interference suppression in cars

Electrical interference generated by cars can be a source of annoyance, not only to the car occupants, but also to users of other electronic equipment external to the vehicle. This article discusses some of the more common causes of interference and their cure.

Anyone who has installed a car radio and then discovered that the programme is drowned out by odd buzzes, pops and crackles will know how difficult it is to trace and suppress interference. Commercially available 'do-it-yourself' suppression kits often do not effect a cure, because the interference is not dealt with at source.

Interference in cars on radio and T.V. bands is caused by high-frequency energy, usually produced by arcing contacts, but also by discharge of static electricity. The interference may be continual, for example that originating from the ignition circuitry, or it may be transient, such as interference occurring when light switches or brake lights are operated. Windscreen wiper motors can also generate substantial interference when they are running.

Interference may be divided into two groups:

1. External Interference.
2. Internal Interference.

External interference affects not only electronic equipment in the car but also radios and televisions in the vicinity. Internal interference is usually restricted to bad reception on the car radio.

The principal sources of interference in a car are as follows:

ignition system
dynamo and regulator
screenwiper motor
electric fan (if fitted)
heater fan motor
petrol gauge
brake light switch
light switches
starter motor
starter relay and switch
trafficator flasher unit
relays
ignition switch

Some of these, such as the ignition switch and light switches, cause interference of a very transient nature and are probably not worth bothering with.

The ignition system is the most powerful source of interference and will be dealt with first. Interference can be suppressed at various points in the ignition circuit. Figure 1 shows a typical arrangement of the high-tension side of an ignition system. Screened plug caps provide a good degree of suppression. The screening makes contact with the plug base and covers the porcelain insulator. A typical screened plug cap is shown in figure 2. These are available from auto electricians. Plug caps with a built-in suppression resistor are also effective, or alternatively 'carbon-string' H.T. leads may be used, though the mechanical reliability of these is questionable. The distributor may already have suppression incorporated, but if not, suppressor caps may be fitted to the distributor cover. These should have a resistance of about 1 k. Alternatively, in-line suppressors may be fitted in the plug leads near the distributor.

If a radiotelephone is installed in a car, an extreme degree of ignition suppression may be necessary in the form of screened cables for all H.T. leads and connections to the coil. Under normal conditions the coil itself may be suppressed by connecting a capacitor of about 3 μ 400 V between the SW (ignition Switch) terminal of the coil and earth. Figure 3 shows how this is done.

The second important source of interference is the dynamo/regulator system of the car. Dynamos generally have two connections, one to the armature (via the brushes and commutator), which is the output terminal of the dynamo, and one to the field winding, the current

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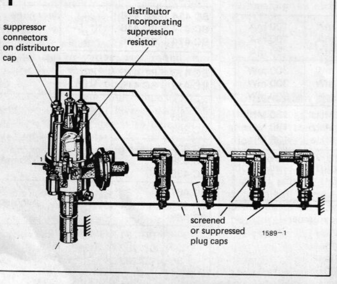

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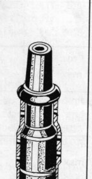

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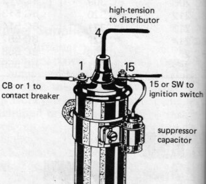

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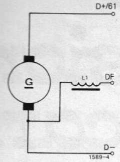

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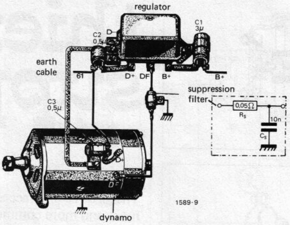

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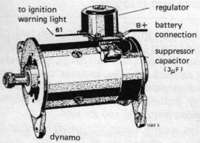

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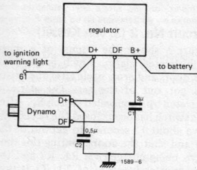

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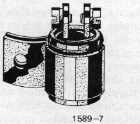

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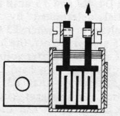

Figure 1. Diagram of the high tension side of a typical car ignition system, showing places to incorporate suppression.

Figure 2. Cut-away drawing of a typical screened plug cap.

Figure 3. Ignition coil showing where to connect suppressor capacitor. Numbers on various terminals are DIN standard codes for these terminals.

Figure 4. Connections to a dynamo. Usually only the armature and field connections are brought out to terminals and the common terminal is earthed to the frame of the dynamo. Again DIN standard codings are used for the terminals.

Figure 5. A low-power dynamo with an integral regulator showing connection of suppressor capacitor.

Figure 6. Circuit showing suppressor connections for dynamo with integral regulator. An 0.5 µcapacitor may be connected from the armature terminal if necessary, or if this is not directly accessible, from the ignition warning light terminal.

Figure 7. General appearance of a non-coaxial feedthrough capacitor.

Figure 8. Internal construction of a non-coaxial feedthrough capacitor.

Figure 9. Suppression of dynamo with remotely-mounted voltage regulator.

through which controls the output voltage. The commonest type of electromechanical voltage/current regulator has three relays that respond to dynamo output voltage and charging current and control these parameters. The contacts of these relays can generate interference, as can the dynamo commutator/brush contact.

Small cars with dynamos of less then 300 W output often have the regulator integral with the dynamo. In that case the terminals of the dynamo are not directly accessible and there are only two connections to the voltage regulator. One is the output terminal to the battery and the other is the connection to the ignition warning light. The battery terminal may be decoupled with a 3 µ capacitor and the indicator terminal with a 0.5 µ capacitor (no larger!) as shown in figures 5 and 6.

For larger dynamos with remotely-mounted regulator, suppression may be connected as shown in figure 9. For improved suppression, capacitors of the non-coaxial feed-through type may be used. These have a lower series self-inductance than the normal type of suppressor capacitor as the current flows in through one terminal virtually right up to the capacitor plates, and out of the other terminal. Any lead inductance is in series with the current-carrying input and output cables. With the normal type of capacitor a length of (inductive) cable connects it to the terminal it is supposed to suppress, which increases its impedance to high frequencies, when it should have a low impedance to shunt them to earth. A non-coaxial feed-through capacitor is shown in figures 7 and 8. If capacitors on the three regulator terminals and on the dynamo armature terminal do not provide sufficient suppression a suppressor filter can be connected in the field cable as shown in figure 9. This can be home-made from a 10 n low-inductance capacitor and a 0.05 ohm resistor wound from 2½ m of 19 SWG copper wire.

Electric Motors

All electric motors in a car (windscreen wiper, heater, electric cooling fan) are potential sources of interference. They can usually be suppressed by a 3 µ capacitor on the supply terminal. If this is not sufficient then non-coaxial feed-through capacitors of 0.5 to 2.5 µ must be used.

Electrostatic Charges

If annoying crackles and pops are heard from the car radio when driving on dry roads, this may be due to electrostatic charges building up on the tyres because of friction between the tyres and the road. Since the grease film in the wheel bearings forms an efficient insulator such charges cannot leak away to chassis except when they achieve a high

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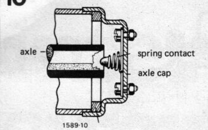

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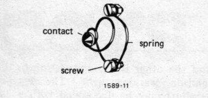

Figure 10. Making good contact between the wheel hub and the axle by means of a spring contact mounted in the axle cap.

Figure 11. Construction of spring contact.

enough voltage to flash over, hence the crackles and pops. A solution to this problem is to make a good electrical contact between the axle hub cap mounted in the centre of the hub (not the decorative hub cap) and the axle. See figures 10 and 11.

Fuel Gauge

The fuel gauge potentiometer may cause interference, as may other contacts such as the trafficator flasher unit. Such interference can usually be cured by a capacitor of about 3 μ between the offending contact and earth.

Conclusions

The ignition system is the principal source of interference and should be tackled first. To avoid possible unnecessary expense the results of suppressing the ignition system should be assessed before proceeding with further measures. With a good car radio suppression of the ignition system will usually be sufficient, but if a cheap car radio with poor selectivity and sensitivity is employed, additional suppression may be necessary. For car radios the adage 'you gets what you pays for' is certainly true, and a cheap radio may prove to be more expensive if a large degree of suppression has to be used. This is particularly true if the radio has an FM band as well as long and medium wave bands, as cheap radios often need a high degree of suppression if FM reception is to be satisfactory. A more expensive car radio is usually a sound investment, especially as a car radio cannot be tested in the shop under the actual conditions in which it will be used.
Cars which are fitted with radiotelephone equipment generally need very effective suppression and such installations are best left to specialists in the field.