CIRCUIT BREAKER

DESCRIPTION

The ignition system has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, switch, primary coil, breaker points, condenser and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The circuit breaker is located on the gearcase cover on the right-hand side of the motorcycle. It has two functions. First, the breaker cam and contact points open and close the low voltage circuit between the battery and ignition coil causing the coil to produce h1gh voltage discharge to the spark plugs. Second, the circuit breaker times discharge for proper engine firing.

The breaker points are operated by a cam with two lobes. The narrow lobe times the front cylinder and the wide lobe times the rear cylinder. A single ignition coil fires both spark plugs at the same time, but one spark occurs in the exhaust stroke of one cylinder and the other spark fires the combustible gases in the other cylinder to produce the power stroke.

The advance mechanism is an extension on the camshaft and operates at half crankshaft speed. The spark timing cam is advanced automatically as engine speed increases and retarded as speed decreases through action of the fly weights in the circuit breaker base. This ensures correct spark timing to suit starting, low and high speed require ments.

OPERATION

In tracing the current through the ignition system, the initial current comes from the battery. The current flows from the battery through the primary coil to ground and back to the battery while the points are closed. When the cam opens the points, the circuit is broken so that a high voltage surge is produced from ignition coil primary to secondary. This voltage will cause a spark to jump the air gap of the spark plugs.

The condenser is connected to the circuit breaker points and functions to produce a quick collapse of the magnetic field in the coil so that high voltage will be produced. In doing this, the condenser acts to prevent current from continuing to flow across the contact points after points open.

The engine must be timed to fire at the proper point before top dead center on the compression stroke of each cylinder. This procedure is covered under subsequent headings.

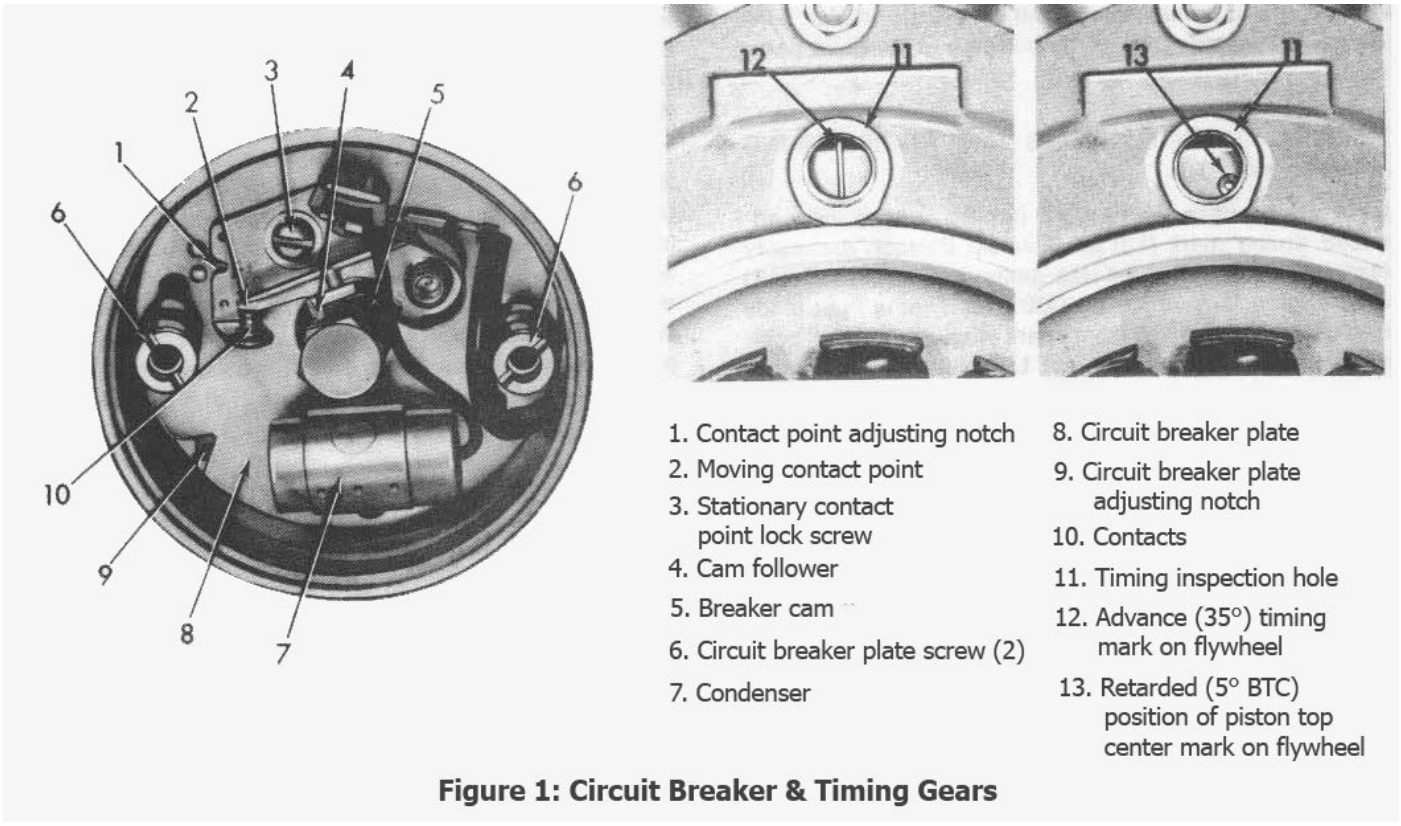


Figure 1: Circuit Breaker & Timing Gears

TROUBLESHOOTING

Disengage spark plug cable and insert a metal rod, screw or nail into each spark plug cable. Arrange cable end so tip of inserted metal object is 1/4 in. away from cylinder head. Turn on the ignition, break the points by hand. See if a “hot” or “blue” spark is obtained. If not, it is an indication of a weak coil, dead battery, broken or loose wires, etc. Arcing of the points and hard starting indicates a faulty condenser.

ADJUSTING POINTS (Figure 1)

Circuit breaker points should be checked for gap and contact surface condition initially at 500 and 1000 miles, and thereafter every 2000 miles. Remove spark plugs to permit engine to turn easily and rotate flywheels so that cam follower (4) is on one of the highest points of wide cam lobe (5). Check the gap between the contacts (10) with a .018 in. gauge (wire preferred). If it is not exactly .018 in. when the cam follower (4) is on highest point of wide cam lobe (5), adjustment is necessary. Incorrect point gap spacing affects ignition timing. To adjust the points, loosen the lock screw (3) and move stationary contact plate, using screwdriver in adjusting notch (1) to provide correct con tact point gap. Retighten the lock screw (3) and again check the gap to make sure it remains correct. Points in pitted or worn condition should be replaced.

IMPORTANT

Point gap should be the same for both small and large cam lobes. If variation exceeds .004in.,it is an indication that the cam is running eccentric and the condition should be corrected. See “Assembling.”

CHECKING AND ADJUSTING IGNITlON TIMING

Ignition timing Is controlled by the circuit breaker. Correct ignition timing and correct setting of the circuit breaker contact point gap is absolutely necessary for proper engine operation and performance.
The spark timing cam is advanced automatically as engine speed increases through action of the fly-weights in the circuit breaker base. This ensures correct spark timing to suit starting, low speed and high speed requirements. To check or reset ignition timing proceed as follows: Remove circuit breaker cover and set circuit breaker contact gap at exactly .018 in. as outlined in previous paragraph.

CHECKING ADVANCED TIMING WITH STROBE TIMING LIGHT (Figure 1)

Use a strobe flash timing light (timing gun) to view advanced timing mark (12) on flywheel through accessory plastic view plug screwed into timing inspection hole (11) while engine is running at 2000 rpm. Timing light leads should be connected to front spark plug, ground and positive red wire to battery terminal. Light will flash each time spark occurs (Figure 5-19). Loosen circuit breaker plate screws (6) just enough so circuit breaker plate (8) can be shifted using a screwdriver in notch (9) as light aimed into inspection hole (11) stops timing mark (12)in center of hole. Timing will retard 30° automatically when engine is stopped.
Rear cylinder advance timing mark is a single drilled dot which should appear on or near the front cylinder advance timing mark while viewing with timing light. See Figure 2. ***NOTE:*** Retard mark (smaller drilled dot) should not move into timing hole at Idle speed.

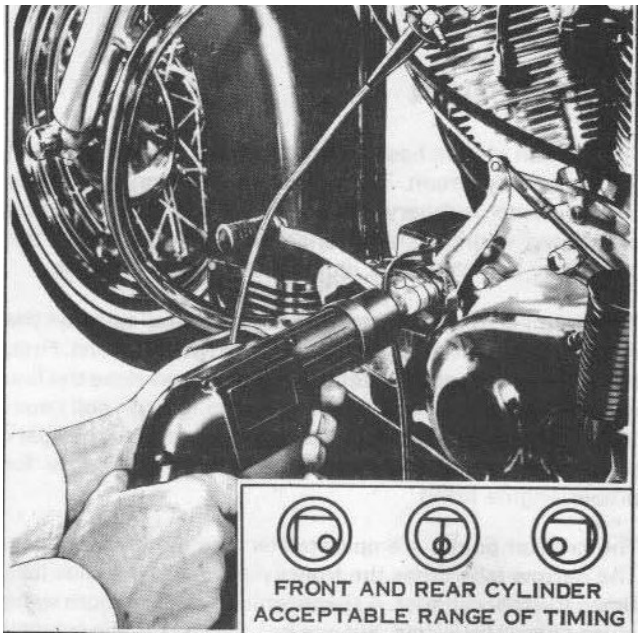


Figure 2: Checking Timing with Strobe Light

CHECKING RETARDED TIMING WITH CIRCUIT TESTER (Figure 1)

If a strobe timing light is not available, approximate timing can be obtained in an emergency, by using the following procedure:

Remove screw plug from timing inspection hole (11) in left side of crankcase. Then remove front pushrod cover so that opening and closing of valve can be observed.

Turn engine indirection in which it runs until front piston is on compression stroke (just after front intake valve closes), and continue turning engine very slowly (less than 1/2 revolution) until piston top center timing mark (13) on fly wheel is aligned in the inspection hole (11) as shown.

The narrow lobe cam is now at the approximate point at which contacts (10) open and front cylinder ignition spark occurs. When the wide cam lobe opens the points, rear cylinder ignition spark occurs. Connect a circuit tester such as a light bulb across the contact points to determine the exact point of contact opening. Loosen circuit breaker plate screws(6) just enough to shift circuit breaker plate(8) using a screwdriver in notch (9), so contacts will open exactly when piston top center timing mark (13) is aligned in inspection hole (11) as shown in Figure 1.

IMPORTANT

This procedure will result in approximate timing and engine can be operated in an emergency for a short period until advanced position timing can be obtained with a strobe timing light.

At regular intervals of 5000 miles or at least once a year, have your dealer check ignition timing and, if necessary, readjust circuit breaker setting to compensate for wear on circuit breaker that may have caused a slight change in timing.

DISASSEMBLING CIRCUIT BREAKER PARTS (Figure 3)

Remove circuit breaker cover screws (1). cover (2) and gasket (3). Pull wire terminal (4) from breaker contact assembly (12) terminal post. Remove circuit breaker cam bolt (5). Remove breaker plate screws (6, 6A or 6B) and lock washers and washers or retainer (7A), to free breaker plate assembly (8). Remove cam (9) from advance assembly (10) and remove advance assembly from gearcase cover. To remove circuit breaker contact assembly (12) from circuit breaker plate (13), pull condenser (15), terminal from breaker contact terminal post. Also unhook flat spring from terminal post. Remove screw (11) to free point set from breaker plate (13). To remove condenser (15) remove screw and lockwasher (14) from breaker plate (13).

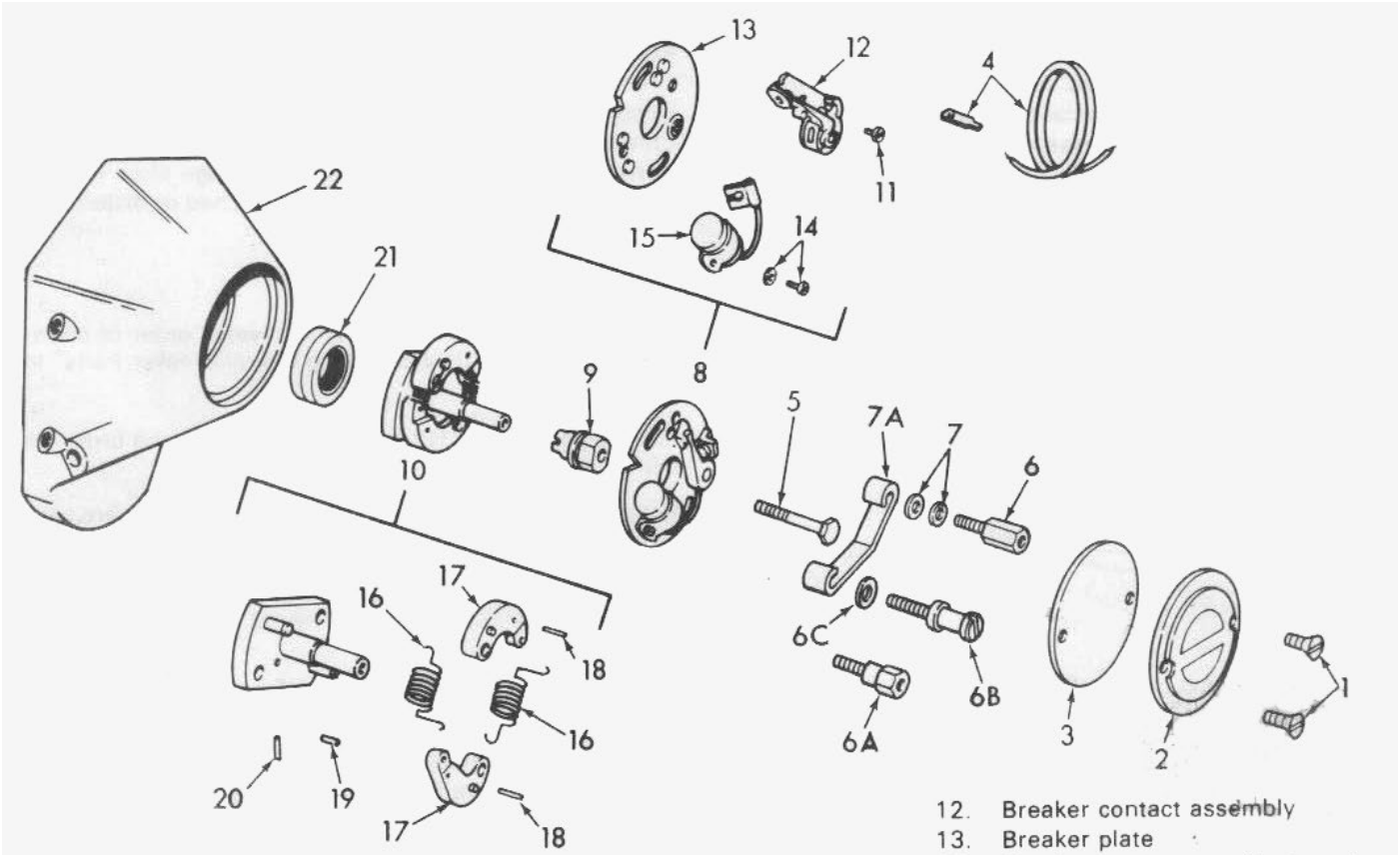
To disassemble advance mechanism, unhook spring (16) loops from grooves in pivot pins and slip flyweights(17) with spring from pivot pins on advance base (18).Do not remove springs from flyweights unless they are to be replaced. Roll pins (18,19 and 20) are pressed in and can be replaced if necessary.

INSPECTING AND REPLACING PARTS (Figure 3)

Using cloth with clean white gasoline, wipe circuit breaker clean and inspect parts.

Inspect circuit breaker contacts (12). If lever rubbing block is badly worn, replace. Contacts that are burned or pitted should be replaced or dressed with a clean, fine-cut con tact point file. Do not attempt to remove all roughness nor dress contacts surfaces down smooth;merely remove scale or dirt.Contact point file should not be used on other metal and should not be allowed to become greasy or dirty.Never use emery cloth or sandpaper to clean contacts since par ticles will embed themselves and cause arcing and rapid burning. The circuit breaker contact assembly (12) should be replaced, if contact point pressure is not within prescribed limits of 14 to 18 oz. Check pressure with a spring gauge. The scale should be hooked to the breaker lever at an angle of 90 degrees with the point surface and reading taken just as contacts break. Excessive pressure causes rapid wear of rubbing block, cam and contacts. Insufficient pressure will permit high speed bounce which will, in turn cause arcing and burning of the contacts and missing of the engine. Contact faces must seat squarely against each other. If bent, square up by bending plate on levers.

Inspect lip of cam seal (21) and replace it if worn or rough. Also replace seal if there is evidence of oil leakage into circuit breaker arm. When installing contacts, be sure contact faces seat squarely against each other. Adjust gap as previously de scribed in “Adjusting Circuit Breaker Points.”
Check flyweight springs, and if bent or stretched, replace them. When installing, be sure that bent end of each spring is hooked through bottom of hole, and that upper looped end grips groove in pin tightly. See Figure 5-21.
Lubricate breaker cam with a trace of “Anti-Seize” , when contact set is replaced or every 5000 miles. Also remove cam and lubricate shaft with the same. Replace cam in correct position so that it engages both flyweights and flat side is next to roll pin (19).



1. Circuit breaker cover screws (2)
2. Circuit breaker cover
3. Circuit breaker cover gasket
4. Wire terminal and wire
5. Circuit breaker cam bolt
6. Breaker plate screw (2) (1970)
6A. Breaker plate screw (2) (1971 & early 1972)
6B. Breaker plate screw (2) (1973 & later)
6C. Breaker plate screw washer (2) (1973 & later)
7. Breaker plate screw lockwasher and washer (2)
7A. Retainer (1971 to early 1972)
8. Breaker plate assembly
9. Breaker cam
10. Advance assembly
11. Breaker contact screw (early 1972 & earlier)
12. Breaker contact assembly
13. Breaker plate
14. Condenser screw and lockwasher (2) (late 1972 & later)
15. Condenser
16. Flyweight spring (2)
17. Flyweight (2)
18. Flyweight roll pin (2)
19. Cam stop roll pin
20. Register roll pin
21. Camshaft seal
22. Gear case cover

Figure 3: Circuit Breaker - Exploded View

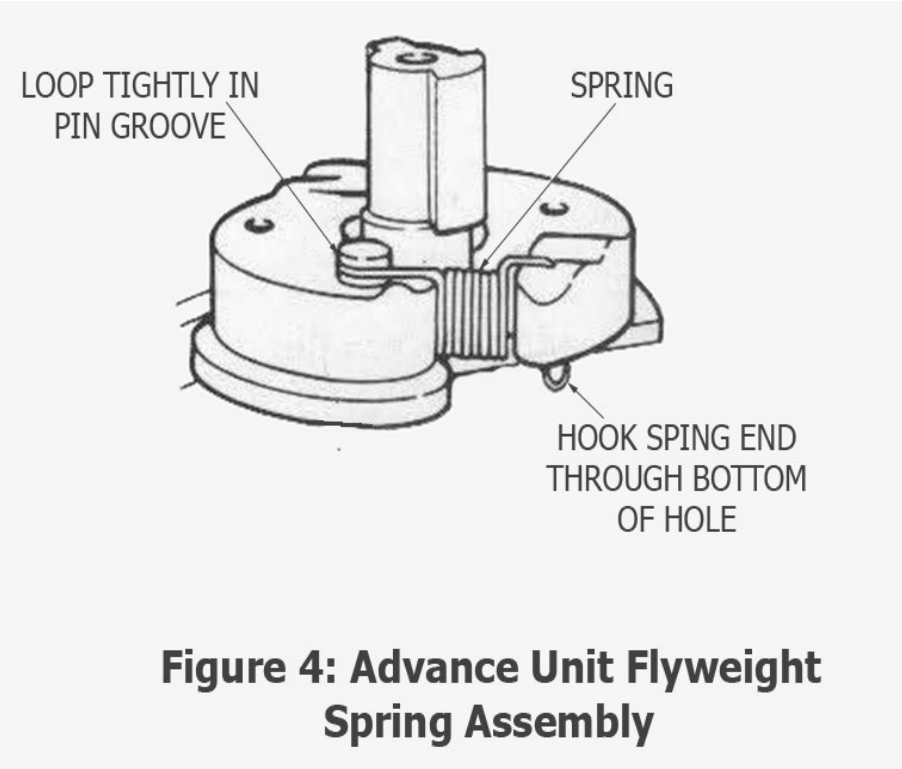


Figure 4: Advance Unit Flyweight Spring Assembly

The circuit breaker contact assembly (12) should be replaced, if contact point pressure is not within prescribed limits of 14 to 18 oz. Check pressure with a spring gauge. The scale should be hooked to the breaker lever at an angle of 90 degrees with the point surface and reading taken just as contacts break. Excessive pressure causes rapid wear of rubbing block, cam and contacts. Insufficient pressure will permit high speed bounce which will, in turn cause arcing and burning of the contacts and missing of the engine.

Contact faces must seat squarely against each other. If bent, square up by bending plate on levers.

Inspect lip of cam seal (21) and replace it if worn or rough. Also replace seal if there is evidence of oil leakage into circuit breaker arm.

When installing contacts, be sure contact faces seat squarely against each other. Adjust gap as previously de scribed in "Adjusting Circuit Breaker Points."

Check flyweight springs, and if bent or stretched, replace them. When installing, be sure that bent end of each spring is hooked through bottom of hole, and that upper looped end grips groove in pin tightly. See Figure 4.

Lubricate breaker cam with a trace of "Anti-Seize" , when contact set is replaced or every 5000 miles. Also remove cam and lubricate shaft with the same. Replace cam in correct position so that it engages both flyweights and flat side is next to roll pin (19).

Check circuit breaker advance flyweight action by moving cam in direction required to advance weights to their fully extended position. Then release the cam and see if springs return to the fully retarded position. Correct causes for faulty action by cleaning and lubricating shaft, cam and flyweights with "Anti-Seize" and replacing weak springs.

Be extremely careful to avoid excessive lubrication. If too much is used, the excess is apt to get on the circuit breaker contacts and cause them to burn. For maximum operating efficiency it is recommended practice to replace circuit breaker contacts when pitted, burned or worn excessively. The condenser (15) is a relatively long-life part and will not require frequent replacement. However, if the condenser is suspected of being defective simply replace w1th a proven new condenser and note whether engine performance is improved. A condenser that is defective will have either an open or short circuit. An open circuit will be evident by excessive arcing at breaker contacts and a shorted circuit will have no noticeable spark at the contacts.

Examine the coil to circuit breaker low tension wire (4, Figure 5-20) for brittle or cracked insulation and broken strands and replace if defective.

Examine cam advance mechanism on automatic advance circuit breakers to see that flyweights (17) move outward freely and springs (16) return them inward against stops.

Check for looseness of cam (9) on spindle (101and wear on
sides of flyweight (17) ears which engage slots in cam. Check springs (16) and replace if stretched or distorted.

ASSEMBLING

Assemble circuit breaker parts in reverse order of disassembly. Refer to "Disassembling Circuit Breaker Parts" in this section.

Advance assembly (10) must seat squarely and firmly on end of camshaft.
Assemble circuit breaker plate (8) so that screws are centered in slots (for approximate timing). Adjust circuit breaker point gap to .018 and set ignition timing as described under "Checking and Adjusting Ignition Timing."

IMPORTANT

Circuit breaker point gap should be within .016-.020 in. limits on both cam lobes. If not within this range, the cam (9, Figure 3) or advance assembly (10, Figure 3) may be assembled incorrectly on camshaft, or parts may be damaged, causing erratic operation. Generally, loosening bolt (5) and repositioning advance assembly (10) toward widest point gap will equalize gap satisfactorily. Cam bolts (5) must be tightened to 60-80 in. lbs. torque.