

# 4-46 1974-79 DISTRIBUTORS & IGNITION SYSTEMS

## Lucas "OPUS" Electronic Ignition

**Jaguar: All Models**  
**MG: 1975-79 Midget, 1976-79 MGB**  
**Triumph: 1975-79 Spitfire, TR7**

### DESCRIPTION

Lucas Oscillating Pick-Up System (OPUS) electronic ignition includes an amplifier unit that is mounted separately or on distributor. See Figs. 1 and 2.

A ballast resistor unit is used on all Jaguar models, while a ballast resistor wire is used on other models. Other components include an ignition coil, a drive resistor (if used), and the breakerless distributor.

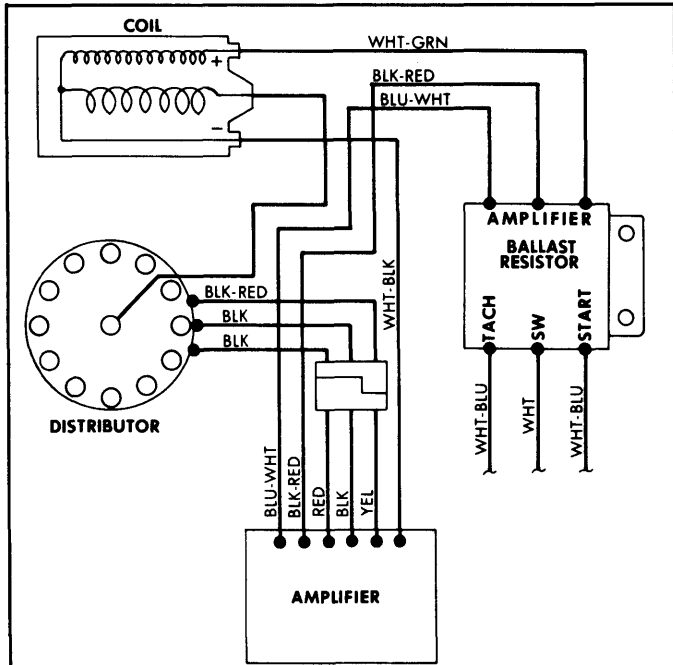


Fig. 1: Jaguar XJ12, XJS & XKE V12 Lucas "OPUS" Electronic Ignition System Wiring Diagram

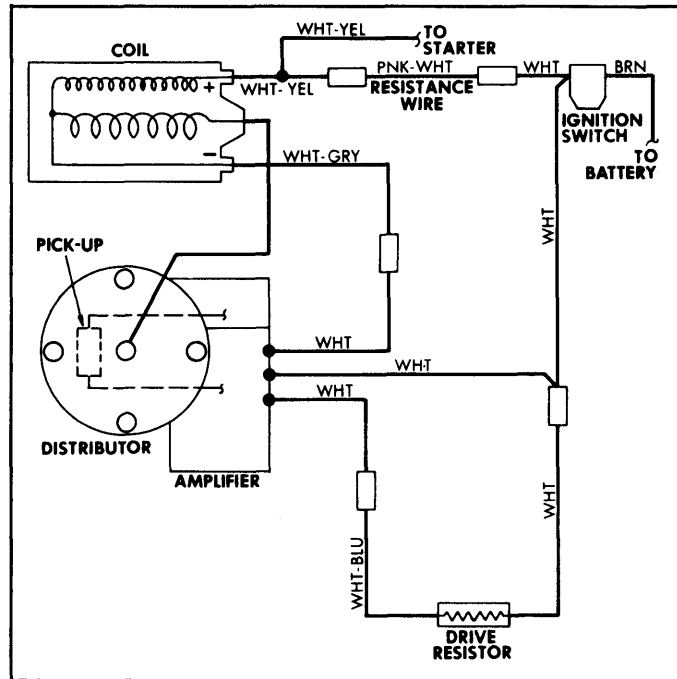


Fig. 2: Triumph TR7 Lucas "OPUS" Electronic Ignition System Wiring Diagram (Others Similar)

### DISTRIBUTOR

The distributor consists of a centrifugal advance mechanism and either a vacuum advance or retard unit, a high tension rotor, an electronic timing rotor, a pick-up module assembly (if used), a fuel injection triggering device. See Fig. 3.

The timing rotor and pick-up module, working with the amplifier, provide the function of breaker points and cam. The timing rotor is a glass-filled nylon disc with small iron rods embedded into its outer circumference, one rod for each engine cylinder. The gap between the timing rotor and pick-up module is adjustable. The pick-up module is magnetically balanced and has input and output windings.

**NOTE: The pick-up module is magnetically balanced at the factory and the setting must not be changed. The sealed adjusting screw must be disturbed.**

A vacuum unit provides automatic vacuum advance or retard depending upon model, by varying the static timing position of the pick-up module in relation to the iron rods in the timing rotor. The timing rotor and pick-up module generate an electronic timing signal, which is fed to the amplifier through special cables.

**NOTE: The length of the triple-core extruded cables must not be changed and cables must not be separated or be replaced by loose individual cables.**

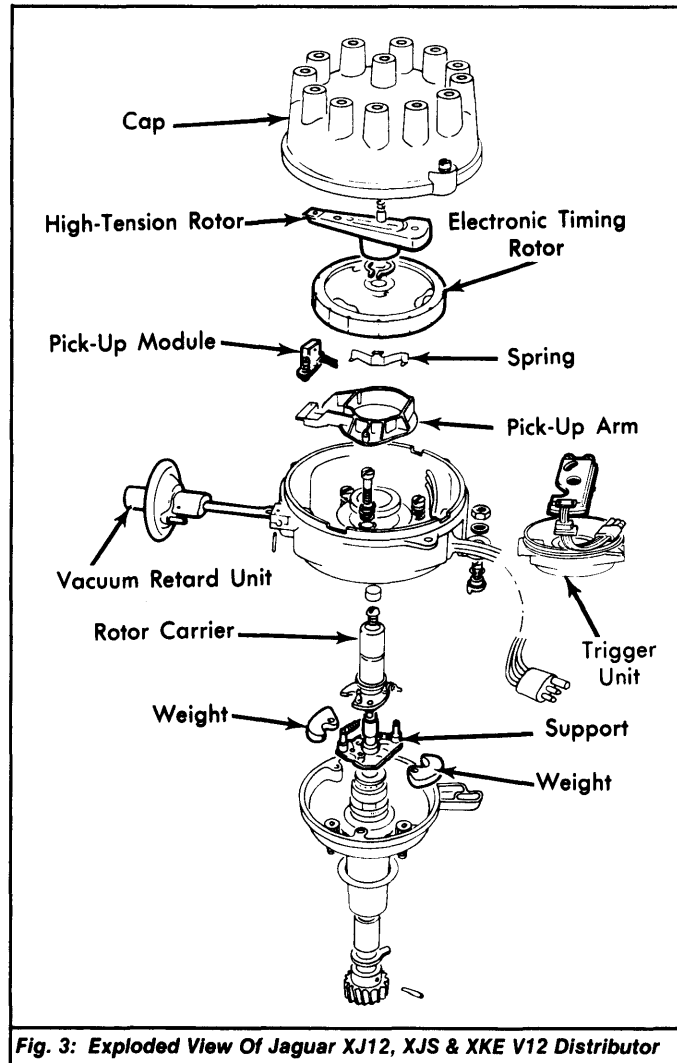


Fig. 3: Exploded View Of Jaguar XJ12, XJS & XKE V12 Distributor

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### AMPLIFIER UNIT

The amplifier unit interprets timing signals from the distributor. A power transistor in the amplifier's printed circuit acts as a switch for the primary circuit of the ignition coil. The amplifier is connected to the coil by cables which pass through a ballast resistor.

### DRIVE RESISTOR

An externally mounted drive resistor is used on most models, functioning as a part of the amplifier. External mounting is required due to size and heat dissipation requirements.

### BALLAST RESISTOR UNIT

All Jaguar models have a ballast resistor unit with 3 resistors enclosed in an aluminum heat sink. Two of the resistors are wired in series to coil primary winding. The third functions with the power transistor in the amplifier.

### BALLAST RESISTOR WIRE

All models except Jaguar have a ballast wire connected in series between the ignition switch and coil primary winding. Resistance value of ballast resistor wire is 1.3-1.5 ohms.

### IGNITION COIL

A fluid-cooled, high performance, ballast-ignition coil is used. Terminals are marked "+" and "-" and have different connectors to prevent incorrect cable connection.

### OPERATION

With ignition off and engine stopped, the distributor timing rotor will normally be positioned so the iron rods of the timing rotor do not align with the iron core of the pick-up module. When ignition turned on, a power transistor in the amplifier unit completes the ignition coil primary winding circuit.

At the same time, a pulsating alternating current is applied by the amplifier unit to the distributor pick-up module primary windings. A small alternating current is produced at the pick-up secondary windings, which at this stage are magnetically balanced.

Voltage at the pick-up module secondary terminals is applied to the amplifier unit, but voltage is insufficient to affect the transistor controlling the ignition coil primary circuit.

As the engine is cranked, the iron rods in the timing core come in alignment with the iron core of the pick-up module. This causes a magnetic unbalancing and voltage increases to maximum as each iron rod passes the pick-up module. The higher voltage is transmitted to the amplifier. The transistor is switched off and the coil's primary winding magnetic field is collapsed. This results in a high voltage surge in the secondary windings, which is transmitted to each spark plug by the distributor rotor.

### SPECIFICATIONS

#### CENTRIFUGAL & VACUUM ADVANCE

See appropriate DISTRIBUTOR ADVANCE SPECIFICATIONS table in this section.

### ADJUSTMENTS

#### PICK-UP MODULE AIR GAP

1) Disconnect battery ground cable. Remove distributor cap and rotor. Remove anti-flash cover (if used). Place rotor arm electrode 180 degrees from pick-up module "E" core. The iron rods in the timing rotor should then be positioned an equal distance on each side of the pick-up module "E" core (misaligned).

2) Using feeler gauges, check air gap. If not to specifications, loosen 2 screws retaining pick-up module to pick-up arm. Place feeler gauge

between iron rod and core of pick-up module and tighten screws. After tightening screws, recheck air gap.

#### PICK-UP MODULE AIR GAP SPECIFICATIONS

Application	Air Gap In. (mm)
Jaguar	
XJ12, XJS & XKE V12 .....	.020-.022 (.50-.55)
XJ6 .....	.010-.017 (.25-.43)
MG & Triumph .....	.014-.016 (.35-.40 mm)

### CENTRIFUGAL ADVANCE

Check distributor in test stand according to test equipment manufacturer's instructions. Operate distributor up and down the RPM range and check advance at all RPM settings specified.

### VACUUM ADVANCE OR RETARD

With distributor in test stand, check advance or retard at all vacuum settings specified. If tests indicate vacuum diaphragm unit is inoperative, out of calibration or leaking, replace vacuum unit.

### TESTING

#### IGNITION SYSTEM

**Jaguar XJ6, MG & Triumph** - 1) Remove high tension lead from distributor and hold wire approximately 1/4" (6 mm) from a known good engine ground. Turn ignition on. Disconnect White/Blue lead from drive resistor and check for high tension spark each time connection is broken. Reconnect lead after test.

2) If spark occurs, check timing rotor-to-pick-up module air gap. If not to specifications, adjust. See PICK-UP MODULE AIR GAP adjustment. If air gap is okay, remove distributor cap, crank engine and check whether distributor shaft rotates. If not, check distributor and drive. If it rotates, replace amplifier unit.

3) If no spark occurs in step 2), check electrical supply at Black connector. If less than 11 volts, check battery wiring, ignition switch or battery condition.

4) If more than 11 volts, check voltage at coil positive terminal. Reading should be 11 volts or more (4-8 volts on ballasted systems). If zero volts, check ballast resistor and wires.

5) If reading at positive coil wire is okay, check voltage at negative coil terminal. If more than 2 volts, check drive resistor resistance value for 9-11 ohms. If okay, check for good distributor and amplifier ground. If still okay, replace amplifier.

6) If reading at negative coil terminal was less than 2 volts, disconnect White/Blue wire at drive resistor. Check voltage at coil negative terminal. If more than 9 volts, check high tension leads. If okay, substitute a known good ignition coil and attempt to start engine. If it now runs, replace ignition coil. If engine will not run with new coil, install original coil and substitute a known good amplifier unit. If engine starts, install the new amplifier.

7) If in step 6) there were less than 9 volts at ignition coil negative terminal, disconnect coil negative lead and check voltage at coil negative terminal. If less than 9 volts, replace amplifier unit. If more than 9 volts, replace ignition coil.

#### BATTERY CIRCUIT TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Check battery voltage for a full 12 volts. Disconnect wire from ignition coil negative terminal. Connect a voltmeter between battery ground and vehicle frame.

2) Operate starter. Voltmeter reading should not exceed 0.5 volts. Replace coil wire. If reading was more than 0.5 volts, check for faulty connection between frame and battery.

#### SPARK TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Disconnect coil wire from distributor. Hold wire approximately 1/4" (6 mm) from a known good engine ground. Crank engine and check for spark at gap.

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2) If not, go to BALLAST RESISTOR TEST. If spark occurs, but a problem still exists with system, check distributor cap for cracks or dirt, high tension cables, rotor arm, spark plugs and fuel supply.

### BALLAST RESISTOR TEST

**Jaguar XJ6, XJ12, XJS & XKE V12** - 1) Remove connector from amplifier side of ballast resistor unit. Connect voltmeter between battery ground and each terminal of ballast resistor amplifier output, in turn.

**NOTE: Voltmeter test lead must not touch ballast resistor housing. Touch terminal only.**

2) Turn ignition on. Voltmeter should read battery voltage. If okay, go to IGNITION COIL VOLTAGE TEST. If no reading is obtained, check supply to "SW" terminal.

3) Replace ballast resistor if voltage is present at "SW" terminal, but not at each resistor amplifier terminal. If no reading is found at "SW" terminal, check circuit back to ignition switch and battery.

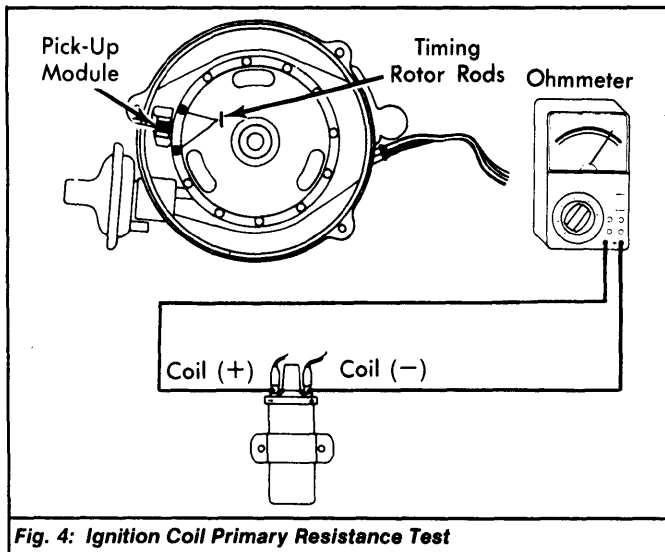
### IGNITION COIL VOLTAGE TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Reconnect connector to amplifier output side of ballast resistor. Disconnect amplifier to distributor connector. Connect a voltmeter between battery ground and coil positive terminal. With ignition on, reading should be 4-6 volts.

2) High voltage readings indicate a faulty coil or amplifier. If there is no reading, check supply by disconnecting wire from positive terminal of ignition coil. Connect a voltmeter between end of wire and battery ground. Turn ignition on. Voltmeter should read battery voltage. If there is no reading, check for a broken lead.

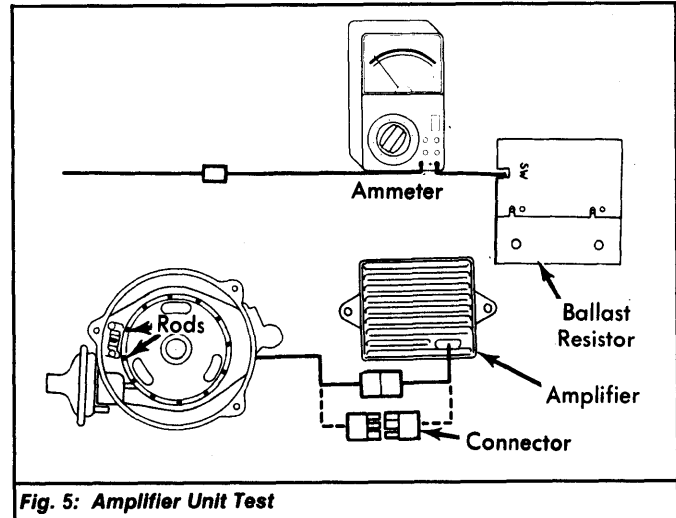
### IGNITION COIL PRIMARY RESISTANCE TEST

**Jaguar XJ12, XJS & XKE V12** - Crank engine until 2 of timing rotor iron rods are equally spaced (misaligned) around pick-up module iron core. See Fig. 4. Using an ohmmeter, attach leads to each ignition coil primary terminal (positive and negative). Coil primary resistance should be .80-1.0 ohms. Replace ignition coil if it shows an open reading or is outside of specifications.



### AMPLIFIER UNIT TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Crank engine until 2 of timing rotor iron rods are equally spaced (misaligned) around pick-up module iron core. See Fig. 5. Disconnect lead from "SW" terminal of ballast resistor unit. Connect an ammeter in series with lead and terminal "SW". Turn ignition on and check ammeter for a reading of 6.5 amperes.



2) Separate connector between distributor and amplifier unit. Connect outside terminals of amplifier connector alternately to center terminal. Ammeter reading should remain unchanged. If reading increases by more than 0.5 ampere, replace amplifier unit.

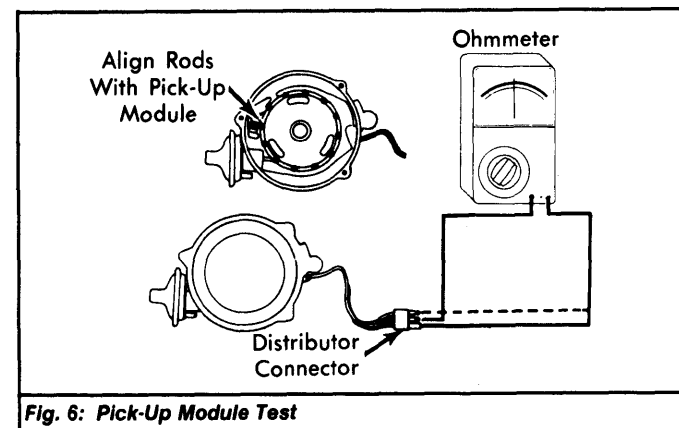
### AMPLIFIER VOLTAGE DROP TEST

**Jaguar XJ12, XJS & XKE V12** - With all wires attached to the ignition coil, connect a voltmeter between the coil negative wire and ground. Turn ignition on. Voltmeter should read 0-2 volts. Replace amplifier if reading is battery voltage. If between 2 volts and battery voltage, check for faulty ground.

### PICK-UP MODULE TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Remove distributor cap. Visually check pick-up module and be sure "E" core of coil is aligned with parallel edge of timing rotor. Check air gap.

2) Check resistance values between center terminal and each outer terminal at distributor connector. See Fig. 6. Center terminal to Red cable should be 2.25-2.75 ohms. Center terminal to Black cable should be .81-.99 ohms. If core faces are out of line or ohmmeter reading is incorrect, replace pick-up module.



### AMPLIFIER SWITCHING TEST

**Jaguar XJ12, XJS & XKE V12** - 1) Connect voltmeter between battery ground and negative terminal of ignition coil. Connect high tension jumper wire to center terminal of coil. Hold jumper wire 1/4" (6 mm) from known good engine ground.

2) Crank engine. Voltmeter should read 3-4 volts and fluctuate with spark. If meter reads 3-4 volts, but does not fluctuate, replace ignition coil. If meter reads 0-2 volts or battery voltage with no spark, replace amplifier.

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### OVERHAUL

#### DISASSEMBLY

**Jaguar XJ6, MG & Triumph** - 1) Disconnect battery and remove distributor from vehicle. Remove cap, rotor, anti-flash cover and felt pad. Remove screws and washers from pick-up module. DO NOT remove pick-up module at this time.

2) Remove screws securing amplifier to distributor. Hold amplifier while removing screw from bottom of housing. Carefully disengage vacuum unit from movable plate.

3) Remove wire grommet, amplifier housing, and pick-up module with lead. Remove spring clips. Tap out roll pin securing vacuum unit and remove unit. Remove external snap ring from distributor shaft and carefully remove timing rotor, washer and "O" ring.

4) Remove 2 Phillips head screws and lift out base plate with movable plate attached. Remove springs carefully, noting spring positions for reassembly reference.

**Jaguar XJ12, XJS & XKE V12** - 1) Remove distributor, distributor cap, rotor, trigger unit, and electronic timing rotor. See Fig. 3. Lift vacuum operating rod off peg on pick-up arm. Pry cable grommet from distributor.

2) Remove pick-up arm bearing spring. Slide pick-up arm sideways to disengage it from bearing. Lift from micro-housing, drawing cable through hole. Detach pick-up module. Use a pin punch to tap out roll pin securing vacuum unit in micro-housing.

3) Remove vacuum unit and micro-housing from distributor body. Remove felt pad from top of rotor carrier shaft and release screw. Remove control springs from posts. Lift rotor carrier shaft from distributor shaft. Remove centrifugal weights.

#### INSPECTION

Check control springs for correct length. Check pivot holes in weights for wear or deformation. Check distributor shaft for excessive play. If any part of distributor body assembly is found to be defective, the complete assembly must be replaced.

#### REASSEMBLY

**Jaguar XJ6, MG & Triumph** - To reassemble distributor, reverse disassembly procedure. See Fig. 7. Lubricate weight assembly, shaft and moving plate with a light-weight grease. Make sure vacuum link is properly attached to moving plate pin. Timing rotor tang must fit into slot on shaft. With distributor assembled and replaced in vehicle, set air gap and ignition timing to specifications.

**Jaguar XJ12, XJS & XKE V12** - 1) Lubricate centrifugal weights with a light-weight grease. Install weights on pivot posts. Lubricate bore of rotor carrier shaft with clean engine oil and install on shaft. Retain with round-headed screw. Install oil pad.

2) Install control springs and 3 socket headed screws with plain washers. Install micro-housing, making sure eccentric peg engages in slot. Secure micro-housing to body with spring-loaded screws. Tighten screws just short of coil binding.

3) Loosely secure pick-up module to pick-up arm. Pass pick-up module connector and cable through hole in micro-housing. Locate pick-up arm on rotor carrier shaft. Install bearing spring.

4) Engage wide part of cable grommet in hole and pry into position. Place vacuum unit in position and secure with new roll pin. Attach vacuum operating rod to peg on pick-up arm.

5) Install electronic timing rotor, wave washer and snap ring. Adjust air gap and tighten pick-up module. Install trigger unit, rotor arm and distributor cap. Install distributor.

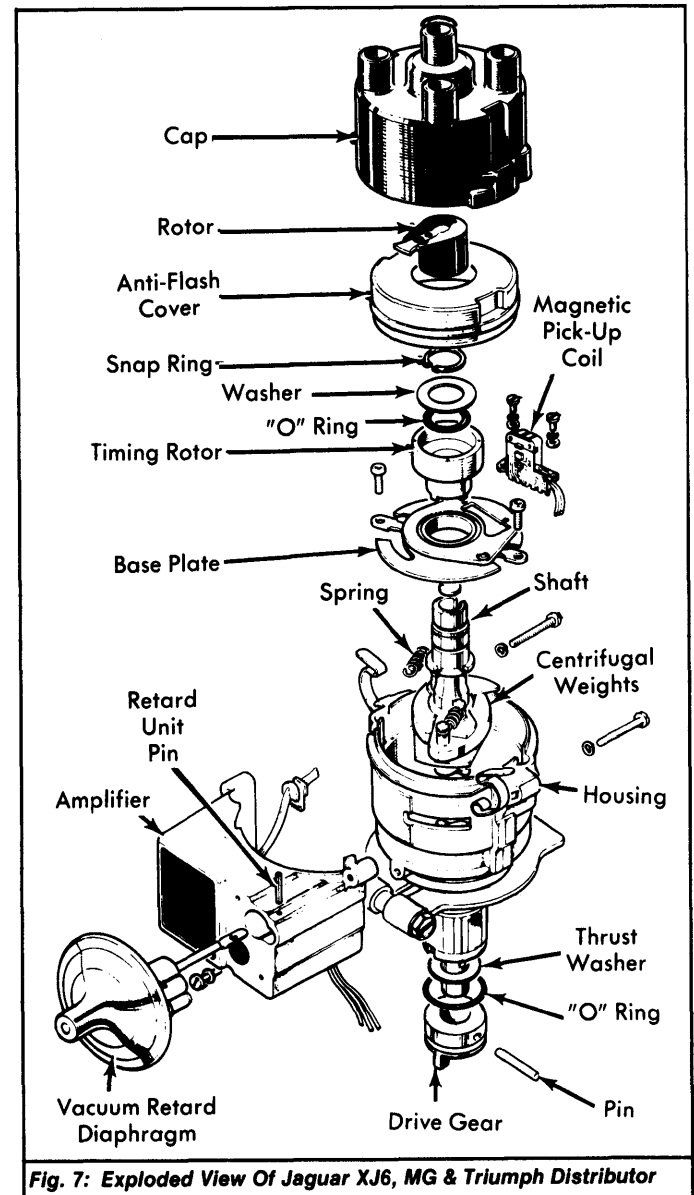


Fig. 7: Exploded View Of Jaguar XJ6, MG & Triumph Distributor