Triumph 650 & 750 Twins

cover. Clutch operating cam and gear change ratchets (Fig. TM3-30) are removed with the outer cover.

To remove the gear box inner cover and gears (Fig. TM3-31), remove the complete clutch assembly and unscrew the output sprocket retaining nut. Remove the two screws attaching inner cover to transmission housing and remove the inner cover complete with cam plate, shift forks, gears and shafts.

To remove bearings (3, 12 & 36—Fig. TM3-32), the respective housing should be heated to approximately 100° C (212° F). On all models except 3TA or 5TA, the needle bearing (12) should project 0.073-0.078 inch into the housing. Installation should be accomplished with a drift shown in Fig. TM3-33.

Bushing (5—Fig. TM3-32) should be installed with oil groove toward gear end of output shaft (4). All bushings must be reamed after installation. Refer to the following and Fig. TM3-32 for finished bushing specifications:

<table>
<thead>
<tr>
<th>Bushing (5)</th>
<th>Diameter</th>
<th>Clearance on shaft</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.752-0.753 in.</td>
<td></td>
</tr>
</tbody>
</table>

| Protrusion | 0.0020-0.0035 in. |

Bushing (12) for 3TA and 5TA models only—

| Diameter | 0.6865-0.6885 in. |

Bushing (20) for 3TA and 5TA models only—

| Diameter | 0.689-0.690 in. |

Bushing (18)—

| Diameter | 0.689-0.690 in. |

Clearance on shaft—

| 0.0015-0.0030 in. |

Free length of kick starter spring (22—Fig. TM3-32) is 1/2 inch. Free length of ratchet springs (3—Fig. TM3-30) is 1 1/16 inches. Free length of springs (8) is 1 1/16 inch. Finished diameter of bushing (6) should be 0.623-0.624 inch and shaft (2) should have 0.001-0.003 inch clearance.

The gears and shafts should be assembled in the inner cover as removed. Check operation before installing. Shift forks (28 & 30—Fig. TM3-32) must be installed correctly. To check, shift the cam plate (25) to both extremes (first and fourth gears) and check position of the guide rollers in the cam plate grooves. If shift forks are correctly installed, both rollers will reach both ends of the grooves. If movement of either roller is incorrect, remove shift forks (28 & 30) and exchange places. NOTE: Shift forks are not interchangeable. The rollers for cam plate are offset.

TRIUMPH UNIT CONSTRUCTION

650 AND 750cc TWINS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Bonneville T120</th>
<th>Thunderbird 6T</th>
<th>Trophy TR6</th>
<th>Bonneville T120V</th>
<th>Bonneville T140V</th>
<th>Tiger TR7V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement—cc</td>
<td>649</td>
<td>649</td>
<td>649</td>
<td>744*</td>
<td>744*</td>
<td>744*</td>
</tr>
<tr>
<td>Bore—mm</td>
<td>71</td>
<td>71</td>
<td>71</td>
<td>76*</td>
<td>76*</td>
<td>76*</td>
</tr>
<tr>
<td>Stroke—mm</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Number of cylinders</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Spark plug type—Champion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrode gap—mm</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.635</td>
<td>0.635</td>
<td>0.635</td>
</tr>
<tr>
<td>Inch</td>
<td>0.020</td>
<td>0.020</td>
<td>0.020</td>
<td>0.025</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Point gap—mm</td>
<td>0.35-0.40</td>
<td>0.35-0.40</td>
<td>0.35-0.40</td>
<td>0.35-0.40</td>
<td>0.35-0.40</td>
<td>0.35-0.40</td>
</tr>
<tr>
<td>Inch</td>
<td>0.014-0.016</td>
<td>0.014-0.016</td>
<td>0.014-0.016</td>
<td>0.014-0.016</td>
<td>0.014-0.016</td>
<td>0.014-0.016</td>
</tr>
<tr>
<td>Valve clearance (cold)—Intake—mm</td>
<td>0.05</td>
<td>0.05</td>
<td>0.05</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Inch</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
</tr>
<tr>
<td>Exhaust—mm</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Inch</td>
<td>0.004</td>
<td>0.004</td>
<td>0.004</td>
<td>0.006</td>
<td>0.006</td>
<td>0.006</td>
</tr>
<tr>
<td>Electrical system voltage</td>
<td>**12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Battery terminal grounded</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
<tr>
<td>Tire size—front</td>
<td>†</td>
<td>3.25 x 19</td>
<td>3.25 x 19</td>
<td>3.25 x 19</td>
<td>3.25 x 19</td>
<td>3.25 x 19</td>
</tr>
<tr>
<td>Tire pressure—Front—kg/cm²</td>
<td>1.68</td>
<td>1.68</td>
<td>1.68</td>
<td>1.68</td>
<td>1.68</td>
<td>1.68</td>
</tr>
<tr>
<td>Psi</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Rear—kg/cm²</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Psi</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Rear chain free play</td>
<td>††</td>
<td>††</td>
<td>††</td>
<td>††</td>
<td>††</td>
<td>††</td>
</tr>
<tr>
<td>Number of speeds</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

*Before serial numbers T140V XH22019 and TR7V AH24044, standard cylinder bore was 75mm and displacement was 724cc.

**Early models are equipped with 6 volt electrical system.

†Various tire sizes have been used including 3.25 x 18, 3.50 x 18, 4.00 x 18, 3.25 x 19 and 3.50 x 19.

††Rear chain free play should be 3/8 inch (18mm) with weight on wheels or 1/2 inches (43mm) with motorcycle on center stand.

Illustrations courtesy of Norton Triumph Corp.

MAINTENANCE

SPARK PLUGS. Recommended spark plug for normal use is Champion N58R for T120TT models. Champion N4 for other 650cc models; Champion N-3 for all 750cc models. Spark plugs are 14mm with 3/8 inch reach and heat range may vary depending upon use. Electrode gap should be 0.020 inch (0.5mm) for all 650cc models; 0.025 inch (0.635mm) for 750cc models.

CARBURETOR. Amal Monobloc and Concentric carburetors are used. Bonneville T120 models use two carburetors, all others use one. Refer to the following specification data:
Service Triumph 650 & 750 Twins

Fig. TM4-1—Exploded view of typical Amal Monobloc carburetor used. Refer to Fig. TM4-2 for view of Amal Concentric float carburetor.

1. Idle mixture needle
2. Jet block screw
3. Throttle slide
4. Clip
5. Valve needle
6. Pilot jet
7. Idle speed stop screw
8. Fuel filter
9. Banjo bolt
10. Jet holder
11. Needle jet
12. Main jet
13. Mainjet
14. Throttle spring
15. Jet block
16. Float
17. Inlet valve
18. Primer
19. Choke valve
20. Choke valve
21. Cable guide

6T (Serial No. DU101 and up)
Refer to Fig. TM4-1
Model .......................................................... 376/303
Main jet ........................................................... 230
Needle jet ......................................................... 106
Valve needle ..................................................... C
Throttle slide ..................................................... 376/3½
Pilot jet ............................................................. 25
Clip (4) in third groove from top of needle (5).

TR6 (Serial No. DU101 to DU5824)
Refer to Fig. TM4-1
Model .......................................................... 376/303
Main jet ........................................................... 230
Needle jet ......................................................... 106
Valve needle ..................................................... C
Throttle slide ..................................................... 376/3½
Pilot jet ............................................................. 25
Clip (4) in third groove from top of needle (5).

T120 (Serial No. DU101-DU5824)
Refer to Fig. TM4-1
Model .......................................................... 376/303
Main jet ........................................................... 230
Needle jet ......................................................... 106
Valve needle ..................................................... C
Throttle slide ..................................................... 376/3½
Pilot jet ............................................................. 25
Clip (4) in third groove from top of needle (5).

TR7V
Refer to Fig. TM4-2
Model .......................................................... 930/89
Main jet ........................................................... 280
Needle jet ......................................................... 106
Throttle slide ..................................................... 3½
Clip (4) in second groove from top of needle (5).

IGNITION AND ELECTRICAL.
Ignition breaker point gap should be 0.014-0.016 inch for all models. The ignition breaker point cam and advance weights are mounted on the right end of the exhaust camshaft. Ignition timing for the right cylinder is adjusted by moving the breaker point base plate after removing the small...
Triumph 650 & 750 Twins

![Diagram of ignition system](image)

Fig. TM4-4—The ignition cam and advance assembly is mounted on the right end of the camshaft. Black and yellow wire goes to breaker points (3) and black and white wire goes to breaker points (4).

Fig. TM4-7—Coils (C) for models with AC (energy transfer) ignition are different than coils for battery ignition models.

round cover from the right side. It may be necessary to vary the breaker point gap on the second set of breaker points in order to set ignition timing for the left cylinder.

Ignition automatic advance range in camshaft degrees (1/4 of camshaft degrees) is stamped on the back of the breaker cam. Standard ignition timing is as follows:

**6T (Serial No. DU101-DU5824)**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>7°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>35°</td>
</tr>
<tr>
<td>Advance range stamped on cam</td>
<td>14°</td>
</tr>
<tr>
<td>Piston position BTDC—</td>
<td>0.015 inch</td>
</tr>
</tbody>
</table>

**6T (Serial No. DU5825-DU44394)**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>11°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>35°</td>
</tr>
<tr>
<td>Advance range stamped on cam</td>
<td>14°</td>
</tr>
<tr>
<td>Piston position BTDC—</td>
<td>0.038 inch</td>
</tr>
</tbody>
</table>

**TR6 and T120 (Serial No. DU101-DU5824)**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>11°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>39°</td>
</tr>
<tr>
<td>Advance range stamped on cam</td>
<td>14°</td>
</tr>
<tr>
<td>Piston position BTDC—</td>
<td>0.038 inch</td>
</tr>
</tbody>
</table>

**TR6 and T120 Models with Battery Ignition (Serial No. DU5825 and up)**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>15°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>39°</td>
</tr>
<tr>
<td>Advance range stamped on cam</td>
<td>12°</td>
</tr>
<tr>
<td>Piston position BTDC—</td>
<td>0.068 inch</td>
</tr>
</tbody>
</table>

**TR6 and T120 Models with Energy Transfer Ignition (Serial No. DU44395 and up)**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>29°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>39°</td>
</tr>
<tr>
<td>Advance range stamped on cam</td>
<td>5°</td>
</tr>
<tr>
<td>Piston position BTDC—</td>
<td>0.25 inch</td>
</tr>
</tbody>
</table>

**TR7V and T14OV**

Crankshaft degrees BTDC—

<table>
<thead>
<tr>
<th>Static</th>
<th>14°</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full advance</td>
<td>38°</td>
</tr>
<tr>
<td>Advance range of cam</td>
<td>12°</td>
</tr>
<tr>
<td>Piston position Static</td>
<td>0.060 inch (1.5mm)</td>
</tr>
</tbody>
</table>

Full advanced ignition timing should occur at 35° (crankshaft degrees) BTDC for all 6T models; 36° BTDC for all TR6 and T120 models; 38° BTDC for all TR7V and T140V models. Full advanced ignition timing can be checked using a degree wheel mounted on the right end of exhaust camshaft and a power timing light.

All models are equipped with an alternator mounted at left end of crankshaft which charges the battery (if so equipped) via a full wave rectifier. On later models, current is controlled by a zener diode after being rectified. Clearance between alternator coil poles and rotor should be 0.008 inch minimum all the way around. Rotor retaining nut should be torqued to 30 Ft.-Lbs. (4.1 kg-m) for all 650cc models; 40 Ft.-Lbs. (5.5 kg-m) for all 750cc models. On all models, stator mounting screws should be torqued to 20 Ft.-Lbs. after correctly centered over the rotor. Make certain that stator wires do not rub on the primary chain. On models with AC (energy transfer) ignition, the alternator rotor must be correctly timed to the engine to provide the electrical current for ignition. Models with energy transfer ignition are equipped with special high tension ignition coils shown in Fig. TM4-7 located under the fuel tank.

When assembling models with energy transfer ignition, observe the following: Install the primary drive sprocket with the rotor locating peg at approximately 9 o'clock position when the crankshaft is at top dead center. Refer to Fig. TM4-8. The rotor has three holes marked "S", "M" and "R". The "S" position should be used with full advanced ignition timing at 37° BTDC. The "M" position should be used with 39° BTDC full advanced ignition timing. The "R" position should be used only if full advance ignition timing is set at 41° BTDC.

NOTE: It is important that ignition timing is correctly set in relation to the rotor location. The current generated when the breaker points open may be insufficient to fire the spark plugs if breaker points open too soon or too late. If one set of breaker points is faulty, both cylinders will be affected. If the brown stop light wire is shorted, the engine will not run.

**VALVE SYSTEM.** The valve clearance should be set with engine cold. On 650cc models, intake clearance should be 0.002 inch (0.05mm) and exhaust clearance should be 0.004 inch (0.10mm). On 750cc models intake clearance should be 0.006 inch (0.20mm) and exhaust should be 0.006 inch (0.15mm). On all models, check the clearance of one valve when the similar valve for other cylinder is a maximum opening. EXAMPLE: Clearance for the inlet valve for the right cylinder should be set when the inlet valve for the left cylinder is fully open.

**LUBRICATION.** On 650cc models, the engine uses a dry sump lubrication system. On models before serial number DU24874, capacity is 6 pints (2.8 liters); later models have capacity of 7/4 pints (3.4 liters). Use SAE 40 oil.
The oil should be drained, filter (F) cleaned and reservoir should be filled with new oil every 1000 miles. Oil should be maintained between marks on dip stick (D).

On all models, installation of hoses to and from the reservoir is important. Refer to Fig. TM4-9 and Fig. TM4-9A. Oil is drawn from the reservoir to the pressure pump through hose (1). The scavenge pump delivers oil back to the reservoir from the engine through hose (3). Oil pumped by the scavenge pump is also used to lubricate the rocker arms via hose (4). On some models, oil is metered by valve (5—Fig. TM4-9) and delivered to the rear chain through hose (6). The engine will probably be damaged because of lack of lubrication if hoses are attached incorrectly.

The oil pump is located on the right crankcase half under the timing gear cover and is driven by an eccentric peg on the nut retaining the timing gear to the inlet camshaft. Normal oil pressure is 20-25 psi at idle and 60-65 psi during normal running. Refer to Fig. TM4-10 for exploded view of pump and relief valve. On early models (bottom of Fig. TM4-10), free length of relief valve spring (10) should be 31/32 inch and auxiliary spring (13) should be 9/32 inch long. On models after serial number DU13375, relief valve spring (10—top of Fig. TM4-10) should be 1 17/32 inches long.

On 650cc models, oil in primary chain case should be drained every 1000 miles. The primary chain case should be filled to level of plug (L—Fig. TM4-11) with SAE 20 oil.

On 750cc models, oil in primary chain case is automatically maintained at correct level by the engine lubricating system. Pour 150cc of engine oil into the chain case before starting engine if chain case has been drained.

On all models, the gear box should be drained every 6000 miles. The gear box should be filled with EP 90 gear lubri-
Triumph 650 & 750 Twins

Fig. TM4-12-The gear box oil level plug is shown at (M) and drain plug at (D). Filler plug is located at top near clutch cable.

Fig. TM4-13-Clutch spring tension can be adjusted as shown after removing the primary chain cover. Refer to text.

Fig. TM4-14-Exploded view of the front suspension used on early models (before serial number DUS825). Refer to Fig. TM4-15 for later type.

Fig. TM4-15-Exploded view of front suspension used from serial number DC5825 to DUS6245. On some models, restrictor valve may be type shown in Fig. TM4-16. Refer to Fig. TM4-14 for legend.

CLUTCH CONTROLS. To adjust the clutch, remove the plug from the side of primary chain case cover, loosen the locknut and turn the adjusting screw (A—Fig. TM4-11) until resistance is felt. Back the adjusting screw (A) out 1 turn and tighten the locknut. Adjust the cable guide at hand lever until cable has 1/8 inch free play.

If clutch slips with controls properly adjusted, remove the primary chain case cover and adjust the spring pressure. Initial setting is with adjusting nuts flush with ends of studs. Each nut must be adjusted to provide even spring pressure. To check adjustment of springs, shift transmission to neutral, disengage clutch and operate the kick starter. Check the pressure plate as it turns and make sure it does not wobble. If one section of pressure plate is higher than the rest, turn the adjusting nuts in and re-check. To turn the adjusting nuts out, it is necessary to hold the springs down as shown in Fig. TM4-11 to release the locking lug on bottom of nut.

PRIMARY CHAIN. Tension of the primary chain is adjusted by turning adjuster (T—Fig. TM4-11) after removing drain plug (D). Special hexagon headed screwdriver (part No. D496) should be used to turn adjuster (T). The chain should have 1/4 inch free play as measured through the filler plug hole (F). Make certain that primary chain case is filled to level of plug hole (L) with SAE 20 oil after adjustment is complete.

To remove the primary chain case cover, remove the left exhaust pipe, loosen the rear brake adjuster until the brake pedal is clear of the primary cover, and remove the left foot rest. Remove drain plug (D—Fig. TM4-11) and allow primary chain case to drain. Remove the two domed nuts and eight attaching screws, then lift off the chain cover. To remove the primary chain, it is necessary to remove the alternator, then remove the clutch, chain and crankshaft sprocket together.

When assembling, tapered side of spacer (5—Fig. TM4-24) must be installed toward the sprocket. Refer to IGNITION AND ELECTRICAL paragraphs for installing alternator rotor and stator. Make certain that alternator wires can not rub on primary drive chain. Install chain tension adjuster and adjust the chain free play after the chain case cover is installed.

SUSPENSION. Each front suspension unit contains 150cc of oil on all 6T, TR6 and T120 models with internal...
service

Triumph 650 & 750 Twins

Fig. TM4-17-Exploded view of front suspension used on models from serial number DU66246.

1. Filler plug
2. Tube
3. Spring
4. Bottom bushing
5. Washer
6. Bushing nut
7. Restricter
8. Screw
9. Snap ring
10. Screw (15)
11. Oil seal
12. Seal retainer sleeve
13. Top bushing
14. Damper sleeve
15. Lower tube
16. Damper washer
17. Damper tube assembly
18. Recall spring

Fig. TM4-18-Exploded view of front suspension unit used on late models.

1. Fork top bolt
2. Tube
3. Spring seat
4. Inner fork spring
5. Inner fork tube
6. Damper valve nut
7. Damper valve
8. Damper tube assembly
9. Inner fork tube end plug
10. Seal for screw (15)
11. Oil seal
12. Outer fork tube
13. Oil drain plug
14. Shuttle valve
15. Snap ring
16. Dust cover
17. Oilseal
18. Outer fork tube end plug

Fig. TM4-18A-A special tool is helpful for holding the damper tube while removing screw.

Valve stem to guide clearance—
Inlet .................. 0.0027-0.0032 in.
Exhaust ................. 0.0032-0.0047 in.
Valve seat and face angle 45 degrees
Valve seat width ............. 0.32 in.
Valve springs—type installed
6T Serial No. DU101 and up
Inner-marked .... Red Spot
Outer-marked .... Red Spot
TR6 Serial No. DU101-DU24874
Inner-marked .... White Spot
Outer-marked .... White Spot
TR6 Serial No. DU24875-DU66245
Inner-marked .... Red Spot
Outer-marked .... Red Spot
TR6 Serial No. DU66246 and up
Inner-marked .... Red Spot
Outer-marked .... Green Spot
TR7V
Inner-marked .... Red Spot
Outer-marked .... Green Spot
T120 Serial No. DU101-DU24874
Inner-marked .... White Spot
Outer-marked .... White Spot
T120 Serial No. DU24875-DU66245
Inner-marked .... Red Spot
Outer-marked .... Red Spot
T120 Serial No. DU66246 and up
Inner-marked .... Red Spot
Outer-marked .... Green Spot
T140V
Inner-marked .... Red Spot
Outer-marked .... Green Spot

Valve spring—specifications
Inner-marked with red spot—
Free length ... 1 17/32 inches
Number of coils .... 7/4

spring (Fig. TM4-14). On models with external spring (Fig. TM4-15 or Fig. TM4-17), each unit contains 190cc of oil. The late type fork (Fig. TM4-18) used on TR7V and T140V models should contain 200cc of Automatic Transmission Fluid (ATF). Recommended oil for earlier models is SAE 50 oil above 90°F. SAE 30 at temperatures from 60°F. to 90°F., and SAE 20 oil below 60°F. Oil should be drained and filled with correct type at least every 6000 miles. Oil is drained by removing plugs at the bottom of fork lower (sliding) tubes. Forks are filled through the hole in top after removing plug (1—Fig. TM4-14, Fig. TM4-15, Fig. TM4-17 or Fig. TM4-18).

Disassembly and reassembly of late forks is more easily accomplished using the special tool shown in Fig. TM4-18A. The tool holds the damper tube assembly (7—Fig. TM3-18) while removing or installing the Allow screw (14). A 13/16 inch socket with a long extension can be used to hold nut (4) in a similar way if the special tool is not available. Coat threads of spring seat (1A) with "Permatex Super 300", "Loc-tite Hydraulic Sealant" or equivalent to prevent leakage.

Rear suspension units are sealed and must be renewed if leaking or damaged.

repairs

CYLINDER HEAD AND VALVES.
To remove the cylinder head, remove the fuel tank, coils, top engine supports (stays), rocker caps and rocker arm oil line. On 650cc models, loosen all nine cylinder head screws, remove the five stud nuts and two screws attaching rocker boxes to cylinder head and lift off the rocker boxes. On 750cc models, remove the attaching screws and stud nuts, then remove the rocker hoses. On all models, lift out the push rods and mark for correct assembly in the same location. Remove the exhaust pipes. On 650cc models, remove the five remaining cylinder head retaining screws and lift the cylinder head off.

NOTE: The four cylinder head screws which also attach the rocker boxes are already removed. On 750cc models, remove the ten cylinder head retaining screws and stud nuts. NOTE: Special threaded nuts are used at locations (3, 4, 5 & 6—Fig. TM4-19A).

When the cylinder head is removed, it is necessary to renew the push rod tube oil seals. Refer to the following specification data:

Rocker arm bore
I.D.) .................. 0.5002-0.5012 in.
Rockertach (O.D.) .. 0.4990-0.4995 in.

Valve stem to guide clearance—
Inlet .................. 0.0027-0.0032 in.
Exhaust ................. 0.0032-0.0047 in.
Valve seat and face angle 45 degrees
Valve seat width ............. 0.32 in.
Valve springs—type installed
6T Serial No. DU101 and up
Inner-marked .... Red Spot
Outer-marked .... Red Spot
TR6 Serial No. DU101-DU24874
Inner-marked .... White Spot
Outer-marked .... White Spot
TR6 Serial No. DU24875-DU66245
Inner-marked .... Red Spot
Outer-marked .... Red Spot
TR6 Serial No. DU66246 and up
Inner-marked .... Red Spot
Outer-marked .... Green Spot
TR7V
Inner-marked .... Red Spot
Outer-marked .... Green Spot
T120 Serial No. DU101-DU24874
Inner-marked .... White Spot
Outer-marked .... White Spot
T120 Serial No. DU24875-DU66245
Inner-marked .... Red Spot
Outer-marked .... Red Spot
T120 Serial No. DU66246 and up
Inner-marked .... Red Spot
Outer-marked .... Green Spot
T140V
Inner-marked .... Red Spot
Outer-marked .... Green Spot

Valve spring—specifications
Inner-marked with red spot—
Free length ... 1 17/32 inches
Number of coils .... 7/4
Inner-marked with white spot—
Free length .......................... 1¼ inches
Number of coils ...................... 7
Outer-marked with red spot—
Free length .......................... 1½ inches
Number of coils ...................... 5½
Outer-marked with white spot—
Free length .......................... 2 1/32 inches
Number of coils ...................... 6¼

When reassembling, renew the push rod tube oil seals and carefully position the cylinder head making certain that push rod tubes are correctly centered.

On 650cc models, start the cylinder head screws (1, 6, 7, 8 & 9—Fig. TM4-19) and install push rods. On 750cc models, install and tighten all ten cylinder head retaining nuts and screws (Fig. TM4-19A). Turn the crankshaft until both inlet push rods are at bottom of travel, then install the rear rocker box and rocker arms assembly. NOTE: Be sure to install the three stud nuts on bottom before installing the screws and stud nuts on top. Turn the crankshaft until both front (exhaust) push rods are at bottom of travel, then install the front rocker box and rocker arms assembly.

On all models, refer to the VALVE SYSTEM paragraphs in the Maintenance section for setting valve clearance.

PISTONS, RINGS AND CYLINDERS. Pistons and rings are available in standard size and oversizes. Nominal bore size is 71mm (2.795 inches) for 650cc models, 75mm (2.953 inches) for early 750cc models, 76mm (2.992 inches) for late 750cc models.

Piston Skirt Clearance—
6T (Serial No. DU101-DU5824) ...... 0.0033-0.0043 inch 0.084-0.109mm
6T (Serial No. DU5825-DU44393) .... 0.0016-0.0027 inch 0.041-0.069mm
TR6 (Serial No. DU101-DU44393) .... 0.0033-0.0043 inch 0.084-0.109mm
TR6 (Serial No. DU44394 and up except 11:1 Compression ratio) .... 0.0046-0.0061 inch 0.117-0.155mm
TR6 and T120 (Serial No. DU44394 and up with 11:1 Compression ratio) .... 0.0046-0.0061 inch 0.117-0.155mm
T120TT (Before Serial No. DU44393 with 11:1 Compression ratio) .... 0.0070-0.0084 inch 0.178-0.213mm
T120 (Serial No. DU44394 and up with 11:1 Compression ratio) .... 0.0070-0.0084 inch 0.178-0.213mm
T120 (Serial No. DU44394 and up except 11:1 Compression ratio) .... 0.0046-0.0061 inch 0.117-0.155mm

Piston Ring Clearance—
T120 (Before Serial No. DU44394 except 11:1 Compression ratio) .... 0.0038-0.0048 inch 0.097-0.122mm
TR7V and T14DV (All 750cc models) .... 0.0036-0.0042 inch 0.091-0.107mm

Maximum cylinder bore taper or out of round .......... 0.005 inch 0.127mm

Ring side clearance in grooves (650cc)—
Compression rings 0.001-0.003 inch 0.025-0.076mm
Oil control .......... 0.0005-0.0025 inch 0.013-0.064mm

Ring side clearance in groove (750cc)—
Compression rings 0.0015-0.0035 inch 0.0038-0.089mm
Oil control .......... 0.0015-0.0025 inch 0.0038-0.089mm

Ring end gap (650cc)—
All rings 0.010-0.014 inch 0.25-0.36mm

TR6 (Serial No. DU44394 and up except 11:1 Compression ratio) .... 0.0070-0.0084 inch 0.178-0.213mm
T120 (Serial No. DU44394 and up with 11:1 Compression ratio) .... 0.0046-0.0061 inch 0.117-0.155mm

Fig. TM4-19—Cylinder head retaining screws and stud nuts should be tightened in sequence shown for 650cc models. Special nuts are used at locations (3, 4, 5 & 6) which accept rocker box screws.

Fig. TM4-19A—Cylinder head retaining screws and stud nuts should be tightened in sequence shown for 750cc models. Special nuts are used at locations (3, 4, 5 & 6) which accept rocker box screws.

Fig. TM4-20—Triumph pistons can be identified by measuring from center of piston pin bore. Pistons shown are for 650cc models.

Fig. TM4-21—On models after serial number DU4474, the exhaust cam followers are pressure lubricated and must be installed with cutaway areas (C) toward outside as shown.
SERVICE

Triumph 650 & 750 Twins

should be installed with cut-away faces (C) toward outside. Inlet cam follower block on late models and both guide blocks on earlier models should be similarly pressed into place; however, these are not pressure lubricated and do not have oil holes (B) or cut away sections (C). In late models, make certain that the cylinder base gasket is installed with hole in gasket over the oil passage (A—Fig. TM4-22) in crankcase and oil passage (B) in cylinder.

When installing piston rings on all models, make certain that side of the two compression rings marked "TOP" is toward top of piston. The cylinder retaining nuts should be tightened to 35 Ft.-Lbs. torque.

CRANKSHAFT, CONNECTING RODS AND CAMSHAFTS. To remove the crankshaft or connecting rods, it is necessary to separate the crankcase halves.

Remove the cylinder head, cylinder, ignition base plate, ignition cam, timing gear cover, oil pump and camshaft and crankshaft gears. NOTE: The nuts attaching gear to camshaft are left hand thread. Remove the clutch, alternator (stator and rotor), primary drive sprockets, primary drive chain, gear box cover and transmission gears. Remove engine from the frame and remove the remaining screws and stud nuts joining the crankcase halves.

NOTE: Two screws are located at (S—Fig. TM4-23). Connecting rod crankpin standard diameter is 1.6235-1.6240 inches (41.237-41.25mm). Bearing inserts are available in standard size as well as undersizes.

Fig. TM4-22—On later 650cc models, make certain hole in cylinder base gasket is over oil passages (A) in crankcase and (B) in cylinder.

Fig. TM4-23—Make certain that the two screws (S) are removed when separating crankcase halves.

Ring end gap (750cc)—

<table>
<thead>
<tr>
<th>Compression rings</th>
<th>Oil control</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.008-0.013 inch</td>
<td>0.010-0.040 inch</td>
</tr>
<tr>
<td>0.20-0.33mm</td>
<td>0.025-1.02mm</td>
</tr>
</tbody>
</table>

When removing or installing the cylinder, a shock absorber mounting rubber or similar rubber block should be wedged between both sets of cam followers. If cam followers are not held in position, they may fall into the crankcase. On models after serial number DU24874, the exhaust cam followers are pressure lubricated. If the exhaust cam follower block is removed, make certain that "O" ring (2—Fig. TM4-21) is positioned around guide block and locking hole (A) is aligned with lock screw hole before pressing into cylinder. Exhaust cam followers (3) should be installed with cut-away faces (C) toward outside. Inlet cam follower block on late models and both guide blocks on earlier models should be similarly pressed into place; however, these are not pressure lubricated and do not have oil holes (B) or cut away sections (C). In late models, make certain that the cylinder base gasket is installed with hole in gasket over the oil passage (A—Fig. TM4-22) in crankcase and oil passage (B) in cylinder.

When installing piston rings on all models, make certain that side of the two compression rings marked "TOP" is toward top of piston. The cylinder retaining nuts should be tightened to 35 Ft.-Lbs. torque.

CRANKSHAFT, CONNECTING RODS AND CAMSHAFTS. To remove the crankshaft or connecting rods, it is necessary to separate the crankcase halves.

Remove the cylinder head, cylinder, ignition base plate, ignition cam, timing gear cover, oil pump and camshaft and crankshaft gears. NOTE: The nuts attaching gear to camshaft are left hand thread. Remove the clutch, alternator (stator and rotor), primary drive sprockets, primary drive chain, gear box cover and transmission gears. Remove engine from the frame and remove the remaining screws and stud nuts joining the crankcase halves. NOTE: Two screws are located at (S—Fig. TM4-23). Connecting rod crankpin standard diameter is 1.6235-1.6240 inches (41.237-41.25mm). Bearing inserts are available in standard size as well as undersizes.

Fig. TM4-22—On later 650cc models, make certain hole in cylinder base gasket is over oil passages (A) in crankcase and (B) in cylinder.

Fig. TM4-23—Make certain that the two screws (S) are removed when separating crankcase halves.
Triumph 650 & 750 Twins

The crankshaft left (drive) side main bearing should be of the roller type. On models before serial number DU13375, early type bearing can be changed to the late roller type without changing any other parts. On models between serial number DU13375 and DU24874, the late type roller bearing can be installed after installing the late type crankshaft timing gear (11—Fig. TM4-24) and washer (26).

When assembling, the projecting tabs on connecting rod bearing inserts should be on same side. The connecting rod nuts should be tightened to the torque. Two types of connecting rod nuts have been used. The early type has a machined finish and should be tightened to 28 Ft.-Lbs. torque (3.87 kg-m). The later, preferred nuts have a dull grey finish for identification and should be tightened to 22 Ft.-Lbs. (3.04 kg-m) torque. The nuts are self-locking but the manufacturer also suggested using "Loctite" to prevent loosening.

The three flywheel retaining screws (9—Fig. TM4-24) should be tightened to 33 Ft.-Lbs. (4.6 kg-m) torque. Make certain that the mating surfaces of crankcase halves are clean and smooth. Seal (30) should be installed from inside after removing the roller bearing outer rod. Closed side of seal should be toward main bearings (27). To remove or install main bearings (25 & 27) from crankcase bores, the crankcases should be heated to approximately 100°C (212°F).

When installing camshaft timing gears, install gears on shafts using the keyway nearest the correct timing mark on gear. Several different gears have been used, but marks are similar. Early camshaft gears have only one mark and are not interchangeable. Late gears have two marks. The "A" mark (Fig. TM4-25) should be used for the exhaust camshaft and the "B" mark for the inlet camshaft. Install the idler gear last making sure that marks are aligned correctly. The slot on crankshaft gear should be between the two long dashes on idler gear as shown at (C). Align the correct dot (A) on exhaust camshaft gear with dot on idler gear. On 6T models, align the correct dot (B) on inlet camshaft gear with short dash (S). On all other models, align inlet camshaft dot (B) with the long dash (L) on idler gear.

CLUTCH. Clutch plates can be removed after removing the primary chain case cover and the spring adjusting nuts (1—Fig. TM4-27). Six friction discs (7) and six driven plates (6) are used on all models. To remove the clutch drum and primary chain, it is necessary to remove the alternator rotor and stator, then use special pullers to remove crankshaft primary drive sprocket, clutch drum and primary chain. When removing the clutch drum (17), the special puller which attaches to the drive hub (20) should be used.

When assembling the shock absorber cushions (11 & 12 Fig. TM4-28), use soap to lubricate rubber cushions and make certain that drive and rebound cushions are on the correct sides of spider (13) as shown. NOTE: Do not use oil or grease to lubricate rubber cush-
SERVICE

Triumph 650 & 750 Twins

Fig. TM4-30-Exploded view of parts located in the gear box outer cover. Refer to Fig. TM4-29 for assembled view.

1. Gear shift pedal shaft
2. Clutch release plunger
3. Kick starter shaft
4. Guide plate
5. Ratchet pawls (2 used)
6. Ratchet springs (2 used*)
7. Pedal return springs
8. Bushing
9. "C" ring
10. Gear shift pedal
11. Connecting link
12. Pedal return springs
13. Washer
14. Cotter pin
15. Spring
16. Washer
17. Center pin
18. Kick starter gear
19. Return spring
20. Bushing
21. Kick starter pedal

Fig. TM4-32-View of the gear box inner cover installed. Refer to text for removal procedure.

Fig. TM4-33-When removing or installing transmission gears, be careful not to lose thrust washer (10) or rollers (2).

Four Speed Gear Box. To remove the gear box outer cover, remove the exhaust pipe and foot rest from the right side. Loosen clutch cable adjuster and disconnect cable from the actuating spoke. Drain gear box and engage fourth gear. Remove the two nuts and four screws attaching outer cover, then remove the outer cover. Clutch operating cam, kick starter and gear change ratchet (Fig. TM4-29), are removed with the outer cover.

To remove the inner cover, bend the tab washer back and remove nut (5—Fig. TM4-32), then lift off the kick starter ratchet assembly. Unbolt and remove the right rear engine mounting plate. Remove nut (4) and withdraw the detent plunger and spring. Remove the primary chain cover, alternator assembly, primary chain, crankshaft sprocket and the complete clutch assembly. On models before serial number DU24875, disconnect the speedometer cable. Remove the three screws (1, 2 & 3) and remove the inner cover. Remove the shift fork rail then lift out the transmission gears and shafts as shown in Fig. TM4-33. The transmission output shaft and fourth gear (4—Fig. TM4-34) can be bumped out of bearing after the output sprocket (28) is removed.

If needle bearings (11 or 12) are renewed, bearings should be installed as shown in Fig TM4-35 using a special drift. Bearing (12—Fig. TM4-34) is closed on outside end, bearing (11) is open. When removing and installing bearings (11, 12, 14 & 25), the appropriate case should be heated to 100° C (212° F.). Oil seal (27) should be installed with open side toward the bearing (25) and against snap ring (26).
Bushing (5) should be pressed into shaft (4) with oil groove toward teeth on shaft. Bushing should protrude 7/16-inch and must be reamed after installation to provide 0.0032-0.0047 inch clearance on input shaft (1). First gear bushing (13) should have 0.0025-0.0045 inch clearance on counter shaft (9).

When assembling, observe the following:
1. Install the cam plate (C—Fig. TM4-36) and detent plunger (D), spring and nut (N). Turn the camplate until the notch between second and third gears engages detent plunger as shown in Fig. TM4-36. Use grease to stick the
2. Thrust washer (10) in position with grooved side out as shown. Stick the rollers (2—Fig. TM4-33) onto forks with grease. Slide the assembled shafts into housing while carefully sliding gears as required to align rollers (2) with grooves in cam plate (C). NOTE: Be careful not to move the camplate when assembling. With parts correctly positioned in housing, slide the shift rail through shift forks with shouldered end (S) toward inside. Use grease to stick thrust washer (10) around bearing (11—Fig. TM4-34) in the inner cover with the grooved side toward gear (6). Coat mating surfaces of inner
3. Output shaft bearing (25) and output shaft (24) of transmission case. Use grease to stick thrust washer (10) around bearing (11—Fig. TM4-34) in the inner cover with the grooved side toward gear (6). Coat mating surfaces of inner
4. Oil seal (27) when assembling. The kick starter return spring should be installed on spline shown.
small and large splined gears. Also listed are the dates when used in original production. Some of the improvements incorporated in later production can be installed in earlier transmissions; however, it is extremely important to select the correct combination to ensure proper operation. Small bore gears should never be installed on a non-stepped shaft and large bore gears should never be used on a stepped shaft. Mainshafts have two different types of threads (C.E.I. or U.N.F.). Be sure that the nuts and spacers are correct for the shaft used as well as the gears used. Installing late mainshaft high gears in early transmission may necessitate installing later plate and seal at rear of clutch. The gearbox casting must be modified to change layshaft (countershaft) from plain bushing to needle roller type.

**FIVE SPEED GEAR BOX.** To remove the gear box outer cover, remove right side exhaust pipe and foot rest. Loosen the clutch cable adjuster and disconnect cable at the hand lever. Remove plug from cover and release the cable from actuating arm. Disconnect cable and housing from gearbox outer cover. Drain gear box and engage fifth gear. Remove the two nuts and four screws that attach cover, then depress kickstarter slightly and remove cover. The clutch operating cam, kick starter and gear change ratchet are removed with cover.

To remove the inner cover, unbolt and remove the right rear engine mounting plate. Bend tangs of lock washer down and remove nut (24—Fig. TM4-52). Remove the three screws (3) and remove cover from dowels. Remainder of disassembly will depend upon work done. The complete clutch assembly must be removed before input shaft (1—Fig. TM4-50) can be removed. The transmission output sprocket (28) must be removed before output shaft (4) can be removed. The gearbox or cover should be heated to approximately 100°C. when removing or installing bearings. Refer to Fig. TM4-35 for installing countershaft (layshaft) needle bearings. The bronze thrust washers on the countershaft should be positioned with grooved
Fig. TM4-50—Exploded view of five speed transmission gears and associated parts.

1. Input shaft (main shaft)
2. Fourth gear
3. Third gear
3B. Bushing
4. Output shaft and fifth gear
5. Needle roller bearings
5S. Oil seal
6. First gear
6B. Bushing
7. Second gear
8. First and second gear
9. Third gear
10. Countershaft (layshaft) with fourth gear and drive gear
11. First gear drive dog
12. Snap ring
13. Ball bearing
14. Snap ring
15. Clutch rod bushing
16. Clutch nut
17. Washer
18. Sleeve
19. Ratchet spring
20. Clutch spring
21. Kick starter gear
22. Ratchet
23. Tab washer
24. Nut
25. Output shaft roller bearing
26. Snap ring
27. Oil seal
28. Output sprocket
29. Lock washer
30. Nut

Surfaces toward gear on shaft (10—Fig. TM4-50) and first gear drive dog (11).

Assemble transmission gears, shafts, shift forks and shift cam with parts in first gear. Install the cover with the top of the second tooth on quadrant aligned with center of foot change spindle bore as shown at (A—Fig. TM4-52).

Fig. TM4-51—Drawing of transmission showing positions of shift cam and shift forks in neutral.

Fig. TM4-52—Drawing of inner cover showing the three screws (3) which attach cover.

Fig. TM4-53—The fourth speed gear and the drive gear are pressed onto the countershaft (lay shaft). Distance (D) must be 0.653-0.655 inch (16.58-16.64 mm) and clearance between gears should be at least 0.007 inch (0.18 mm).