How to kill ignition noise

Radio hash, thrown out by your automobile engine, can wreck CB, ham and other two-way mobile reception. Now something can be done. Here's how to cut the noise and suppress interference easily and efficiently.

by R. W. Woodbury

Manufacturers of CB and other 2-way radios strive to produce communications equipment providing clear, clean reception. Most radios are designed with sophisticated circuitry incorporating safeguards against generating noise from within. But even the best of equipment cannot assure interference-free reception when the source of vehicular noise happens to be from devices such as generators, alternators, voltage regulators, ignition coils, etc. Vehicular electrical systems produce one of the worst possible environments for radio reception.

In order to reduce this type of interference, you must take up where the radio manufacturer left off . . . he did all he could to keep his equipment from emitting interference, now it's up to *you* to suppress vehicle originated noise at its source.

SAFETY PRECAUTION

Before carrying out any of the procedures outlined in this article which pertain to mobile radio interference, REMOVE BOTH RED (+) and BLACK (–) CABLES FROM BATTERY TERMINALS. ***Failure to remove both cables may result in personal injury.*** **Follow all installation instructions completely and in the correct sequence. Automotive wiring can be hazardous since the battery can deliver hundreds of amperes instantaneously. Such high currents can heat up finger rings, pliers, and screwdrivers, with resultant burns and other possible physical injuries.**

Take time to do it right

Satisfactory interference suppression can only be achieved if all components are properly connected where necessary and grounded where necessary. Be sure that paint, oil, grease, dirt, or rust is removed from those areas where good electrical contact is required. This means those areas where filter capacitors will be mounted by their mounting straps and/or brackets. Scrape or wire-brush these areas down to bare metal. When you mount components, use clean hardware and sharp-toothed lock-washers to further ensure positive ground connections. Where wires connect to filter capacitors, be sure that connections are electrically and mechanically *good*. Every soldered joint must be sound. Tape all

(continued)

exposed connections where there is the slightest possibility of accidental contact with other wires, the grounded engine, or nearby accessories. Whenever it becomes necessary to cut the wiring leading to an alternator or generator in order to put a filter into the circuit, use cable connectors, such as Sprague QH2-5 or QH2-10, on the cut ends to ensure positive and permanent connections.

Careful attention to every aspect of installation of filter components will result in improved radio reception and tape playback.

Pre-filtering suggestions

When installing or replacing radio or audio equipment in your car, truck, boat, or tractor, these simple suggestions will minimize any additional steps for reducing interference:

1. Check all suppression components installed as original equipment by the vehicle manufacturer. These include resistor plug wiring, bonding straps, and bypass capacitors. Replace anything that doesn't look right.
2. Have the engine tuned by a good mechanic. This will not only eliminate some of the interference, but will give you better engine performance.
3. Connect the radio or tape deck directly to the battery through the proper in-line fuse.
4. Route all new wiring away from other wires, especially high-voltage ignition wires. THIS IS IMPORTANT!
5. Make certain the antenna lead-in wire shield is properly grounded at each end. All connections must be clean, tight, and properly soldered.

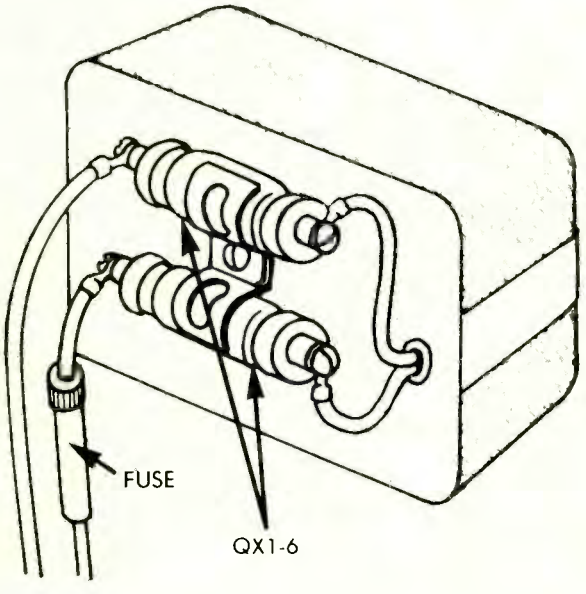

Figure 1A

Filtering the power line

To suppress radio-frequency noise, which is usually the most troublesome for CB and other AM radio installations, mount a general-purpose .1μF @ 400 VDC, 20-amp feed-thru filter capacitor (Sprague Type QX1-6) on the back of the radio chassis, as shown in Figure 1A. Cut it into the power line as close as possible to the radio. If there is more than one power lead, install the filter in the lighter-gauge lead first. If noise persists, install a second filter in the remaining lead.

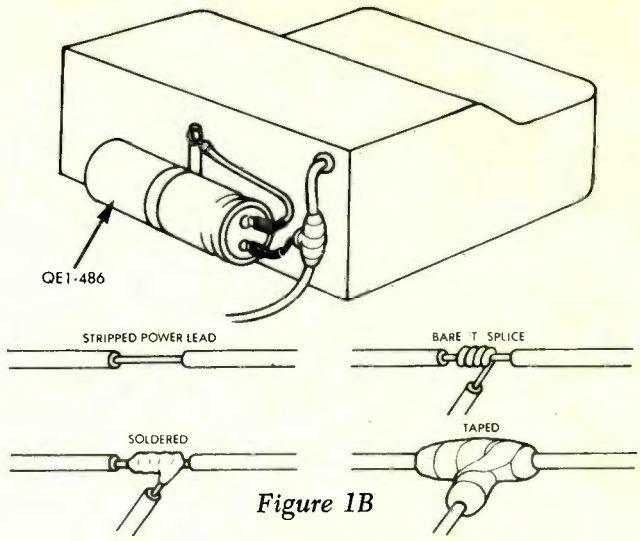

Figure 1B

Audio-frequency noise, especially in tape decks and AM/FM receivers, can be just as annoying and troublesome. In these situations, connect a 200μF @ 200 VDC electrolytic filter capacitor (Sprague Type QE1-486) to the power line as closely as possible to the cabinet, as shown in Figure 1B.

With negative-ground electrical systems, connect the black lead to the tape deck cabinet, and the red lead to the power line. With positive-ground electrical systems, ground the red lead and connect the black lead to the power line.

Filtering the ignition coil

Mount a general-purpose .1μF @ 400 VDC, 20-amp feed-thru filter capacitor (Sprague Type QX1-6) as closely as possible to the ignition coil, as shown in Figure 2. Don't mount the filter on the engine block. Disconnect from the coil the wire which leads to the ignition switch. Connect this wire to one end of the

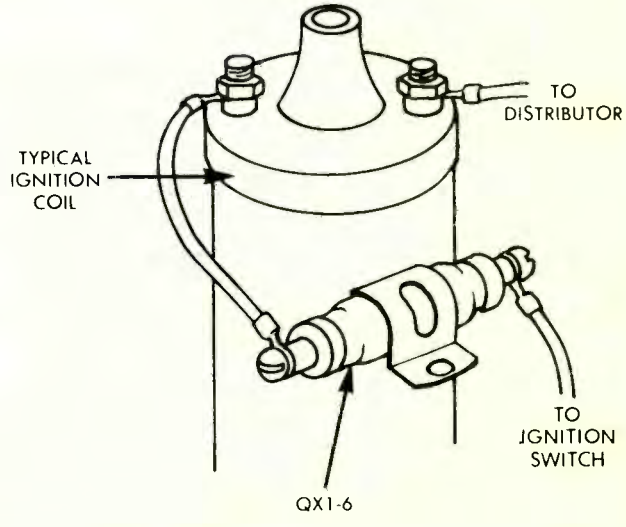

Figure 2

filter capacitor. Install a jumper wire using the same size and type of wire, from the remaining end of the filter to the coil terminal from which the wire was removed.

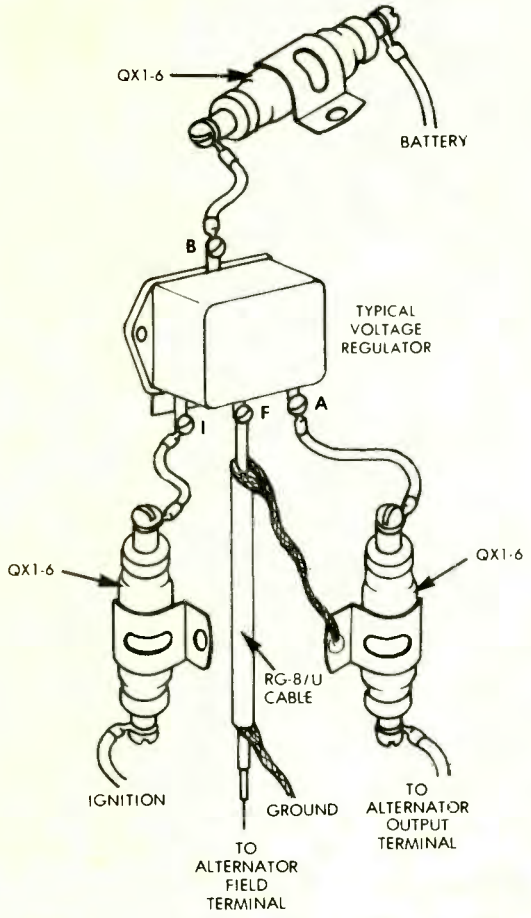

Figure 3

Filtering the voltage regulator

For vehicles with plug-in type electrical connectors, check with your auto mechanic for proper wire identification.

Mount a general-purpose .1μF @ 400 VDC, 20-amp feed-thru filter capacitor (Sprague Type QX1-6) as closely as possible to the voltage regulator, as shown in Figure 3. Disconnect the wire from the terminal marked "I" or "ignition", and connect it to one end of the filter capacitor. Install a jumper wire, using the same size and type of wire, from the opposite end of the capacitor to the "I" terminal.

If noise persists, disconnect the wire from terminal "A" (armature) and connect it to one end of a second filter capacitor. Install a jumper wire from the opposite end of the capacitor to the "A" terminal.

If noise persists, disconnect the wire from terminal "B" (battery) and connect it to one end of a third filter capacitor. Install a jumper wire using the same size and type of wire, from the opposite end of the capacitor to the "B" terminal.

If regulator noise still persists, replace the wire from Terminal "F" with Type RG-8/U coaxial cable, grounding both ends of the braided "shield" portion of the cable to the chassis or nearest grounding point other than the engine block. Be certain that the cable does not touch the engine block or any other accessory which may become hot during operation.

WARNING: Do not install any filter device on the terminal marked "F" or field. Permanent damage will result if this terminal is filtered or by-passed.

Filtering the alternator or generator

For standard alternators and generators, use a .5μF @ 50 VDC 40-amp feed-thru filter capacitor (Sprague Type QX1-18). For heavier-duty alternators, use a .5μF @ 50 VDC 40-amp feed-thru filter capacitor (Sprague Type QXI-100). For heavy-duty truck alternators, use a .5μF @ 600 VDC 100-amp feed-thru filter capacitor (Sprague Type QX1-500), or a .5μF @ 600 VDC 200-amp feed-thru filter capacitor (Sprague Type QX1-600).

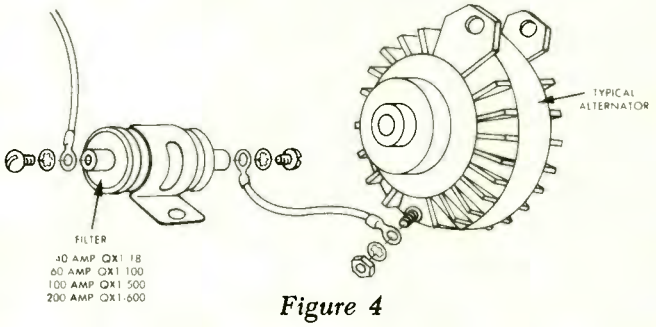

Figure 4

Mount the filter capacitor as close as possible to the alternator or generator, as shown in Figure 4. However, do not mount it on the engine block. Disconnect the wire from the output terminal on the alternator or generator and connect it to one end of the filter capacitor. Install a heavy jumper wire from the other end of the capacitor to the alternator output terminal.

Additional auto noise suppression measures.

Additional suppression steps can be taken at the terminals of such devices as the ammeter, oil pressure gauge, engine temperature gauge, and fuel gauge. It may even be necessary to suppress noise caused by the wiring at the dome light, trunk light, and instrument panel lights. In such cases, a general-purpose .1μF @ 400 VDC, 20-amp feed-thru filter capacitor (Sprague Type QX1-6) should be located as close as possible to the offending accessory, or where its lead wire passes through the engine compartment firewall.

Grounding the exhaust end of the tail-pipe can reduce re-radiated interference. Such grounding can be accomplished by using a length of braided grounding strap.

For severe cases of ignition noise, before you resort to complete ignition system shielding, try the following less-expensive alternatives first:

1. Use resistor-type spark plugs, *after* you have checked with your auto mechanic. These plugs are

not to be used with capacitor discharge ignition systems.

2. Investigate the use of bonding or jumper straps, especially between the engine hood, fenders, engine block, alternator frame, and tail-pipe.

3. General-purpose .1μF @ 400 VDC, 20-amp feed-thru filter capacitors (Sprague Type QX1-6) will often eliminate intermittent noise from turn signal flashers or windshield wipers by installing them at the terminals of the offending devices. NOTE: Feed-thru filter capacitors will have *no effect* on wiper motor noise, or signal fading, where the auto radio antenna is embedded in the windshield.

Automotive noise suppression requirements will vary with different vehicles, engines, and accessories. It is not possible to prescribe pat cure-alls for all noise problems. Each must be considered a custom case, with solutions for that particular car only. However, the information in this article should give you a good step forward in the suppression of noise for most of your specific problems. It remains for you to put the finishing touches to the job.

Boats and aircraft

Since electrical systems, power sources, and accessories in boats and airplanes are substantially more varied than those found in automotive vehicles, it would be extremely difficult to even generalize on procedures for noise suppression. It is suggested that you consult with your marine or aviation serviceman to determine the best approach and solution to your particular noise problems. Note that in the case of aircraft, a certified, licensed mechanic must be employed. It is always best to check with your dealer.

Filtering at Power Cord of A-C Radios

CAUTION: Before doing any work on A-C line operated equipment, *Pull the Plug!*

If your fixed-station radio rig is used in a properly-grounded electrical system (a 3-wire 110 volt a-c system, a system using BX cable in good condition, or a permanent chassis-to-ground system), an a-c power line filter with a dual 3-amp rating @ 250 VAC/60Hz (Sprague Type QX1-03) may be installed in your radio to suppress line interference, as shown in Figure 5. Remove the line cord from the a-c receptacle and discharge any filters or bypass capacitors connected across the line cord.

Disconnect the line cord from the terminal strip, fuse holder, transformer, etc. Remove any bypass capacitors (usually disc ceramic capacitors) connected across the line cord or connected between the line cord and the chassis ground. Install the filter so that its lead wires reach the points where the line cord was originally connected. Connect the original line cord to the lug terminals of the filter.

CAUTION: When servicing equipment in which a line filter has been installed, always remove the line cord from the receptacle *before* removing the ground connection. Conversely, always connect the ground line *before* plugging the cord back into the receptacle.

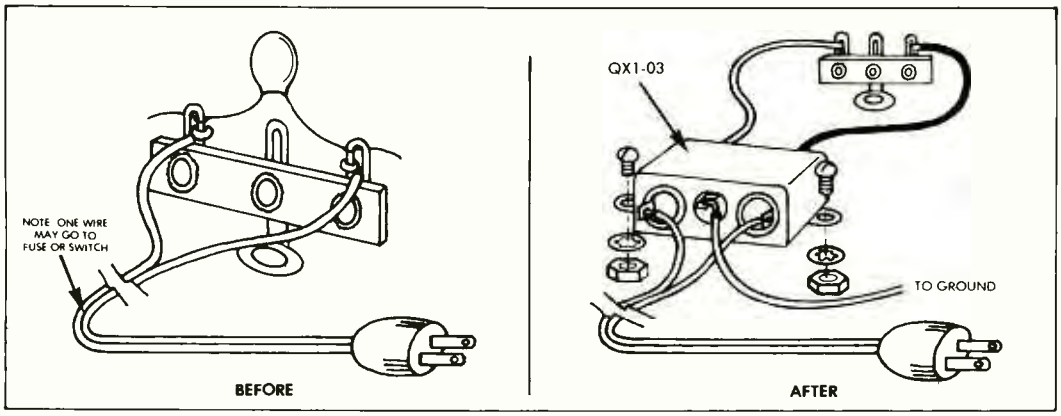

Figure 5