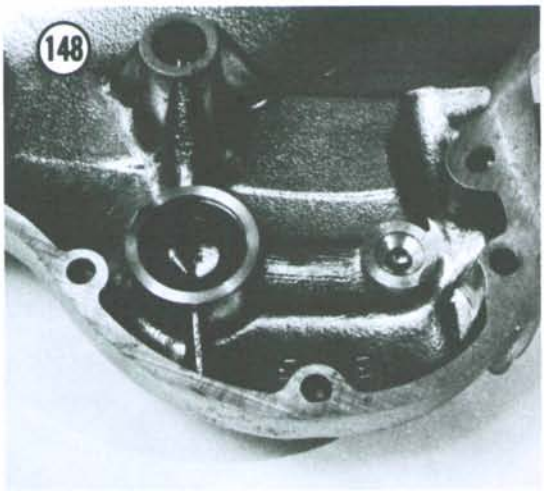




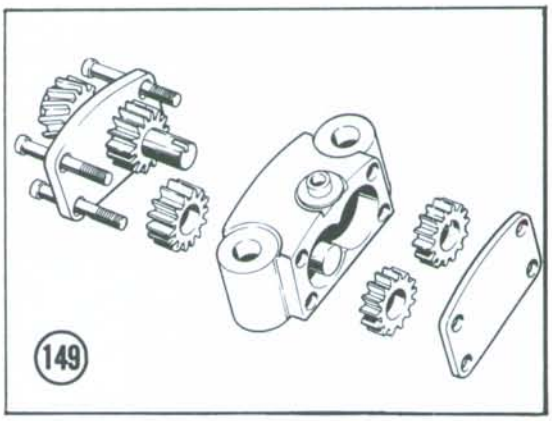
The crankshaft seal is held in the case with a circlip. To remove the seal, first remove the circlip (**Figure 147**). Then carefully pry the seal out of the case. Install a new seal squarely in the bore, with the open side facing in (**Figure 148**), and install the circlip with its sharp edge facing out so it will lock in the groove.

7. Check the end-play of the oil pump gears. If the gears have begun to wear into the oil pump





body covers, in and out movement of the drive gear will be apparent. Wearing in of the gears reduces the efficiency of the pump but the condition can be corrected by honing the sides of the pump body to compensate for the wear. Remove the 4 screws from the pump and remove the rear cover. Use a small drift to drive the shaft out of the keyed gear (**Figure 149**). Disassemble the pump and clean and dry the parts thoroughly. Beginning with the feed side of the pump (narrow gears), hone the face of the pump on a piece of fine emery cloth laid on a surface plate or a piece of glass. Periodically check your work by assembling the pump and checking its rotational movement. Sufficient material has been removed when a slight resistance to rotation can be felt.

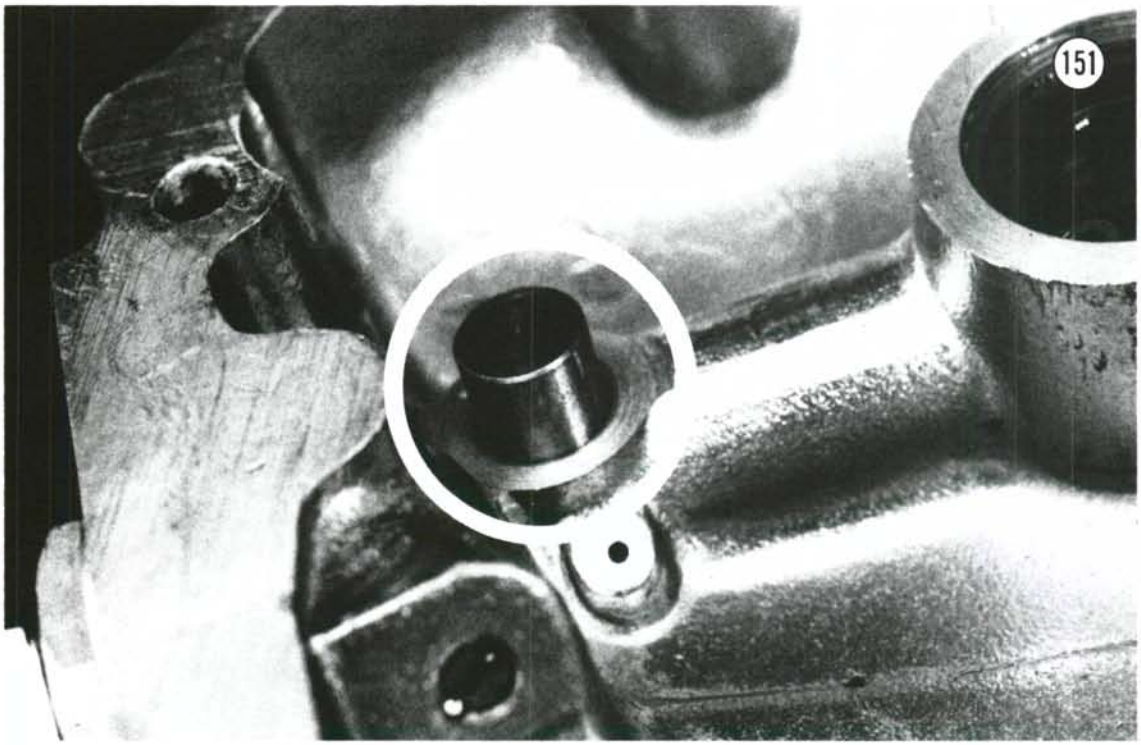


Hone the scavenging side in the same manner, checking the resistance with only the scavenging gears installed in the pump. When both sides have been corrected, carefully wash and dry all of the parts and assemble the entire pump. Squirt oil into the feed hole (**Figure 150**) and turn the pump drive gear several revolutions until the pump turns freely.

8. On 850 Mark III models, clean and check the oil anti-return valve in the outer cover (**Figure 151**). The valve piston should move freely in its bore with a slight spring resistance.

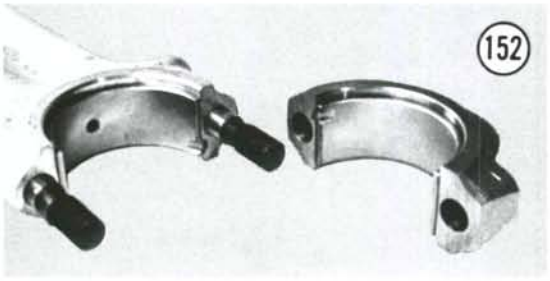
Assembly and Installation

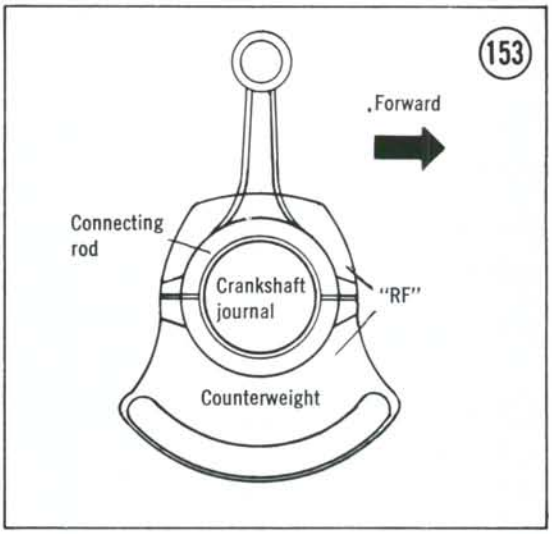
1. Polish the connecting rod journals with fine emery tape. Wash and dry the crank halves. Blow out the oilways with compressed air. Install 2 short studs in the inner holes in the flywheel. Set the drive side crank half over the studs on the drive side of the flywheel (opposite of side marked with "T") and install the lock plate and 2 short nuts. Set the timing side crank



half in place on the opposite ends of the studs and install the lock plate and 2 short nuts. Install the remaining 4 studs from the drive side with the long studs in the outer holes and screw on the nuts—short nuts to short studs and long nuts to long studs. Tighten the nuts, beginning with the inner ones and working diagonally, to 25 ft.-lb. (3.45 mkg). Bend the tabs over on the inner nuts and stake the others with a center punch to keep them from backing off. Screw the oilway plug into the timing side crank cheek and tighten it securely.

2. Oil the bearing shells and fit them to the connecting rods and end caps (**Figure 152**). Note that the drilled shell half is fitted to the rod and the plain one to the cap. Oil the journals and install the right side rod and cap on the right journal (timing side) with the oil hole in the rod to the outside. The front of the rod, as marked during disassembly, should be on the right side of the journal viewing the crank from the right end (**Figure 153**). Install the original bolts and new nuts and tighten them to 25 ft.-lb. (3.45 mkg). Install the left-hand rod and cap in the same manner, with the oil hole in the rod to the outside.

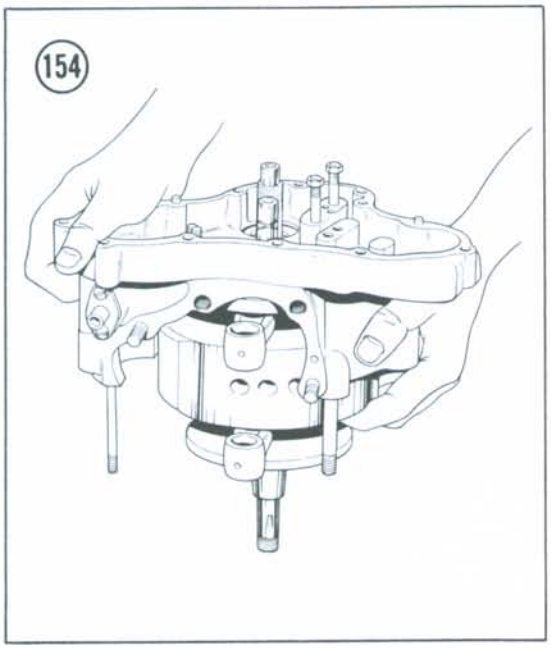




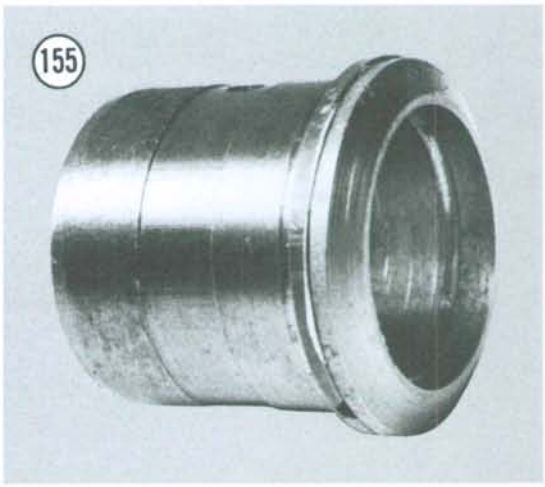
NOTE: *The self-locking nuts must be replaced each time the connecting rod assembly is parted. Also, if a new connecting rod is being installed, do not use the non-locking nuts that hold the rod assembly together in the package. Discard these and use the self-locking nuts that are also included.*

3. Oil the main bearings and the crankshaft and set the timing side of the crankcase in place over the right end of the crankshaft (**Figure 154**) and press it down into place. Make sure the connecting rods line up with the cylinder spigot cutaway in the case. Hold the rods in this position and prevent them from turning by slipping a heavy rubber band or piece of inner tube over them and pushing it down against the flywheel.

NOTE: *Main bearings should be replaced with bearing No. 064118, available through Norton parts dealers. See* Sources *list in Chapter Eleven.*



4. Dab some grease on the flat side of the camshaft thrust washer and set it in place on the bushing (**Figure 155**). On engines from No. 200000 to 300000, make sure that the flat thrust washer is located between the bushing and the chamfered washer, and that the tab on the washer engages in the hole beneath the bushing.

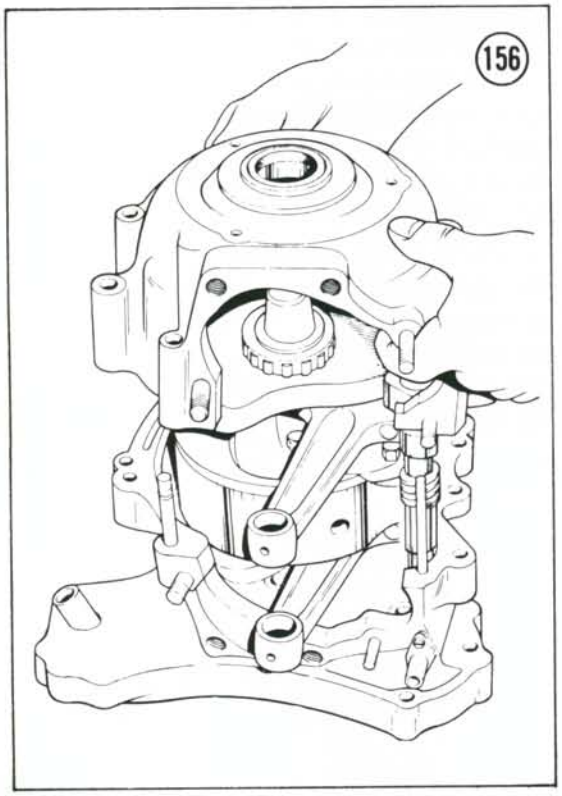


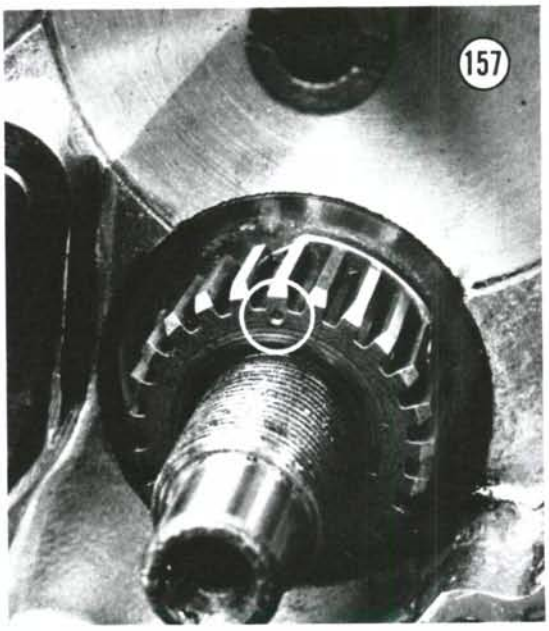
5. In the drive-side case half, install the rotary disc and spring on engines prior to No. 200000. Lightly oil the end of the camshaft and install it in the bushing. (On engines prior to No. 200000, make sure the camshaft engages with the dogs on the disc.)

6. Coat the mating surface of the timing-side case half with Loctite "Plastic Gasket" or gasket cement and oil the timing end of the camshaft and the drive side main bearing. Hold the camshaft in place in the drive side case and set the case in position on the crankshaft (**Figure 156**). Push the case into place, making sure the camshaft lines up with the thrust washer and the bushing and that the connecting rods are centered in the cylinder spigot recesses. If resistance is felt just before the case halves contact, check the tachometer drive to make sure it engages with the gear on the camshaft. Tap the crankcase halves together all around the mating line with a soft mallet. Check the camshaft to make sure it has some end-play.

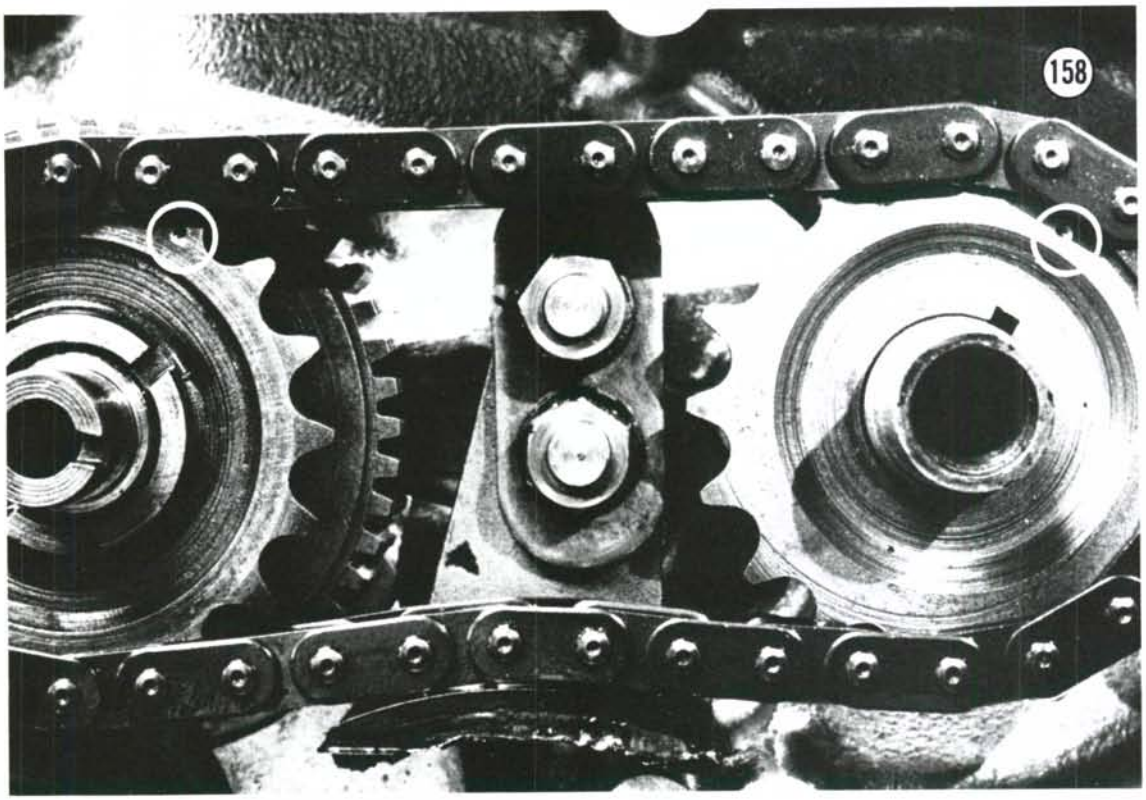
7. Install the screws, studs, washer, nuts, and short front bolts in the crankcase. Omit the bottom bolt at this point so that the crankcase may be clamped in a vise. Tighten the nuts and screws evenly in a crosswise pattern.

8. Clamp the crankcase in a vise as for disassembly and install the oil seal disc (lip out) and the washer on the timing side of the crankshaft. Set the key in the crankshaft recess and install the crankshaft gear with the timing marks outward. Rotate the crankshaft so the timing mark is at the top and journals are at TDC (**Figure 157**).



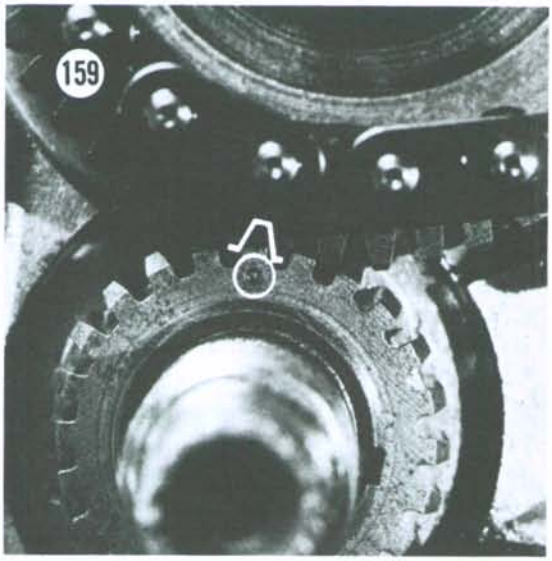


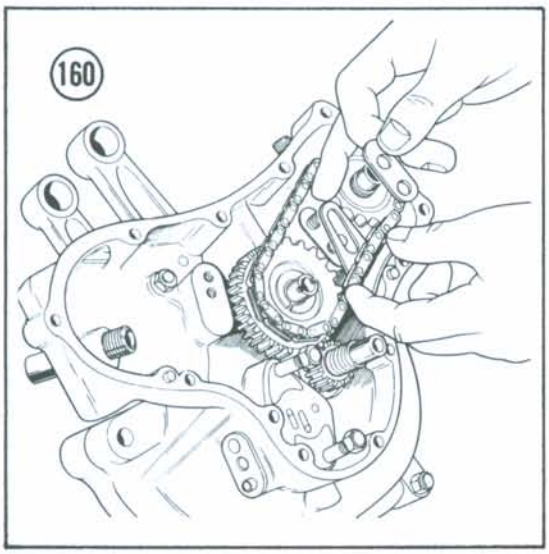
9. Assemble camshaft sprocket, gear sprocket, and chain with the marks on the sprockets located 10 rollers apart (**Figure 158**). Line up the marked space on the intermediate gear with the



marked tooth on the crankshaft gear and install the assembled sprockets and chain (**Figure 159**).

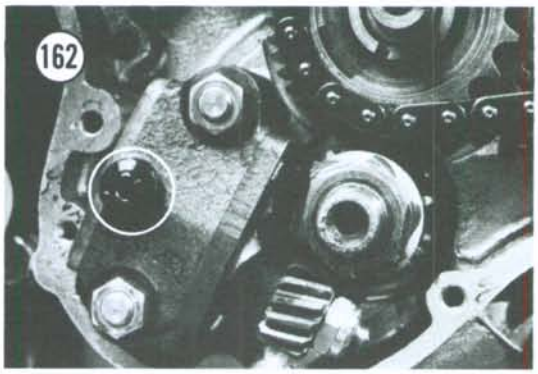
10. Install the cam chain tensioner as shown in **Figure 160**—thin plate inside with the long end down, the tensioner, and the thick plate on the outside with the long end up. Install the washers and nuts and adjust the tensioner so that the maximum up and down movement of the chain is 3/16 in. (4.8mm) at the tightest point. Rotate the crankshaft, checking the chain movement every several plates until you are certain that the adjustment is correct at the tightest position. Tighten tensioner nuts to 15 ft.-lb. (2.07 mkg).



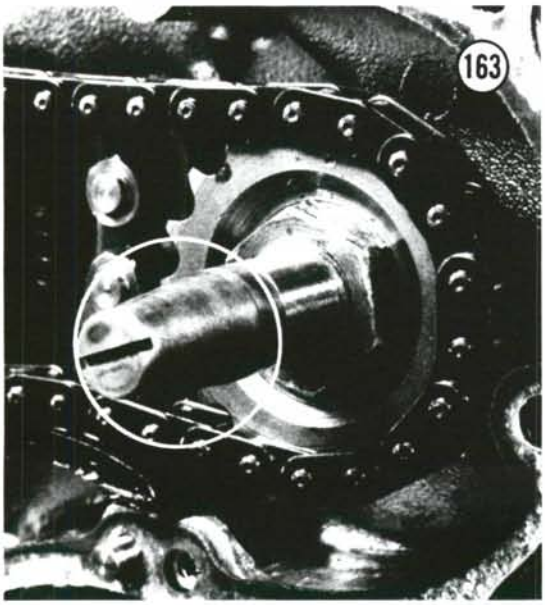


11. Screw on the oil pump drive gear (left-hand thread) and the camshaft nut (right-hand thread). Lock the crankshaft as described in the disassembly section, this time rotating the crankshaft counterclockwise (from the right end) until the drift is stopped against the blocks. Then tighten both the drive gear and the camshaft nut.

12. Prime the oil pump by turning the drive gear and squirting oil into the pump through the feed port (**Figure 161**). Install the oil pump on the mounting studs (with a gasket if one was removed during disassembly) after making sure the studs are tight. Screw on the nuts (no washers) and tighten them to 10-12 ft.-lb. (1.38-1.66 mkg). Install a new oil seal (part No. NMT272) on the pump outlet (**Figure 162**). Omit any shims that may have been removed during disassembly, provided a gasket is used. Check the tightness of the drive gear.

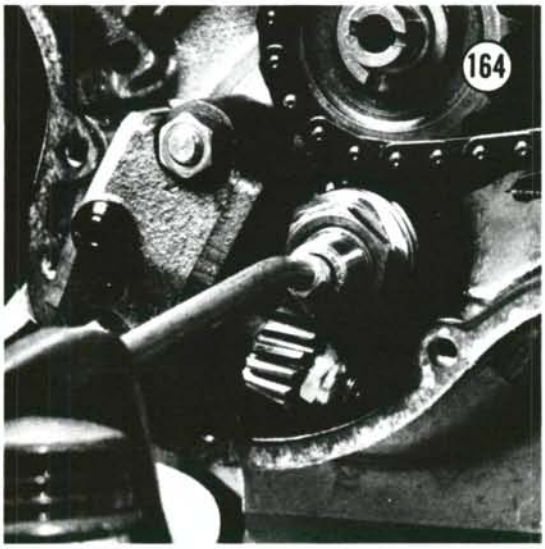


13. Install the timing cover gasket over the dowels in the crankcase. Screw a seal protector (Norton tool No. 061359) into the end of the camshaft and lightly oil it (**Figure 163**). If the



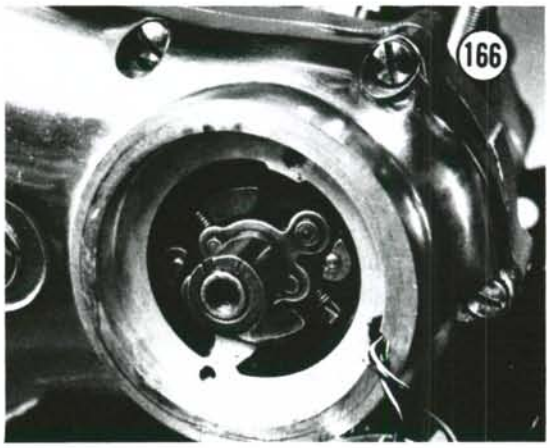
tool is not available, wrap the end of the shaft with a piece of transparent mending tape and shape it into a cone. The tool or the tape are required to protect the contact breaker oil seal from damage when the timing cover is installed.

14. Remove the crankcase from the vise, tilt it onto its left side (drive side) and squirt several ounces of fresh engine oil into the flywheel through the right end of the crank (**Figure 164**). Allow a couple of minutes for the oil to run into the journals and reclamp the crankcase assembly in the vise.

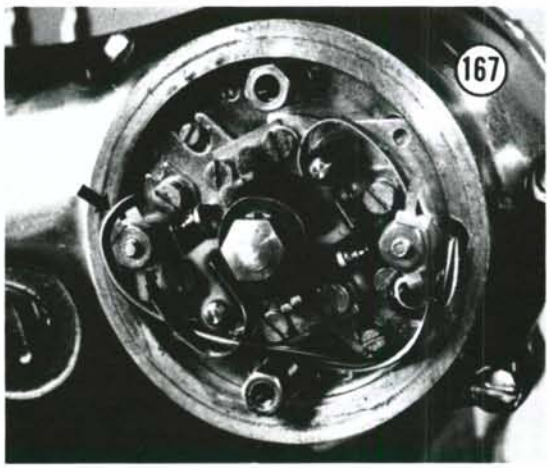


15. Insert the contact breaker electrical leads through the hole in the timing case and set the cover in place. Install the timing cover screws and tighten them in the sequence shown in **Figure 165**. Unscrew the seal protector tool if used, or remove the tape from the end of the camshaft.

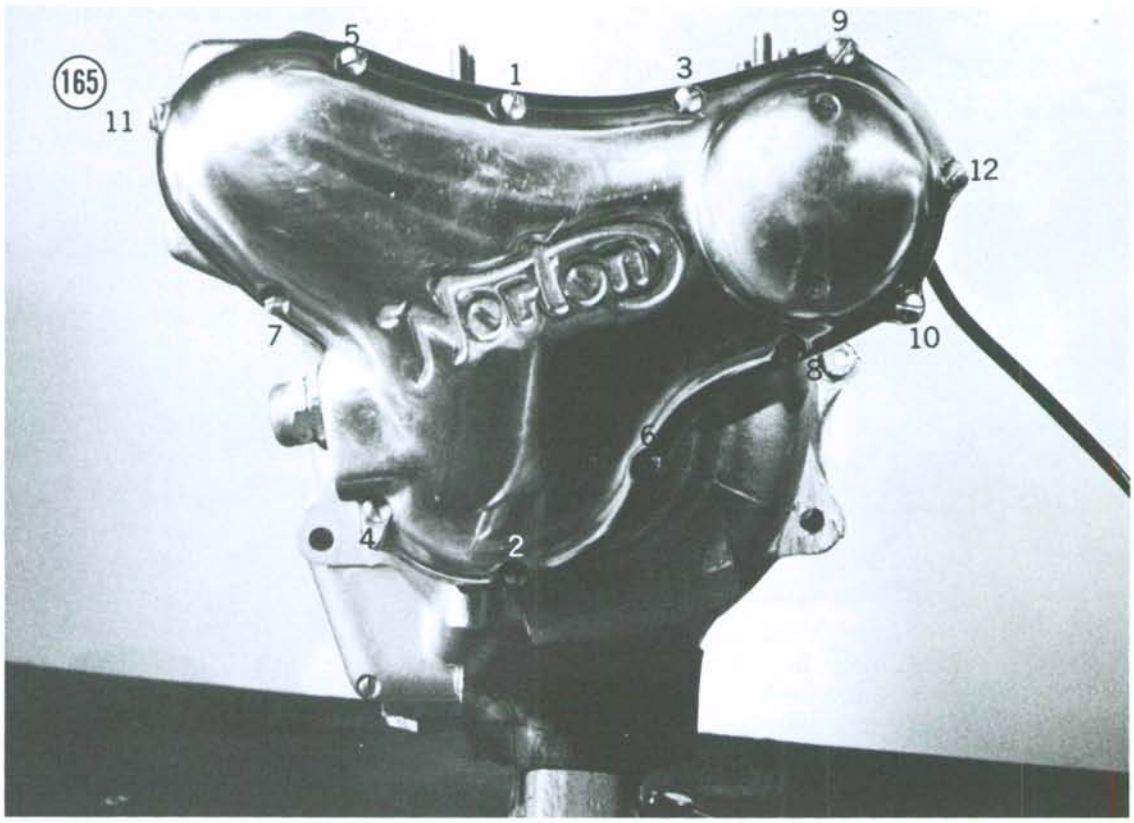
16. Lightly lubricate the automatic advance mechanism with oil. Make sure the cam taper is clean and dry and set the unit in position (**Figure 166**).



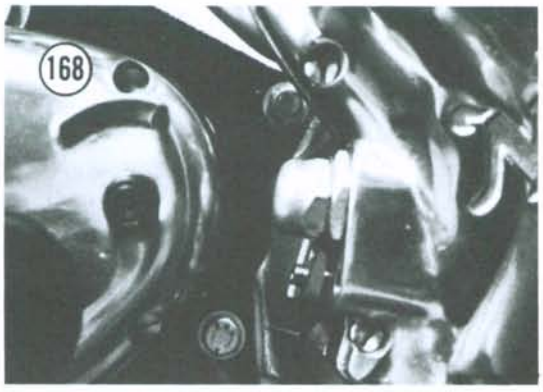
17. Install the contact breaker assembly with the yellow lead to the rear (**Figure 167**). Line up the plate so that the pillar bolts are in the center of their slots and tighten them.



18. Remove the crankcase from the vise and install the bottom front bolt, the drain plug, and the oil filter on 850 models.



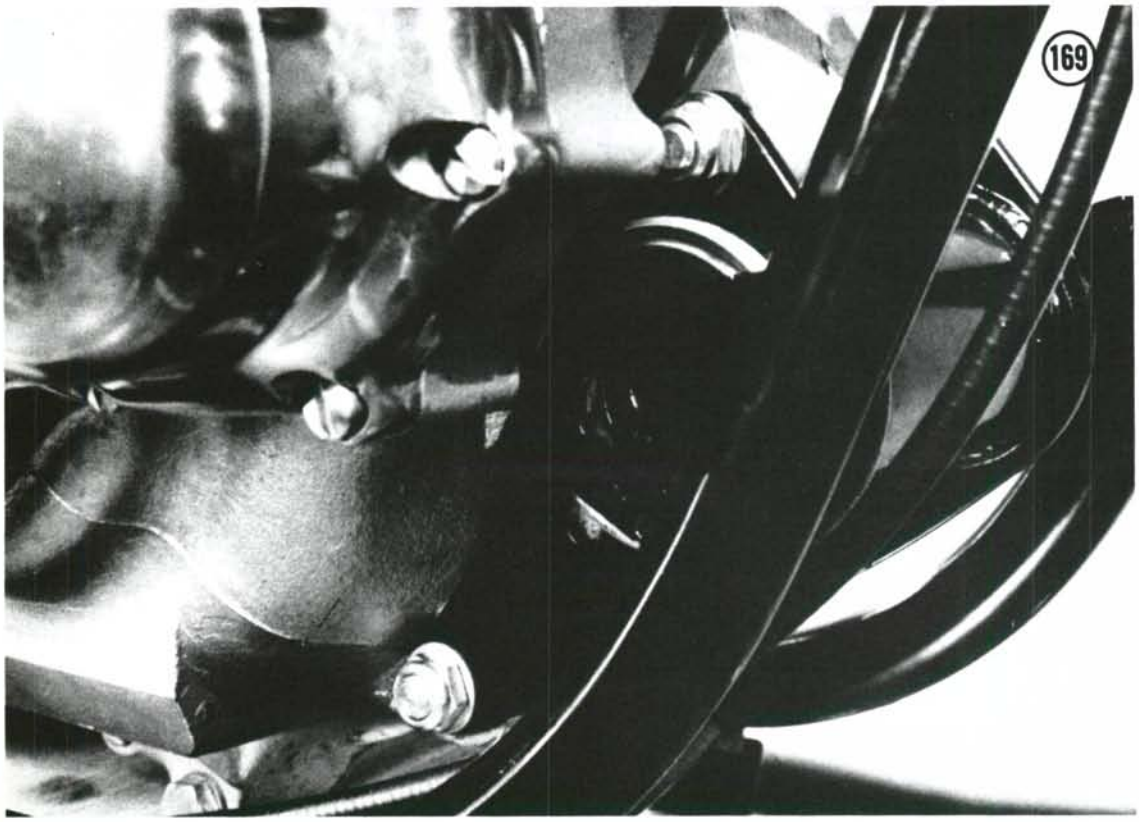
19. Set the crankcase in the frame, between the rear mounting plates, and install the top and center rear bolts (**Figure 168**). Lift up on the engine and install the bottom bolt from the right side. Install the washers and screw the nuts on finger-tight.



20. Set the complete front mount in place as shown in **Figure 169** and install the bottom bolt. Pivot the mount up and install the top bolt. Refer to Chapter Ten and assemble the shims, caps, spacers, and covers. Install the right-hand set first and lift up the front of the crankcase to align the mount with the frame tab. Push the bolt into the mount, lining up one of the flats on the bolt head to clear the timing case. Before the bolt reaches the other bushing, install the left-hand set and then push the bolt the rest of the way through.

Fit the lips of the outer covers over the caps, install the washer and nut, and tighten it to 25 ft.-lb. (3.45 mkg). Tighten the nuts on the ⅜ in. studs to 25-30 ft.-lb. (3.45-4.15 mkg) and those on the 5/16 in. bolt to 15 ft.-lb. (2.07 mkg).

21. The remaining components should be assembled and installed in reverse order of disassembly. Refer to the appropriate sections and chapters to ensure that your work is correct. Following engine installation, the engine should receive a major service including fresh oil, ignition timing and adjustment, carburetor adjustment, primary and secondary chain adjustment, clutch adjustment, and brake adjustment.


169

CHAPTER FIVE

TRANSMISSION

The 4-speed Norton transmission (**Figure 1**) is not unitized with the engine and can therefore be completely dismantled and serviced without dismantling the engine. However, removal of the gearset from the transmission housing, removal of the entire transmission from the motorcycle, or removal and replacement of the countershaft sprocket requires disassembly of the primary drive.

There are few situations requiring removal of the transmission housing from the motorcycle (such as repair to a crack or fracture, renewal of the drain plug threads, etc.). Even the bearings in the main housing can be removed with an expanding type bearing puller with the housing in place.

Beginning in 1975, with the Mark III Electric Start, the gear selector mechanism was redesigned to provide left-foot shifting with a 1-down, 3-up change pattern. This change was made to accommodate international agreements for standardization of motorcycle controls.

The transmission service procedures in this chapter are arranged by subassembly (outer cover, inner cover, gasket, and selectors). It's not necessary to totally dismantle the transmission to correct many unsatisfactory conditions that may arise through normal use and wear. For instance, replacement of a worn kickstarter pawl requires no disassembly beyond that required for the inner cover. Be certain, however, that an unsatisfactory condition that's found in an early disassembly step has not affected components covered in later steps. If the possibility exists that subsequent components may have been damaged by a known failed component or assembly, continue to disassemble and inspect the transmission until you're confident that all unserviceable parts and conditions have been corrected.

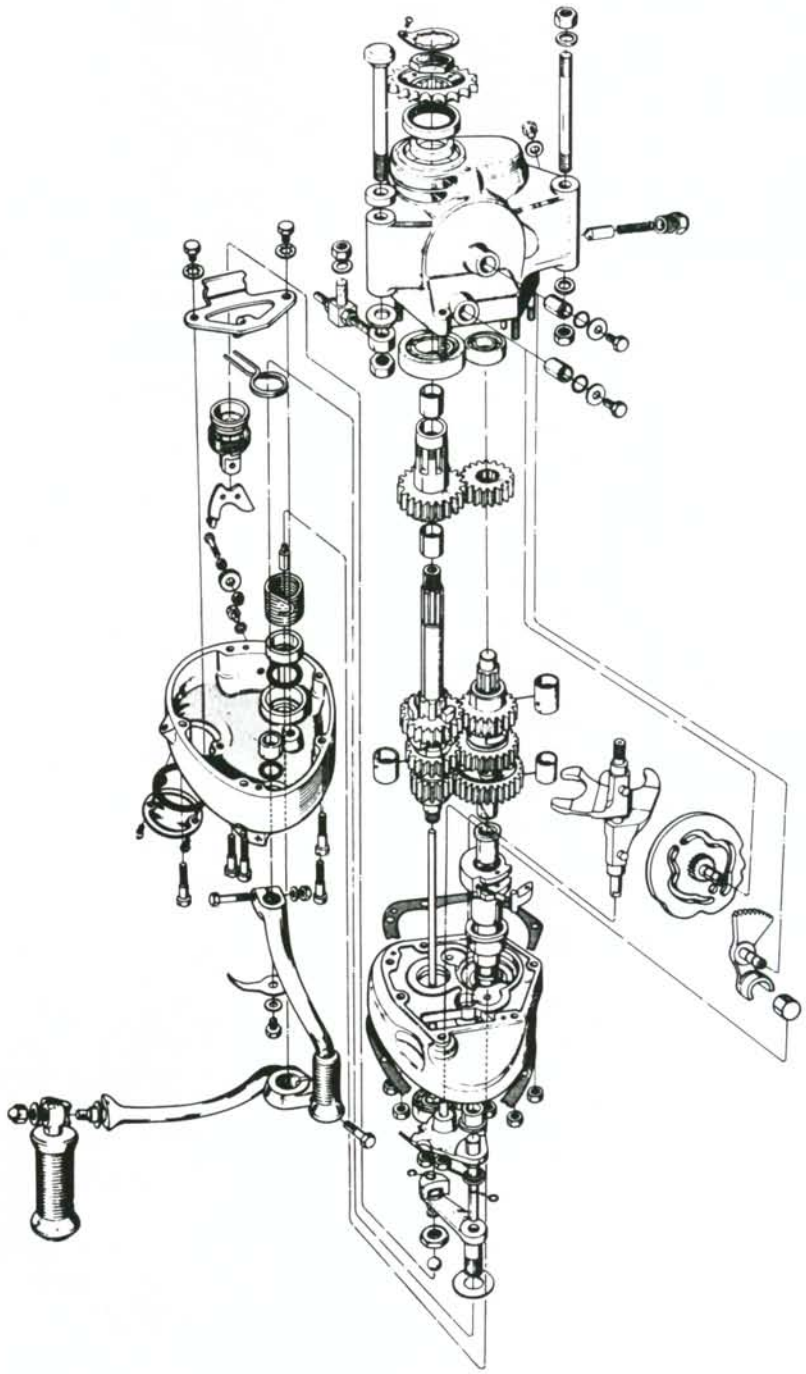
OUTER COVER

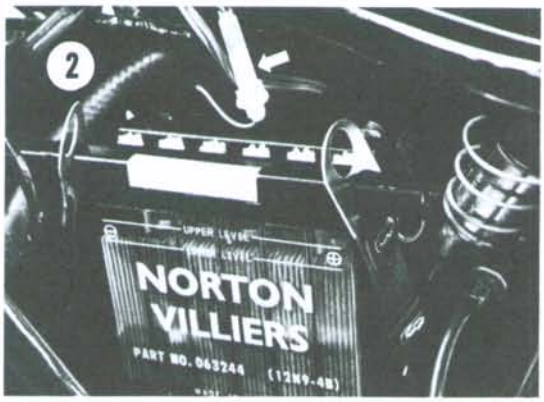
The outer cover houses the clutch operating mechanism, the gear selector stop plate, and the starter return spring.

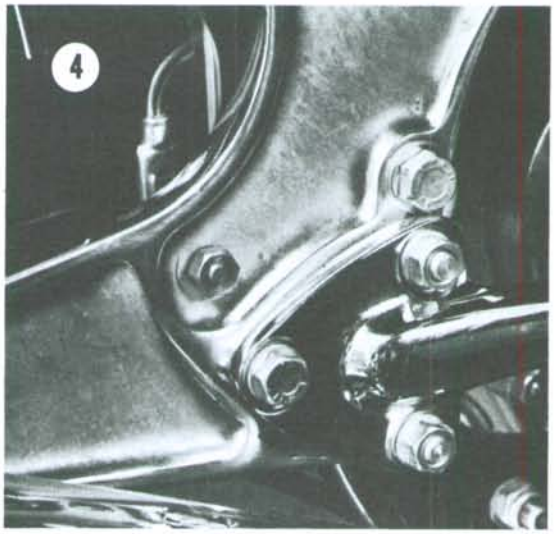
Removal

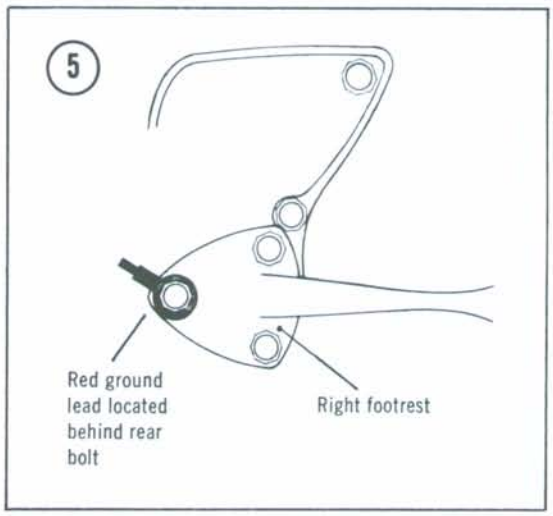
1. Place a drip pan beneath the transmission and remove the drain plug. Remove the fuse from the holder on the negative battery lead (**Figure 2**).
2. Unscrew and remove the bolt from the kickstarter lever (**Figure 3**) and pull the kickstarter lever off the shaft. It may be necessary to strike the bottom of the foot lever with a mallet to break the kickstarter loose from the shaft.

FOUR-SPEED TRANSMISSION







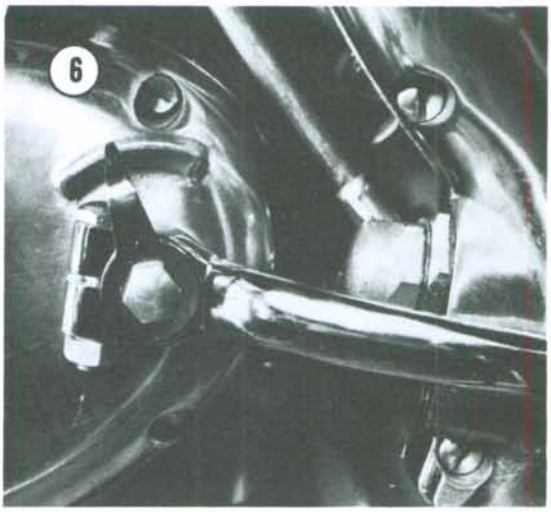


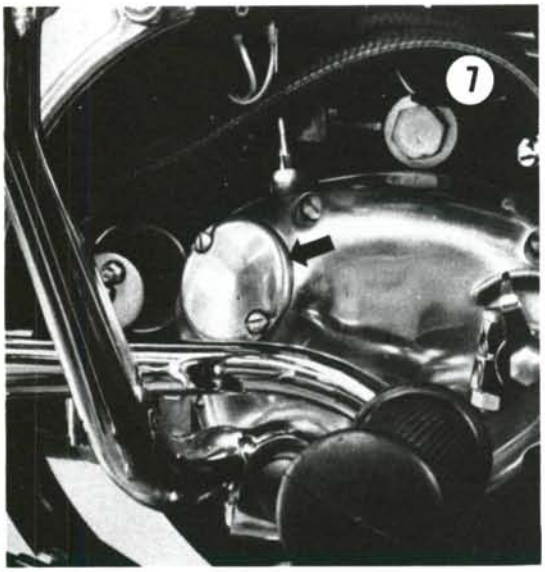
3. Unscrew the nuts and bolt from the right footrest (**Figure 4**) and remove it. Note the location of the red ground wire (**Figure 5**) so it can be installed in the same manner later.

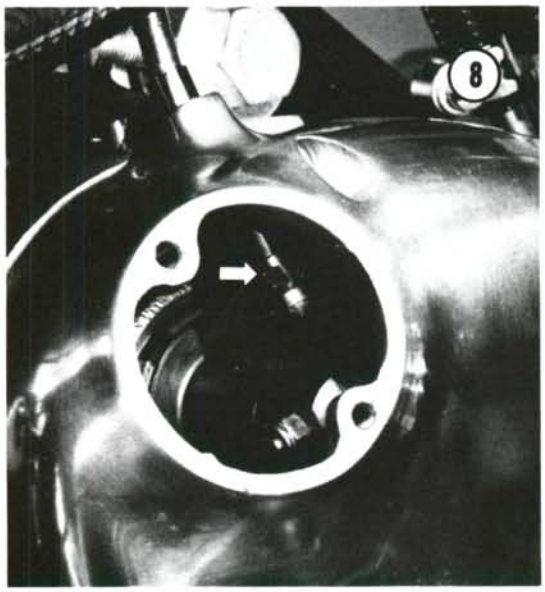
4. On right-foot selector models, remove the setscrew and washer from the gear selector indicator (**Figure 6**) and remove the indicator but not the gear selector pedal.

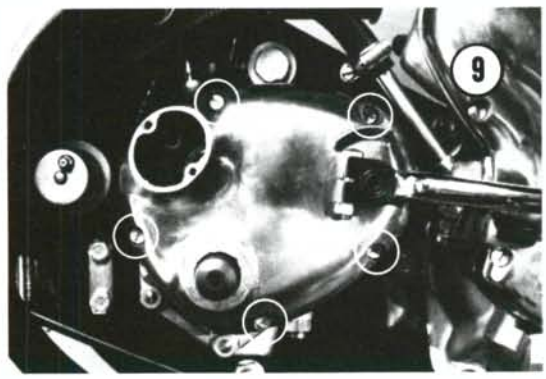
5. Remove the cover inspection cap and gasket (**Figure 7**) and disconnect the end of the clutch cable from the clutch fork (**Figure 8**).

6. Remove the 5 screws which hold the cover in place (**Figure 9**). Place the drip pan beneath the outer cover. Tap gently around the edge of the outer cover with a soft mallet and pull the cover



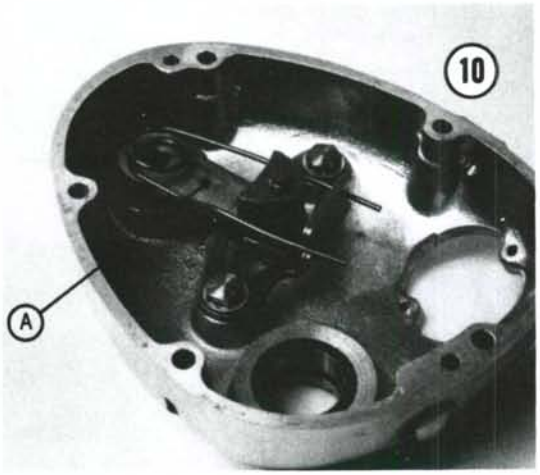






away from the transmission with the shift lever and off the starter and gear selector shafts.

7. On right-foot selector models, unscrew and remove the bolt from the gear selector pedal and remove the pedal from the shaft. Remove the pawl assembly and the ratchet plate from the cover (**Figure 10**). On left-foot selector models, remove the pawl assembly and ratchet from the inner cover.



A. Pawl assembly

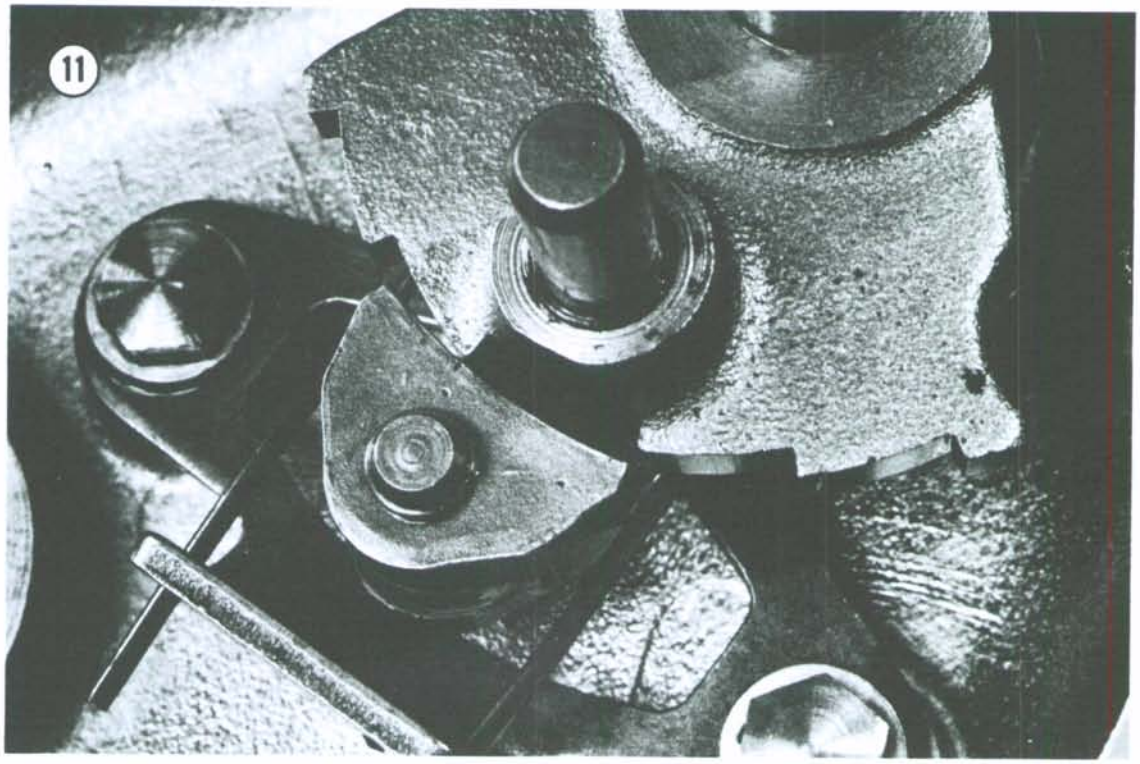
Inspection

1. Thoroughly clean and dry all parts. Check the O-rings and gaskets for damage and deterioration and replace them if necessary.

2. Check the teeth on the pawl (**Figure 11**) and the ratchet plate for wear. They should be even and sharp to ensure accurate engagement.

3. Install the kickstarter lever on its shaft and depress it part way to check the resiliency of the spring. The resistance of the spring should be firm and even, and when the lever is relaxed, the spring should hold it firmly against the stop.

4. Install the ratchet and pawl assembly in the outer cover (**Figure 12**) and fit the gear selector pedal onto its shaft. Alternately lift and depress the pedal and check the resiliency of the pawl spring by observing the movement of the pawl. With the pedal relaxed, the pawl should be centered with the arms of the spring not quite touching the ends of the pawl (**Figure 13**). As the pedal is lifted or depressed, the pawl should immediately begin to move toward engagement.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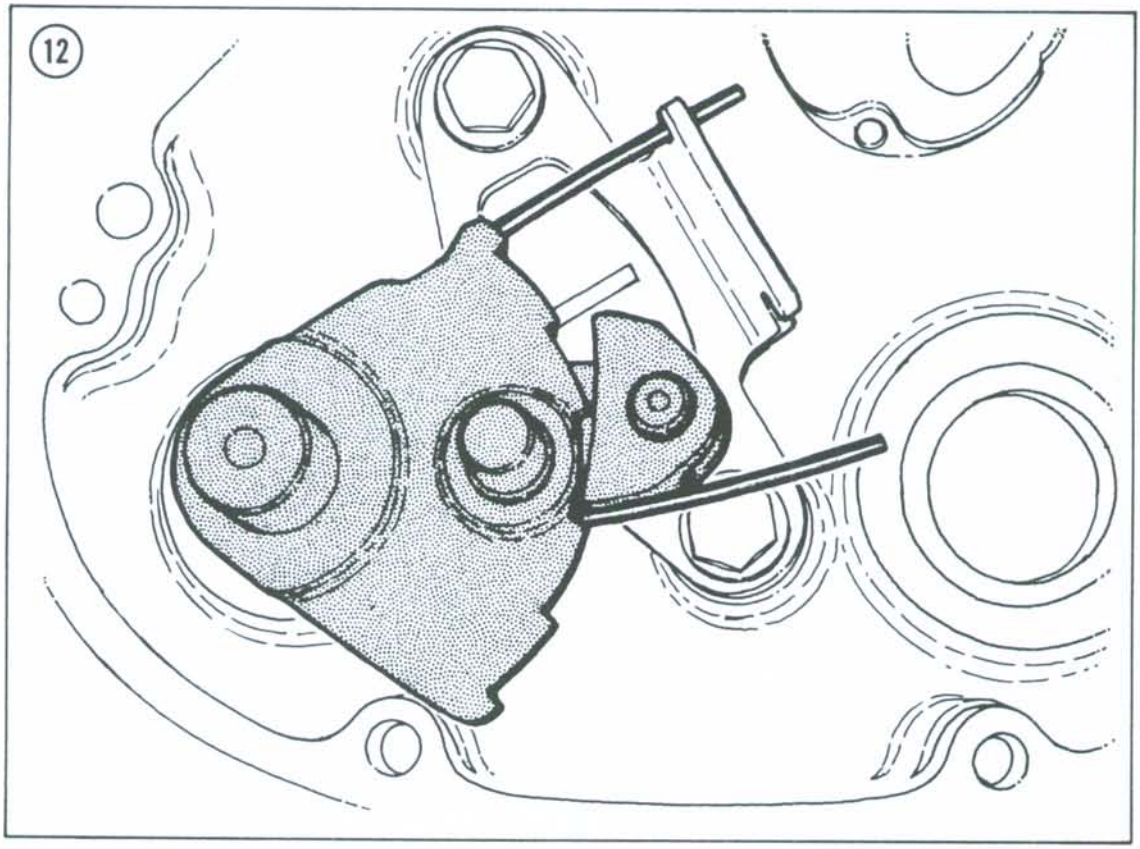
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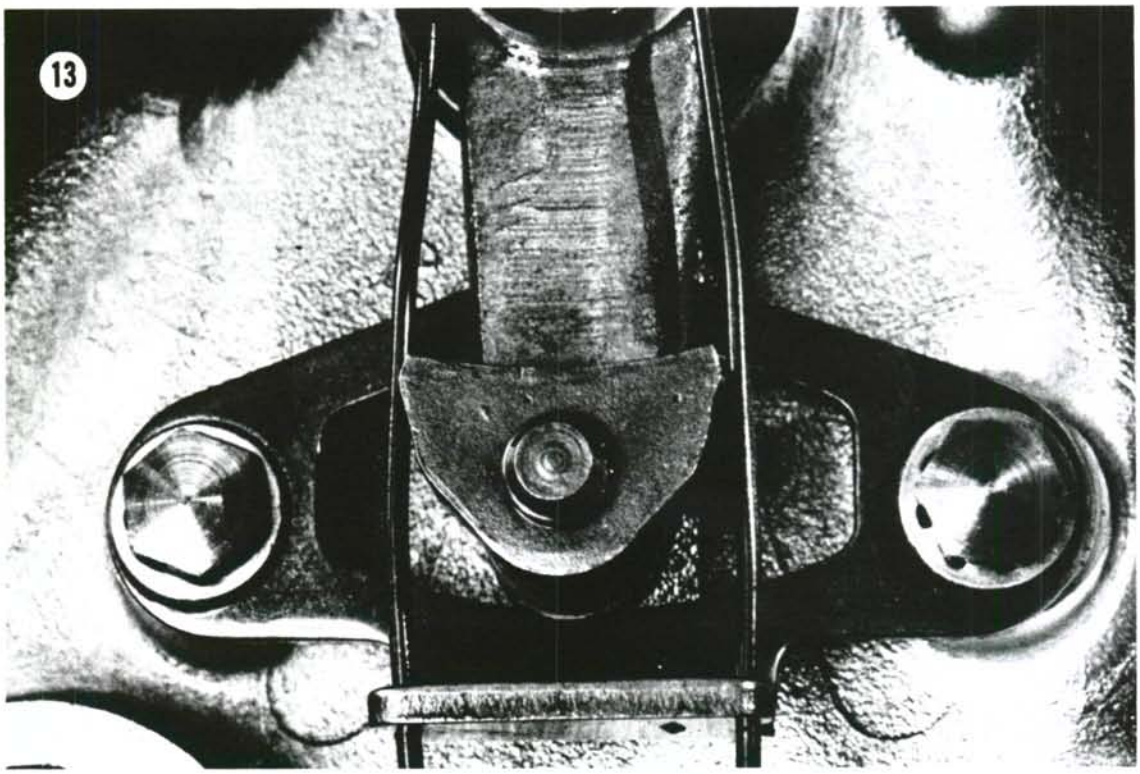
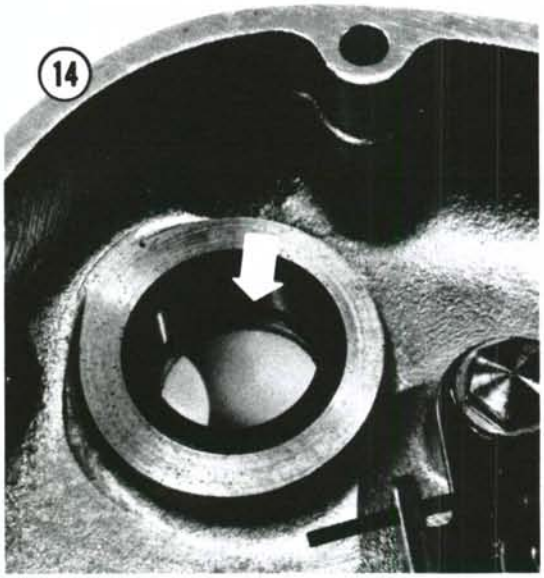


5. On 850 Mark III models, check the condition of the splines on the pawl assembly shaft for rust or damage. Light rust can be removed with a wire brush, after which the splines should be lightly coated with oil to inhibit further rust. Check the protector boot on the coupling sleeve for damage or deterioration and replace it if necessary.

6. Check the mating surfaces of the inner and outer covers for roughness and burrs. Minor damage can be removed by carefully dressing the surface with fine emery cloth. Remove any bit of gasket that may have remained attached when the gasket was removed.

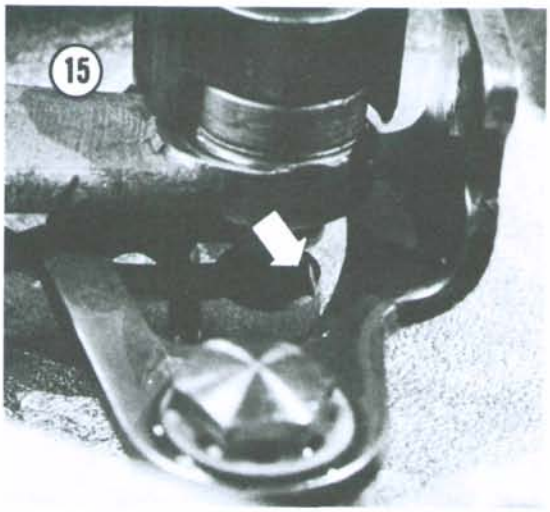


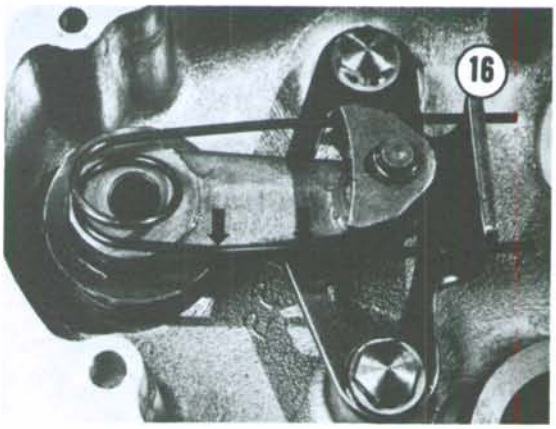
Installation

1. Install new O-rings (**Figure 14**) in the starter shaft and selector shaft bores in the outer cover, and in the groove on the ratchet shaft.

2. Put the spring washer and the return spring on the selector shaft. Make sure the ends of the spring straddle the arm on the pawl assembly (**Figure 15**). Install the shaft and pawl assembly in the cover. Install the stop plate, making sure the ends of the return spring straddle the tang on the inside of the stop plate (**Figure 16**). Then tighten the stop plate screws.

3. Install the pawl spring (**Figure 17**). The spring arm which has 2 bends must be on the bottom. Check to see that there is a very slight



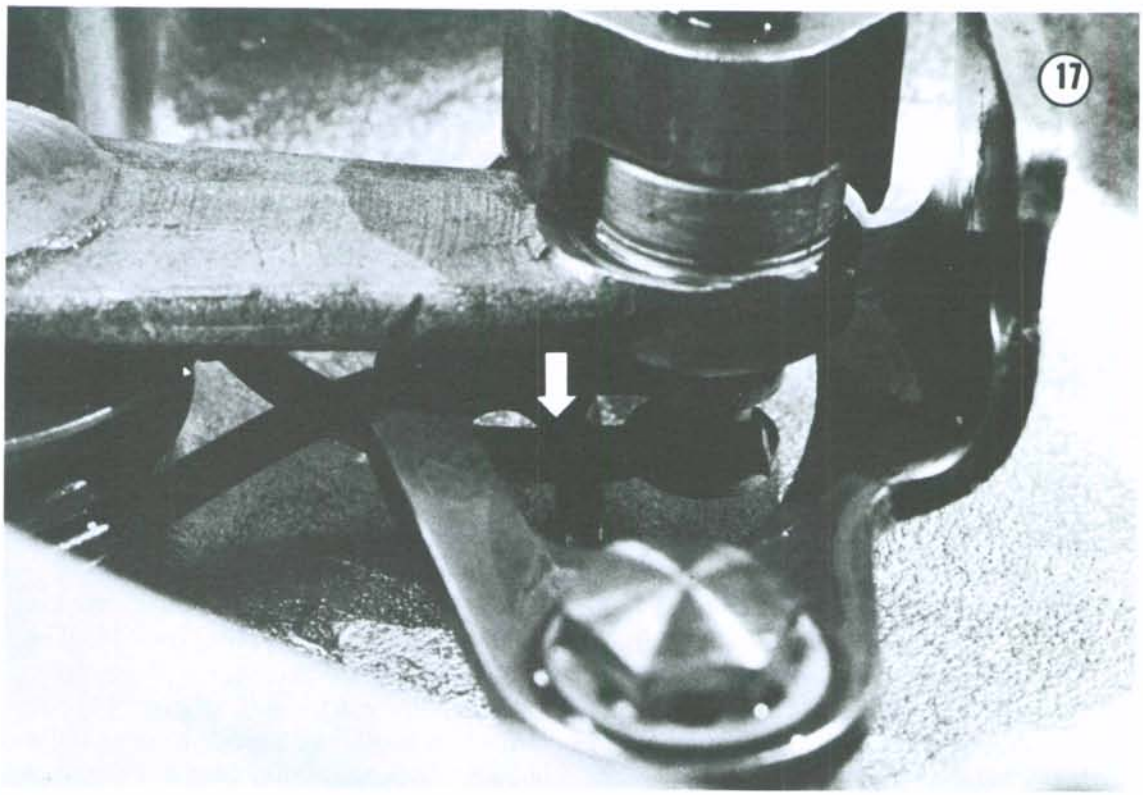


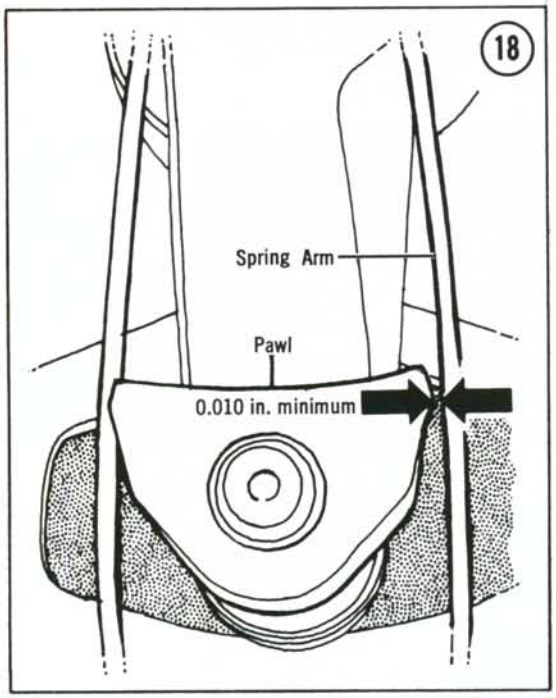
clearance (0.010 in. minimum) between the spring arms and the ends of the pawl (**Figure 18**).

4. Coat the mating surfaces of the inner and outer covers with gasket cement and set the gasket in place on the inner cover.

5. Line up the outer cover with the inner cover, making sure the coil of the pawl spring goes over the ratchet shaft. Be careful not to disturb the position of the pawl spring. Otherwise, it will rotate the pawl and disturb its alignment with the ratchet plate. Carefully push the outer cover all the way on. If there is hard resistance before the cover contacts the gasket, pull the cover away and check the alignment of the pawl spring and the pawl.

On left-foot selector models, also check the alignment of the splines on the pawl assembly shaft with the splines of the collar that connects it to the thru-shaft.





7. Install and tighten the transmission drain plug and fill the transmission with 0.9 pts.—U.S.; 0.75 pts. Imperial—U.K.; 420cc of oil. Connect the clutch cable to the fork and adjust the cable's free play. Install the inspection cover and gasket and check the cover mating surface and drain plug for leaks.

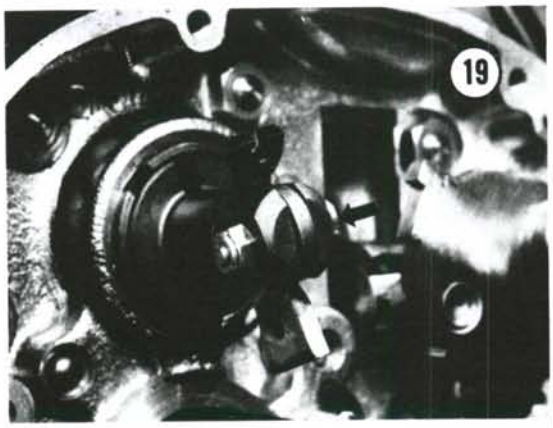
6. When the cover is in position, install the 5 screws and tighten them securely. Install the kickstarter lever and gear selector pedal on their shafts and check their operation. Slowly rotate the rear wheel and operate the gear selector pedal to engage each of the gears. If the operation is satisfactory, install the gear selector indicator.

INNER COVER

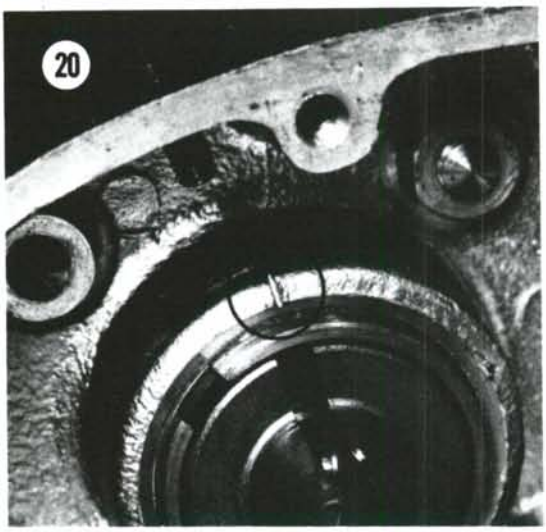
The inner cover functions as the right half of the transmission case in addition to housing the clutch operating mechanism and part of the gear selector mechanism.

Removal

1. Remove outer cover as described previously.
2. Unscrew the bolt which holds the clutch lever (**Figure 19**) in the clutch operating body and remove the lever.

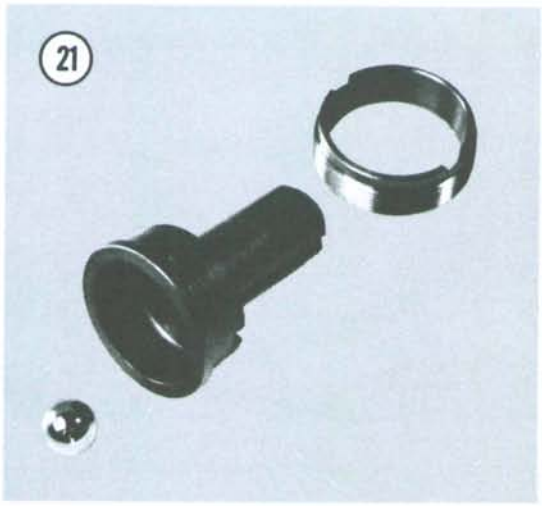


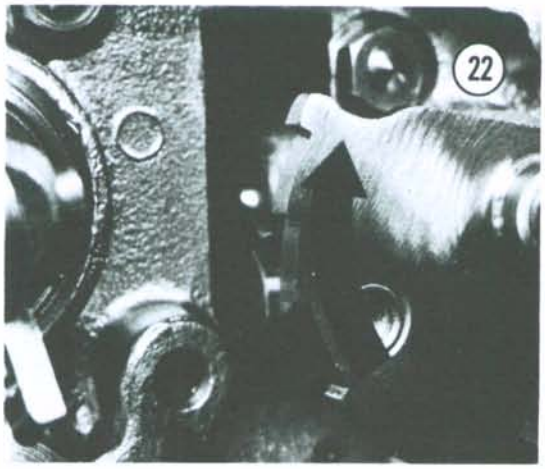
3. Mark the location of the clutch operating body with 2 punch or scribe marks (**Figure 20**) and unscrew the lock ring from the inner cover. Remove the clutch operating body and the ball (**Figure 21**).

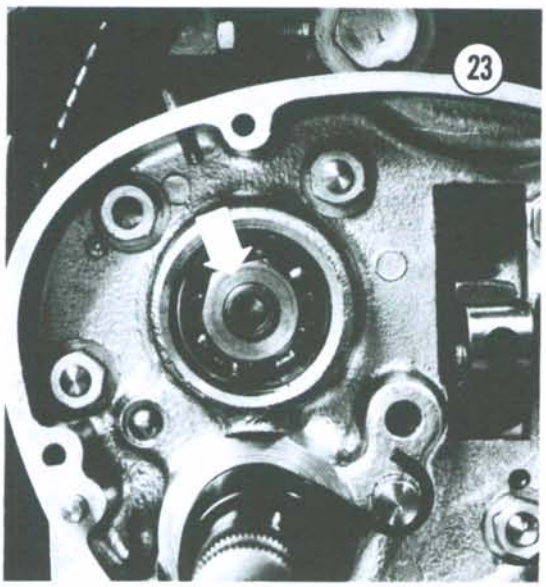


4. Shift the transmission into fourth gear by carefully prying the quadrant up (**Figure 22**) while slowly rotating the rear wheel. With assistance, apply the rear brake and unscrew the transmission main shaft nut (**Figure 23**). Release the brake, slowly rotate the wheel, and shift the transmission back into neutral by carefully prying the quadrant down.

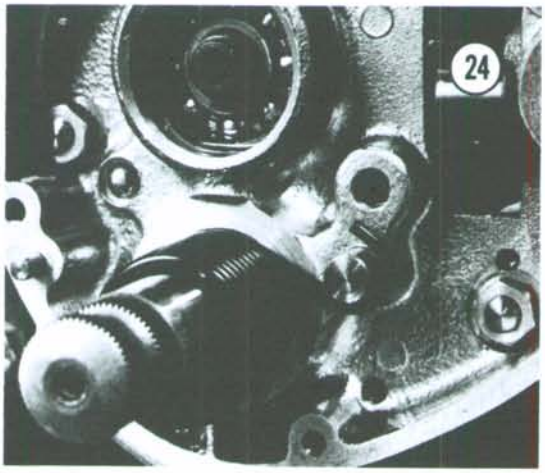
5. It is not necessary to remove the kickstarter assembly from the inner cover. However, if the kickstarter pawl is suspected of being damaged or worn (see *Inspection*), carefully pry the the inboard tang of the kickstarter spring off



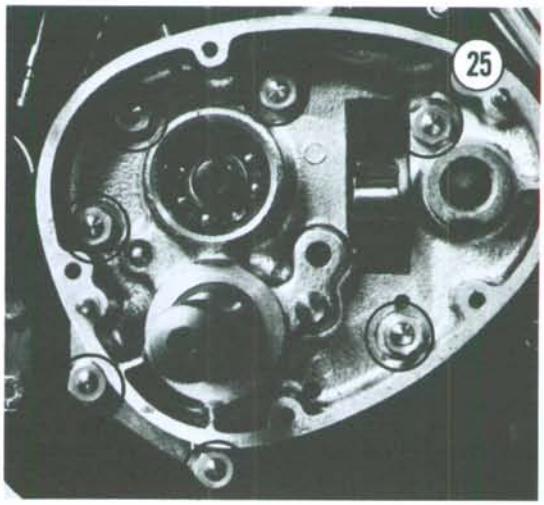




the post (**Figure 24**). Disengage the outboard tang from the hole in the starter shaft and remove the spring.



6. Unscrew 7 nuts which mount the inner cover to the transmission (**Figure 25**).

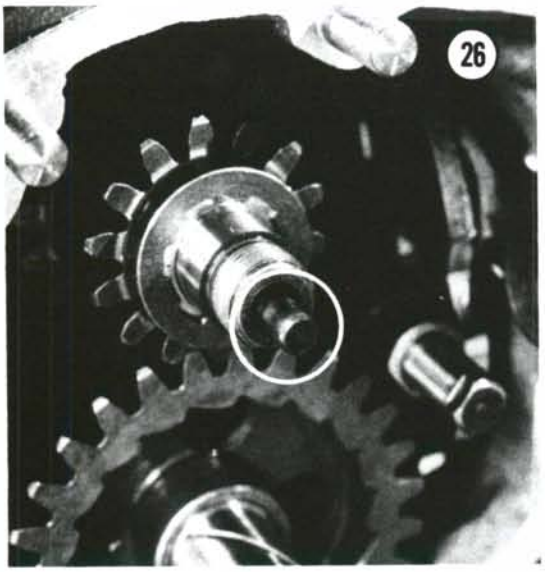


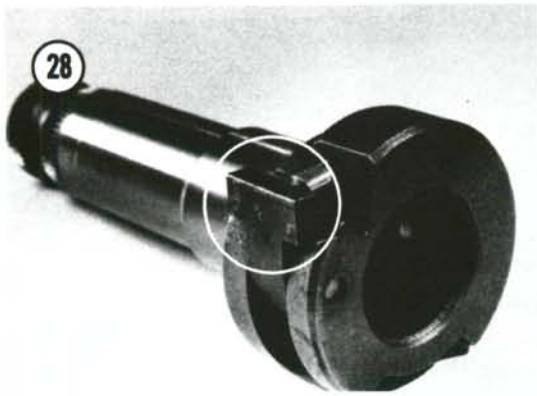
7. Tap gently around the edge of the inner cover with a soft mallet and pull the cover away from the transmission.

8. Withdraw the clutch operating rod from the transmission main shaft (**Figure 26**) and pull the starter shaft out of the cover (**Figure 27**).

Inspection

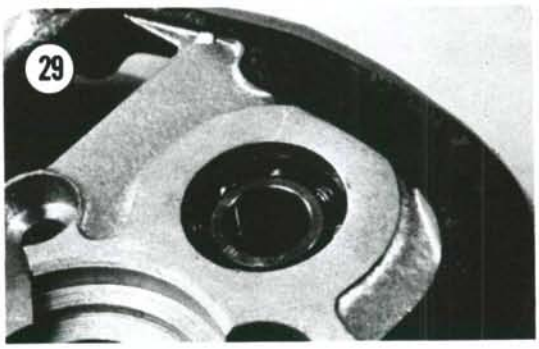
1. Thoroughly clean and dry all parts. Check the gasket for damage or deterioration and replace it if necessary.

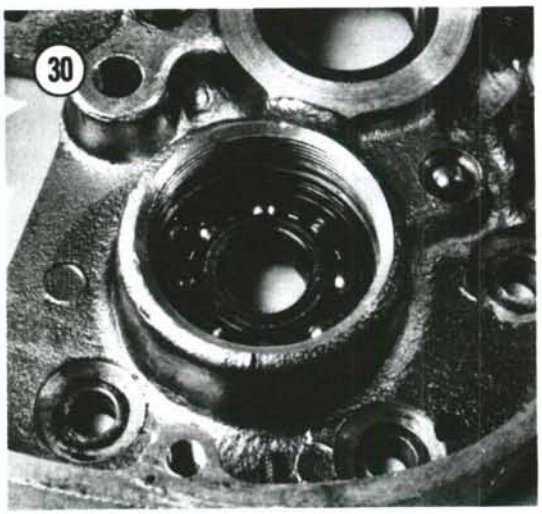




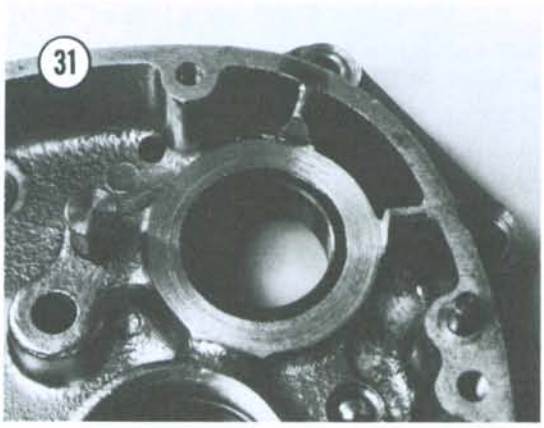
2. Check the kickstarter pawl (**Figure 28**) for wear. Also make sure it moves freely in its pivot and that the spring and plunger will hold it open.

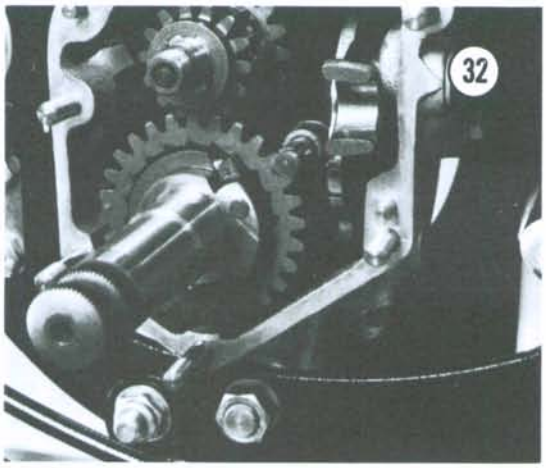
3. Rotate the main shaft bearing (**Figure 29**) by hand and feel for roughness and radial play. Any movement other than smooth rotation should be barely perceptible. If the bearing is found to be unserviceable, warm the case and dislodge the bearing by tapping the cover on a block of soft wood. Press in a new bearing while the case is still warm, until the bearing is fully seated in the bore (**Figure 30**).

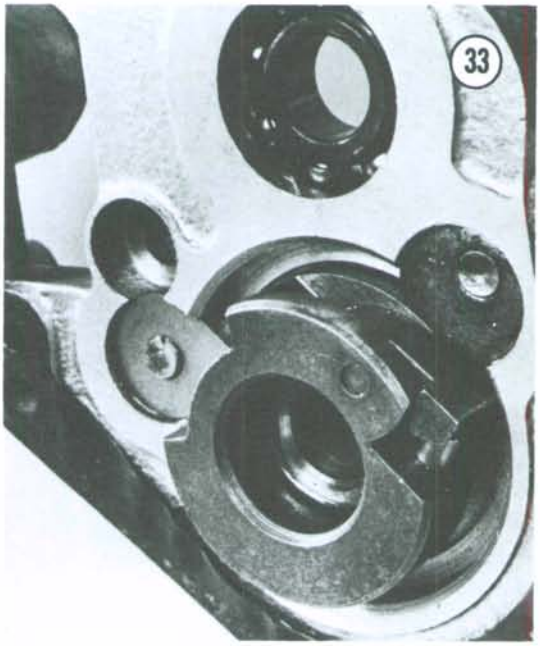


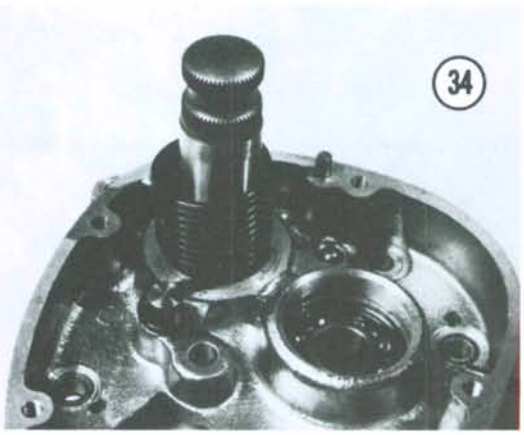


4. Check the starter shaft and layshaft bushings (**Figure 31**) for signs of wear and galling. Lightly oil the starter shaft bushing and install the shaft in the cover. Rotate the shaft and check to see that it turns smoothly and that there is only slightly perceptible radial movement. Check the layshaft bushing in the same manner, while installed in the end of the starter shaft, then while installed on the end of the layshaft (**Figure 32**). Check the bushing for the ratchet plate.









5. Examine the cover casting for cracks and fractures. If any are found, the casting must be replaced or repaired by a specialist familiar with repairing precision aluminum castings.

Installation

1. Install the kickstarter shaft and bushing in the case. Compress the pawl and rotate the shaft so that the pawl is held down by the stop (**Figure 33**). Fit the starter return spring on the shaft with the outboard tang in the hole in the shaft and the inboard tang over the post in the cover (**Figure 34**).

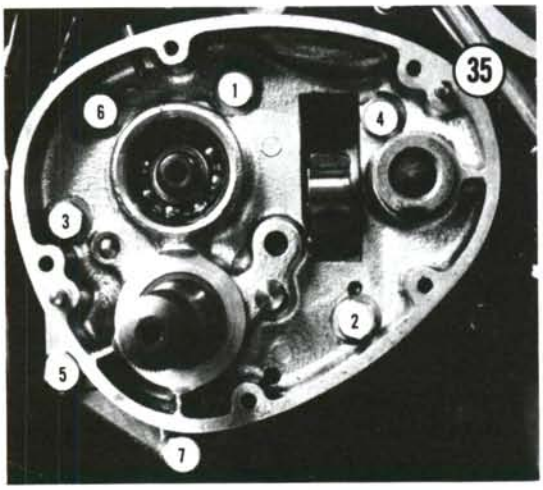
2. Fit the layshaft bushing into the end of the starter shaft.

3. Coat the mating surfaces of the transmission case and the inner cover with gasket cement and set the gasket in place on the transmission.

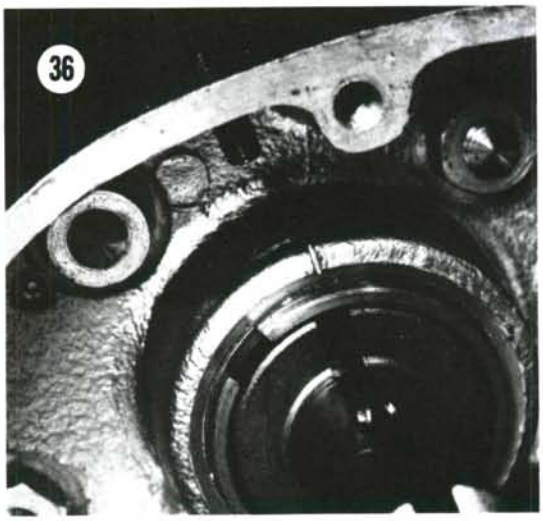
4. Check to make sure the main shaft and layshaft are completely seated in transmission case.

5. Line up the inner cover with the main shaft and the layshaft and push it into place. Screw on the 7 mounting nuts and tighten them in the pattern shown to 12 ft.-lb. (1.66 mkg). See **Figure 35**.

6. Shift the transmission into fourth gear by levering the ratchet plate carefully upward while slowly rotating the rear wheel. With assistance, apply the rear brake and tighten the transmission main shaft nut to 70 ft.-lb. (9.7 mkg). Then shift the transmission back into neutral.

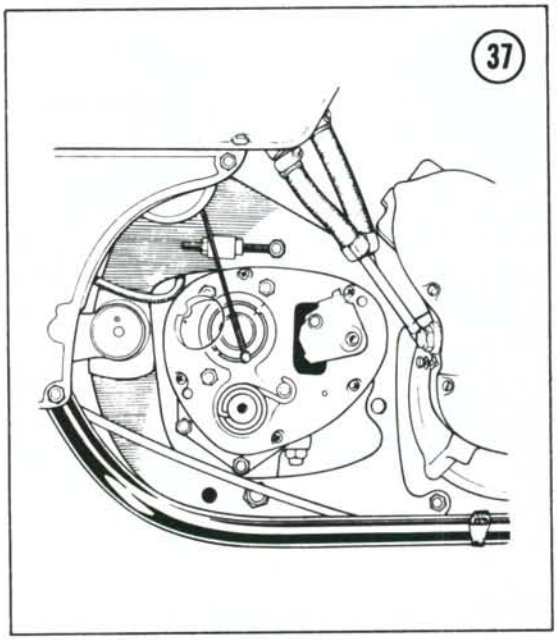


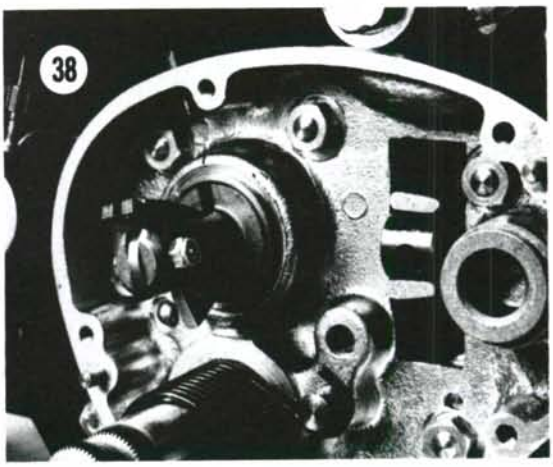
7. Assemble the clutch operating body, ball, and lock ring and install it in the cover. Line up the mark in the body with the mark in the cover (**Figure 36**) and tighten the lock ring until its notches line up with the marks. When the clutch operating body is correctly aligned, the cable and lever are in alignment so that a straight pull is applied to the lever (**Figure 37**).

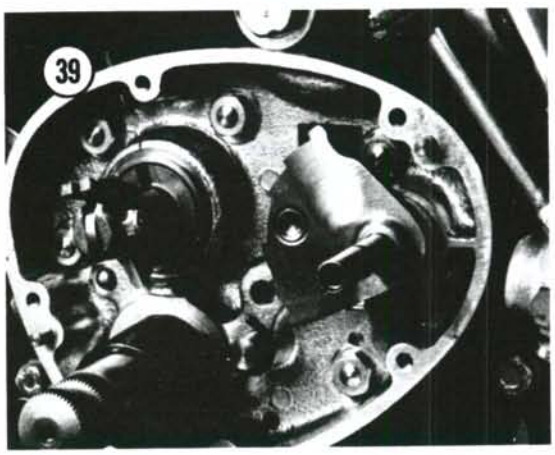


8. Install the clutch lever, roller, bushing, and bolt in the end of the clutch body and screw on and tighten the locknut (**Figure 38**).

9. Install the ratchet plate in the cover (**Figure 39**), making sure the peg in the plate engages the hole in the quadrant roller. Put the O-ring on the ratchet shaft and seat it in the groove.







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10. Install the outer cover referring to the procedure presented earlier.

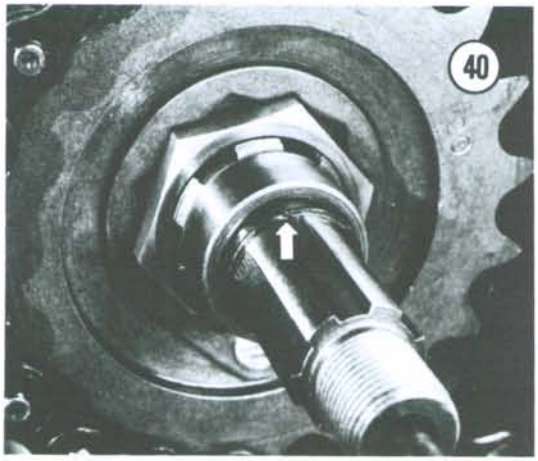
GEARSET AND HOUSING

The main transmission housing contains the gearset, shifting forks, camplate, and quadrant. Removal of the gearset from the housing requires that the inner and outer cover assemblies be removed and the primary drive and clutch be disassembled (see Chapter Four).

Removal

1. Remove the shims, spacer, and circlip from the left end of the main shaft (**Figure 40**).

NOTE: *Reuse of this circlip is not recommended.*

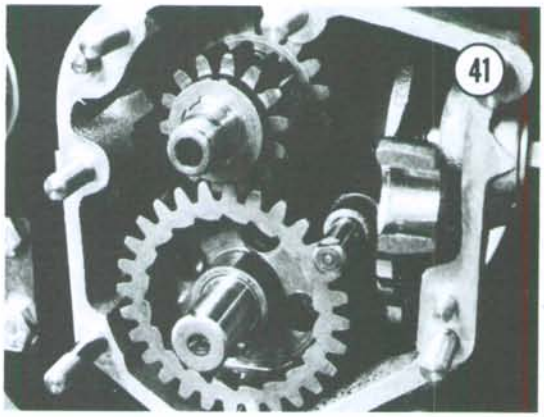


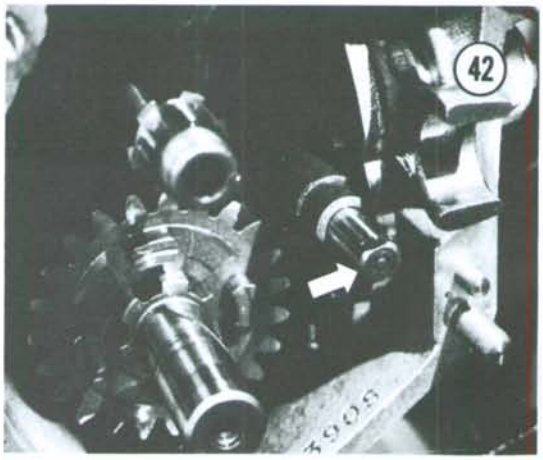
2. Remove the first gearset from the right ends of the main shaft and layshaft, along with the layshaft first gear bushing (**Figure 41**).

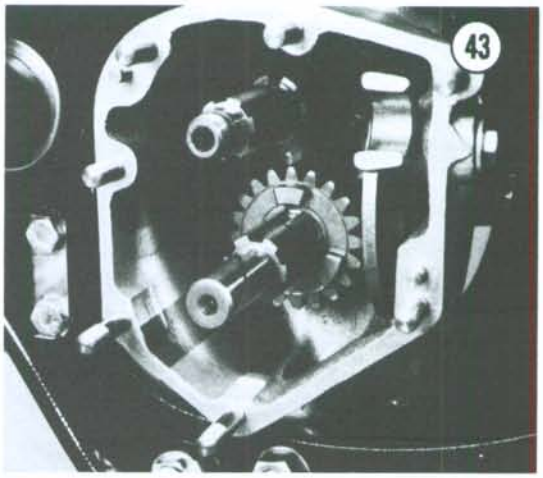
3. Unscrew the selector spindle (**Figure 42**) from the case and pull it out of the forks. Remove the forks from the gearset.

4. Pull the main shaft, with second and third gears (**Figure 43**), out of the case. Fourth gear will be held in the case by the countershaft sprocket and bearing. Remove the layshaft and gears. It may be necessary to warm the case in the area of the countershaft left-end bearing and remove the bearing with the shaft.

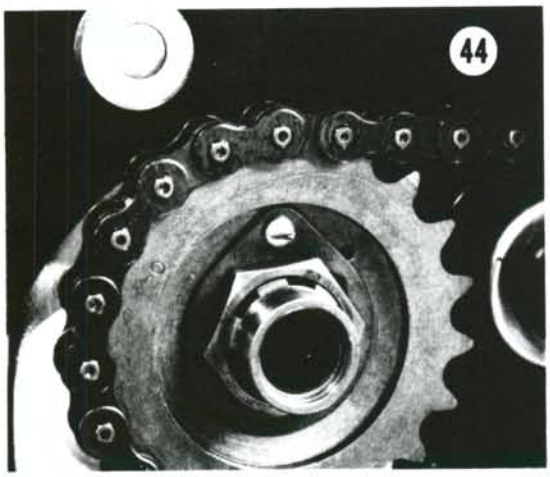
5. Unscrew the setscrew from the countershaft nut lock plate (**Figure 44**) and remove the plate. Install the left footrest and brake lever assembly

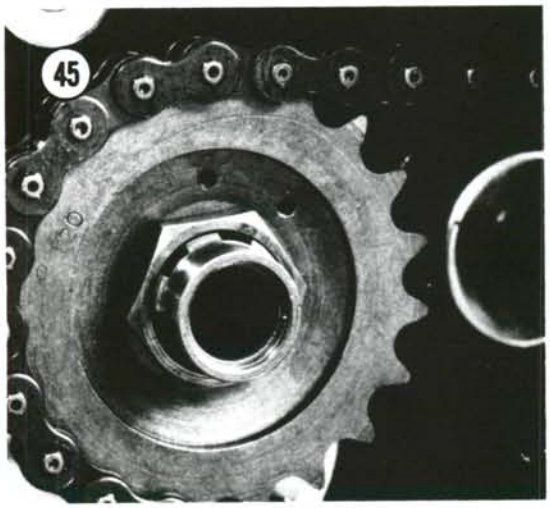






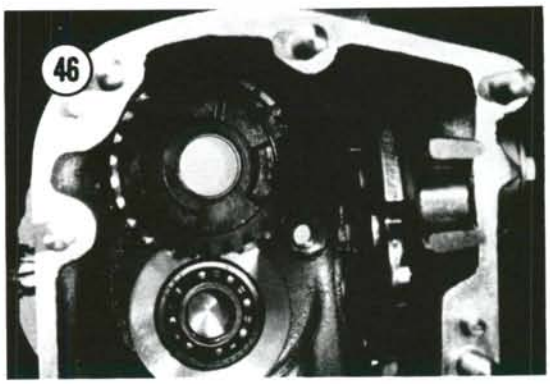
and tighten the nuts finger-tight. Apply the rear brake and unscrew the left-hand thread countershaft nut (**Figure 45**). Disconnect the rear chain and remove the sprocket from the shaft. Tap

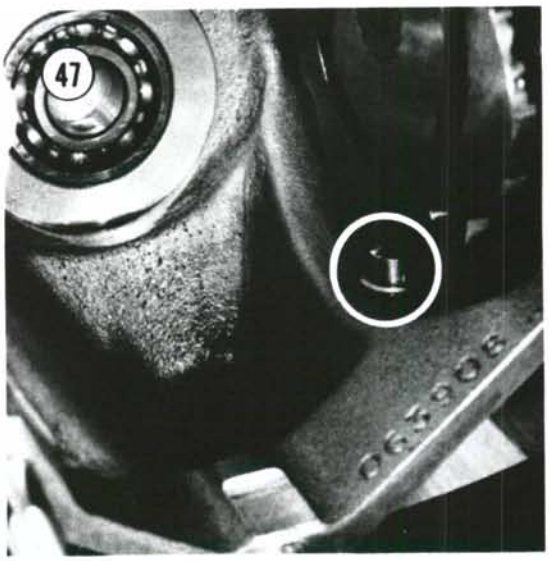




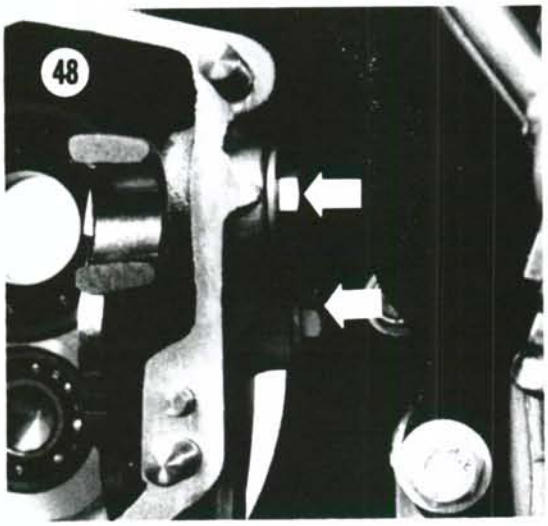
the fourth sleeve gear (**Figure 46**) carefully into the case with a soft mallet.

6. Unscrew the detent bolt from the bottom of the case and remove the camplate detent plunger and spring (**Figure 47**).





7. Unscrew the 2 bolts which hold the camplate and quadrant in the case (**Figure 48**). Remove camplate and quadrant and the 2 O-ring seals.



8. Remove the spacer from the countershaft seal (**Figure 49**) and carefully pry the seal out of the case.

9. Warm the case in the area of the main shaft left-end bearing and remove the bearing with an expanding type bearing puller. If a puller is not available, the bearing may be removed by tapping very gently on a soft drift inserted through the left side of the case. If the bearing does not release easily, don't force it; excessive pressure

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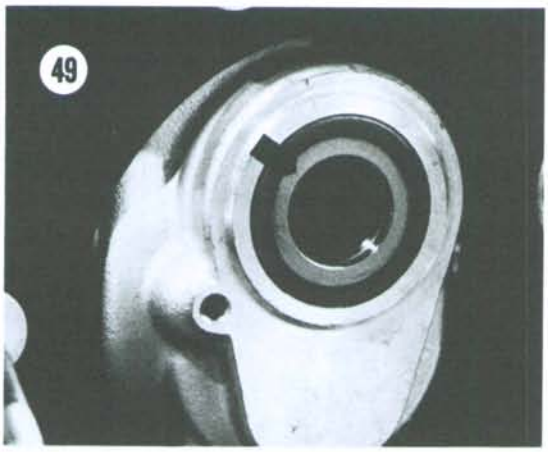
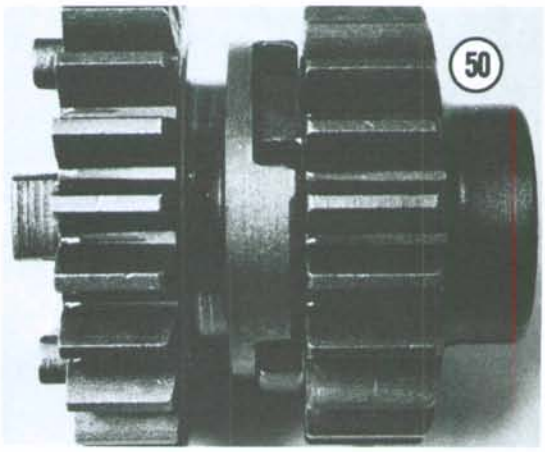
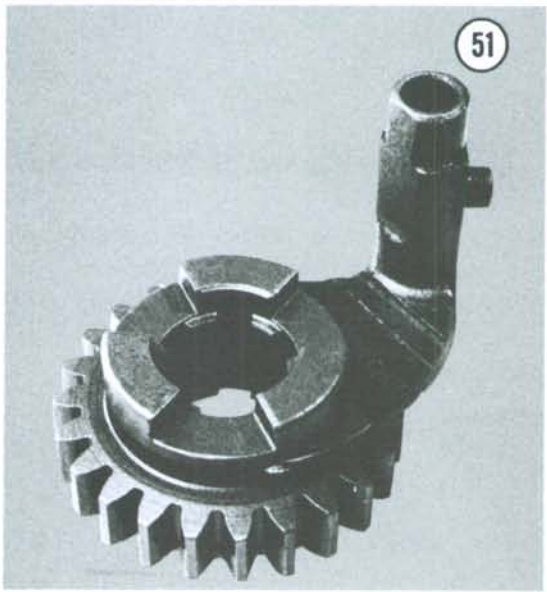




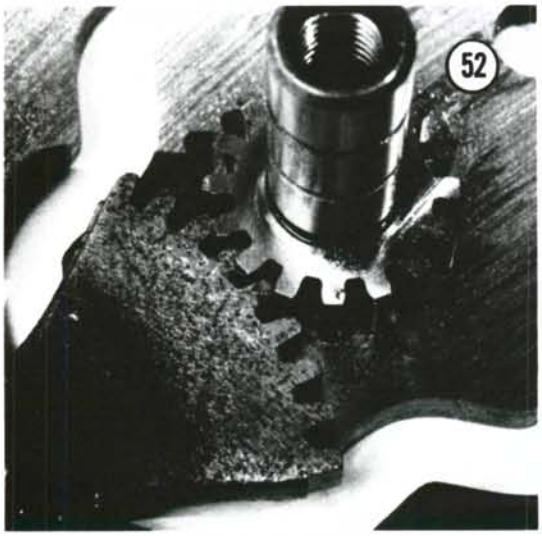
on the bearing will damage it. In such case, it's better to inspect the bearing installed in the case and remove it only if it's found to be defective.

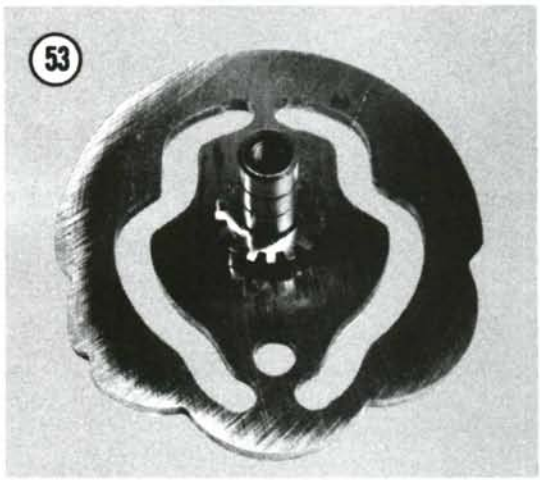
Inspection

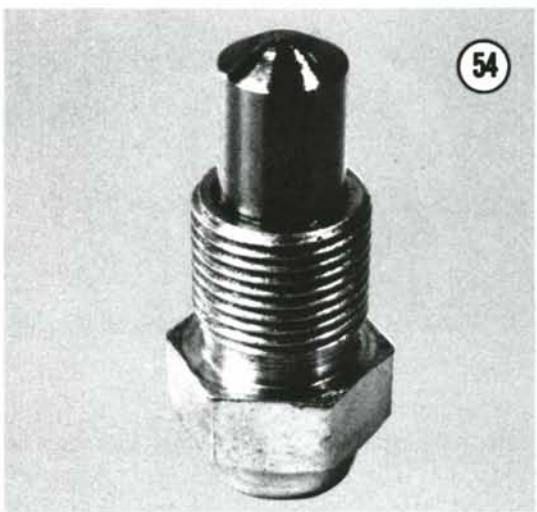
1. Thoroughly clean and dry all the components as well as the inside of the transmission case.
2. Rotate the bearings by hand and feel for roughness and radial and axial play between the inner and outer races. The bearings should turn smoothly and play should be barely perceptible.
3. Check both shafts for wear and damage to the splines, threads, and bearing surfaces.
4. Check each gear for chipped or worn teeth. Some bright burnishings of the contact area of the gear teeth is normal, but deep scores or chips indicate an unsatisfactory gear. It's recommended that both gears in a set (layshaft and main shaft) be replaced if one of the gears is unsatisfactory; while wear or damage on the mating gear may not be as apparent, its condition could be such that it won't permit a new gear to wear in correctly.
5. Check the engagement dogs (**Figure 50**) for excessive rounding or chipping. Check internally splined gears for wear and damage to the splines.
6. Examine the gear bushings for signs of wear or damage and check their serviceability by installing them on the shaft with their gears and attempt to rock the gear from side to side. Any appreciable rocking movement is an indication that the bushing should be replaced. Check the condition of the camplate and quadrant bushings in a similar manner, by installing the bushings and camplate and quadrant in the case and checking for rocking movement.
7. Check each selector fork in the groove of its appropriate gear by rotating the gear and feeling for roughness or sticking (**Figure 51**). Minor roughness on the fork or in the groove can be removed with fine emery cloth but excessive wear or damage is an indication that the fork or gear or both should be replaced.



8. Check the condition of the teeth in the quadrant and on the camplate for roughness, chipping, or wear (**Figure 52**). Check the camplate tracks and the detent profile (**Figure 53**) and the detent plunger (**Figure 54**) for wear and galling.



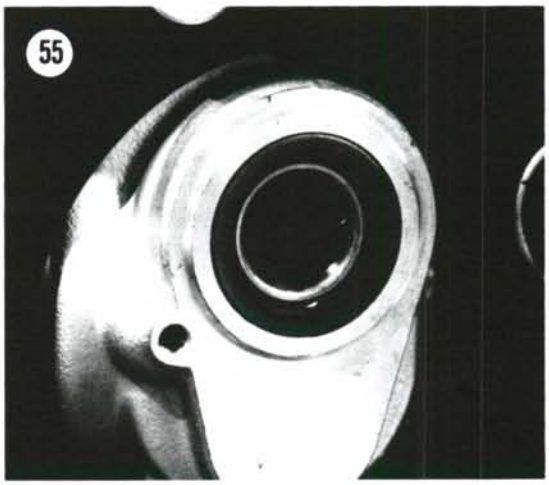




Assembly

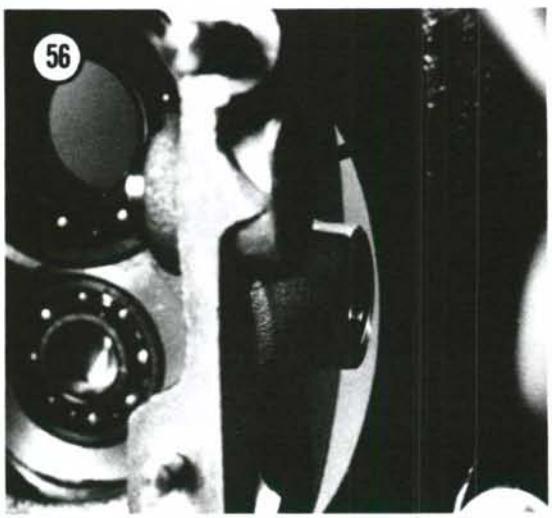
1. Warm the transmission case in the area of the left-end bearings and press them into the case until they contact shoulders in bearing bores.

2. Allow the case to cool; then line up the countershaft seal squarely with the bore, with the lip seal facing inward, and press the seal in evenly until it is flush with the case (**Figure 55**).

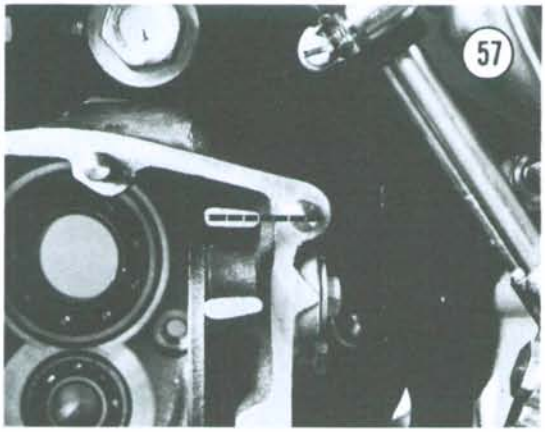


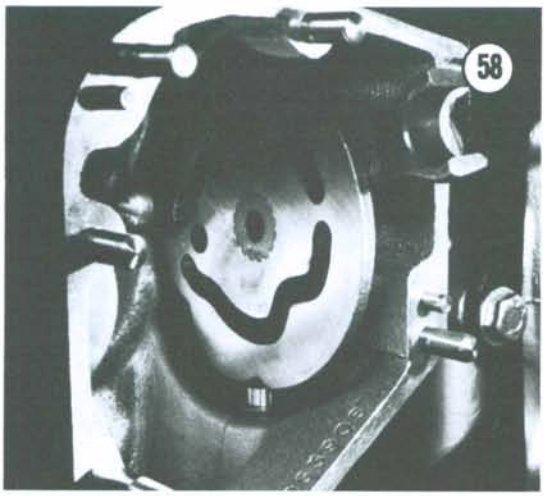
3. Assemble the detent plunger, spring, and acorn bolt and install them in the bottom of the case. Turn the bolt in only a couple of turns.

4. Install the quadrant in the case. Make sure the bushing is in place and that the O-ring seal is installed in the outside end of the boss (**Figure 56**) and is covered by the washer. Tighten the bolt securely.

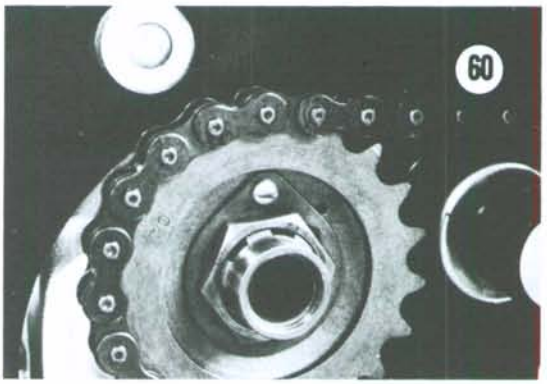


5. Line up the upper edge of the quadrant arm with the top front case stud (**Figure 57**) and install the camplate with its teeth engaged with the teeth on the quadrant with the camplate positioned as shown (**Figure 58**). The notched edge of the camplate must face the left side of the transmission and the plunger should index the bottom notch. Make sure the camplate bushing is in place in the boss in the case and install the O-ring seal, washer, and bolt. Tighten the camplate bolt securely, then tighten the acorn detent bolt in the bottom of the case.



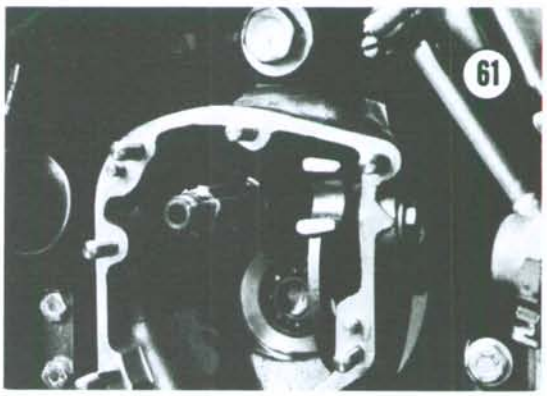


6. Install the main shaft fourth gear in the case and install the spacer on the shaft on the seal side, inside the seal bore (**Figure 59**). Fit the countershaft sprocket to the shaft and reconnect the rear chain. Screw on the countershaft sprocket nut (left-hand thread), apply the rear brake, and tighten the nut securely. Install the lockwasher and screw (**Figure 60**).

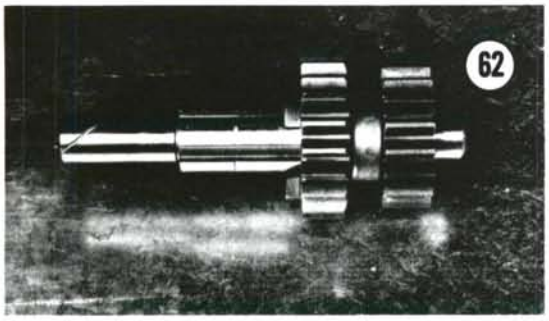


7. Fit main shaft into fourth gear (**Figure 61**).

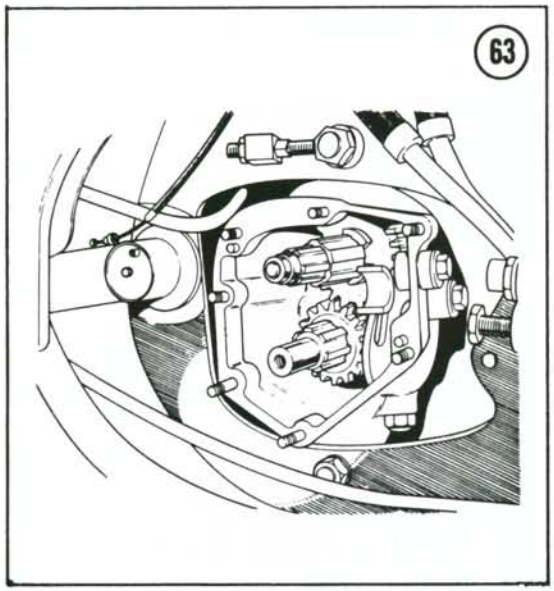
Install a *new* circlip on the clutch end of the main shaft (Figure 40). Make sure it is completely seated in the groove.



8. Assemble the layshaft, third and fourth gears, and the third gear bushing, as shown in **Figure 62**. The dogs on third gear must face outward, and the flat side of fourth gear must



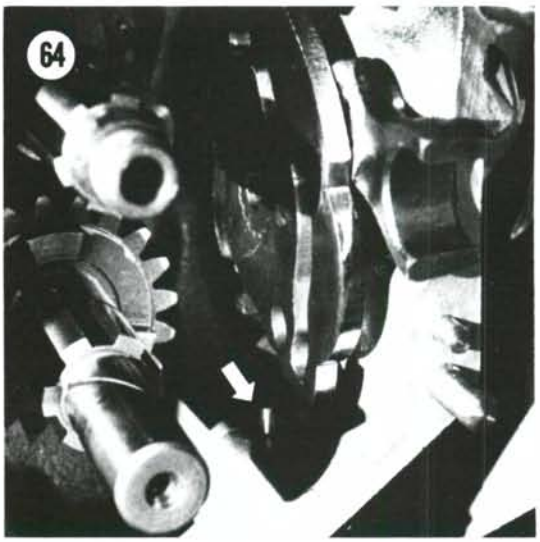
face third gear. Install the layshaft in the bearing in the case (**Figure 63**).

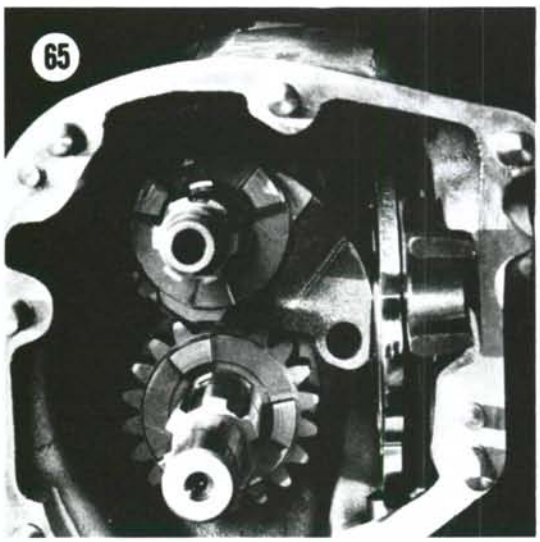


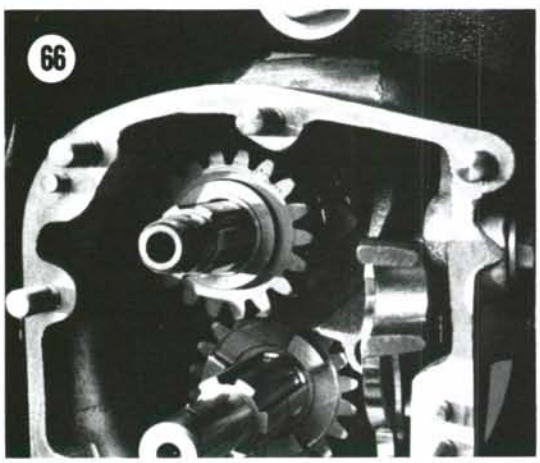
9. Rotate the camplate 2 notches counterclockwise (viewed from the rear). See **Figure 64**. Fit the main shaft shifting fork to third gear with the fork grooves facing outward and install the gear on the main shaft while engaging the inside cam track with the pin on the fork (**Figure 65**). Install the main shaft second gear and bushing on the main shaft with the shifting dogs facing inward (**Figure 66**).

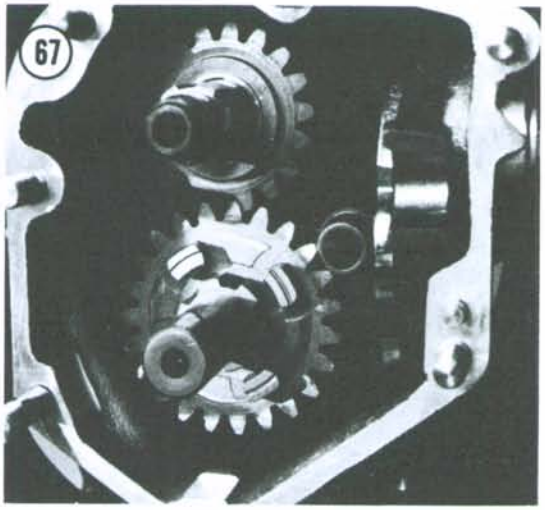
10. Fit the layshaft selector fork to second gear with the fork groove facing inward and install the gear on the layshaft while engaging the outside cam track with the pin on the fork (**Figure 67**).

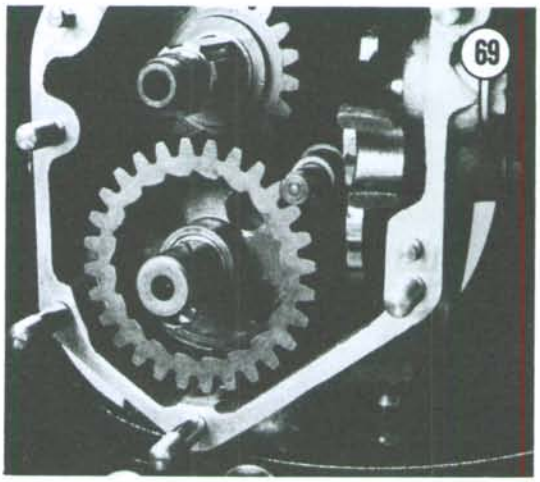
11. Install the fork pivot pin through the forks, threaded end first, and screw it into the case (**Figure 68**).

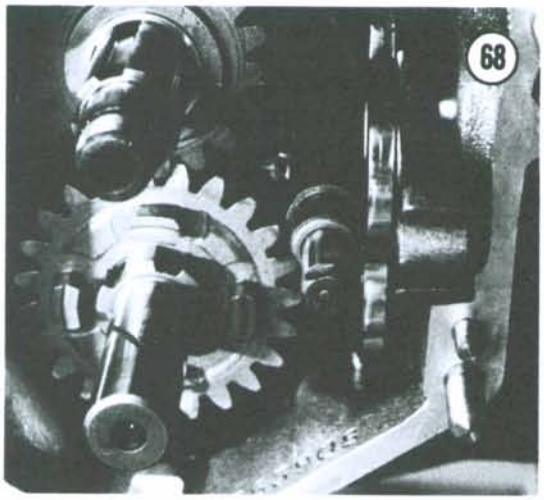


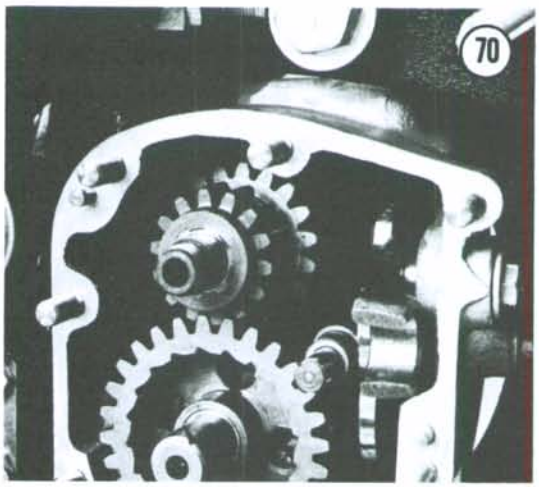


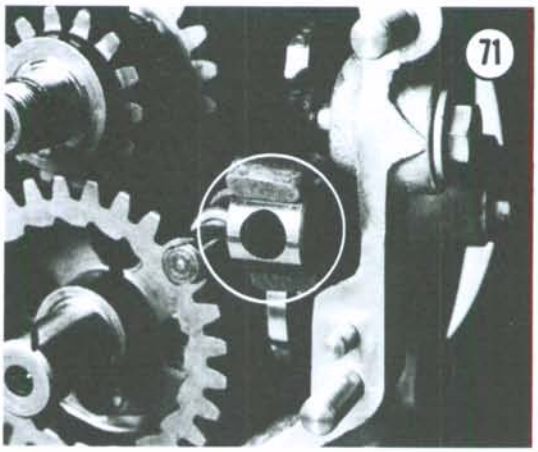












12. Install the bushing and first gear on the layshaft (**Figure 69**). Then install the first gear on the main shaft with the shoulder on the gear facing outward (**Figure 70**).

13. Apply a dab of grease to the quadrant roller and set it in place in the end of the quadrant with the hole in the roller positioned horizontal (**Figure 71**).

14. Refer to the earlier instructions in this chapter and install the inner and outer transmission covers. Refer to Chapter Four and install the clutch and primary drive.

CHAPTER SIX

FUEL SYSTEM

The fuel system consists of the fuel tank, air cleaners, and carburetors.

CARBURETORS

Amal concentric float bowl carburetors are used on late model Norton twins. The carburetor is shown in exploded view in **Figure 1**. On some earlier models, such as the Atlas, Amal monobloc carburetors are used. This carburetor is shown in **Figure 2**. Twin carburetor models are fitted with a right-hand and a left-hand carburetor. The chief difference between the right and left units is that the float "ticklers," the throttle stop screws, and air pilot screws are located on the outboard side of each carburetor. If a carburetor is to be replaced, be sure to specify either right or left when ordering.

Basic Principles

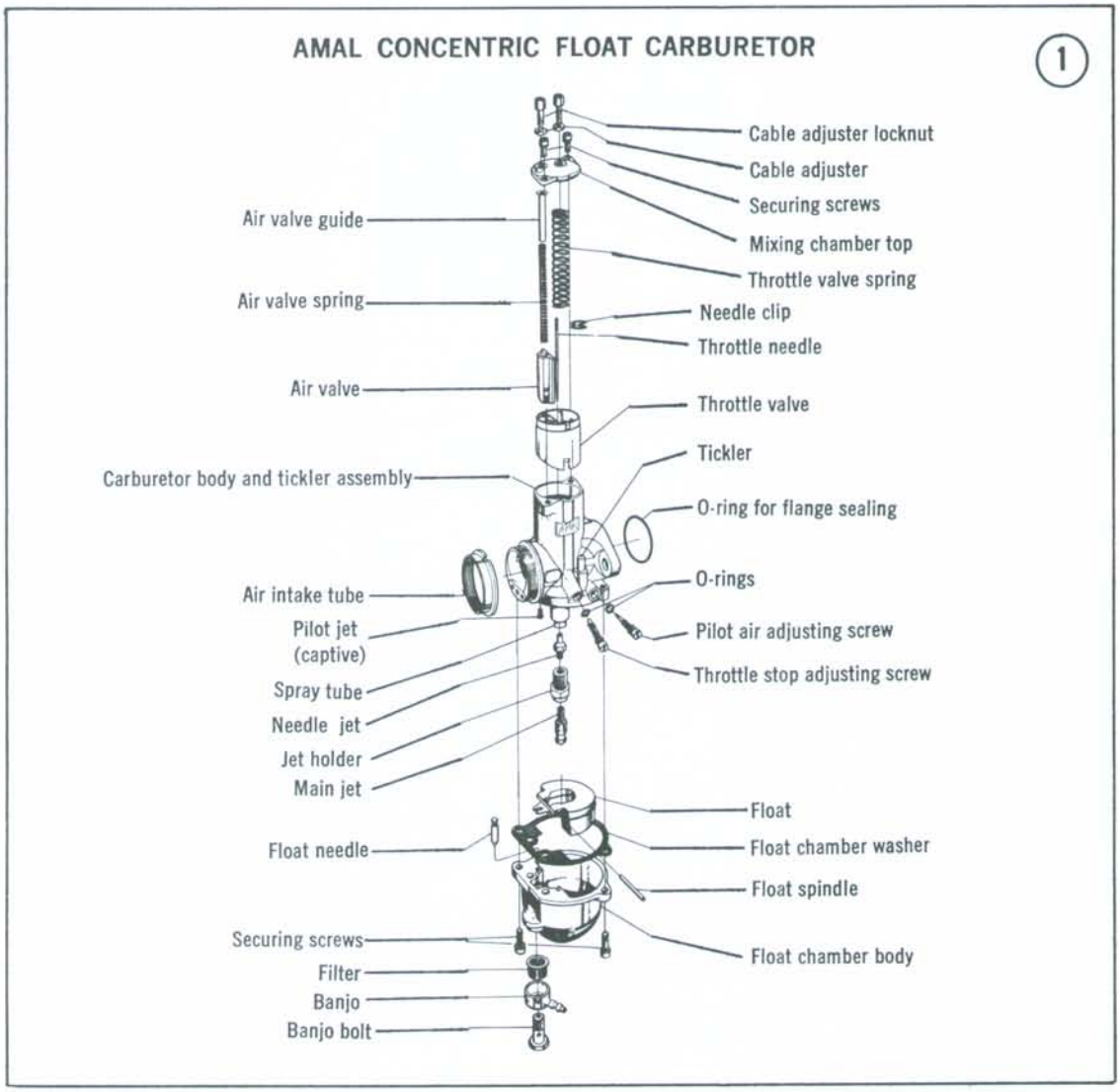
An understanding of the function of each of the carburetor components and their relationship to one another is a valuable aid for pinpointing a source of carburetor trouble.

The carburetor's purpose is to supply and atomize fuel and mix it in correct proportions with air that is drawn in through the air intake. At the primary throttle opening—at idle—a small amount of fuel is siphoned through the pilot jet by the incoming air. As the throttle is opened further, the air stream begins to siphon fuel through the main jet and needle jet. The tapered needle increases the effective flow capacity of the needle jet as it is lifted with the air slide in that it occupies decreasingly less of the area of the jet. In addition, the amount of cutaway in the leading edge of the throttle slide aids in controlling the fuel/air mixture during partial throttle openings.

At full throttle, the carburetor venturi is fully open and the needle is lifted far enough to permit the main jet to flow at full capacity.

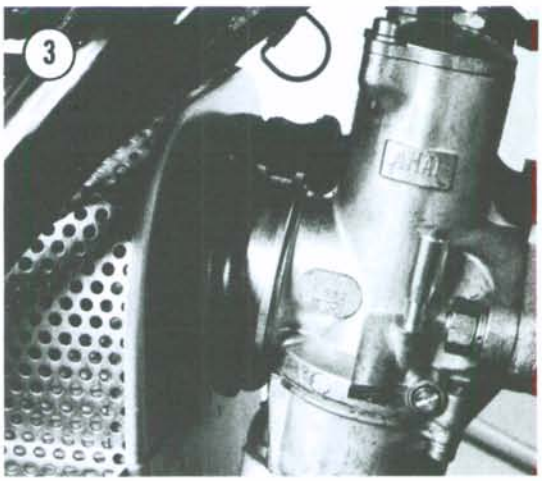
Service

The carburetor service recommended at 10,000-mile intervals involves routine removal, disassembly, cleaning, and inspection. Alterations in jet size, throttle slide cutaway, changes in needle position, etc., should be attempted only if you're experienced in this type of "tuning" work; a bad guess could result in costly engine damage and at the very least poor performance. If after servicing the carburetors and making the adjustments described in Chapter Two, the motorcycle does not perform correctly (and assuming that other factors affecting performance are correct, such as ignition timing and condition, valve adjustment, etc.), the motorcycle should be checked by a Norton dealer or a qualified performance tuning specialist.



Removal

1. Close both fuel taps and disconnect the lines. Refer to Chapter Four and remove the fuel tank.
2. Disconnect the inlet bellows from the carburetor inlets (**Figure 3**).
3. Remove the Allen screws which hold the manifolds to the cylinder head (**Figure 4**) and remove the carburetors from the motorcycle.
4. Remove the screws from the carburetor tops and pull out the slides (**Figure 5**).

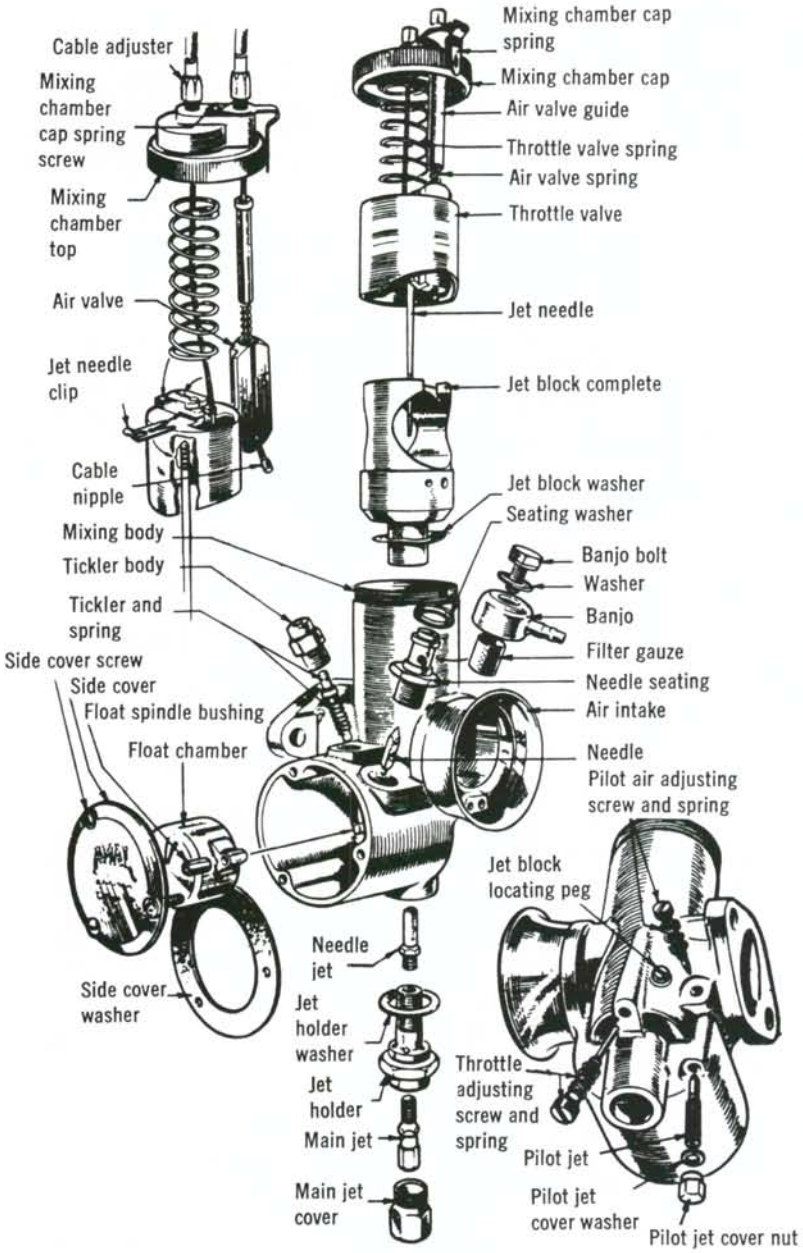


Disassembly

1. Disconnect the balance pipe from the carburetors (**Figure 6**).

(2)

AMAL MONOBLOC CARBURETOR



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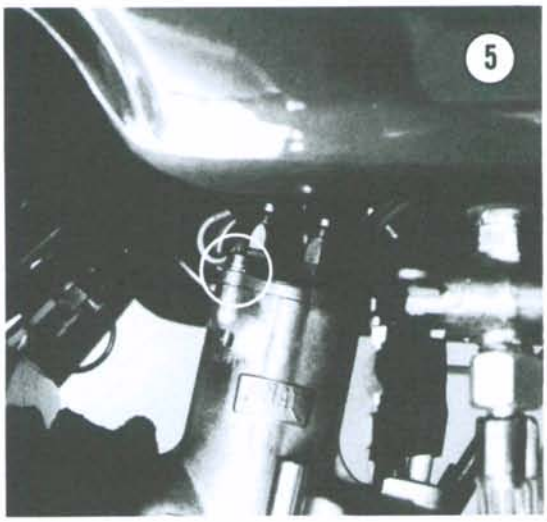
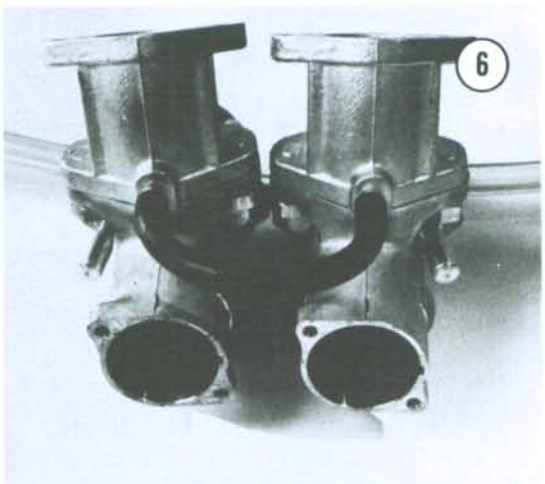
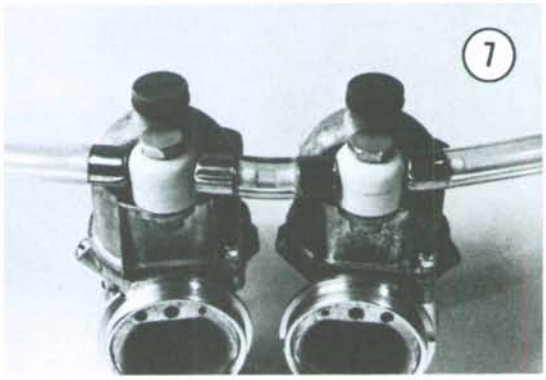


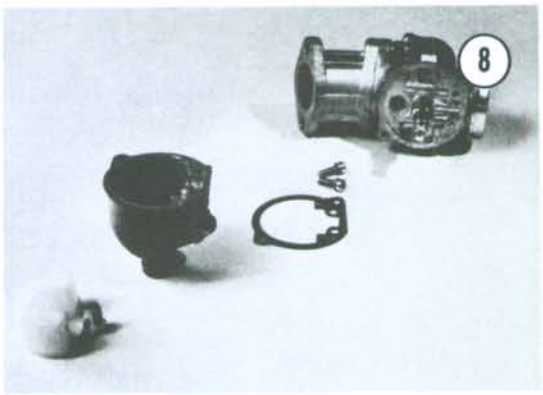


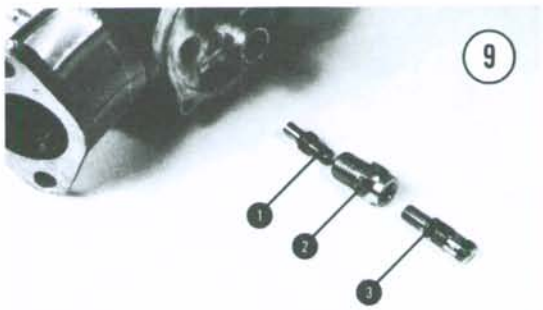
2. Unscrew the fuel banjo nut from the bottom of each carburetor and remove the banjo and the filter screen (**Figure 7**).



3. Remove the 2 screws which hold the float bowl to the carburetor and remove the bowl, float, float needle, and gasket (**Figure 8**).

4. Remove main jet and needle jet (**Figure 9**).



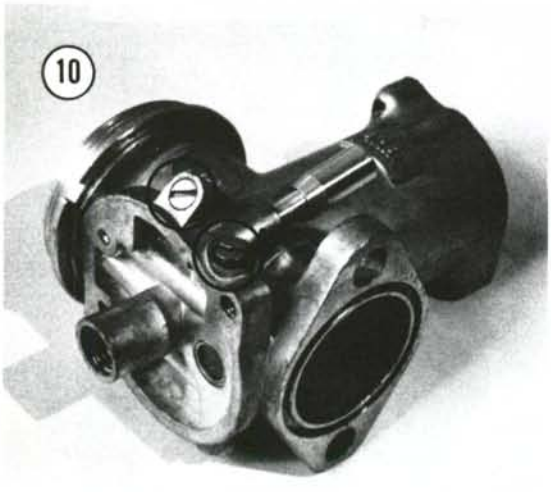


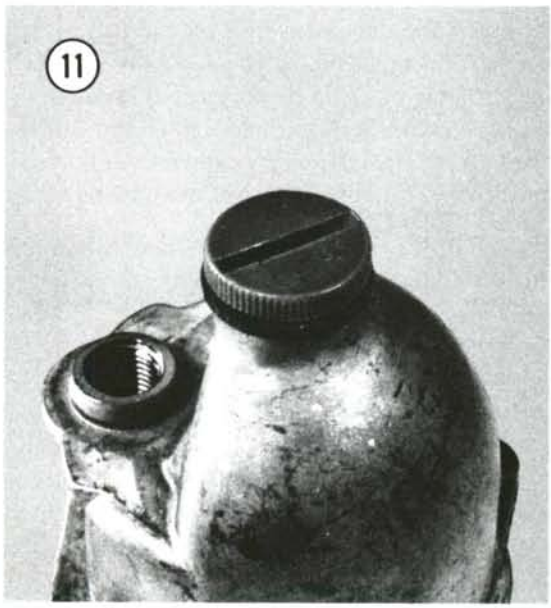
1. Needle jet 2. Jet block 3. Main jet

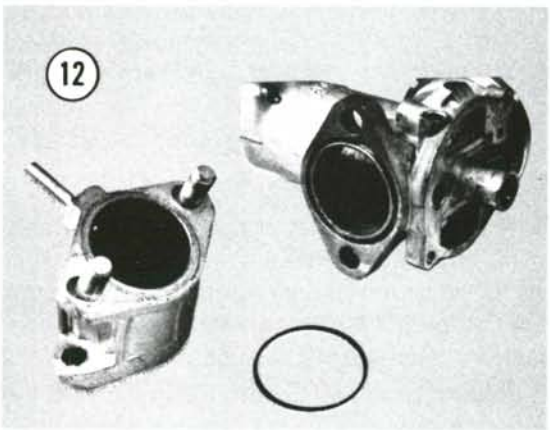
5. Unscrew the air pilot screw and the throttle stop screw (**Figure 10**).

6. Unscrew the drain plug from the bottom of the float bowl (**Figure 11**).

7. Disconnect the carburetor from the manifold pipe and remove the O-ring (**Figure 12**).







Cleaning and Inspection

1. The carburetors should be cleaned by submersing all their metal parts in a cleaner that's specially compounded for carburetors and other fuel system components. This type of cleaner is available under several brand names through automotive supply stores. In one-gallon sizes it frequently includes a handy dip basket for holding the parts while they are soaking. The parts should remain in the cleaner for at least 5 minutes. Solvent may also be used to clean the carburetors, but it is not effective for dissolving the residues that form as gasoline evaporates.

CAUTION

Don't clean the non-metal parts in a carburetor cleaning solution; it's harmful to such things as rubber O-rings, fiber gaskets, and the nylon float and needle.

2. Remove the carburetor parts from the cleaning solution and rinse them with water or solvent. Dry all of the parts thoroughly with a clean rag and blow out all the jets and the passages in the carburetor body with compressed air.

3. Check the floats for leakage by holding them up to a bright light to see if there is gasoline in them.

4. Check the tapered end of the float needle for grooves, scores, or pits which would prevent it from shutting off the fuel flowing through the needle valve.

5. Check each of the jets for blockage and any damage that might alter the size of the flow area. Don't use wire to clean blockage from the jets, but instead blow them out with compressed air.

6. Check the throttle slide for wear and scoring. Minor surface imperfections can be removed with fine emery cloth but if the slide is deeply scored or severely worn it should be replaced.

7. Check the slide bore in the carburetor body for wear or damage. Wear on the slide is often accompanied by similar wear in the bore. Also check the jet seats for damaged threads.

8. Check the throttle needle to make sure it is straight and that the taper is not worn.

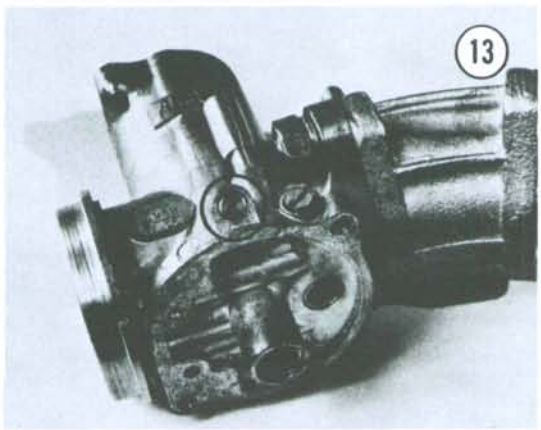
9. Check the taper of the pilot air screw for wear and grooving.

Reassembly

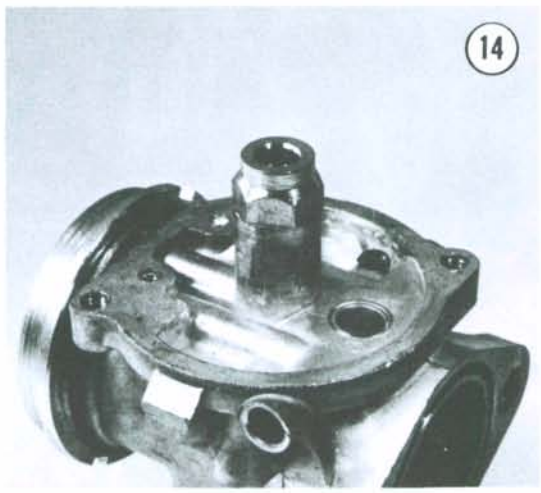
If possible, the O-rings, fiber washers, and float bowl gasket should be replaced each time the carburetors receive major service. If any of these pieces are damaged or have deteriorated it's essential that they be discarded and replaced with new pieces.

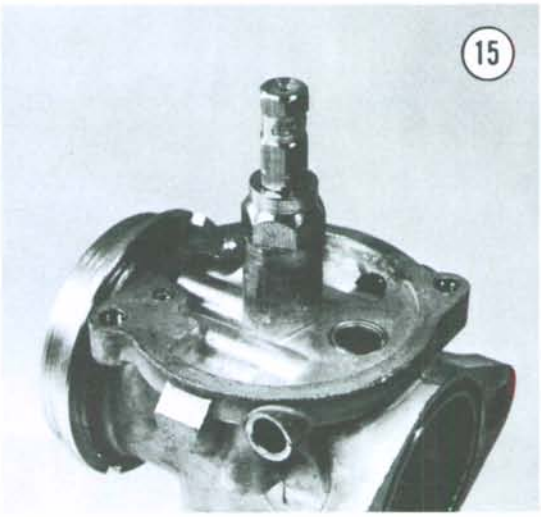
1. Screw the pilot air screw in all the way and then back it out 1½ turns. Make certain its friction O-ring is in place.

2. Screw in the throttle stop screw until the head protrudes about 1/16 in. (**Figure 13**).



3. Screw the needle jet into the jet holder and screw the holder into the carburetor body (**Figure 14**). Screw the main jet into the holder (**Figure 15**). The jets should be tight but care must be taken not to strip the threads.

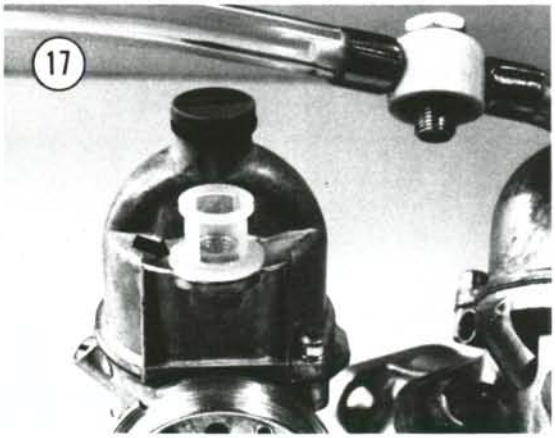




4. Invert the float bowl and set the float, float needle, and pivot pin in place (**Figure 16**). Set the gasket in place on the flange and install it on the carburetor. Screw in and tighten the 2 float bowl screws. Install a fiber washer on drain plug and screw it into the bottom of the float bowl.

5. Set the fuel strainer in the banjo fitting and install it on the bottom of the carburetor with the flange on the strainer against the carburetor body (**Figure 17**). Put a fiber washer on the banjo bolt and screw it in tight.

6. Reinstall the carburetors on the engine by reversing the steps in the removal procedure.



Before installing the Allen screws which mount the manifolds to the cylinder head, thoroughly clean the screw threads and apply a few drops of Loctite to them.

Assemble the needles and slides, making sure each needle clip is in the same groove from which it was removed. Install the slide assemblies in the carburetors, taking care to line up the needles with the needle jets and the vertical grooves in the slide bores with the lug at the top of the slide. Reinstall the fuel tank and reconnect the lines. Adjust the carburetors as described in Chapter Two.

AIR FILTER

Service of the air filter element is described in Chapter Two.

FUEL TANK

Removal/Installation

1. Shut off fuel taps.
2. Disconnect fuel lines.
3. Remove the fuel tank. On Commando tanks, the front of the tank mounts on 2 studs beneath the tank and is held by 2 self-locking nuts. The rear mount on some models uses a rubber loop which passes beneath the top frame tube. Others are held in place with a metal cross bar.
4. Installation is the reverse of these steps.

CHAPTER SEVEN

IGNITION AND ELECTRICAL SYSTEMS

The Norton Commando ignition system is a battery-coil type system with a centrifugally controlled automatic advance contact breaker for spark timing control. The 1972 and later models are fitted with two 6-volt coils which are isolated from the 12-volt portion of the electrical system by a ballast resistor.

The Norton Atlas and G15 CS models use a Lucas K2F magneto mounted behind the cylinders and driven by a chain connected to the camshaft drive idler in the timing side case. Routine service of this unit is covered at the end of the chapter.

The charging-lighting system in all Norton 750/850 twins uses an alternator (AC generator). A rectifier changes alternating current to direct current to charge the battery and power the lights. The charge rate to the battery is controlled by a zener diode.

IGNITION

Primary electrical power is supplied to the ignition through the battery and charging circuits. The advance mechanism and contact breaker cam are driven off the camshaft sprocket on the right of the engine. The firing point occurs at 28° BTDC (fully advanced).

CONTACT BREAKER

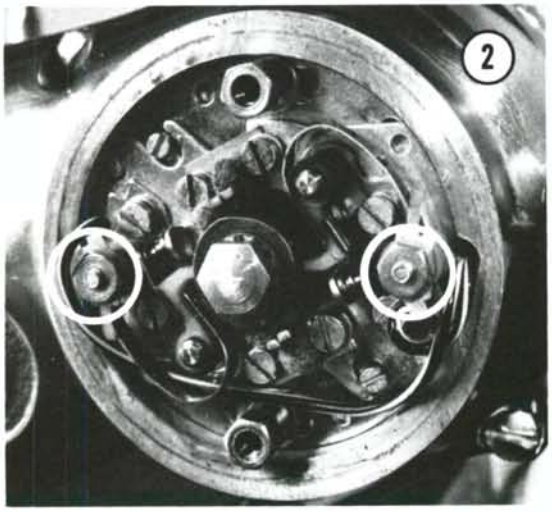
Two similar contact breaker assemblies are used on Norton Commandos. On both types, the contact set for each cylinder can be set independent of the other set. Different adjustment procedures are used for each type. Both types should be checked every 5,000 miles for contact condition and point gap.

The Lucas 6 CA breaker assembly is fitted to models prior to 1973. There is a single lock screw for each contact set and the fixed contact plate is moved with an eccentric adjuster. On 1973 and later models, a 10 CA breaker assembly is used which has 2 lock screws for each point set but no eccentric adjuster screws; during adjustment, the plates must be moved with a screwdriver tip.

Removal

1. Remove the ignition cover plate (**Figure 1**).
2. Unscrew the nuts from the spring anchor

posts and remove the terminals and movable contact, along with the insulating bushing and washer (**Figure 2**).

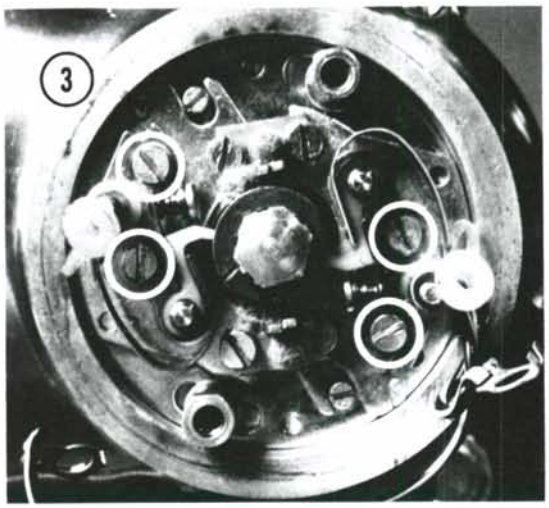


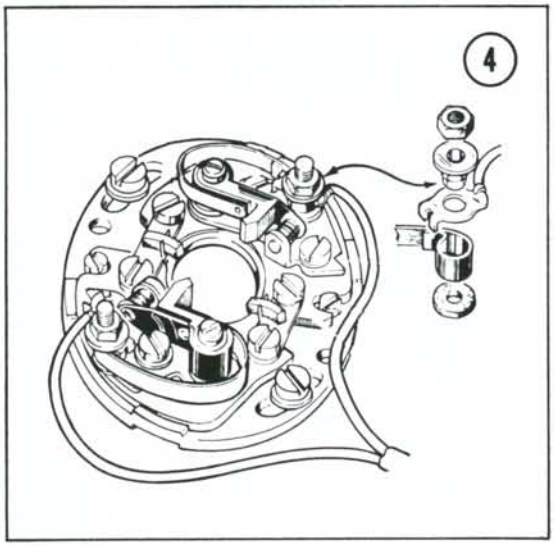
3. Unscrew the lock screws from the fixed contact plates and remove the plates (**Figure 3**).

4. Inspect the contacts for wear and pitting. If neither is excessive, the points can be dressed with a flat point file and cleaned with lacquer thinner or acetone. Don't dress the points with emery cloth; this will round the edges of the contacts and create the type of condition you may be trying to correct. If the points can't be dressed with a few strokes of the file they should be discarded and replaced with new parts.

Installation

Install the contact breaker assembly by reversing the steps above. Make sure the insulating washer and bushing are installed in the order shown in **Figure 4**.



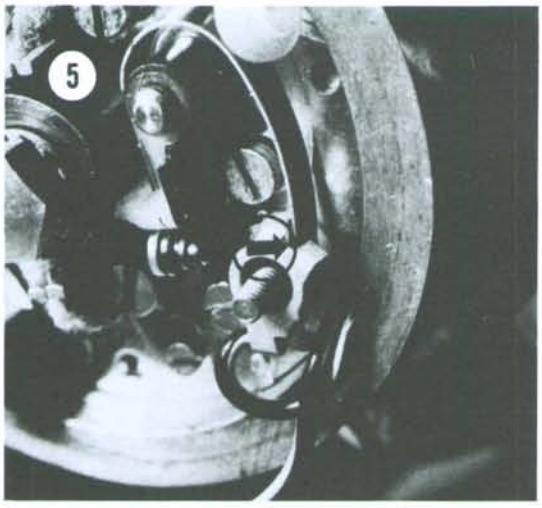


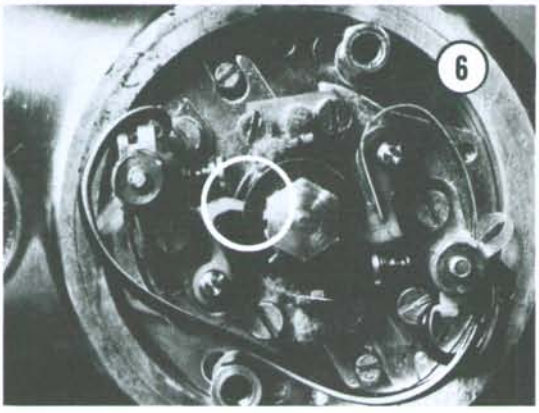
1. Lightly grease the pivot posts and the breaker cam with breaker lubricant. Knead a couple of drops of oil into each of the felt lubricators.

2. Locate the tangs on the terminals over the contact spring (**Figure 5**).

Adjustment

1. Remove the spark plugs from the cylinder head and rotate the crankshaft to line up the mark on the cam with the lifter heel on one of the contacts (**Figure 6**). This is the maximum contact opening.



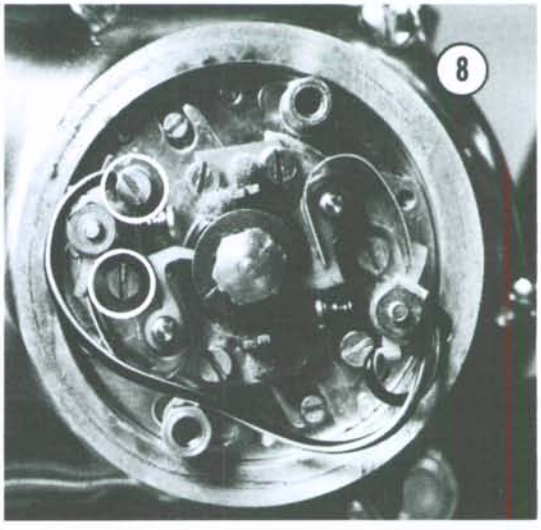


2. Measure contact gap with a flat feeler gauge (**Figure 7**). It should be 0.015 in. (0.38mm). If it is not, loosen the breaker lock screws (**Figure 8**) and move the plate in or out until the gap is correct. Tighten the lock screw and recheck the gap to make sure the plate did not move when the lock screw was tightened.

3. Rotate the crankshaft to line up the cam mark with the other lifter heel and adjust this contact set in the same manner as above.

AUTOMATIC ADVANCE UNIT

The automatic advance unit (**Figure 9**), located behind the contact breaker plate, advances ignition timing as the engine speed increases. The unit is spring loaded and returns to the static timing position when the engine is shut off. The unit may be serviced without removing it from the engine.

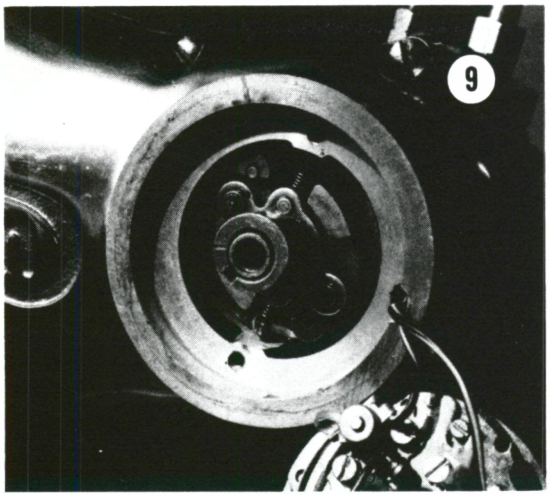


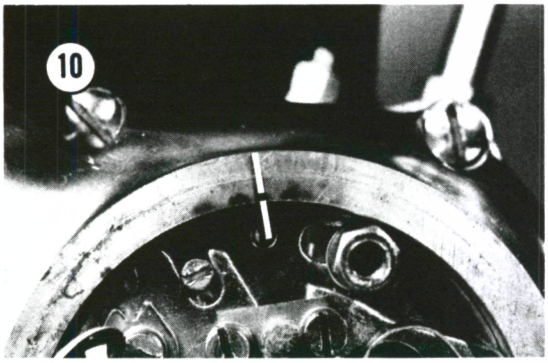
1. Mark the position of the contact breaker plate (**Figure 10**), unscrew the 2 plate-holding screws, and remove the plate with the contacts and terminals intact.

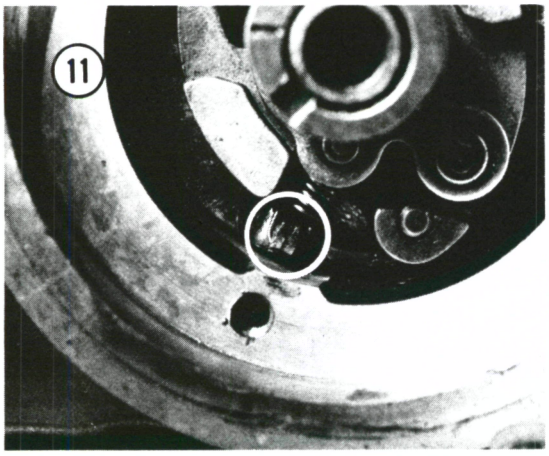
2. Lightly lubricate the pins and pivots on the advance unit.

3. Check to see that the ends of the springs are seated in their recesses in the bobweights and on the raised tangs in the fixed plate (**Figure 11**).

4. Turn the cam by hand to the fully advanced position to extend the bobweights. Then release







it. If the springs are in good condition, the bobweights will snap back to the static position. If they do not, the springs should be replaced.

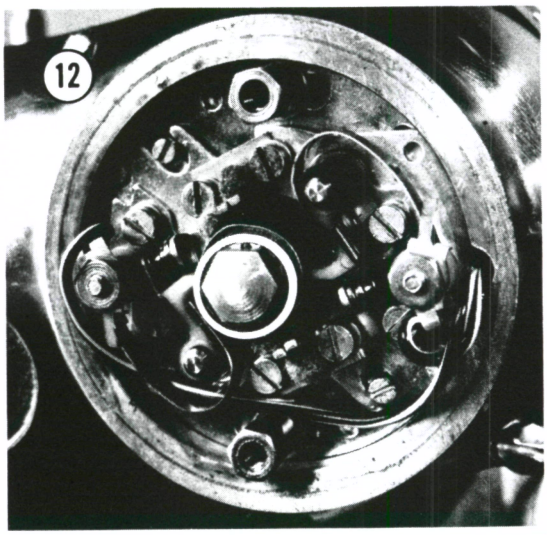
5. Reinstall the contact breaker plate, making sure the marks are aligned. Recheck the contact gap and the ignition timing.

IGNITION TIMING

Ignition timing can be accomplished in one of two ways, either statically or dynamically with the use of a timing strobe. The static method is accurate enough for most situations but strobe timing is essential for complete timing accuracy required for maximum performance.

Static Timing

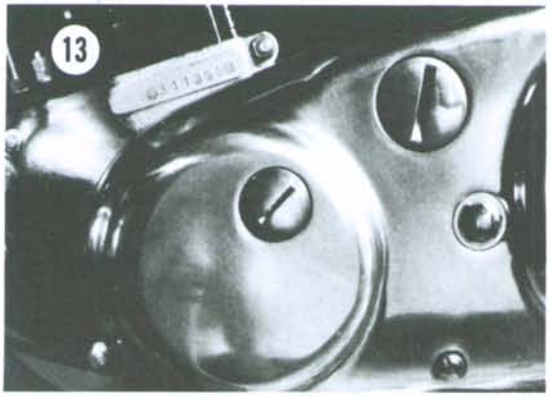
If the breaker cam has been removed and reinstalled, it must first be correctly located on the shaft before the ignition can be timed. To do this, first remove the intake and right-hand rocker exhaust covers and the spark plugs. Rotate the crankshaft clockwise to bring the right piston to TDC with both valves closed (firing position). Use the wire color coding to determine which contact set fires the right cylinder. Turn the breaker cam on the shaft counterclockwise until it just begins to open the right cylinder points and tighten the bolt in the end of the shaft (**Figure 12**).

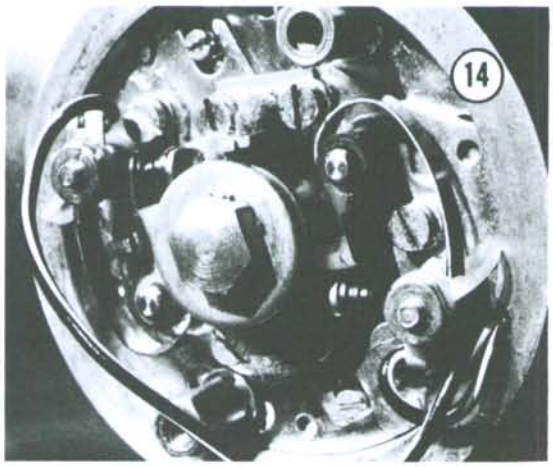


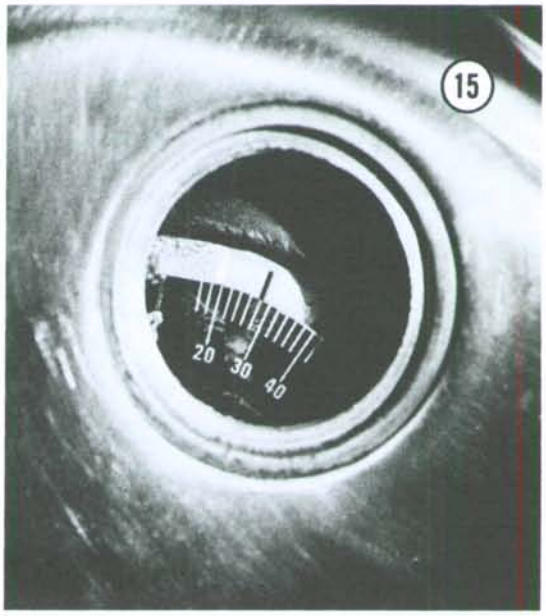
1. Check the contact gap as described earlier and adjust it if necessary.

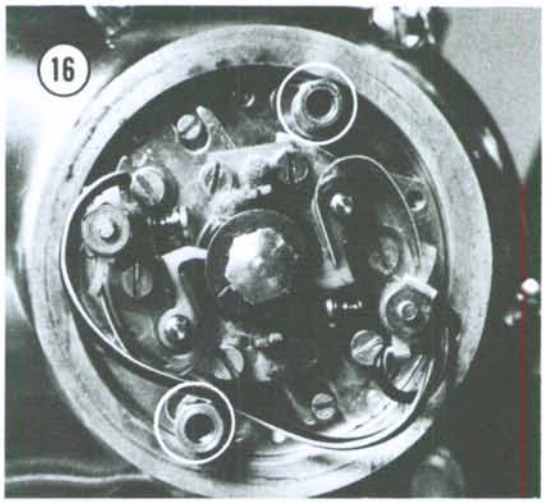
2. Remove the inspection plug from the primary chaincase (**Figure 13**).

3. Remove the bolt and washer from the end of the breaker cam shaft and install a washer with a large enough hole to pass over the end of the shaft and contact the face of the cam (**Figure 14**). Reinstall the bolt and washer in the shaft, hold









the advance unit at full advance, and tighten the bolt to hold the advance unit in place.

4. Shift the transmission into fourth gear and rotate the rear wheel to bring one of the pistons to TDC with both valves closed. Slowly rotate the wheel backward to align the timing mark with the 28° mark on the degree plate (**Figure 15**). At this position, the contact breaker for the cylinder being timed should just begin to open.

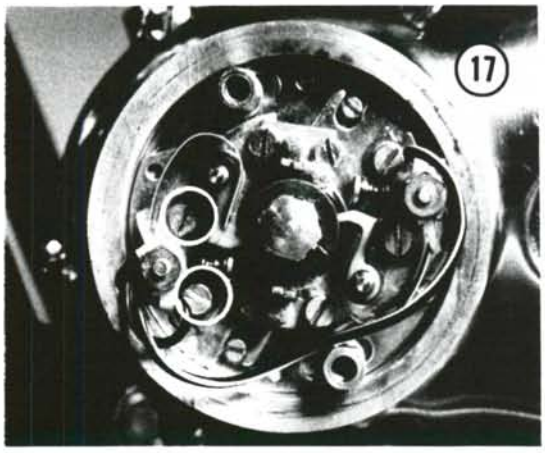
5. To determine the precise opening point, insert a strip of thin paper between the contacts. Slowly rotate the crankshaft until the paper can be withdrawn with a slight pull. This is the point at which contact opening begins.

6. Check the alignment of the timing mark with the degree plate. If the timing is correct, the mark should line up with the 28° mark.

7. If the timing is not correct, align the timing mark at 28° and loosen the 2 screws which secure the contact breaker plate (**Figure 16**). Insert the paper between the contacts for the cylinder being timed and rotate the breaker plate clockwise or counterclockwise as required until the paper can be withdrawn with a slight pull. Then tighten the breaker plate holding screws.

8. Check the timing of the opposite cylinder in the same manner. If the timing must be adjusted for this cylinder, loosen the screws holding the secondary contact plate (**Figure 17**), move the plate as required until the timing is correct, and securely tighten the screws.

9. Double check both the timing and the contact gap or both cylinders and both sets of contacts.



Dynamic (Strobe) Timing

Before the ignition can be timed with a strobe, the contact gap and static timing must be adjusted as described above.

1. Remove the inspection plug from the primary chaincase.
2. Connect the strobe to the high-tension lead on the right cylinder.
3. Start the engine and run it at 3,000 rpm.
4. Point the strobe light at the indicator plate in the chaincase. The rotor mark should line up with the 28° mark on the degree plate. If it does not, loosen the 2 screws which secure the contact breaker plate and rotate the plate clockwise (advance) or counterclockwise (retard) until the marks line up correctly. Then tighten the screws in the contact breaker plate. Shut off the engine.
5. Connect the strobe to the high-tension lead on the left cylinder, start the engine and run it at 3,000 rpm and check the timing for the left cylinder in the same manner as for the right. If the rotor mark does not line up with the 28° mark, loosen the screws in the secondary contact plate, move the plate as required until the marks line up, and tighten the screws.
6. After both cylinders have been timed, recheck them again with the strobe to ensure that neither of the contact plates has moved.

> NOTE: *If the timing mark tends to jump around during strobe timing, check the adjustment of the camshaft chain and the tightness of the alternator rotor. Also, a loose rotor will often sound like lower end trouble.*

COILS

Both 6- and 12-volt coils are used, in pairs, on Norton Commando electrical systems. The 6-volt coils are isolated from the rest of the 12-volt electrical system by a ballast resistor. The coils should be checked to see that they are mounted securely and that their connections are clean and tight; no other service is necessary.

If a coil is suspected of being faulty it can be partially tested by checking the resistance of the primary windings. To do this, connect an ohmmeter across the primary terminals. At an ambient temperature of about 70°F the resistance in a 6-volt coil should be at least 1.7 ohms but not greater than 1.9 ohms. For a 12-volt coil, the resistance should be at least 3.3 ohms but not greater than 3.8 ohms. If the resistance of the primary windings is all right, the coil should be taken to a shop specializing in automotive and motorcycle electrical work for further testing. Even better, substitute a known good coil to check a suspected coil.

Ballast Resistor

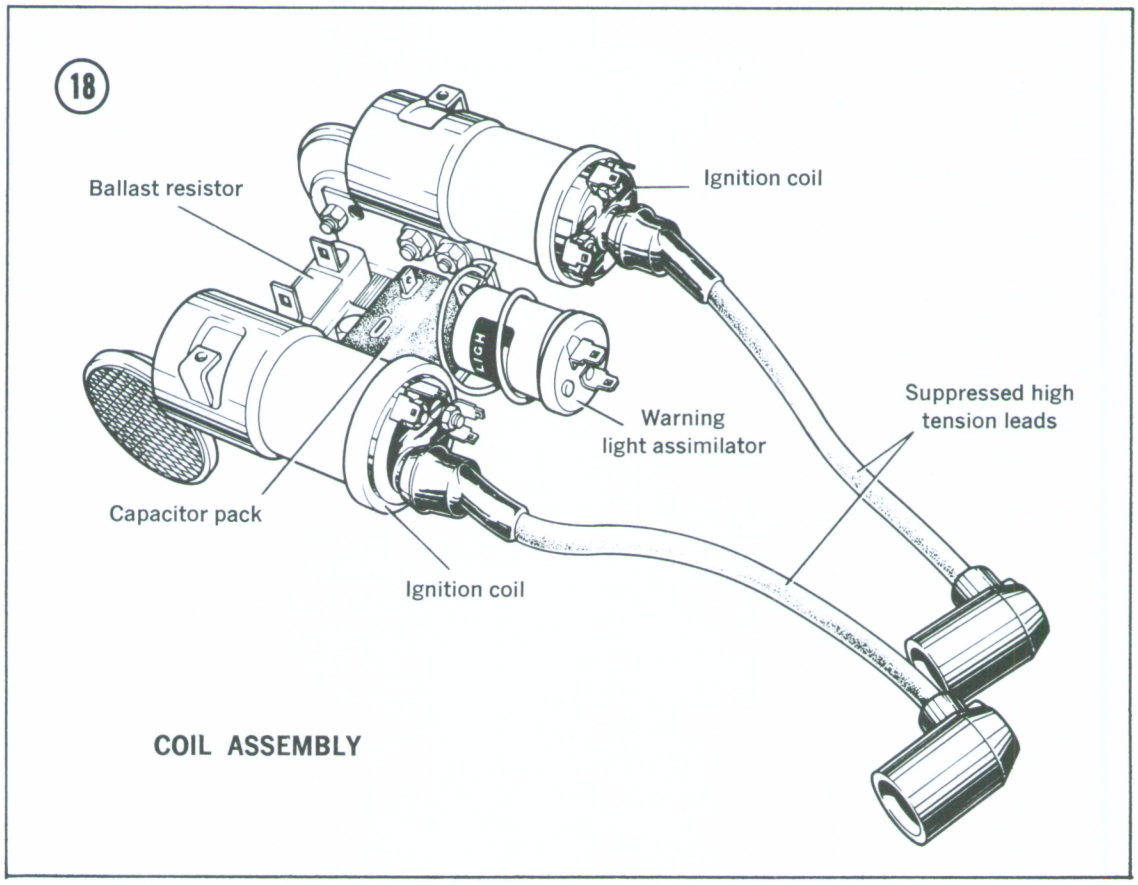
The ballast resistor used with 6-volt coils can be checked with an ohmmeter. Resistance should be 1.8-2 ohms.

CAPACITORS

The ignition capacitors can be tested while installed on the motorcycle. First, remove the fuel tank and the contact breaker cover plate. Rotate the crankshaft to open one of the contact sets. Connect a voltmeter to the contacts and turn on the ignition switch. If no voltage is indicated the capacitor should be replaced. Rotate the crankshaft to open the other contact set and check it in the same manner.

If voltage is present but the capacitors are still suspected of not being within service limits (evidenced by hard starting or erratic running), check the contacts for signs of burning—an indication that the capacitor is failing.

Capacitors on early models can be removed and replaced by unscrewing them from the coil clips. On 1971 and later models, remove the entire coil assembly from the motorcycle and then remove the capacitor pack from the coil assembly (**Figure 18**).



SPARK PLUGS

For normal use, and for all models except the 750 Combat, Champion N7Y spark plugs are recommended; however, equivalent plugs of different manufacture can be used provided their heat range corresponds to that of the N7Y. Plugs with an incorrect heat range can cause hard starting at one extreme, or preignition at the other, resulting in possible engine damage.

Champion N6Y spark plugs are recommended for use in the 750 Combat and for sustained high-speed operation.

The spark plug electrode gap should be 0.028 in. (0.71mm).

CHARGING SYSTEM

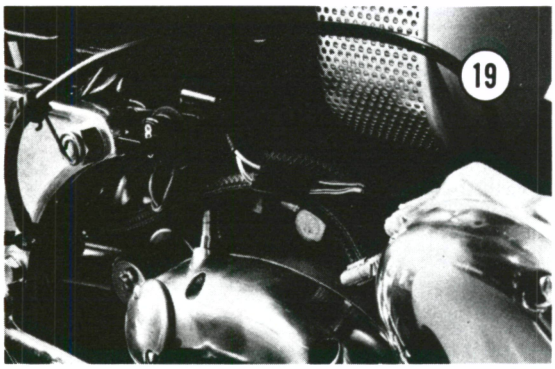
The charging system consists of the alternator, current rectifier, zener diode regulator, and heat sink. The charging system requires no service other than periodic inspection of the connections to ensure they are clean and tight.

When trouble occurs in the charging system, the components can be checked while installed on the motorcycle. The wiring diagrams at the end of this chapter will be helpful for locating and testing the components and circuits referred to in the text.

ALTERNATOR

Testing

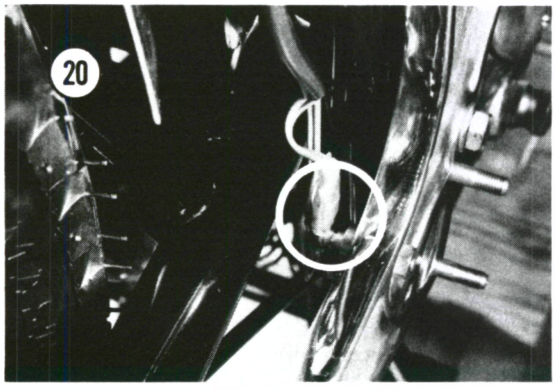
1. Unplug the alternator leads from the wiring harness (**Figure 19**).
2. Connect a voltmeter (set to AC scale) with a one ohm resistor wired parallel to the alternator leads.
3. Start the engine and run it at a steady 3,000 rpm. The meter should indicate a minimum of 9 volts.
4. Measure the voltage between each of the leads and ground. There should be no reading.



5. If there is no reading in Step 3, an open circuit is indicated in the coil circuit. In such case, the rotor should be replaced. If the reading was substantially less than 9 volts, it's again possible that the rotor is faulty. This can be verified by installing a new rotor and checking it as described above.

6. If the readings were correct, connect the black lead of an ammeter to the battery negative terminal and the red lead of the meter to the negative cable.

7. Disconnect the zener diode (**Figure 20**).



8. Start the engine and run it at a steady 3,000 rpm. With the ignition switch in the IGNITION ONLY position, the ammeter should indicate a charging rate of at least 4.5 amps. With the ignition switch in the LIGHTS AND IGNITION position, the ammeter should indicate a charging rate of at least 1.0 amp. If the ammeter readings are higher than these, the system is all right. If they are not, continue with the next steps and check the condition of the rectifier.

Removal/Installation

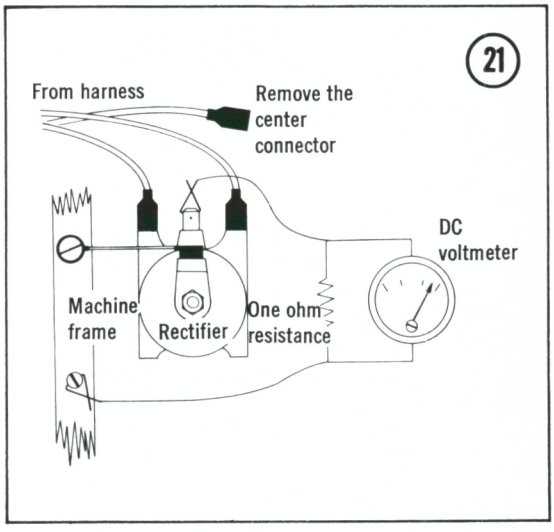
To remove the alternator rotor and stator, perform Steps 1-6, *Primary Drive and Clutch Disassembly*, Chapter Four. To install, perform Steps 10-15, *Primary Drive and Clutch Assembly*, Chapter Four.

RECTIFIER

Testing

1. Check to make sure the alternator leads are correctly connected to the main harness and that the connections are clean and tight.

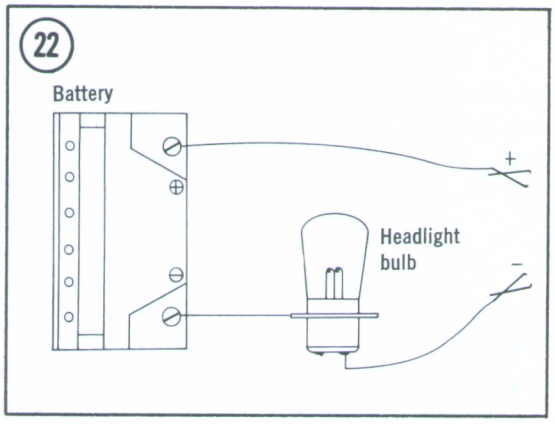
2. Unplug the center lead from the rectifier (**Figure 21**) and connect the black (—) lead of a voltmeter (set to DC scale). Ground the voltmeter red (+) lead to the frame.



3. Start the engine and run it at a steady 3,000 rpm. The meter should indicate at least 7.5 volts. If it indicates less, the rectifier is unsatisfactory and should be replaced. If the reading is satisfactory, proceed to bench test the rectifier to verify that it permits current to flow in only one direction.

4. Using a pair of test leads, connect a headlight bulb to the battery as shown in **Figure 22**.

5. Clip the other ends of the test leads to each combination of rectifier terminals shown below first in one polarity and then in the other. Each hookup should be made for more than a few seconds at a time.



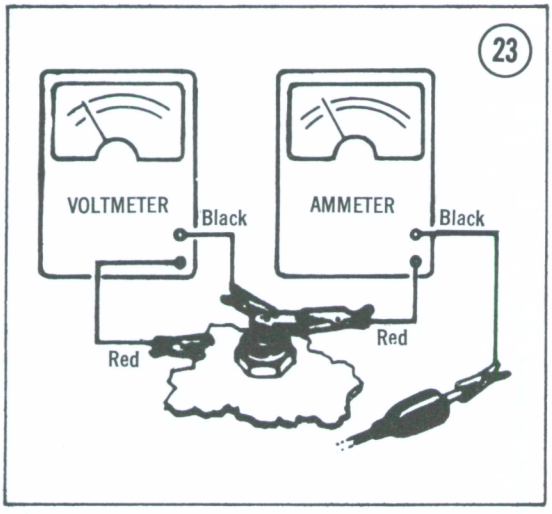
a. Terminals 1 and 2
b. Terminals 2 and 3
c. Terminal 1 and bolt
d. Terminal 3 and bolt

If the bulb lights in both directions on any one hookup, or if it lights in neither direction on any one hookup, the rectifier is defective and must be replaced.

ZENER DIODE

Testing

1. Unplug the electrical cable from the zener diode and connect the red (+) lead of a DC ammeter to the Lucar blade on the diode and the ammeter black (—) lead to the cable (Figure 20). Connect the black (—) lead of a DC voltmeter to the Lucar blade and the voltmeter red (+) lead to ground. See **Figure 23**.



2. With all the lights switched off, start the engine. Slowly increase the engine speed and observe the 2 meters. Up to 12.75 volts, as indicated by the voltmeter, the ammeter should indicate nil current flow. From 13.5-15.5 volts, the ammeter should indicate a current flow of 2 amps. If current begins to flow before the voltmeter indicates 12.75 volts, or if the voltmeter indicates more than 15.5 volts before the ammeter reaches 2 amps, the diode is unsatisfactory and must be replaced.

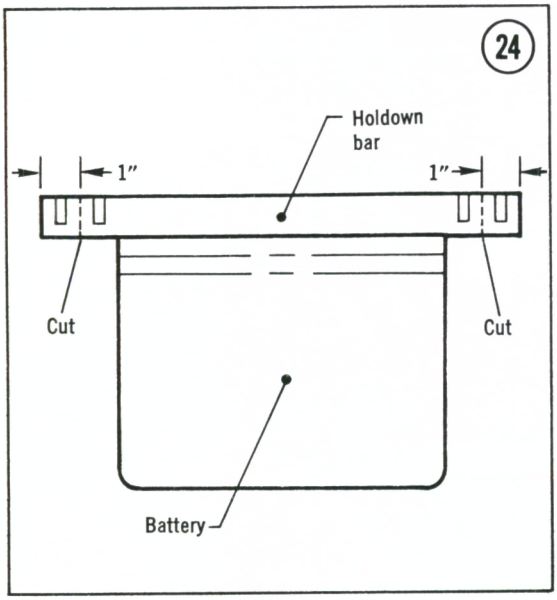
Before installing the diode, lap its contact surface to the contact surface on the footrest using a fine grade of lapping compound. The footrest functions as a heat sink to help the diode dissipate heat produced by the alternator when the battery is fully charged and the lights are off. For this reason it is essential that there be a good contact between the diode and the footrest. In addition, a thin coat of silicone compound, such as G.E. Electronic Silicone Compound Transistor Z-5 No. 8101 or G.E. Silicone Compound G-640 or G-641, should be applied to the contact area before installing the diode. This compound is available through TV repair shops and electronic supply houses. When the diode has been installed, tighten the mounting nut to 24-28 in.-lb., taking care not to strip the soft copper threads.

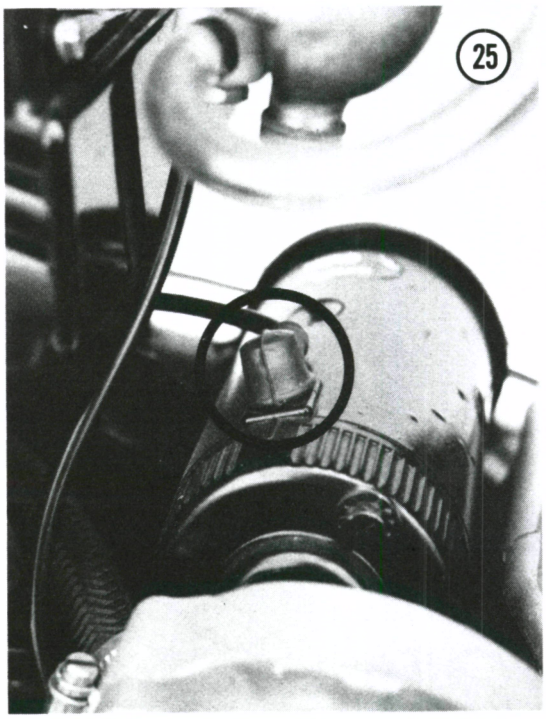
BATTERY

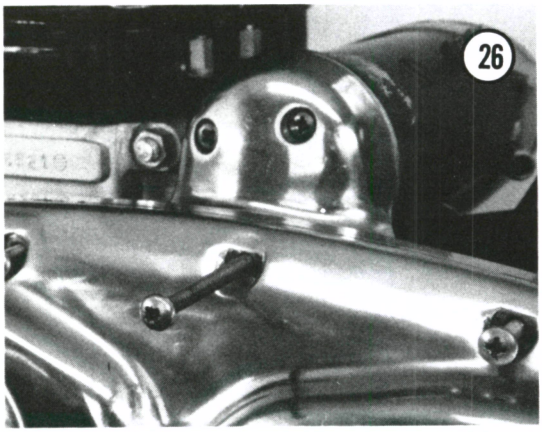
Service battery as described in Chapter Two.

BATTERY CROSSBAR MODIFICATION

On many 850 Mark II models built between engine numbers 307311 and 32500, the rectifier is installed in such a manner that the battery hold-down crossbar can foul the electrical leads to the rectifier should the battery shift backward in its holder. To reduce the likelihood of this occurring, cut about one inch off each end of the battery crossbar—about midway between the notches (**Figure 24**). Dress the sawed edges with a fine file to remove burrs and sharpness and spray paint the raw metal to inhibit corrosion.







STARTER (850 MARK III)

Service to the starter is limited to replacement of the brushes. If additional work is required, the starter should be entrusted to a Norton dealer or an electrical specialist.

Removal/Installation

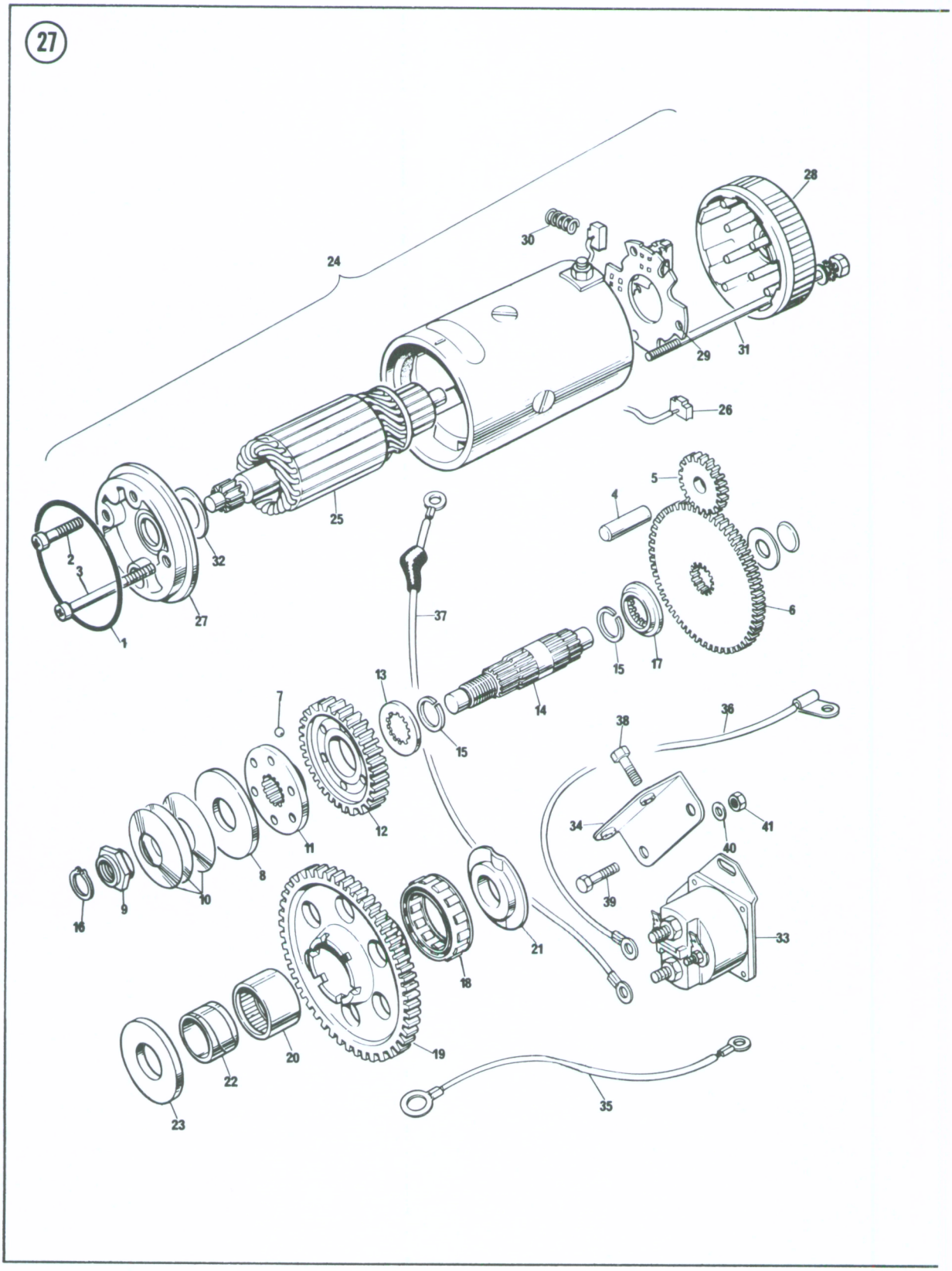
1. Disconnect the ground lead at the fuse holder. Disconnect the electrical lead from the starter motor (**Figure 25**).
2. Remove the 2 screws from the starter mounting boss on the primary case and the long screw from the outer chaincase cover (**Figure 26**). Pull the starter motor out of the mount.
3. Reverse the above to install the starter. Make sure the large O-ring is in good condition before installing the motor. Tighten the nut on the electrical post securely and fit the rubber cover.

Brush Replacement

1. Remove starter motor as described above.
2. Unscrew the 2 through bolts from the right end of the starter and remove the end cap (**Figure 27**). Note the position of the brush holder plate and remove it.
3. Remove the springs and brushes from the plate and install new ones. Reinstall the plate in the starter in the same position from which it was removed, making certain the brushes are in contact with the armature.
4. Install the end cap and screw in the through bolts. Install the starter as described earlier.

Relay

If the starter relay energizes but the starter fails to turn over, check the connections of the relay-to-starter electrical lead to make sure they are tight and corrosion-free. If the starter still fails to turn over it may need new brushes.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ELECTRIC STARTER (850 MARK III)

1. O-ring
2. Screw
3. Long screw
4. Idler spindle
5. Idler gear
6. Idler gear
7. Ball
8. Thrust washer
9. Nut
10. Disc spring
11. Carrier
12. Gear
13. Thrust washer
14. Shaft
15. Circlip
16. Circlip
17. Thrust washer
18. Clutch
19. Crank gear
20. Needle roller bearing
21. Inner washer
22. Inner race
23. Outer washer
24. Starter motor
25. Armature
26. Brush
27. Head assembly (commutator end)
28. Head brush and seal (drive end)
29. Brush plate and holder
30. Spring
31. Thru-bolt
32. Thrust washer
33. Solenoid
34. Solenoid bracket
35. Starter ground lead
36. Battery to solenoid lead
37. Solenoid to starter lead
38. Solenoid bracket bolt
39. Bolt
40. Washer
41. Nut

If all of the connections are clean and tight and the relay does not energize, it is very likely faulty. In such case, remove the relay and have it checked by a Norton dealer or an electrical specialist to verify its condition.

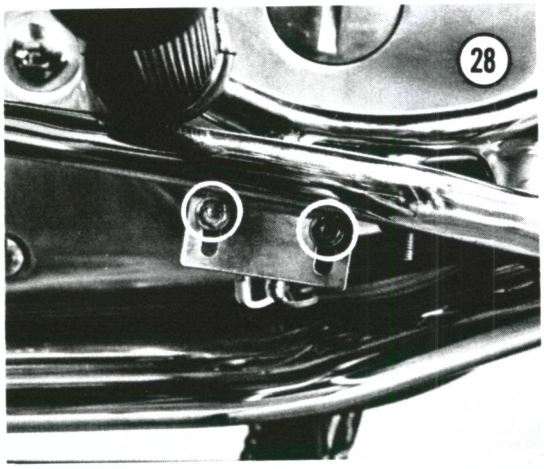
LIGHTS AND SWITCHES

Service of the lights and switches is limited to checking connections to make sure they are clean, dry, and tight.

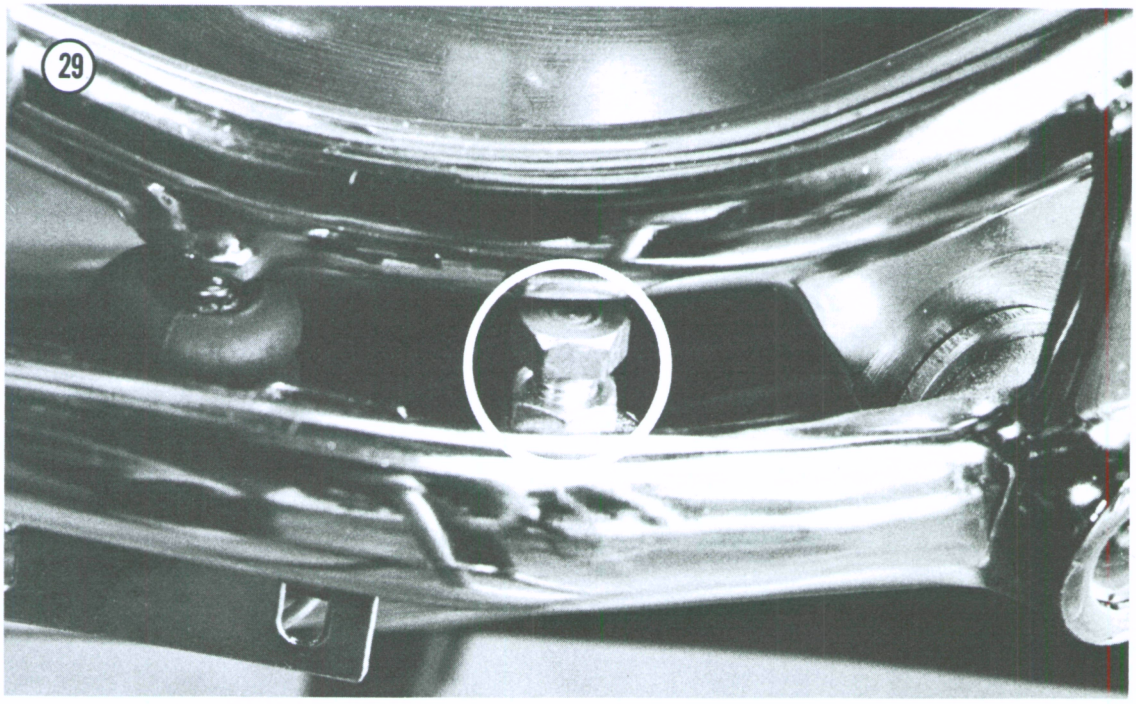
Fault tracing and replacement of most of the lighting and switching components is simple and straightforward. However, the adjustment of the rear brake stoplight switch must be done carefully to prevent damage to the unit, and the functional test procedure of the directional lights flasher relay should be followed to determine if the flasher unit itself is at fault when trouble occurs in this circuit.

Rear Brake Stoplight Switch

1. Loosen the bolts which mount the switch to the brake pedal (**Figure 28**).



2. Adjust the brake pedal stop (**Figure 29**) so that the pedal position is comfortable. Adjust rear brake free play, described in Chapter Two.
3. Slowly move the switch up, positioning the switch plunger in the center of the contact boss on the foot peg, until the slightest downward movement of the brake pedal causes the stoplight to light. The movement of the switch plunger, from full extension to the point at



which the pedal contacts the pedal stop, should be about 1/32 in. (0.79mm).

4. Tighten the switch mounting bolts and recheck the adjustment. The switch plunger must not be fully depressed before the pedal contacts the stop.

Directional Light Flasher

1. Check the directional lamp bulbs to make sure the filaments are not broken and check to see that all the connections are clean and tight.

2. Switch on the ignition and check the voltage of the "B" terminal on the flasher with a voltmeter. The meter should indicate battery voltage (12 volts).

3. Using a test lead, connect the "B" and "L" terminals on the flasher together and operate the flasher switch in both directions. If both lamps on one side light but do not flash, the relay is faulty and should be replaced.

MAGNETO SERVICE

Routine periodic service on the Lucas K2F magneto used on Atlas and G15 CS models, presented here, is within the ability of the hobbyist mechanic. However, major service of the unit, recommended at 10,000-mile intervals, should be referred to a Norton dealer or an electrical service specialist with experience on this particular unit.

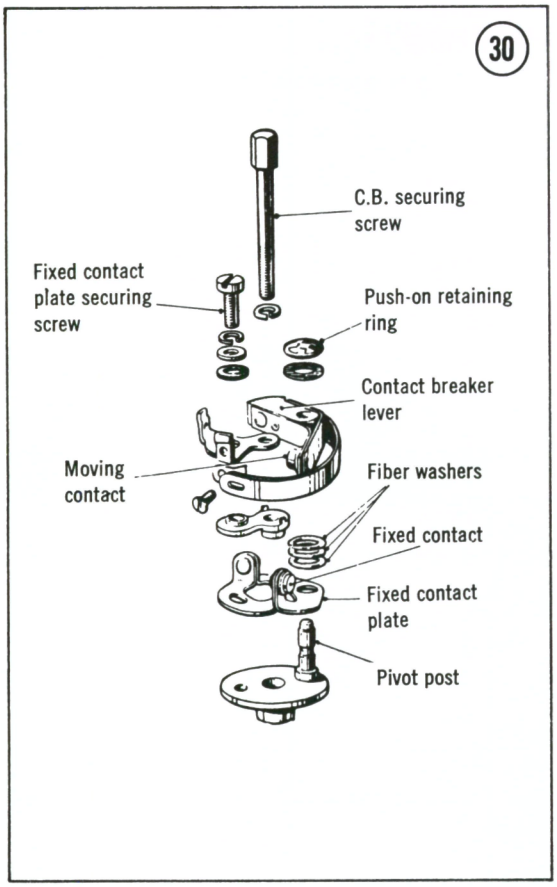
Cleaning

1. Remove the contact breaker cover. Unscrew the long hex-head screw from the center of the breaker assembly (**Figure 30**) and pull the assembly off the shaft.

2. Inspect the contacts for burning and pitting. If their condition is reasonably good, dress them with a point file; do not use emery cloth as it will round the edges of the contacts. Clean the points thoroughly with lacquer thinner or acetone and grease the breaker cam ring with contact breaker lube. Apply a drop of oil to the end of the pivot post.

3. Reinstall the contact breaker assembly, making sure the keyway in the shaft lines up with the projection in the bore of the cam.

4. Lift the hold-down springs from the high-tension brushes and check the movement of the brushes in their holders. They should move freely in and out. If they do not, clean them with



lacquer thinner or acetone. Check them also for wear. If they are worn down to within ⅛ in. of the shoulder, they should be replaced.

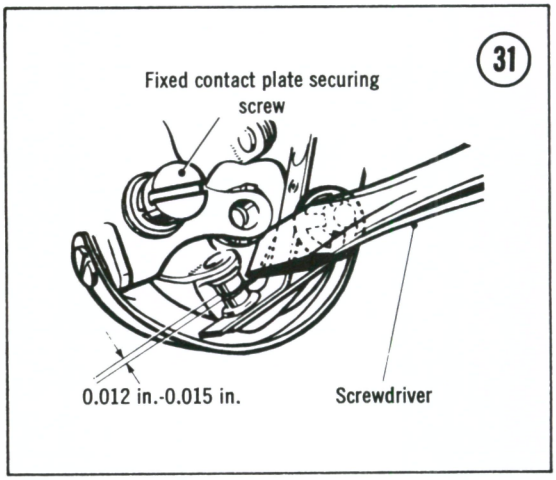
5. Inspect the contact track for dirt and corrosion. To clean, insert a small length of dowel, wrapped in clean cloth, in one of the brush holders and slowly rotate the engine.

6. Reinstall the brushes, making sure the hold-down springs are correctly positioned, and adjust the contacts as described below.

Adjustment

1. Remove the spark plugs from the cylinder head and rotate the engine until the contacts are fully opened. Measure the gap; it should be 0.012 in. (0.30mm) and there should be a slight resistance on the feeler gauge when it is inserted and removed.

2. If the gap is incorrect, loosen the securing screw for the fixed contact (**Figure 31**) and move it in or out until the setting is correct. Then tighten the securing screw and recheck the gap.

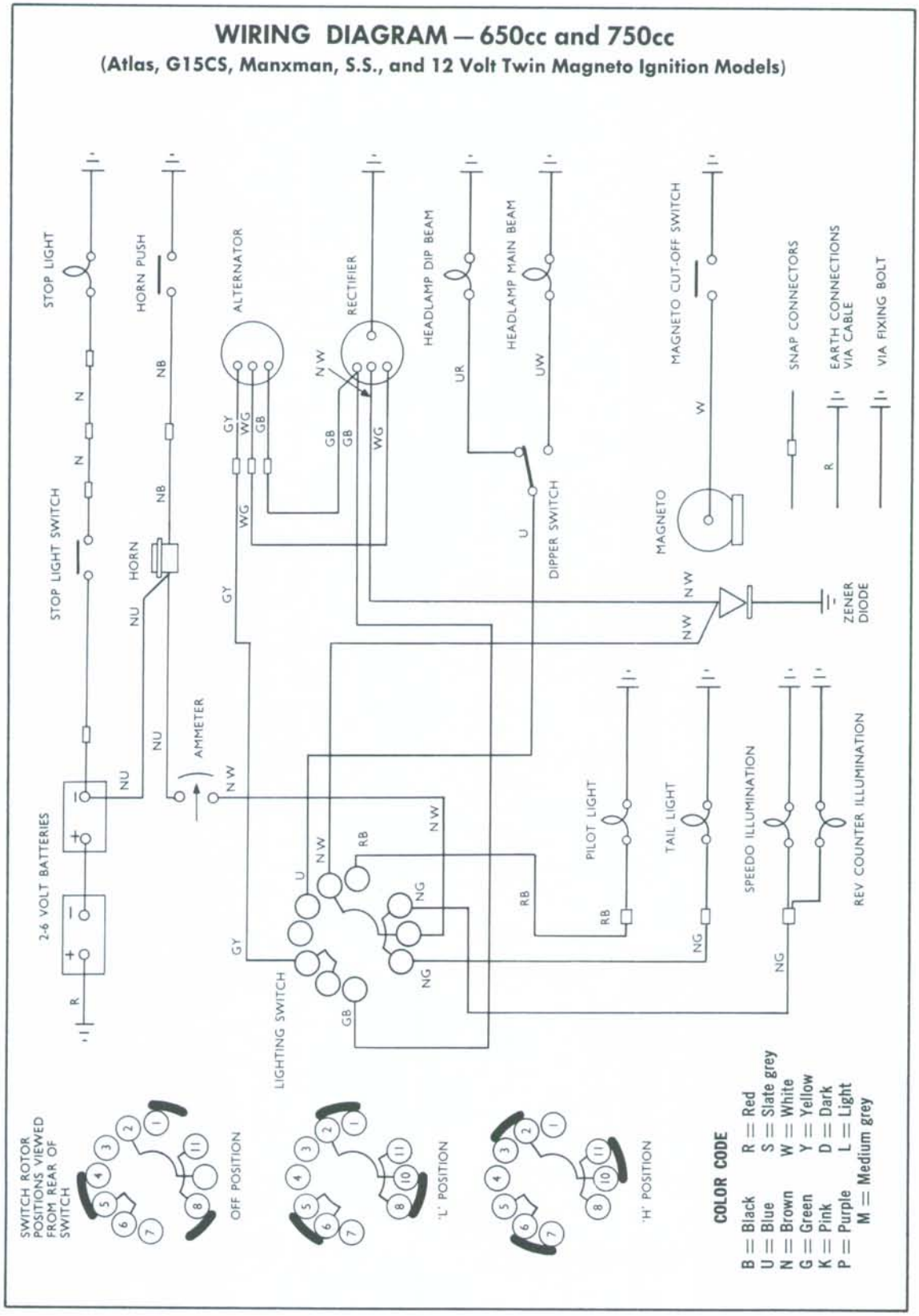


WIRING DIAGRAMS

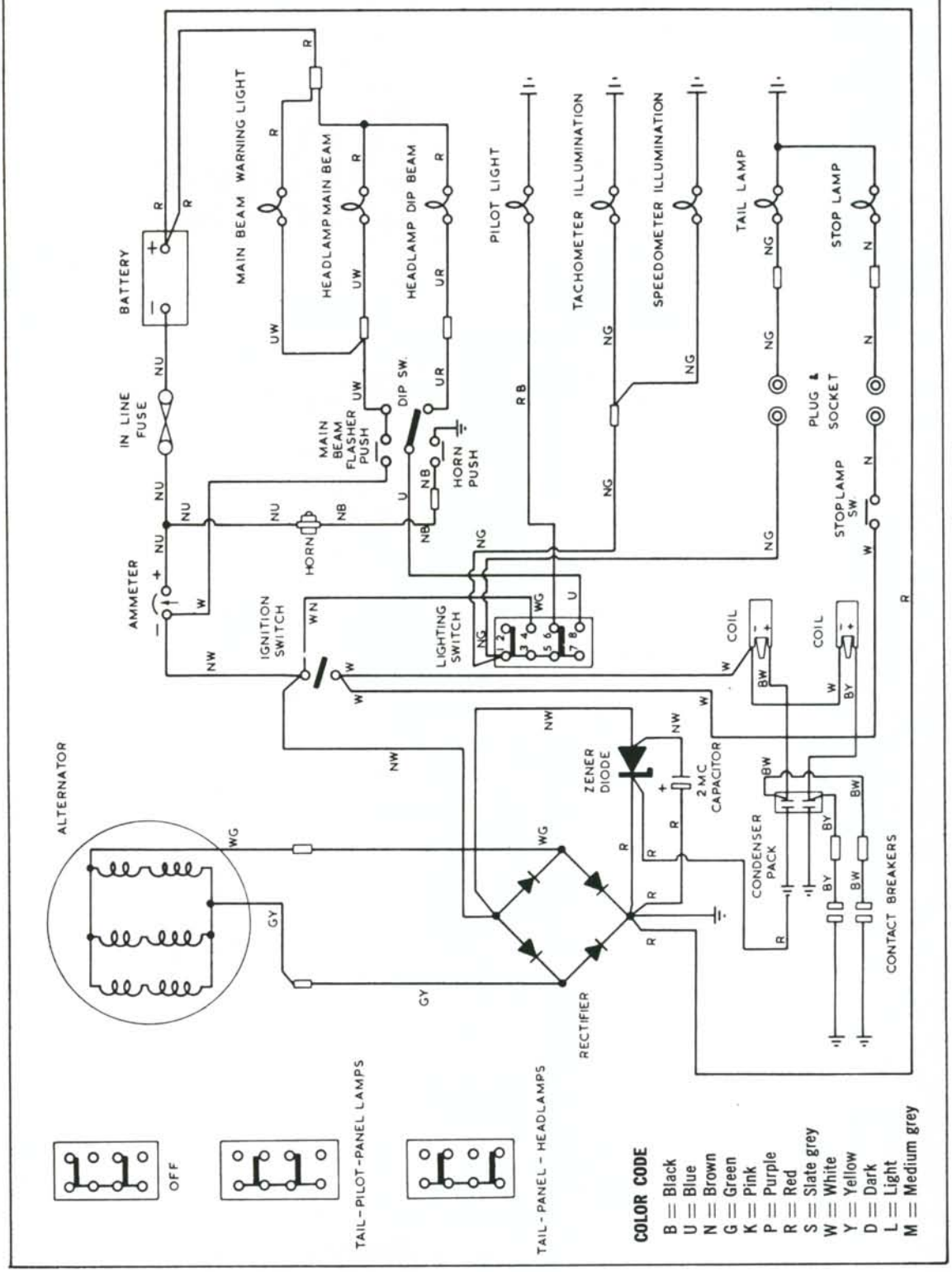
Wiring diagrams will be found on the following pages:

WIRING DIAGRAM — 650cc and 750cc

(Atlas, G15CS, Manxman, S.S., and 12 Volt Twin Magneto Ignition Models)



WIRING DIAGRAM — 750 Commando (Before 1971)



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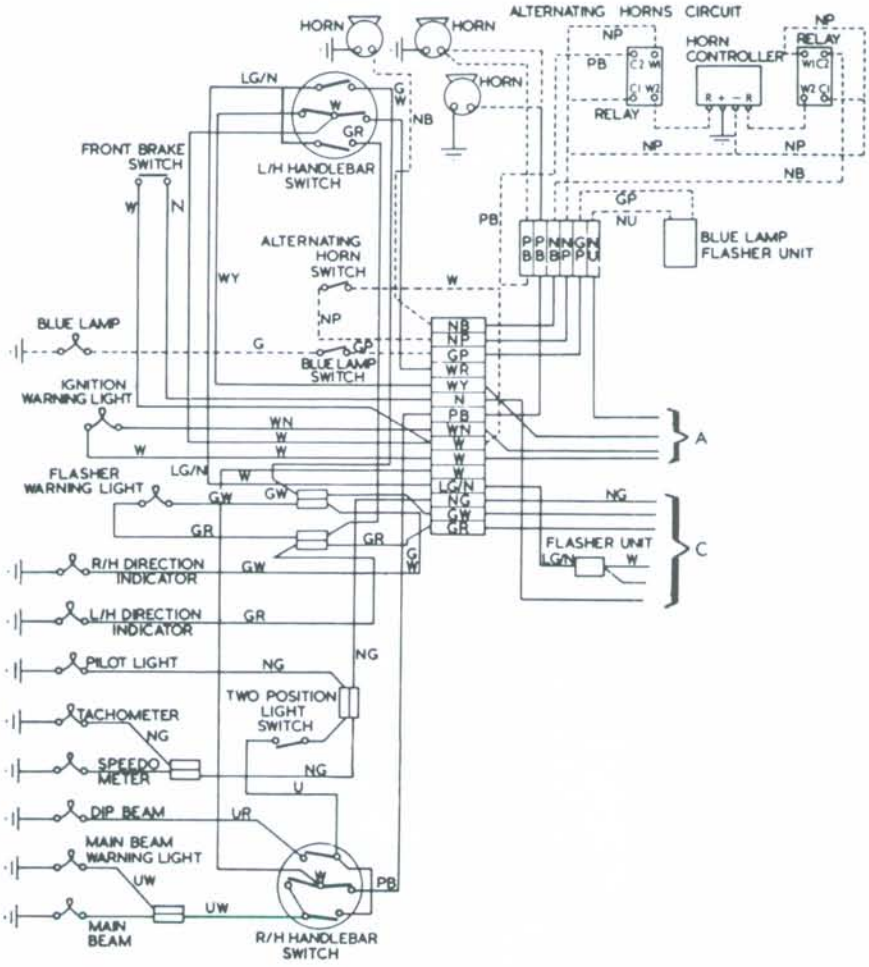
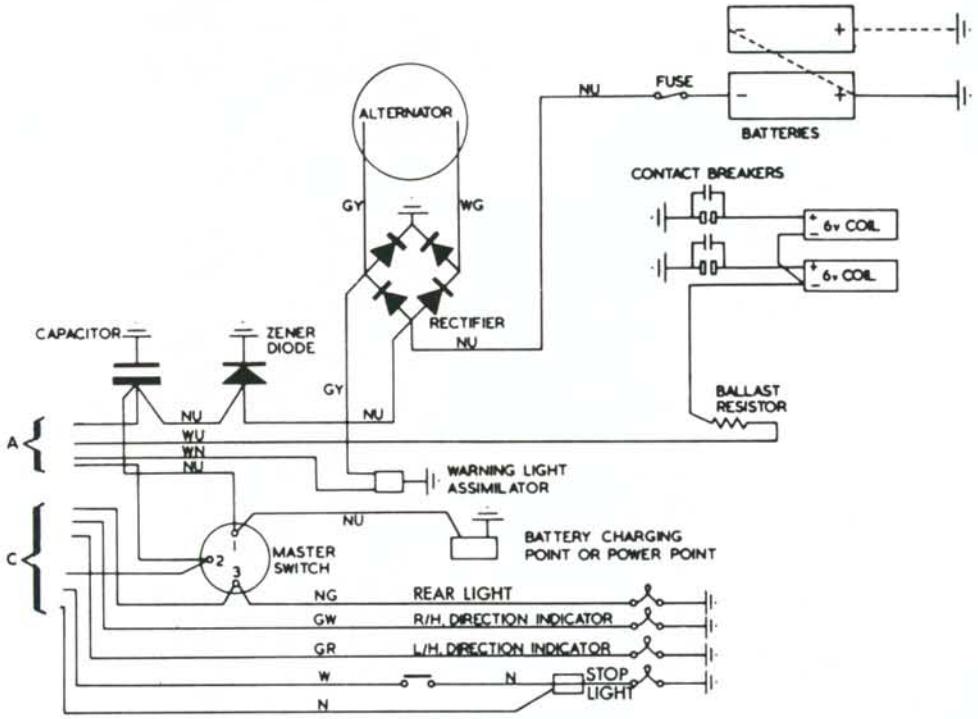
WIRING DIAGRAM



..... Denotes Interpol Circuits

1971 750 Commando

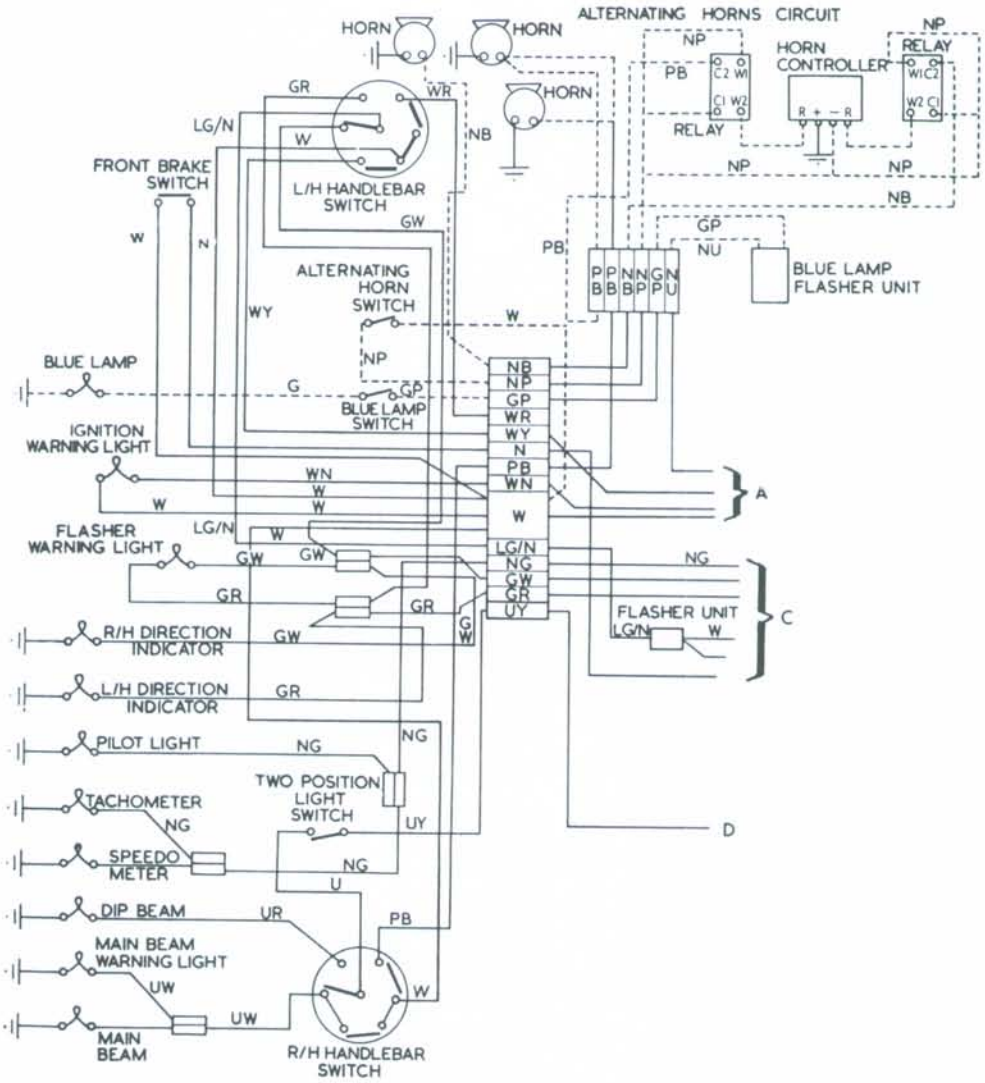


COLOR CODE

U = Blue
B = Black
N = Brown
G = Green
K = Pink
P = Purple
R = Red
S = Slate grey
W = White
Y = Yellow
D = Dark
L = Light
M = Medium grey

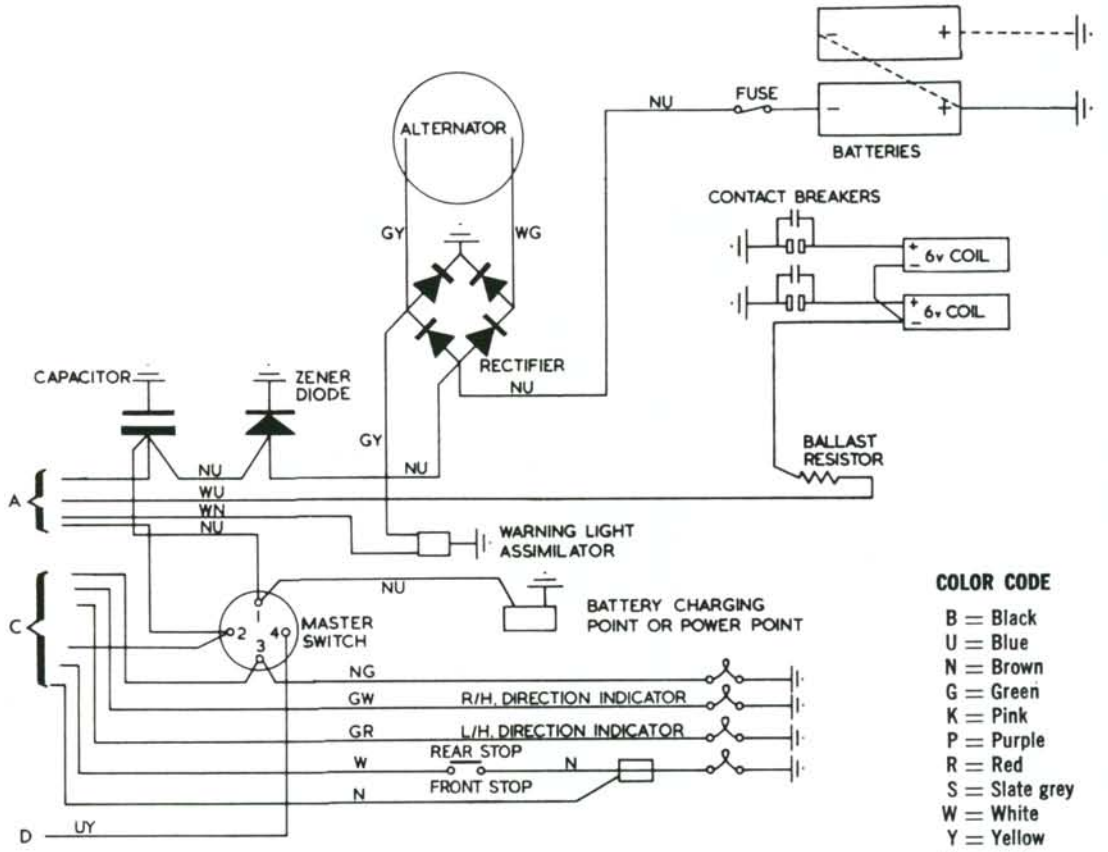
7

WIRING DIAGRAM



..... Denotes Interpol Circuits

1972-1974 850 Commando Mark II

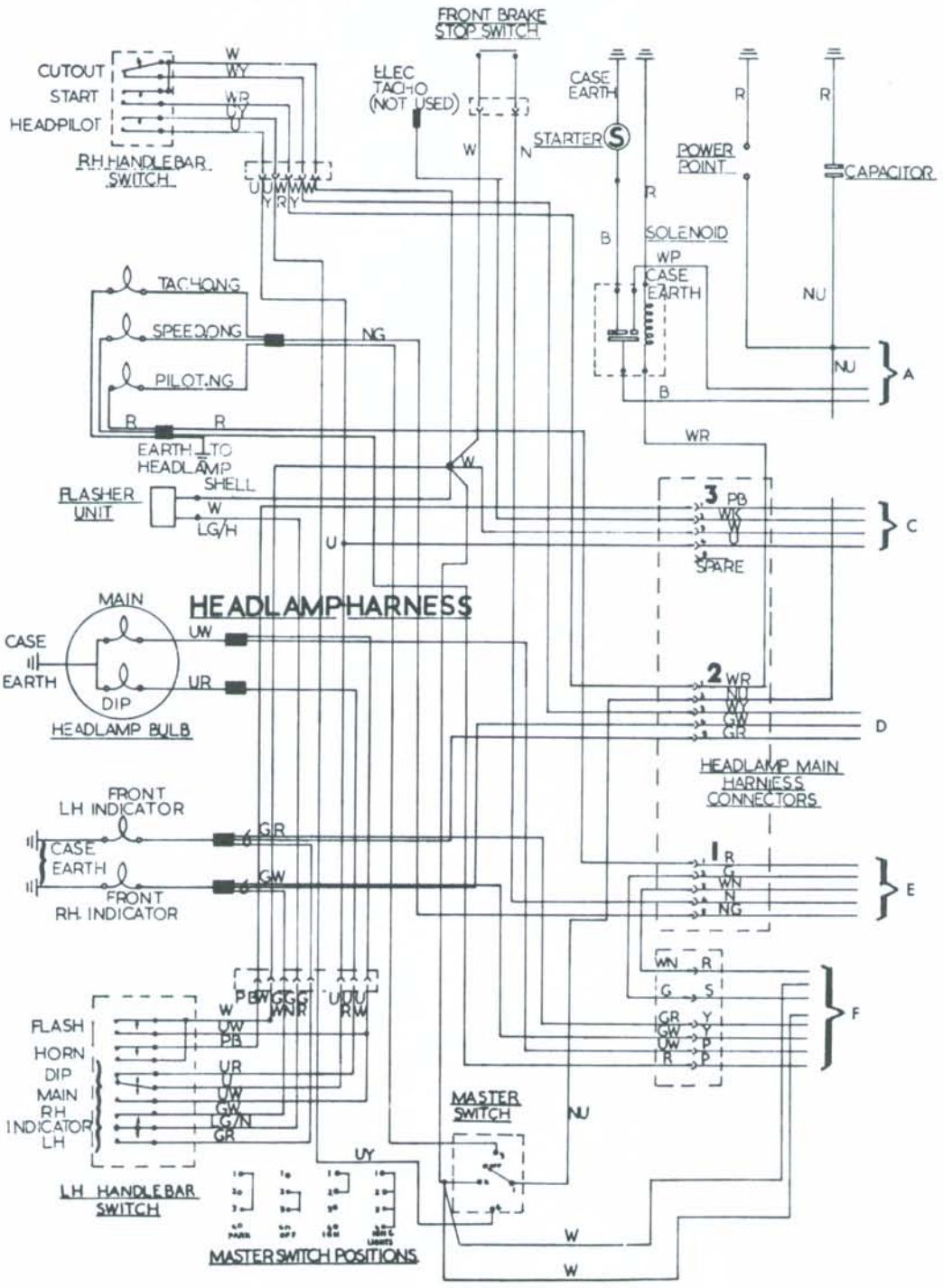


COLOR CODE

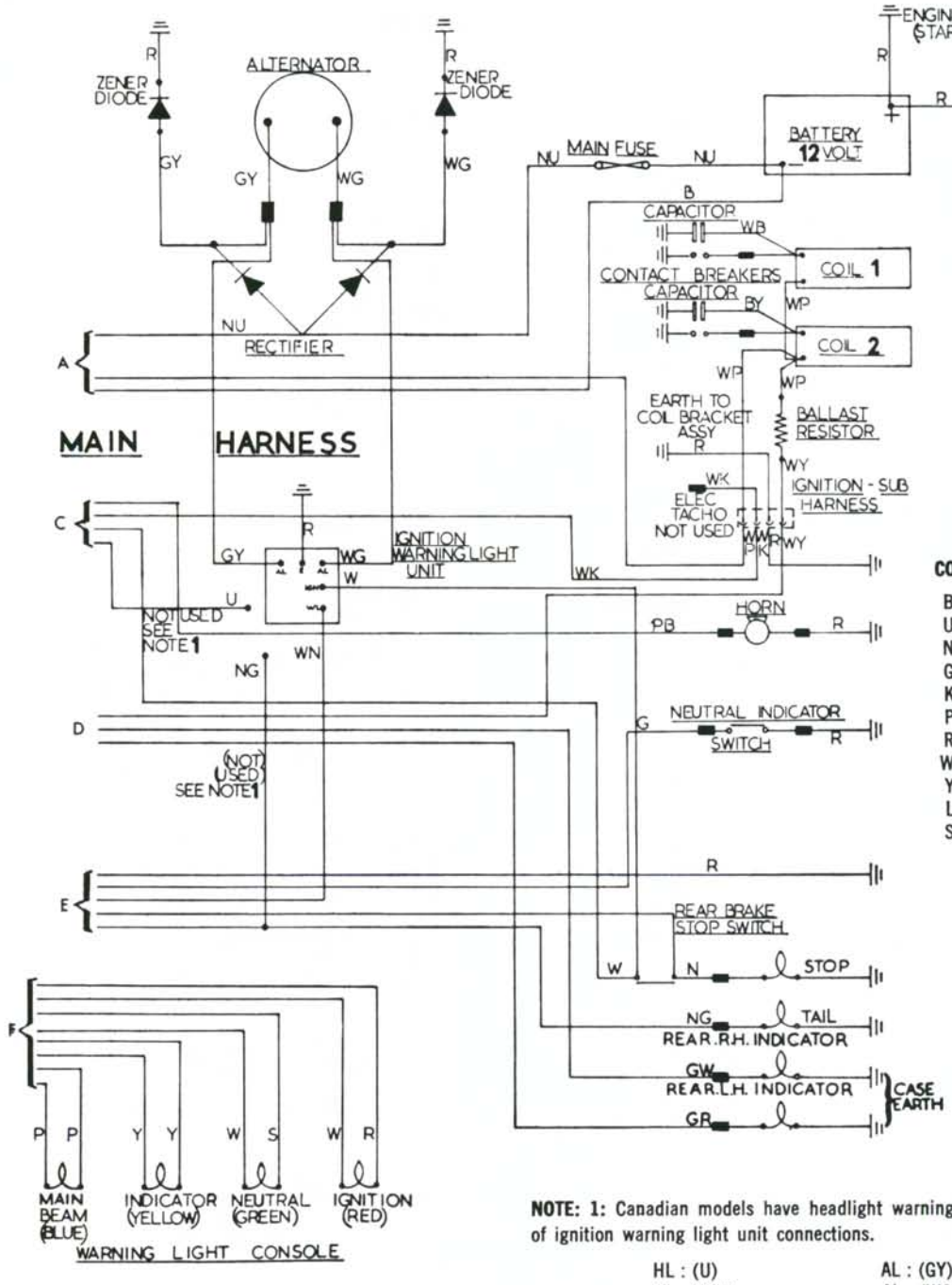
B = Black
U = Blue
N = Brown
G = Green
K = Pink
P = Purple
R = Red
S = Slate grey
W = White
Y = Yellow
D = Dark
L = Light
M = Medium grey

7

WIRING DIAGRAM



850 Commando Mark III (All Years)



COLOR CODE

B = Black
U = Blue
N = Brown
G = Green
K = Pink
P = Purple
R = Red
W = White
Y = Yellow
L = Light
S = Slate grey

NOTE: 1: Canadian models have headlight warning unit in place of ignition warning light unit connections.

HL : (U) AL : (GY)
WL : (WN) AL : (WG)
TL : (NG)

R & W wires not used on Canadian models.

NOTE 2: Indicator leads are not color coded.

7

CHAPTER EIGHT

FRONT WHEEL AND BRAKE

This chapter describes repair and maintenance of the front wheel, hub, drum brake, and disc brake.

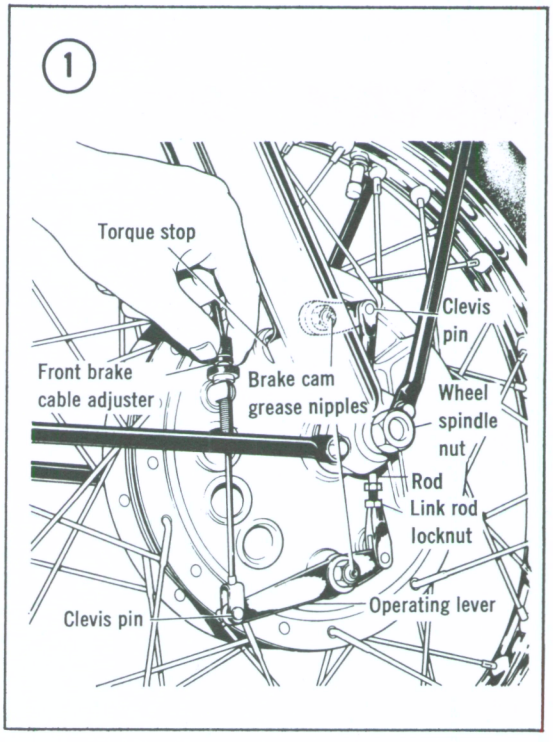
FRONT WHEEL

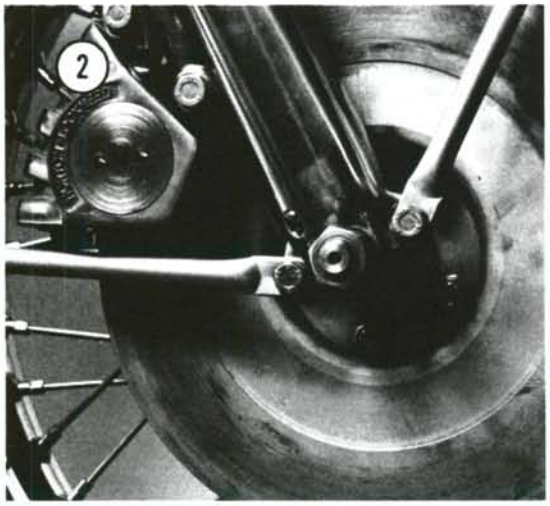
Removal/Installation

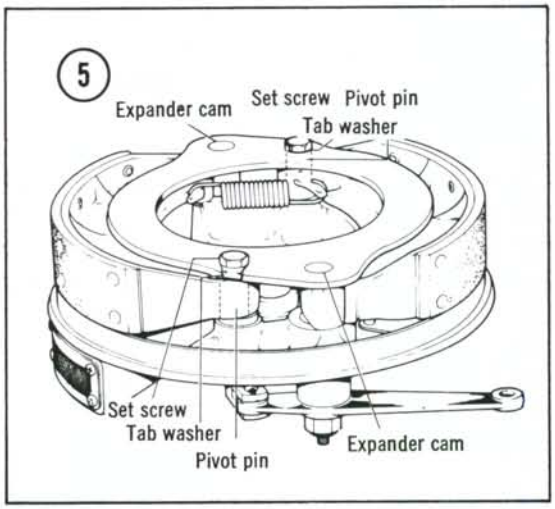
1. Block up the front of the motorcycle to lift the front wheel off the ground.
2. On models with a drum type front brake, disconnect the brake cable from the lower brake arm by removing the clevis pin (**Figure 1**). Unscrew the cable adjuster from the boss on the brake and backing plate.
3. On all models, unscrew the axle nut (**Figure 2**). Loosen the pinch bolt at the bottom of the left leg (**Figure 3**). Insert the shaft on a screwdriver or small bar through the hole in the left end of the axle and pull it out of the forks and wheel while lifting and supporting the weight of the wheel.
4. On disc brake models, pull wheel forward to disengage the disc from the caliper.
5. Installation is the reverse of these steps.

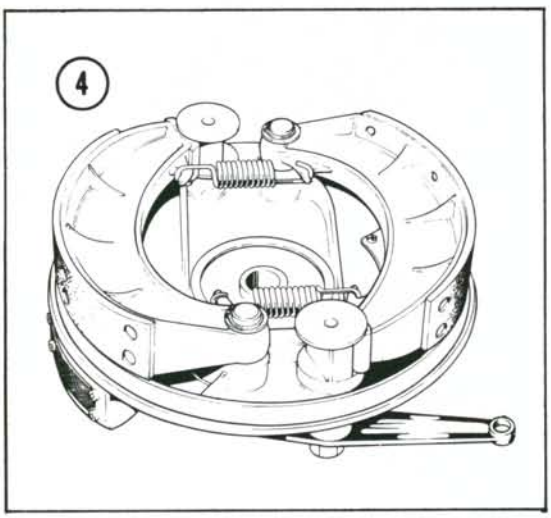
FRONT DRUM BRAKE

Two types of drum brakes are used on Norton Commandos. On the standard brake, the shoes are retained on the pivots with circlips (**Figure 4**). On the modified high-performance brake, with the expander plate, the plate and shoes are held in position with bolts secured by tab washers (**Figure 5**). Both brakes are double-leading-shoe type units.









Disassembly

1. Block up the front of the motorcycle to lift the front wheel off the ground. Remove it as described in this chapter. Then remove the complete brake assembly from the drum.

2. Position the brake backing plate horizontally in a vise and clamp it by the brake anchor peg.

3a. On the standard brake, remove the circlips and washers from the shoe pivot pins.

3b. On the modified brake, straighten the tab washers on the pivot bolts and unscrew the bolts. Remove the expander plate by carefully prying the plate up with a screwdriver inserted between the plate and the shoes, to the right of each of the expander cam pivots.

4. Remove the return springs by lightly gripping the coil section with a pair of conventional pliers and extending one of the spring ends with needle-nose pliers. Then remove the brake shoes.

5. Remove the backing plate from the vise and unscrew the nuts which hold the brake arms to the cams. Remove the arms from the camshafts and pull the cams out of the backing plate.

Inspection

Thoroughly clean and dry all the parts except the linings. Check the contact surface of the drum for scoring. If there are grooves deep enough to snag a fingernail, the drum should be entrusted to a brake specialist to have it trued. In such case, the linings will have to be replaced and the new ones arced to the new drum contour.

Check the linings for wear as described above. If they are serviceable, inspect them for imbedded foreign material. Dirt can be removed with a stiff wire brush, but if they are soaked with oil or grease they will have to be replaced.

Inspect the cam lobes and the pivot area of the shaft for wear and galling. Minor roughness can be removed with emery cloth but if either area is deeply scored or severely worn, the cam should be replaced. In addition, check the expander cam bushings and replace them if they are worn or galled.

Assembly

Assemble and install the front brake and wheel by reversing the disassembly steps. Grease the shafts and contact areas of the expander cams, the bushings in the cam bores, and the brake shoe pivot posts with a light coat of a molybdenum disulfide grease; excess grease is likely to find its way onto the brake linings and render them unserviceable.

On a modified brake, don't enlarge the pivot or cam holes in the support plate to get it to fit more easily; to do its job, the plate must fit tightly so that it can maintain the pivots and cams in a constant relationship.

After the front wheel has been installed in the motorcycle, adjust the brake as described below. Before tightening the axle nut, spin the front wheel and apply the front brake. Hold the brake on to locate it centrally in the drum and tighten the axle nut securely.

Adjustment

1. Remove the clevis pin from the top brake arm (Figure 1).
2. With assistance, pull both of the brake arms down to bring the shoes in contact with the drum and hold them there.
3. Turn the link adjuster either in or out until the clevis can be installed with a light push fit. Tighten the locknut on the link.
4. Adjust the control cable so that the brake is applied with a slight movement of the hand lever but the shoes do not drag in the drum when the lever is relaxed. Hold the adjuster to prevent it from turning and tighten the locknut.

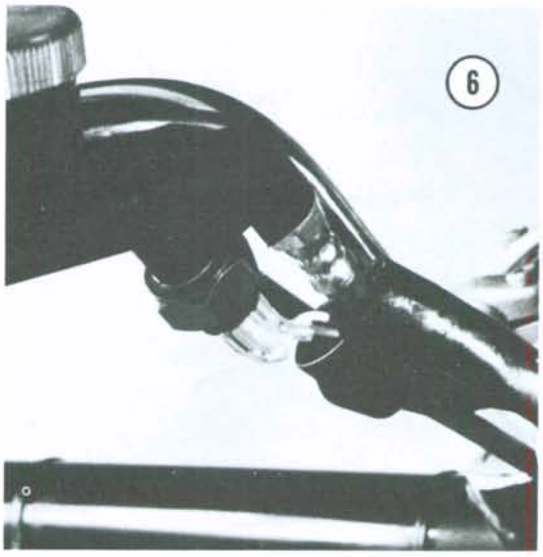
FRONT DISC BRAKE

The front disc brake is actuated by hydraulic fluid and is controlled by a hand lever like the drum-type brake. Unlike the drum brake, however, the disc brake does not require adjustment.

It's essential that the work area and all tools be scrupulously clean when doing any major service on the hydraulic system. Tiny particles of foreign matter and grit in the caliper assembly or the master cylinder can damage the components making the system unsafe and requiring replacement of the damaged parts. Also, sharp tools must not be used inside the calipers or on the pistons. If there is any doubt about your ability to correctly and safely carry out major service on the brake components, take the job to a Norton service shop or a brake specialist.

Master Cylinder Removal and Disassembly

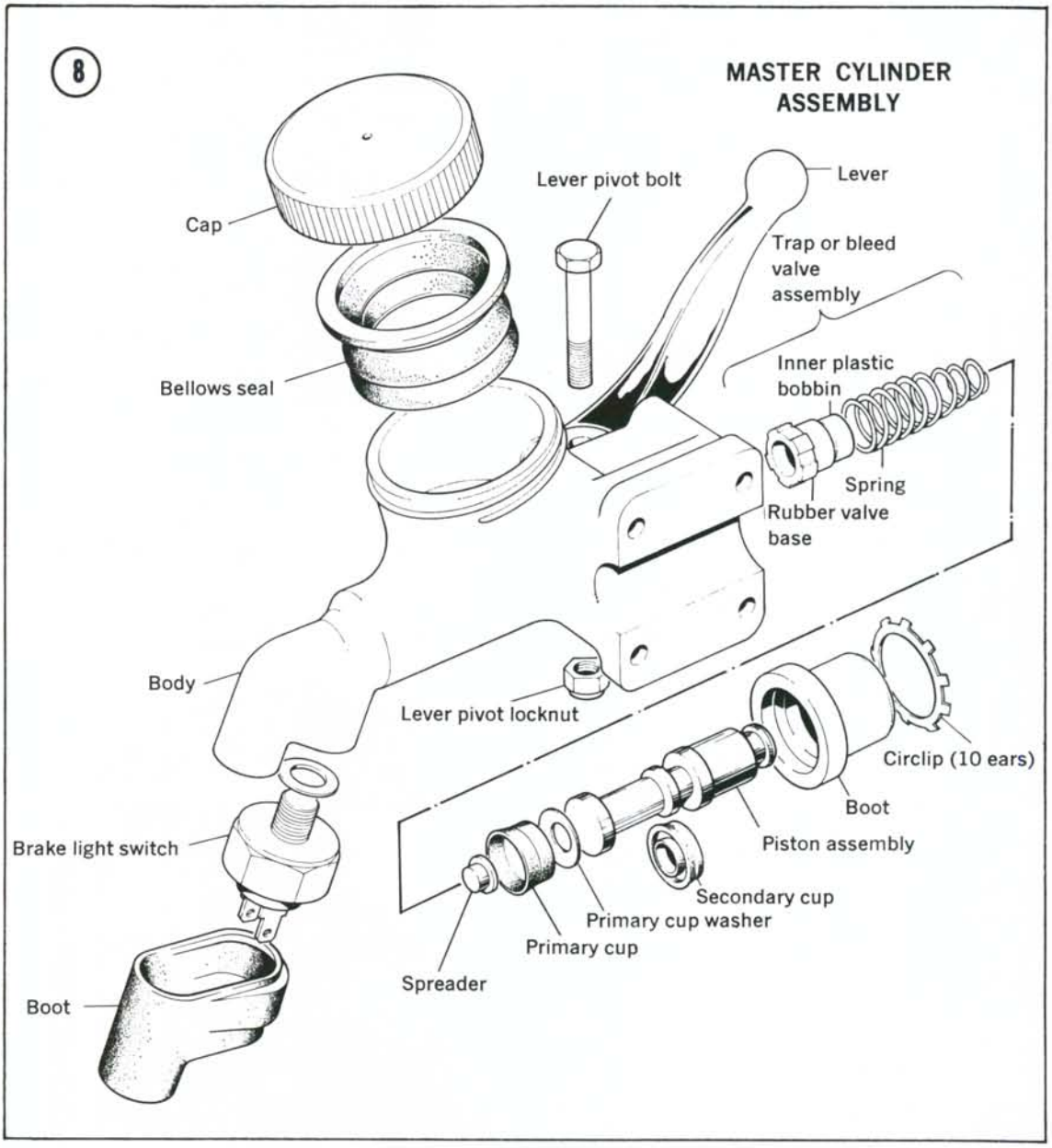
1. Unplug the electrical leads from the brake light switch (**Figure 6**). Peel the rubber boot away from the switch and master cylinder to expose the brake line nut. Unscrew the nut and 4 screws which hold the master cylinder to the handlebar (**Figure 7**).



2. Remove the cap and bellows from the master cylinder and unscrew the brake light switch. Unscrew the pivot nut and bolt (**Figure 8**) and remove the lever.

3. Remove the circlip from the end of the master cylinder by carefully prying out several adjacent tangs on the clip. Remove the rubber boot and the piston.

4. Remove the cups, washer, and spreader from the master cylinder by lightly tapping the open end of the cylinder on a clean piece of wood or by applying light air pressure to the brake-line port. Do not use any hooks or sharp objects to pull the pieces out of the cylinder.



Inspection

1. Thoroughly clean the piston and master cylinder in fresh brake fluid and allow them to drain on a clean surface. Inspect the master cylinder bore and the piston contact surfaces for signs of wear and damage. If either component is less than perfect, replace it. Check the end of the piston for wear caused by the lever and check the pivot bore in the lever. Discard the bleed valve assembly, rubber boot, and cups.

2. Make sure the passages in the bottom of the brake fluid reservoir are clear. Check the reservoir cap and bellows for damage and deterioration and replace as necessary. Finally, check the condition of the threads in the bores for the brake line and the switch and examine the lever pivot lug for cracks. Any one instance of wear or damage to either the master cylinder or piston is reason for replacement of the affected component.

Assembly

1. Soak the new seal cups in fresh brake fluid for at least 15 minutes to make them pliable. Carefully work the secondary cup on the piston over the primary flange and into its groove by hand.

2. Install the boot on the piston. Make sure the outer end of the boot seats in the piston groove.

3. Assemble the trap valve, spring, and spreader. Make sure the plastic bobbin seats in the large end of the spring and the spreader seats in the small end. The hole in the bobbin must be clear.

4. Hold the cylinder upright and install the assembly, valve first. Set the primary cup into the cylinder, open end down, and set the washer on top of it with the convex surface up.

5. Coat the secondary cup with brake fluid and set the piston into the cylinder, crown first. Set the lock clip in place on the end of the boot with the clip fingers facing away from the boot.

6. Slowly turn and press in the piston assembly at the same time. Make sure that the lip of the secondary cup enters the cylinder without snagging. When the piston portion of the assembly is in the cylinder, hold it in place and fit the shoulder of the boot into the groove in the cylinder. Fit the boot lock clip into the groove. While still holding the piston assembly in the cylinder, engage the end of the piston assembly with the lever, line up the lever pivot holes, and install the pivot bolt and nut.

7. Reinstall the master cylinder by reversing the removal steps. Check to make sure the master cylinder is horizontal on the handlebar and fill and bleed the system.

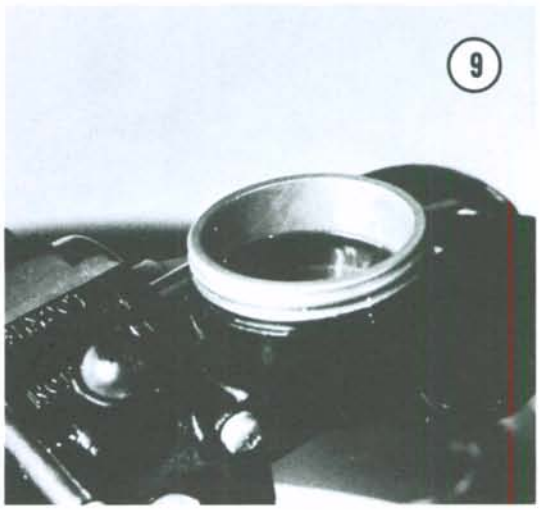
Bleeding

1. Connect a length of tubing to the bleed valve on the brake caliper and place the other end of the tube in a clean, glass jar. The tube should be long enough so that a loop can be made higher than the bleed valve to prevent air from being drawn back into the caliper during bleeding.

2. Fill the fluid reservoir almost to the top lip. Open the bleed valve a full turn and slowly pump the hand lever. As the fluid enters the system, the level will drop in the reservoir. Maintain the level at about ½ inch from the top of the reservoir to prevent air from being drawn into the system.

3. Continue to pump the lever and fill the reservoir until there are no more air bubbles in the fluid coming from the bleed line. Then hold the lever full on and tighten the bleed valve and remove the bleed tube.

4. If necessary, add fluid to correct the level in the reservoir. It should be ½ inch from the top edge (**Figure 9**). Install the rubber bellows, closed side down, and screw on the reservoir cap.



5. Test the feel of the brake lever. It should be firm and should offer the same resistance each time it's pulled. If it feels spongy, it's likely that there is still air in the system and it must be bled again. When all air has been bled from the system, and the fluid level is correct in the reservoir, double check and tighten all the fittings and connection.

WARNING

Before riding the motorcycle, make certain that the front brake is operative by compressing the lever several times.

Brake Pad Replacement

There is no recommended mileage interval for changing the friction pads in the disc brake; service life is heavily dependent on riding conditions and habits. The disc and pads should be checked for wear every 1,000 miles and replaced when the friction material is worn down to a thickness of about ⅛ in. (3.2mm).

1. Remove front wheel as described earlier.
2. Carefully remove the pads from the caliper and discard them. Clean the pad recesses and the ends of the pistons with a soft brush. Don't use solvent, wire brush, or any hard tool which would damage the cylinders or the pistons.
3. Lightly coat the ends of the pistons and the backs of the new pads (not the friction material) with disc brake lubricant.

NOTE: *Check with your dealer to make sure the friction compound of the new pads is compatible with the disc material. Remove any roughness from the metal backs of the pads with a fine file and blow them clean with compressed air.*

4. Remove the cap and bellows from the master cylinder and slowly push the pistons into the caliper while checking the reservoir to make sure the fluid does not overflow. The pistons should move freely. If they do not and there is any evidence of them sticking in the cylinders, the caliper should be removed and serviced as described later.
5. Install the pads in the caliper and push them all the way in against the pistons.
6. Carefully remove any rust or corrosion from the disc and install the front wheel. With the front of the motorcycle still supported, spin the front wheel and activate the brake for as many times as it takes to refill the cylinders in the caliper and correctly locate the pads.

WARNING

Don't ride the motorcycle until you're sure the brake is operating correctly with full hydraulic advantage.

7. Bed the pads in gradually for the first 50 miles by using only light pressure as much as possible. Immediate hard brake applications will glaze the new friction material and greatly reduce the effectiveness of the brake.

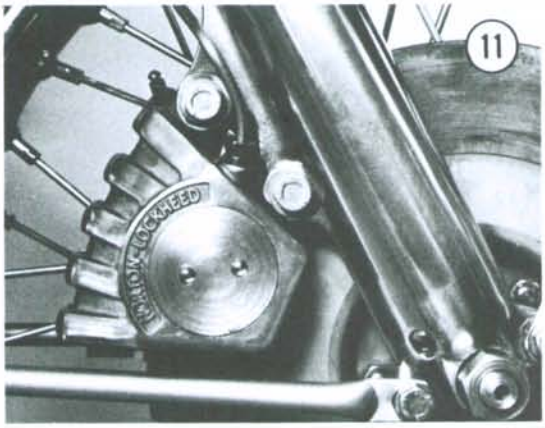
Caliper Rebuilding

If the caliper cylinders leak, the caliper should be rebuilt. If the pistons bind in the cylinders, indicating severe wear or galling, the entire unit should be replaced. Rebuilding a leaky caliper requires special tools, a super-clean work environment, and experience. Even minor damage to the cylinders, pistons, or seals during service, or an assembly error could cause the brake to malfunction. Therefore, caliper service should be limited to removal and replacement. Take an unsatisfactory caliper to an authorized Norton dealer or to a brake specialist with experience on this particular unit for rebuilding.

Caliper Removal

1. Unscrew the pipe union at the hose bracket (**Figure 10**). Loosen or remove 2 nuts which fasten the fender bridge and hose bracket to the fork leg so the hose and pipe can be separated without bending the pipe.

2. Unscrew the caliper mounting bolts (**Figure 11**) and slide the caliper off the disc.



Caliper Installation

Install the caliper by reversing the removal steps. Fill the system with brake fluid and bleed it as described earlier. Make certain that the brake is fully operative before riding the motorcycle.

FRONT HUB

The front wheel should be removed and the hub disassembled, inspected, and the bearings cleaned and greased every 10,000 miles.

Disassembly/Assembly (Drum Type)

1. Block up the front of the motorcycle so the wheel is off the ground and remove it as described earlier.

2. Unscrew the lock ring (right-hand thread) from the left side of the hub (**Figure 12**) with Norton tool No. 063965, or by applying the end of a small drift against the side of one of the recesses and tapping the ring loose. If the ring cannot be broken loose, warm the hub with a propane torch or similar low flame.

3. Remove the seal and the spacer from the left side of the hub and install the axle from the right side. Using the axle as a drift, tap it into the hub with a soft mallet. As the right side bearing and the spacer are driven into the hub they will displace the left-side bearing. Drive it only as far as necessary for it to drop out.

4. Remove the axle and install it in the left side through the spacer tube. Drive out the right-side bearing along with the washers and seal.

5. Clean and dry the parts thoroughly. Check the bearings by hand for roughness and radial play and inspect the seals for damage or deterioration and replace any pieces that are defective. Pack the bearings with grease.

6. Line up the left-side bearing squarely with the bore in the hub and tap it into place, applying a drift only to the outer race. Install the spacer (with the flat side against the bearing), the seal, and the lock ring. Tighten the lock ring securely.

7. Install the spacer into the left-side bearing through the right side of the hub. The short end of the spacer must go into the left bearing and the spacer must be driven all the way in until its shoulder contacts the bearing inner race. Fill the area between the spacer and the inside of the hub with grease.

8. Line up the right-side bearing (double row) squarely in the right bearing bore. Using the axle as a drift, drive the bearing into the hub until it contacts the shoulder on the spacer.

9. Install the small washer, seal, and large washer. On early models it may be necessary to tap the large washer on.

10. Assemble the brake to the hub and install the wheel. Centralize the brake in the drum as described under *Front Drum Brake Assembly*.

11. Adjust the brake as described earlier.

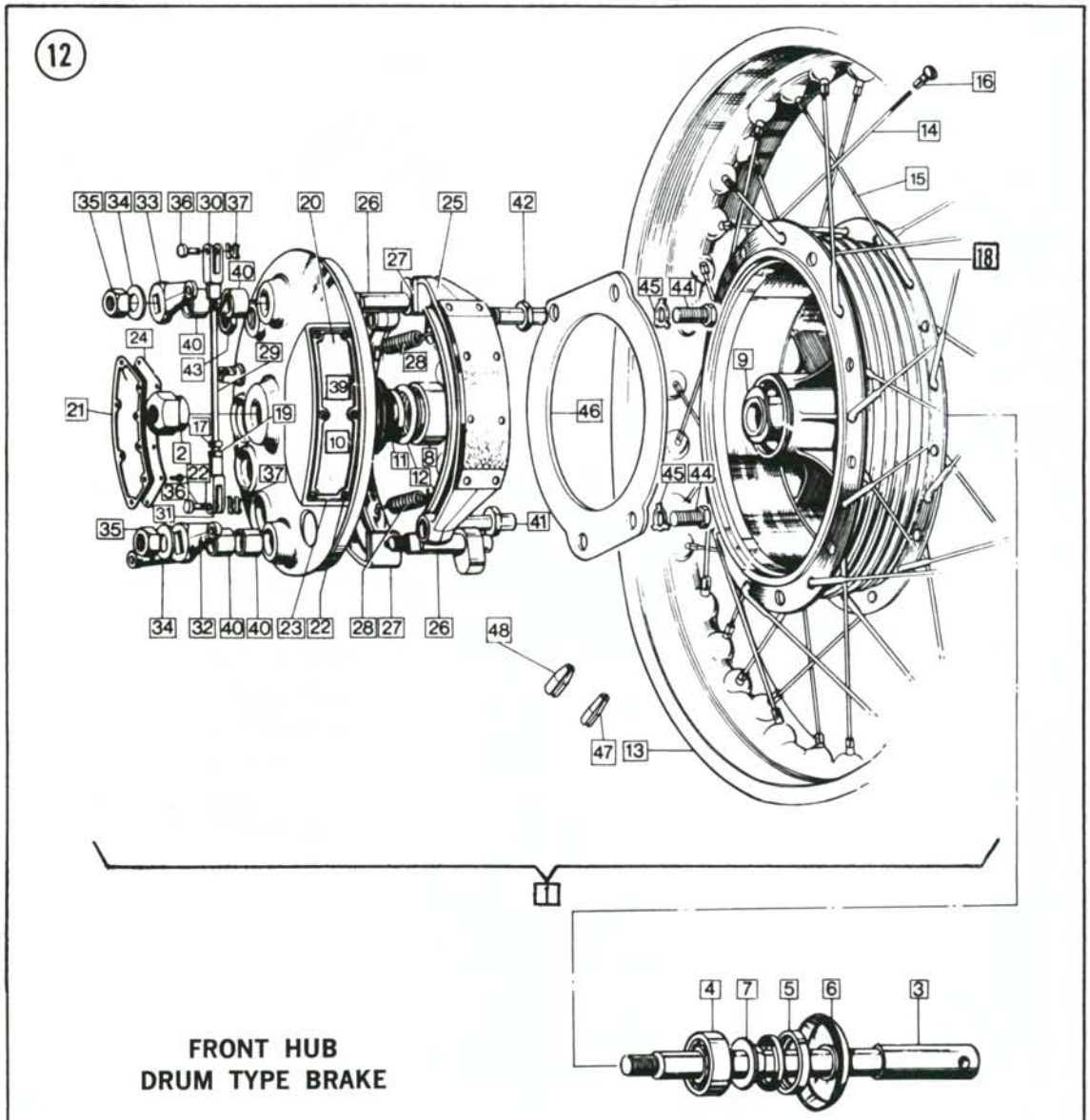
Disassembly/Assembly (Disc Type)

1. Block up the front of the motorcycle so the wheel is off the ground and remove it as described earlier.

2. Unscrew the lock ring (left-hand thread) from the left side of the hub (**Figure 13**) using Norton tool No. 063965, or by applying the end of a small drift against the side of one of the recesses and tapping the ring loose. If the ring cannot be broken loose, warm the hub with a propane torch or similar low flame.

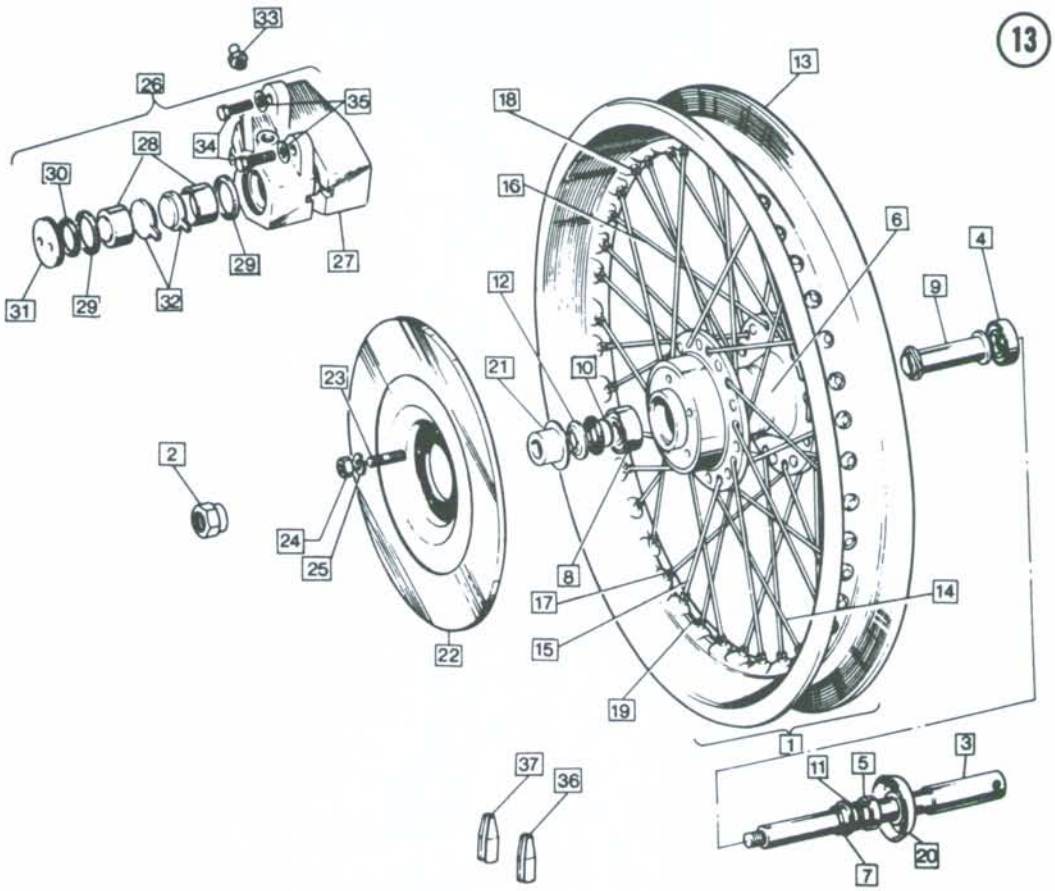
3. Remove the seal and spacer and heat the hub with *water* to about 212°F (100°C).

4. Insert a drift through the double-row bearing and into the spacer tube. Move the opposite end



FRONT HUB
DRUM TYPE BRAKE

1. Wheel assembly
2. Spindle nut
3. Wheel spindle
4. Bearing
5. Bearing lock ring
6. Dust cover
7. Spacer
8. Right-side bearing
9. Spacer
10. Washer
11. Seal
12. Washer
13. Rim
14. Inner spoke
15. Outer spoke
16. Spoke nipple
17. Nut
18. Hub shell
19. Adjuster nut
20. Inlet gauze
21. Exit gauze
22. Air scoop screw
23. Air inlet cover
24. Air exit cover
25. Brake shoe
26. Expander
27. Slipper
28. Brake shoe spring
29. Tie rod
30. Yoke (left-hand thread)
31. Yoke (right-hand thread)
32. Long expander lever
33. Short expander lever
34. Washer
35. Expander lever nut
36. Cable pin
37. Spring clip
38. Dust cover
39. Washer
40. Expander bush ing
41. Pivot pin
42. Pivot pin/torque stop pin
43. Nut
44. Bolt
45. Tab washer
46. Support plate
47. Balance weight
48. Balance weight



FRONT HUB
DISC TYPE BRAKE

1. Rim and hub assembly
2. Spindle nut
3. Wheel spindle
4. Left-side bearing
5. Bearing lock ring
6. Hub shell
7. Spacer
8. Right-side bearing
9. Spacer
10. Washer
11. Seal
12. Washer
13. Rim
14. Right-side inner spoke
15. Right-side outer spoke
16. Left-side inner spoke
17. Left-side outer spoke
18. Right-side spoke nipple
19. Left-side spoke nipple
20. Dust cover
21. Right-side spacer
22. Disc
23. Stud
24. Nut
25. Washer
26. Caliper assembly
27. Caliper
28. Piston
29. Seal
30. Seal
31. End plug
32. Friction pads
33. Bleed nipple
34. Screw
35. Spring washer
36. Balance weight
37. Balance weight

of the spacer to one side so the end of the drift can be applied to the bearing race. Tap the bearing out slightly and move the drift to the opposite side, moving the spacer so the drift can be applied to the bearing, and tap the bearing out, continuing the procedure—from side-to-side—until the bearing has been driven out of the hub.

5. Remove the spacer tube from the hub and drive the double-row bearing out to the right side of the hub, along with the washers and seal.

6. Clean and dry the parts thoroughly. Rotate the bearings by hand and check them for radial play and roughness. Inspect the seals for damage or deterioration and replace any pieces that are defective. Pack the bearings with grease.

7. Line up the left-side bearing (single-row) squarely with the bore in the hub and tap it into place, applying a drift only to the outer race. Install the spacer, seal, and lock ring. Tighten the lock ring securely.

8. Install the spacer tube into the left-side bearing through the right side of the hub. Fill the area between the spacer and the inside of the hub with grease.

9. Line up the right-side bearing (double-row) squarely in the right bearing bore. Using the axle as a drift, drive the bearing into the hub until it contacts the shoulder of the spacer.

10. Install the small washer, seal, large washer, and spacer in the right side of the hub and install the wheel in the motorcycle as described earlier.

CHAPTER NINE

REAR WHEEL AND BRAKE

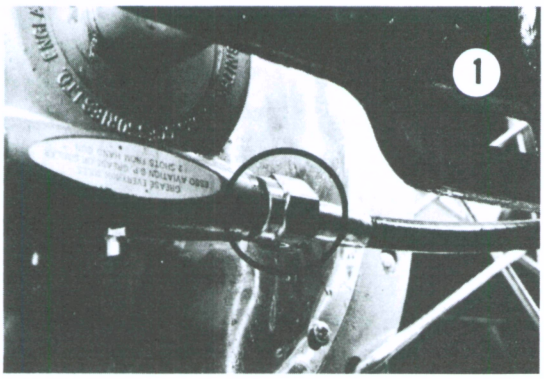
This chapter describes repair and maintenance of the rear wheel hub, sprocket, and drum and disc brakes.

REAR WHEEL

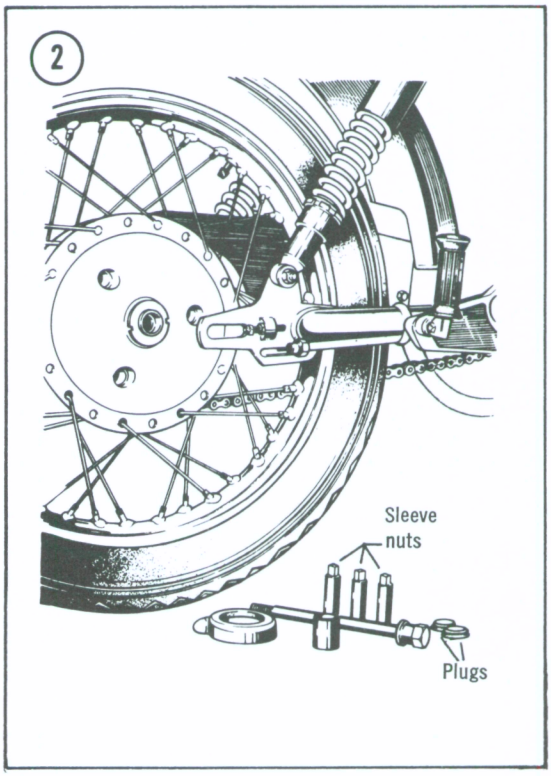
The rear wheel can be removed without disturbing the brake, sprocket, or drive chain.

Removal (1970 and Earlier)

1. Support the rear of the motorcycle so the wheel clears the ground.
2. Disconnect the speedometer cable from the drive unit (**Figure 1**).



3. Carefully pry the 3 rubber plugs out of the right side of the hub and unscrew the 3 sleeve nuts (**Figure 2**).

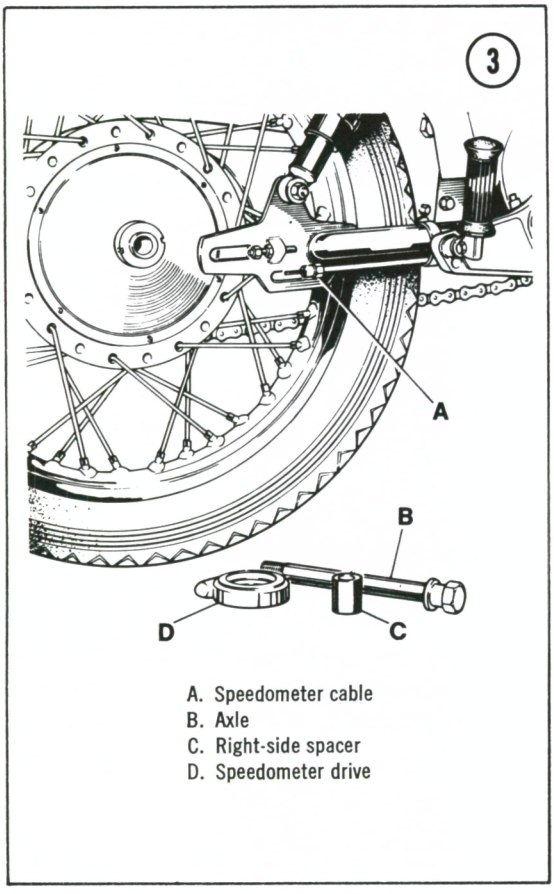


4. Unscrew the axle and pull it out while lifting up on the rear wheel. The spacer tube and the speedometer drive should fall clear as the axle is removed. Pull the hub away from the drum to the right and remove wheel from motorcycle.

Removal (1971 through 1974)

1. Support the rear of the motorcycle so the rear wheel clears the ground.

2. Unscrew the axle (**Figure 3**) and pull it out while lifting up on the rear wheel. The spacer and speedometer drive should fall clear as the axle is removed.



A. Speedometer cable
B. Axle
C. Right-side spacer
D. Speedometer drive

3. Pull the wheel to the right to release it from the drum and remove it to the rear.

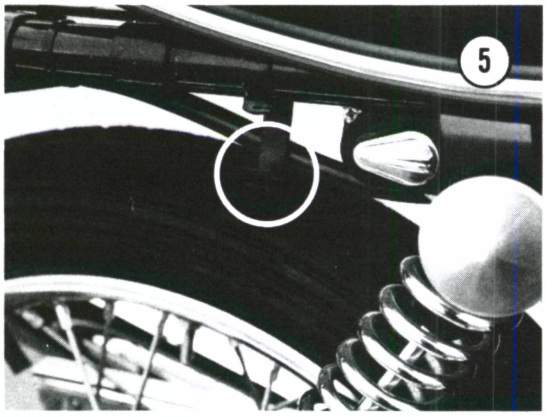
Removal (1975 with Disc Brake)

1. Support the rear of the motorcycle so the rear wheel clears the ground.

2. Loosen the lower mounting bolt on the right rear suspension unit (**Figure 4**) and push the unit as far to the left as the circlip on the bolt will allow.

3. Unscrew the axle from the right side and pull it out while supporting the rear wheel. The right side spacer will fall clear as the axle is removed.

4. Disconnect the brake caliper mount from the shock absorber mount and hang the caliper on the hook beneath the seat rail (**Figure 5**); do not let the caliper hang on the brake line.



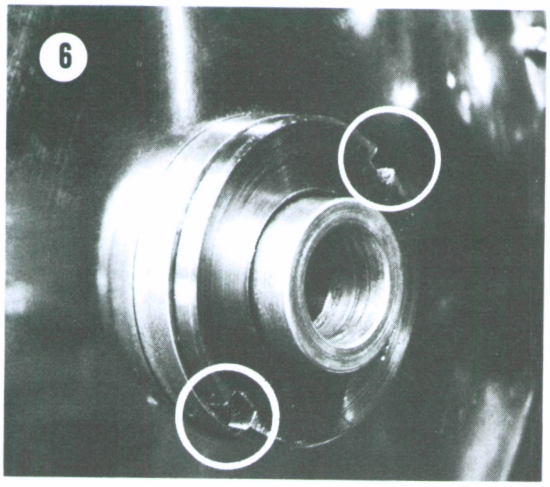
5. Pull the wheel to the right to release it from the sprocket and remove it to the rear.

Installation

Install the wheel by reversing the removal steps. On early models, line up one of the mounting studs in the brake drum with the swing arm so the bearing boss on the hub will pass between

the other 2 studs. Then line up the studs with the hole in the hub and push the wheel to the left. On late models, line up the paddles on the drum (on the sprocket on disc brake models) with the shock absorber holes or slots in the wheel and push the wheel to the left.

On drum brake models, set the speedometer drive in place so that the tangs in the drive gear are engaged with the slots in the bearing lock ring (**Figure 6**).



Hold the spacer in place between the swinging arm and the speedometer drive and start the axle in through the arm. Push it all the way in and tighten it securely.

REAR HUB

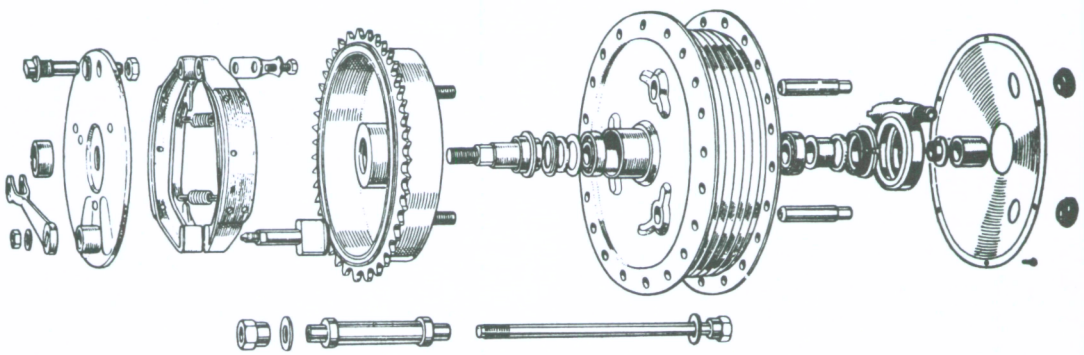
Three hub types are used on Norton twins. On the early drum brake hub, through 1970 (**Figure 7**), the brake drum and drive sprocket bolt to the hub. On the later drum brake hub, 1971 on (**Figure 8**), 3 plastic shock absorber elements in the hub engage 3 paddles in the brake drum. In the disc brake hub, 1975 models (**Figure 9**), 5 paddles in the sprocket engage 5 rubber blocks located in the drive center in the hub.

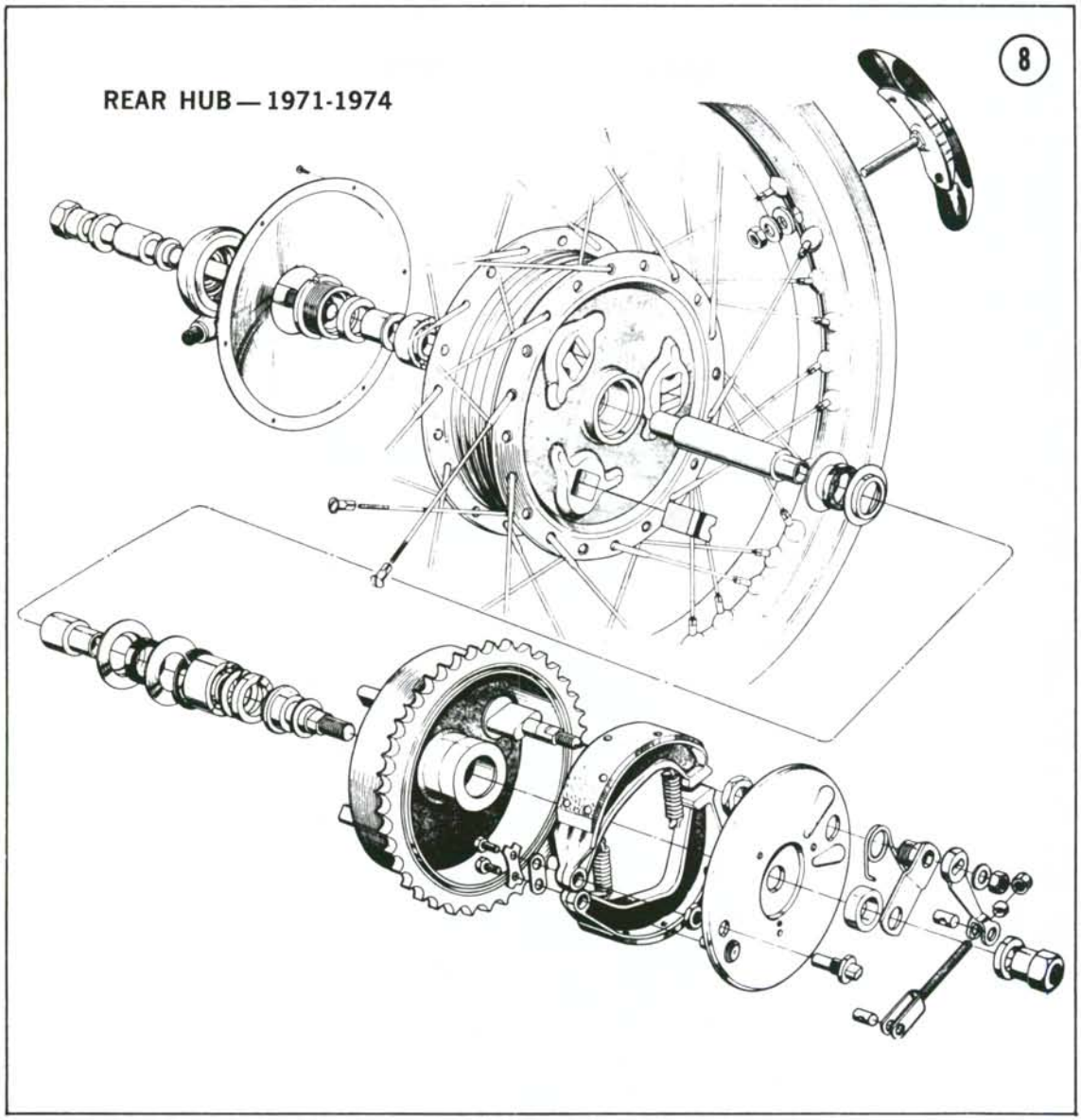
With all types, the rear wheel can be removed without disturbing the brake, sprocket, or drive chain. For major service such as repacking or replacing the bearings, however, the entire assembly must be removed from the swinging arm. The recommended service interval for bearings is every 10,000-12,000 miles. The bearings and brake components should be inspected during each service and replaced as required.

The early and late drum brake wheels differ internally only in that the early wheel does not have a bearing in the brake drum. Instead, it has a double-row ball bearing assembly in the brake side of the hub and a single-row ball in the right side. The late wheel has a double-row ball assembly in the brake drum and a single-row ball assembly at each side of the hub. The procedure for removing the bearings from the hub is the same for both types.

7

REAR HUB — 1961-1970

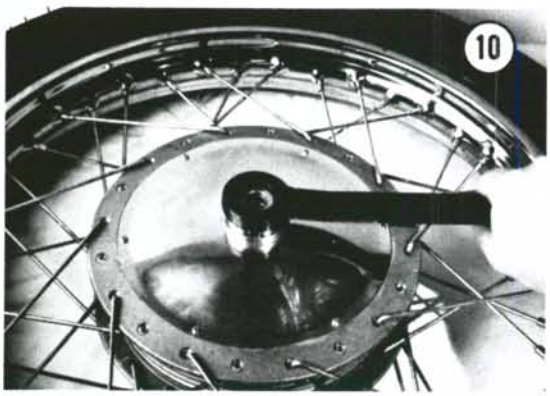


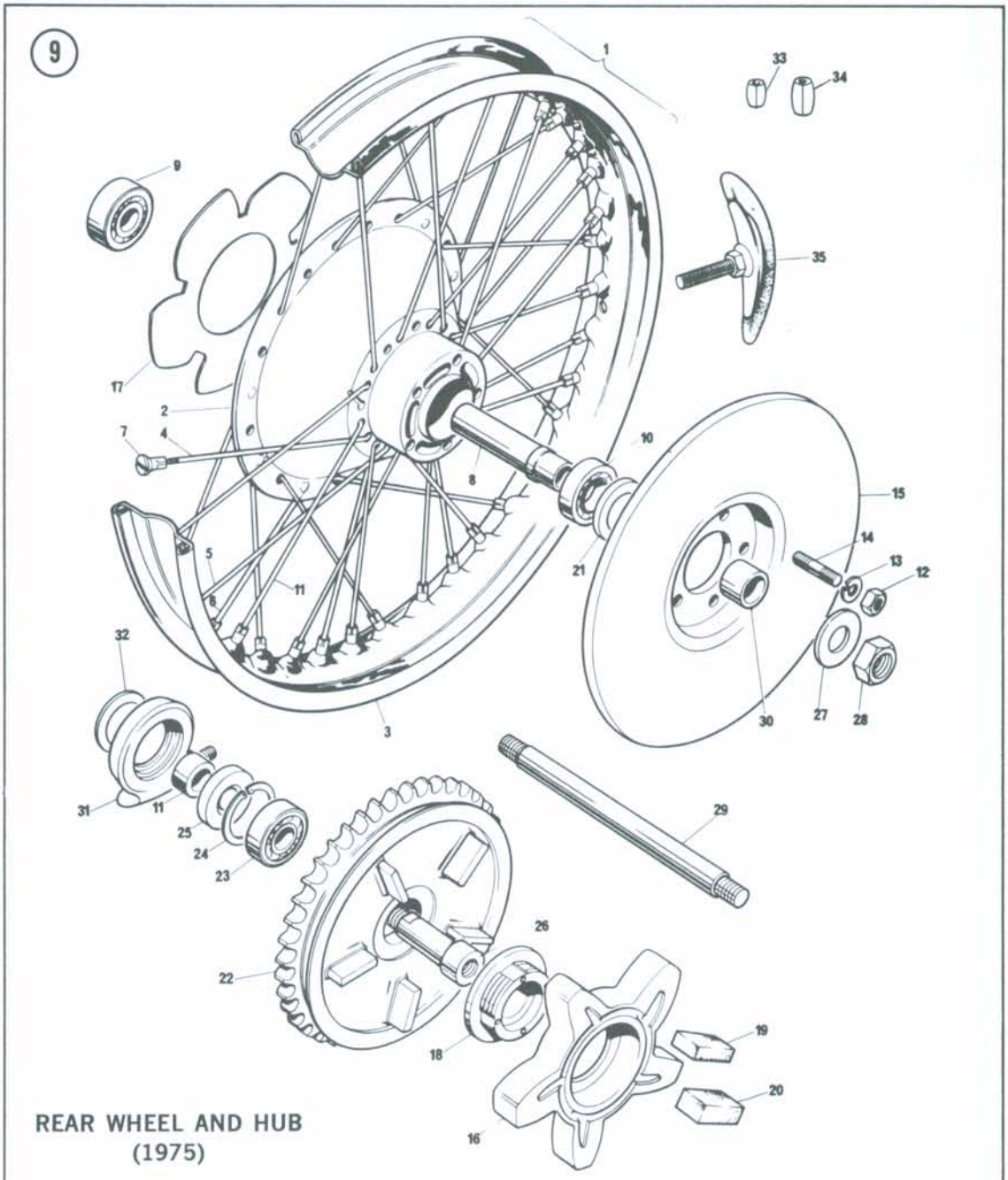


Disassembly (Drum Brake Hubs)

1. Unscrew the lock ring from the right side of the hub (**Figure 10**). This piece has a left-hand thread. A drift or punch should not be used to break the ring loose. Instead, use either Norton tool No. 063965 or make a wrench from ⅛ in. wall tube or pipe like the one shown in **Figure 11**.

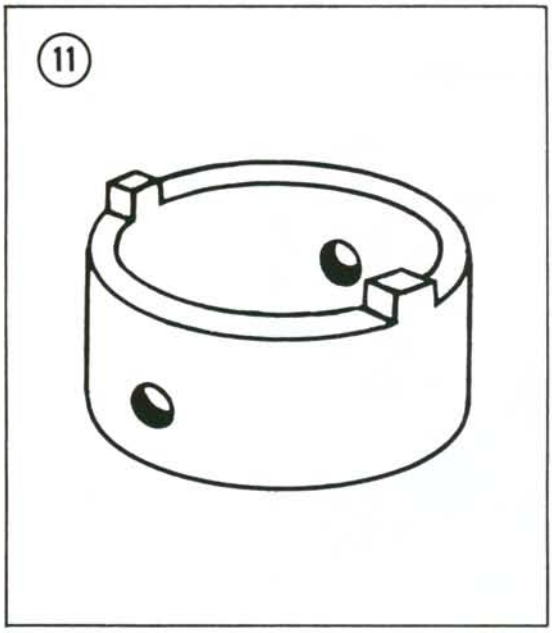
2. Remove the felt washer and spacer from the hub. Put a washer and the large right-side spacer on the rear axle. Insert the axle into the hub from the left side (**Figure 12**). Drive the axle





REAR WHEEL AND HUB
(1975)

1. Wheel assembly
2. Hub
3. Rim
4. Spoke, right hand
5. Spoke, left hand inner
6. Spoke, left hand outer
7. Spoke nipple
8. Bearing sleeve
9. Bearing
10. Bearing
11. Sprocket bearing spacer
12. Nut
13. Washer
14. Stud
15. Disc
16. Drive center
17. Plate
18. Lock ring
19. Drive rubber
20. Drive rubber
21. Oil seal
22. Sprocket
23. Ball journal bearing
24. Circlip
25. Oil seal
26. Dummy shaft
27. Washer
28. Axle nut
29. Axle assembly
30. Seal sleeve
31. Speedometer gearbox
32. Washer
33. Balance weight
34. Balance weight
35. Security bolt



into the hub with a soft mallet until the bearing contacts the machined stop. This pushes the right-side bearing partially out of the hub. Remove the rear axle.

3. Drive the spacer out of the brake-side bearing using a shouldered drift that will pass through the bearing inner race. This drives the right-side bearing out of the hub. If a suitable drift is not available, the front axle can be used; however, make sure that the front of the frame is supported before removing the axle from the front wheel.

4. Insert the rear axle and large spacer into the brake-side bearing from the right end of the hub and drive the bearing out.

5. On late wheels, remove the drum from the brake assembly and remove the spacer, washers, and circlip from the right side of the drum (**Figure 13**). Screw the axle nut onto the left end of the short axle and drive the bearing out of the drum to the right using a soft mallet.

Disassembly (Disc Brake Hub)

1. Remove the wheel as described earlier. Unscrew the nut from the end of the dummy axle (Figure 9) and withdraw the axle from the sprocket. Collect the washer and disengage the sprocket from the chain. Pull the speedometer drive free of the sprocket.

2. Remove the bearing spacer, the seal, and the circlip from the sprocket. Insert the dummy axle into the bearing and knock it out by tapping on the dummy axle with a soft mallet.

3. Unscrew the nuts which attach the disc to the hub and remove the lockwashers, spacer, and oil seal. From the other side of the hub, unscrew the bearing lock ring and remove the drive center.

4. With the dummy axle, drive the bearing spacer into the hub from the drive side. This will knock the opposite bearing out of the hub toward the brake side. Then, invert the hub and using the dummy axle with the long axle screwed into it, knock out the drive side bearing.

Inspection

Thoroughly clean and dry all parts, including the inside of the hub and drum. Rotate bearings by hand and check for roughness and axial play. Inspect metal parts for corrosion. If there is any doubt about a bearing's condition, replace it. Replace the felt seals.

Assembly (Drum Brake Hubs)

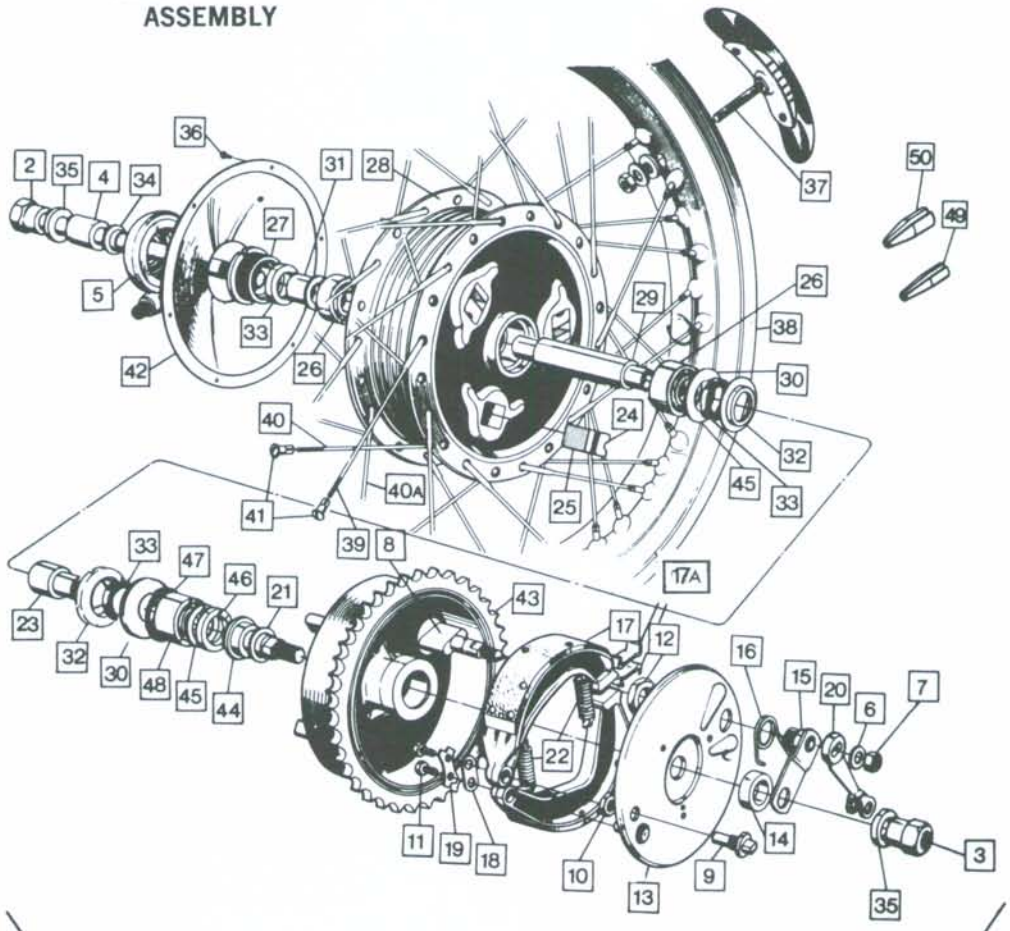
1. Pack the bearings with a good grade of bearing grease.

2. Line up the right-side hub bearing (single-row) with the bearing bore and tap it in evenly far enough to permit the spacer, felt washer, and lock ring to be installed. Tighten the lock ring (left-hand thread) securely.

3. Tap the bearing spacer tube into the right-side bearing from the left. On 1970 and earlier

13

RIM AND HUB ASSEMBLY



1

1. Hub assembly
2. Wheel axle
3. Wheel axle nut
4. Axle spacer
5. Speedometer gearbox
6. Washer
7. Nut
8. Brake cam
9. Torque stop pin
10. Torque stop pin nut
11. Bolt
12. Cam bearing nut
13. Cover plate assembled
14. Cover plate outer spacer
15. Bearing cam and stay
16. Lever return spring
17. Brake shoe
17A. Brake shoe slipper
18. Plate
19. Washer
20. Lever
21. Washer
22. Spring
23. Left-side bearing spacer
24. Thick cush drive buffer
25. Thin cush drive buffer
26. Bearing
27. Lock ring
28. Hub shell
29. Inner bearing spacer
30. Felt retaining washer
31. Spacer
32. Dished washer
33. Seal
34. Gearbox spacer
35. Spindle washer
36. Disc screw
37. Security bolt
38. Rim
39. Spoke
40. Left-side inner spoke
40A. Right-side inner spoke
41. Nipple
42. Rear hub disc
43. Brake drum
44. Dummy axle
45. Felt retaining washer
46. Felt seal
47. Circlip
48. Bearing
49. Balance weight
50. Balance weight

models, the distance between the end of the spacer and the shoulder is greater on the left (brake) side than on the right to accommodate the wider double-row bearing in the left side of the hub. Make certain that the shorter end of the spacer is installed in the right-side (single-row) bearing.

4. Set the left-side bearing squarely in the left side of the hub and tap it evenly around the outer race until it is stopped by the shoulder on the spacer tube. Don't apply any pressing or tapping force to the bearing inner race.

5. Install the felt washer and seal and the outer metal washer. On early wheels, the outer washer may be tapped in with a small punch or drift.

6. On late wheels, install the washer and short axle in the drum, followed by the felt seal and the felt retainer. Line up the double-row bearing squarely with the bearing bore in the drum and tap it evenly around the outer race until its outer edge is beneath the circlip groove. Install the circlip with the outer edge facing outward and make certain it's completely seated in the groove. Install the inner felt retainer, the felt seal, the dished washer, the outer felt retainer, and the bearing spacer.

NOTE: *An improved bearing spacer for Commando models up to engine No. 305427 can be purchased through Norton dealers as a standard replacement item. The new spacer (part No. 065290) replaces spacer No. 062070 and is interchangeable without any modifications.*

SPROCKET AND BRAKE ASSEMBLY

Removal/Installation

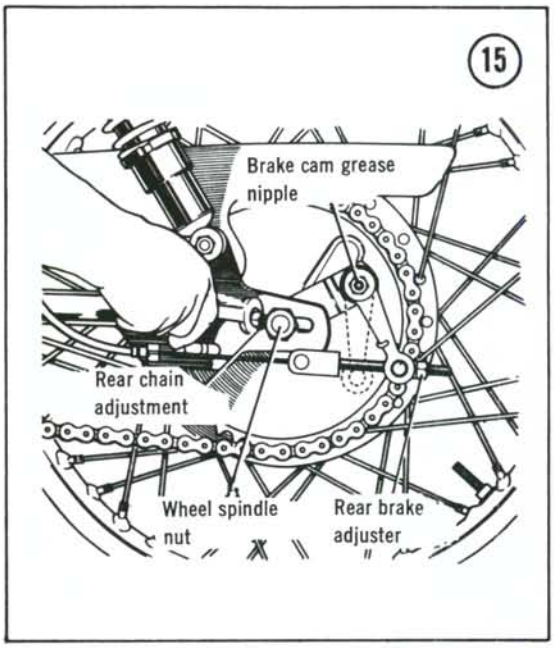
1. Remove the wheel as described earlier.

2. Remove the master link from the rear chain and remove the chain from the rear sprocket. Unplug the electrical leads from the brake light switch (**Figure 14**).

3. Disconnect the rear brake cable from the brake cam arm (**Figure 15**).

4. Unscrew left axle nut and remove the brake and sprocket assembly from the swinging arm.

5. Installation is the reverse of these steps.



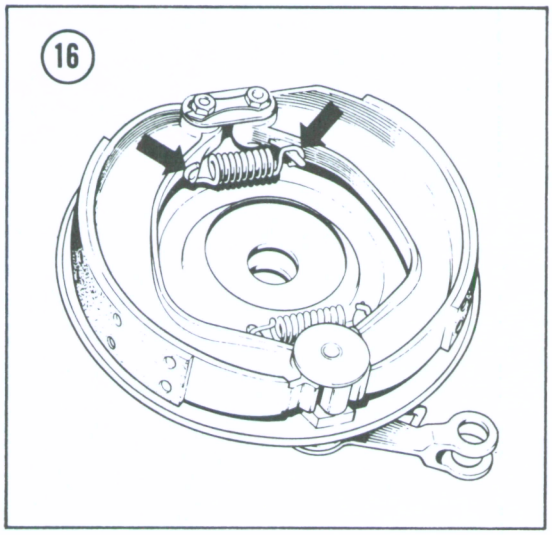
REAR DRUM BRAKE

There is no specified interval for replacing the brake linings; the rate of wear varies greatly depending upon riding habits. The linings should be carefully examined each time the wheel bearings are serviced. If the lining is worn down to or near the rivet heads, the complete shoes and linings should be replaced. If these are not available, the existing shoes can be relined and the new linings arced to fit the drums. This is a job for a specialist and should not be attempted by a hobbyist mechanic.

Removal and Disassembly

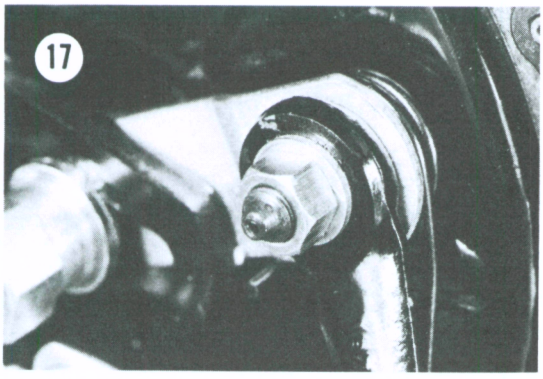
1. Remove the rear wheel and sprocket/brake assembly as described earlier.

2. Remove the springs by lightly gripping the coil section with a conventional pair of pliers and extending one of the spring ends with needle-nose pliers (**Figure 16**).



3. Straighten the tab washers and unscrew the 2 nuts from the shoe pivots. Remove the shoes from the brake backing plate.

4. Unscrew the nut from the end of the camshaft (**Figure 17**) and remove the lever. Pull the cam out of the backing plate. It is not necessary to remove the cam bearing and stay unless the bearing bore is badly worn and must be replaced.



Inspection

Thoroughly clean and dry all parts except the linings. Check the contact surface of the drum for scoring. If there are grooves deep enough to snag a fingernail, the drum should be trued by a brake specialist. In such case, the linings will have to be replaced and the new ones arced to the new drum contour.

Check the linings for wear as described above. If they are serviceable, inspect them for imbedded foreign material. Dirt can be removed with a stiff wire brush, but if they are soaked with oil or grease they will have to be replaced.

Inspect the cam lobes and the pivot area of the shaft for wear and galling. Minor roughness can be removed with emery cloth but if either area is deeply scored or severely worn, the cam should be replaced.

Assembly

1. Grease the cam bearing bore, the cam pivot area and lobes, and the pivot pins with high-temperature grease. Apply only a light coat to each of these points; excess grease is likely to find its way onto the linings and render them unserviceable.

2. Install the cam in the plate. Install the shoes on the pivot pins and against the cam. If the shoes have detachable slippers, make sure these are located between the cam and the ends of the shoes.

3. Install the tie plate, the tab washer plate, and the pivot bolts. Tighten the bolts securely and bend the tab washers over against the flats.

4. Install the return springs between the shoes. Use a short wire loop and screwdriver to stretch the springs over the ears on the shoes.

5. Reinstall the brake, sprocket, and rear wheel as described earlier. Before tightening the axle nut, connect the cable to the brake arm and apply the brake fully to centralize it in the drum. Hold the brake on and tighten the axle nut.

REAR DISC BRAKE

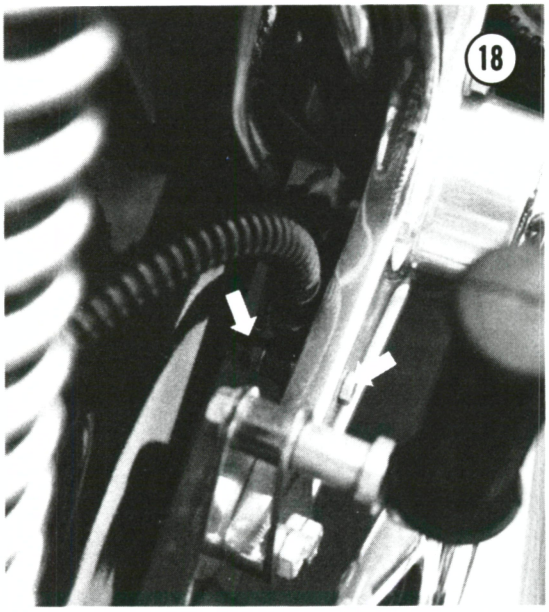
The rear disc brake is actuated by hydraulic fluid and is controlled by a foot lever like the drum-type brake. Unlike the drum brake, however, the disc brake does not require adjustment.

It's essential that the work area and all tools be scrupulously clean when doing any major service on the hydraulic system. Tiny particles of foreign matter and grit in the caliper assembly or the master cylinder can damage the components making the system unsafe and requiring

replacement of damaged parts. Also, sharp tools must not be used inside the caliper or on the pistons. If there is any doubt about your ability to correctly and safely carry out major service on the brake components, take the job to a Norton service shop or a brake specialist.

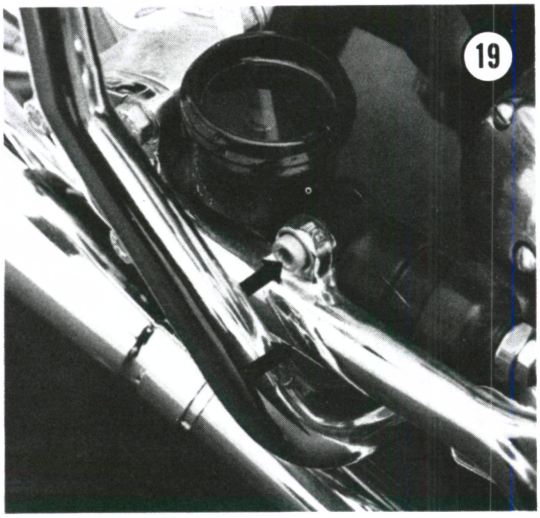
Master Cylinder
Removal and Disassembly

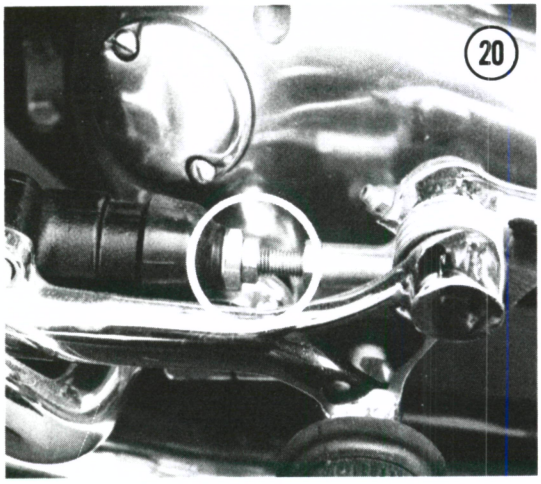
1. Unscrew the bolt which attaches the brake union to the right foot peg plate (**Figure 18**). Note the position of the ground wire so it may be reinstalled in the same location.



2. Slightly loosen the Allen screws which attach the master cylinder to the foot peg stalk (**Figure 19**). Depress the kickstarter and block it or tie it down so it is out of the way. As an alternative, the kickstarter pedal may be removed. Unscrew the 3 bolts which attach the foot peg stalk to the plate. Swing the stalk out far enough to gain access to the brake line union in the end of the master cylinder and unscrew it. It is a good idea to place a drip pan beneath the cylinder to catch brake fluid when the union is disconnected.

3. Loosen the forward locknut on the brake rod (**Figure 20**) and remove the cotter key from the pin which attaches the clevis to the brake pedal. Remove the pin and disconnect the clevis from the brake pedal. Unscrew the clevis from the brake rod. Unscrew the Allen screws which attach the master cylinder to the foot peg stalk and remove the cylinder.





4. Refer to Chapter Eight, *Front Disc Brake*, for disassembly, inspection, assembly, and bleeding procedures.

Brake Pad Replacement

Brake pad replacement for the rear wheel caliper is identical to that for the front. Refer to Chapter Eight.

Caliper Rebuilding

Refer to Chapter Eight for caliper rebuilding instructions.

CHAPTER TEN

FRAME, SUSPENSION, AND STEERING

Included in this chapter are service, maintenance, and repair procedures for all chassis components such as frame, front suspension, rear suspension and swinging arm, and the Isolastic system.

FRAME

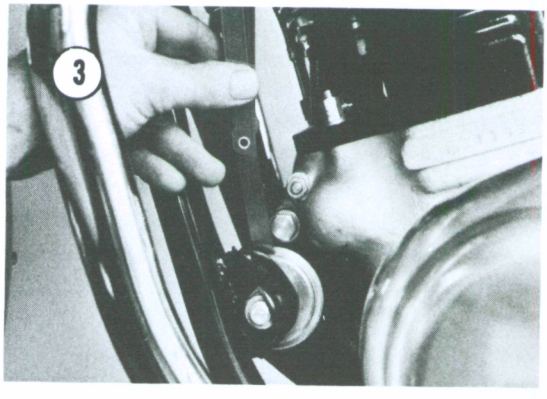
Frame service is limited to inspection for cracks in welds and tubes and restoration of the paint. If bending damage is suspected or apparent, the frame should be inspected and repaired by an authorized Norton service shop or by a specialist experienced in frame repair. **Figure 1 and Figure 2** are provided as reference for inspection and repair.

ISOLASTIC ENGINE MOUNTS

One of the Norton Commando's key features is its Isolastic system. The entire power train fastens to the rest of the motorcycle with resilient mounts, thereby preventing normal but still bothersome drive train vibrations from affecting the rider and the controls. The Isolastic mounts must be inspected and adjusted occasionally, and need to be removed and serviced only after long use.

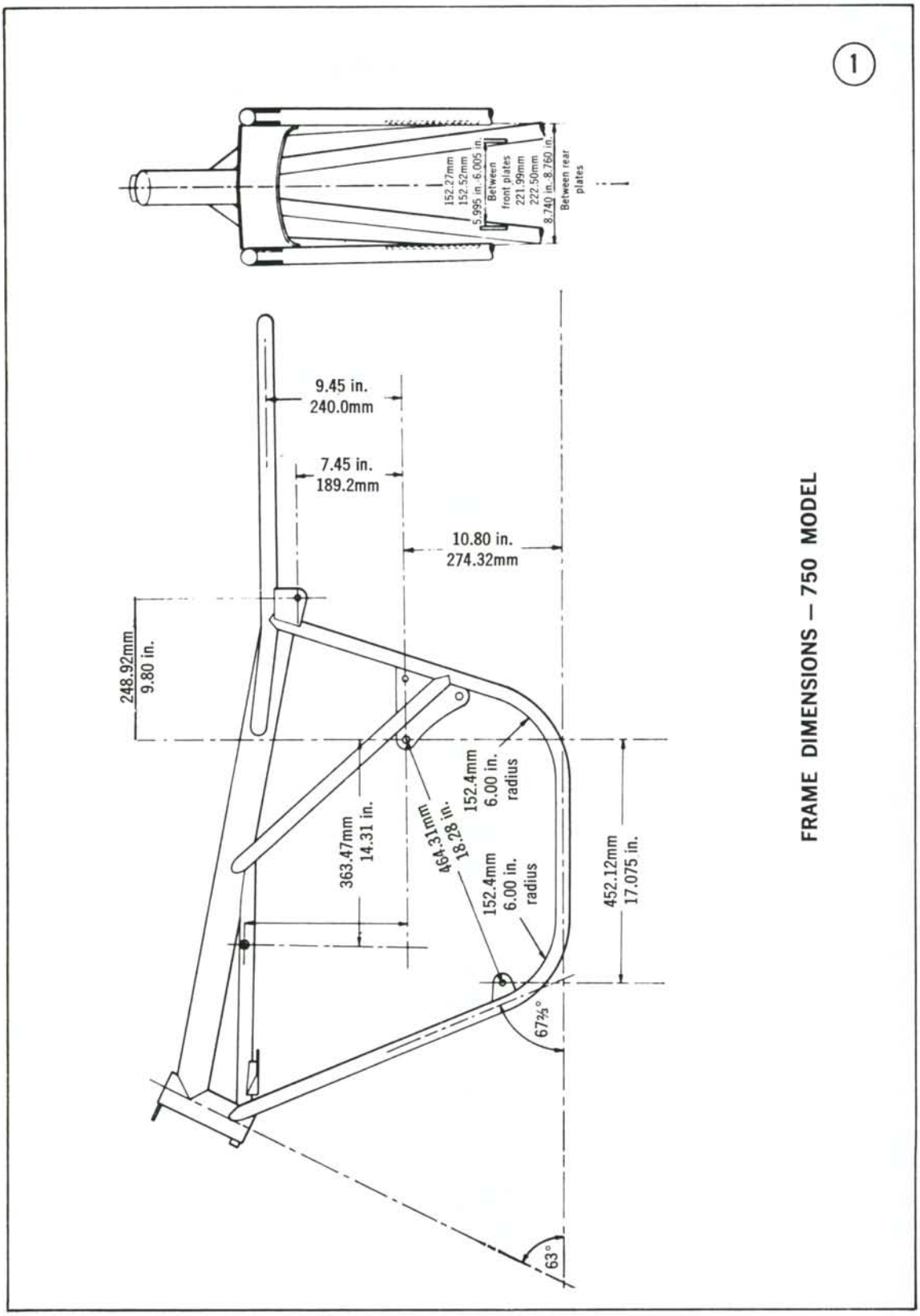
Inspection

1. Peel back the rubber cover on the left side of the Isolastic mount.
2. Push the engine (front mount) or rear wheel (rear mount) to the right to take up the slack in the mount and measure the clearance between the plated collar and the plastic washer (**Figure 3**). Clearance should be 0.010 in. (0.25mm).



Front Mount Adjustment (750 and 850 Mark II Models)

1. Unscrew the nut from the left side of the front mount (**Figure 4**). Line up one of the flats on the right end of the bolt so it will clear the engine case (**Figure 5**).



FRAME DIMENSIONS — 750 MODEL

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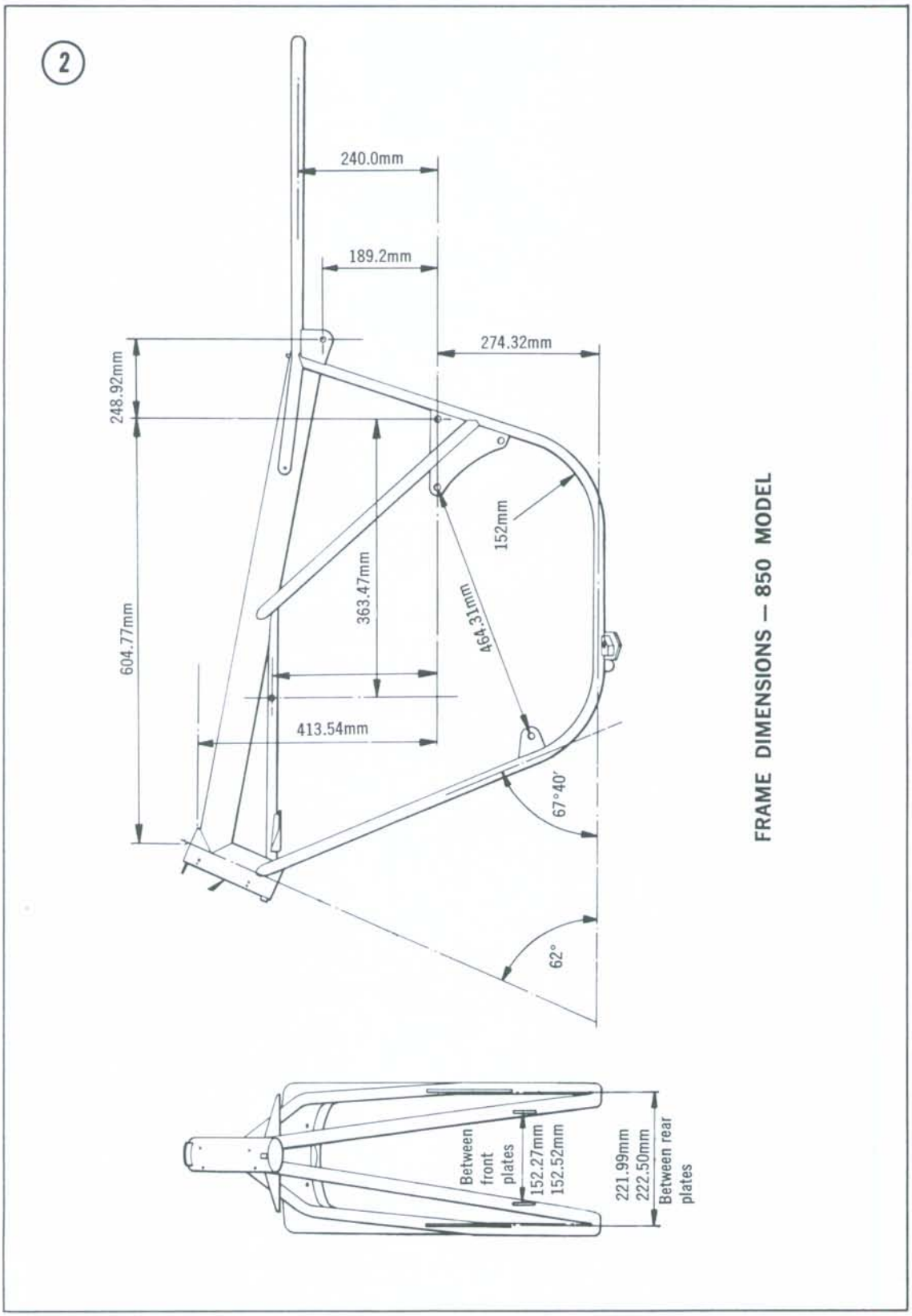
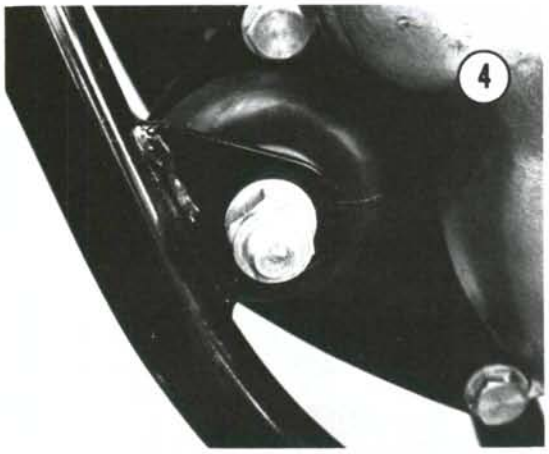
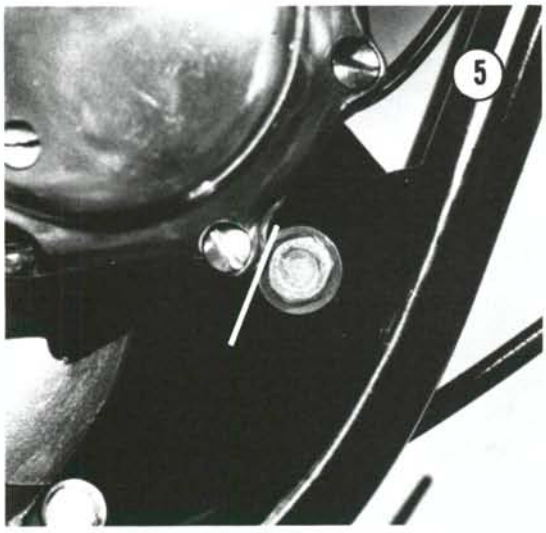


FRAME DIMENSIONS — 850 MODEL





2. With a soft drift, drive the bolt into the mount from the left side far enough so that the rubber cover, spacer, and plastic washer can be removed. Remove the tube cap and the shim (**Figure 6**).

3. Install shim(s) of appropriate thickness. Shims are available in thicknesses of 0.005, 0.010, 0.020, and 0.030 in. Use as few shims as possible; for instance, use one 0.030-in. shim rather than three 0.010-in. shims.

Example:	Actual clearance	0.040 in.
	Desired clearance	0.010 in.
	Difference to be compensated	0.030 in.
	Existing shim	0.010 in.

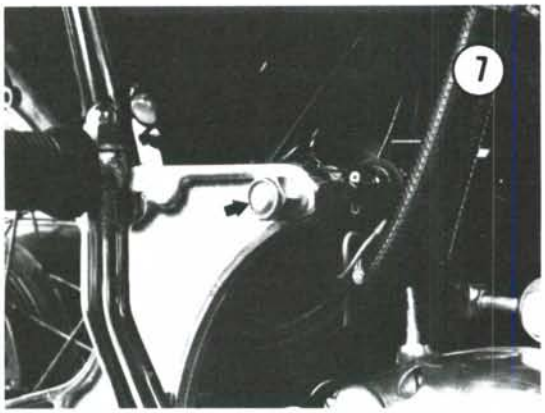
In this instance, discard the 0.010 in. shim and substitute a 0.030 in. shim.

4. Replace the plastic washer if it shows wear.

5. Reassemble the pieces in order—shims, tube cover, plastic washer, spacer, and rubber cover. Gently tap the bolt in from the right while aligning the pieces. Screw on the nut and tighten it to 25 ft.-lb. (3.456 mkg).

Rear Mount Adjustment (750 and 850 Mark II Models)

1. Unscrew the nut from the right end of the mounting bolt (**Figure 7**).



2. With a soft drift, drive the bolt into the mount from the right side until it protrudes about 4 inches on the left side.

3. Peel the rubber cover off the tube and push it down and back. Remove the cover, spacer, and plastic washer. Remove tube cap and shim.

4. Install shim(s) of appropriate thickness (see example above). Replace the plastic washer if it shows signs of wear. Clean the parts thoroughly and lubricate them with a light coat of silicone grease.

5. Install the shims and cap on the mounting tube. If more than one shim is required, the thinner shim should be outboard, against the cap. Assemble the rubber cover, spacer, and plastic washer together. Peel back the lip on the cover so that the assembly can be fitted between the mounting tube and the frame plate. It may be necessary to have someone push the rear wheel to the left to provide sufficient clearance. The rubber cover must fit completely over the end cap and the tube, and the spacer, washer, and cap should turn freely when the cap is turned.

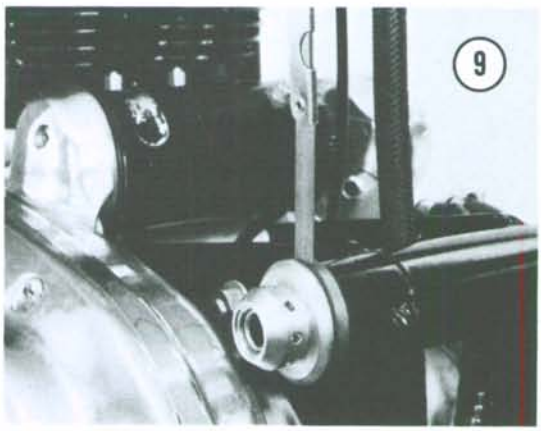
6. With assistance, line up mounting bolt with mounting hole in the frame and carefully drive bolt in from the left side. Be sure to reinstall the spacer between the frame mounting bracket and the footrest plate. Install the flat washer and the nut. Tighten the nut to 25 ft.-lb. (3.456 mkg).

Front and Rear Mount Adjustment (850 Mark III Models)

The Isolastic mounts on 850 Mark III models are equipped with threaded adjusters and adjustment does not require the addition or removal of shims.

1. Loosen the nut on the end of the mount and peel the rubber cover away from the adjuster. Remove the spring clip (**Figure 8**).

2. Insert a 0.010 in. (0.25mm) flat feeler gauge in the mount between the thrust washer and the end cap (**Figure 9**) and turn the adjuster until there is a slight drag on the feeler gauge when it is removed. Then, without turning the adjuster further, tighten the end nut on the mount and install the spring clip and refit the rubber cover. Repeat this procedure for the remaining mount.



Front Mount Removal

In time, the Isolastic mounts require removal, cleaning, replacement of worn parts, installation, and adjustment. However, this service is not routine and is rarely required before many thousands of miles. If the Isolastic units must be rebuilt to the extent that the rubber bushings are to be replaced, a special installation tool is required (Norton tool No. 063971). If you do not have access to this tool, the bushings must be replaced by a Norton service shop after the Isolastic mounts have been removed from the motorcycle. Refer to **Figure 10** for the following procedure.

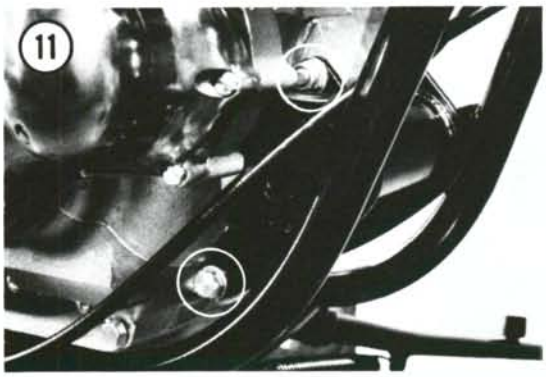
> NOTE: *Construction of the Isolastic units on 850 Mark III models is such that they require a press to remove them from the mounts. This should be entrusted to a Norton dealer. Removal of the mounts is essentially the same as for the earlier mounts. Adjustment is described above.*

1. Remove the right-side exhaust pipe and unscrew the nut from the left end of the front mounting bolt.

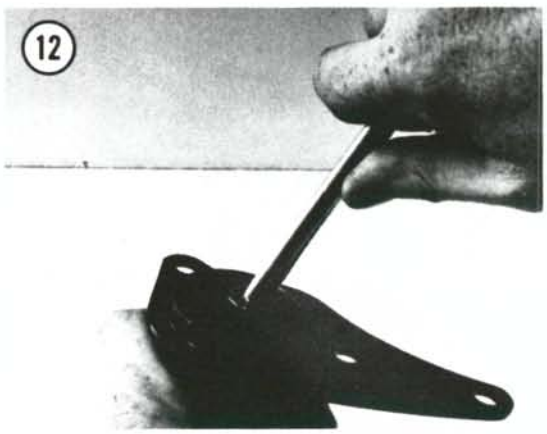
2. Line up one of the flats on the head of the mounting bolt so that it will clear the engine case (Figure 5) and drive the bolt out to the right side with a soft drift. The front of the engine should be supported so that the bolt threads will not be damaged by frame mounting plates as the bolt is drifted out.

3. Peel back the left-side rubber cover and remove it along with the spacer and plastic washer. Do the same to the right-side cover. Remove the tube caps and shims from both sides.

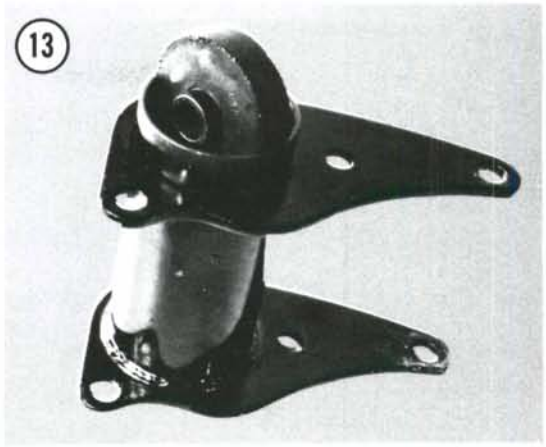
4. Unscrew 2 nuts and bolts which attach the mount to the engine (**Figure 11**). Remove the mount.



5. Insert the end of a drift about ½ inch into the sleeve of one of the bushings (**Figure 12**). Using the drift as a lever, turn the bushing in the tube (**Figure 13**) so it can be easily removed.



6. Remove the spacer and rubber buffers from the mounting tube. Remove the opposite bushing in the same manner as the first.



Rear Mount Removal

1. Remove the engine from the motorcycle. Refer to Chapter Four.

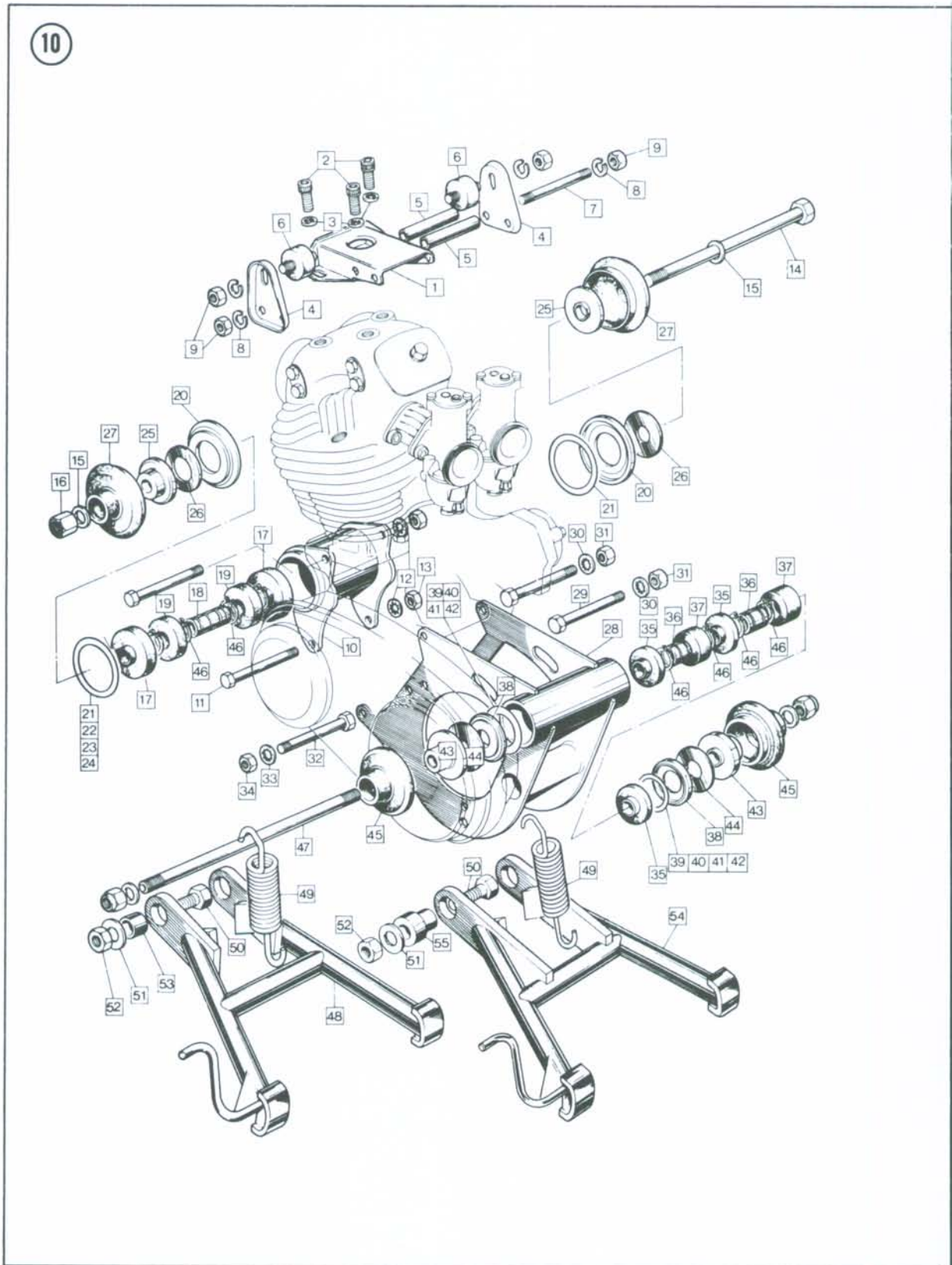
2. Remove the end bushings in the same manner as for the front mount. Remove the spacer tubes and buffers from each end of the mounting tube.

3. Set the end of a drift against one side of the center bushing and tap the drift with a hammer to turn the bushing in the mounting tube so it can be easily removed.

Front Mount Assembly (750 and 850 Mark II)

1. Place the tapered bushing guide (Norton tool No. 063971) over the end of the mounting tube (**Figure 14**). Coat the circumference of one of the bushings with rubber lubricant (e.g., glycerine) and press it evenly into the guide.

2. Set the driver in place on the bushing (**Figure 15**) and press it into the mounting tube until the driver bottoms on the bushing guide.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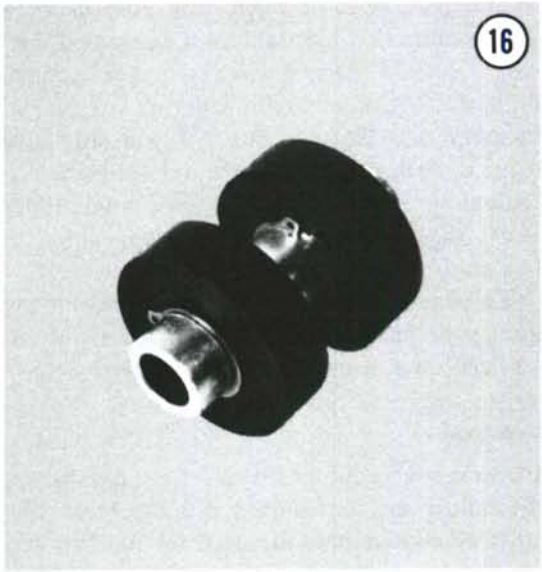
ENGINE MOUNT

1. Engine steady
2. Engine steady to head screw
3. Engine steady screw washer
4. Engine steady side-plate
5. Engine steady spacer
6. Engine steady rubber mounting
7. Engine steady stud
8. Engine steady stud washer
9. Engine steady stud nut
10. Front engine mounting
11. Front engine plate bolt
12. Front engine plate washer
13. Engine front plate nut
14. Front engine plate bolt to frame
15. Front engine plate bolt washer
16. Front engine plate bolt nut
17. Front engine mounting bushing
18. Front engine mounting spacer
19. Front engine mounting buffer
20. Front engine mounting tube cap
21. Front engine mounting shim .005 in.
22. Front engine mounting shim .010 in.
23. Front engine mounting shim .020 in.
24. Front engine mounting shim .030 in.
25. Front engine mounting collar
26. Front engine mounting washer (PTFE.)
27. Front engine mounting gaiter
28. Rear engine mounting
29. Rear engine plate bolt
30. Rear engine plate washer
31. Rear engine plate nut
32. Rear engine plate bolt bottom
33. Rear engine plate washer
34. Rear engine plate nut
35. Rear engine mounting rubber
36. Rear engine mounting spacer
37. Rear engine mounting buffer
38. Rear engine mounting tube cap
39. Rear engine mounting shim .005 in.
40. Rear engine mounting shim .010 in.
41. Rear engine mounting shim .020 in.
42. Rear engine mounting shim .030 in.
43. Rear engine mounting collar
44. Rear engine mounting washer (PTFE.)
45. Rear engine mounting gaiter
46. Circlip for isolastic buffers
47. Rear engine mounting stud
48. Center stand (750 only)
49. Center stand spring
50. Center stand bolt
51. Center stand washer
52. Center stand nut
53. Center stand spacer (750 only)
54. Center stand (850 only)
55. Center stand spacer (850 only)

3. Install the buffers and circlips on the spacer tube (**Figure 16**), turn the mounting tube over, and set the buffer assembly in place so that the tube rests on the bushing that has been installed.



4. Install the second bushing in the same manner as the first, using the guide and driver.

Rear Mount Assembly (750 and 850 Mark II)

1. Coat the circumference of the center bushing with rubber lubricant and press it into the mounting tube by hand, using a length of tubing or pipe as a driver. The bushing must be centered in the tube, 3½ in. (82mm) from each end.

2. Install the buffer and circlips on one of the spacer tubes. Set it in place in the mounting tube.

3. Coat the circumference of one of the outer bushings with rubber lubricant and press it into the mounting tube until it is stopped against the spacer.

4. Turn the mounting tube over and install the other buffer and tube assembly and the outer bushing in the manner just described.

Front and Rear Mount Installation

Reinstall the mount and engine/transmission package by reversing the removal steps. Install new Isolastic mounts on the cylinder headsteady and check and adjust the clearance of the front and rear mounts as described earlier.

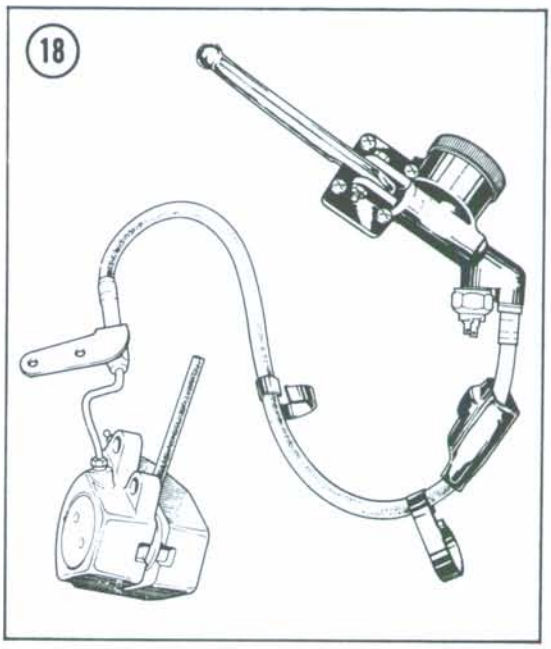
FRONT SUSPENSION

The Norton front suspension consists of a spring-controlled, hydraulically dampened telescopic fork. Before suspecting major trouble, drain the fork oil and refill with proper type and quantity. See Chapter Four. If you still have trouble, such as poor dampening, tendency to bottom out or top out, or leakage around rubber seals, then follow the service procedures in this section.

To simplify fork service and to prevent the mixing of parts, the legs should be removed, serviced, and reinstalled individually.

Removal

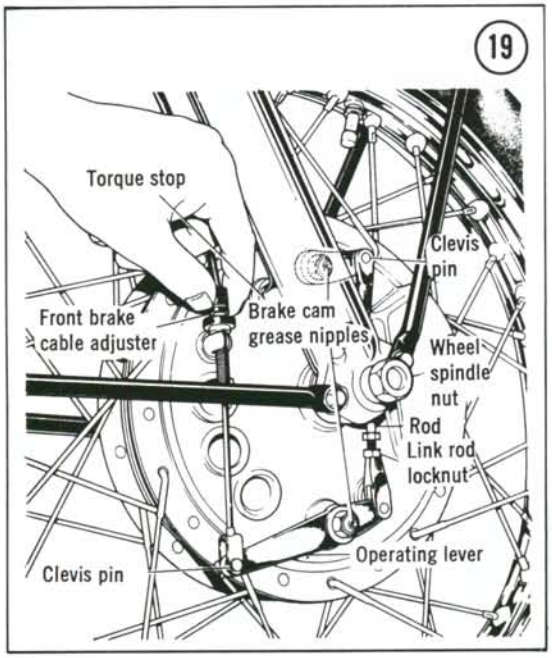
1. On models equipped with a front disc-brake, the caliper can be removed with the brake line attached to eliminate the need for refilling and bleeding the system. Remove the nuts which hold the brake line bracket to the right fork leg (**Figure 17**). Remove the bolts which hold the caliper to the fork leg and pull the caliper away from the disc. Insert a block, such as a piece of tubing, between the brake pads to prevent them from being ejected (**Figure 18**) by accidental movement of the brake lever. Suspend the caliper from the end of the right handlebar with a piece of cord so that it is out of the way. Be careful not to bend the brake line too sharply. As a precaution against damaging the caliper, the fuel tank, or the engine cooling fins, wrap several thicknesses of newspaper around the caliper and tape it in place.

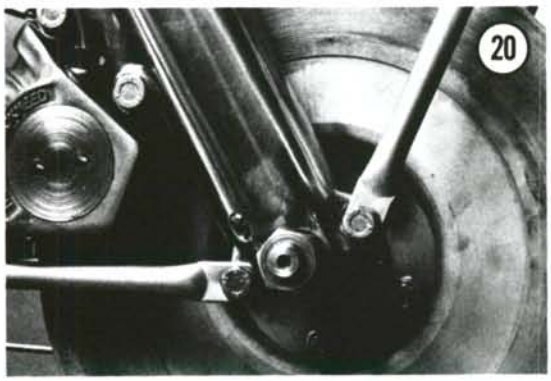


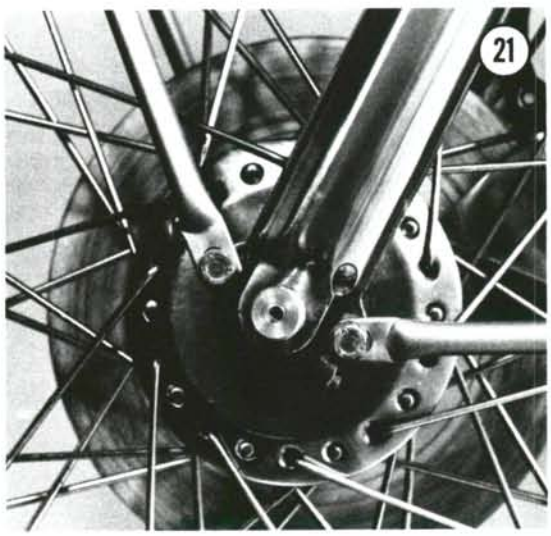
2. Block up the front of the motorcycle to lift the front wheel off the ground.

3. On models with a drum-type front brake, disconnect the brake cable from the lower brake arm by removing the clevis pin (**Figure 19**). Unscrew the cable adjuster from the boss on the brake backing plate.

4. On all models, unscrew the axle nut (**Figure 20**). Loosen the pinch bolt at the bottom of the left leg (**Figure 21**). Insert the shaft of a screwdriver or small bar through the hole in the left end of the axle and pull it out of the forks







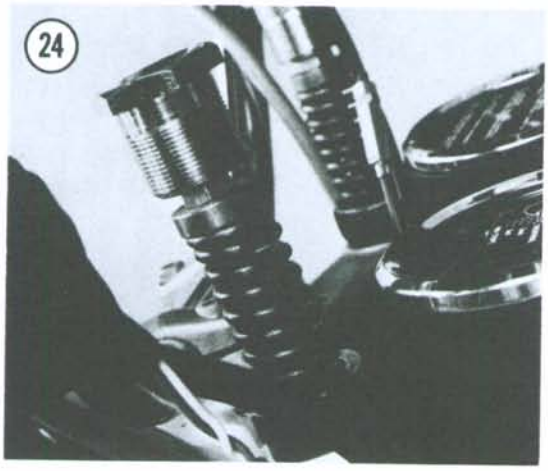
and wheel while supporting the weight of the wheel.

5. Unscrew the 4 bolts that hold the fender struts to the bottom of the fork legs, and the remaining 2 nuts that hold the center stay to the aluminum fork slider (**Figure 22**). Remove the fender and set it aside.

6. Unscrew the cable collars from the tachometer and speedometer and unplug the instrument lamp lead from the wiring harness.

7. Unscrew the caps from the tops of the forks (**Figure 23**). Hold the damper locknut with a wrench and unscrew the cap from the top of the damper rod (**Figure 24**). Remove the instruments and set them aside.

8. If the motorcycle is equipped with fork gaiters, loosen the upper clamps. Loosen the pinch bolts in the bottom fork yoke (**Figure 25**). Screw one of the caps several complete turns into the top of the fork to be removed and tap it sharply with a soft mallet to break the tube loose from the yoke (**Figure 26**). Remove the cap once again and pull the fork leg down and out of the yokes.



Disassembly

1. Invert the fork leg over a drip pan and pour out the oil. Clamp the lower end of the fork leg in a vise with the leg positioned vertically. Wooden blocks or soft jaw pads should be used between the vise jaws and the fork leg to prevent damage.

2. Peel the dust cover away from the slider and move it up the tube (**Figure 27**). If the motorcycle is equipped with fork gaiters, loosen the bottom clamps and slide the gaiters off the tubes.

FRONT FORKS

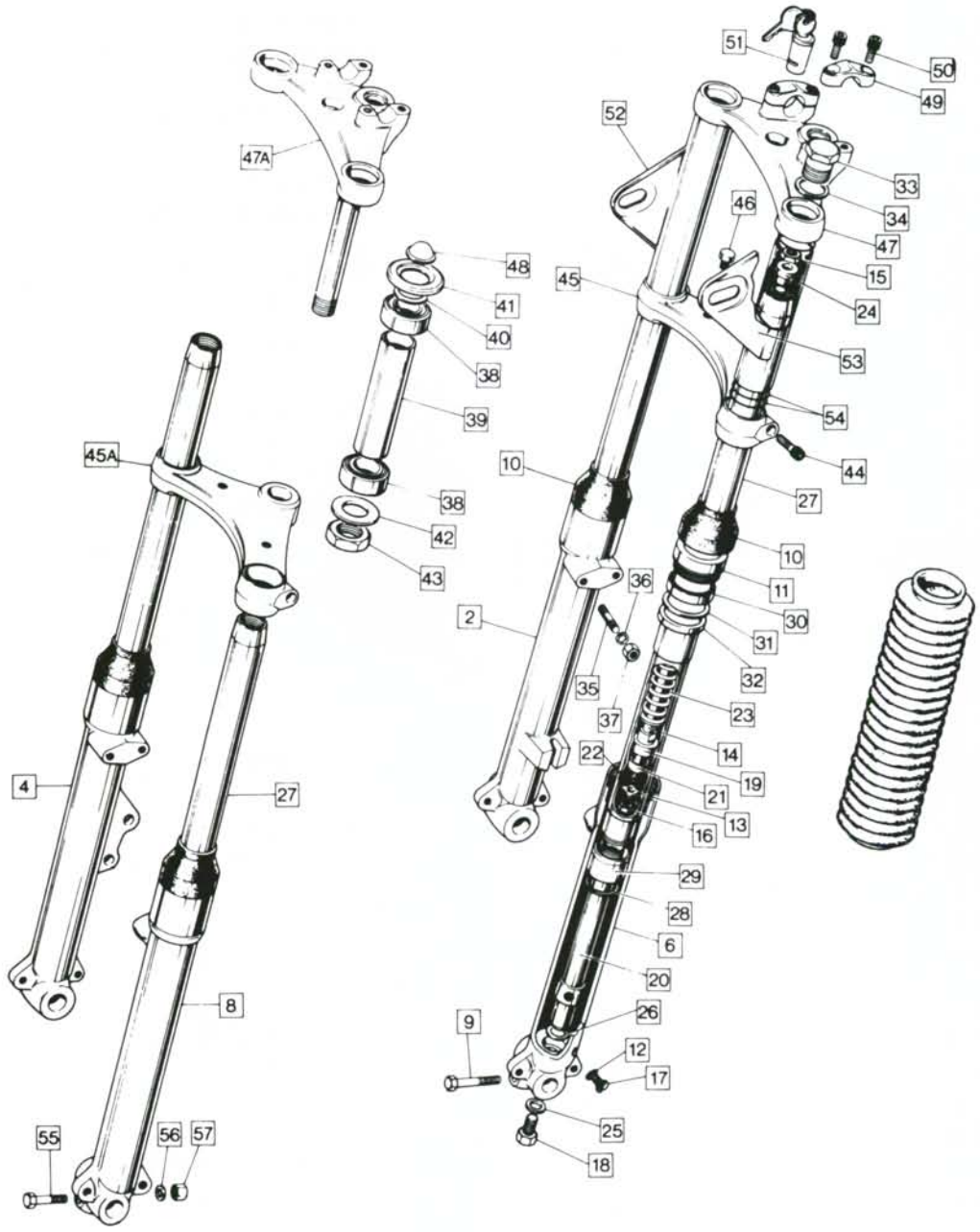
1. Right leg assembly (drum brake)
2. Right slider (drum brake)
3. Right leg assembly (disc brake)
4. Right slider (disc brake)
5. Left leg assembly (drum brake)
6. Left slider (drum brake)
7. Left leg assembly (disc brake)
8. Left slider (disc brake)
9. Pinch bolt (drum only)
10. Gaiter
11. Collar
12. Washer
13. Damper rod seat
14. Damper rod
15. Damper rod cap nut
16. Damper rod locknut
17. Slider drain plug
18. Damper tube anchor bolt
19. Damper tube cap
20. Damper tube
21. Damper valve
22. Damper valve stop pin
23. Fork spring
24. Fork spring locating bushing
25. Damper tube anchor bolt washer
26. Damper tube anchor bolt washer
27. Main tube
28. Fork tube bushing circlip
29. Fork tube bushing
30. Oil seal
31. Oil seal washer
32. Fork tube guide bushing
33. Fork tube top bolt
34. Washer
35. Stud
36. Washer
37. Nut
38. Steering head bearing
39. Bearing spacer
40. Washer
41. Cover
42. Washer
43. Nut
44. Socket screw
45. Lower yoke (750 only)

45A. Lower yoke (850 only)

46. Plug for lower yoke
47. Upper yoke with stem (750 only)

47A. Upper yoke with stem (850 only)

48. Stem blanking plug
49. Clip
50. Screw
51. Lock/keys
52. Right headlight bracket/top cover
53. Left headlight bracket/top cover
54. O-ring
55. Bolt
56. Washer
57. Nut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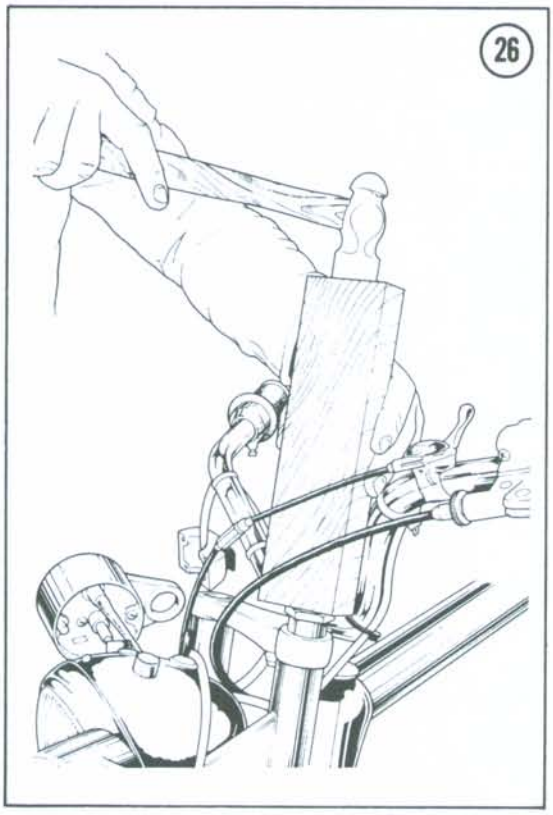


Unscrew the collar from the top of the slider and pull up on the leg to remove it from the slider.

3. Unscrew the bottom bolt from the slider and pull out the spring and damper assembly.

4. Lightly clamp the damper tube in a vise and unscrew the cap. Pull out the damper rod, clamp it in the vise and remove the locknut, washer, and valve. Remove the valve stop pin.

5. Remove the circlip and steel bushing from the end of the fork tube.

Inspection

Thoroughly clean and dry all parts. Check the bushings and the fork tube for signs of wear or galling. Check the damper rod for bending by rolling it on a flat surface. Carefully check the damper valve and the stop pin for wear or damage. Inspect the seals for scoring and nicks and loss of resiliency. If there is any doubt about their condition, pry them out and press in new seals using a large socket as a driver.

Any parts that are worn or damaged should be replaced; simply cleaning and reinstalling unserviceable pieces will not improve performance of the front suspension.

Reassembly

Refer to Figure 27 and reassemble the fork leg components in reverse order of disassembly. When the damper assembly has been assembled and installed in the slider, oil the outside of the upper fork tube and fit it into the slider. Install the collar in the top of the slider and tighten it securely by hand. Slide the rubber dust cover down over the top of the slider.

Installation

Slide the assembled fork leg up into the lower yoke, through the headlight bracket tube, and into the top yoke. Install the instrument case and fork cap and tighten the cap to draw the fork tube up into the taper in the top yoke.When the fork tube is firmly seated in the yoke, tighten the pinch bolt in the lower yoke and unscrew the top cap.

Refer to Chapter Two. Fill the fork legs with the correct amount and grade of oil. Reconnect the top cap to the damper tube rod and securely tighten the locknut. Screw the top cap into the tube and tighten it to 40 ft.-lb. (5.83 mkg).

Reassemble the rest of the components in reverse order of disassembly. On front disc brake models, make certain that there is sufficient operating pressure by pumping the lever several times before riding the motorcycle.

STEERING

Service to the steering consists of periodically checking and correcting the tightness of the stem (1970 and earlier models) and replacing the bearings.

Adjustment (1970 and Earlier)

1. Block up the front of the motorcycle so the wheel is off the ground. Take hold of the lower fork legs and try to move them back and forth. If any movement can be felt, the steering head must be tightened.

2. Unscrew 4 Allen bolts from the handlebar retainers (**Figure 28**) and remove the handlebars.

The handlebars can be rested on the fuel tank, but the tank should first be covered with a clean cloth to prevent the handlebars from damaging the paint.

3. Loosen the cap nut on the steering stem and pinch bolts in the lower fork yoke.

4. Tighten the stem adjuster nut, turning it one flat at a time while checking the movement of the forks from lock-to-lock and as described in Step 1.

When correctly adjusted, the forks should turn freely from lock-to-lock and there should be no apparent back-and-forth movement of the fork assembly in the steering head.

WARNING

If the steering head is adjusted too tight, the front end will tend to bind under load, creating a hazardous condition.

5. When the adjustment is correct, retighten the top stem nut and the pinch bolts, and reinstall the handlebars.

Disassembly (1970 and Earlier)

1. Remove the fork legs and handlebars as described earlier. Unscrew the stem cap nut and tap the top yoke up and off the stem with a soft mallet.

2. Unscrew the stem adjuster nut and remove the dust cover. Tap the stem and bottom yoke down and out of the bearings.

3. Carefully drive the bearing assemblies out of the steering head—first the bottom bearing, then the top. Apply the end of the drift to the inner race of each bearing.

Disassembly (1971 and Later)

1. Straighten the tab washer on the bottom stem nut and unscrew the nut (**Figure 29**).

2. Take hold of the headlight and tap the bottom yoke down and off the stem with a soft mallet. Remove the O-rings from each of the headlight bracket tubes (2 on the bottom and one on the top). To prevent damage to the headlight, wrap several thicknesses of newspaper around it and tape them in place.

3. Drive the stem and top yoke upward with a soft mallet and remove the assembly from the steering head along with the dust cover and washer.

4. Insert a drift through the inner race of the top bearing and push the interior spacer tube to the side so the end of the drift can be applied to the inner race of the bottom bearing. Carefully tap the bearing out of the steering head and remove the spacer. Remove the top bearing by driving it upward from the bottom. Again, apply the drift to the inner race.

Inspection

Thoroughly clean and dry the bearings and the inside of the steering head. Rotate the bearings by hand and check for roughness and radial play. If there is any doubt about their condition, they should be replaced.

Assembly (1970 and Earlier)

1. Lightly oil the outer race of one of the bearings and fit it squarely into the bottom of the steering head. Tap it all the way in with a soft mallet until it bottoms on the machined lip inside the head. Then install the top bearing in the same manner.

2. Insert the stem into the bearings from the bottom. Set dust cover over the top of stem.

3. Screw on the stem nut and tighten it until no movement can be felt in the yokes but they will still turn freely from lock-to-lock.

4. Position the headlight and brackets on the bottom yoke and set the top yoke in place. Install the washer and acorn nut on top of the yoke but do not tighten it.

5. Install the fork legs as described earlier. When the tops of the fork legs are correctly seated in the tapers in the top yoke, adjust the stem nut as described under *Adjustment (1970 and Earlier).*

6. Reassemble the remaining components as described earlier.

Assembly (1971 and Later)

1. Lightly oil the outer race of one of the bearings and fit it squarely into the bottom of the steering head.

2. Refer to Figure 27 and set the spacer into the top of the steering head.

3. Oil the outer race of the top bearing and fit it squarely into the top of the steering head. The bearings are pressed in by the yokes as the stem nut is tightened.

4. Install the washer and dust cover on the top of the steering head. Tap the stem and top yoke down into the bearings with a soft mallet.

5. Grease 2 of the O-rings and set them in place on the underside of the top yoke. Grease the remaining 4 O-rings and set them in the recesses in the bottom yoke.

6. Hold the headlight and bracket tubes in position and line up the tops of the tubes with the top yoke. Line up the bottom yoke with the bottoms of the bracke ttubes and the stem, and push it up into place.

7. Set the tab washer in place and screw on the bottom stem nut while checking the alignment of the bracket tubes with the yokes. Tighten the nut only enough to pull bottom yoke into place.

8. Install the fork legs as described earlier. When the tops of the fork legs are correctly seated in the tapers in the top yoke, tighten the stem nut and then the pinch bolts in the bottom yoke. Bend the tab washer over against one of the flats on the stem nut.

9. Reassemble the remaining components as described earlier.

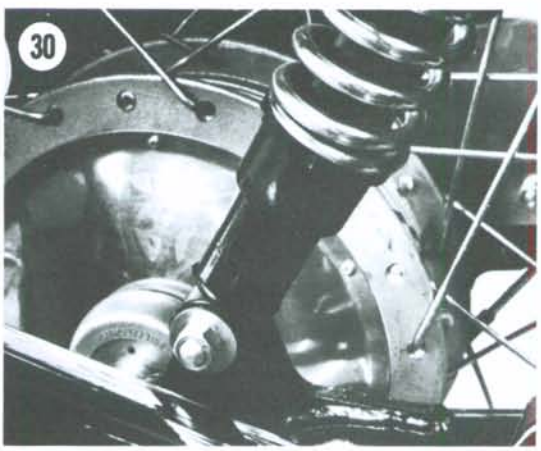
REAR SUSPENSION

The rear suspension units are spring controlled and hydraulically damped. Spring preload can be adjusted by rotating the cam rings at the base of the springs—clockwise to increase preload, counterclockwise to decrease it. Both cams must be indexed on the same detent. The damper units are sealed and cannot be rebuilt. Service is limited to removal and replacement of either an entire unit or the damper alone after the spring has been removed.

Removal

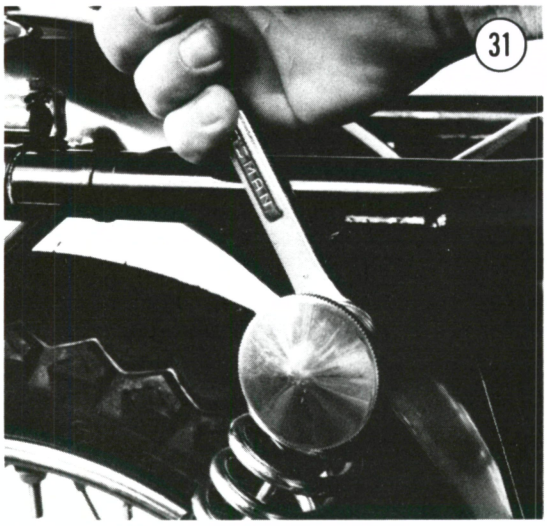
Removal and installation of the rear suspension units is easier if they are done separately. The remaining unit will support the rear of the motorcycle and maintain the correct relationship between the top and bottom mounts.

1. Unscrew the bottom nut and bolt which attach the suspension unit to the swinging arm (**Figure 30**).



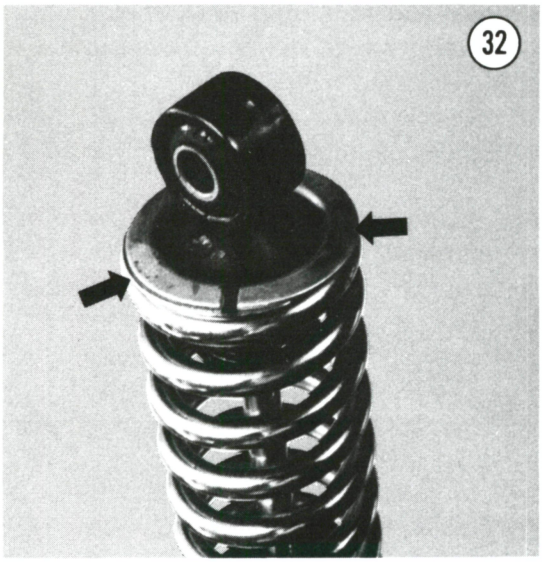
NOTE: *On 850 Mark III models, remove the circlip from the lower right bolt before removing the bolt.*

2. Remove the seat and unscrew the knob far enough to expose the top suspension nut so it can be turned with a wrench (**Figure 31**). Pull the suspension unit out of the top mount.



Disassembly

1. Clamp the lower mounting eye in a vise and rotate the preload cam to its softest position.
2. With assistance, compress the top spring and remove the 2 keeper segments (**Figure 32**). Remove the spring from the damper.



Reassembly and Installation

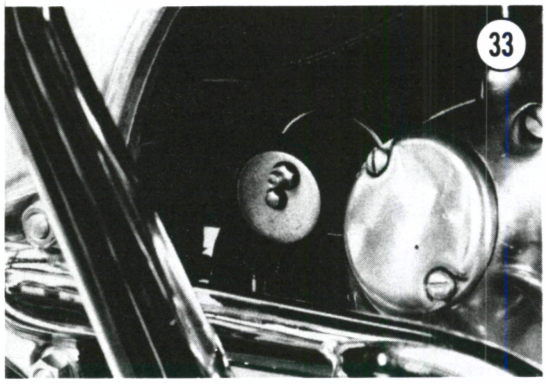
Reassemble and install the suspension unit by reversing the steps above.

SWINGING ARM

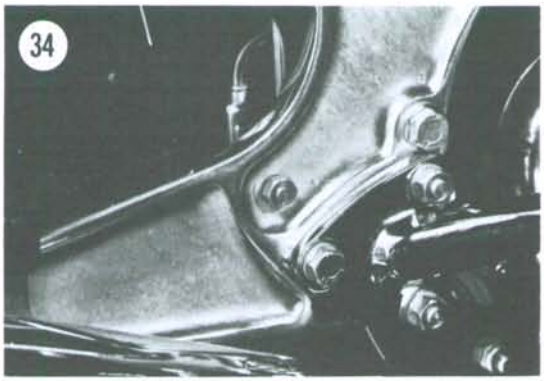
Under normal use and with correct periodic lubrication, the swinging arm bushings have a long service life. However, in time the bushings will wear and must be replaced. Indications of excessive bushing wear are imprecise steering, and a tendency for the motorcycle to pull to one side or the other during acceleration and braking.

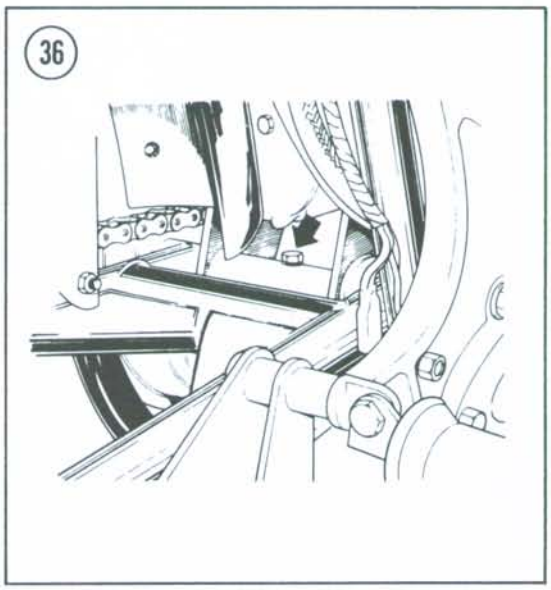
Removal

1. Block up the motorcycle so the rear wheel is clear of the ground. Disconnect the rear chain and remove it from the wheel sprocket. Leave it in place on the countershaft sprocket to simplify installation later on. Refer to the section on the rear wheel and brake in this chapter and remove the wheel from the swinging arm.
2. On 750 and 850 Mark II models, place a drip pan beneath the right end of the swinging arm pivot and remove the long screw, end cap, and washers from the arm (**Figure 33**). Allow the oil to drain.



3. Remove the entire right footrest assembly, noting the location of the ground lead for the zener diode (**Figure 34**).
4. Disconnect the chain oiler on the swinging arm (**Figure 35**) and remove the bottom bolts from the rear suspension units.
5. On 750 and 850 Mark II models, remove the lock bolt from the center of the swinging arm



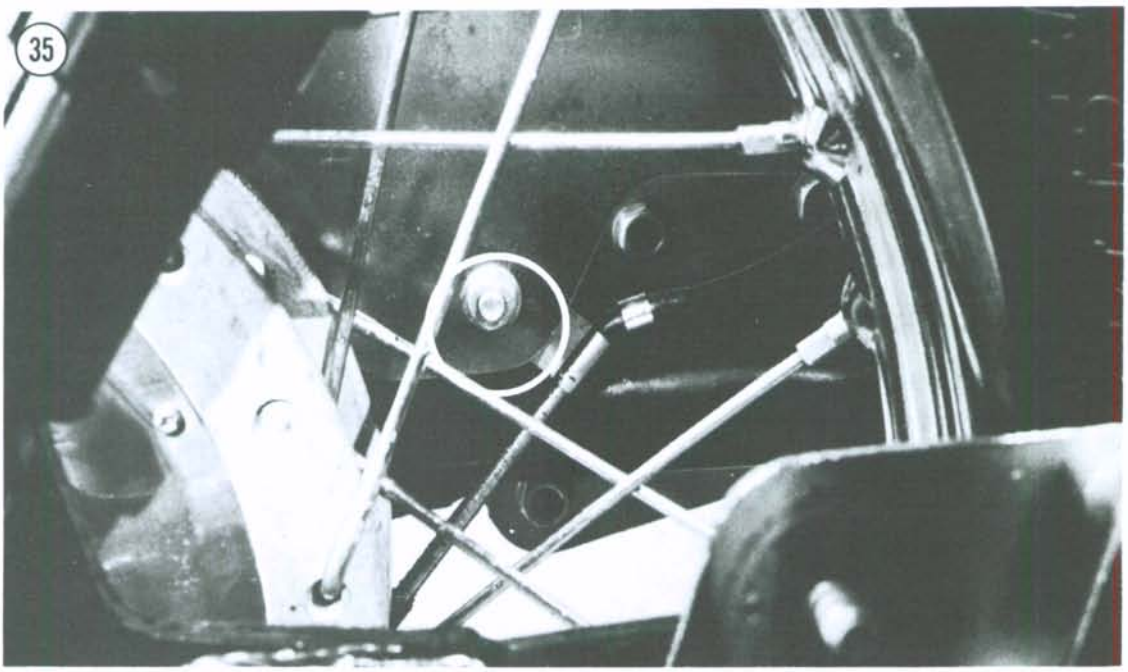


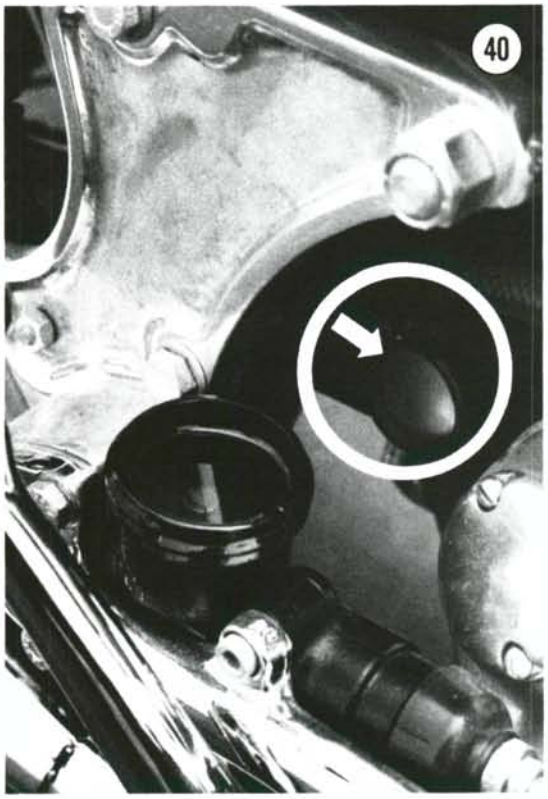
spindle (**Figure 36**). Remove the main front mounting bolt from the engine and screw the nut all the way down on the threads. Screw the bolt into the end of the pivot tube and tighten the nut to lock it in place. Slowly twist the bolt and pull the spindle out (**Figure 37**). Remove the swinging arm, left cover, O-rings, and bearings (**Figure 38**).

6. On 850 Mark III models, unscrew the nuts from the pivot lock pins, remove the rubber caps from the pin bosses, and tap the pins upward to break them loose, using a soft mallet (**Figure 39**). Remove pins. Referring to **Figure 40**, drill a hole in each of the swinging arm end caps and pry out the caps and discard them. Remove the felt wicks from both sides and carefully tap out the pivot using a soft drift.

Inspection

Thoroughly clean and dry all parts. Slide the pivot bolt back into the swinging arm and check for radial play. If any play can be felt, the bushings and O-rings, and possibly the pivot bolt, should be replaced.





Bushing Replacement (750 and 850 Mark II)

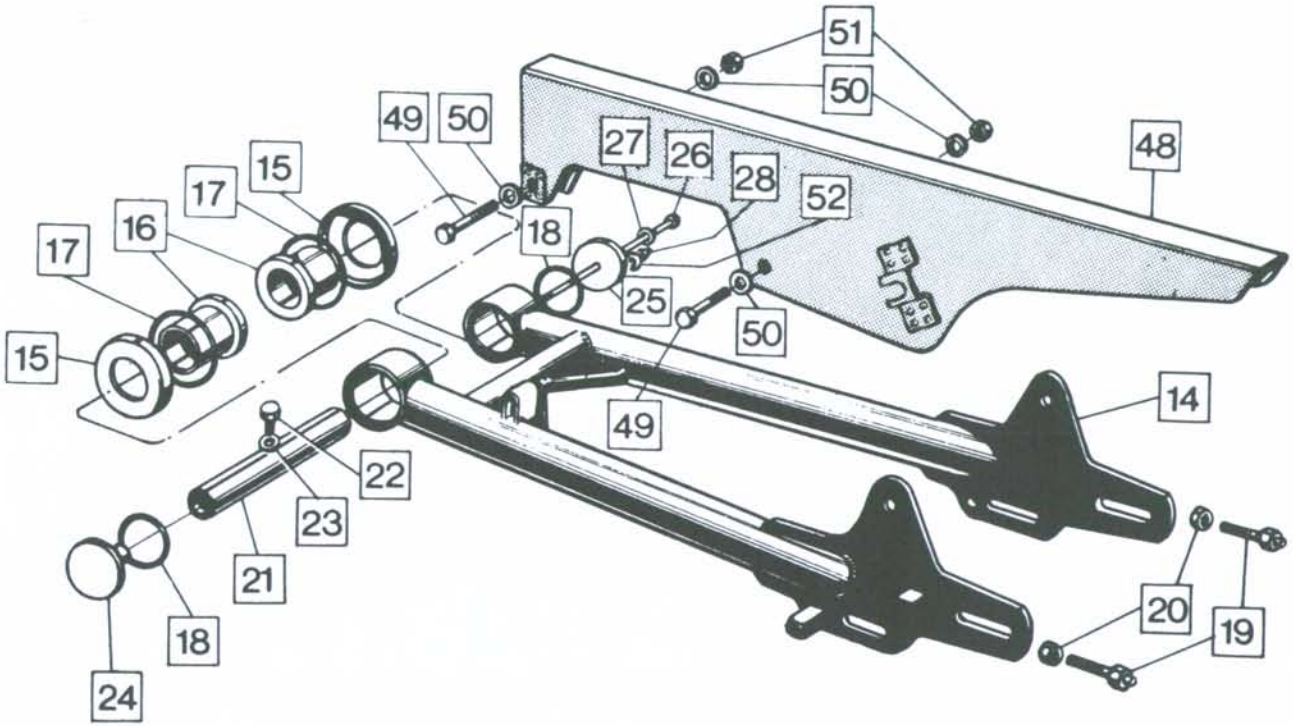
1. Remove the outer O-rings and press the bushings out of the arm.
2. Install the dust covers on the bushings and press them into the arm.
3. Fit the large O-rings into the dust covers and the small O-rings into the outer recesses around the bushings.

Bushing Replacement (850 Mark III)

1. Press the bushings out of the arm.
2. Install new seals on new bushings and press them into the arm, making sure they are squarely seated in the bushing bores.

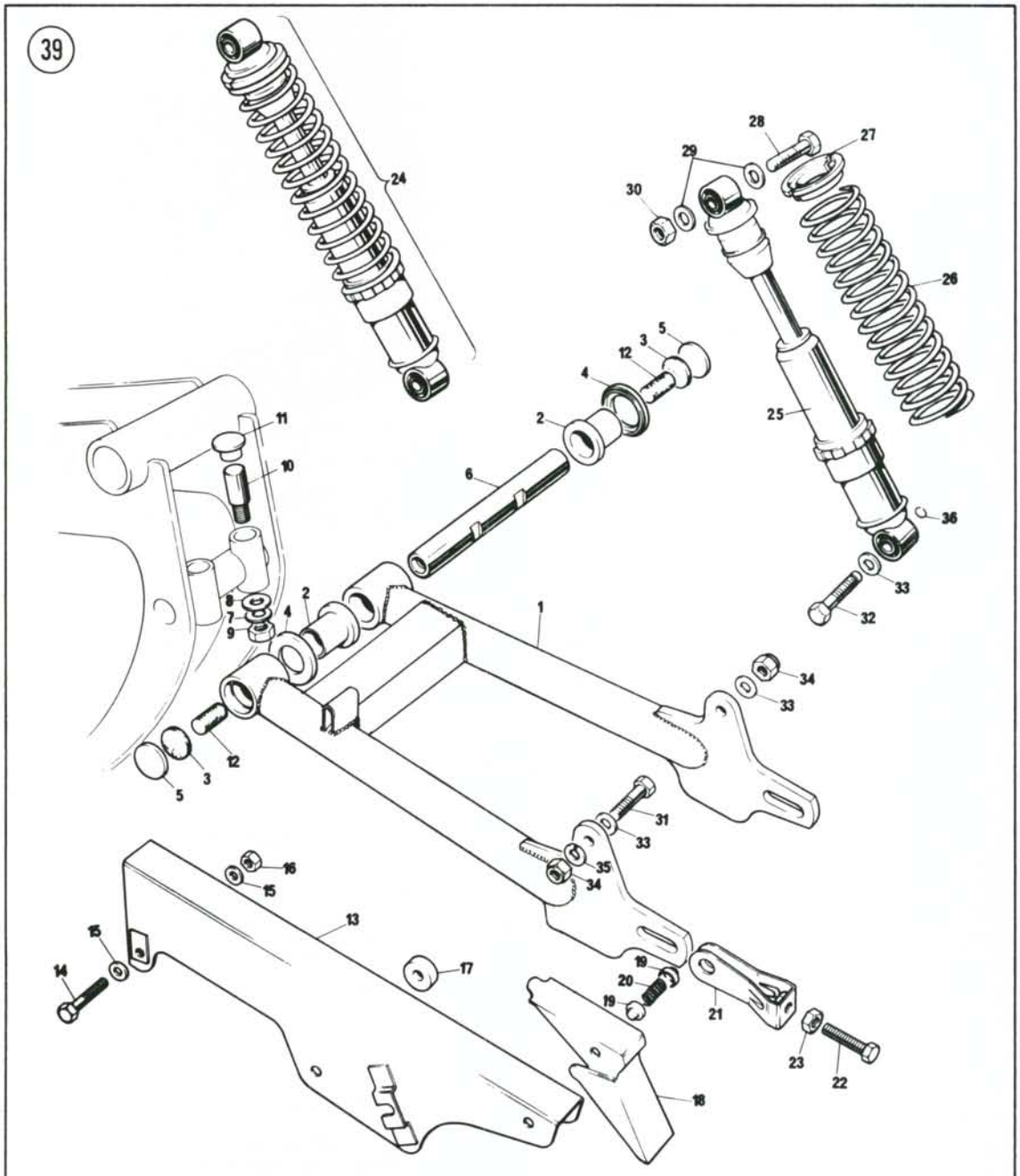
Installation (750 and 850 Mark II)

1. Oil the bushings. Lightly coat the inside face of the left-end cap with grease, and set it in place on the end of the arm pivot (**Figure 41**).
2. Carefully move the swinging arm into place, taking care not to dislodge the left cap until the



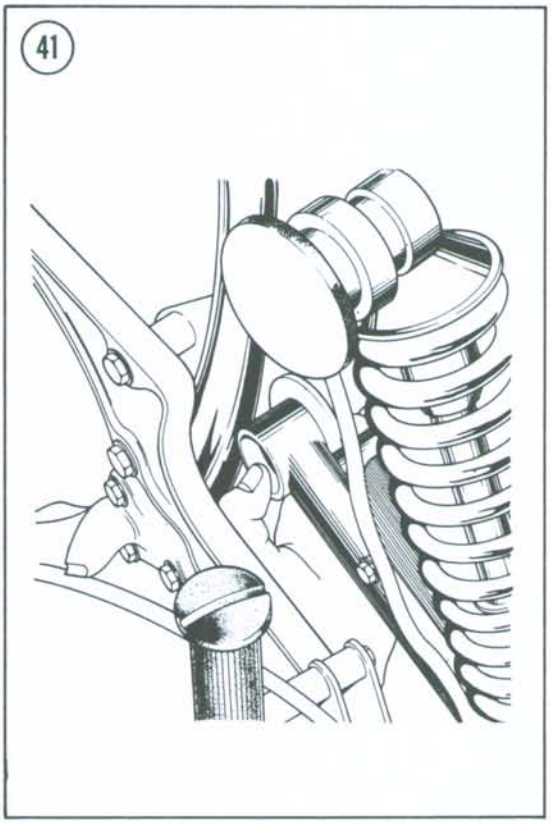
SWINGING ARM — 750 AND 850 MARK II

14. Swinging arm
15. Dust cover
16. Bearing
17. O-ring
18. O-ring
19. Chain adjuster
20. Adjuster nut
21. Pivot spindle
22. Bolt
23. Washer
24. End cap
25. End cap
26. End cap rod
27. Washer
28. Oil nipple
48. Chainguard
49. Chainguard bolt
50. Washer
51. Nut
52. Nipple washer



SWINGING ARM, SUSPENSION UNITS, CHAINGUARD — 850 MARK III

1. Swinging arm
2. Bearing
3. Disc wick
4. Seal assembly
5. Welch plug
6. Pivot spindle
7. Washer
8. Fiber washer
9. Nut
10. Cotter
11. Rubber plug
12. Oil wick
13. Chainguard
14. Guard to swinging arm bolt
15. Washer
16. Nut
17. Chainguard spacer
18. Extension
19. Button
20. Spring
21. Chain adjuster
22. Screw
23. Nut
24. Suspension unit
25. Shock absorber
26. Spring
27. Collar
28. Top suspension unit bolt
29. Washer
30. Nut
31. Bolt
32. Bolt
33. Washer
34. Locknut
35. Washer
36. Caliper plate to bolt circlip

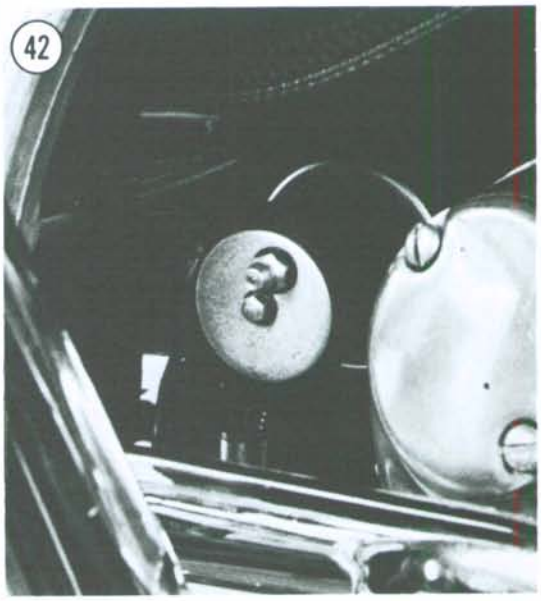


arm is in position and the cap is held by the primary chaincase.

3. Oil the pivot spindle and push it into the arm from the right side. Turn the bolt slowly as you apply pressure. Make sure that the arm is correctly lined up and push the pivot spindle all the way in. Line up the pivot lock bolt hole with the hole in the mounting tube and screw in the bolt. Tighten it securely and unscrew the front engine mount bolt from the spindle. Then reinstall the bolt in the front engine mount.

4. Make sure the right-end O-ring is in place and install the cap and lock bolt. Position the lubrication fitting on the cap so it is near the 12 o'clock position (**Figure 42**) and tighten the bolt securely.

5. Reinstall the chain guard, the bottom suspension mounts, the rear wheel, and the chain, reversing the disassembly steps and referring to the appropriate chapters where necessary. Reconnect the rear brake and adjust it. Adjust the free-play of the chain. Fill the spindle with oil as described in Chapter Two.



Installation (850 Mark III)

1. Lightly coat the insides of the bushings with oil and set the swinging arm in place.

2. Oil the pivot spindle and start it into the swinging arm. Line up the spindle so that the lock slots are vertical, to the rear. Tap the spindle into the arm, being careful not to rotate it, using a soft mallet and finally a soft drift. When seated, the spindle ends should be equidistant from the ends of the swinging arm pivot tube.

3. Install the spindle lock pins with the tapered flat facing forward. Tap the pins down into place with a soft mallet to engage the notches in the spindle. Install the washers and screw on the nuts, drawing the pins down into place. Install the rubber plugs in the lock pin bores.

4. Oil the felt wicks and install them in the arm. Install new end plugs, tapping them squarely into the ends of the arm with a soft mallet.

5. Install the chain guard, bottom suspension bolts, the rear wheel, brake caliper, and the chain, reversing the disassembly steps and referring to the appropriate chapters where necessary. Do not forget the circlip on the bottom right suspension bolt. Adjust free-play of chain.

NOTE: *On all models, refer to Chapter Seven,* Zener Diode, *and install the diode as described.*

APPENDIX

SPECIFICATIONS

This chapter contains specifications for the Norton Commando models covered by this book. The tables are arranged in order of increasing engine displacement. Since there are differences between various models of the same engine displacement, be sure to consult the correct table for the motorcycle in question.

750 COMMANDO

ENGINE

GENERAL	
Displacement	45 cu. in. (745cc)
Bore	2.875 in. (73mm)
Stroke	3.503 in. (89mm)
Maximum torque	
Standard	48 ft.-lb. at 5,000 rpm
Combat	49 ft.-lb. at 6,000 rpm
Compression ratio	
Standard	9 : 1
Combat	10 : 1
CRANKSHAFT	
Main bearing size (all)	1.18 x 2.84 x 0.75 in. (30 x 72 x 19mm)
Big end journal diameter	1.7505-1.7500 in. (44.462-44.450mm)
Permissible end float	0.005-0.015 in. (0.127-0.381mm)
CONNECTING RODS	
Big end ID (less bearings)	1.895-1.8955 in. (48.133-48.145mm)
Rod side clearance	0.013-0.016 in. (0.330-0.406mm)
Rod end clearance	Less than 0.001 in. (0.0254mm)
PISTONS	
Diameter (bottom of skirt) (standard)	2.8712-2.8703 in. (72.931-72.906mm)
Wrist pin diameter	0.6869-0.6867 in. (17.447-17.442mm)
Rings (type)	Two compression, one oil-control
Ring end gap	
Top compression	0.010-0.012 in. (0.254-0.305mm)
Second compression	0.008-0.012 in. (0.203-0.305mm)
CYLINDER BLOCK	
Bore size	
Grade A	2.8746-2.8750 in. (72.959-72.969mm)
Grade B	2.8750-2.8754 in. (72.969-72.979mm)
CYLINDER HEAD	
Valve seat angle	45°
CAMSHAFT	
Bearing journal diameter	0.8735 in. (22.187mm)
CAMSHAFT BUSHINGS	
Fitted ID, left	0.8750 in. (22.225mm)
Fitted ID, right	0.8750 in. (22.225mm)
ROCKER SHAFT	
Diameter	0.4988-0.4985 in. (12.694-12.669mm)

(continued)

750 COMMANDO (continued)

VALVE TAPPET CLEARANCES (Engine Cold)	
Inlet	
Standard	0.006 in. (0.15mm)
Combat	0.008 in. (0.2mm)
Exhaust	
Standard	0.008 in. (0.2mm)
Combat	0.010 in. (0.25mm)
VALVES	
Inlet	
Head diameter	1.490 in. (37.846mm)
Stem diameter (plated area)	0.3115-0.3105 in. (7.912-7.886mm)
Exhaust	
Head diameter	1.302 in. (33.0708mm)
Stem diameter (plated area)	0.3115-0.3105 in. (7.912-7.886mm)
VALVE GUIDES	
Inside diameter	0.3145-0.3135 in. (7.988-7.962mm)
Outside diameter	0.5015-0.500 in. (12.738-12.725mm)
Washer thickness	0.062 in. (1.574mm)
VALVE SPRINGS	
Free length	
Inner	1.482 in. (37.642mm)
Outer	1.618 in. (41.097mm)
Fitted length	
Inlet inner	
Standard	1.197 in. (30.40mm)
Combat	1.259 in. (31.98mm)
Inlet outer	
Standard	1.259 in. (31.98mm)
Combat	1.321 in. (33.55mm)
Exhaust inner	1.222 in. (31.04mm)
Exhaust outer	1.284 in. (32.61mm)
INTERMEDIATE TIMING GEAR	
Bushing diameter (finished)	0.5627-0.5620 in. (14.292-14.274mm)
Shaft diameter	0.5615-0.5610 in. (14.262-14.249mm)
CAMSHAFT CHAIN	
Size	0.375 in. x 0.225 (single-row, endless)
Number of links	38
Ideal adjustment	3/16 in. (4.8mm) up and down on top run of chain
IGNITION TIMING	
Fully advanced position	28° BTDC
CONTACT BREAKER	
Point gap	0.014-0.016 in. (0.35-0.4mm)

(continued)

750 COMMANDO (continued)

SPARK PLUG	
Type	Champion N7Y or equivalent
Gap	0.023-0.028 in. (0.59-0.72mm)
CARBURETORS	
Standard	
Type	Two Amal concentric float 930 30mm
Main jet	
1970	220 with early megaphone muffler 210 with modified megaphone 180 with restricted megaphone
1971	220
1972	220 (210 with mute)
Needle jet	
1970	0.107
1971	0.106
1972	0.106
Needle position	
1970	Middle
1971	Middle
1972	Middle (top with mute)
Throttle valve (1970-1972)	3
Combat	
Type	Two Amal concentric float 932 32mm
Main jet	230 (220 with mute)
Needle jet	0.106
Needle position	Middle (top with mute)
Throttle valve	3
AIR FILTER	
Type	Impregnated paper

TRANSMISSION

RATIOS		
Internal		
1st		2.56 : 1
2nd		1.70 : 1
3rd		1.21 : 1
4th		1.00 : 1
Overall		
With 19T gearbox sprocket (U.S. 1969-1972)	1st	12.40 : 1
	2nd	8.25 : 1
	3rd	5.90 : 1
	4th	4.84 : 1
With 21T gearbox sprocket (U.S. and U.K. 1968)	1st	11.20 : 1
	2nd	7.45 : 1
	3rd	5.30 : 1
	4th	4.38 : 1
With 22T gearbox sprocket (optional)	1st	10.71 : 1
	2nd	6.84 : 1
	3rd	5.10 : 1
	4th	4.18 : 1

(continued)

750 COMMANDO (continued)

BUSHINGS	
4th gear bushing OD	0.9060-0.9053 in. (23.012-22.995mm)
4th gear bushing ID	0.8145-0.8140 in. (20.688-20.675mm)
4th gear bushing fitted ID	0.8133-0.8120 in. (20.657-20.625mm)
Layshaft bushing ID	1.126-1.124 in. (28.60-28.549mm)
Main shaft second gear bushing fitted ID	0.8125-0.8115 in. (20.637-20.608mm)
Layshaft third gear bushing fitted ID	0.8125-0.81 in. (20.637-20.57mm)
Layshaft first gear bushing fitted ID	0.6885-0.6875 in. (17.488-17.462mm)
Selector spindle bushing, kickstarter case fitted ID	0.6290-0.6285 in. (15-976-15.964mm)
Camplate/quadrant bushing fitted ID	0.5005-0.4995 in. (12.713-12.687mm)
Kickstarter spindle bushing fitted ID	0.675-0.673 in. (17.145-17.094mm)
CAMPLATE PLUNGER SPRING	
Free length	1.5 in. (38.1mm)
Spring rate	21 in.-lb.
SELECTOR	
Spindle diameter	0.3740-0.3735 in. (9.499-9.486mm)
Fork bore	0.3755-0.3745 in. (8.537-9.525mm)
DRIVE CHAIN	92 pitches, 0.375 x 0.250 in., triple row
REAR CHAIN	99 pitches, 0.400 x 0.380 in.
CLUTCH	
Type	Multi-plate, oil bath, diaphragm spring
Number of plates	5 bronze, 4 steel
Friction plate thickness	0.125 in. (0.32mm)
Pushrod length	9.813-9.803 in. (249.250-248.996mm)
Pushrod diameter	0.237-0.232 in. (5.984-5.857mm)
Operating ball diameter	½ in. (12.70mm)
Clutch adjuster length	0.904-0.894 in. (22.962-22.708mm)

CAPACITIES

FUEL TANK	
Fastback	3.9 gallons (15 liters)
LR Fastback	4.8 gallons (18 liters)
Roadster	
Fiberglass	2.7 gallons (10 liters)
Steel	3.0 gallons (11 liters)
SS Hi-Rider	2.4 gallons (9 liters)
Interstate	
Fiberglass	6.3 gallons (24 liters)
Steel	6.6 gallons (25 liters)
OIL TANK	6.0 pints (2.8 liters)
GEARBOX	0.9 pints (0.42 liters)
FRONT FORKS	5 ounces (150cc) each leg
PRIMARY CHAINCASE	7 ounces (200cc)

(continued)

750 COMMANDO (continued)

CHASSIS

DIMENSIONS	
Length	87.5 in. (222cm)
Wheelbase	56.75 in (144cm)
Width	26 in. (66cm)
Ground clearance	6 in. (15cm)
Front brake diameter	7.95 in. (20.32cm)
Rear brake diameter	7 in. (17.78cm)
Braking area, front	18.69 sq. in. (120 sq. cm)
Braking area, rear	13.60 sq. in. (88 sq. cm)
Exhaust system length (flange to muffler tip)	60 in. (154.4cm)
Front fork travel	6 in. (15.2cm)
Turning circle	17 ft. 10 in. (518.16cm)
Seat height	33-34 in. (838-863mm) depending on model
WEIGHT	
Gross weight (oil and one gallon of fuel)	
Roadster	422 lb. (191.44 kg)
Interstate	436 lb. (197.75 kg)
Dry weight	
Roadster	395.4 lb. (179.3 kg)
Interstate	410 lb. (186 kg)
Distribution	
Front	45.5 percent
Rear	54.5 percent
Gross vehicle rating	859 lb. (389.6 kg)

850 COMMANDO

ENGINE

GENERAL	
Displacement	50.5 cu. in. (828cc)
Bore	3.030 in. (77mm)
Stroke	3.503 in. (89mm)
Maximum torque	56 ft.-lb. at 5,000 rpm
Compression ratio	8.5 : 1
CRANKSHAFT	
Main bearing size	1.18 x 2.84 x 0.75 in. (30 x 72 x 19mm)
Big end journal diameter	1.7505-1.7500 in. (44.462-44.450mm)
Permissible end float	0.005-0.015 in. (0.127-0.381mm)
CONNECTING RODS	
Big end ID (less bearing)	1.895-1.8955 in. (48.133-48.145mm)
Rod side clearance	0.013-0.016 in. (0.33-0.406mm)
Rod end clearance	Less than 0.001 in. (0.0254mm)
PISTONS	
Diameter (bottom of skirt—standard)	3.028-3.071 in. (76.888-76.913mm)
Wrist pin boss ID	0.6869-0.6867 in. (17.447-17.442mm)
Wrist pin diameter	0.6869-0.6867 in. (17.447-17.442mm)
Rings (type)	Two compression, one oil control
Top compression	0.010-0.012 in. (0.254-0.305mm)
Second compression	0.008-0.012 in. (0.203-0.305mm)
CYLINDER BLOCK	
Bore size	
Grade A	3.0315-3.0320 in. (76.942-76.954mm)
Grade B	3.0320-3.0325 in. (76.954-76.967mm)
CYLINDER HEAD	
Valve seat angle	45°
CAMSHAFT	
Bearing journal diameter	0.8735 in. (22.187mm)
CAMSHAFT BUSHINGS	
Fitted ID, left and right	0.8750 in. (22.225mm)
PUSHRODS	
Assembled length, inlet	8.166-8.130 in. (207.416-206.466mm)
Assembled length, exhaust	7.321-7.285 in. (186.053-185.039mm)
ROCKER SHAFT	
Diameter	0.4988-0.4985 in. (12.694-12.669mm)
VALVE TAPPET CLEARANCES (Engine Cold)	
Inlet	0.006 in. (0.15mm)
Exhaust	0.008 in. (0.20mm)

(continued)

850 COMMANDO (continued)

VALVES	
Inlet	
Head diameter	1.490 in. (37.846mm)
Stem diameter (plated area)	0.3115-0.3105 in. (7.912-7.886mm)
Exhaust	
Head diameter	1.302 in. (33.0708mm)
Stem diameter (plated area)	0.3115-0.3105 in. (7.912-7.886mm)
VALVE GUIDES	
Inside diameter	0.3145-0.3135 in. (7.988-7.962mm)
Outside diameter	0.6265-0.6260 in. (15.90-15.88mm)
Washer thickness	0.062 in. (1.574mm)
VALVE SPRINGS	
Free length	
Inner	1.482 in. (37.642mm)
Outer	1.618 in. (41.097mm)
Fitted length	
Inlet inner	1.197 in. (30.40mm)
Inlet outer	1.259 in. (31.98mm)
Exhaust inner	1.222 in. (31.04mm)
Exhaust outer	1.284 in. (32.61mm)
INTERMEDIATE TIMING GEAR	
Bushing diameter (finished)	0.5627-0.5620 in. (14.292-14.274mm)
Shaft diameter	0.5615-0.5610 in. (14.262-14.249mm)
CAMSHAFT CHAIN	
Size	0.375 in. x 0.225 in. (single-row, endless)
Number of links	38
Ideal adjustment	3/16 in. (4.8mm) up and down on top run of chain
IGNITION TIMING	
Fully advanced position	28° BTDC
CONTACT BREAKER	
Point gap	0.014-0.016 in. (0.35-0.4mm)
Bolt thread size	¼ in. x 26 threads per inch
SPARK PLUG	
Type	Champion N7Y or equivalent
Gap	0.023-0.028 in. (0.59-0.72mm)
CARBURETORS	
Type	Two Amal concentric float 932 32mm
Main jet	260 (Mark II); 230 (Mark III)
Needle jet	0.106
Needle position	Top
Throttle valve	3½
AIR FILTER	
Type	Impregnated paper (Mark II) Oil-wetted foam (Mark III)

(continued)

850 COMMANDO (continued)

TRANSMISSION

RATIOS		
Internal		
1st		2.56 : 1
2nd		1.70 : 1
3rd		1.21 : 1
4th		1.00 : 1
Overall		
With 19T gearbox sprocket (U.S. 1969-1972)	1st	12.40 : 1
	2nd	8.25 : 1
	3rd	5.90 : 1
	4th	4.84 : 1
With 21T gearbox sprocket (U.S. 1973, U.K. 1972-1973)	1st	11.20 : 1
	2nd	7.45 : 1
	3rd	5.30 : 1
	4th	4.38 : 1
With 22T gearbox sprocket (U.K. 1974-1975)	1st	10.71 : 1
	2nd	6.84 : 1
	3rd	5.10 : 1
	4th	4.18 : 1

BUSHINGS	
4th gear bushing OD	0.9060-0.9053 in. (23.012-22.995mm)
4th gear bushing ID	0.8145-0.8140 in. (20.688-20.675mm)
4th gear bushing fitted ID	0.8133-0.8120 in. (20.657-20.625mm)
Layshaft bushing ID	1.126-1.124 in. (28.60-28.549mm)
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Camplate/quadrant bushing fitted ID	0.5005-0.4995 in. (12.713-12.687mm)
Kickstarter spindle bushing fitted ID	0.675-0.673 in. (17.145-17.094mm)
CAMPLATE PLUNGER SPRING	
Free length	1.5 in. (38.1mm)
Spring rate	21 in.-lb.
SELECTOR	
Spindle diameter	0.3740-0.3735 in. (9.499-9.486mm)
Fork bore	0.3755-0.3745 in. (8.537-9.525mm)
DRIVE CHAIN	92 pitches, 0.375 x 0.250 in., triple row
REAR CHAIN	99 pitches, 0.400 x 0.380 in.
CLUTCH	
Type	Multi-plate, oil bath, diaphragm spring
Number of plates	5 bronze, 4 steel
Friction plate thickness	0.125 in. (0.32mm)
Pushrod length	9.813-9.803 in. (249.250-248.996mm)
Pushrod diameter	0.237-0.232 in. (5.984-5.857mm)
Operating balance diameter	½ in. (12.70mm)
Clutch adjuster length	0.904-0.894 in. (22.962-22.708mm)

(continued)

850 COMMANDO (continued)

CAPACITIES

FUEL TANK	
Roadster	
Steel	3.0 gallons (11 liters)
Hi-Rider	2.4 gallons (9 liters)
Interstate	
Steel	6.6 gallons (25 liters)
OIL TANK	6.0 pints (2.8 liters)
GEARBOX	0.9 pints (0.42 liters)
FRONT FORKS	5 ounces (150cc) each leg
PRIMARY CHAINCASE	7 ounces (200cc)

CHASSIS

DIMENSIONS	
Length	87.5 in. (222cm)
Wheelbase	56.75 in. (144cm)
Width	26 in. (66cm)
Ground clearance	6 in. (15cm)
Front brake diameter	7.95 in. (20.32cm)
Rear brake diameter	7 in. (17.78cm)
Braking area, front	18.69 sq. in. (120 sq. cm)
Braking area, rear	13.60 sq. in. (88 sq. cm)
Exhaust system length (flange to muffler tip)	60 in. (154.4cm)
Front fork travel	6 in. (15.2cm)
Turning circle	17 ft. 10 in. (518.16cm)
Seat height	33-34 in. (838-863mm) depending on model
WEIGHT	
Gross weight (oil and one gallon of fuel)	
Roadster	422 lb. (191.44 kg)
Interstate	436 lb. (197.75 kg)
Dry weight	
Roadster	395.4 lb. (179.3 kg)
Interstate	410 lb. (186 kg)
Distribution	
Front	45.5 percent
Rear	54.5 percent
Gross vehicle rating	859 lb. (389.6 kg)

INDEX

F

G

H

I

L

M

O

P

R

S

T

V

W

Z