TELEVISION

MANY THINGS WITHIN A TV SET CAN INterfere with its picture. Unfortunately, there are several things that can interfere with the picture from *outside,* too! It won't help to tear down a set looking for trouble that's coming in from outside. You must be able to recognize outside interference when you see it.

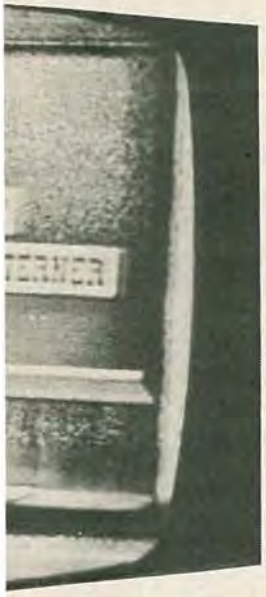
Outside interference (TVI) is generally lumped under the term *noise*—random-frequency signals generated by electrical apparatus, or even power lines themselves. That is normally *radiated* into the TV antenna. It's possible for some to get in by way of the AC line cord (conduction), but that seldom happens; most of it is radiation.

Luckily there's a simple test that will separate internal from external noise. Just try another TV set. If you see the same symptoms on a second screen, the problem is definitely external. That is a useful test for sets on master-antenna systems in apartments, etc. As an alternative, check with neighbors to see if they're having the same kind of trouble.

A few interference problems can be caused by simultaneous troubles in and outside the set. Here again, a substitute TV set will help you separate them. The photos in this article show the typical appearance of each major noise source. Your picture may not look exactly like those, but if you check the basic *pattern* characteristics, you'll be a long way toward identifying the cause.

AC line noise

If the screen shows two lines of dots, which may float up or down, that means



TV INTERFERENCE CAUSES and CURES

Nobody's immune to TVI. In most cases, though, there's a simple cure, if you know the cause. Some of the situations you're likely to encounter are described in this article, together with suggestions for combatting them.

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SERVICE EDITOR

FIG. 1—DOUBLE LINES of hash indicate 120-Hz rate of AC power-line noise.

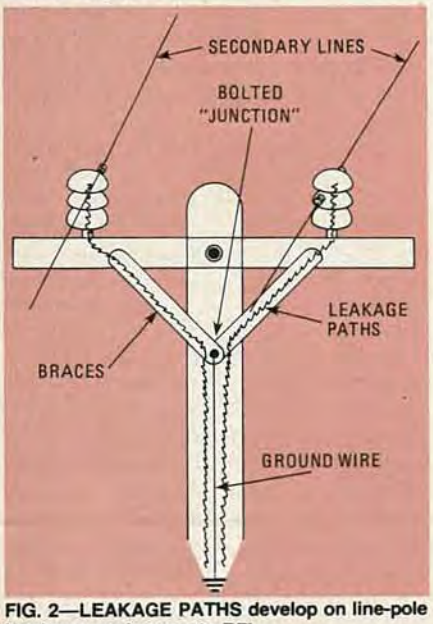

FIG. 2—LEAKAGE PATHS develop on line-pole hardware and generate RFI.

that the source is a 120Hz signal (see Fig. 1). That is often due to loose or faulty hardware on a pole carrying the secondary AC lines. It's often called "line noise," but a more accurate name is "hardware noise."

Figure 2 shows the cause: A small leakage path has formed from the line, over or through the insulator, to the crossarm, and down the metal brackets to the ground wire. Industrial smog deposits, etc., with high carbon content can cause that. The plated metal hardware can oxidize and form tiny "rectifiers" at points where it is bolted together. That can cause noise by a form of "diode oscillation."

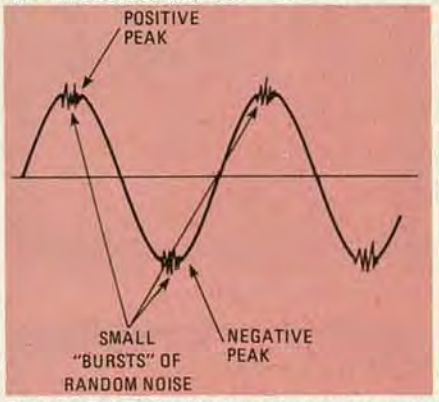

FIG. 3—RF BURSTS of random noise occur twice in each 60-Hz AC line cycle.

The 120-Hz pattern is due to the fact that leakage is greatest at the peak of each half-cycle. If you could see the waveform, it would look like Fig. 3. The small RF "bursts" on the peak of each half-cycle have frequency components in all bands up through the VHF TV bands.

For a quick check, disconnect the antenna. If the noise disappears, that's it. If the set has a directional antenna with a rotator, turn it. You'll generally find one direction where the noise is stronger. If so, the antenna is aimed directly at the noise source. Two antennas like that, several blocks apart, get a very accurate bearing on the noise location. Draw lines on a map; where they cross, that's the source.

In cases of severe interference, use a car radio. Set the tuner to about 800 kHz, off station, and turn the volume up. Listen for a loud, buzzing roar. Cruise the area and when you find a place where that noise can be heard over the entire dial very loudly, you're very near the source. If the noise peaks at around 800 kHz, you're still quite a way off.

Report such interference to the power company. They will send a crew out to find the offending pole, clean it up and tighten the hardware. A second clue to that type of noise is that it will disappear or be drastically reduced in wet weather. The moisture provides a much lower resistance path for the leakage, and it doesn't generate so much RF hash. If that type of noise gets much *worse* in wet weather, there is a *cracked insulator* somewhere on a secondary line. The water makes a path through the crack, setting up a heavy arcing and generating strong RF interference. TVI like that has caused problems at distances of up to five miles.

Figure 4 shows a similar type of interference, often mistaken for hardware noise. Notice, however, that the pattern is different. That type of TVI is due to an old fluorescent lamp without RFI fil-

FIG. 4—FLUORESCENT LAMPS without filters can cause this type of problem.

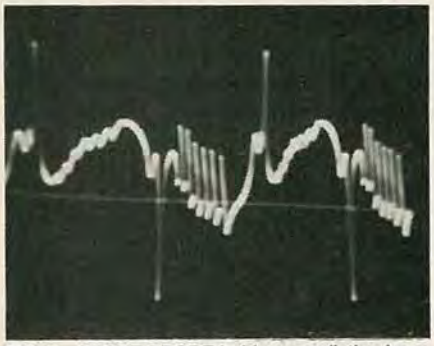

FIG. 5—SCOPE PROBE held near radiating lamp revealed this jagged waveform.

tering. The scope waveform in Fig. 5 shows why. It was picked up on a probe held *near* the bulb.

Interference often found if the antenna is near, or pointing across, a busy highway is shown in Fig. 6. That is ignition noise from old cars and trucks. It will show up as a jittering display of dashes, sometimes in heavy horizontal bars. The TVI will often be accompanied by a buzzing roar. Later-model cars with suppressors in the ignition will not cause that trouble.

If one of the lead-in interference filters on the market doesn't stop it, there's really only one cure: Move away from the highway! The noise is picked up by the *antenna*, not by the lead-in, so shielded cable won't help. A test was run on two antenna test towers. One tower had no antenna mounted at the time, only a lead-in all the way to the top. The tower with the antenna picked up the noise, but another TV set connected only to the lead-in didn't. Aiming the antenna directly away from the highway got rid of almost all noise.

Figure 7 shows a puzzling type of intermittent interference. There will be a high-frequency beat in the picture, usually jittering quite rapidly. This type of interference may also cause a color picture to (temporarily) revert to black-and-white. There may be squawks in the sound. That happens at irregular intervals and lasts only about 15—30 sec.

The cause is simple: You're picking up the high-powered FM transmitter of a passing police car. That signal is often in the 40–50-MHz band, and will be picked up directly, by the TV set's IF stages. In some cases, tuner cross-modulation will cause beats to get through to the IF. Ordinarily, that will happen only when the police cruiser is transmitting within about ¼ mile of the antenna and in front of it. It doesn't happen often enough to be really annoying, but many viewers want an explanation.

A similar kind of interference can be generated by nearby CB or amateur radio transmitters. You'll also get a herringbone pattern, but the audio may be a littler clearer. A good high-pass filter installed at the TV set's antenna terminals will usually clear up the problem.

The Fake-Outs

A confusing kind of trouble can be caused by faulty power supplies in home antenna boosters, master antenna systems and even CATV line amplifiers. That is not, strictly speaking, "noise," but is due to hum-modulation of the RF signal. The same symptoms can be produced by a heater-cathode short in the RF amplifier, mixer tube, or even the IF tubes. Also, AC ripple in the power supply to RF stages in transistor TV sets will cause that problem.

FIG. 6—IGNITION NOISE from vehicles without suppressors may cause this.

FIG. 7—FM TRANSMITTERS in police cars may cause occasional interference.

FIG. 8—S-BENDING in picture due to hum modulation of RF signal. Low-value capacitor in a booster caused distortion.

FIG. 9—WHITEOUT caused by severe hum modulation. An open-filter capacitor in antenna-booster power supply was source.

In mild cases, the picture will show severe S-bending, as in Fig. 8. If the hum is bad enough, half of the screen may be blacked out or whited out as in Fig. 9. Again, try a different TV set. If it shows the same symptoms, the trouble is in the input signal. Rabbit-ear antennas can be used in secondary areas, or any place where you can get even a bad picture on them. However, if the picture is clean with no hum bars, the trouble isn't in the set itself.

In some cases the picture will not show hum bars without an input signal; disconnecting the antenna leaves a clean raster. Of course, if you can see hum bars without the antenna, then the problem is definitely in the set.

Tube-type boosters generally have the power supply in the top unit. So, if it shows either 60-Hz or 120-Hz hum, lower the antenna. Solid-state boosters usually have the DC power supply in the bottom unit, making things much easier. Figures 8 and 9 were taken from sets with solid-state boosters. In Fig. 8, the filter capacitor was low in value; in Fig. 9, the capacitor was completely open.

Master-antenna systems, with full-wave bridge rectifiers or full-wave rectifiers in their DC power supply, can produce a 120-Hz ripple in the picture. At times, that will make two dark bars across the picture similar to hardware noise but quite a bit sharper and more distinct.

If the fault is in one of the line amplifiers, all TV sets fed from that amplifier will be affected. If the fault is in one of the head-end amplifiers at the antenna, all sets in the system will be affected. If tube amplifiers are still used, heater-cathode shorts in any of the amplifier tubes will cause a 60-Hz hum bar to appear on the screens of all sets after that amplifier.

When you see any of those particular symptoms in a TV picture, check out the antenna and any external noise. That can save hauling a set to the shop only to find it works perfectly. **R-E**