service clinic

Attacking the intermittent. *Logic can win the battle.*

JACK DARR, SERVICE EDITOR

INTERMITTENTS ARE THE BANE OF OUR existence. They're responsible for more frustration, bad language, and monetary loss than anything else. Nobody ever made money on an intermittent. There aren't any hard and fast ways of handling them (especially "fast") but there are ways that can help; two of them. You could call them active and passive.

The passive method means "set it up on the bench and let it play till it cuts out." This can take up a lot of time since the stock intermittent will usually play indefinitely on the bench. (I may hold the U.S. record! I watched one set for more than 120 hours without catching it acting up; all summer, in fact.

Since surveys show that long delays in getting sets repaired and returned are a major cause of "consumer complaints" (even more than high service charges!) this method isn't too good.

The active way is best. "Don't just sit there; DO SOMETHING!" Attack it. Intermittents can be classified, and this gives us a place to start. There are two kinds; intermittent shorts or opens. Shorts are a bit easier. They can often be located from the burnt resistors or other signs of damage. Intermittent opens are another thing. They interrupt circuits causing the loss of signal, sync, sweep, and, in the easier ones, a loss of voltage. However, the nature of the fault will lead us to the *function* that is affected.

Intermittents are caused by one of three things:

Thermal: some part gets hot enough to open, change value, etc.

Physical: a bad *connection* somewhere that makes and breaks.

Voltage: the least frequent but still possible. Certain voltages go out of tolerance causing trouble. Solid-state sets with automatic hold-down circuits are quite prone to this. Either of the first two things can cause this, so this is really a "subclass."

There is no definite line of demarcation between these, of course. For example, a thermal might be a burnt resistor that is cracked. Thermal expansion can make it open, and it can also be made to act up by jarring the chassis. So, don't freeze on any single attack; be flexible. Use them all at once if necessary!

A "thermal" resistor, in this sense, means one that changes in value when it gets hot. It may even open entirely. This definitely includes those types which are supposed to change, such as thermistors. These may be changing too much or not enough. Now let's see about methods of attack.

Check the *characteristics* of the intermittent fault. If the trouble shows up within the first 8 to 10 minutes of operation, this could be a thermal resistor in a current-carrying circuit. Plate or collector load resistor, etc. The heat that makes it go bad is developed in the resistor itself from the current. This could be called a "conduction" thermal. Such resistors usually heat up enough during the first few minutes to go bad.

If the resistor is used in a "dry" circuit, with practically no normal current-flow, it too can be thermal. In this case, it is heated by radiation of heat from nearby parts or from the chassis. It could be called a "radiation" thermal. (The heat is "conducted" through the chassis, but let's not mention that; we'll be confused enough as it is!)

The main characteristic of such thermals is the much longer time-constant. This is normally at least an hour and may be far longer. These little gems are the ones that act up in the cabinet and just won't show up at all with the chassis out of the case, or even with the back off!

Where to start

Now, to the attack. If the problem shows these signs of being thermal, locate the function or circuit which is affected. For example; the problem is a sudden loss of picture and sound leaving a clean raster. Here we have three suspects; tuner, IF and AGC. Eliminate the tuner by checking with a tuner-substituter. Eliminate the AGC by clamping it. This leaves us with the IF strip. (Unless the previous tests showed that the trouble was in one of the first two. We should be so lucky?)

How do we attack? We've agreed that this shows signs of being thermal. So we heat things up or cool them off to see if we can *make* the problem show up. You can use a heat-gun, such as the Wahl *Thermal-Spot,* to heat up individual parts. You can also hold the tip of a soldering iron on the part long enough to warm it up. If this doesn't make it happen, try the opposite; cool things off with freeze-spray.

These tests are very useful for finding things like thermal transistors, of which there are quite a few. (I have a pet on my bench: At room temperature it works perfectly. Warm it or cool it only a very few degrees, and out it goes, only to come back when it returns to room temperature!)

These things are also useful for finding drifting resistors that cause such things as a gradual loss of vertical sync, color, etc. Heat or cool them while watching the screen. If you do find one, replace it and then check all of the others in the circuit. There may be more than one.

The physical or "jar-intermittent" can be made to show up by jarring the cabinet (the famous "Punt" treatment.) These shouldn't be too hard to find, but of course often are. If you can make it act up by jarring the cabinet, note which function is affected. This tells you where to start. Go to the area of this circuit and start tapping things *very lightly.* Use an insulated tool. Something like a plastic screwdriver is my favorite. You can tap with the end or hit harder with the handle if necessary. The part that is causing the problem will be the most sensitive to tapping. Use a very light touch until you find a place where only a very light tap will make it act up.

Bad solder joints are one common cause. Hairline cracks in PC board con-

This column is for the service technician's problems—TV, radio, audio or industrial electronics. We answer all questions submitted by service technicians on their letterheads individually, by mail, and the more interesting ones will be printed here.

If you're really stuck, write us. We'll do our best to help you. Don't forget to enclose a stamped, self-addressed envelope. If return postage is not included we cannot process your question. Write: Service Editor, Radio-Electronics, 200 Park Avenue South, New York, NY 10003

ductors are another. (These can *also* be thermal, when the board warms and expands.) Small electrolytic capacitors are another common cause. And do *not* overlook dirty tube-socket or other plug-in contacts. If you can get it pinned down to only a small area but can't *see* the one that is bad (not uncommon), you're justified in "shotgunning" this.

Remelt and add fresh solder to all of the joints in this area. This normally won't involve more than about a dozen at the most. This catches a good many of them though you never know just which one it was. (Who cares?)

The last class involves voltages. If they are high or low, they can cause intermittents. It may be the AC line voltage or one of the DC power supply voltages. A variable-voltage transformer is invaluable here. You can run the AC line voltage up or down to see if this makes the problem show up.

Look for "common-cause" circuitry. For example, many solid-state sets have a regulated low-voltage DC power supply. It feeds the horizontal output stage that in turn develops other low-voltage DC supplies. An intermittent condition in the primary DC supply will cause all of the rest to go bad, apparently affecting a great many circuits at the same time.

In one set, an intermittent Zener clamp in the low-voltage regulator let the output voltage go too high. This made the high-voltage rise, triggering the high-voltage shutdown circuit (which it was supposed to do). In cases like this, always go back far enough to make sure that the fault is not in circuits such as the DC low-voltage regulator and not in the high voltage at all. All of these regulated low-voltage supplies are critical.

All intermittents are annoying, and some can be infuriating. These are the "touchy" ones. The problem shows up; but touch any point in the circuit with a test-lead and it promptly goes back to working perfectly. There is an attack for these, too. One way is to use your scope, but do not make actual contact with the circuit. Hold the probe tip near, but NOT touching, the circuit. By increasing the vertical gain, you can get a pickup pattern and see whether a signal is present at certain points.

Another way is to connect a high-impedance voltmeter to test points, with the power *off*. When the set is turned on, you will be able to see the reading without causing the transient that shocks it back into operation. Still another way is to open the supply circuit and insert a milliammeter or ammeter. The current drain will give you a better idea of the nature of the fault; short or open. Use your ingenuity, and you will find numerous other ways of making tests in cases like this.

I might say in closing that I feel well-qualified to discuss the subject. Right now, my TV is intermittent, my *car* is intermittent, and I've got a flashlight that's not working all that well. Just as soon as I get this done, I'm going to have to go to work. **R-E**

reader questions

VERTICAL SYNC PROBLEM

Thank you for your suggestions on the vertical sync problem in this Wards Airline GEN-12440A, (Sams 1143). The horizontal sync was good, but the vertical weak. We found both capacitors C406 and C413 open. Replacing them cured the trouble. Now tell me how I got horizontal sync through capacitor C406?—R.S., Littleton, CO.

This is simple. (Note how simple all of these problems are, *after* they're solved.) Both of these are 3.3-μF *electrolytic* capacitors. They lose capacitance where a paper capacitor can't; it's either good or open.

Capacitor C406 is the coupling capacitor, and it had enough capacitance left to let the high-frequency horizontal sync get through, though it reduced the vertical sync amplitude. (Vertical sync works on amplitude.) Capacitor C413 is the screen grid bypass on the sync-separator 6GH8, and if it's open, you'll get quite a bit of degeneration and a loss of gain.

AGC PROBLEM

Here's one for your collection. I apparently had AGC problems in this Sears 529.7246 chassis. The set had a raster, but no snow or sound. Adjusting the AGC control had no effect. Checking DC voltages, I found No. 1 B+ source to the tuner read zero. This comes from the cathode of the 50C5 audio output tube. Read this voltage (from underside of chassis) and *it* was zero. Replaced 50C5 tube and still nothing.

Looking at the top side, I saw that the 50C5 and a pair of 12AV6's weren't lit. Since they use a series heater string, I'd assumed that all of the tubes were lit. Turns out that these three are fed through a 300-ohm 10-watt dropping resistor all by their little selves. This resistor is R231, even though the parts lists says C231. It was open and replacing it fixed the set.

Thanks to Joe Witt, of Maxi-Watt Electronics, Vineland, NJ.

RELAYS CHATTER ON PEAKS

Here's one for you on ham gear. I'm trying to drive a Heath SB-230 linear amplifier with a Hallicrafters SR-150 transceiver. This works well in all bands except the 7-MHz band, but here the relays chatter and cut out on voice peaks. Happens only in PTT (Push-to-talk). This must be RF getting in, but so far I can't find it.—F.K., Raytown, MO.

Speaking from a background of almost complete ignorance on actual amateur gear, I can give you a couple of ideas. You noted that the relay driver tube grid varied when the relay chatters. Try connecting a diode from this grid to ground, anode grounded. The idea of this is to clip the negative going peaks of the interfering signal and help hold the plate current steadier. Also, add more bypassing to ground on this grid.

(Feedback: "Tried diode to ground. It works. Fantastic!")

FUSE BLOWS

The 2.5 fast-blow fuse that supplies the +145 volts to the flyback in this Magnavox T982-12, blows within 30 seconds after turn-on. I've changed the horizontal output transistor, tripler and the flyback, and it still blows. It makes a perfect picture till the fuse goes. What's going on here?—B.H., Decatur, GA.

After the things you've changed, nothing. Hi! Seriously, something *else* is causing this, but what? I hunted through the schematic for about 15 minutes and finally came up with a good possible. This same fuse is also connected to a pulse supply that develops +250 volts. This is what took me so long; I couldn't find out where that 250 volts went.

Finally stumbled over it. This is the DC bias applied to the picture tube heater, and nothing else. You have a diode and a couple of electrolytic capacitors in that circuit. If any of these are bad, the fuse could blow; just disconnect the +250 volts and see.

HIGH-VOLTAGE ARCING

The high-voltage arcs all around the back of the picture tube in this Zenith 21X1C36. I can see arcs and flashes all around it. Sometimes the picture goes out of focus and then goes out. I suspect the picture tube but I'm not sure. How can I verify this?—J.H., Houston, TX.

This is one of those "might be the picture tube; might not" things. There *is* one way to tell. Hook the chassis up to a test jig! If you get the same symptoms, this is some kind of oddball problem in the grounding of the dag coating, etc. If this clears all symptoms up, the original is bad.

VOLTAGE-DEPENDENT RESISTOR

Where can I find a VDR used in a Motorola TS-597C? It's the one connected between the +250-volt source and the brightness control. The part number is 6C66263A08. Can't find it anywhere around here, even in the factory parts catalogue!—R.A., Thibodaux, LA.

This VDR can be replaced with an Oneida GB-308. This is rated 1.0 mA at 110-120 volts. This one will also replace an RCA 114862. Oneida parts are available at a lot of radio-TV supply houses. Their address is 853 North Cottage St., Meadville, PA 16335. **R-E**